An Index of Groundworks and Bearings

architectural lessons on foundation building in Vuntut Gwitchin traditional territory

by

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis including any required final revisions as accepted by my examiners.

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ABSTRACT

The foundation mediates the relationship between a building and the land. It is a connection that is particularly challenging to ground in frozen soils.

Bridging the Arctic Circle in the Northern Yukon, Vuntut Gwitchin First Nation traditional territory is situated between overlapping realities of the North and the South. The lives and knowledge of the peoples who have inhabited this place for millennia are entangled with a shifting land, one that experiences both changing seasons and increasing warming trends. Distanced professional 'experts' also engage these critical issues of environmental change through research and design. Within this dynamic context, holes exist in the dominant, arborescent decision-making models for foundation systems framing design as a *problem*, with solutions that privilege techno-scientific knowledge.

This thesis is a constellation of work informed by architectural research, conversations, and time spent over the course of two summer seasons in Old Crow, Yukon, and my experience out on the land with local citizens who live close to it. Written from the position of a 'not-knower' – a visiting student of architecture and the land – this thesis offers a series of questions, attunements, and prompts for the designer. The work culminates in an index of annotated deep sections that detail the reciprocal relationships between what is above and below the ground's surface. *An Index of Groundworks and Bearings* suggests a deeper reading of the foundation as a site of dialogue between buildings, the hands and minds that build, and the land. These exchanges, both voiced and silent, involve multiple ways of knowing and relating to the land. The index is a non-comprehensive illustrated inventory of foundations encountered in this region that float above the shifting ground or search for stasis deep below grade. It explores a multiscalar meshwork of projected abstractions and foundational relationships with the land that architecture might build on. Ultimately, the intention of this thesis is to open the visiting architect's awareness of different ways to touch the land, while questioning the foundations of architectural practice itself.

I owe a debt of gratitude to my supervisor, Dr. Anne Bordeleau. Thank you for your steadfast support, generosity and grounding counsel that enabled me to pull a thread through this shifting work. Your mentorship has left me with an entangled sense of inspiration, wonder and stupefaction that I have trouble expressing.

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CMHC	Canada Mortgage and Housing Corporation
EMR	Energy, Mines and Resources (Government of Yukon)
PWF	Preserved Wood Foundation
RAIC	Royal Architectural Institute of Canada
VGFN	Vuntut Gwitchin First Nation
VGG	Vuntut Gwitchin Government
YT	Yukon Territory, Canada

fig 0.1 Air North's Hawker Siddeley 748 awaiting departure on Whitehorse airport's paved airport taxiway

I have always been attentive of the ground beneath my feet. While I have tried to attune myself to the land, as a second generation Canadian with Anglo-Slovak heritage, my own roots on this continent are shallow but growing. My knowledge and relationships with this land pale in comparison to the deep ancestral, experiential, and cultural ties that exist in this country's North.

I was first introduced to the northern Yukon while working in an architecture firm in Whitehorse that designed several projects with the Van Tat Gwich'in community of Old Crow. I became interested in understanding how architecture might be responsibly grounded in place, and how the vising architect might design with a community that is so closely tied to the land. While spending two summer seasons living in the community and briefly working as an architectural adviser with the Vuntut Gwitchin First Nation, I began to question the visiting architect's agency more deeply.[1]

One connective building element surfaced in numerous open conversations with community members: the foundation was suggested as a potentially useful architectural topic to navigate in this work.[2] Foundations connect buildings above grade to the immensity of what is beneath the land's surface. The practice of foundation design requires a deep understanding of the ground, its behaviour, and the web of relationships in which these connective elements are entangled.

While the architect may first encounter a site through the standardized conventions of lines drawn on a property survey or the data and borehole logs of a geotechnical report, each site in itself is singular. The complex meshwork of layered relationships and connections with which it is intertwined cannot be communicated through the reductive lens of one isolated medium.

I first travelled to Old Crow in the belly of an Air North Hawker Siddeley. As the aircraft rose above the Whitehorse airport, the long linear swaths of tarmac dissolved. Roads below gave way to trees and my body recognized hills it has walked over and felt the patches of ground it has rested on.

The plane's twin propellers droned in unison as we headed north to cross the invisible line of the Arctic Circle. In each community, the ground plane greeted the aircraft with a different reception. Smooth tarmac made with fine-grained aggregate was hard beneath my feet, and felt different from a ground plane paved with a coarser gravel, or one made of packed fill.

As we climbed higher above ground, skipping through air pockets, we

felt turbulence, which can occur on invisible borders where two bodies of air meet. These borders are often present above mountain ranges. Here, the air is shaped by the ground plane.[3]

At the same time, the earth is shaped by the air's currents and temperatures. In the continuous permafrost zone, these changes are expressed in ways that can be seen from terrestrial and aerial perspectives. Polygonal patterns on the ground's surface can emerge as visible evidence of the growth of ice-wedges below, *thermokarst* lakes can appear where the ground ice has thawed and settled, and conical mounds called *pingos* can form with the expansion of ice within the underlying soils.[4]

The ground is also shaped by industrial development. Resource extraction projects, invisible from most ground transportation, become apparent from the air. Coloured rings surrounding bodies of water, open pits cutting deep into the ground's surface, and mounds of dredged earth standing testament to human land use. Many resources from the North support distant users in the South.

The movements and migration of any animals, like the undulating waves of the Porcupine Caribou Herd, and the Peoples who depend on them for physical and cultural sustenance, animate the ground's surface. At the same time, the movements of animals are impacted by what the land can provide.

As a visiting researcher, I felt like a Sandhill Crane. I had flown in to Old Crow with these birds in the late spring, arriving nosily. I would fly out with them at the end of the summer when the temperature dropped, experiencing only a part of the seasonal shifts that occur on and in the land. Once back in the South, I would feel the reverberations of many changes that had taken place within me through relationships I had founded with people and the land.

As a student both of architecture and of the land, I wondered how the visiting architect might build on discussions of environmental change. After returning to the South and continuing this thesis, this question of agency remained. What right does the visiting architect have to engage with a land she is not from? How can she allow herself to be open in order to pursue work of value? How can she attune herself to the land, while knowing that she can never be completely culturally attuned to the land in a place in which she is a newcomer? Can a visitor's technical expertise enter into a productive conversation with knowledge that is held by those who know the land? Can knowledge, like the land, shift with time?

fig 0.2 Air North's Hawker Siddeley 748 on the Old Crow airport gravel taxiway

INTRODUCTION

holes in the land

The *foundation* is a building component grounding a structure into the land. When building on permafrost, two main foundation typologies exist: deep foundations, which attempt to isolate a building above the upper surface of the ground from the shifting, active layer by connecting to a more solid material below; and shallow foundations, which act more like rafts, floating on top of or within the ground's shifting surface.[1]

This thesis is shaped by three intentions:

Conceptually, this work positions foundations as connections to the land. The work is reflexive in nature, questioning architectural practice and agency. It untangles multiple relationships with and understandings of the land – relationships that are supported and concealed through the process of foundation building.

Methodologically, the document is compiled as an academic overview of the ground's shifting nature; it is an illustrated study of existing foundation typologies for building on permafrost that I encountered during my personal experience in Vuntut Gwitchin traditional territory, often learned through local stories that relate to this land.

Together, these first two understandings of foundations form the 'head' and 'hands' of this body of work.[2]

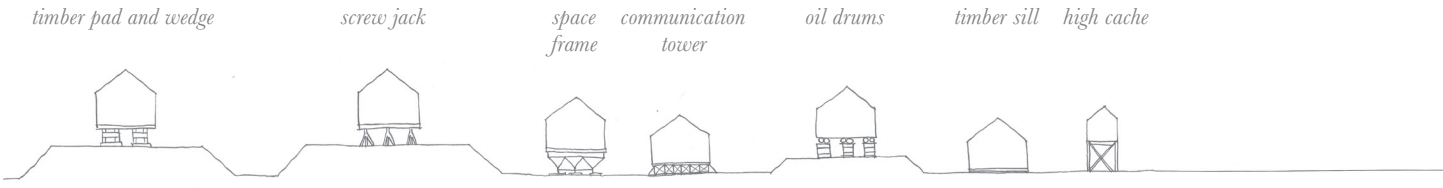
The 'heart' that guides the head and hands is formed by a desire to offer something of potential use back to the community of Old Crow. This intention is rooted in a responsibility to honour personal relationships with people and the land that have developed over the course of this work.

Through a search for *gaps* in the existing, universalizing narratives, we may trace an outline of the forces that draw them, says anthropologist Anna Tsing in *Friction: An Ethnography of Global Connection*. This process requires a shift in perspective.

An Index of Groundworks and Bearings inhabits many of the gaps that exist in the visiting architect's understanding, mapping limits and extensions of foundational relationships with land. Many paths lead to knowledge of the land, and each is of value in its own right. This work is an attempt to understand and unlearn underlying assumptions about foundations in order to follow more ethical bearings and build the groundwork for a practice founded on architectural empathy. The thesis approaches the question of how to build responsibly on a shifting land from the multitude of perspectives presented to me as a visiting student of architecture looking at the land.[3]

Vuntut Gwitchin territory occupies a cultural and geographical North-South gap where the Arctic circle intersects the Yukon subarctic region, and where fundamentally different relationships with the land overlap. Through this work, it has become clear that while a visiting architect can learn by practicing with empathy, a difference of culture means she can still never be wholly attuned to a place she is not *of*.[4]

Another gap exists in the typical framing of foundation building as a 'problem' that can be solved by understanding the land, usually with universalized, technoscientific knowledge. Building with the land is intertwined



with cultural, social and environmental relationships that are embedded in place. While academic distancing from the land can be found in the pages of foundation guidebooks and manuals, this separation from place is not possible when sharing conversations over mugs of bush tea.

These gaps in the visiting architect's knowledge and understanding are introduced by looking at the land through four holes:

The first hole develops in the Van Tat Gwich'in long-ago story of a hole in the earth; it looks into the social and cultural relationships with the land existing in this territory since time immemorial.

The second hole develops in the story of the hole in the first Western cartographic projection of the Arctic, and examines the limits of 'objective' ways of drawing and producing the land.[5]

The third hole develops in the story of the engineer's borehole that navigates the boundaries of distanced technical expertise.

The fourth hole develops in the story of holes in the earth caused by thawing permafrost, and considers the urgency of climate change now faced by this land. It brings together multiple forms of expertise.

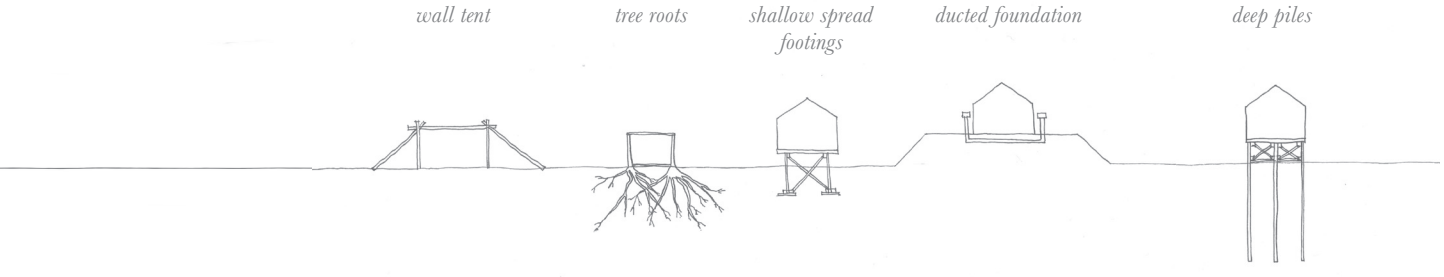


fig. 0.3 (below) A collection of foundation types in Old Crow, Yukon

fig. 0.4 (opposite) Geological time scale depicting the physical and geological landscape of the Old Crow area noting particular geological attributes of deposits from specific periods. The land has been shaped and modified by millions of years of processes of living creatures and forces such as wind (eolian), water (fluvial), frozen ground (cryogenic), and gravity (colluvial). (Data sourced from Northern Climate ExChange, Yukon College)

HOLE 01: THE VAN TAT GWICH'IN LONG-AGO STORY OF A HOLE IN THE LAND

The first hole looks at the Van Tat Gwich'in long-ago story of a hole in the earth.

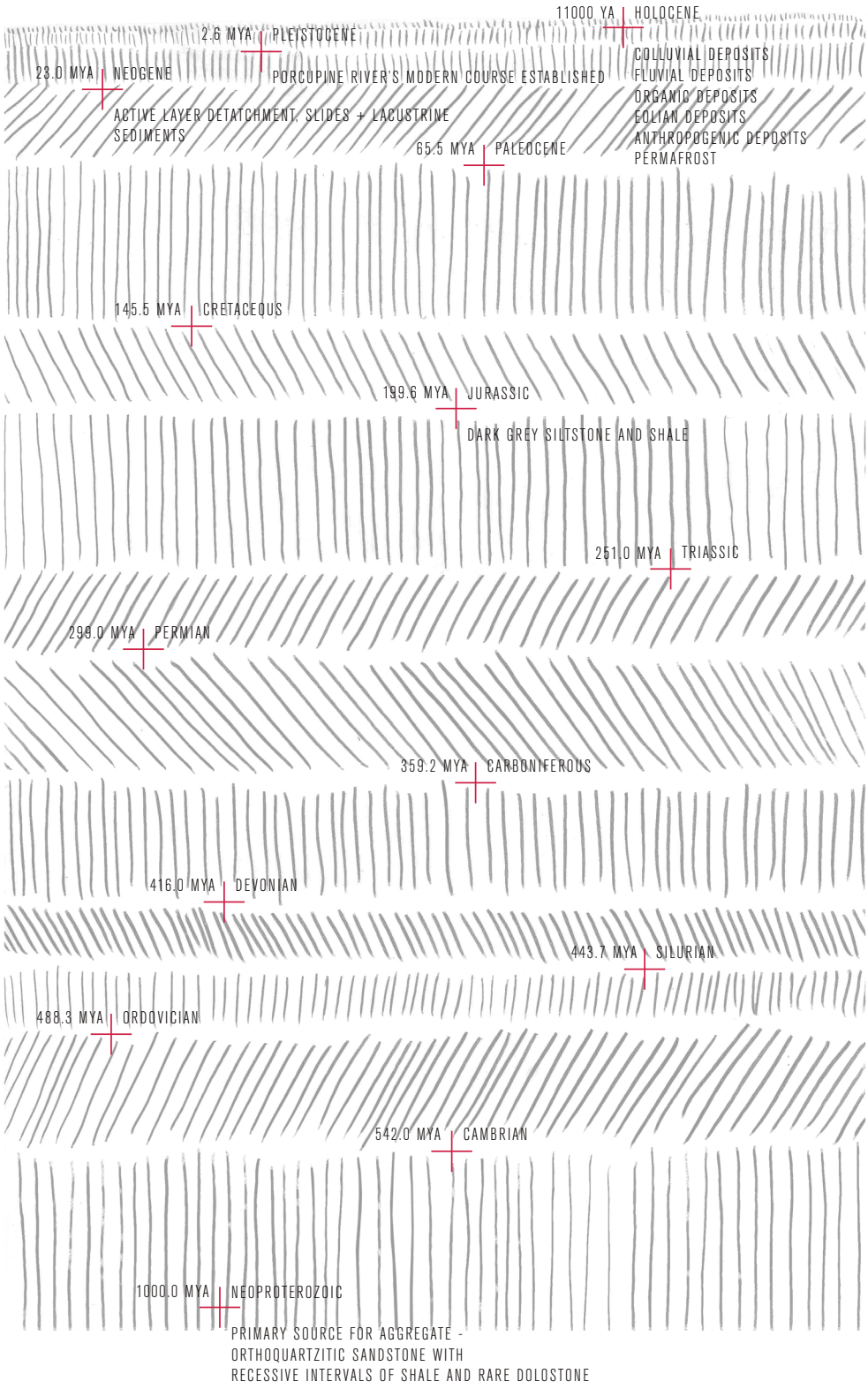
While in Old Crow, I spent time in the cultural centre: a building whose plans I had looked over in Whitehorse during my former experience working with the firm that designed it. Inside the building's bones, I felt myself forget the space as an architect-in-training, and experienced it as a new visitor to this place. I tried to make myself useful: I listened while helping pin curtains for a local historical site; I assisted with the assembly of an inflatable canoe, and volunteered as a deck hand on a supply boat to deliver the curtains downriver.

When I first arrived in the community, Vuntut Gwitchin citizen Robert Kyikavichik had just recently discovered a woolly mammoth (*Mammathus primigenius*) femur bone while hunting with his son and nephew on the Crow River. An outside article reported the find, narrowly labeling him as a 'duck hunter.'[6] The bone is currently housed in the solar panel–clad John Tizya Centre. Brandon Kyikavichik, one of the community's cultural interpreters, told me more about a 'long-ago' story of mammoths, while I ran my hands over the femur that felt cool and hard beneath my fingers. Brandon described the way these animals once pushed through the riverbanks, and as he did I could feel the weight of the ground from which the bone had been unearthed.

Pouring through the centre's research library, I flipped through a publication on the region's Ice Age bones. Old Crow resident Joe Kaye's words caught my attention. In 1967, he told a long-ago story from Van Tat Gwich'in culture to palaeontologist Richard Harington. In the book, Harington describes the impact this story had on the present:

"The tale involved a 'monster' that had broken out of a lake bed near the upper Porcupine River, trudged up the river and died under a bank on Whitestone River, a tributary of Porcupine River… Our investigation of Whitestone River led us to the 'monster' that Joe Kay told us about."[7]

That summer, Old Crow citizens Peter Lord and Richard Harington found the partial remains of a 30,000-year-old female woolly mammoth in a riverbank on the *Sheihveenjìk*, or Whitestone River.[8]


11000 YA | HOLOCENE
COLLUVIAL DEPOSITS
FLUVIAL DEPOSITS
ORGANIC DEPOSITS
EOLIAN DEPOSITS
ANTHROPOGENIC DEPOSITS
PERMAFROST
2.6 MYA | PLEISTOCENE
PORCUPINE RIVER'S MODERN COURSE ESTABLISHED
23.0 MYA | NEOGENE
ACTIVE LAYER DETATCHMENT SLIDES + LACUSTRINE SEDIMENTS
65.5 MYA | PALEOCENE
145.5 MYA | CRETACEOUS
199.6 MYA | JURASSIC
DARK GREY SILTSTONE AND SHALE
251.0 MYA | TRIASSIC
299.0 MYA | PERMIAN
359.2 MYA | CARBONIFEROUS
416.0 MYA | DEVONIAN
443.7 MYA | SILURIAN
488.3 MYA | ORDOVICIAN
542.0 MYA | CAMBRIAN
1000.0 MYA | NEOPROTEROZOIC
PRIMARY SOURCE FOR AGGREGATE -
ORTHOQUARTZITIC SANDSTONE WITH
RECESSIVE INTERVALS OF SHALE AND RARE DOLOSTONE

In the book, another passage quoted the words of Van Tat Gwich'in Elder Charlie Peter Charlie Sr.:

"Mammoth — used to be, he lived in the ground. If he's going to die, he pushes his way to the water, to the river — like a D-9 Cat!"[9]

Harington speculated that the part of the story that involved the 'monster' breaking out of a lake bed may have evolved from observing an event where the river bank was eroded away and cut back to the edge of a lake behind. In such rare occasions, the bank can collapse and slump, draining a violent and abrupt release of turbid water into the river.[10]

The region surrounding Old Crow has been undisturbed for millennia, appearing at the edge the Geological Survey of Canada's depiction of the last glacial period, the Wisconsin glaciation.[11]

Van Tat Gwich'in oral history tells of their territory's occupation since time immemorial, while scientific radiocarbon dating of artifacts from Bluefish Caves, the oldest known archaeological site in North America, demonstrates human presence going back 24,000 years ago.[12]

Here, history is embedded in the land. In Van Tat Gwich'in culture, place-based knowledge is learned through stories that are told out on the land and about it.

HOLE 02: THE HOLE IN MERCATOR'S POLAR PROJECTION

The second hole looks into the story of the filled hole in the first Western cartographic projection of the Arctic.

In early Western polar mappings, navigators measured the earth with optical instruments, recording data that cartographers inscribed on the projection, translating places both known and unknown onto meridians and parallels. In 1595, the first 'scientific' cartographer Gerhard Mercator published a collection of maps entitled, *Atlas sive cosmographicae meditationes de fabrica mundia et fabrica figura.* Operating with a Euro-Western cartographic gaze, Mercator constructed a drawing that fixed land in space and produced the first printed map of the Arctic.[13] The surfacing of the expression *fabrica mundi* in the title of this atlas suggests the cartographer's recognition of the fact

fig. 0.5 (top) Still from the film The Berger Inquiry (1977) showing a "Cat D-9" bulldozer plowing through ice-rich soils in Inuvik, NT
fig. 0.6 (middle) A hole in a bank along the Porcupine River with a large, elevated ground depression behind
fig. 0.7 (bottom) Detail of the woolly mammoth femur Robert Kyikavichik found approximately 100 kilometers up the Crow River from Old Crow

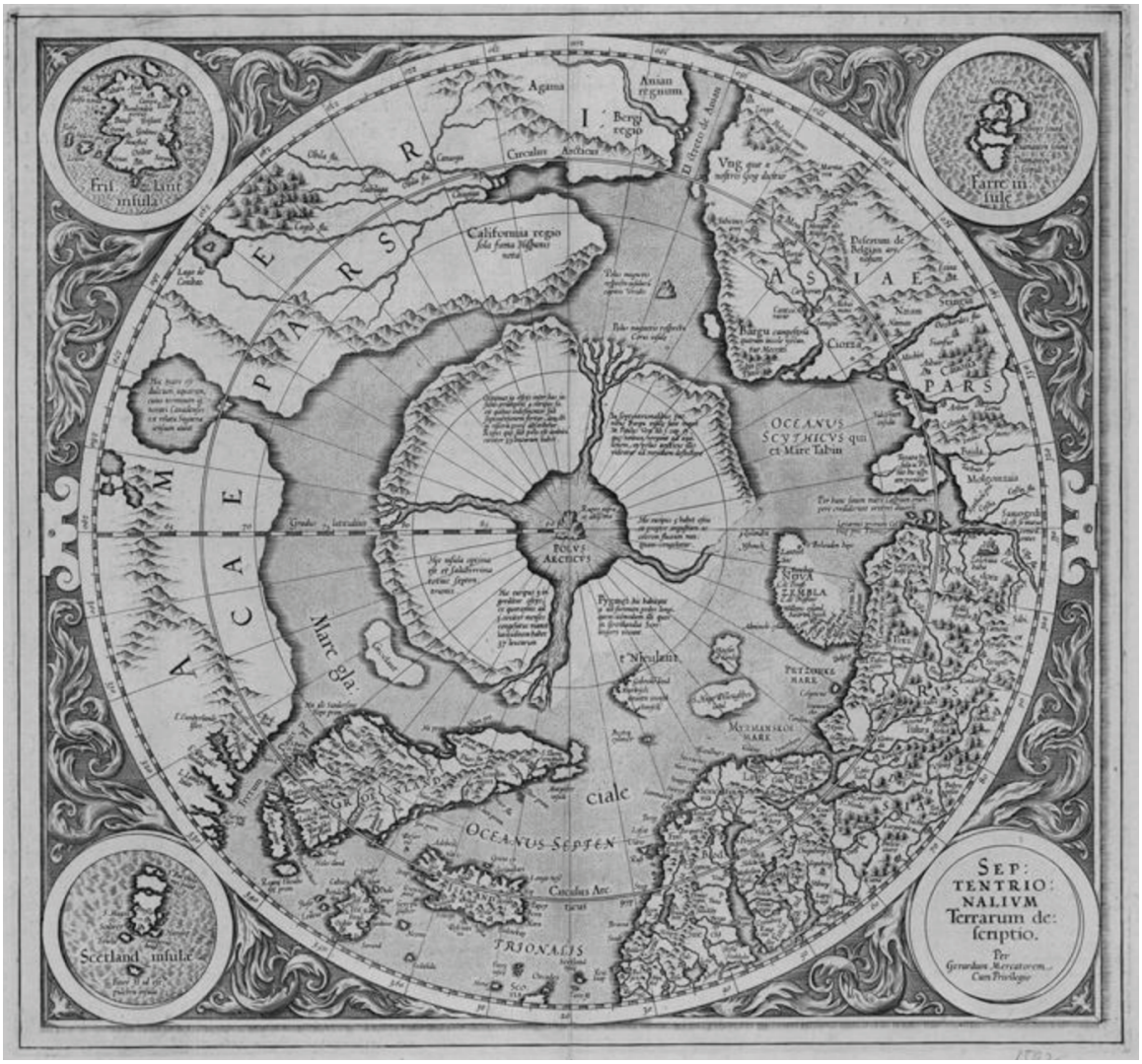


fig. 0.8 Gerardus Mercator's 1595 *Septentrionalium terrarum descriptio* depicting a mountain at the North Pole and one in the Bering Strait drawn from erroneously interpreted data. (Courtesy of Library and Archives Canada, MIKAN no. 3681390)

that the act of representing the world by mapping it also *produces* it.[14] Maps, like many graphic artefacts engaged in the practice of architecture, can promote an empirical reading of the world that sustains the 'conceit of objectivity' while intertwining design with imperial power structures.[15]

The North Pole occupies the centre of Mercator's Arctic projection. While no European explorer, scientist, or geographer had seen this ground, Mercator imaginatively filled the void of the unknown. He produced a map that fantastically depicted an unmoving magnetic mountain: a 'figure' located in space and projected against the static 'ground.' Offering a scientific hypothesis to account for the experienced reality on the land where magnetic declination turns compass needles away from True North, the cartographer drew two smaller magnetic mountains.[16]

While this cartography was drawn in a way that made it appear as a scientific reality by filling the hole in the map, it was a mistranslation. The phenomenon of magnetic North is not created by static mountains of rock, but rather a dynamic system. The dip pole is engaged in a constant wandering, endlessly shifting the magnetic field. The most recent official magnetic survey determined that the North Magnetic Pole is moving approximately 55km north-northwest per year.[17]

Much like the ephemeral character of magnetic north, the shifting nature of this land becomes evident as one approaches it.[18] During my first time out on the land near Old Crow, I brought a surveyor's compass with me and duly noted the local magnetic declination of 20° East.[19] As my body moved over and adjusted to the land's surface, I felt it move beneath me, meeting my weight with less resistance where the ground was wet, and more where it was dry and hard. The explorer-cartographer seeks to measure and chart unknown lands, but lacks a deeper relationship with the ground beneath her feet. The act of surveying the land is a mode of occupation, not habitation. Each time I was invited out on the land by people who knew it well, I left the compass in town, and followed a bearing of trust and experience instead.

Mercator's projections and universalizing grid continue to inform representations of the North. When I first visited Old Crow, the Van Tat Gwich'in Navigation Systems Project was underway. While the technical processes of mapping and drawing risk producing power-knowledge, they can also be useful tools. Elders and experienced navigators direct helicopters in

the navigation of traditional trails and routes, tracing them on maps, while documenting and geo-locating Gwich'in place names. Collective memory can be navigated by community members, located with satellites, drawn with pixels and inscribed on a Mercator projection.[20]

HOLE 03: THE TECHNOSCIENTIFIC LENS OF THE BOREHOLE

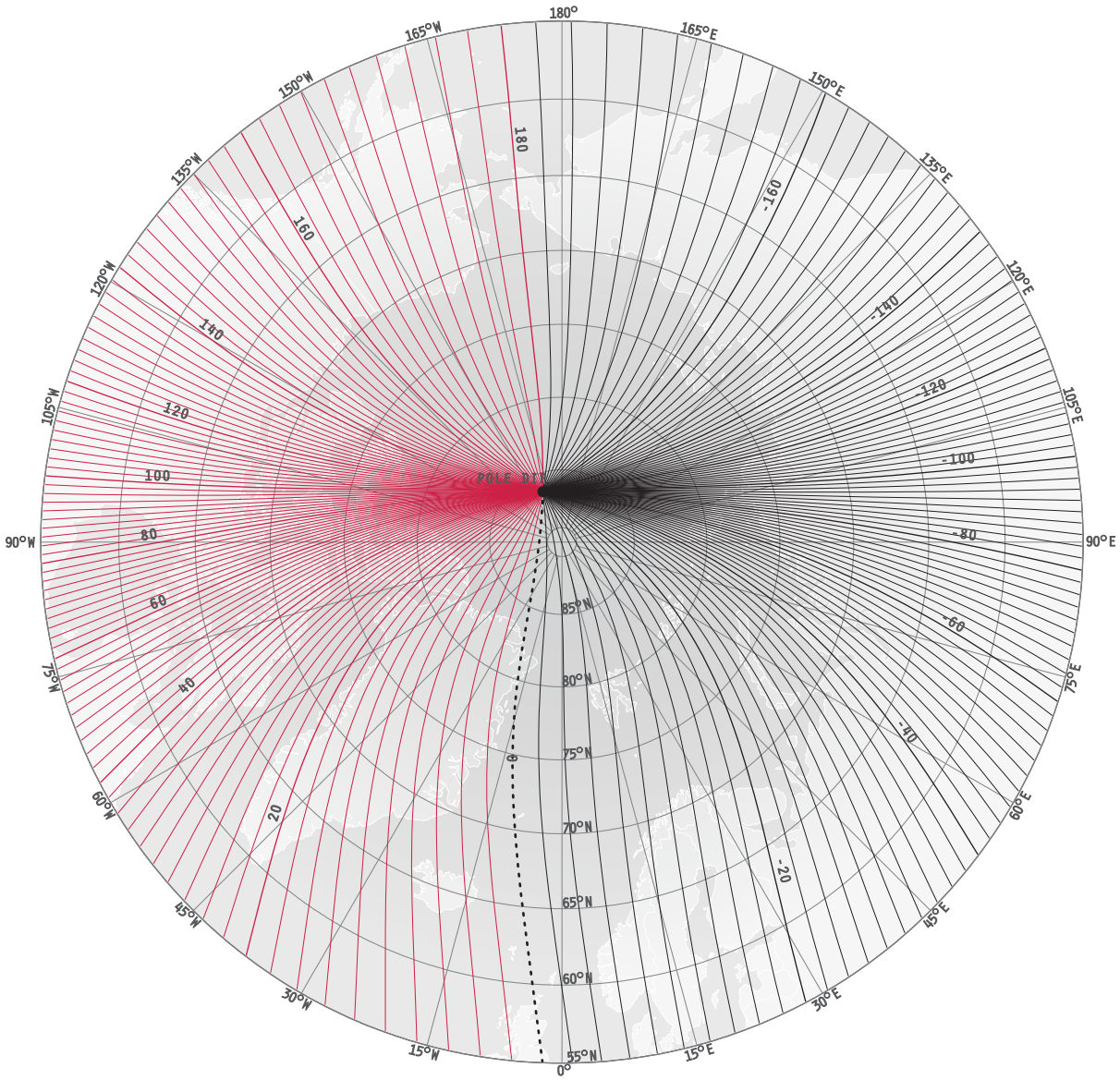
The third hole looks into the engineer's borehole and technoscientific ways of knowing the land.

Architecture is dimensioned, specified, and prescribed with certain tolerances. Where it touches the land through the foundation, it connects to a limitless site that tolerates movement at different scales and speeds.[21] Often hidden from view beneath the skin of the land, permafrost is ground that remains frozen for two or more consecutive years.[22] When ice-rich permafrost thaws, the meltwater can be displaced, creating space and allowing the ground to settle. If the earth freezes back, it can heave and alter its surface again. This shifting ground plane can prove challenging to build with.[23]

Core samples extracted from boreholes and other methods such as vibration testing offer information in the Euro-North American quest to build upon empirical knowledge and certainty by reading the land through instruments. The ground's temperature can be measured with a thermistor, a cable with thermal sensors that is inserted into the borehole. Heat flux from the centre of the earth warms the permafrost the further down you go. When the climate is stable, the warmest temperatures in a deep borehole should be found at the bottom and decrease steadily along a geothermal gradient as you move towards the surface. [24] In today's warming Arctic, the lowest temperatures are no longer found at the top of the permafrost, but instead exist somewhere in the middle. Many scientists have accepted these measurements as a clear indication that the climate is warming.[25]

Providing localized data on the slow movement of geological forces and the temporality of the freeze-thaw cycle, the borehole minimizes doubt and unpredictability in the land. While extracted 'undisturbed samples' of the ground can be analyzed in order to approximate the material properties of

fig. 0.9 North Polar Region stereographic projection showing the wandering magnetic dip pole and main magnetic field grid variation. Due to the complex shape and dynamic nature of Earth's magnetic field, there are few places where compass needles will point to both 'True North,' and the geographic pole. Grid variation describes the angle between the magnetic and true meridians. Contour interval shown is two degrees. (Data courtesy of NOAA National Geophysical Data Center)



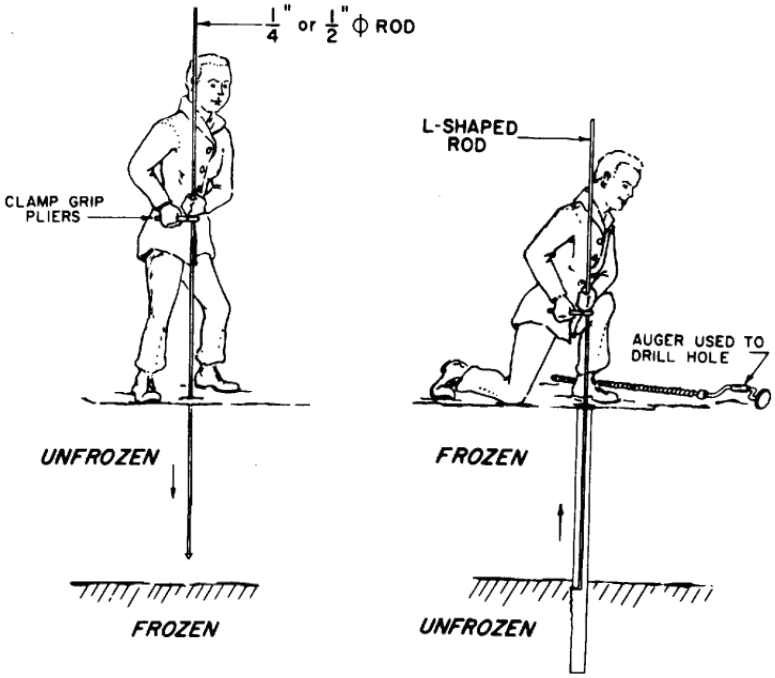


fig. 0.10 (left) Technique for probing through unfrozen ground to frozen soils beneath to measure depth of unfrozen ground
fig. 0.11 (right) Technique for drilling a hole and probing frozen ground on the surface with an L-shaped rod to measure thickness of the frozen layer

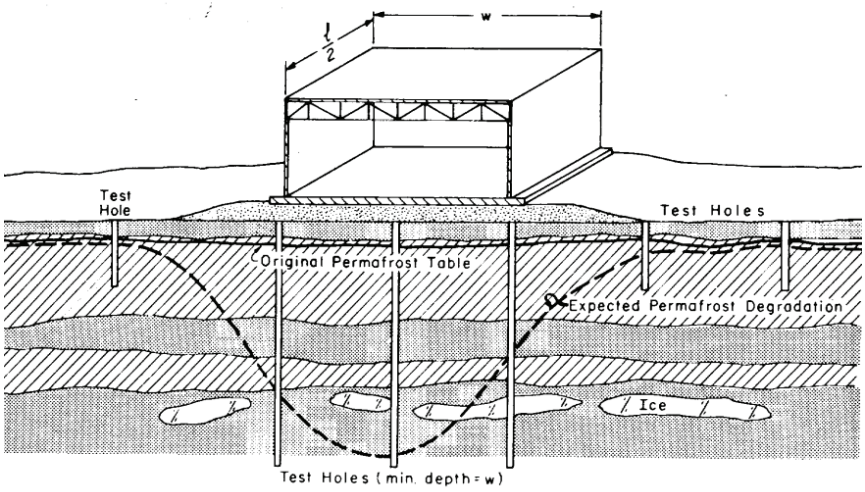


fig. 0.12 (right) Diagram depicting the "required extent of explorations for large structure," showing test holes and generalized soil profiles

the soil *in situ*, what is outside of the width of the drilled hole, and beyond the moment in time in which it was captured, must be imagined before it can be drawn in generalized soil profiles.[26] The core sample itself can only tell a single story of the land through one moment in time and space. Then lens of the drill sample is myopic.

HOLE 04: THE HOLE IN THE THAWING PERMAFROST

The fourth hole looks into a hole in the land created by thawing permafrost.

This story returns briefly to the first story of the hole in the earth in which palaeontologist Richard Harington proposed that the hole in the story of the woolly mammoth may have been influenced by local observations of a violent lake drainage. While this point remains speculative, the reality of this thawing land is experienced on the ground by contemporary Van Tat Gwich'in – or 'people of the lakes.'

Van Tat, or Old Crow Flats, is a wetland area in this territory. Roughly the size of the Greater Toronto Area, the area is integral to the First Nation's culture and is an important wildlife habitat for animals such as migrating waterfowl and muskrats. From the air, the 8700 lakes and ponds that make up the wetland form a shimmering mosaic on the land. Nearly all of these waterbodies are *thermokarst* in nature. Formed by the thawing of underground ice and subsequent thaw settlement, these shallow lakes are dynamic ecosystems that are sensitive to disturbance, expanding and draining as the surface permafrost degrades. These bodies of water are formed in literal holes in the ground.

Recently, Zelma Lake, one of the largest thermokarst lakes in Van Tat, drained suddenly. Scientists estimate that nearly 5.3 million cubic meters of water emptied from the lake when its banks were eroded and breached by high water levels. Residents of Old Crow expressed concerns over the rapid changes they have noticed while out on the land in Van Tat. Scientists conducting field studies on the ground and analyzing aerial photographs from a distance attribute the increased frequency of lake drainages in this area to changing climatic conditions.[27]

While distanced technical expertise has gravitated towards studying this rapidly shifting land, many Old Crow community members hold traditional and place-based knowledge of this region. As people who interact with the land and its changes in their everyday lives, they are the 'ground truthers' of global environmental change.[28]

LOOKING INTO THE HOLES

These four holes underline the depth and complexity entailed in the act of building with permafrost in Vuntut Gwitchin traditional territory.

In *People of the Lakes,* a work co-authored by the Vuntut Gwitchin First Nation and long-term community researcher anthropologist and ally Shirleen Smith, the land is the foundation of traditional Van Tat Gwich'in economy, culture, and identity. This understanding of land does not simply refer to the surface of the ground, but rather it includes the lakes, rivers and non-human beings, particularly the Porcupine Caribou Herd.[29] For the visiting architect, land as site cannot be enclosed within the boundaries of the map, nor can it be reduced to soil types separated by the lines of a borehole log.

How can the newcomer architect work *with* rather than *for*? A responsible practice of architecture requires more than purveying exclusive expertise. The land we build with is more than a site whose behaviour and potential can be understood through technical expertise. It is a place that is known through local, place-based and indigenous knowledge; it is entangled with life and culture. Picking berries, gutting fish, and going 'out on the land' with those who know it well can be ways of approaching foundations as connections with the land. Empathy and listening form a ground upon which meaningful exchange is built.

This thesis presents an indeterminate index of groundworks and bearings for the visiting architect. Grounded in my own personal experiences of foundations as sites for open conversation, this work seeks to understand how one might build more responsibly with the land and with each other. When we look for *gaps* in the seams of Euro-North America's architectural culture, and its universalizing technoscientific narrative, we find that foundations, like ourselves, are tied to place in a web of reciprocity.

The thesis is organized in four parts:

Touching the Land positions the foundation as a tie to the land and introduces the complex web of foundational relationships and understandings that are entangled with land in Vuntut Gwitchin territory.

Groundworks reflects critically on the underlying foundations of architectural agency and practice.

Bearings opens a dialogue with various forms of expertise that ground a more responsible approach to foundation building.

An Indeterminate Index of Foundations offers a series of annotated deep sections that illustrates foundations encountered throughout the work and details the reciprocal relationships that are formed between what is above and below the land's surface.

NOTES - PREFACE

1. There are several different orthographies of the Gwich'in Athapaskan language. The Archdeacon, Robert McDonald (1829-1913) led the project to create the first writing system for the Gwich'in or Tukudh language. Today, this orthography is used in the official spelling of 'Vuntut Gwitchin First Nation.' Today, however, the people of the Gwich'in community of Old Crow use the modern orthography and refer to themselves as the 'Van Tat Gwich'in.' Megan Williams, VGFN Heritage Branch Manager, personal communication, August, 2017.

2. Howard Linklater (VGFN citizen and VGG Government Services Director), discussion with the author, August 2017.

3. "Violent turbulence: A look at what causes shakes mid-flight," *CBC News*, January 25, 2016, http://www.cbc.ca/news/technology/turbulence-air-travel-1.3385566.

4. Robert van Everdingen, ed., *Multi-Language Glossary of Permafrost and Related Ground-Ice Terms* (Svalbard: International Permafrost Association, 2005), 50-84.

NOTES - INTRODUCTION

1. Canadian Standards Association, *Moderating the Effects of Permafrost Degradation on Existing Building Foundations* (Mississauga, ON: Canadian Standards Association, 2014), 8.

2. Robin Kimmerer quotes Dennis Martinez's understanding of ecology that involves the limited nature of the 'head' and 'hands' of Western science, which must be guided by the 'heart' of Indigenous traditional knowledge. In Robin Kimmerer, "Restoration and Reciprocity: the Contributions of Traditional Ecological Knowledge," in *Human Dimensions of Ecological Restoration*, ed. Dave Egan, Evan E Hjerpe, and Jesse Abrams (Washington, DC: Island Press/Center for Resource Economics, 2011), 263.

3. As Tsing writes, "Gaps develop in the seams of universal projects; they are found where universals have not been successful in setting all the terms. While a transcendent, nonsocial, global 'nature' has become a powerful thing worldwide, it is not the only kind of nature on the planet. Whenever we want to trace the limits of hegemony, we need to look for gaps." Anna Lowenhaupt Tsing, *Friction : An Ethnography of Global Connection* (Princeton, N.J.: Princeton University Press, 2005), 202.

4. Dr. David Fortin (Assistant Professor of Architecture at Laurentian University) in discussion with the author, December 2016.

5. This conceptual collection of holes is inspired by Seth Denizen, "Three Holes in the Geological Present," in *Architecture in the Anthropocene : Encounters Among Design, Deep Time, Science and Philosophy*, ed. Étienne Turpin (Ann Arbor: Open Humanities Press, 2013).

6. Paul Tukker, "Duck hunter fishes woolly mammoth bone out of Yukon's Crow River," *CBC News,* June 14, 2016, http://www.cbc.ca/news/canada/north/massive-bone-mammoth-yukon-old-crow-1.3634746

7. Richard Harington, *Legend to Reality : The Story of the Whitestone Mammoth,* Beringian Research Notes No. 21 (Whitehorse, YT: Yukon Government, 2008), 1-4.

8. The bones were radiocarbon dated to be 30,000 years old. Harington, *Legend to Reality : The Story of the Whitestone Mammoth,* 3.

9. Charlie Peter Charlie Sr. quoted in Duane Froese, and Grant Zazula. *Ice Age Old Crow*, ed. Patricia Halladay (Whitehorse, YT: Government of Yukon, 2013), 24.

10. Harington, *Legend to Reality : The Story of the Whitestone Mammoth,* 1-4.

11. V K Prest, Geological Survey of Canada, *Retreat of Wisconsin and Recent Ice in North America*, 1969, "A" Series Map 1257A. GEOSCAN, Natural Resources Canada. https://doi.org/10.4095/109206.

12. Bluefish Caves is just 54 km from Old Crow. Lauriane Bourgeon, Ariane Burke, and Thomas Higham, "Earliest Human Presence in North America Dated to the Last Glacial Maximum: New Radiocarbon Dates From Bluefish Caves, Canada," *Hakai Magazine: Coastal Science and Societies* 12, no. 1 (January 6, 2017), https://doi.org/10.1371/journal.pone.0169486.

13. Gerardus Mercator, *Septentrionalium terrarum descriptio. Per Gerardium Mercatorem cum privilegio*, map, 1595, Library and Archives Canada, Mikan no. 3682241. http://data2.archives.ca/e/e177/e004414662-v6.jpg.

14. Sandro Mezzadra, and Brett Neilson, "Fabrica mundi : producing the world by drawing borders," in *Scapegoat: Architecture, Landscape, Political Economy: 04 Currency*, ed. Adrian Blackwell and Chris Lee (Winter/Spring 2013): 3-19.

15. Maps project lines and draw 'property', what James Corner describes as a "…phenomena that can only achieve visibility through representation rather than through direct experience." From Chris Lee, "This was written on stolen Indigenous land," *Decolonising Design*, September 26, 2016, http://www.decolonisingdesign.com/guest-contributions/2017/guest-post-this-was-written-on-stolen-indigenous-land/#5.

16. Charles Stankievech described these two mythical mountains in a lecture at UWSA in 2016. Charles Stankievech, "Magnetic Anomalies in the Arctic Colonial Resource Extraction, Meteoric Cults, and the Rare Earth Age," in *Rare Earth*, ed. Boris Ondreička, and Nadim Samman, (Berlin: Sternberg Press / Thyssen-Bornemisza Art Contemporary, 2015).

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24. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost,* 99.

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PART 01

TOUCHING THE LAND

LAND LEXICON

land and language

active layer means the top layer of ground above the *permafros*t table that thaws each summer and refreezes each fall[1]

active layer means the top layer of ground that is subject to annual freezing and thawing in areas underlain by *permafrost*[2]

adfreezing means the adhesion of *soil* to a *foundation unit* resulting from the freezing of soil water[3]

adfreezing[2] the process by which two objects are bonded together by ice formed between them. Generally, adfreeze is considered a combination of the ice-to-surface bonding (adhesion), mechanical interaction, and friction[4]

authority having jurisdiction means the governmental body responsible for the enforcement of any part of the Code or the official or agency designated by that body to exercise such a function[5]

building means any structure used or intended for supporting or sheltering any use or *occupancy*[6]

condenser means the upper part (above ground) of a thermosyphon where gas, such as CO2, flowing from below the ground surface is cooled in winter and condenses into a liquid[7]

deep foundation means a *foundation unit* that provides support for a *building* by transferring loads either by end-bearing to *soil or* rock at considerable depth below the *building*, or by adhesion or friction, or both, in the *soil or* rock in which it is placed. *Piles* are the most common type of *deep foundation*[8]

designer means the person responsible for the design[9]

drunken forest means a group of trees leaning in random directions in a *permafrost* region. A descriptive term for trees usually growing on ice-rich terrain and subject to repeated differential *frost heave* or *thermokarst* subsidence[10]

evaporator means the underground part of a *thermosyphon* in which a liquid, such as CO2, evaporates by extracting heat from the surrounding soil[11]

excavation means the space created by the removal of *soil,* rock or *fill* for the purposes of construction[12]

fill means *soil,* rock, rubble, industrial waste such as slag, organic material or a combination of these that is transported and placed on the natural surface of *soil* or *rock* or organic terrain. It may or may not be compacted[13]

foundation means a system or arrangement of *foundation units* through which the loads from a *building* are transferred to supporting *soil* or *rock*[14]

foundation unit means one of the structural members of the *foundation* of a *building* such as a footing, raft or *pile*[15]

frost action means the phenomenon that occurs when water in *soil* is subjected to freezing which, because of the water/ice phase change or ice lens growth, results in a total volume increase or the build-up of expansive forces under confined conditions or both, and the subsequent thawing that leads to loss of *soil* strength and increased compressibility[16]

frost heave means the upward or outward movement of the ground surface (or objects on, or in, the ground) caused by the formation of ice in the soil[17]

frost jacking means the cumulative upward displacement of objects embedded in the ground, caused by frost action[18]

frost-susceptible soil means soil in which significant detrimental ice segregation occurs when the requisite moisture and freezing conditions are present[19]

geothermal gradient means the increase in temperature with depth below the maximum depth of annual variation. The gradual increase in temperature is due to the heat of the Earth's interior[20]

ground heave means the upward movement of the ground causing a raising of the ground surface as a result of the formation of ground ice in excess of pore fillings[21]

ground settlement means the downward movement of the ground causing a lowering of the ground surface resulting from the melting of ground ice in excess of pore fillings[22]

groundwater means a free-standing body of water in the ground[23]

hummock means small lumps of soil pushed up by frost action, often found uniformly spaced in large groups. Hummocks can form in areas of permafrost or seasonally frozen ground, and are one of the most common surface features of the Arctic[24]

ice-rich permafrost means *permafrost* containing excess ice[25]

land or place is not simply some material object of profound importance to Indigenous cultures (although it is this too); instead, it ought to be understood as a field of "relationships of things to each other"[26]

nan athatan is the Van Tat Gwich'in term for permafrost that literally translates to "frozen ground"[27]

non-frost-susceptible soil means a *soil* that does not display significant detrimental ice segregation during freezing[28]

permafrost is ground (*soil* or *rock*) that remains at or below 0 °C for at least two winters and an intervening summer[29]

permafrost, continuous means *permafrost* occurring everywhere beneath the exposed land surface throughout a geographic regional zone, with the exception of widely scattered sites (such as newly deposited unconsolidated sediments) where the climate has just begun to impose its influence on the ground thermal regime and will cause the formation of continuous permafrost[30]

permafrost, ice-rich means perennially frozen ground that contains ice in excess of that required to fill pore spaces[31]

pile means a slender *deep foundation unit* made of materials such as wood, steel or concrete or a combination thereof, that is either premanufactured and placed by driving, jacking, jetting or screwing, or cast-in-place in a hole formed by driving, excavating or boring (cast-in-place bored *piles* are often referred to as *caissons* in Canada)[32]

place means a way of knowing, of experiencing and relating to the world and with others[33]

polygon means a type of patterned ground consisting of a closed, roughly equidimensional figure bounded by several sides, commonly more or less straight, but some, or all, of which may be irregularly curved. A polygon may be either "low center" or "high center," depending on whether its center is lower or higher than its margins[34]

rock means that portion of the earth's crust that is consolidated, coherent and relatively hard and is a naturally formed, solidly bonded, mass of mineral matter that cannot ready be broken by hand[35]

seasonal frost heave means the upward or outward movement of the ground surface that occurs in response to seasonal freezing of the ground[36]

soil means the portion of the earth's crust that is fragmentary, or such that some individual particles of a dried sample may be readily separated by agitation in water, it includes boulders, cobbles, gravel, sand, silt, clay and organic matter[37]

subsurface investigation is the appraisal of the general subsurface conditions of a *building* site by analysis of information gained by such methods as geological surveys, in situ testing, sampling, visual inspection, laboratory testing of samples of the subsurface materials and *groundwater* observations and measurements[38]

terra nullius is the racist legal fiction that declared Indigenous peoples too 'primitive' to bear rights to land and sovereignty when they first encountered European powers on the continent, thus rendering their territories legally 'empty' and therefore open for colonial settlement and development[39]

test pit means a hand or machine excavation used to examine and take samples of the near surface ground[40]

thaw stable permafrost means perennially frozen ground that will not experience either significant thaw settlement or loss of strength upon thawing[41]

thermokarst lake means a lake occupying a closed depression formed by settlement of the ground following melting of ground ice[42]

thermokarst terrain means the irregular topography resulting from the melting of excess ground ice and subsequent thaw settlement[43]

thermosyphon means a two-phase passive refrigeration device charged with a working fluid that transfers heat from the ground to the air when appropriate temperature differentials prevail[44]

A LIVING LAND

foundational relationships with the land

> But it's my people who are threatened by potential oil development and climate change. We are the ones who have everything to lose. The Gwich'in are going to fight as long as we need to. We know that without the land and the caribou, we are nobody.
>
> Sarah James, "We are the Caribou People," *Arctic Voices*

> Should the future of the North be determined by the South?
>
> Justice Thomas Berger, *Northern Frontier, Northern Homeland: The Report of the Mackenzie Valley Pipeline Inquiry*

Vuntut Gwitchin traditional territory is a dynamic land full of interminglings. Positioned at the overlap of the Subarctic and Arctic, it extends from the mountain headwaters of the Peel River in the south, to the Arctic National Wildlife Refuge and Vuntut National Park in the North, and from the Mackenzie Delta in the Northwest Territories in the East, to north-eastern Alaska in the West. Gwich'in homeland is shared with hundreds of thousands of animals. The black bear, the grizzly bear, and the polar bear co-exist in this rich and varied ecosystem. During their annual migration to and from their calving grounds, the Porcupine Caribou Herd undulate through this land like a living tide. This land is alive, dynamic, and steeped in history.

This region lies within an area geologists have named 'Beringia.' Unlike the surrounding land, this territory was not covered by glaciers in the last Ice Age – the land is ancient. There is evidence the surrounding walls of ice did impact the land, though, reversing the flow of the Porcupine River and forming new lakes, seen today in the land's strata and heard in Gwich'in long-ago flood stories.[1] According to oral historical accounts, the Van Tat Gwich'in have inhabited and governed themselves in the land now recognized as the North Yukon since time immemorial.[2] Their histories continue to be inscribed here.

Old Crow is one of fifteen Gwich'in Nation communities, located at the confluence of the Porcupine and Crow rivers in Vuntut Gwitchin traditional territory. The site is tied to stories of a fish camp that belonged to Chief *Zzeh Gittlit* (whose name refers to residing to the corner, and who was also known by the name *Deetru' K'avihdik* or "Crow May I Walk"). Old Crow's first cabin was built by John Tizya in 1905. Today, Old Crow is the northernmost community in the Yukon territory, and can be accessed by plane, boat, or snow machine.[3]

fig. 1.1 (opposite, top) A canvas-wall tent that Brandon Kyikavichik and Robert Kyikavichik put up outside of the John Tizya Centre in Old Crow. Many of these structures, which sit lightly on the ground, are used out on the land in Vuntut Gwitchin traditional territory

fig. 1.2 (opposite, bottom) A detail of a caribou skin on the spruce bough floor of the canvas-wall tent

Gwich'in can be translated to English from the Gwich'in Athapaskan language (rarely referred to as Dene) as 'one(those) who dwell(s).' Similarly, *Van Tat* can be translated as 'among the lakes.' *Van Tat Gwich'in* is often understood as 'people of the lakes' or 'one(those) who dwell(s) among the lakes.' The relationship between people and the land embedded in these names is clear: the two are intertwined. When seen through the myopic lens of the Euro-North American world view, this relationship can be misunderstood as one based purely on material survival. The late Lakota scholar and philosopher Vine Deloria Jr. draws a distinction between Western time-oriented and Indigenous place-based understandings of the world, in which place serves as an ontological framework for understanding and relating to the world and other beings. Glen Coulthard, a scholar and member of the Yellowknives Dene First Nation, expands on this understanding of place-based relationships, writing:

> Seen in this light, it is a profound misunderstanding to think of land or place as simply some material object of profound importance to Indigenous cultures (although it is this too); instead it ought to be understood as a field of 'relationships of things to each other.[4]

The land is not defined by a single meaning, but multiple interrelated meanings. Coulthard continues by describing a framework of place-based ethics that is informed by the land as a system of reciprocal relations and mutual obligations with the human and nonhuman others, and past and future generations. He suggests this 'grounded normativity' acted as the foundation of many Indigenous critiques of the coupled influences of colonial sovereignty and capitalist accumulation that have defined the postwar era of northwestern development, the commercialization and commodification of land that Chris Lee has termed 'settler normativity.'[5]

While a building's foundation literally ties it to the land, it is built upon certain underlying assumptions of what land is and how to relate to it. While the visiting architect cannot ever fully culturally attune herself to a place, she can and must engage the complex and deeply important web of relationships entangled in the land with which she builds.[6] This essay pulls a thread through three foundational understandings and relationships with the land in the contemporary North Yukon: land as *material of capitalist accumulation*; land as *property of colonial sovereignty*; and land as *reciprocal relationship*.

'FOUNDATION' STORIES

fig. 1.3 (opposite, top) Detail of *Plate 8* showing the Geological Survey of Canada's exploration team's drawing of Old Crow at the confluence of the Porcupine River and the Old Crow River with annotations describing the land through observed geological conditions

fig. 1.4 (opposite, middle) *The Geological Survey of Canada's Index Map Shewing the Routes Followed by the Members of the Yukon Expedition 1887-1888* (1891) as explored by Dawson, Ogilvie and McConnell

fig. 1.5 (opposite, bottom) An annotation of 'unexplored' land fits into colonial projections of the North as an unknown place despite centuries of Indigenous occupation and stewardship of this land

Discovering. Exploring. Mapping. Settling. Surviving. These are the thematic actions that have shaped both literary and historical narratives of the Canadian North.[7] Many of the origin stories of Northwestern Canada have been written as monologues from the outside – the perspectives of explorers, miners, traders, missionaries, and geologists:

> *Mackenzie followed the greatest river in Canada to its mouth at the Arctic Ocean, and surveyed it on behalf of the North West Company (NWC) and saw oil seeping on its banks.*
>
> *Franklin mapped the North Coast of what is now the Yukon before he went to meet his doom looking for the Northwest Passage.*
>
> *Dawson, Ogilvie, and McConnell explored the North Yukon on behalf of the Geological Survey of Canada.*
>
> *Bell established new fur trading posts, expanding the Hudson Bay Company (HBC) further West into the Yukon.*
>
> *Carmack discovered gold and staked a double discoverer's claim, which launched the Klondike Gold Rush that would shape development in the North.*

Today, Northern voices and oral histories unsettle these entrenched foundation stories, re-centering them around a new historical consciousness:

> *The Dene already called the area of Norman Wells in the Delta as 'Le Gohlini' – or 'place for where the oil is' – long before Mackenzie found oil in the ground.*[8]
>
> *Like other Northern Indigenous Peoples, the Van Tat Gwich'in established trade-based relationships long before the arrival of the fur trade to the region, brought by the Russian-American Company from the West and the Hudson's Bay Company and North West Company from the East.*


P O R C U P I N E R I V E R
OLD CROW Mts
Old Crow R.
Fishing R.
Blue Fish R.
Geological Survey Department, Canada
INDEX MAP
Shewing the ROUTES followed by The Members of the
YUKON EXPEDITION
1887-1888.
Statute Miles
Unexplored
MOUNTAINS
Athabasca District.
PACIFIC OCEAN
B R I T I S H C O L U M B I A
International Boundary
Sheet
Unexplored

The long-ago story of Tl'oo Thał, or 'Grass Pants,' relates one of the first Van Tat Gwich'in encounters with Euro-North American newcomers and humorously tells of their strange customs.[9]

Shaaw Tláa, George Carmack's Tagish-Tlingit wife (whom he re-named Kate), and her brother Keish 'Skookum Jim' Mason, have each been named as the true discoverers of gold at Bonanza Creek.[10]

While the history of Northern development as told from the South relates stories of mutual social and cultural exchange, technological development, economic benefit, self-governance, and the settling of land-claims agreements, it has also left legacies of residential schools, cultural genocide, geopolitical hegemony, and the exploitation of both land and people.

NORTHERN DEVELOPMENT

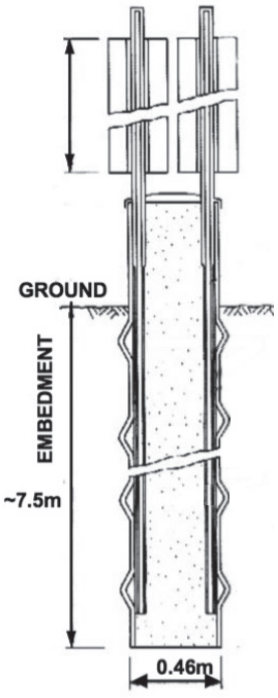


fig. 1.6 (below) Technical drawing of a thermoprobe within a pile structure used in the Trans-Alaska Pipeline System (TAPS)
fig. 1.7 (opposite) Photograph of a section of the Trans-Alaska Pipeline System, where the hot oil pipeline is raised above the ground to prevent the thawing of any ground ice below, which could in turn damage the pipeline above

A deeper look at two oil and gas developments reveals their entanglement in a series of ongoing and evolving relationships with the land. After the Klondike Gold Rush, history books written from Southern perspectives suggest that the next great Northwestern resource exploitation quest was prompted by the 1960s discovery of oil in Prudhoe Bay, on the Arctic coastal plain of Alaska.

Like many Northern First Nations, the Van Tat Gwich'in were concerned upon hearing of the proposed pipeline that would bring natural gas to Southern markets from Alaska across then-Crown lands of the North Yukon and Northwest Territories. They worried about the impact this would have on the land and on the animals, particularly the Porcupine Caribou Herd, a species at the core of Gwich'in culture, economy, and identity.[11]

The Canadian Arctic Gas Pipeline Ltd., proposed two routes from the Prudhoe fields in Alaska that would cross the North Yukon on its way to the Mackenzie Delta and then south to Alberta to supply Southern markets.[12] Unlike the Trans-Alaska Pipeline System (Alyeska), in which sections of the pipeline containing hot oil are raised on coupled thermopiles to maintain the frozen ground, the Mackenzie Valley Pipeline proposals aimed to freeze natural gas and pump it through a pipe below grade.(figs. 1.6-7) The consulted

fig. 1.8 (opposite) Stills from Ian Waddell's *The Berger Inquiry* (1977) some of the many participants in the Mackenzie Valley Pipeline Inquiry, ranging from community members to researchers to industrialists, and the community hearings in Old Crow, YT that concluded with a baseball game between the community and the visiting Inquiry and media teams

engineering experts were concerned about the reciprocal relationship between the chilled pipeline and ground, as the pipeline could freeze any unfrozen ground it passed through and cause a frost heave.[13]

At the time the pipeline was proposed, many Northern Indigenous organizations had embarked on grass roots movements to claim their rights to lands that the pipeline right-of-way crossed over. Their voices could no longer be met with silence from the Crown. In 1974, Canada's then Minister of the Department of Indian Affairs and Northern Development (DIAND), Jean Chretien, appointed Justice Thomas Berger of the Supreme Court of British Columbia to lead the Mackenzie Valley Pipeline Inquiry and negotiate the tensions between Northern and Southern interests.[14]

The commission traveled across Canada and the North the following two years, listening to hearings over the course of twenty-one months. Berger insisted that the testimony from hundreds of expert witnesses and people whose lives might be impacted by the proposed pipeline be equally weighted (fig. 1.9). The community of Old Crow participated in the Inquiry, presenting testimony and oral historical accounts, speaking, as Berger noted, "with one voice."[15] The hearings ended at two o'clock in the morning and were followed by a game of baseball, which the community of Old Crow won against the Inquiry team and CBC media party.[16]

The commission's hearings and research culminated in the publication of the report, *Northern Frontier, Northern Homeland* in which Justice Berger recommended that no pipeline be built until Northern Indigenous land-claims had been settled and that no pipeline ever be constructed in the Northern Yukon due to social, cultural, technical, and environmental concerns, and the potential consequences that any failures would have on the caribou-based economy of Old Crow.[17] While the report polarized the land as a 'frontier' and 'homeland,' it navigated a variety of concerns from North and South. At the close of the Berger Inquiry, Yukon geographer Jim Lotz contemplated the position of southern Canadians, writing:

> It is going to be hard for such people, who have chased Gold, God and Glory to the ends of the earth, to accept that the quest for redemption ends in their own minds, in the values they hold, in the assumptions they make and the concepts they have formed. The Berger and Lysyk reports may become the foundation stones for a new ethic of northern development.[18]

A decade later, circumpolar political economist Frances Abele described the


PETER LORD
Resident of Old Crow


N.W.T.


PROF. WILLIAM IRVING
Dept. of Anthropology, U. of T.


Ltd.

fig. 1.9 The media was highly involved in the Berger Inquiry, and many articles such as this one brought the voices of Northerners into the consciousness of Southerners

The Whitehorse Star, Old Crow Section, Friday, July 18, 1975, Page A

A Star Special on the Berger Pipeline Hearings at Old Crow

The Berger Inquiry hearings at Old Crow last Friday, Saturday and Sunday drew 81 witnesses in the tiny, isolated community. They don't want a pipeline and told Mr. Justice Tom Berger why.

The Old Crow People Say:

Testimony at the Old Crow community hearings of the Berger Inquiry was often repetitive, and tedious because of the repetition; the number of witnesses (81) and the necessity of translating every few sentences. Most people older than 35 or 40 years of age chose to testify in their native tongue, Loucheux, or Kutchin.

What follows is a summary of that testimony, both quoted as translated by Jim Sitlichinli of Aklavik, NWT, and paraphrased and edited for convenience.

It was humorous at times, especially when Sitlichinli translated English into English. It was sincere, but never a plea for salvation. At the most, the people of Old Crow said in effect, "Mr. Berger, we're counting on you."

Despite attempts by Arctic Gas, which visited the village on several occasions, many people were ill-informed about what the pipeline would bring, both during construction and afterwards. Many could not distinguish between oil, gasoline and natural gas because there is no difference when translated into Loucheux.

The full transcripts of the testimony given at the Old Crow hearing will be available in the Whitehorse library in about a month.

ROY ALLEN - said his main concerns are job opportunities of natives at operation and maintenance of the pipeline. He said he is presently working for Arctic Gas, who he said, "didn't want to give us an equal opportunity." He said the company guaranteed him and other natives permanent operating jobs soon after they had worked there awhile. Ten months later, the foremen tell him to mind his own business. He said white men got the jobs promised to him within a month of working there. "We know for a fact we can't rely on white man's word alone."

PETER BENJAMIN, special constable to the RCMP in Old Crow for 20 years, is worried about caribou and bird migration on the north coast, and doesn't want the pipeline on either the coast or near Old Crow.

ROBERT BRUCE, Jr. said a pipeline in the area would damage hunting and trapping areas, and maybe the fishing areas, too. He also queried, "What'll people do for jobs after three years of construction?" He said caribou are scared of any motor noise, and the people can't go up river to hunt them by boat now because the caribou leave when they hear the noise. He said a camp nearby would spoil the way of life; with more drinking homes would break up and there would be a higher population.

ABRAHAM PETER said a pipeline would mean a lot of vehicles would be grinding up the land. It would mean people would come to settle after they worked at the construction camp, and a liquor store would come in too. "That'll be the end of Old Crow."

MRS. CLARA FROST, "If they ever spoil our country, we can just sit in our houses and remember the good old days."

Gloria Nukon, 16; Christine Nukon, 15; Linda Netro, 15; Joanne Charlie, 13; and Donna Frost, 14 had this statement read to Berger by Peter Nukon: "We are against the pipeline because it might change our way of life. It will spoil the caribou that we all love to eat. It will wreck our culture. Some of us go out to the Crow flats, ratting with our fathers. We love the land. It means we can be anything we want and go anywhere where we want. We all want to go to university, and we all have to go south to school. But we want to come back to Old Crow, to see our friends again, because Old Crow is our home."

MRS. SARAH ABEL said she doesn't want to make bad friends about the pipeline, but too many people would make problems for the town. She wished Judge Berger God's blessing in his travels.

MRS. ELIJAH KASSI said she is frightened of the pipeline "just the same as it would frighten the animal that is in the land."

WINSTON MOSES: "If you keep this pipeline out, we'll have a regular (caribou) migration route and something to eat, too."

Asked by Council For Yukon Indians' lawyer Ron Veale what effects he could predict with an 800-man camp nearby, Moses said you probably couldn't find a dozen honest men among them. "You never know what evil lurks in the hearts of men," he said. Moses said the people of Old Crow would be destroyed with liquor and drugs, and that the lives of the girls in town would be wrecked.

KEN NUKON: "We are all the same. There are lots of silly Indians and lots of silly white men."

"The white men have their own country outside. They bother us. It's not that because I think too much of myself, but for the sake of my young children. It's no matter how you call it, it (the pipeline) shouldn't be around here."

MRS. JOHN CHARLIE: "Even if they put the pipeline underground, ground can crack and the pipeline, too. And destroy the land."

CHARLIE ABEL, Old Crow justice of the peace and former band chief (17 years): "I would like to see this land claim be first settled, and then the pipeline." He said the pipeline is not wanted by the people because "it would bring in many white people . . . some good people, and a lot of bad people, too."

"We talk about our land in which we were born and brought up. We love our land.

"They (the oil companies) spoiled a lotta good land where we used to trap. Later on, people saw what they did . . . Since then, they kinda stopped ploughing up the earth too much.

"The caribou now beginning to travel around where they never migrate before. Last year, we never see no caribou all winter. Only after the ice break up did the caribou come."

ELLEN CHARLIE: "I'm against the pipeline, as it will affect the people. What happens if the pipeline breaks at 60 or 70 below?...and if it breaks under the ice. It will pollute our rivers and lakes. We will surely get sickness from this."

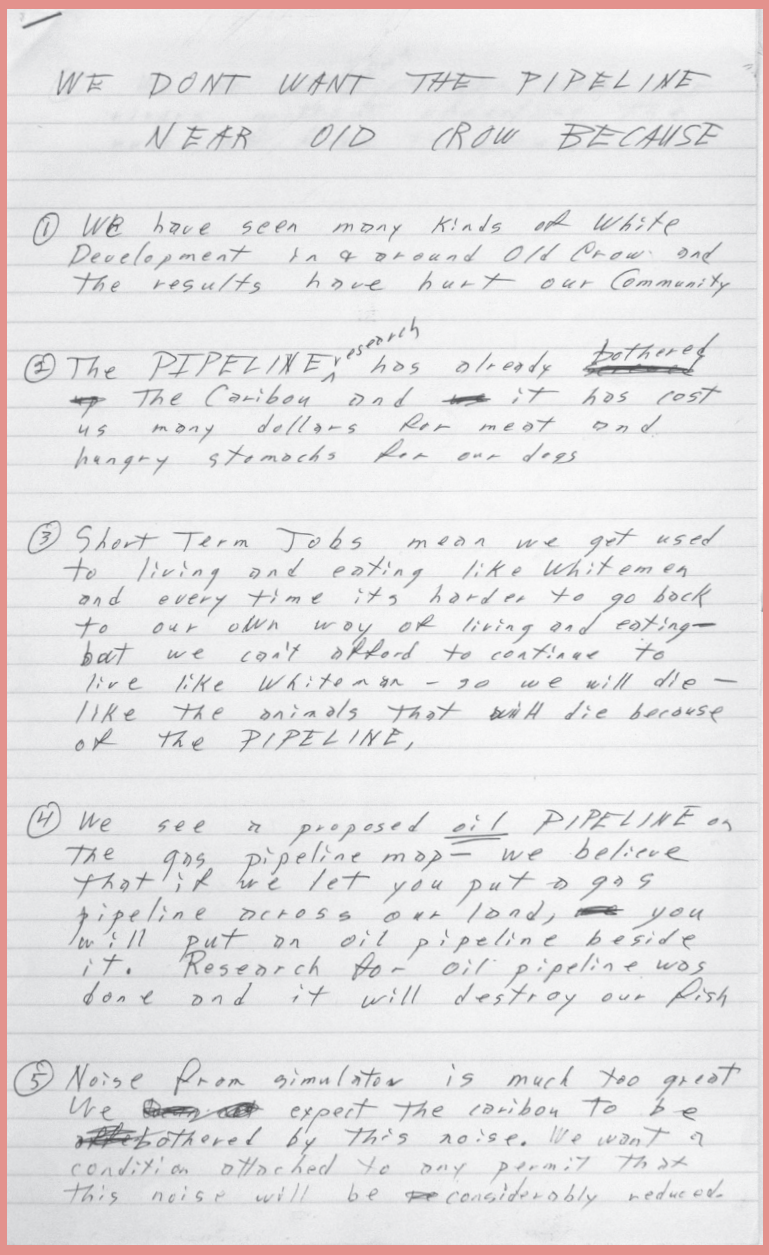
PETER LORD: "We use all this land. Everybody use it, whatever it is, the Old Crow people needs what's in it, this land. And supposing the pipeline go through here near Old Crow, that's gonna bring a lotta jobs for some people. Because we won't be very many Old Crow people get jobs on this.

"...But after that is gone, the people will be gone. They people who make the big money will probably go back down south and say 'goodbye' to Old Crow."

JOHN TIZYU: "If something happen with the proposed pipeline, it will destroy many places where the caribou migrate each year. Another thing we use very much is fish. He understand if it's going to cross rivers, it might break. And if it does, it will destroy a lot of our fish. I know it will destroy, and that is the reason why nobody is in favor of it."

LAZARUS CHARLIE: "I hear the pipeline is going to cross creeks where fish are...if it breaks, then all the land in there will be all destroyed. Also, if fire breaks out, it will not be safe for the land. We use the land very much. We don't want the lakes and creeks and rivers to be spoiled, and especially our caribou.

fig. 1.10 Notes collected by the Mackenzie Valley Pipeline Inquiry's team in Old Crow read, "We don't want the pipeline near Old Crow because..."



WE DONT WANT THE PIPELINE
NEAR OID CROW BECAUSE

(1) We have seen many kinds of White Development in & around Old Crow and the results have hurt our Community

(2) The PIPELINE research has already ~~bothered~~ The Caribou and ~~~~ it has cost us many dollars for meat and hungry stomachs for our dogs

(3) Short Term Jobs mean we get used to living and eating like Whitemen and every time its harder to go back to our own way of living and eating— but we can't afford to continue to live like Whiteman - so we will die — like the animals that ~~will~~ die because of the PIPELINE,

(4) We see a proposed oil PIPELINE on the gas pipeline map — we believe that if we let you put a gas pipeline across our land, ~~~~ you will put an oil pipeline beside it. Research for oil pipeline was done and it will destroy our fish

(5) Noise from simulator is much too great We ~~don't~~ ~~can't~~ expect the caribou to be ~~~~bothered by this noise. We want a condition attached to any permit that this noise will be ~~to~~ considerably reduced.

fig. 1.12 (below, left) The Berger Report recapitulated the information the Inquiry team had heard from the people of Old Crow about their relationship with the land

fig. 1.13 (below, right) Testimonials reveal Southern questions that try to measure Norther relatonships with the land

facilities could in turn lead to the development of oil and gas within the Arctic National Wildlife Range, as well as the Beaufort Sea Offshore Province specifically, and could influence the development of the entire Alaskan arctic coastal area including Naval Petroleum Reserve Number 4, which lies to the west of the Colville River and encompasses approximately 23 million acres. [F7462]

Moreover, construction of a pipeline along either the Coastal or the Interior Route would accelerate oil and gas exploration and development in the Yukon Territory. Thus, if the Coastal Route is used, exploration may be expected on the coastal plain and offshore, beneath the shallow waters of the Beaufort Sea. On the other hand, if the Interior Route is chosen, it would spur oil and gas exploration on the Old Crow Flats and the Eagle Plains. The latter area has already been extensively explored and some petroleum discovered.

I consider that, once a gas pipeline is built across the Northern Yukon, increased exploration is inevitable. There will be demands for a second gas pipeline and, later, a hot oil pipeline. Vern Horte, President of Arctic Gas, told the Inquiry it is likely that the whole Arctic Gas pipeline system would be looped. An oil pipeline, for at least part of its length, would be elevated rather than buried in the ground to avoid the adverse effects of the hot oil pipe in ice-rich permafrost. Also, a permanent road or roads would probably be built to service the oil pipeline and other facilities and to provide access to the energy corridor.

Man and the Land: Old Crow

The people of Old Crow are the only people who live permanently in the Northern Yukon. What does the land mean to them? When I took the Inquiry to their village, they told me that, in their view, the construction of a pipeline across the Northern Yukon would change their homeland and their way of life forever.

The Arctic Gas pipeline on the proposed Interior Route would pass between the village of Old Crow and Old Crow Flats. If this route were followed, a construction camp of 800 workers would be established near the village. The people of Old Crow do not look forward to that prospect, but, at the same time, they oppose a pipeline along the Coastal Route, because of the threat it represents to the calving grounds of the Porcupine herd on the coastal plain: they believe that the decline of the herd would undermine their way of life. Whichever route the gas pipeline takes, it may be followed by an oil pipeline, and by increased gas and oil exploration and development along the route. The people of Old Crow realize the implications of this.

The whole village told me they were opposed to the pipeline. I heard 81 people testify; virtually everyone, man and woman, young and old, spoke and they spoke with one voice. Here are the words of 21-year-old Louise Frost, who expressed the feelings of her people:

> I can see our country being destroyed and my people pushed on reservations, and the white men taking over as they please. ... The pipeline is only the beginning of all this. If it ever does come through, there will be a time when other companies will want to join in on this. Any major development that has taken place in the North has been of a rapid nature. Their only purpose in coming here is to extract the non-renewable resources, not to the benefit of northerners, but of ... southern Canadians and Americans. To really bring the whole picture into focus, you can describe it as the rape of the northland to satisfy the greed and the needs of southern consumers, and when development of this nature happens, it only destroys; it does not leave any permanent jobs for people who make the North their home. The whole process does not leave very much for us to be proud of, and along with their equipment and technology, they also impose on the northern people their white culture and all its value systems, which leaves nothing to the people who have been living off the land for thousands of years. So to put it bluntly, the process of the white man is destroying the Indian ways of life. [C1569ff.]

To assess the environmental and social impact of a pipeline across the Northern Yukon, we must understand the relation between the people of Old Crow and the land and animals.

The fall caribou hunt, when the animals migrate southward to their winter range, after they have fed and fattened on the coastal plain and the nearby mountains, has always been the most important event in the yearly cycle of the Old Crow people. They believe the pipeline will interfere with the caribou migration and break what they see is the essential link between their past and their future. Peter Charlie told the Inquiry about the caribou migration:

> People used to travel back and forth ... and in the fall after the freeze-up, the caribou would migrate up around Driftwood River, and they crossed the river there, and when the caribou does that, that means that there's going to be caribou amongst the timber country. And when they hear that, it makes the people very happy that the caribou have migrated into the timber country. Now, this migration that I am telling you about happened many, many years

start by seasons and start with the spring.

THE WITNESS: Start by seasons well we start the spring of the year, say around the first part of March. We start trapping rats. That was a? few years ago, like I can't go out now from when the season opens till it closes, because I just have so much holiday and that's it, but we hunt rats in the spring of the year. After we come down from Crow Flats then we start setting fish nets --

MR. VEALE: Just}et me interrupt you there, Stephen. Did you start to -- did you go out to the Flats this year?

THE WITNESS: Yes, I was out to the Flats this year.

MR. VEALE: How many rats did you hunt?

THE WITNESS: I got about 500.

MR. VEALE: Okay, go on then about the fish.

THE WITNESS: Yes, then we fish all we could in the summer and towards fall when the big run come, everybody is out there on the river, pretty near all hours of the day trying to prepare food and dog food for the winter.

MR. VEALE: Do you have a fish I net out on the Porcupine River now?

THE WITNESS: Yes, I have cot a fish net out now.

MR. VEALE: Do you know approximately how many fish nets are out at this time

fig. 1.14 A map showing the various pipelines proposed in the region in the 1970s, and the nearby communities that would be impacted

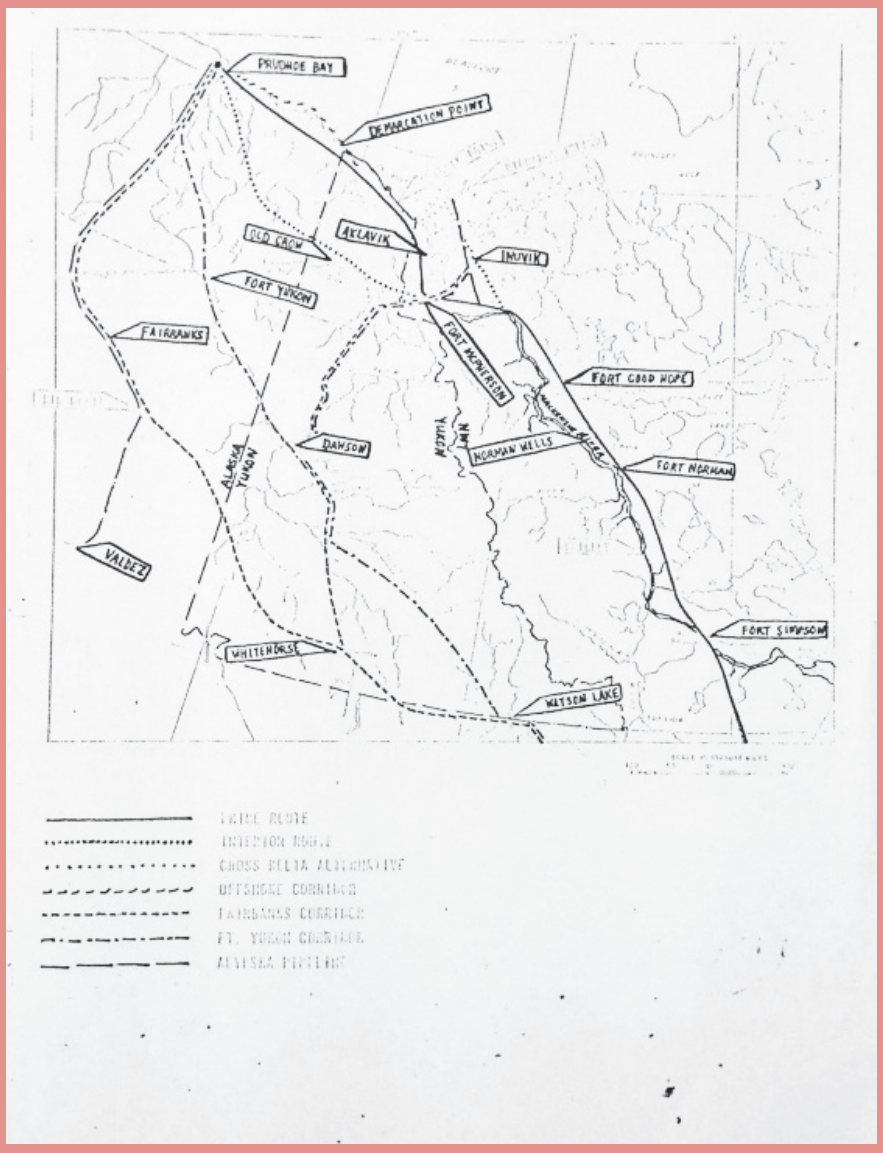


fig 1.15 (opposite) A view of the South as seen from the North depicts the coastal route of Canadian Arctic Gas Ltd.'s proposed Mackenzie Valley Pipeline, which would have had to cross varying permafrost regions, and be designed accordingly. Data sourced from: NASA Black Marble and National Snow and Ice Data Center.

significance of the Berger Inquiry in foregrounding the positions and struggles of Northern Indigenous Peoples, stating: "Probably no royal commission or public inquiry has sustained such a large and diverse audience, or provoked, years after its conclusion, such strong emotional responses."[19]

In a contemporary reflection on the Berger Inquiry and the subsequent series of land-claims agreements and designations of protected areas, Glen Coulthard describes the difficulties that many Indigenous peoples had in translating their intricate reciprocal relationships with the land into the terminology of 'property.' In describing these multiplex relationships, Coulthard notes this understanding is communicated through many testimonials. He points to the testimony of a member of the Teetł'it Gwich'in (Dene) community of Fort McPherson, noting the entwined understandings of the land that it presented: "land-as-resource central to our material survival; land-as-identity, as constitutive of who we are as a people; and land-as-relationship." Coulthard suggests that this process of 'discursive translation' has reoriented struggles for land in this region.[20]

The self-governing Vuntut Gwitchin First Nation settled their land-claims agreement with the Federal Government in 1993. Shortly after, Vuntut National Park was established in Vuntut Gwitchin traditional territory north of Old Crow. It is co-managed by the Vuntut Gwitchin Government and Parks Canada, in part to protect the migratory range of the Porcupine Caribou Herd.[21] While a pipeline has not been built across the North Yukon, there have been a number of development proposals near the region, including the Mackenzie Gas Project (MGP) in the Northwest Territories. The project involves a partnership with the Aboriginal Pipeline Group (APG) and notably has received the support of many Dene activists who opposed the 1970s version of the project.[22] The positions of people, like the land itself, can shift.

The story of the Berger Inquiry suggests that the 'North' is composed of complex and specific place-based relationships. It is also generalized as a frontier, a wilderness, and a homeland – all at once. Despite the significant work of many knowledge holders, scientists, politicians, cultural activists, and journalists to communicate the impacts of such issues as climate change, geo-political power struggles and "exploitative practices of the land and the people," the idea of 'North' conjures other images in the minds of many people in the South.[23]


VANCOUVER, BC
OTTAWA, ON
PROPOSED CANADIAN ARCTIC GAS LTD. MACKENZIE VALLEY PIPELINE (COASTAL ROUTE)
WHITEHORSE, YT
DAWSON, YT
ISOLATED PERMAFROST
SPORADIC PERMAFROST
PRUDHOE BAY, AK
DISCONTINUOUS PERMAFROST
CONTINUOUS PERMAFROST
OLD CROW, YT
INUVIK, NT

fig. 1.16 (opposite, above) Still showing then-Senator Frank Murkowski presenting a blank poster board to represent ANWR in an address to the U.S. Senate
fig. 1.17 (opposite, below) Gwich'in Elder Stephen Frost holding the intertwined antlers of two caribou who died in a deadlock. This and above still are sourced from *Locked Horns: The Fate of Old Crow* (2005).

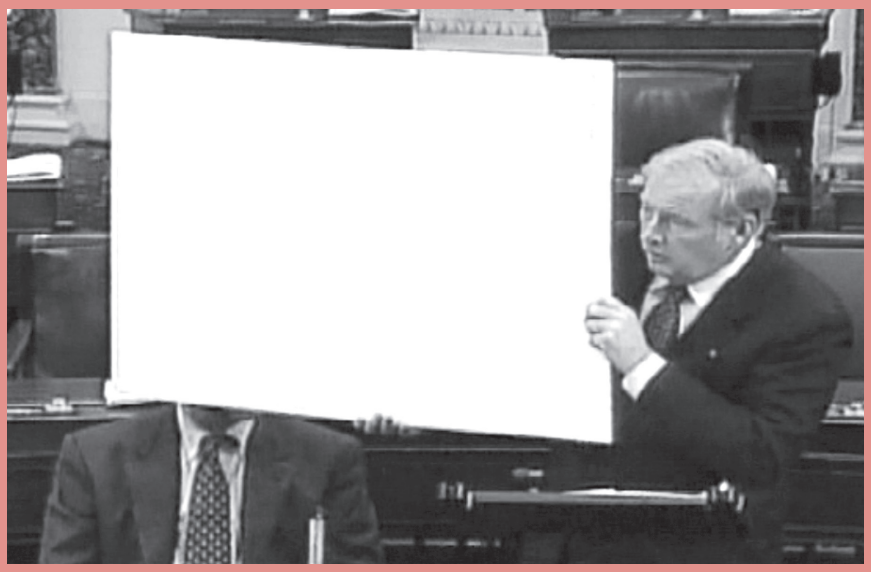
The projection of the North as a barren, empty wasteland supports the exploitation and dispossession of this 'industrial frontier,' while the depiction of a wild and untouched landscape is tied to narratives of conservation that exclude human participation. From these perspectives, people are positioned outside of natural systems. In his seminal essay, *The Trouble with Wilderness; or, Getting Back to the Wrong Nature,* the American historian William Cronon writes from a Euro-North American perspective, regretfully stating*:*

> To the extent that we celebrate wilderness as the measure with which we judge civilization, we reproduce the dualism that sets humanity and nature at opposite poles. We thereby leave ourselves little hope of discovering what an ethical, sustainable, honorable human place in nature might actually look like.[24]

In an address to the UN Climate Change Conference in Copenhagen, Gwich'in Elder Sarah James from Arctic Village, Alaska said, "I learned from living out in the wilderness, our natural world." Subhankar Banerjee, an educator, ex-scientist and ally of the Gwich'in suggests her use of wilderness points towards this 'honourable' contemporary relationship between humans and the land.[25] Although the Gwich'in have been ostensibly championed by Southern environmentalists, many of the Nation's spokespeople are self-proclaimed Indigenous and human rights advocates. Gwich'in lives and the survival of their contemporary hunting culture depend on the health of the land and the Porcupine Caribou Herd whose calving and post-calving grounds, like many creatures, are in the Arctic coastal plain. This region is known by its Gwich'in name *Ilzhik Gwats'an Gwandaii Goodlit*: the 'Sacred Place Where Life Begins,' and is recognized by the US Federal Government as the *Arctic National Wildlife Refuge.*

The area was originally protected in 1960 to preserve "unique wildlife, wilderness and recreational values." The names of the Gwich'in and Iñupiat communities that have inhabited this region were conspicuously absent from Public Land Order 2214. The US Congress renegotiated the lands in 1980, highlighting the '1002 Area' along the Arctic coastal plain and requesting a report and recommendation on oil and gas exploration and development in the area.[26]

The (mis)translation of this land from a *place* full of life to a barren *space* has saturated the rhetoric of many American politicians and industrialists who have described it as an ugly, empty, and a frozen wasteland. In a regularly cited



address to the US Senate, then-Senator Frank Murkowski held up a blank sheet of paper and stated, "This is a picture of ANWR as it exists for about nine months of the year. This is what it looks like. It's flat, it's unattractive; don't be misinformed"[27] (fig. 1.17).

While outside of their traditional territory, the land that contains the calving and post-calving grounds of the Porcupine Caribou Herd is deeply entangled with Gwich'in culture.[28] In 1988, Gwich'in leaders called a gathering of the entire Nation in Arctic Village, Alaska to address the issue and seek the advice of Elders: the *Gwich'in Niintsyaa*. The Gwich'in People spoke with one voice, passing a resolution to prohibit development in the calving and post-calving grounds of the Porcupine Caribou Herd, and have gathered biennially to re-confirm it. They continue to fight and make their resilient voices heard in the South by addressing the publics, the US Congress, and the United Nations.[29]

The impacts of industrial development are felt across the North – both directly and indirectly – and are changing the way that many Northerners interact with the land, a statement that has been communicated by many Indigenous rights activists and environmental advocates. While resource extraction processes have left their marks on the land in situ, it has been impacted by global environmental change and industrial development. Pollutants generated in the South manifest in changes in the North that can be felt on the ground: warming temperatures, melting polar ice, thawing frozen ground and increased 'Arctic haze.'[30]

UNDERLYING CONTEMPORARY RELATIONSHIPS

The South differentiates itself from the North by drawing lines: the tree line, the projected border of the Arctic Circle, the extents of the continuous permafrost zone, the line of best fit along a curve of winter design temperatures, and the lines of tables that measure social and infrastructural qualities to quantify 'North.'[31] While defined by data, each of these projected borders is in flux: the tree line is advancing north, temperatures are warming at unprecedented rates, geopolitical boundaries are being redefined, and even the border of the Arctic Circle is understood to be moving.[32]

This narrative of entangled humanity the and natural world is tied to the concept of the 'Anthropocene': the current geohistorical epoch, as defined by many scientists, which is characterized by the agency of humans in measurable geological and ecological change. Humanity's unbridled consumption of the land and its resources are identified as the actions that have brought us here. In many ways this concept also involves the drawing of lines. While major scientific bodies have yet to recognize this epoch as an official unit on the Geological Time Scale, the Anthropocene thesis is often supported by graphs whose lines of best fit identify measurable anthropogenic proxies of climate change: atmospheric carbon dioxide levels, environmental warming trends, species extinction trends.[33]

The neologism is a child of natural science thinking, born to Dutch atmospheric chemist Paul Crutzen and marine science specialist Eugene Stoermer.[34] The pair hypothesize that the period began near the end of the eighteenth century, when data extrapolated from glacial ice cores extracted from Antarctica's depths revealed an upwards inflection in the production of greenhouse gases.[35] The period coincides with the introduction of the steam engine, the advance of large scale industrial development, imperialism, and an exponential growth in the use of fossil fuels such as coal, oil and gas.[36]

In abstracting interrelationships with the land, Anthropocene thinking obfuscates the temporal and spatial origins and relationships responsible for the current climate crisis. Swedish scholars Andreas Malm and Alf Hornborg, among others, have critiqued the dominant framing of the Anthropocene in which the natural scientist's gaze is projected across all of humanity, undermining social relationships and phenomena such as world view, power and property, and their capacities to mould and engage the land. Métis scholar Zoe Todd echoes Malm and Hornborg's assertion that humanity is "far too slender an abstraction to carry the burden of culpability."[37] She critiques the Anthropocene's underlying universalizing assumptions:

> With the prevalence of the Anthropocene as a conceptual 'building' within which stories are being told, it is important to query *which* humans or human systems are driving the environmental change the Anthropocene is meant to describe.[38]

Global environmental change is not the result of innate human traits, but is a product of capital accumulation and industrial development.[39] Some critics of the Anthropocene have re-conceptualized the epoch as the 'Capitalocene'.[40]

The Anthropocene and its derivative, the Capitalocene, are often presented as meta-problems caused by the human destruction of the land to which there are no clear solutions. As the political philosopher Slavoj Žižek observes, it is easier for most people to imagine the apocalyptic end of the world than to imagine the end of capitalism.[41] However, the Anthropocene and Capitalocene concepts present geological opportunities for more responsible relationships.

Conceptually, the Anthropocene has dissolved the human-nature divide.[42] As Dipesh Chakrabarty, an Indian historian and postcolonial theorist, writes in *The Climate of history: Four Theses*, natural and human histories are related.[43] This messy comingling provides an unstable ground from which to reconsider Euro-North American society's relationships with the land. The universalizing narrative of 'human over nature' in species-thinking seems shallow, especially once re-centered and examined through the context of land and place-based relationships in the North Yukon. But what does a more responsible and honourable relationship with the land look like?

This prompt suggests a need for understanding all forms of existing relationships more deeply and practicing critical self-reflexivity before acting. The environment is not separate from where we live. When approaching a 'site,' it is important to build on the layered nature of place. This includes place-based knowledge, soil surveys, and relationships that are entangled with the land. The visiting architect can support a solid – and existing – foundation in the land, but only through listening. This could involve grounding a design in a community's own cultural vision, to ensure a project's legacy endures once the visiting architect has left.[44] Any act of touching the land responsibly should involve looking into the overlapping foundational understandings of land that are embedded in the particularities of a place.

Relationships with the land are not relegated to the occupation of the surface: critics of the Anthropocene such as Zoe Todd reveal that they are deep, multi-layered, "reciprocal, ongoing and dynamic."[45] On the first page of *Northern Frontier, Northern Homeland,* Justice Berger asks, "Should the future of the North be determined by the South?" Testimonial from across the North answered with a resounding, "No."[46] While the South depends on resources from the North, the Van Tat Gwich'in continue to fight oil and gas development that might endanger their cultural survival and participate directly in political processes. Van Tat Gwich'in relationships with the land may have shifted and

adapted, but they have maintained their foundational relationships with the land, although not without considerable efforts. Today, they are positioned to navigate the future of their lands.

A 'FROZEN' GROUND

building with permafrost

> But perhaps the most shocking of all was that the very ground beneath our feet was no longer solid.
>
> Sheila Watt-Cloutier, *The Right to Be Cold*

In Old Crow, as I reoriented myself with the bearings provided to me through conversations, I began to consider the foundation as a site of dialogue between building and land. The physical site of these foundations provided the space to ground open conversations and develop relationships with the people that built them. One of my most meaningful friendships was with respected Gwich'in Elder Stephen Frost, who spent much of his life living 'out on the land.' Now in his eighties, he continues to return. It was because of Stephen's generosity that I was able to visit the camp that he and his family, like many local residents, had built along the *Ch'oodèenjik* (trans. Quill River, but more commonly called Porcupine River in English) where it meets the *Sriinjik* (trans. Bluefish River).

We began our journey to Bluefish Camp by pushing the boat off of Old Crow's gravel beach, its shallow aluminium hull scraping over rocks exposed by the falling river.[1] The silty water embraced its metal frame, making velvety sounds beneath the water's surface. Navigating towards the Alaskan border downriver, we passed bush camps seated atop steep and eroded banks, reminders of the continuous and contemporary relationships Vuntut Gwitchin citizens have with the land.

After rounding another serpentine bend in the river, the surface of the water changed colour, announcing the confluence with another waterway. Here Stephen Frost's Bluefish Camp came into view: a collection of timber-frame structures along the river.

Earth rained down from beneath the steep bank's undercut edge as we climbed a wooden ladder to the camp. From where we climbed, a small structure seated on the edge appeared to be moving in a slow descent towards the water. Its vertical log base sat on the shifting ground where the permafrost had already melted, and looked as if it would need to be moved before the bank's impending collapse. This is not unusual: years ago, this eroded riverbank had collapsed below Bluefish Camp's first cabin, sending both the building and the ground it was founded upon into the water.

Adapting to the changing landscape, Stephen built the Camp's current cabin on firm, dry ground after the collapse of his first, locating it further away from the disintegrating shoreline (fig. 1.23). Unlike the raised cabins in Old

fig. 1.18 (above) Photograph of Stephen Frost's Bluefish Camp on the *Ch'oodèenjik* (trans. Porcupine River), with visible bank erosion below

fig. 1.19 (opposite) Cottongrass often forms in moist ground, where ice-rich permafrost can be present

fig. 1.20 (above) Bluefish Camp smokehouse made of timber harvested near the camp
fig. 1.21 (opposite) Smokehouse foundation detail of tree root

Crow, this one rests directly upon the surface of the land, its log floor embracing the soil. Stephen had carefully selected the timber for its construction from his years of experience, choosing a stand of spruce trees just a few hundred feet behind the camp as the material, felling the logs in the spring when their sap began to flow and their bark would be easiest to peel.[2]

fig. 1.22 (opposite) Stephen Frost's current cabin at Bluefish Camp built directly on the ground and made with logs harvested from within several hundred meters of the site

Many of the other buildings at Bluefish Camp are founded on the surface of the ground. The open outdoor smokehouse for curing meat sits on an earthen floor while its structure is anchored to the ground plane through the roots of a tree.

Here, the relationship between these timber structures and the soil beneath them is virtually unmediated. These buildings are engaged in an evolving dialogue with the land.

In the northern Yukon, the ground is always shifting. Soil changes with the cycle of seasons, repeating undulating patterns and eddying back on itself while moving along with time's strong current. Soil flows as gravity pulls it downhill. Soil melts as the wind blows and forms snowdrifts on its surface. Soil marks the footprints of animals, people, and buildings. Soil's surface today will become tomorrow's substrate. Soil supports the growth of plants and animals, growing with their deposits. Soil is both a historical and geological archive and a living body.[3]

Vasily Dokuchaev, a Russian geologist, is believed to have founded the discipline of soil science in the late 1800s.[4] This marked a shift in the scientific understanding of soil, moving away from its depiction as a passive residue of the process of erosion by the 'tooth of time,' to a living and developing 'body.'[5]

In the contemporary scientific community, soil is often considered a dynamic natural body defined in relation to climate, organisms, topography, parent material, and time.[6] It might be maimed or nourished by anthropogenic deposits. By comparison, in the Euro-Western Academy architectural discourse, *Forensic Architecture*'s co-founder Eyal Weizman positions the earth's surface as a "thick fabric of complex relations, associations, and chains of actions" that "overflows any map that tries to frame it, because there are always more connections to be made."[7] Soil is alive and dynamic. This also holds true in the *continuous permafrost zone*, where the shifting ground plane proves challenging to build with (fig. 1.24).

My first visit to Bluefish Camp took place in late summer. Here, the un-

setting polar sun was ripening the season's fruit. Soon after arriving at the camp, we went to check on the berries at a place he knew well. We walked to a clearing, treading carefully over the brush below. The ground plane was soft beneath our feet, retaining the form of our footsteps momentarily on its surface that was swollen with moisture before rebalancing itself. This was good berry growing ground, supporting the growth of *lidii masgit* / Labrador tea, *jak zraii* /blueberries and *nakàł* / salmonberries (figs. 1.25-27).

'Permafrost' – ground that remains frozen through two consecutive winters – is often found beneath moist top soil, where plants such as Labrador tea like to grow.[8] It can be virtually impermeable to water, allowing moisture to gather on its surface from summer rain, melted snow, and ground ice. This moisture supports ecosystems, affecting vegetation, insects, birds, and other forms of life.[9]

As we walked lightly across the ground plane that was coloured red and orange with berries, I wondered how far the permafrost was below our feet. The surface of the ground that we touched as we walked is called the 'active layer.' Here the ground can freeze and thaw seasonally and support the life of plants from lichen to trees depending on many factors including the active layer's depth.[10] As ice-rich permafrost melts, the active layer deepens and receives the released moisture from below, impacting surface and groundwater drainage.[11] Permafrost thaw can weaken the ground and alter the landscape. What was once solid ground can slump, hills become vulnerable to erosion and landslides, forests can become destabilized, and wetlands can drain or evaporate. Less water content supports fewer plants who feed fewer animals. This relationship necessarily extends to humans, making it more difficult to find food and water in regions where permafrost has disappeared.[12]

At Stephen's camp, *nakàł* / salmonberry plants grow low to the ground and lift their heavy berries up to the sun. Picking these berries requires a gentle and attentive hand. We mindfully harvested from the patch, making sure to tug gently on the ripest fruit to see if they would willingly release from the plants. We had learned to do this so as not to pull up their roots, leaving the vegetation to grow and unpicked berries to seed so that they might offer people their berries again the next year. Even once these plants have died, their roots will remain. Temperatures are so low that they do not fully decompose, but are slowly pushed down and frozen into the permafrost through the process of

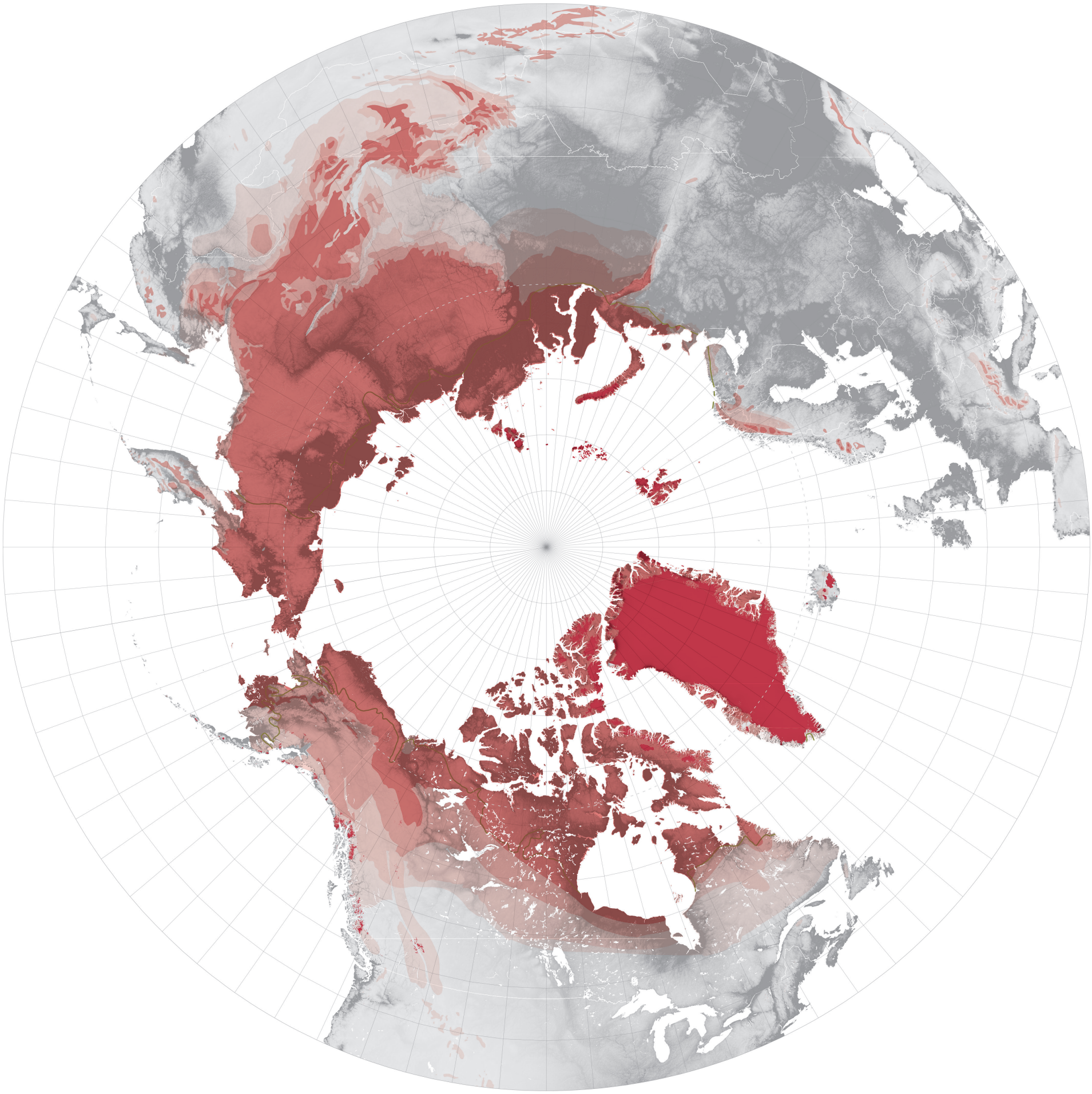


fig. 1.23 Map showing circum-Arctic permafrost and ground ice conditions reveals that permafrost underlies much of the 'North,' but its distribution is not uniform.

fig. 1.24 Picking *lidii masgit* (trans. Labrador tea), a plant that likes to grow in moist soils, for tea

fig. 1.25 Berry picking *nakàt* (trans. salmonberries), growing in moist spongey ground

fig. 1.26 Detail of picked *nakàt* (trans. salmonberries)

fig. 1.27 Tussocks create a bumpy, semi-frozen ground that can be difficult to walk on

'cryoturbation.'[13]

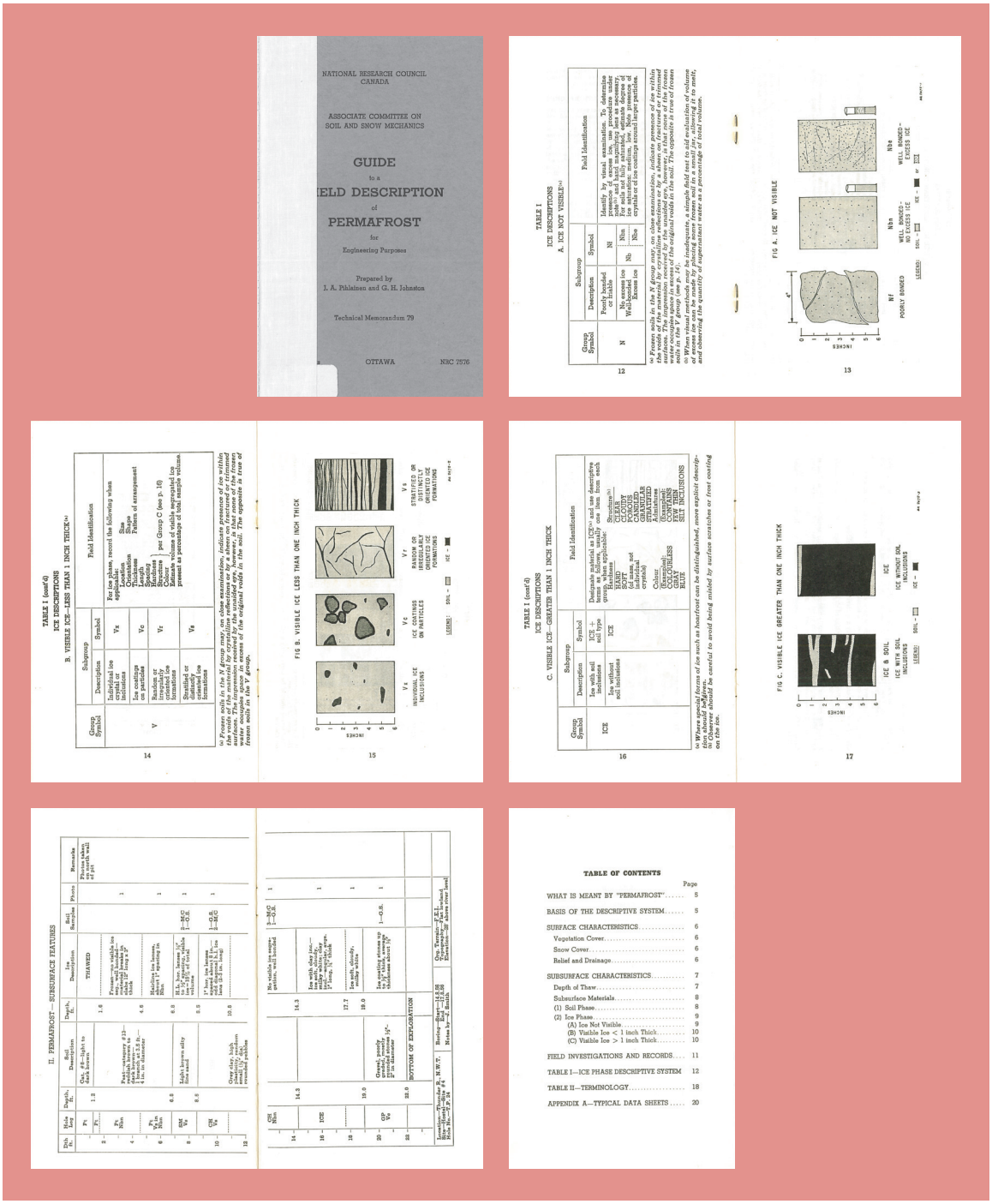
When we returned to camp with our harvest, we sat by the fire cleaning the berries, and Stephen told us trapping stories of time he had spent out in the bush and at his cabin. We talked of animals and ice jams this camp had seen and the land that Stephen has traveled in many ways: dog sled, boat, snow machine, and helicopter. Well-traveled routes may be changing, but people are adapting as relationships with the land endure.[14]

fig. 1.28 (opposite, left) Detail of permafrost core sample of Dempster Highway with ice lenses from the Yukon Research Centre

A similar change is observable across the North. As Arctic temperatures begin to rise with accelerating warming trends, the permafrost is melting; the permafrost table in many places now ends deeper beneath the surface of the ground.[15] Today, the Arctic is one of the fastest warming regions on the planet. Within Canada alone, this part of the North is warming at nearly twice the rate of the country's South.[16] In the Northern Yukon, winters are warming faster. Average temperatures during this season have raised by four degrees Celsius in the past 50 years.[17] Many scientists attribute this thermal increase directly to climate change, and believe that permafrost thaw, in return, contributes to warming trends. As permafrost melts, the large stores of frozen organic material it contains begins to thaw. This organic matter, which can date back to the last ice age in certain regions of the North, once acted as a carbon sink.[18] As it thaws and decomposes, this material releases large amounts of carbon dioxide and methane into the atmosphere.[19] According to Northwest Territories Geological Survey member Kumari Karunaratne, this process creates a positive feedback loop: climate change leads to permafrost degradation, releasing emissions such as carbon and methane, increasing the rate of climate change.[20]

The consequences of permafrost thaw are widespread for human and non-human communities alike. The thawing of permafrost can impact the hydrology of northern ecosystems, increasing or decreasing moisture in the ground and draining lakes.[21] While frozen permafrost provides a firm foundation to build upon, when fine-grained frozen soils melt, it loses strength. In these cases, soil surfaces might even subside as the underlying material 'flows' under its weight as water is released. Tundra can even be considered 'land floating on ice.'[22] Permafrost and ground ice lend particular qualities to the terrain in which they are present.

The ground in the Northern Yukon is peppered with terrain features that



NATIONAL RESEARCH COUNCIL
CANADA

ASSOCIATE COMMITTEE ON
SOIL AND SNOW MECHANICS

GUIDE
to a
ELD DESCRIPTION
of
PERMAFROST
for
Engineering Purposes

Prepared by
J. A. Jahlainen and G. H. Johnston

Technical Memorandum 79

OTTAWA NRC 7576

TABLE I
ICE DESCRIPTIONS
A. ICE NOT VISIBLE[a]

Group Symbol	Subgroup Description	Subgroup Symbol		Field Identification
N	Poorly bonded or friable	Nf		Identify by visual examination. To determine presence of excess ice, use procedure under ice with soil inclusions, Table I, Group V. For soils not fully saturated, estimate degree of saturation from presence of ice lenses, ice crystals or ice coatings around larger particles.
	No excess ice Well bonded	Nb	Nbn	
	Excess ice		Nbe	

[a] *Frozen soils in the N group may, on close examination, indicate presence of ice within the voids of the material by crystalline reflections or by a sheen on fractured or trimmed surfaces. The interstitial ice is invisible to the naked eye. The material exists as frozen soil with water occupying space in excess of the original voids in the soil. The opposite is true of frozen soils in the V group.*

[b] *When visual methods may be inadequate, a simple field test to aid evaluation of volume of excess ice can be made by placing some frozen soil in a small jar, allowing it to melt, and observing the quantity of supernatant water as a percentage of thaw volume.*

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FIG A. ICE NOT VISIBLE

Nf
POORLY BONDED

Nbn
WELL BONDED -
NO EXCESS ICE

Nbe
WELL BONDED -
EXCESS ICE

LEGEND: SOIL - ☐ ICE - ■ or ▤

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TABLE I
ICE DESCRIPTIONS
B. VISIBLE ICE—LESS THAN 1 INCH THICK[a]

Group Symbol	Subgroup Description	Subgroup Symbol	Field Identification
V	Individual ice crystal or inclusions	Vx	For ice phase, record the following when applicable: Size Shape Pattern of arrangement
	Ice coatings on particles	Vc	
	Random or irregularly oriented ice formations	Vr	Orientation Hardness Length Thickness Colour per Group C (see p. 16)
	Stratified or distinctly oriented ice formations	Vs	Estimate volume of visible segregated ice present as percentage of total sample volume.

[a] *Frozen soils in the V group may, on close examination, indicate presence of ice within the voids of the material by crystalline reflections or by a sheen on fractured or trimmed surfaces. The interstitial ice is invisible to the naked eye. The material exists as frozen soil with water occupying space in excess of the original voids in the soil. The opposite is true of frozen soils in the V group.*

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FIG B. VISIBLE ICE LESS THAN ONE INCH THICK

Vx
INDIVIDUAL ICE INCLUSIONS

Vc
ICE COATINGS ON PARTICLES

Vr
RANDOM OR IRREGULARLY ORIENTED ICE FORMATIONS

Vs
STRATIFIED OR DISTINCTLY ORIENTED ICE FORMATIONS

LEGEND: SOIL - ☐ ICE - ■

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TABLE I (cont'd)
ICE DESCRIPTIONS
C. VISIBLE ICE—GREATER THAN 1 INCH THICK

Group Symbol	Subgroup Description	Subgroup Symbol	Field Identification
ICE	Ice with soil inclusions	ICE + soil type	Designate material as ICE[a] and use descriptive terms as follows, usually one item from each group, where applicable: Structure[b]: CLEAR CLOUDY POROUS CANDLED LAMINATED STRATIFIED Hardness HARD SOFT (applies to soft crystals) Colour: COLOURLESS GREY BLUE Abundance CONTAINS FILLED WITH SILT INCLUSIONS
	Ice without soil inclusions	ICE	

[a] *Where special forms of ice such as hoarfrost can be distinguished, more explicit descriptions should be given.*

[b] *Observers should be careful to avoid being misled by surface scratches or frost coating on the ice.*

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FIG C. VISIBLE ICE GREATER THAN ONE INCH THICK

ICE & SOIL
ICE WITH SOIL INCLUSIONS

ICE
ICE WITHOUT SOIL INCLUSIONS

LEGEND: SOIL - ☐ ICE - ■

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II. PERMAFROST—SUBSURFACE FEATURES

Hole No.	Depth, Ft.	Soil Log	Depth, Ft.	Soil Description	Ice Description	Sample No.	Remarks
		Pt		Pt	THAWED		
	1.3	Clay, grey-light to dark brown	1.6				
		Peat—watery grey fibrous matter, wood fragments, roots, 1/2" to 1" thick	4.5	Peat—watery, grey fibrous matter, wood fragments, roots, 1/2" to 1" thick	Pleasant—no visible ice crystals, soil bonded in ice, 1/2" thick	1	
	6.8	Silt, brown, silty fine sand	6.9	Silt, brown, silty fine sand	Hardness: soft Structure: clear ice, few bubbles	1	
	8.6	Silt, brown, fine sandy	8.9	Silt, brown, fine sandy	15 % ice lenses, 1/8" to 1/2" thick, 20° to horizontal	2—MC 1—O.E.	
			10.8	1" bed, ice lenses and segregated ice, 1 % ice, 1/8" to 1/2" thick	1" bed, ice lenses and segregated ice, 1 % ice, 1/8" to 1/2" thick	1—O.E. 1—MC	

Hole No.	Depth, Ft.	Soil Log	Depth, Ft.	Soil Description	Ice Description	Sample No.	Remarks
CH Silt	14.3		14.3		No visible ice crystals, soil bonded	1—MC 1—O.E.	
ICE	14.3		17.7		Ice with clay inclusions—some white, clear ice crystals, 1/4" to 3/4" thick	1	
	17.7		19.0		Ice with, chiefly, milky white	1	
GW Vs	19.0		19.8	Gravel, sandy gravelly cobbles, 3" in diameter	Impurities thrown up in 1/4" thick, wavy to distorted wavy bands	1—O.E.	
	19.8			BOTTOM OF EXPLORATION			

Location—Sample #, M.W.T.
Elev. Ground—Date
Boring—Elev. 114.98
Hole No.—Date 7-7-48
Rotary—Elev. 117.26
Hole No.—Date 7-14-48

Geo. Turner—P.E.I.
Tidewater—Ice Sediment
Tidewater—Ice Sediment

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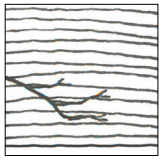
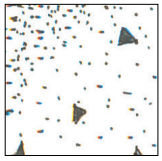
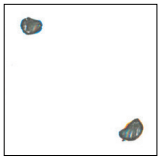


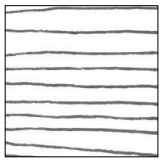
active layer



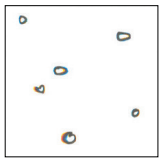
gravel



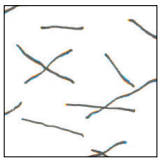
rocks



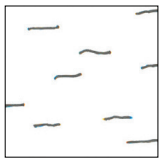
permafrost



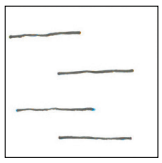
suspended cryostructure



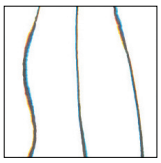
reticulate cryostructure



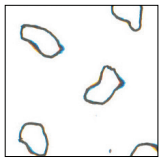
microlenticular cryostructure



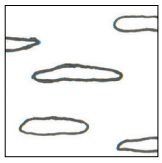
lenticular cryostructure



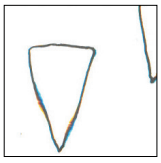
ice veins



porous visible cryostructure



ice lenses



ice wedges

fig 1.29 (opposite) Scans from the National Research Council of Canada's Associate Committee on Soil and Snow Mechanics' book, *The Guide to the Field Description of Permafrost for Engineering Purposes* (1962) showing graphic standards for representing various forms of permafrost, including invisible ice in soils
fig 1.30 Soil hatches for representing permafrost adapted from *The Guide to the Field Description of Permafrost for Engineering Purposes*

hint at the presence of ice below. When the ground's surface freezes to a much lower temperature than the underlying soil, it can heave and form intersecting cracks. These deep vertical cracks can fill with spring melt water. When it reaches down to the permafrost, the water freezes, becoming a thin wedge of clear ice that grows each season, forming striations that reveal its age much like the rings of a tree. Eventually, these cracks can form a network, leaving a distinctive pattern of polygonal ground over ten meters across on the ground's surface that can be seen from the air.[23]

Thousands of shallow lakes riddle the Old Crow Flats region of Vuntut Gwitchin traditional territory, supporting both wildlife and contemporary Gwich'in hunter culture.[24] These bodies of water, known as thermokarsts lakes, were formed when the ground gave way and subsided following the melt of underlying ground ice.[25] When ice melts and the ground settles unevenly, frost action can push large groups of small lumps of soil up, stippling the land's surface.[26]

Within the boreal forest, some trees lean as though they have been pushed over. The freezing and thawing of the active layer above permafrost can dislocate trees above, leaving 'drunken' forests. Active layer movement can create other slump features. Slope instability and the rapid mass movement of soils on hillsides, such as landslides, can be identified from the air, revealing the presence of ice-rich permafrost.[27]

Many of these permafrost terrain features are found near Old Crow. The community exists in the 'continuous permafrost zone' but some of the soil here is melting.[28] Warmed by a shifting climate and heat produced by sedentary buildings, ground that once provided a 'stable' grounding now moves. This changing layer might prompt the detachment of the active surface layer of the ground, causing landslides and erosion. Other communities at similar latitudes are experiencing problems with foundations due to melting permafrost. Pile foundations in some places must reach deeper into the ground to find the stability they require. In Inuvik, NT, construction crews have had to adapt from a standard of six meters below the earth to more than twice that depth, in order to find stable substratum.[29]

Permafrost terrain and its dynamic nature presents many challenges for anyone wishing to build with it. As the land continues to shift, many foundations must either dig deeper or tolerate more movement.

NOTES – LAND LEXICON

1. Arvind Phukan, *Frozen Ground Engineering* (Toronto: Prentice-Hall, 1985), 299.
2. Canadian Standards Association, *Moderating the Effects of Permafrost Degradation on Existing Building Foundations* (Mississauga, ON: Canadian Standards Association, 2014), 9.
3. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015* (Ottawa, ON: National Research Council of Canada, 2015), 1-4.
4. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation* (Mississauga, ON: Canadian Standards Association, 2010), 86.
5. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015*, 1-4.
6. Ibid., 1-4.
7. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: a Guideline for Climate Change Adaptation*, 10.
8. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015*, 1-5.
9. Ibid., 1-5.
10. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*, 86.
11. Canadian Standards Association, *Moderating the Effects of Permafrost Degradation on Existing Building Foundations*, 10.
12. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015*, 1-6
13. Ibid., 1-6.
14. Ibid., 1-6.
15. Ibid., 1-6.
16. Ibid., 1-6.
17. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*, 87.
18. Ibid., 87.
19. Phukan, *Frozen Ground Engineering*, 299.

20. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*, 87.

21. Phukan, *Frozen Ground Engineering*, 299.

22. Ibid., 299.

23. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015,* 1-8.

24. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*, 87.

25. Ibid., 87.

26. Vine Deloria Jr., "Power and Place Equal Personality," in *Power and Place: Indian Education in America*, ed. Vine Deloria Jr. and Daniel Wildcat (Golden, Colo.: Fulcrum Publishing, 2001), 23.

27. Thank you to Allan Benjamin for first suggesting this as an important term to be included in this lexicon and to Stanley Njootli Sr., Joel Peters, and Sophia Flather for confirming its orthography.

28. Phukan, *Frozen Ground Engineering*, 299.

29. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*, 99.

30. Phukan, *Frozen Ground Engineering*, 299.

31. Ibid., 299.

32. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015*, 1-10.

33. Glen Coulthard, *Red Skin, White Masks: Rejecting the Colonial Politics of Recognition* (Minneapolis: University of Minnesota Press, 2014), 61.

34. Phukan, *Frozen Ground Engineering*, 299.

35. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015*, 1-11.

36. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*, 88.

37. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015*, 1-11.

38. Ibid., 1-12.

39. Coulthard, *Red Skin, White Masks : Rejecting the Colonial Politics of Recognition*, 175.

40. Standards Council of Canada, and Bureau de Normalisation du Québec, *National Standard of Canada: Geotechnical Site Investigations for Building Foundations in Permafrost Zones* (Québec, QC: Bureau de normalisation du Québec, 2017), 9.

41. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*, 89.

42. S A Harris et al., *Glossary of Permafrost and Related Ground-Ice Terms* (Ottawa, ON: National Research Council of Canada, 1988), 88.

43. Ibid., 89.

44. Canadian Standards Association, *Thermosyphon Foundations for Buildings in Permafrost Regions* (Mississauga, ON: Canadian Standards Association, 2014), 11.

NOTES – A LIVING LAND

Epigraph

Sarah James, "We are the ones who have everything to lose," in *Arctic Voices : Resistance at the Tipping Point*, ed. Subhankar Banerjee (New York: Seven Stories Press, 2012), 260.

Thomas Berger, *Northern Frontier, Northern Homeland: The Report of the Mackenzie Valley Pipeline Inquiry* (Ottawa, ON: Minister of Supply and Services Canada, 1977), 1.

1. Vuntut Gwitchin First Nation and Shirleen Smith, *People of the Lakes: Stories of Our Van Tat Gwich'in Elders* (Edmonton: University of Alberta Press, 2009), xli-xlv.

2. As previously mentioned, artifacts have been found that have dated human inhabitation of this territory back 24,000 years.

3. This and all other translations, unless otherwise specified, from Vuntut Gwitchin First Nation and Smith, *People of the Lakes* and/or verified by Megan Williams (Heritage Manager, Heritage Branch, Vuntut Gwitchin Government), personal communication, 2017. For historical information about the foundation of Old Crow see Vuntut Gwitchin First Nation and Smith, *People of the Lakes*, lxi.

4. Glen Coulthard, *Red Skin, White Masks: Rejecting the Colonial Politics of Recognition* (Minneapolis: University of Minnesota Press, 2014), 60-61.

5. Coulthard, *Red Skin, White Masks*, 62-78. The term "settler normativity" was introduced in Chris Lee, "This Was Written on Stolen Indigenous Land," *Decolonizing Design* (September 2016), http://www.decolonisingdesign.com/guest-contributions/2017/guest-post-this-was-written-on-stolen-indigenous-land/#5.

6. See the use of Papaschase Cree scholar Dr. Dwayne Donald's term "web of relationships" in Zoe Todd, "Indigenizing the Anthropocene," in *Art in the Anthropocene: Encounters Among Aesthetics, Politics, Environments and Epistemologies*, ed. Heather Davis and Étienne Turpin (London: Open Humanities Press, 2015), 241–54.

7. Margaret Atwood outlines these motifs and notes the intolerable angst communicated by the central theme of survival. Margaret Atwood, *Survival : A Thematic Guide to Canadian Literature* (Toronto: House of Anansi Press, 1972), 42.

8. Mackenzie River Basin Board, *The Mackenzie River Basin State of the Aquatic Ecosystem Report 2003* (Fort Smith, NT: Mackenzie River Basin Board Secretariat, 2003), 171.

9. This and previous historical note from Vuntut Gwitchin First Nation and Smith, *People of the Lakes,* xlvii.

10. Sherrill Grace, *Canada and the Idea of North* (Montreal: McGill-Queen's University Press, 2001), 90-98.

11. Vuntut Gwitchin First Nation and Smith, *People of the Lakes,* lxi-lxii.

12. The longest of which was 3860km and would be the largest engineered project in the world if completed. Their competitors, Foothills Pipe Lines Ltd. proposed a shorter pipeline from the Mackenzie Delta to Alberta.

13. Berger, *Northern Frontier, Northern Homeland*, 36,47-48.

14. See for example the Committee for Original People's Entitlement (COPE), or the Indian Brotherhood of the Northwest Territories. "Berger Inquiry," First Nations and Indigenous Studies, University of British Columbia, accessed June 2, 2017, http://indigenousfoundations.arts.ubc.ca/berger_inquiry/. See also Coulthard, *Red Skin, White Masks*, 59.

15. Justice Berger states, *"I heard 81 people testify; virtually everyone, man and woman, young and old, spoke and they spoke with one voice."* Berger, *Northern Frontier, Northern Homeland*, 36.

16. The final score of the baseball game was twenty to six. Ian Waddell, *The Berger Inquiry*, 1975.

17. Berger, *Northern Frontier, Northern Homeland*, xiii-xxiv.

18. Jim Lotz, "Northern Pipelines and Southern Assumptions," *Arctic* 30, no. 4 (December 1977): 199–204.

19. Frances Abele, "The Berger Inquiry and the Politics of Transformation in the Mackenzie Valley" (PhD diss., York University, 1983), 1. Quoted in Coulthard, *Red Skin, White Masks*, 59.

20. Coulthard writes, "Any cursory glance at the testimony made by Indigenous participants at the Berger Inquiry clearly demonstrates the significance of land in our critique of colonial development." Part of the testimony reads, "If our Indian nation is being destroyed so that poor people of the world might get a chance to share this world's riches, then as Indian people, I am sure that we would seriously consider giving up our resources. But do you really expect us to give up our life and our lands so that those few people who are the richest and most powerful in the world today can maintain their own position of privilege? That is not our way. I strongly believe that we do have something to offer your nation, however, something other than our minerals. I believe it is in the self-interest of your own nation to allow the Indian nation to survive and develop in our own way, on our own land. For thousands of years we have lived with the land, we have taken care of the land, and the land has taken care of us." See Coulthard, *Red Skin, White Masks*, 62.

21. Vuntut Gwitchin First Nation and Smith, *People of the Lakes,* xxxiii.

22. Coulthard, *Red Skin, White Masks*, 76.

23. Alessandra Ponte, "Journey to the North of Quebec: Understanding (McLuhan's) Media," in *The House of Light and Entropy*, (London: Architectural Association, 2014), 136.

24. William Cronon, "The Trouble with Wilderness; or, Getting Back to the Wrong Nature," in *Uncommon Ground Rethinking the Human Place in Nature*, ed. William Cronon, (New York: W. W. Norton & Company, 1995) 69-90.

25. Subhankar Banerjee, *Arctic Voices* (New York: Seven Stories Press, 2012), 13-15.

26. Mark Nuttall, "Alaska's Arctic National Wildlife Refuge Debate," *Indigenous Affairs*, no. 2 (2006): 8–11.

27. Banerjee, *Arctic Voices*, 6-7.

28. The Iñupiat have relied on subsistence hunting from the ocean, and have supported on-land development in the area.

29. Jonathon Solomon, "Testimony Before the US Congress," in *Arctic Voices : Resistance at the Tipping Point*, ed. Subhankar Banerjee (New York: Seven Stories Press, 2012), 254-260.

30. Banerjee, *Arctic Voices*, 8-9.

31. Louis-Edmond Hamelin, *Canadian Nordicity: It's Your North, Too* (Montréal: Harvest House, 1978), 70-80.

32. Charles Stankievech, *Magnetic Norths*, Leonard and Bina Ellen Art Gallery, 2010.

33. Reinhold Martin, "Visualizing Change : The line of the Anthropocene," in *The Underdome Guide to Energy Reform*, ed. Janette Kim and Erik Carver (New York: Princeton Architectural Press, 2015), 22-29.

34. Crutzen went on to write an article "The geology of mankind" in *Nature* in 2002. This is a reference to Paul Crutzen, and Eugene Stoermer, "The 'Anthropocene'," *International Geosphere–Biosphere Programme (IGBP) Newsletter*, no. 41 (May 2000): 17–18.

35. Will Steffen, Paul Crutzen, and John McNeill, "Editorial," AMBIO: A Journal of the Human Environment 36, no. 8 (2007): 613.

36. Crutzen and Stoermer, "The 'Anthropocene'." Martin, "Visualizing Change : The line of the Anthropocene," 22-29.

37. Andreas Malm, and Alf Hornborg, "The Geology of Mankind? a Critique of the Anthropocene Narrative," *The Anthropocene Review* 1, no. 1 (2014): 62-69.

38. Todd, "Indigenizing the Anthropocene," 244.

39. See the overlapping criticisms of the "Anthropocene argument" by Jason Moore in *Capitalism in the Web of Life* and Andreas Malm in *Fossil Capital. See also Naomi Klein's This Changes Everything,* "We are stuck because the actions that would give us the best chance of averting catastrophe — and would benefit the vast majority — are extremely threatening to an elite minority that has a stranglehold over our economy, our political process, and most of our major media outlets."

40. While the term "Capitalocene" has been leveraged by Donna Haraway, Jason Moore, and Alf Hornborg, it has been attributed to Andreas Malm. See also the overlapping criticisms of the "Anthropocene argument" by Jason Moore in *Capitalism in the Web of Life* and Andreas Malm in *Fossil Capital.*

41. Martin, "Visualizing Change : The line of the Anthropocene," 27.

42. Although in Western thinking a hierarchy of human agency over non-human agency often remains.

43. Dipesh Chakrabarty, "The Climate of History: Four Theses," *Critical Inquiry* 35, no. 2 (January 2009): 197–222.

44. Dr. Patrick Reid Stewart, an architect, a professor, a member of the Nisga'a First Nation and the Chair of the RAIC Indigenous Task Force describes his practice as a visiting architect, which involves grounding a design in a community's cultural vision to ensure the project's legacy endures once the architect has left. See Samantha Wright Allen, "Aboriginal architect hosting lecture at library," *The Prince George Citizen*, October 11, 2016, http://www.princegeorgecitizen.com/news/local-news/aboriginal-architect-hosting-lecture-at-library-1.2363045.

45. Todd, "Indigenizing the Anthropocene," 251.

46. Berger, *Northern Frontier, Northern Homeland*, 1.

NOTES – A 'FROZEN' GROUND

1. Parts of this essay appeared in an article I wrote for *The Site Magazine* in direct consultation with VGFN and Gwich'in Elder Stephen Frost.

2. Stephen Frost (Gwich'in Elder), discussion with the author, July 2016.

3. Seth Denizen, "Three Holes in the Geological Present," in *Architecture in the Anthropocene : Encounters Among Design, Deep Time, Science and Philosophy*, ed. Étienne Turpin (Ann Arbor: Open Humanities Press, 2013), 43.

4. Alfred E Hartemink, "The Depiction of Soil Profiles Since the Late 1700s," *Catena* 79, no. 2 (November 15, 2009): 117, https://doi.org/10.1016/j.catena.2009.06.002.

5. Denizen, "Three Holes in the Geological Present," 36.

6. Nyle C. Brady and Ray R. Weil, *The Nature and Properties of Soils* (Upper Saddle River, N.J.: Pearson Education, 2008).

7. Eyal Weizman, *Forensic Architecture: Notes From Fields And Forums* (Ostfilldern: Hatje Cantz Verlag, 2012), 6-7.

8. Environment Division, Department of Environment and Natural Resources Government of the Northwest Territories, *A Homeowner's Guide to Permafrost in the Northwest Territories* (Yellowknife, NT: Government of the Northwest Territories, 2015), 9.

9. "Climate and Frozen Ground," National Snow and Ice Data Center, accessed January 12, 2017, https://nsidc.org/cryosphere/frozenground/climate.html.

10. Elizabeth Kolbert, "The Climate of Man I," *The New Yorker*, April 25, 2005, https://www.newyorker.com/magazine/2005/04/25/the-climate-of-man-i.

11. Bronwyn Benkert et al., *Old Crow Landscape Hazards* (Whitehorse, YT: Northern Climate ExChange, Yukon Research Centre, Yukon College, 2016).

12. National Snow and Ice Data Center, "Climate and Frozen Ground."

13. Kolbert, "The Climate of Man I."

14. "Facing the change: Old Crow stays resilient as the northern Yukon heats up," *CBC Radio*, October 7, 2016, http://www.cbc.ca/player/play/2695975858/.

15. Watt-Cloutier, *The Right to Be Cold*, 191

16. E J Bush et al., "An Overview of Canada's Changing Climate," in *Canada in a Changing Climate Sector Perspectives on Impacts and Adaptation*, ed. F J Warren and D F Lemmen (Ottawa, ON: Government of Canada, 2014), 26.

17. "Facing the change: Old Crow stays resilient as the northern Yukon heats up," *CBC Radio*.

18. National Snow and Ice Data Center, "Climate and Frozen Ground."

19. Kolbert, "The Climate of Man I."

20. "'It scares me': Permafrost thaw in Canadian Arctic sign of global trend," *CBC North*, April 7, 2017, http://www.cbc.ca/news/canada/north/it-scares-me-permafrost-thaw-in-canadian-arctic-sign-of-global-trend-1.4069173.

21. Bush et al., "An Overview of Canada's Changing Climate," 37.

22. Thomas Berger, *Northern Frontier, Northern Homeland: the Report of the Mackenzie Valley Pipeline Inquiry*. (Ottawa, ON: Minister of Supply and Services Canada, 1977), 35.

23. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation* (Mississauga, ON: Canadian Standards Association, 2010), 10.

24. Brent B. Wolfe et al., "Environmental Change and Traditional use of the Old Crow Flats in Northern Canada: An IPY Opportunity to Meet the Challenges of the New Northern Research Paradigm," *Arctic* 64, no. 1 (2011): 130.

25. S A Harris et al., *Glossary of Permafrost and Related Ground-Ice Terms* (Ottawa, ON: National Research Council of Canada, 1988), 88.

26. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*, 89.

27. Ibid., 12.

28. National Atlas of Canada, *Canada Permafrost*, MCR 4177, (ed. 5), 1995, National Research Canada, https://doi.org/10.4095/205314.

29. "'It scares me': Permafrost thaw in Canadian Arctic sign of global trend," *CBC North*.

PART 02

GROUNDWORKS

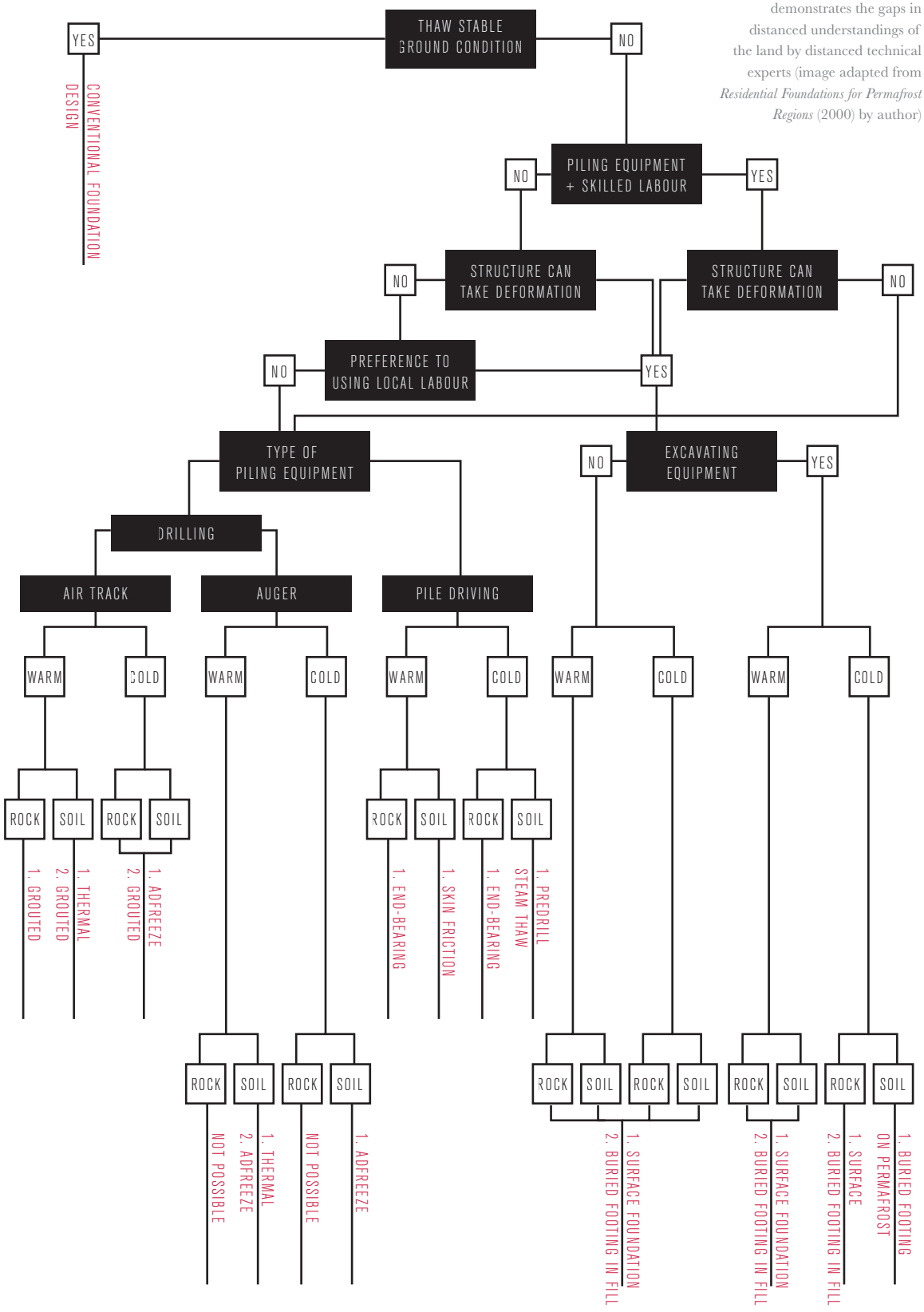


fig 2.1 This foundation design 'decision making tree' demonstrates the gaps in distanced understandings of the land by distanced technical experts (image adapted from *Residential Foundations for Permafrost Regions* (2000) by author)

FOUNDATION DESIGN DECISION TREE

an arborescent framework

Foundation design and selection is often approached as a technical 'problem.' This is apparent, for example, in the report *Residential Foundations for Permafrost Regions* (2000), prepared for the Canada Mortgage and Housing Corporation (CMHC), which aims to present a comprehensive outline of foundation options for building in permafrost regions. As the nation's housing agency, the CMHC, a Crown corporation, facilitates access to dwellings. The Corporation is one of the nation's largest publishers of housing information, offering 'objective housing research' in an effort to enable individuals to benefit from their housing expertise.[1]

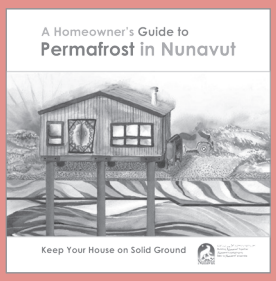
Residential Foundations for Permafrost Regions suggests that conventional foundation systems (i.e. those implemented in the South) are unsuitable in this context. Rather, 'care' must be taken in the selection of sites and foundation systems that more appropriately match site conditions.[2] The report outlines various foundation options and culminates in a decision making tree that aims to "help facilitate appropriate foundation choices based on individual requirements."[3] As an intended decision aid, this arborescent tool reduces a complex, dynamic, and site-based relationship in order to help homeowners and builders determine foundation 'solutions' (fig. 2.1). It considers a number of significant logistical factors: skill levels of local labour, and equipment available for use. At the same time, it presents a surface reading of some important geotechnical factors to understand before founding on a site: thaw stability of the soil, founding stratum, and ground temperature. The tree's restrictive questions privilege its authors' technical expertise, while inviting shallow and closed answers. For example, the tree categorizes permafrost as either warm or cold.[4] This binary drawn between warm and cold obscures the fact that permafrost may, at times, be considered 'in-between,' and conceals the reality that ground temperatures are dynamic and can shift throughout a building's life.[5] The borders outlined by the table's boxes do not invite conversation about the particular qualities of the land, as both a site and a place: the diagram risks prescribing without listening.

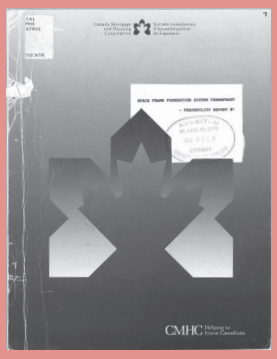
The following chapter looks into the conceptual *gaps* that exist in the understanding of land both in this decision making tree and in the practice of architecture itself.

EXISTING FOUNDATION GUIDES

The following foundation design manuals, government reports and technical guides are included as a sampling of the sources that have been consulted throughout the process of this work, and that can be found in the bibliography. A number of documents in this literature review are implicitly and explicitly related to military, resource extraction and industrial development sectors. While the literature available is generally written from distanced technical perspectives and geared towards an academic or professional audience, some contemporary sources are written in language that is accessible to the general public. For example, while the Yukon government has yet to produce a *Homeowner's Guide to Permafrost*, the Northwest Territories and Nunavut governments have each released one. These publications briefly touch on environmental forces and the impacts they can have on the reciprocal relationship between building, land and people. The existence of these non-technical guides reflects the on-going and often challenging process of maintaining and re-leveling of buildings that occurs in many communities long after visiting architects and engineers have been involved in the projects, if they have been at all.

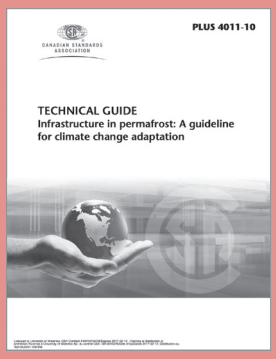
A glance at the following documents gives a sense of the multiple overlapping perspectives that engage with building foundations in the continuous permafrost region.

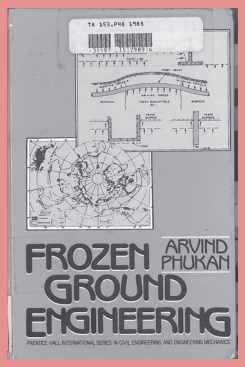


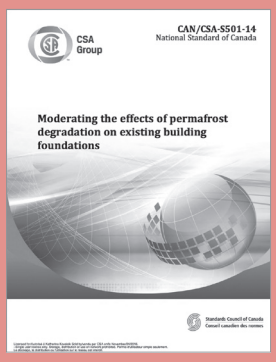


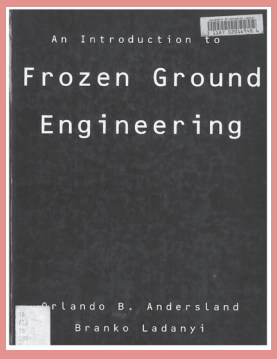
(from top left)
fig 2.2 Department of Environment, Government of Nunavut, and Soaring Tortoise Creative. *A Homeowner's Guide to Permafrost in Nunavut*. Iqaluit, NU: Government of Nunavut, 2013.
fig 2.3 Agra Earth and Environmental Limited. *Residential Foundation Systems for Permafrost Regions.* Yellowknife, NT: Canada Mortgage and Housing Corporation, 2000.
fig 2.4 Department of Environment and Natural Resources, Government of the Northwest Territories, and Soaring Tortoise Creative. *A Homeowner's Guide to Permafrost in the Northwest Territories*. Yellowknife, NWT: Government of the Northwest Territories, 2015.
fig 2.5 Ferguson, Simek, and Clark Engineers Architects, *Feasibility Report #1: Space Frame Foundation System Permafrost*, Ottawa, ON: Canada Mortgage and Housing Corporation, 1987.

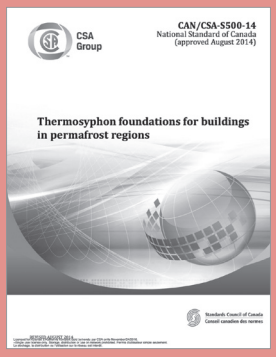
(from top right)
fig. 2.6 Canadian Standards Association. *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*. Edited by Erik Sparling. Mississauga, ON: CSA, 2010.
fig. 2.7 Phukan, Arvind. *Frozen Ground Engineering.* Toronto: Prentice-Hall, 1985.
fig. 2.8 Canadian Standards Association. *Moderating the Effects of Permafrost Degradation on Existing Building Foundations.* Mississauga, ON: CSA, 2014.
fig. 2.9 Andersland, Orlando B, and Branko Ladanyi. *An Introduction to Frozen Ground Engineering*. New York: Chapman & Hall, 1994.
fig. 2.10 Canadian Standards Association. *Thermosyphon Foundations for Buildings in Permafrost Regions.* Mississauga, ON: CSA, 2014.

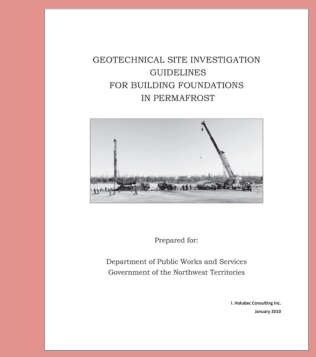


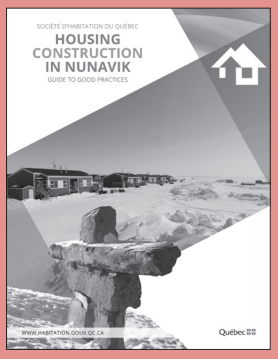


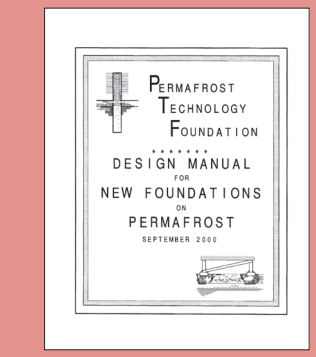












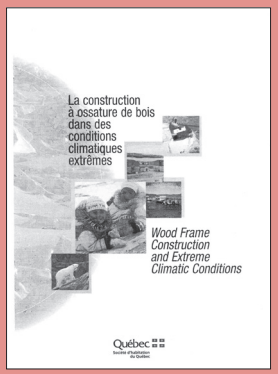


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fig 2.11 I. Holubec Consulting Inc. "Geotechnical Site Investigation Guidelines for Building Foundations in Permafrost." Department of Public Works and Services, Government of the Northwest Territories, 2010.
fig 2.12 Société d'Habitation du Québec. "Housing Construction in Nunavik." Québec: SHQ, 2017.
fig 2.13 McFadden, Terry. *Design Manual for New Foundations on Permafrost.* North Pole, AK: Permafrost Technology Foundation, 2000.
fig 2.14 Angers, Paul. "La Construction À Ossature De Bois Dans Des Conditions Climatiques Extrêmes." Société d'habitation du Québec, 1999.
fig 2.15 U.S. Department of Housing and Urban Development, U.S. Army Corps of Engineers. "Building Under Cold Climates and on Permafrost." 1980.

AN 'INVESTIGATED' LAND

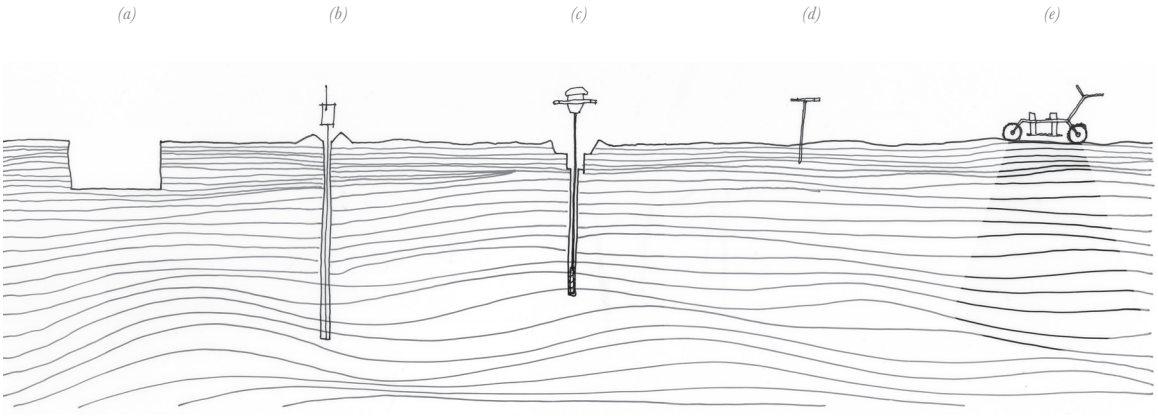
looking above and below the surface

The ground underlying the continuous permafrost region of Canada's North is often understood from a distance, through the work of scientific 'experts' such as geotechnical engineers and permafrost researchers. This body of research provides a firm base of technical knowledge in the form of empirical evidence and data that architects and constructors build upon.

In the practice of geotechnical engineering, a site is often first approached from afar through a desktop evaluation. This process implements remote sensing technologies and resources that can involve studying satellite imagery, local climate data, and climate change projections. While this research operates with an objective gaze, each individual site is recognized as being unique – its characteristics can never be fully understood through such universalizing methods. A site must therefore be 'ground truthed' through the performance of a field investigation. This methodology is grounded in a typical model of Euro-North American technoscientificity, always performed with the desire to build with certainty.

In this field survey, the soil's behaviour is gleaned through observing surface conditions. An attentive eye can discern information about underlying soils through surficial water drainage and the presence of particular vegetation. The performance of existing foundations built on adjacent sites can also reveal information about the ground's movement.[1]

In a physical encounter with the ground, the surveyor can prod, extract, or scan the earth in order to retrieve data, usually through mediation by a device. For example, the process of *rodding* or *probing* involves the researcher driving a sharpened steel rod into the land until it can no longer penetrate the soil. With her body, she can feel the depth of the active layer at that moment in time through the instrument. The materiality of the surface can be determined by listening to the rod: a sharp clang might suggest the rod has struck stone, while a dull reverberation might indicate wood. *Auger boring* and *pit digging* are other methods of investigating the soil. One of the most trusted methods of determining soil characteristics and active layer depth is *coring*. In this process, the surveyor drills into the ground, and brings core samples of soils to the surface of the borehole. Ground temperature measurements are also important in understanding the ground's behaviour and can be taken with a *thermistor* inserted into a borehole. Geophysical surveys may be produced through the use of technologies such as *Ground Penetrating Radar* (GPR) or *Electrical Resistivity*


(a)
(b)
(c)
(d)
(e)

Tomography (ERT), for which a device is pulled across the surface of the land, translating reflected beams into data. [2]

Each method offers a glimpse into a site's underlying characteristics. A story is woven together from these fragmented perspectives. The researcher performs a creative and imaginative act of extrapolating collected data into a drawing. For instance, she might expand on the myopic lens of her devices by interpreting the lines of generalized soil profiles. A tone of exactitude underlies these, and similar technical site drawings, despite their somewhat imprecise methods of production. This way of knowing a site is grounded in – and contributes to – a fabricated 'objective' reality.[3]

fig. 2.16 (opposite) Section drawing showing different methods and mediating devices that can be used to perform a site investigation.

(a) a *test pit* exposes the soils and allows their physical and visual inspection
(b) a *thermistor* senses and records the ground temperature
(c) a drilled *bore hole* can be used to extract a soil core sample for analysis
(d) an active layer *probe* roughly locates the edge of frozen soils
(e) remote sensing technologies reveal the soils' resistivity and density

A PAPER LANDSCAPE

regulating relationships with the land and materials

Drawings. Specifications. Codes. These are considered the official languages of architecture. Through a technical and objective lens, this triad can define relationships with building materials in both design and construction. Architects speak through these languages, determining solutions to "limit the probability" of undesirable situations and remove any instances that result in "unacceptable risk."[1] Communication does not rely solely on the knowledge of a lexicon of terms. Tone, inflection, and what is left unsaid can also shape what is conveyed.

I found myself stumbling over heavy words as I leaned on this vocabulary in an initial effort to describe relationships between land and building. The technical language I learned from pouring over the National Building Code and technical standards and guidelines felt awkward, and distanced when applied to land I was trying to understand as a place, rather than simply a space. The language of these governing documents imposes Southern conceptions of living on the North. Suggestive terms like 'ownership' and 'property' are burdened with the legacy of colonial powers in this land.

Hard and heady, this technical jargon invites a one-sided conversation. In a good conversation, though, each listener must create space for the other's perspective. How can the architect hope to inform before she has learned the most malleable vocabulary with which to express herself? How can she invite open conversation with opaque words?

In addition to abiding by technical codes and standards, architects must uphold codes of ethics. While Yukon architects do not have their own governing body, other provinces and territories offer moral guidance. The Ontario Association of Architects' Code of Ethics states:

> Architects will demonstrate respect for the natural and cultural environments of the people and places that are influenced by their work.[2]

The Northwest Territories Architect's Act states:

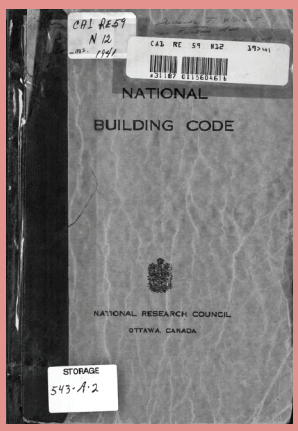
> An Architect will consider the social, cultural and environmental impacts of design decisions, and decisions that have been overruled or disregarded by clients.[3]

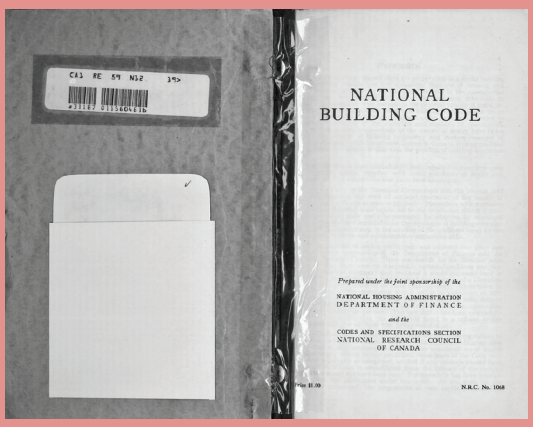
If the practice of architecture is an act of service, then those who engage in its design cannot work out of habit. They should engage in reciprocal conversation. This involves learning the language of empathy and asks that designers take a reflexive look at the lexicon with which their profession

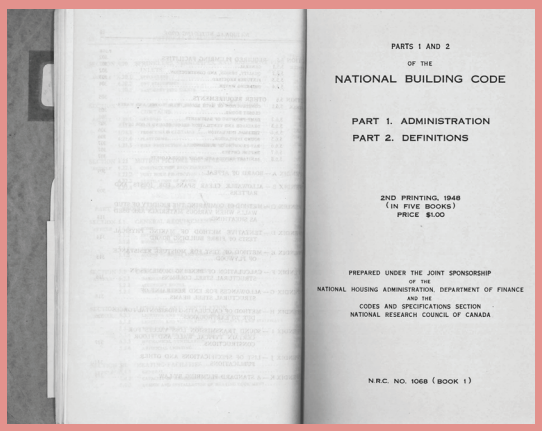
communicates. How can the visiting architect reflect on her position in order to make space for discussion and learn to look without the myopic lens of distanced technical expertise? The term 'architect' itself describes an implicit separation between designing and building, between prescribing and making.

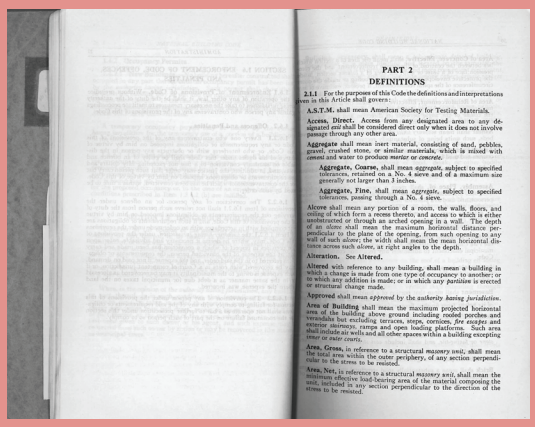
Researcher and architectural scholar Adrian Forty attributes this disassociation of intellectual from manual labour to the emphasis on command and craft of drawing within the practice of architecture.[4] Architectural theorist Alberto Péréz-Gómez recounts a similar story, stating the practice and profession of architecture is founded on a separation from building by virtue of its privileging of the intellectual discipline of geometry through the practice of drawing.[5] These accounts align with Simon Unwin's definition of architecture as "the determination by which a mind gives intellectual structure to a building, a place," and the building as "the performance of physical realization; and 'a building' the product."[6] The dominant Euro-Western narrative is clearly expressed here: the architect conceives and prescribes a form that a builder is then meant to produce with material.[7] In Canadian professional practice, this distancing between designer and builder is registered in the 'tender package,' the contractual conversation through which the two parties are often introduced. The contemporary architecture community has turned much of its attention to the drawing; they explore the physicality of the world's material character through this facet of architectural language and representation in great depth. This on-going exploration of the drawing can be traced back to Robin Evans' influential 1986 piece, *Translations from Drawing to Building*.[8] Beyond the discourse of professional practice, the discipline has remained largely mute on the significance of the other critical account of the building: the specification.[9]

Both drawings and specifications are part of the tender package: orthographic drawings operate virtually and describe formal aspects, while technical language in the specification concerns itself with denoting materials. This dual understanding of materiality is aligned with Aristotle's hylomorphic model, in which matter is inert and given form. In its application to architecture, the architect might be understood as the 'form-giver' of materials.[10] Through the Janus-faced nature of materiality, one side presents the raw physicality of the world's material character, while the other presents the human agency that projects meaning and design on a material, producing an 'artefact.'[11]









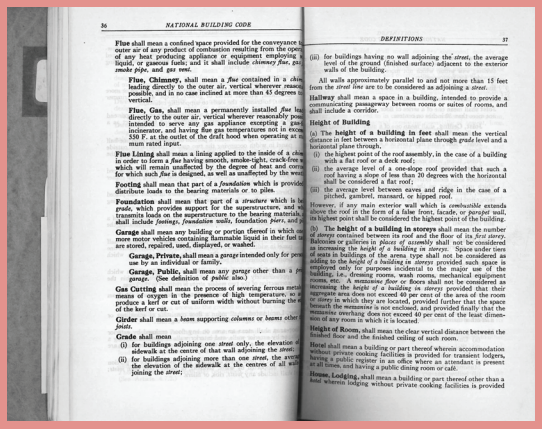
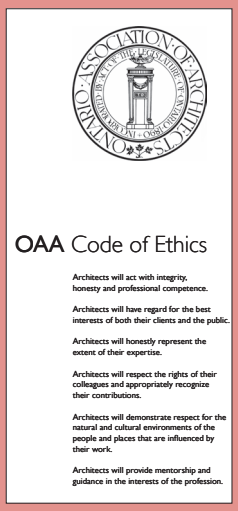


fig. 2.17 (above, left) Spreads showing the first *National Building Code of Canada* (1941) was divided into two sections: administration and definitions *fig. 2.18 (right)* The Ontario Association of Architects' Code of Ethics includes the text: "Architects will act with integrity, honesty and professional competence" "Architects will honestly represent the extent of their expertise." "Architects will demonstrate respect for the natural and cultural environments of the people and places that are influenced by their work."



The architectural specification, much like the foundation, is often regarded as a merely 'technical' component that exists outside the purview of architectural discourse.

The drawing describes form in its orthography and loosely outlines the visual character of the materials. It is the specification that supplements the building's material description through a more technical language. Katie Lloyd Thomas questions this understanding of the specification as something that is purely technical in her reading of specifications in Euro-Western architecture. Drawing on her research of materiality and architecture, she writes of materials:

> They are social and cultural constructs, produced through the complexities of legislation and regulation, through techniques of production and fabrication, through language and use. In turn they create possibilities and limitations, ways of working and experiential conditions which are specific and individuated.[12]

Lloyd Thomas identifies various types of description, or 'forms of clause,' applied to building materials within British specifications – from naming to process to performance. In the first, and perhaps the most banal instance, materials are prescribed by simply being named. The author raises the question of variation that the act of naming is subjected to, which might range from "a generic type of material (hardwood), a particular species (Honduras mahogany) or a product (ThermoWood®)."[13] The act of naming a material ties it to social, economic, and environmental forces.

According to Lloyd Thomas, the sudden proliferation of the process-based clause can be attributed to a shift away from craft-based tendering, which located practical material knowledge within the expertise of each trade. Rather than relying on the tradesperson to determine the means to produce the desired material, an explicit description of the methods to apply was specified as a 'recipe.'[14]

The last and most contemporary type cited by Lloyd Thomas is the performance clause. Here, the process of preparing the material is irrelevant and excluded. It is only the end criteria of the material that is defined.[15] Performance clauses are increasingly related to material standards and describe how the material is to behave in the constructed building, which might be provided as expectations in the form of structural, acoustical, or thermal properties. The language of this form of clause is adapted from the

material scientist's dialect rather than the builder's tongue, reflecting a shift in attitudes away from production towards scientific analysis.[16]

While these measurements and properties might be of use to an engineer or architect, the information yielded from these tests and standards does not compare to the knowledge gained by a skilled practitioner through experience.[17] The political theorist and feminist Jane Bennett makes a similar distinction between the scientist's desire to know what the material *is* and the artisan's wish to see what it can *do*, concluding it is the latter's methodology that allows them to "collaborate more productively" with the material.[18] In the performance-based clause, the material is no longer the 'artefact' described in the process-based clause, but an 'actant.'

In an effort to re-frame the agency of the non-human world, a concept of agency has been advanced by Euro-Western academics such as Bennett and sociologist Bruno Latour.[19] This discourse suggests that the conceptual intermingling of nature and society – although certainly merged in reality – has dissolved a conceived binary between them.[20]

Haudenosaunee and Anishnaabe scholar Vanessa Watts questions the foundation of this position. She points to its hidden underlying assumptions that an epistemology-ontology divide separates constituents of the world from how the world is understood, writing:

> We can see how Euro-Western thought is beginning to embrace the contributions of the non-human world; however, the controversial element of agency is often redesigned when applied to non-humans, thereby keeping this epistemological-ontological divide intact.[21]

This alleged 'agency' is underwritten in many of the technical documents architects employ. Canadian National Master Construction Specification (NMS) outlines prescriptive technical specifications as well as performance-based sections. Many building components, such as foundations, are described in both ways.[22] The National Building Code of Canada 2015 also contains performance-based descriptions such as:

> The NBC (National Building Code) establishes regulations to address the following five objectives, which are fully described in Division A of the Code:
>
> - safety
>
> - health

fig. 2.19 (opposite) Map of North America depicting steel manufacturers across Canada and showing the hatched permafrost zones. Dots represent ferroalloy plants and steel mills.

- accessibility for persons with disabilities

- fire and structural protection of buildings

- environment

…They become minimum acceptable requirements once they are adopted and passed into law or regulation by an authority having jurisdiction: i.e. the requirements represent the minimum level of performance required to achieve the objectives that is acceptable to the adopting authority.[23]

The following text outlines the preservation treatment of wood and the performance standards to which it must conform, entangling the material in certain political, social and environmental relationships:

4.2.3.2. Preservation Treatment of Wood

1) Wood exposed to *soil* or air above the lowest anticipated *groundwater* table shall be treated with preservative in conformance with CAN/CSA-O80 Series "Wood Preservation" and the requirements of the appropriate commodity standards as follows:

a) CAN/CSA-O80.2 "Processing and Treatment"

b) CAN/CSA-O80.3 "Preservative Formulations" or

c) CSA O80.15 "Preservative Treatment of Wood for building foundation systems, basements, and crawl spaces by pressure process."

2) Where timber has been treated as required in Sentence (1) it shall be cared for as provided in AWPA M4 "Care of Preservative-Treated Wood Products" as revised by Clause 6 of CAN/CSA-O80 Series "Wood Preservation"[24]

The technical and prescriptive language of specifications and codes that determine the success of architecture in post-colonial contexts appears to be deeply embedded in Western metrics. In a discussion on tropical architecture in Southeast Asia, Jiat-Hwee Chang illustrates how common it is for techno-scientific principles to be developed in metropolitan research and development institutions then applied to this disparate region. Usually these principles are expressed through such means as specifications, technical standards and materials, amongst others. In this context, he argues that a "reliance on imported expertise, building materials, and building components" is tied to a "continued technological gap and inequalities in distribution of resources."[25]

It is important to be mindful of the existing foundations of power-knowledge structures that the discipline of architecture supports.

As with many building components, foundations in Canada are defined by regulations developed in the South, reducing the geographic and cultural contexts of these literal connections between building and ground within a framework of Euro–North American legal obligations. Métis architect and professor Dr. David Fortin expands on these regulations, stating, "Their landscape is that piece of paper that they're written on. That's really as grounded as they are."[26] While this might be true, they define many of the materials that compose these systems.

While of course the minimal safety and performance standards set by these regulations are valuable, it is important to remember who holds the pen that writes them. Daniel Millette, a professional planner and author of *Architectures of Renewal: The Indigenous Architectural Landscape of Canada*, describes what must be done, regardless of who holds the 'design pen,' in the development of 'Indigenous vernacular architecture and planning.' He states that it must be:

> …diverse and dynamic… comprised of culture-specific land use planning and purpose-built buildings commissioned by communities; conceived with traditional elements in mind; insisting on community involvement within the design process, regardless of who holds the design pen (architect, planner, or non-pedigreed architect or planner); aiming at involving community members within construction; considers program combinations that extend beyond conventional praxis; containing a high element of community pride; and incorporating within its design a host of environmental considerations.[27]

Contemporary Euro–North American conceptions of the vernacular can be traced back to Bernard Rudofsky's problematic definition of the term as "architecture without architects" in his 1964 MoMA exhibition. Today, the vernacular might be considered an approach that "transcends binary dialects" such as past-present, local-global, or technical knowledge – embodied knowledge.[28] For instance, Daniel Millette argues that vernacular indigenous architecture is not static nor anachronistic, but rather dynamic and contemporary work that embraces complexity. He asserts that design by non-pedigreed architects does not require some form of "reconciliation with codes." Millette urges architects and planners to truly listen to communities they engage with, which for him means extending all efforts to "understand the immediate cultural realities, the underpinnings of historical legacies, and the deep desire for better futures."[29] To do good work, the designer must listen

in order to meet technical codes while building on moral codes.

This designer-as-listener is not common practice, says Tim Ingold, a British social anthropologist. Ingold points to the Euro-Western understanding that has developed within the last five centuries of the profession of architecture's history. He notes that a building is often considered a more permanent manifestation of design that stands as a "monument to the genius of its creator."[30] This perspective can be traced back to Leon Battista Alberti's mid-fifteenth century treatise *On the Art of Building in Ten Books*, in which the architect is portrayed as a man of "learned intellect and imagination," who can "project whole forms in mind without any recourse to the material."[31] This statement is aligned with the hylomorphic model of understanding material. Ingold contrasts this with Alberti's recommendation that "in choosing the ground on which to build, advice should always be sought from local residents whose daily experience both with existing buildings and with constructing new ones will have yielded a reliable understanding of the nature and quality of the soil."[32]

The idea that designers can learn from local relationships with soil, nurtured by living with the land, resonates with the complex nature of building on frozen ground. Soil itself might be understood as a material that is constantly becoming. The surface of the land is not a solid, raw, unchanging substrate. It is always growing, changing, morphing – an intermingling of earth and sky. Rather than simply occupying a space filled with fixed and finalized objects, human beings inhabit the world and in doing so participate in these processes of formation and the "dynamic world of energies, forces and flows."[33] If materials within this meshwork are also in flux, they preclude being fully grasped as technical objects.

This reductive understanding is deaf to the social and cultural stories of materials. For instance, Euro-North American based authors of an extensive documentation of indigenous architecture in North America state in their discussion of technology, "Indians had no choice but to build with raw materials from the land around them."[34] To rebalance this assertion, the Métis architect David Fortin writes:

> A timeless relationship with the land that does not endorse mineral extraction for economic gain can surely be interpreted as a definitive choice, and one that would seemingly be central to indigenous futures.[35]

fig 2.20 Shavings from peeled spruce logs harvested on the land near Old Crow, YT

fig 2.21 River gravel from the Porcupine River

fig 2.22 Quarried and crushed sandstone / quartzite gravel

Technical documents, such as specifications and codes, seem to consider building materials as ubiquitous objects occurring throughout the world, unrelated to localized, natural features. Yet the naming of each article on a page necessarily entangles it in a relationship with a material and the land. A global supply chain of materials has distanced many construction materials from the land they are *of*. But understanding that creation in one place can be destructive to a remote and unseen place, and that this is the consequence of a specified choice, is important for the responsible practice of architecture.

The architectural community would benefit from thinking more carefully about the objective technical value of building codes and specifications. A reflection on their impacts on material, social, and environmental relations to the land they are built upon seems necessary in order to practice responsibly with them. While helpful in some ways, codes regulating design and construction also present rigid forms of barriers for many communities.[36] If we consider material properties "are not attributes but histories," then perhaps the success of architecture in these contexts would benefit from a revaluation by local voices – particularly in determining how buildings should touch the land.[37] The CSA Group (previously the Canadian Standards Association) has recognized the tendency for "solutions for the North to be imposed by or based on circumstances in the South," and identifies the inclusion of northern perspectives, Peoples, and data as a core area for improvement in policy and decision-making.[38]

The land and the people who live close to it speak for themselves, but the newcomer architect must learn to listen. In order to meaningfully converse, she must remove her myopic lens and re-learn how to see and speak.[39] Meaningful and equitable conversations cannot be grounded in the technoscientific language of codes and regulations. The visiting architect cannot occupy the space of 'not-knowing' while her perspective and words are shaped by these prescriptive languages.[40]

DRAWING THE LAND

a case for the deep section

As an architecture student, I was taught to think through drawing. The construction of drawings involves a series of decisions and actions. Architectural representations are always fragments of reality: in order to communicate a design with clarity and salience, only certain information is supported and explored. Similarly, foundations are built upon a set of selected, underlying assumptions. In constructing either drawings or foundations, it is important to look beyond what is reinforced in order to question what is excluded in the process.

Contemporary Euro-Western architectural and landscape drawings are often reductively concerned with the surface, pushing the complex nature of what lies beneath it to the margins. Environmental researcher Stephanie Carlisle and landscape architect Nicholas Pevzner examine these omissions in a 2012 *Scenario Journal* article entitled, "*The Performative Ground: Rediscovering the Deep Section*." The authors suggest that through an act of flattening, drawings depict only the visible, rather than visualizing unseen processes below grade. Questioning the shallow section's analytical omissions of the urban environment, the authors call for the development of 'deep sections': drawings that consider processes relationally, while exploring depth and its associated behaviours and qualities.[1]

While the periphery of architectural practice continues to expand from its migrating centre, the codification of numerous disciplines, such as civil and geotechnical engineering, has divested architects of many professional below-grade responsibilities such as foundation design, and shifted their attention upwards, to the superficial. This is reflected in many architectural sections where the land is reduced to an absolute ground line. Below grade information is concealed by the blank space of the paper or engulfed by the opaque space within the section cutline: the *poché*.

The use of *poché* as a representational technique can help clarify the focus of the drawing and express spaces available to the human experience. Its use also reveals that which the designer has explicitly or implicitly blinded themselves to, denoting the limits of their scope of inquiry.

Giambattista Nolli's 1748 mapping of Rome and its public spaces is considered to be a 'figure-ground' architectural drawing: buildings are illustrated with *poché* and projected against the blank space of the paper, representing the connected public space of the city made up of roads, squares,

fig. 2.23 (opposite) Deep section showing the movement over time experienced by one core sample width section of soil reveals how the active layer freezes and thaws with seasonal variation, and the phenomenon of permafrost degradation

and the interior space of public buildings. A visually similar representation is customarily used in architectural sectional representations where all that lies beneath the surface of the ground and outside of the building and its foundations is rendered as *poché*.

In these drawings the relationship between the architecture and the land is simplified; the land is excluded from the designer's responsibilities, consideration, and care. Carlisle and Pevzner state:

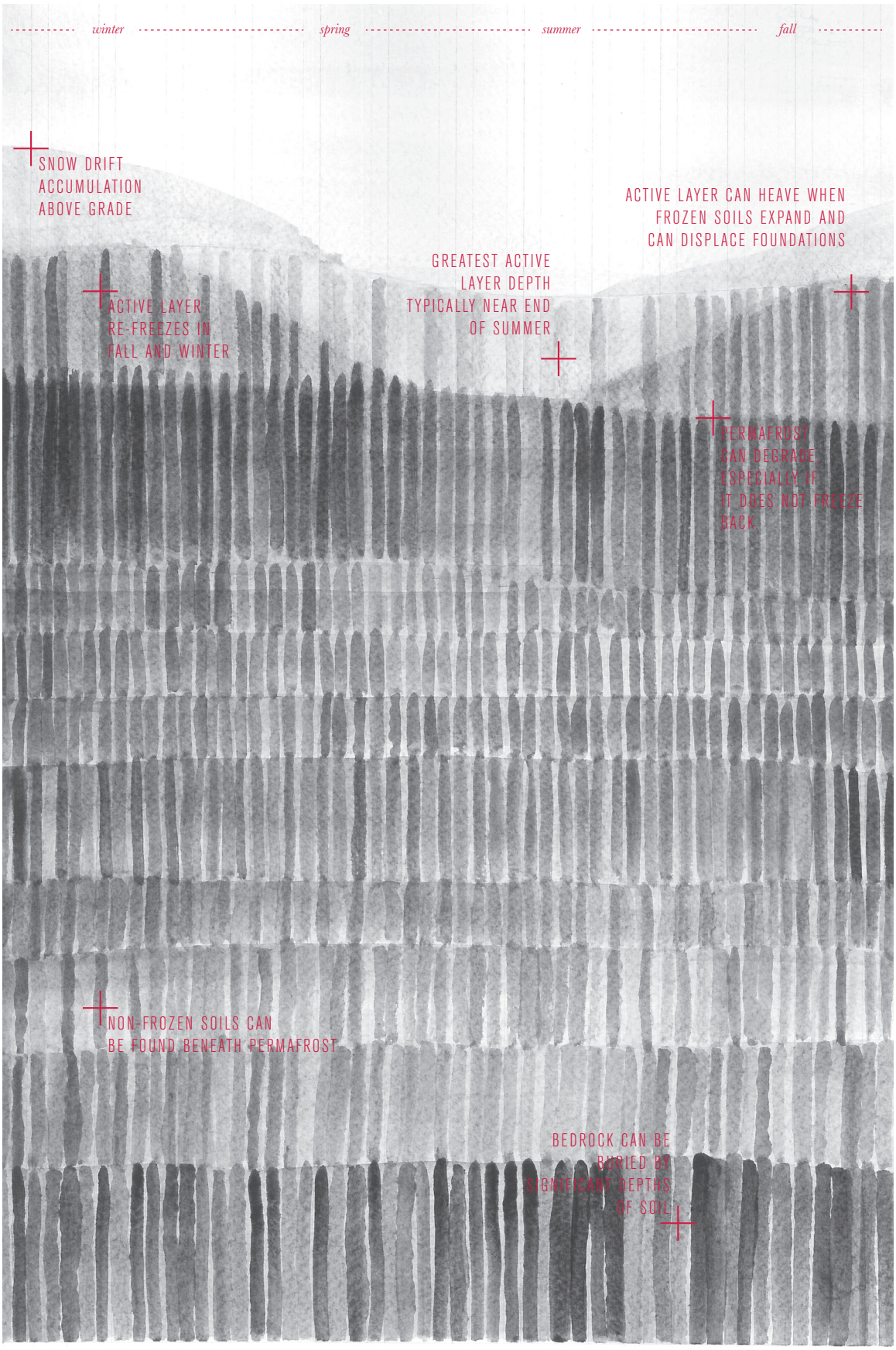
> If we understand drawings to be a critical space for construction and exploration of architectural questions, then the designation of material, zones or properties as *poché* is a clear expression of the limits of the designer's inquiry. When the properties relegated to *poché* matter deeply, then this omission should be cause for concern.[2]

The dynamic nature of the land is discounted by the absolute ground line typical of a 'figure-ground' style section drawing. In the everyday experience of the shifting ground plane in Old Crow, the dynamic relationship between building and land is clear: each is transformed by the presence of the other. In short, there exists a delineable 'figure-figure' relationship between the two: the figure of the building and the figure of the ground.

The lives of buildings and people are intertwined with the land in this slow dance of figures. Site is always entangled in a complex web of forces above, below, and within the surface of the land.[3] This surface is not the inflexible barrier represented by the hard edge of a drawing's solid fill. The horizon marks the extent of what we can perceive and delineates earth from sky with a line. This line is not static: it shifts with us as we move on the land.

While architects are technically responsible for everything 'from the ground up,' responsible design requires an intimate knowledge of the land you are building with. The forces entangled with a site are often unseen by the architect's myopic vision. As an architectural student, I found myself reflecting on the perspectives the discipline chooses to privilege and delineate as the "limits of the designer's inquiry." Attempting to draw the ground's dynamic movements extends these limits and begins to expand the drawer's understanding of the land and helps her occupy the fruitful space of the 'not-knower.'

Perhaps the architectural profession could expand its perspectives to reveal the porous nature of this line to render it as a zone where the earth and sky touch, intermingling with each other in an unending generation of life.[4] The


winter
spring
summer
fall
SNOW DRIFT ACCUMULATION ABOVE GRADE
ACTIVE LAYER RE-FREEZES IN FALL AND WINTER
GREATEST ACTIVE LAYER DEPTH TYPICALLY NEAR END OF SUMMER
ACTIVE LAYER CAN HEAVE WHEN FROZEN SOILS EXPAND AND CAN DISPLACE FOUNDATIONS
PERMAFROST CAN DEGRADE ESPECIALLY IF IT DOES NOT FREEZE BACK
NON-FROZEN SOILS CAN BE FOUND BENEATH PERMAFROST
BEDROCK CAN BE BURIED BY SIGNIFICANT DEPTHS OF SOIL

consideration of a shifting land that moves buildings and vice versa suggests a move towards another form of representation. This might allow both the land and the building to be conceptualized as entangled figures that form the ground, built form, and space of the world that is inhabited by many figures, including humans. While no drawing can communicate the reality of living with a shifting ground plane, this 'figure-figure' method of drawing might be considered an act of attunement: paying attention to the surface of our experience and what lies beneath it to engage in the silent dialogues of a site.

NOTES – FOUNDATION DESIGN DECISION TREE

1. "About CMHC," Canada Mortgage and Housing Corporation, accessed June 04, 2017, https://www.cmhc-schl.gc.ca/en/corp/about/.

2. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions* (Yellowknife, NT: Canada Mortgage and Housing Corporation, 2000), 6.

3. Agra Earth and Environmental Limited, 7.

4. This particular table defines warm permafrost as greater than -1°C and cold permafrost as less than -1°C. See Agra Earth and Environmental Limited, 7. Other definitions of warm and cold permafrost temperature ranges vary. For instance, CSA defines warm permafrost as being around 0°C while cold permafrost is less than -3°C, creating a gap, or 'in between' condition. See Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation* (Mississauga, ON: Canadian Standards Association, 2010), 21.

5. As ground temperatures fluctuate, many geotechnical guidelines suggest studying historical temperature changes while projecting future shifts. Canadian Standards Association, 78.

NOTES – AN 'INVESTIGATED' LAND

1. For more on guidelines for geotechnical site investigations in permafrost zones, see Standards Council of Canada, and Bureau de Normalisation du Québec, *National Standard of Canada: Geotechnical Site Investigations for Building Foundations in Permafrost Zones* (Québec, QC: Bureau de normalisation du Québec , 2017), 10-25.

2. For more on field investigation operations, see Art Nash, and Axel R Carlson, *Permafrost: A Building Problem in Alaska* (Fairbanks, AK: University of Alaska Fairbanks Cooperative Extension Service, 2015), 3. See also Standards Council of Canada, and Bureau de Normalisation du Québec, 21-30.

3. See the related concept of 'fabrica mundi,' which suggests that in drawing the world through projecting lines and borders, we produce the world. For more, see Sandro Mezzadra, and Brett Neilson, "Fabrica mundi : producing the world by drawing borders," in *Scapegoat: Architecture, Landscape, Political Economy: 04 Currency*, ed. Adrian Blackwell and Chris Lee (Winter/Spring 2013): 3-19.

NOTES – A PAPER LANDSCAPE

1. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015* (Ottawa, ON: National Research Council of Canada, 2015), viii.

2. "Code of Ethics," Ontario Association of Architects, last updated February, 2010, http://www.oaa.on.ca/the%20oaa/about%20the%20oaa/code%20of%20ethics.Ontario Association of Architects, *OAA Code of Ethics*, 2014, http://www.oaa.on.ca/the%20oaa/about%20the%20oaa/code%20of%20ethics.

3. Northwest Territories Association of Architects, *Bylaws of the Northwest Territories Association of Architects* (Yellowknife, NT: Northwest Territories Association of Architects, 2015), http://nwtaa.ca/data/uploads/NWTAA_Bylaws_rev-2015-04-11.pdf.

4. Adrian Forty, *Words and Buildings* (London: Thames & Hudson, 2000), 30.

5. Alberto Péréz-Gómez and Louise Pelletier, *Architectural Representation and the Perspective Hinge* (Cambridge, Massachusetts: MIT Press, 1998).

6. Simon Unwin, "Analysing Architecture Through Drawing," *Building Research & Information* 35, no. 1 (February 2007): 102, https://doi.org/10.1080/09613210600879881.

7. Tim Ingold, *Making : Anthropology, Archaeology, Art and Architecture* (Milton Park, Oxon: Routledge, 2013), 58.

8. Robin Evans, "Translations from Drawing to Building," *AA Files* 12, (Summer 1986): 3–18.

9. Katie Lloyd Thomas, "Specifications: Writing Materials in Architecture and Philosophy," *Architectural Research Quarterly* 8, no. 3 (2004): 277.

10. Katie Lloyd Thomas, "Introduction," in *Material Matters: Architecture and Material Practice,* ed. Katie Lloyd Thomas (Milton Park, Oxon: Routledge, 2007), 3-4.

11. Ingold, *Making.*

12. Lloyd Thomas, "Introduction," 8.

13. Katie Lloyd Thomas, "Building Materials: Conceptualising Materials via the Architectural Specification" (PhD diss., Middlesex University, 2010), 47, http://eprints.mdx.ac.uk/id/eprint/6284.

14. Katie Lloyd Thomas attributes the 'recipe' clause to Bertrand Gille in Lloyd Thomas, "Building Materials: Conceptualising Materials via the Architectural Specification," 57-58.

15. Lloyd Thomas, "Introduction," 7.

16. Katie Lloyd Thomas, "'Of Their Several Kinds': Forms of Clause in the Architectural Specification," *Arq* 16, no. 3 (2012): 229.

17. My intention here is not to create a binary between technical expertise and nontechnical knowledge.

18. Jane Bennett, *Vibrant Matter : A Political Ecology of Things* (Durham : Duke University Press, 2010), 60.

19. Lloyd Thomas, "'Of Their Several Kinds': Forms of Clause in the Architectural Specification," 229. See also Bruno Latour, *Reassembling the Social: an Introduction to Actor-Network-Theory*, (Oxford: Oxford University Press, 2005).

20. This idea ties back to concepts mentioned in "A Living Land."

21. Vanessa Watts, "Indigenous Place-Thought & Agency Amongst Humans and Non-Humans (First Woman and Sky Woman Go on a European World Tour!)," *Decolonization: Indigeneity, Education Society* (2013), 28.

22. "The 2007–07 NMS update table of contents," Government of Canada, http://www.nrc-cnrc.gc.ca/eng/publications/nrc_pubs/nms/nms_masterformat.html.

23. Canadian Commission on Building and Fire Codes, *National Building Code of Canada: 2015*, vi.

24. Canadian Commission on Building and Fire Codes, Division B, 4-78.

25. Jiat-Hwee Chang, "Tropical Variants of Sustainable Architecture: A Postcolonial Perspective," in *The SAGE Handbook of Architectural Theory*, (London: SAGE Publications Ltd., 2017), 605, https://doi.org/10.4135/9781446201756.n36.

26. Quote from Dr. David Fortin (Assistant Professor of Architecture at Laurentian University and Métis scholar), discussion with the author, December 2016.

27. Daniel Millette, "Architectures of Renewal," interview by Amrit Phull, *The Site Magazine* 36 (Winter 2016): 22.

28. See editorial review of the term 'vernacular' in "'Worldwide vernacular' – Is this a Contradition in Terms?," *The Site Magazine* 36 (Winter 2016): 7.

29. Daniel Millette, "Architectures of Renewal," 23.

30. Tim Ingold, "The Conical Lodge at the Centre of the Earth-Sky World," in *About the Hearth: Perspectives on the Home, Hearth, and Household in the Circumpolar North*, ed. David Anderson, Robert Wishart and Virginie Vaté (New York: Berghahn, Books, 2013), 13.

31. Leon Battista Alberti, *On the Art of Building in Ten Books, trans. J Rykwert, N Leach and R Tavernor (Cambridge, Mass.: MIT Press, 1988), 7 quoted in* Ingold, "The Conical Lodge at the Centre of the Earth-Sky World," 13.

32. Ingold paraphrasing Alberti in Ingold, *Making,* 49.

33. Ingold writes, "To inhabit the world, by contrast, is to join in the processes of formation. It is to participate in a dynamic world of energies, forces and flows. Such, I contend, is the world of earth and sky." Ingold, *Making,* 89.

34. Peter Nabokov and Robert Easton, *Native American Architecture* (New York: Oxford University Press, 1989), 16.

35. David Fortin, "Indigenous Architectural Futures: Potentials for Post-Apocalyptic Spatial Speculation," (Paper, ARCC, 2014), 481.

36. Dr. David Fortin (Assistant Professor of Architecture at Laurentian University and Métis scholar), discussion with the author, December 2016.

37. Tim Ingold, "Materials Against Materiality," *Archeological Dialogues* 14, no.1 (2007): 15, https://doi.org/10.1017/S1380203807002127.

38. CSA Group, *Canada's North* (Mississauga, ON: CSA Group, 2017), 6.

39. Millette, "Vernaculars."

40. Here I am referring to Paulette Regan's use of the term 'space of not knowing' in Paulette Regan, *Unsettling the Settler Within* (Vancouver, BC: UBC Press, 2010), 18.

NOTES - DRAWING THE LAND

1. Stephanie Carlisle, and Nicholas Pevzner, "The Performative Ground: Rediscovering The Deep Section," *Scenario Journal* 2, March 24, 2012, https://scenariojournal.com/article/the-performative-ground/.

2. Carlisle, and Pevzner, "The Performative Ground;" emphasis in original.

3. In "The Material Culture of Landscape Architecture," Jane Hutton describes the complexity of materials and their formation in the discipline of landscape architecture, writing, "The materials and methods of the field slip between being geologically or anthropogenically formed, carved or assembled, existing or introduced, and inert or alive, generating profoundly complex relationships between the operations of design and non-human forces." See Jane Hutton, "Substance and Structure I: The Material Culture of Landscape Architecture," *Harvard Design Magazine* 36 (Spring/Summer 2013): 123.

4. See this description of the earth's surface in Tim Ingold, *Making : Anthropology, Archaeology, Art and Architecture* (Milton Park, Abingdon, Oxon: Routledge, 2013), 88.

PART 03

BEARINGS

BEARINGS

re-levelling 'expertise'

Foundation building is a practice grounded in knowledge of the land and its 'behaviour.'[1] This knowledge comes in many forms including the place-based, the traditional, and the technical. While too often the latter is centred and privileged, each way of knowing is powerful and offers valuable insight when listened to with care.[2] Reflecting on which understandings of the land 'technical' building elements, like the foundation, support helps to bring undermined views to the surface. The act of building is a discussion that can involve myriad ways to know the land.

Euro–North American society regards the 'expert' as a person who has special knowledge and technical aptitude, upholding her as a respected figure of truth and certainty. In Canada's short history, southerners bearing this title have projected their authority onto the lands of the nation's North, striating the place and its people in order to shape this last 'frontier' and ensure its productive value for the South.[3] Amid a history that tells a monologue of one-sided development, a collective scepticism of the self-proclaimed expert in the Canadian territories has emerged. The circle of latitude of the 60th parallel draws a border between the territories to the north and the provinces to the south.

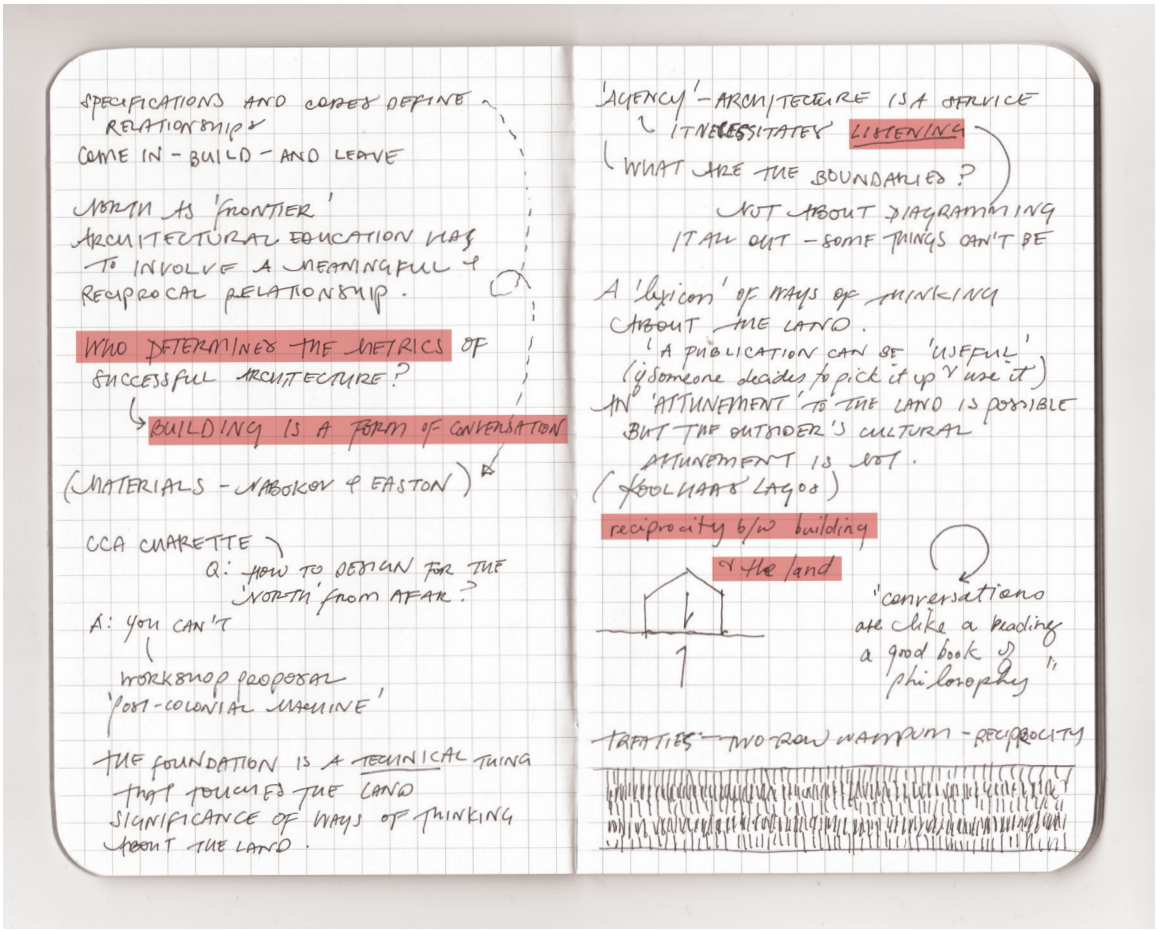
Reflecting on the use of the term 'expert' in this geographical region, Yukon geographer Jim Lotz writes, "To claim any degree of expertise about such a vast and varied land as the Canadian north is to reveal an ignorance of the real nature of this part of the nation; little wonder that 'expert' is a dirty word north of sixty."[4] The title isolates the autocratic authority of the specialist from the knowledge of a community. The designation of 'researcher' similarly distances the observer from the subject, involving the extraction, translation, and re-appropriation of knowledge as information, while the term 'architect' separates the designer from the client.[5] Nature and built form. Localized and codified. Embodied and technical knowledge. These are false binaries inherited from modernism that a critical engagement in design erodes.[6] Each of these ways of knowing the land is complex and legitimate. Across the Canadian Arctic, a re-valuation of place-based knowledge and local observations is occurring in research in the realms of climate change and ecology. *Forensic Architecture's* Susan Schuppli has described this ongoing shift as a "reordering of expertise."[7]

AGENCY

fig 3.1 (opposite) It was difficult to fully listen to someone, and engage in meaningful conversation with them while attempting to 'extract' and record information. I wouldn't write much during my conversations with people but would sit down afterwards and draw out what resonated with me from the conversation. This is a scan from my sketchbook that relates to my conversation with David Fortin and Patrick Stewart.

Back at home in Ontario, in the winter following my first trip to Old Crow, I drove North to Sudbury. Here, I was fortunate enough to have a conversation with two professors at Laurentian University: Dr. Patrick Stewart, an architect and a member of the Nisga'a First Nation, and Dr. David Fortin, an architect and member of the Métis Nation of Ontario. Both Patrick and David are members of the RAIC Indigenous Task Force, a group that seeks ways to foster and promote Indigenous design in Canada. We sat at a table in the expansive undergraduate studio and talked about architectural agency in northern communities, who and what determines the metrics for 'successful' architecture, and the importance of listening. This was one of many foundational conversations that would later shape my understanding of the types of relationships to be considered before touching the land with architecture.

The following text weaves together a series of conversations on touching the land, conducted between myself and various 'experts' and knowledge-holders. Although these discussions reflect only a few views in a broad spectrum of ways of knowing the land, a multitude of questions nevertheless emerge for the visiting architect to consider if she hopes to do good work: What are the metrics for successful architecture here and who is determining them? What perspectives have framed the visiting architect's understanding of this place? Can the visiting architect un-learn what she knows in order to re-learn it from another perspective? Can the visiting architect-researcher participate in this space without controlling it? If so, how?


SPECIFICATIONS AND CODES DEFINE RELATIONSHIP
COME IN - BUILD - AND LEAVE
NORTH AS 'FRONTIER'
ARCHITECTURAL EDUCATION HAS TO INVOLVE A MEANINGFUL & RECIPROCAL RELATIONSHIP.
WHO DETERMINES THE METRICS OF SUCCESSFUL ARCHITECTURE?
BUILDING IS A FORM OF CONVERSATION
(MATERIALS - NABOKOV & EASTON)
CCA CHARETTE
Q: HOW TO DESIGN FOR THE 'NORTH' FROM AFAR?
A: YOU CAN'T
WORKSHOP PROPOSAL
'POST-COLONIAL MACHINE'
THE FOUNDATION IS A TECHNICAL THING THAT TOUCHES THE LAND
SIGNIFICANCE OF WAYS OF THINKING ABOUT THE LAND.
'AGENCY' - ARCHITECTURE IS A SERVICE
↳ ITNECESSITATES LISTENING
WHAT ARE THE BOUNDARIES?
NOT ABOUT DIAGRAMMING IT ALL OUT - SOME THINGS CAN'T BE
A 'lexicon' of ways of thinking about the land.
'A PUBLICATION CAN BE 'USEFUL'
(if someone decides to pick it up & use it)
AN 'ATTUNEMENT' TO THE LAND IS POSSIBLE
BUT THE OUTSIDER'S CULTURAL ATTUNEMENT IS NOT.
(KOOLHAAS' LAGOS)
reciprocity b/w building
& the land
"conversations are like a reading a good book of philosophy"
TREATIES - TWO ROW WAMPUM - RECIPROCITY

DISCUSSION: DAVID FORTIN AND PATRICK STEWART

In the undergraduate studio at the Laurentian University McEwen School of Architecture in Sudbury, Ontario, Dr. Patrick Stewart, associate professor, and Dr. David Fortin, assistant professor and the school's incoming Director, consider architectural agency in the North:

DF | You're interested in this idea of agency. And you're questioning the agency of the architect. And that's really clever.

In most of the cases as I'm sure you've seen in rural locations that are so far remote, there are not many local architects. I mean how many registered architects ever set foot in Old Crow? I'm sure there are not many firms that have done buildings in this region, right?

KK | It's unfortunate but it seems like architects can't afford to spend the time in the places they should.

PS | Or they chose not to. Because not everyone practices like that. Not everyone practices community place-based or culturally-based architecture.

KK | I'm interested in hearing more about your perspective on agency in Northern communities. David, you recently gave a presentation at the University of Toronto entitled, Urgency, Agency, and Exoticism: Competing metrics for design in Northern Canada. Could you expand on your framing of this lecture?[1]

DF | I framed my talk through the two sides of the North. One is the real North, which is going through, and talking about, very briefly, Indigenous people living there and the colonization process. I'm no expert. I've never been north of the territory border. But then there's the reality of the people who move there and establish firms there. People like Simon Taylor for instance and Gino Pin. Those are people that did what you're talking to me about as architects. They went there. They were disoriented. In French Philosophy terms, they de-territorialized themselves and then re-territorialized themselves into locations and there was that whole process. And for me, they're still not Indigenous people and they never will be, but they have given themselves the time to live with people there and understand the patterns and all of those other things. So to me, the reality of the situation is that there are the people who have lived there for thousands of years and even the people as architects who move there and start a firm like that.

So, with Arctic Adaptations, it seems to me that [Lateral Office] did a lot of things right as academic Southerners. Like we all do in some of our research, they made sure they were talking to the right people: Indigenous people. In the end, to me, they're on this borderline between the reality of people and building in places and then this other thing, which is the architecture culture, which is what you're hinting about. Which is part of this other machine of cultural thought and now anthropological studies. And the Western architecture world is loving this

1. David Fortin's lecture abstract reads: "It is well known that northern Canada is being disproportionately affected by climate change and that this is having a direct and immediate impact on the people who have inhabited these landscapes for centuries. The urgency for these communities to adapt continues to attract political and scientific attention while architects and engineers search for design solutions. But what determines successful design in these cases? Who is making these design decisions, how, and at what cultural expense?"

idea of going anywhere. And you know I've been part of this too. I'm including myself. I've been working in Kenya and South America. We are globalized profession. But what you realize, at least my argument would be, having done a little bit of that, is that you always can only get so deeply into an understanding of a place and that is just a reality. What you really can extract is minimal.

You know as architects we're often looking for five things, right. This is what I tell my students. If you're sitting down with an Indigenous person like an Elder, we're trained to sit there and listen. What we're really trying to listen for are things that we can extract from that conversation. We can then go back and diagram that out and start to change that diagram into a cool thing that then is going to feed this project that then is going to have an aspect of novelty to it that people will say, 'Hey that's an interesting project.' And then you're going to get kudos and awards from that.

And that's part of what architectural culture has been doing for a hundred years: it has been looking for new things to colonize or whatever you want to call it. And sometimes it's not even about the place. A lot of what I'm seeing happening in the Arctic, in my opinion – again I am not an expert – is there's this wave of designers that are interested in extracting all of these things because it's cool. It's the frontier. So in my talk it was the frontier. And I pulled those quotes from various people who are working out there and they're all saying it's a 'frontier.'

KK | Which might be considered derogatory?

DF | Well the frontier has its own history.

PS | It's a colonial term. As Indigenous Peoples we need to start using our own terms to define our territories. Whose frontier? It's certainly not Indigenous Peoples frontier. Just like the term, reconciliation. It's a settler term. As Indigenous Peoples, we do not need to reconcile anything. We did not steal the land, destroy cultures and languages. Colonialism is not our guilt. That is why our entry into the 2018 Venice Architectural Biennale is so freeing. We can concentrate on a future that rises from the ashes of the destruction of colonialism. Our entry is a future we are imagining. Of course realizing that we live within the context of continuing colonization. It took many generation for us to get where we are. It will take many more generations for us to truly be free…

DF |It's a colonial term. In my talk, for instance, at U of T, I talked about that because I had been teaching in Montana. The 'Wild Wild West', right. So I framed it as the 'Wild Wild North'. So I discuss it as the Wild Wild North. And the thing about the Wild Wild West is that it was totally defined, in terms of the imagination of the people, from the East Coast. New York. London. All of the academic people, they were the ones writing about the West. They never lived there. They might have visited it once or twice, and seen you know a few Indians out there. And then they would go back and write these stories and get someone to draw images of these barbaric Indians ready to scalp people. So everybody - the population of Eastern United States and Europe - thought that this was the reality of the Wild Wild West. But it really wasn't.

KK | It was just a projection?

DF | It was a projection. And so yes we are more globalized and we understand things better but some of this stuff that I'm seeing coming out of this Arctic, has been happening for fifty years. I'm sure you've seen the earlier work in the 60s and 70s. So that idea of extracting something because it is cool and it will get you into the architectural scene by providing this novelties, that's where Arctic Adaptations is sort of on the border in that realm. That's where I'm careful because I don't like to be too critical of them because they were clever enough to know that they - as opposed to some other things that I have seen - they should meet with people. And I have talked to people who were in Iqaluit and other places who were part of that. And most of the people that I'm getting posititve-ish feedback on that project who are saying, 'Look, yes we actually did participate' and some of the more vocal people are really excited about this. They feel like they were a part of that process.

PS | And when you look at it from the other side – from the Indigenous side – going into communities and talking to people and getting their ideas, it's creating more, I don't know what the word is, but you're able to push culture in a way that you couldn't before. Because really it's only this generation back that communities have had access to things like design, especially on reserve. The Indigenous post-1951 world, with the repeal of the Indian Act, when we could actually attend high school and university has seen a growing independence over the last sixty years where we are taking control of our communities and our own lives. If you look at the way the government provided everything, things were drawn in Ottawa or wherever and people would come in, build it, and leave. But then you'd have a school, you'd have a nursing station, you had all that stuff. But now there's a growing, I think, awareness in communities that they can actually influence what gets built. They can have their ideas and we can design them and it's something that at a community level, when the building's built or whatever. They're happy with it because it's them.

I know in my own projects, that's what I'm trying to do. I may not be from that community but I'm trying to make sure that when the project is done that they're happy with it, that they're invested in it, that they've been participating all the way through. It is their legacy.

….

DF | So those are the things, right? Arctic Adaptations is an interesting one for me in that way because there's a whole wave of architects, maybe the majority, who are looking for success in those terms because some things will eventually lead to projects. But for me, what's questionable, and I guess why I go back to the way you've positioned your research as a student who is trying to figure out this territory that is getting controversial, I would say.

2. See David's piece, *Other places, other incentives: The African spectacle in cross-cultural architectural education.*

Part of my talk was on Rem Koolhaas. I think a gaining awareness of this kind of work in architecture is coming from all of this. But to critically position yourself as giving something potentially meaningfully back to those people, even if you can't be there –

PS | Or available to them – Indigenous society in this country has changed so much in the past twenty-five years. I see a more positive future for our communities.

DF | And it's available to them. That's what I like about what she's talking about. Because other projects, and I don't know enough about Arctic Adaptations, but a lot of other things that I've seen in this context and even in some of my own work. You go to these places, you talk to people, you learn from them, and it's amazing, right? As a personal learning experience.

This is what I dealt with with my students in Kenya and why I wrote that piece that you might have read, because you go to this place and everyone is learning.[2] Coming back, we were really reflecting on that and I think that we were trying to add agency back to the local people of Kenya and actually a couple of projects have been successful in that way. But with the student projects, it was hard, because we were designing housing projects with students who couldn't go to Kenya. Only a few of them actually went there.

Anyway, for me, the biggest question that keeps coming up is how are the communities and the people that you're talking about meaningfully benefiting? Because if there is a benefit that they're actually receiving something back from you, from your educational benefit then you've got a reciprocity on some levels, right. But what I'm seeing in various studios in other contexts where it's so one-sided. And this is the colonial problem.

PS | It's doing it for. As we say, not for us or without us! The time has come that Indigenous communities will harness their Indigenous knowledge for the good of their community and we are starting to see it, here at Laurentian, other schools of architecture and in the profession.

LISTENING

Across the circumpolar region of our planet, many northern communities face an urgent need to adapt to environmental, social, and geographical change. In Canada, the disciplines of planning and architecture have participated in forcibly re-shaping the land and the lives tied to it by acting – and continuing to act – as tools in the settler-state's process of colonization and land accumulation.[8] At the same time, strong warming trends are rapidly reshaping the land and impacting the lives tied to it. In the Canadian Western Arctic, the movement of the ground itself is changing, amplifying the challenges of foundation building.[9]

This region is composed of many homelands, each intertwined with a meshwork of diverse and dynamic relationships. The urgency faced by this region with increasing warming trends has entangled multiple realities. One reality is that of the real North: the land that is intertwined with the lives of people who have lived close to it for countless generations. Another is the reality of the newcomers: the scientists and the often-distanced architects, planners, and engineers who explore these critical issues of environmental change with their expertise and participate in an effort to design 'solutions.'[10]

Current climate models project that the Western Arctic will continue its current warming trends at a rate that is significantly higher than the global average. In Old Crow, mean annual air temperatures are predicted to increase by 1.1 to 1.5 degrees Celsius between 2011 and 2040. If the permafrost underlying the community warms to just below 0°C, it can result in the ground's increased vulnerability and material sensitivity to climate change.[11]

The communities that have had roots in this land since time immemorial are experiencing these changes first-hand. They are felt on the land in melting permafrost, increased ground slumping, the growing unpredictability of weather patterns and accelerated erosion.[12] The land's behaviour is becoming increasingly difficult to predict as weather patterns, caribou migrations, and the ground shift.[13] These changes are entangled with life and culture. In recent years, the United Nations has recognized the effects of climate change as a human rights issue for all Indigenous peoples, while the grassroots movement *Idle No More* has called "on all people to join in a peaceful revolution, to honour

Indigenous sovereignty, and to protect the land and water."[14] In the face of this physically changing land, the strong relationships that many First Nations, Inuit, and Métis peoples in the Western Arctic have with the land are shifting with it and communities are facing an urgent need to adapt. The Gwich'in and Inuvialuit peoples have noticed many changes to their traditional territories in the Northern Yukon, which in turn have impacted their relationships with the land as source of food and cultural sustenance.

While distanced technical 'experts' may measure, quantify, and gather data that documents similar changes to those observed on the ground, the Van Tat Gwich'in, like many northern Indigenous peoples, occupy the critical role of place-based knowledge holders of this shifting land. They are the 'ground truthers' of global environmental change.[15] Many are noticing these changes in their daily lives. Some community members in Old Crow are concerned with the impact they will have on the traditional foods and land their people depend on.[16] These rapid changes the land is undergoing have made it more difficult for elders to teach young people about the land they grew up on.[17] Amid these changes, the community's relationships with the land have adapted and endured. Expert knowledge of this land is held by the Van Tat Gwich'in.

Many different ways of knowing the land exist in Old Crow. The community is grounded in a region scientific experts term a 'continuous permafrost zone.' Subsurface soils here remain frozen throughout the year.[18] Despite this name, this land might be considered a durational environment: a meshwork of forces in constant flux. Factors such as seasonal freeze-thaw cycles, permafrost degradation, erosion, and flooding are registered as changes by the ground plane. These changes are manifested in eroding riverbanks, landslides, and undulating building pads. Any notion of stasis in this place is challenged by the shifts seen by those who know this land.

Strong and deeply knowledgeable Van Tat Gwich'in voices are instigators of their own research and are important collaborators in research within their traditional territory. Local understandings, place-based observations, and Gwich'in knowledge of the land are powerful. While they stand on their own, they also provide solid foundations for contemporary research practices, approaching a more horizontal relationship between the community's concerns and the work of southern-based technical experts on ecological and climate change science projects.[19]

"I see a lot of bank erosions along the river and permafrost melt."

"The land is drying up and the permafrost is melting fast."

"The weather is getting warmer and warmer. Plants are growing faster, especially the willows. The caribou migration is changing. They're going a different route…"[20]

"The water in the rivers is low. Everything is drying up."

"I see a lot of land slides and a lot of lakes drying up."

"It's really warm. I don't trust the weather. You can't read the weather anymore."[21]

I met Gwich'in Elder Stephen Frost at a feast held in the community hall. As we sat in the hall, sharing a meal with community members and visiting researchers, he told me how many people in town had worked together to harvest logs from the land and construct this space. Later that night I learned to jig on its floorboards, dancing clumsily with two left feet as I began to get to know this building as a connection to place.

Stephen's presence was a constant in my time in Old Crow. His friendship and generosity was a vital contribution to my experience. While spending time with him, I learned about Gwich'in culture, hunting and the territory, but I also learned foundational lessons about listening to people and the land.

Stephen knows Vuntut Gwitchin territory intimately and has spent much of his life out on it. He has travelled all over the Western Arctic by dog sled, helicopter, skidoo, boat, plane, canoe, and on foot. His stories have guided my thoughts to Firth River, Hershel Island, *Van Tat* (Old Crow Flats), the Mackenzie Delta, northern Alaska and the southern Yukon.

Van Tat Gwich'in culture is place-based. Life is learned by spending time on the land and listening to stories about it. While I was in Old Crow, Stephen, along with several other elders and knowledge holders, went out on the land with youth. As part of an ongoing cultural heritage project, they visited significant places and shared individual and collective stories about them.

Stephen told me about building his camp that he had recently taken me to while we sat at his kitchen table drinking tea. The camp sits on the bank of the Porcupine River, across from the mouth of the Bluefish River. A skilled hunter and trapper, Stephen had maintained his trapline near his camp and spent much of his life out in the bush. The first cabin he had built there had

fallen into the water when an eroded bank collapsed beneath it. He had looked carefully for firm ground to build his current cabin on, knowing that within the space of a few hundred feet the soil might be completely different. Attention is required to look at the ground and ensure it is firm. Attentiveness is a skill and a necessity. If the ground is soft, your cabin could fall in.[22]

Some of the best tea I have had was made with Bluefish water. I would sit with Stephen on his porch, in his kitchen or on his couch and drink *lidii masgit* (Labrador tea). Every time I went out on the land, I would catch my eyes searching for this plant. They had attuned to recognize its leaves and flowers; my nose could discern its sharp fragrance and my body had learned its height and how to feel the moist terrain on which I knew it grew. *Lidii masgit* likes wet and spongy ground. In this region, the plant's presence alone can tell you when ice-rich soils are located beneath its shallow rhizomatic root system. I would pick the leaves, tie them and carefully dry the bundle upside-down as Stephen had taught me.

I would make tea with Stephen on a fire out at his camp and in his kitchen in town; we would often be joined by Stephen's friends, family and other visiting students. I was used to fast-paced conversations where it was common courtesy to fill the silence between people with a steady stream of words. As I became more comfortable with the quiet that was sometimes only broken by pouring tea, I also grew more attentive of the voices and actions of others. While our discussions were sometimes serious and heady, we would inevitably find ourselves joined in laughter over one of Stephen's jokes.[23]

Our conversations, like *lidii masgit's* subtle flavours, built on themselves with time. The tea's heady aroma of pine and lemon would find its way into my hair and clothes, lingering in the air around me like the residue of Stephen's words. Discussions left me with the sensation that I was waiting for my strained eyes to adjust to a change in light. Conversing with Stephen felt like reading a good book of philosophy.[24] Eventually, my mind would attune itself to his words and something in my understanding would shift.

After making a significant point, Stephen once asked, "Do you hear me?" Receiving this prompt felt different then the more familiar question of "Do you see?" Noticing and observing are important, but seeing what is visible cannot teach you to be a good listener.

Listen. Hear. Absorb. Attune. Only then can something be offered up that is worth being heard.

DISCUSSION: STEPHEN FROST

In his kitchen in Old Crow, Yukon, I listen to Gwich'in Elder Stephen Frost describe his log cabin at Bluefish Camp that we had recently visited together:

KK | Can you tell me about your cabin at Bluefish?

SF | Well my cabin is a different thing. You've been there. And it's too bad we couldn't do, have did such a thing at that time but I didn't know either. And maybe not enough time but that's more or less one of the cabins you won't see much of anymore. It's built right on the ground.

KK| So there isn't anything below?

SF | No insulation. I didn't even like the idea of lining it with few of those plywood and that but the kids did that. I'd sooner not have that. The floor's different. You get some plywood. And the roof, so it don't leak, but you build it on the ground like, good hard ground. (taps on table) And you might put 2x2 you know, 5, 6, inches in diameter along on the ground and you try to get it as smooth as you could. Level. And then you start your log on top of that. And each side is the same way. You leave it open for that. Cabin has been there how many years, it never settle yet. So it's little bit by looking at the ground and making sure there's no water underneath. And you start building your cabin there, where as maybe 200 feet from there wouldn't be the same. And then at the corners of it, it's easy to take a shovel and dig down to the last log, supposing that got out of shape and you can jack it up or take a log and pry it up and try to level it. Now you see the logs in there, there's no insulation. I don't know if you noticed. I just used moss. We didn't have insulation way back so we just use moss, which is just as good. It's not extremely built too well but it had lots of time and use, that moss. Any sort of ventilation that might come in or out you plug it with moss and that stays there forever.

Long time ago we used to get mud or clay if we could. There's a couple of places up the river where we get clay. Put it in a big pail and boil it up and you rub it on that moss on the outside in between each log and that and it's warm. You build a fire and it warms up real fast. The only ventilation we get is the door. If it's too hot or you know we always have a little vent where you could get fresh air inside so it don't moisten and get mouldy.

…

KK | I'm trying to understand how the ground is shifting.

SF | Nature controls the river. So you can't always put cabin in the right spot. And that's what happened in my first cabin. And you camped in that cabin I've got there now. It's probably good for a long time yet. So where we build that cabin, you know five hundred feet from there, could be soft ground and it would sink then. So you look for hard ground… OK. Now you eat some berries!

fig 3.2 (opposite) While I abandoned the myopic gaze of my attunement devices, choosing instead to experience the land without these mediators, the devices surfaced in conversations

ATTUNING

Scientific rhetoric is embedded in techno-scientific rationalism. Scientists and engineers quantify this modulation. They measure, test, and categorize the ground while collecting data to calculate solid rates of change. And yet the more I learned about permafrost, the more I understood how few generalizations can be made about its behaviour. Each site is unique and has a multiplicity of relationships that are always changing and intermingling, like a piece of felt where each toothed fibre is entangled with the movement of others.

The Euro-North American world view is grounded in ways of knowing that privilege rational and objective thought. We name, divide, categorize, and order things. Michel Foucault describes reading a Chinese taxonomy of animals in Borges' writing as the moment in which his own "landmarks of thought" were shattered.[25] A good hunter knows the land and uses landmarks learned through individual and collective experience to navigate a dynamic landscape without getting lost. Particular landmarks are known to the Euro–North American world view and are used to navigate our shifting space of knowledge. When presented with a place or an ordering without these familiar beacons, an inevitable sense of disorientation surfaces when confronted with the limitations of our own myopic system of thought, the constellation of relationships Foucault terms our *episteme*.

Architectural discourse about the North has, for a long period of its history, originated in the South – or the rest of the world as seen from the North. A short reflection on the history of Canadian architecture on this 'frontier' conjures images of modernist buildings set against the bare backdrop of the 'ice desert.'[26] The Northwest Territories town of Inuvik was founded in the Western Canadian Arctic in 1954. Its dedication plaque describes it as "the first community north of the Arctic Circle built to provide the normal facilities of a Canadian town."[27] At a similar period in northern nation-state building, architect Buckminster Fuller contributed to military geodesic Radome structures constructed for the D.E.W. (Distant Early Warning) line, a design that was driven by efficiency, ease of transportation, and performance.[28] British architect Ralph Erskine, once considered an 'expert' in northern building, described his master plan for Resolute Bay, Nunavut that was featured on a

1977 cover of Architectural Design as a "new town in the Arctic wastes of northern Canada." A deeper look into the narratives around this community reveals the story of the Canadian government's forced relocation of Inuit from their traditional territory on the Hudson Bay to found new settlements including Resolute Bay in 1932.[29] Many stories told about the North through postwar architecture are built on these same dangerous foundations of colonial logic.

A site is never 'discovered.' European explorers did not 'discover' the Arctic. It was there all along, they just weren't aware. Some early European explorers were so disoriented by the Arctic landscape and its lack of familiar landmarks that they could not re-orient themselves in the land and lost the ability to differentiate between up and down. This phenomenon was termed the *ganzfeld* effect. Today we can experience a similar sensation in the works of James Turrell, where carefully curated light temperatures and calculated intensities disorient us in the white box of the gallery, disconnected from any landscape.

How we attune ourselves to a site impacts how the buildings we help design will connect to a place. It seems to me that getting to know a place also involves having a series of open conversations with it. The visiting architect can only expand her understanding of a place if she learns to listen to it.

Open conversations with elders, local knowledge-holders, builders, and foundation levellers in Old Crow deepened my understanding of the ground. An attentive eye can look at the foundations of nearby buildings and understand the ground through the reciprocal relationship these structural components have with it. What is above the ground is entangled with what is below its surface. While data often speaks louder, listening to these silent dialogues of site is also necessary to understand a place.

DRIFT COMPASS

This perceptual device attempts to render visible the formation of drifts, condensing the temporality of this event. Carved from soapstone, the device is pointed into the wind until tracings of the wind through conceptual snow (here rendered shown with wind-blown soapstone dust made in the process of milling) can be seen and felt on its surface. The drift direction reveals the prevailing wind direction during its use.

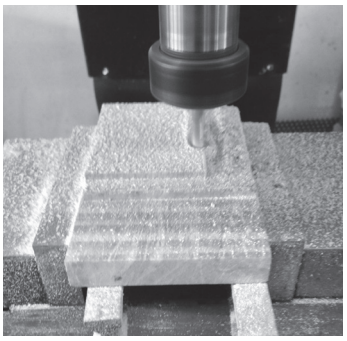
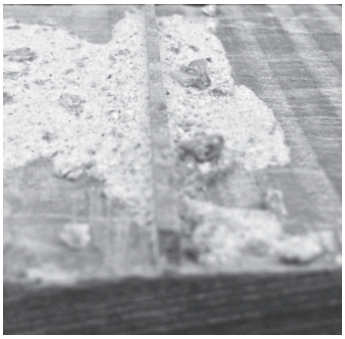
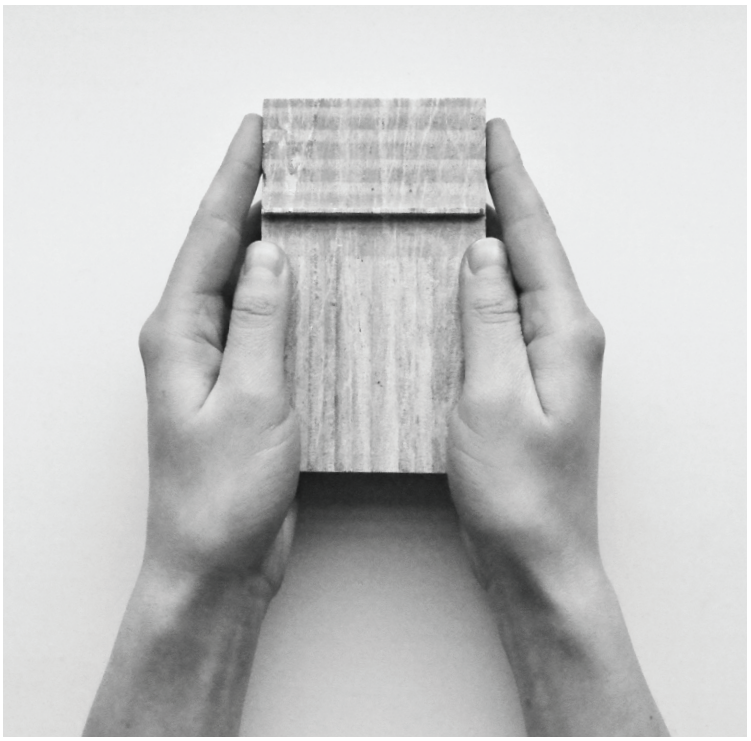


fig. 3.3 (top, left) A block of soapstone quarried in Northern Québec
fig. 3.4 (top, right) Manually milling the block and carving away at the material
fig. 3.5 (bottom, left) Soapstone dust blown by the wind against the bar registers the wind's movements
fig. 3.6 (bottom, right) The finished 'wind compass'

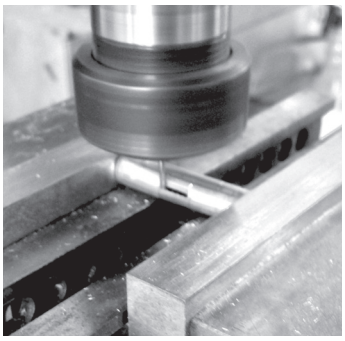


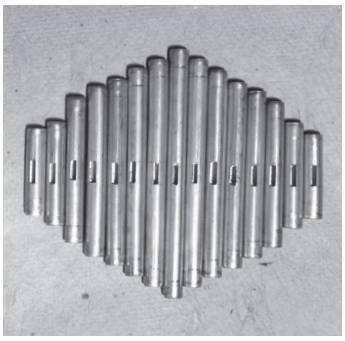


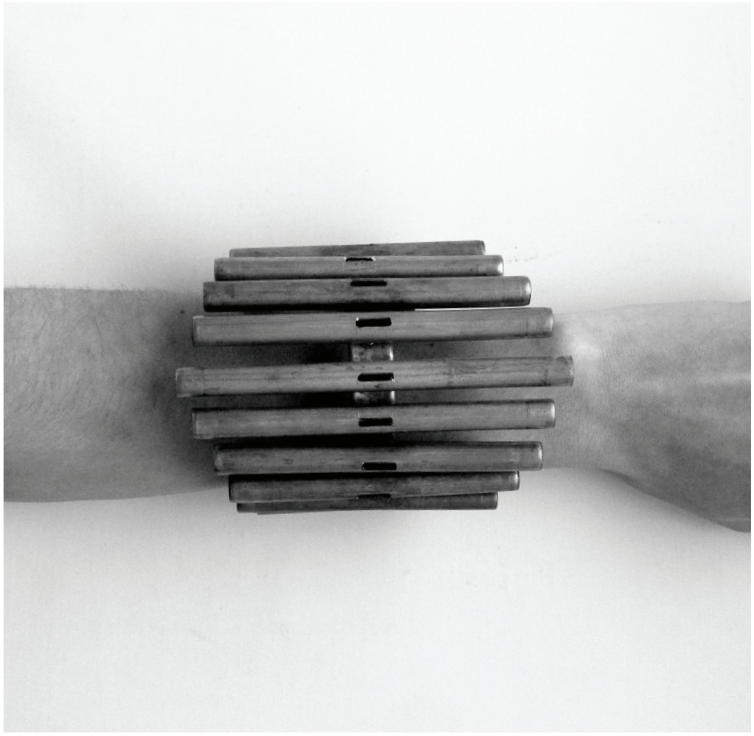
WIND WHISTLE

A cuff made of copper conduit of different lengths, catches the wind and creates a series of sounds which invite its beholder's attunement. This perceptual device attempts to cultivate attunement through a dynamic engagement with the prevailing wind. When exposed, the conductive material leaches heat, bringing an awareness to its presence.

fig. 3.7 (top, left) Copper conduit used for plumbing projects
fig. 3.8 (top, right) Manually milling angled openings into the pipes to create sound
fig. 3.9 (bottom, left) Copper pipes that have been cut, straightened and milled before welding
fig. 3.10 (bottom, right) The finished 'wind whistle'

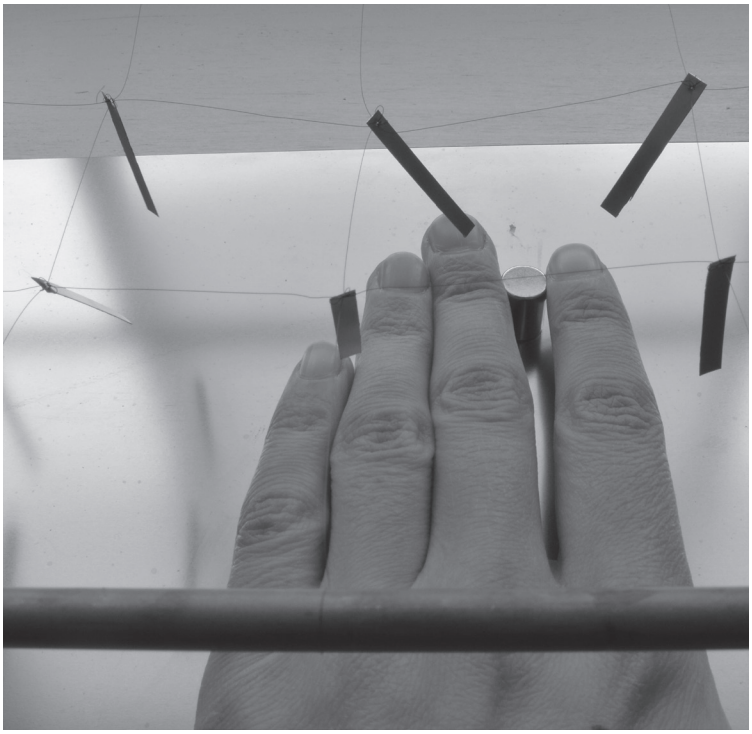






MAGNETIC GRID VARIATION DEVICE

This perceptual device attempts to render visible the deformation of a magnetic grid. A wandering pole (magnet) can be slid along the metal based of the model. As it moves, it attracts points along the grid, which in turn pull on other nodes. Each movement of the attractor is felt across the entire grid; no movement occurs in isolation.



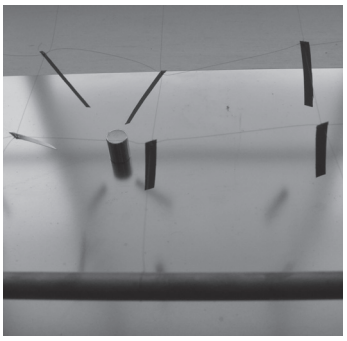
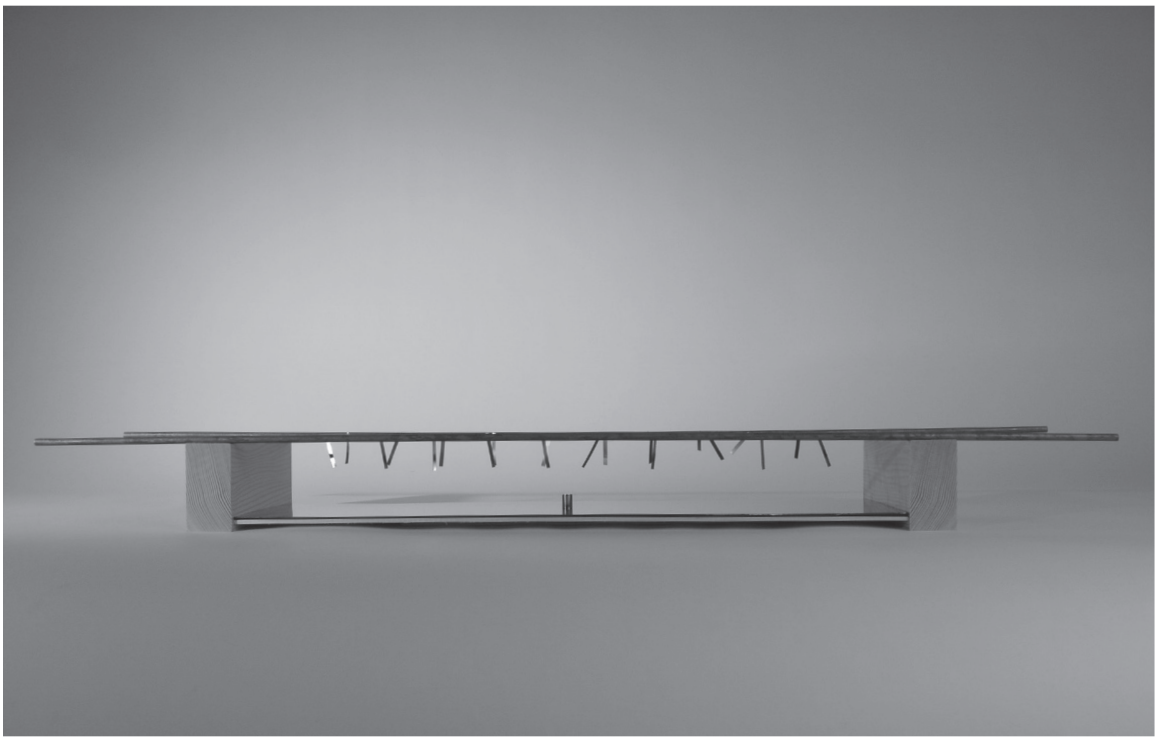


fig. 3.11 (top, left) Moving the magnet along the metal base
fig. 3.12 (top, right) The grid deforms and registers the movement of the wandering magnetic pole
fig. 3.13 (bottom) The finished grid resting on wooden blocks



BUILDING

While in Old Crow, I learned a lot about building on the shifting ground from the Vuntut Gwitchin Government's Director of Government Services, Howard Linklater. His years of experience going out on the land, living in this community, and leading construction projects in town positioned him as an important knowledge-holder and 'expert' of building on permafrost in town. I would sit with Howard at a table in his office supported by the floor of the Sarah Abel Chitze Building that rested in the ground on shallow spread footings. While my architectural education and research gave me a surface understanding of this challenge, spending time with Howard helped deepen my knowledge of it more than any text book could.

In the practice of architecture, responsibilities and designs are often compartmentalized and divided. Foundation building is not an isolated challenge. It can impact and be impacted by heating systems, ventilation systems, sewage systems, and the overall building design. My conversations with many people in Old Crow about foundations often started at grade, but quickly progressed to above-grade discussions.

Another dialogue forms between the building and the land. From my own observations, architectural research, discussions with technical experts, and conversations with knowledge-holders it became clear that both permafrost degradation and the freeze-thaw cycle impacted buildings and the land. Howard told me about the impacts these both had on buildings and described the ways the freeze-thaw cycle translated into the reality of living in a house built on frozen soils. This story of the dynamic relationship between the shifting ground below and the moving building above felt to me like a conversation that they each participated in.

GETTING TO KNOW THE LAND

A technical site 'investigation' can be considered as another form of conversation. The geotechnical engineer or permafrost researcher who probes the ground searching for the edge of the active layer asks a question and listens for the ground's answer. The subtle difference between pushing the metal probe into the organic layer of the ground and hearing a sharp clang or a dull thud might indicate the presence of stone or wood.[30] Once the ground's resistance meets the researcher's probing, her attuned body is able to feel the presence of frozen ground. She can then translate this and infer the thaw depth, drawing it as a line on a chart or section. Depending on the time of year she returns to have a subsequent exchange, the ground might thaw further down or freeze higher up. These exchanges can give a sense of the active layer, but the nature of what is below the surface is then confirmed by digging a test pit, installing a thermistor, or drilling a bore hole and extracting core samples of the ground from which to analyze, quantify, and harvest data. Soils are classified according to industry standards and temperature readings are logged and averaged.

When I returned to Whitehorse after my second summer in Old Crow, I met with two geotechnical engineers who had practiced in the community, Richard Trimble and Chad Cowan. We sat down at a busy diner overlooking the airport and the overlapping Alaska and Klondike highways. The pace of our conversation and the traffic outside felt dizzying. Our conversation was filled with numbers, categories and technical terms that felt clumsy on my lips. Since my return from Old Crow I have continued to notice shifts in the tone and inflection of my voice. I am learning how to take up less space and select each word carefully to hold more weight.

I sat across from the engineers and shared the work I was doing with them as we ate lunch together. I was trying to deepen about the relationship between buildings, foundations, the hands and minds that build, and the shifting land. Richard and Chad shared their technical expertise and their professional method of approaching and understanding a site that they developed over years of experience in the field and at their desks. Their stories were also filled with conversations with the land, in which they asked specific questions of the

land and listened to the land's answers. Richard described their approach to a site:

> We do a technical investigation. Every building has to have what we call a 'site investigation', which includes drawing. You can't just look at a site and say 'oh this foundation is right'. You have to know. Engineers need data. We have to have information. With permafrost, we need to know the soil type and the ground temperature. Those are very important. You need both. You can't just have one.[31]

Site investigations provide valuable information to further the Euro–North American quest to build with certainty. While these conversations are translated into the languages of data and prescriptive taxonomies, there are other ways the technical expert's senses are attuned to the land. For geotechnical engineers, soil samples and measured ground temperatures play an important role in categorizing permafrost as warm, cold, or in between. At the same time, the presence of certain plants and even the surface of the ground itself can communicate significant information about the nature of the ground beneath it. The presence of Black Spruce trees, hummock features, and ponding water can all suggest there is ice rich soil beneath the ground's surface. Chad elaborated on this:

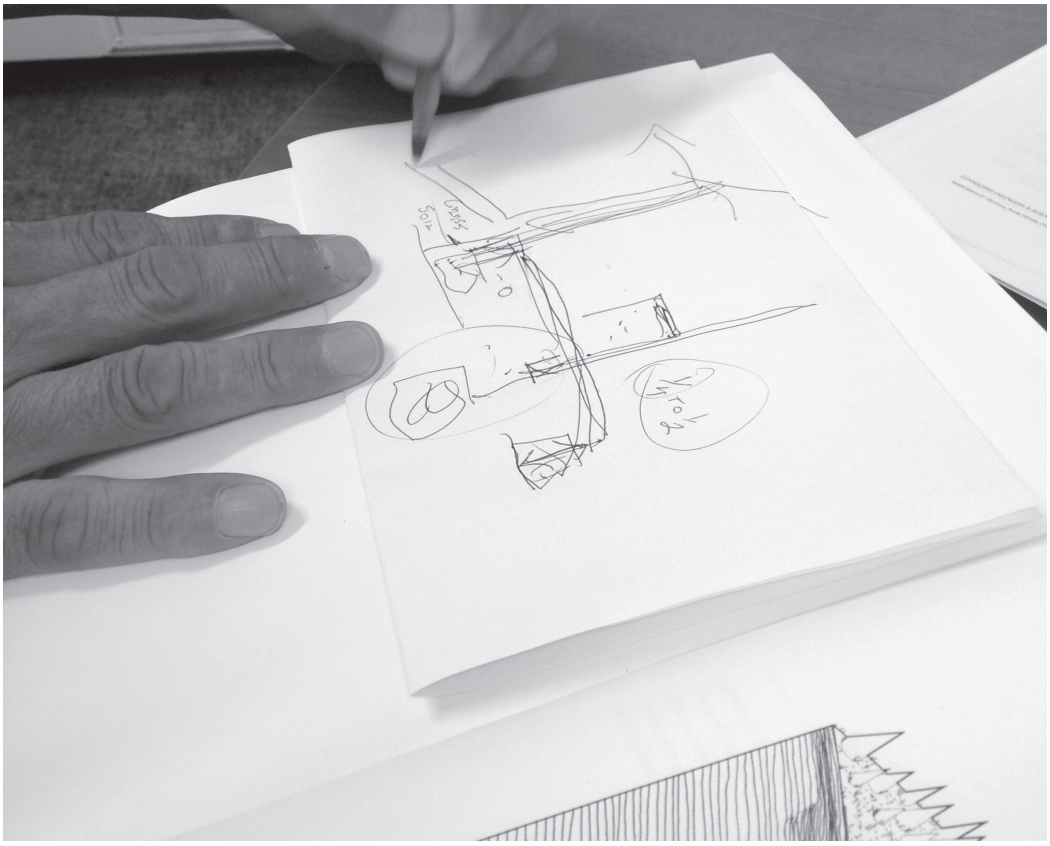
> During the site investigation stage, that is when you are out there doing your field reconnaissance. You're actually looking at the vegetation too. You look at features. You can identify an area as potentially having permafrost by looking at stuff like black spruce, looking at the hummock feature, looking at ponding water, drainage etc.[32]

I think with my hands, by making and drawing. Early on in my research I fabricated a series of attunement devices. These pieces were designed to mediate my experiences and help my body and senses re-orient themselves to particular forces out on the land: wind, snow, gravity, and the magnetic field. Euro–North American society has a tendency to trust devices over our own senses. While I learned about these forces through making attunement devices that sharpened my attention towards them, it became clear that, if I was to do good work, I needed to engage with the land and develop relationships with it and people who know it that were open and unmediated.

While the newcomer architect can never be *of* a place, and her knowledge of it will never reach the level of those who are *from* it, she can attune herself to a place through time spent out on the land listening to traditional knowledge-holders and people who know it through years of personal and

shared experience. The visiting architect's 'site' is implicitly grounded in these stories and in this land. While complete cultural attunement may be beyond the visiting architect's capacities, she can learn to practice with listening and empathy. In de-centering her own expertise, attuning herself to the land, and re-learning how to practice responsibly, the visiting architect can strive to ground her work in a *site* as a *place* and build on genuine connections to it through balanced conversations with others.

Although the professional purview of the architect can be considered to be from the 'ground-up,' it is imperative that she knows the land she is building with as closely as possible. While this series of conversations presents a number of different ways of approaching a site, these perspectives resonated around the understanding that each and every site is unique. Getting to know the land involves having meaningful exchanges with the land and about it with various experts and knowledge-holders.



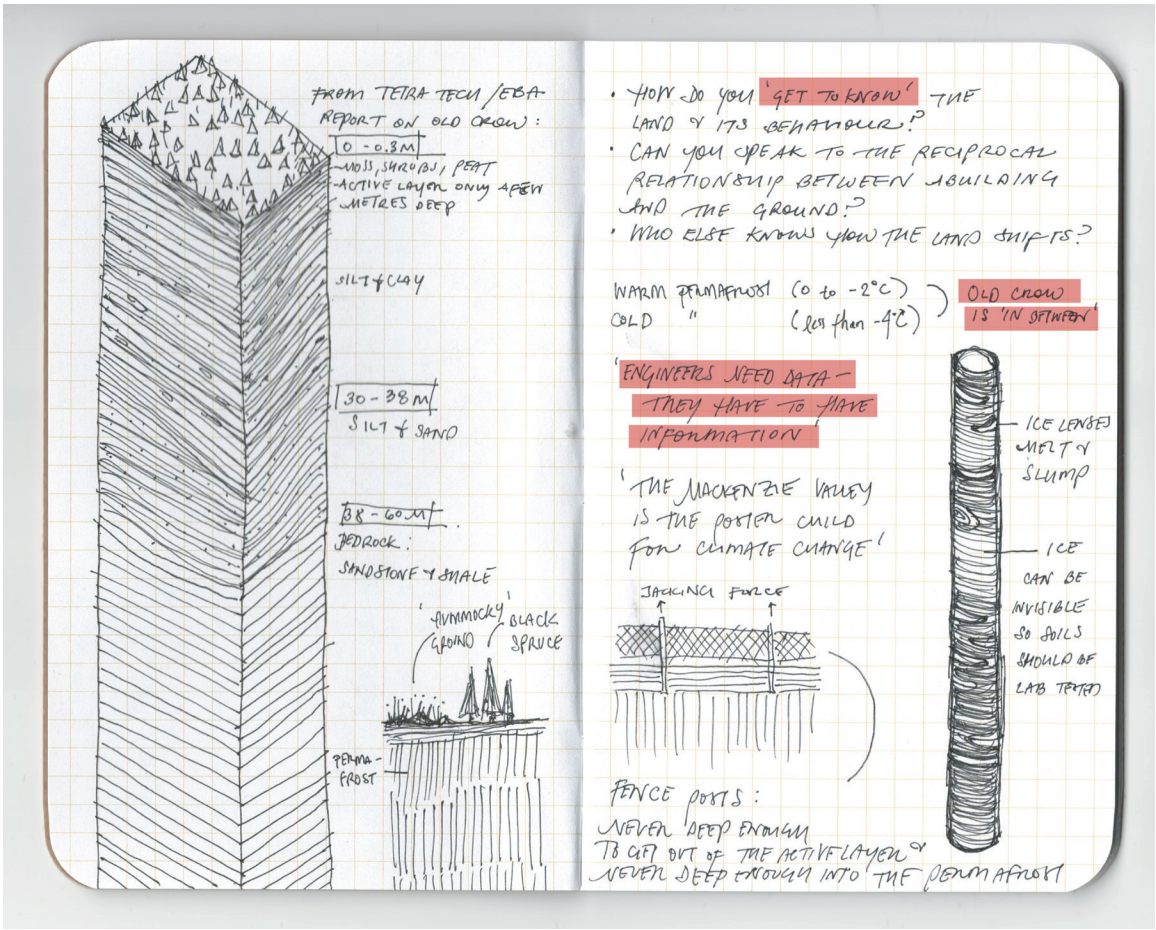
DISCUSSION: HOWARD LINKLATER

Howard Linklater is Old Crow's Government Services Director, and a Vuntut Gwitchin First Nation citizen. Sitting with me in his office, he recounts the impact of the freeze-thaw cycle on buildings:

HL | My first house I built on a swamp. Poor natural drainage. I shouldn't call it a swamp. It was just a natural creek or something and the house used to every summer, the door wouldn't work. But in the fall it would work fine. The freeze and thaw cycle would drop the house down to a point where it would, the door was staying like this (points up) and the house was coming down (points down) so it wouldn't work but it would come back up in the same spot in the fall.

That freeze-thaw cycle is the major impact on our buildings. We know this from the early days because what they used to do was build on the ground and use sawdust as an insulator. Back in those days they didn't have a problem with the ground, because the ground was frozen because of the sawdust. The ground was maintained. The ground remained frozen because the sawdust was an insulator. So when they built houses they threw all the chips and sawdust in the foundation and covered it up and that was, they didn't have an issue.

fig 3.14 (opposite) Howard is experienced in building with permafrost, and his knowledge greatly contributed to my own. In my conversations with him, drawing was another form of language.


FROM TETRA TECH / EBA REPORT ON OLD CROW:
0 - 0.3M
MOSS, SHRUBS, PEAT
ACTIVE LAYER ONLY A FEW METRES DEEP
SILT & CLAY
30 - 38M
SILT & SAND
38 - 60M
BEDROCK:
SANDSTONE & SHALE
'HUMMOCKY' GROUND
BLACK SPRUCE
PERMA-FROST
• HOW DO YOU 'GET TO KNOW' THE LAND & ITS BEHAVIOUR?
• CAN YOU SPEAK TO THE RECIPROCAL RELATIONSHIP BETWEEN BUILDING AND THE GROUND?
• WHO ELSE KNOWS HOW THE LAND SHIFTS?
WARM PERMAFROST (0 to -2°C)
COLD " (less than -4°C)
OLD CROW IS 'IN BETWEEN'
'ENGINEERS NEED DATA — THEY HAVE TO HAVE INFORMATION'
'THE MACKENZIE VALLEY IS THE POSTER CHILD FOR CLIMATE CHANGE'
JACKING FORCE
ICE LENSES MELT & SLUMP
ICE CAN BE INVISIBLE SO SOILS SHOULD BE LAB TESTED
FENCE POSTS:
NEVER DEEP ENOUGH TO GET OUT OF THE ACTIVE LAYER &
NEVER DEEP ENOUGH INTO THE PERMAFROST

DISCUSSION: RICHARD TRIMBLE AND CHAD COWAN

Richard Trimble and Chad Cowan are geotechnical engineers who have worked throughout the Yukon. In a discussion at the Whitehorse airport diner, they describe their process of getting to know a site:

fig. 3.15 (opposite) A scan from my notebook open to a page reflecting on my conversation with Richard Trimble and Chad Cowan

KK | I am interested in knowing how you get to know the land from your technical perspective. How you understand how it is behaving: methodologies, what you see when you go to site and what you look for on the land.

RT | We do a technical investigation. Every building has to have what we call a 'site investigation' which includes drawing. You can't just look at a site and say 'oh this foundation is right'. You have to know. Engineers need data. We have to have information. With permafrost, we need to know the soil type and the ground temperature. Those are very important. You need both. You can't just have one.

CC | During the site investigation stage, that is when you are out there doing your field reconnaissance. You're actually looking at the vegetation too. You look at features. You can identify an area as potentially having permafrost by looking at stuff like black spruce, looking at the hummock feature, looking at ponding water, drainage etc.

KK| Right - and some types of berries and Labrador tea.

CC | And when you're going around you can walk around and using a permafrost probe you can get through the organics and hit some kind of hardness.

RT | That just gives you the active layer.

KK | And would that be when the active layer is thickest, in the summer?

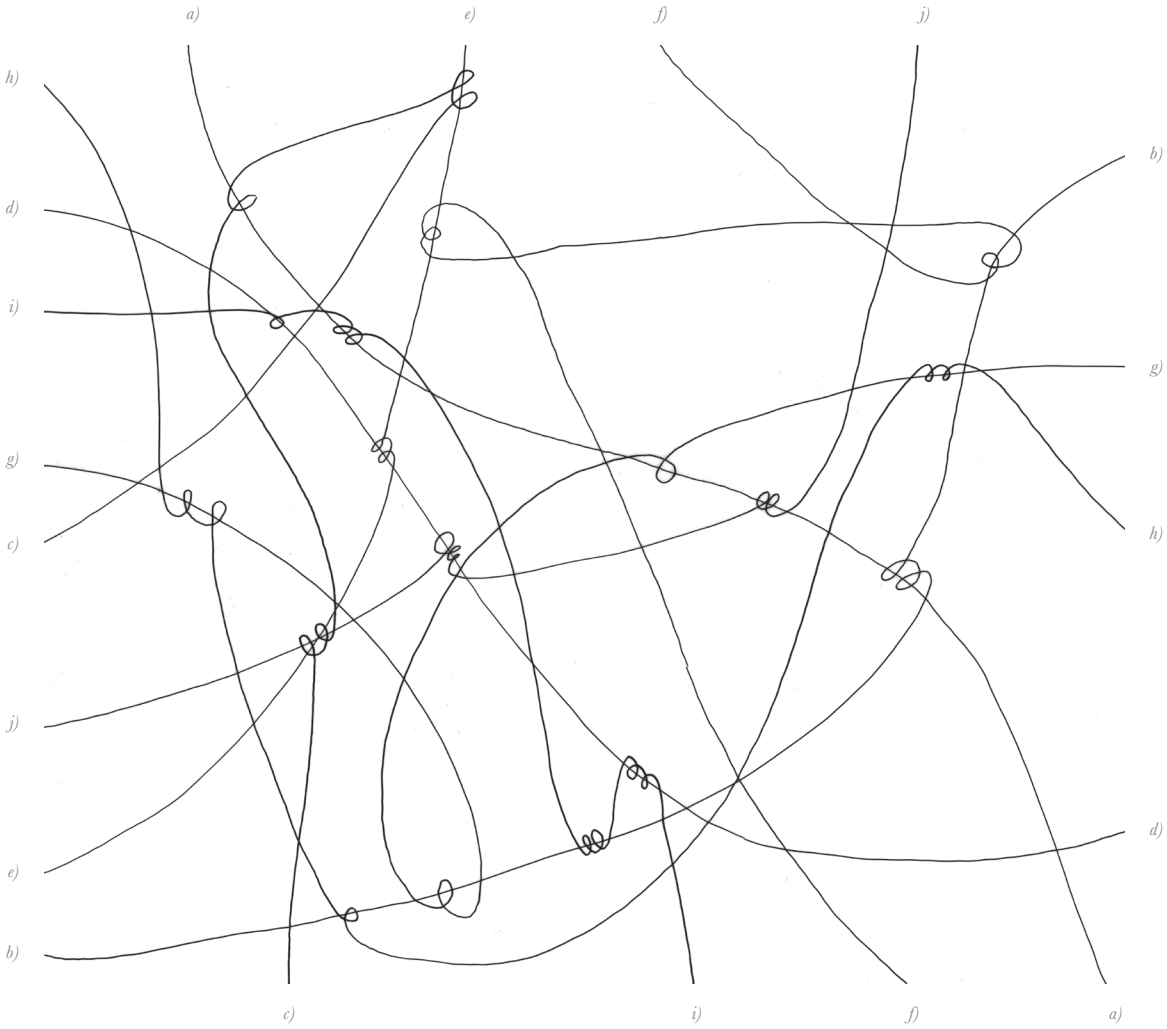
CC| Whenever you are there, you can determine what the condition of the active layer is at that time. After that, you'd definitely need to drill some holes and actually do some test pits to confirm what's under the surface.

KK| Engineering involves a lot of data but in some ways it seems very imaginative because you have to predict so much. Once you get that information and look at those drill holes, do you have to imagine what the ground might be like?

CC| It depends on your drilling technique. Especially with permafrost, you're trying to drill so that you can get a sample that you can use. There are many methods that you can use to get those samples. There are different types of drilling: there's physical drilling and sonic drilling, etc. You try to recover samples and look at the ice contents within those samples.

RT | It's a whole new world out there in terms of technology.

CC| The key is to get almost an undescript sample that you want to bring to the surface to take a look at that ice content and then you're taking visual observations. Plus you're also bringing those samples back to a lab to get an idea of ice content that might not be visible in the sample. When it thaws it might just be a puddle. That's the information you try to get out of that site investigation. So you are then trying to extrapolate between those. You can only drill so many holes for a site investigation because otherwise it would just be economically unfeasible.


a)
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AN ENTANGLED WEB OF RELATIONSHIPS

inhabiting the decision tree's 'gaps'

The CMHC decision making tree reinforces the dominant technoscientific approach to building on permafrost. There are significant gaps in its arborescent framework. This meshwork proposes an alternative process for approaching a site. It outlines overlapping, open-ended questions and trajectories for the visiting architect's actions and 'field operations.' Each question presents a prompt for more levelled conversations about constructing connections to the ground. Building is a form of conversation that should engage multiple voices. As each web of relationships is specific to place, this diagram should not be understood as a universalizing metric but as one assemblage of constantly shifting interconnections within which myriad configurations are possible.

fig. 3.16 (opposite) An entangled web of prompts raise questions for the visiting architect to consider. Each path of questioning is entwined with the paths of knowledge-holders, places, and further questions. Unlike the decision tree, there are no definite beginnings or ends, only 'in-betweens.'

a) Who knows different ways that the land shifts? How can you learn about this shifting and ensure the building will be resilient and adaptive to change?

b) Who knows the history of this site and might share these stories with you?

c) What perspectives have framed your understanding of this place? Can you un-learn what you know about this place in order to re-learn about it?

d) How much shifting can the building tolerate?

e) What forces should you attune yourself to and how?

f) How can you attune yourself to this place without the mediation of devices?

g) How can you ensure that you involve everyone close to this project meaningfully, and how will you ensure you have meaningful conversations with these people before you touch the land by building?

h) Who will this project impact and how? What are the metrics for successful architecture in this context and who is determining them?

i) Have you looked at other nearby foundations? How can you better understand their relationships with the land?

j) How can you start to understand the multiple perspectives and relationships that are entangled with this land to build responsibly? What sort of relationship will the people who inhabit this building have with it once the architect has left?

k) What protocols and relationships are entangled with this land and how will you learn more about them?

NOTES - BEARINGS

A version of this essay appears online in the "Vernaculars" (Winter 2016) edition of *The Site Magazine*.

1. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation* (Mississauga, ON: Canadian Standards Association, 2010), iii.

2. Sheila Watt-Cloutier, *The Right to Be Cold : One Woman's Story of Protecting Her Culture, the Arctic and the Whole Planet* (Toronto: Allen Lane, 2015), 324.

3. Thomas Berger, *Northern Frontier, Northern Homeland: the Report of the Mackenzie Valley Pipeline Inquiry*. (Ottawa, ON: Minister of Supply and Services Canada, 1977), 10.

4. Jim Lotz, *Northern Realities : The Future of Northern Development in Canada* (Toronto: New Press, 1970).

5. As Linda Tuhiwai Smith writes, "From the vantage point of the colonized, a position from which I write, and choose to privilege, the term 'research' is inextricably linked to European imperialism and colonialism." Linda Tuhiwai Smith, *Decolonizing Methodologies* (London: Zed Books Ltd., 1999), 1. See also Amrit Phull, "Between North and South," *The Site Magazine* 36, (2017).

6. Hosagrahar, "Interrogating Difference: Postcolonial Perspectives in Architecture and Urbanism.", 14.

7. Susan Schuppli, "Can the Sun Lie?" in *Forensis : The Architecture of Public Truth*, ed. Forensic Architecture (Berlin: Sternberg Press, 2014), 59.

8. There are a number of critiques of architects' and planners' complicity in the process of colonization that include a presentation by the University of Waterloo School of Architecture's Treaty Lands and Global Stories group at the 2017 SSAC Layered Histories Conference as well as Hosagrahar, "Interrogating Difference: Postcolonial Perspectives in Architecture and Urbanism."

9. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost*, v. See also "Impacts of Climate Change," Government of Canada, accessed July 02, 2016, http://climatechange.gc.ca/default.asp?lang=En&n=036D9756-1.

10. My understanding of these two groups emerged from a discussion with Dr. David Fortin. Dr. David Fortin (Assistant Professor of Architecture at Laurentian University and Métis scholar), discussion with the author, December 2016.

11. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost*, 51, 71.

12. James Ford, and Tristan Pearce, "What We Know, Do Not Know, and Need to Know About Climate Change Vulnerability in the Western Canadian Arctic: A Systematic Literature Review," *Environmental Research Letters* 4, no. 2 (2010): 6.

13. Government of Canada, "Impacts of Climate Change."

14. See for example, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), and "Climate Change," United Nations Permanent Forum on Indigenous Issues, accessed July 04, 2017, https://www.un.org/development/desa/indigenouspeoples/climate-change.html. See also "Idle No More," Idle No More, accessed July 04, 2017, http://www.idlenomore.ca/.

15. Sheila Watt-Cloutier, "Keynote Address," filmed November 2013 at Pan-Territorial Permafrost Workshop, Yellowknife, NT, video, 48:29, http://www.northernadaptation.ca/news/pan-territorial-permafrost-workshop-youtube-videos.

16. See for example community members' reports in *Arctic Borderlands Ecological Knowledge Co-op : Community Reports 2006-2007*, Arctic Borderlands Ecological Knowledge Society, 2008, 37.

17. See Matthew Gilbert quoted in *Arctic Voices : Resistance at the Tipping Point*, ed. Subhankar Banerjee (New York: Seven Stories Press, 2012), 484.

18. J. Brown, O.J. Ferrians, Jr., J.A. Heginbottom, and E.S. Melnikov, *Circum-arctic map of permafrost and ground ice conditions*, digital media, 2001, National Snow and Ice Data Center, http://nsidc.org/data/ggd318.html.

19. To expand, members of the self-governing Vuntut Gwitchin First Nation continue to be vital in protecting critical habitat areas of many animals threatened by oil and gas development in northern Yukon and Alaska including the Porcupine caribou herd. See Brent B. Wolfe et al., "Environmental Change and Traditional use of the Old Crow Flats in Northern Canada: An IPY Opportunity to Meet the Challenges of the New Northern Research Paradigm," *Arctic* 64, no. 1 (2011): 130.

20. Old Crow community members in *Arctic Borderlands Ecological Knowledge Co-op : Community Reports 2005-2006*, Arctic Borderlands Ecological Knowledge Society, 2007, 37-38.

21. Old Crow community members in *Arctic Borderlands Ecological Knowledge Co-op : Community Reports 2006-2007*, Arctic Borderlands Ecological Knowledge Society, 2008, 37.

22. Stephen Frost (Van Tat Gwich'in Elder), discussion with the author, July 2016.

23. Amrit Phull expands on learning to listen in the James Bay in Amrit Phull, "Hunting for: Lessons on Architecture in Cree Territory" (master's thesis, University of Waterloo, 2014).

24. Dr. David Fortin compared speaking with Elders to "reading a good book of philosophy" in our discussion. Dr. David Fortin (Assistant Professor of Architecture at Laurentian University and Métis scholar), discussion with the author, December 2016.

25. See this quote and the term 'episteme' in Michel Foucault, *The Order of Things* (New York: Random House, 1971), xiv.

26. Alessandra Ponte, "Journey to the North of Quebec: Understanding (McLuhan's) Media," in *The House of Light and Entropy*, (London: Architectural Association, 2014), 136.

27. Lola Sheppard, and Mason White, "The Untapped Promise of Arctic Urbanism," Metropolis, January 10, 2017, metropo-lismag.com/cities/planning-cities/untapped-promise-arctic-urbanism/.

28. "Early-Warning Radars," Lincoln Laboratory, Massachusetts Institute of Technology, https://ll.mit.edu/about/History/earlywarningradars.html.

29. "Profile 9: Ralph Erskine," *Architectural Design* 11–12 (1977), 735. In Jérémie Michael McGowan, "Ralph Erskine, Colonist? Notes toward an Alternative History of Arctic Architecture," in *Arctic Perspective Cahier No.1: Architecture*, ed. Andreas Müller (Ostfildern: Arctic Perspective Initiative, 2010), 96-106.

30. Art Nash, and Axel R Carlson, *Permafrost: A Building Problem in Alaska* (Fairbanks, AK: University of Alaska Fairbanks Cooperative Extension Service, 2015), 3.

31. Richard Trimble (geotechnical engineer), discussion with the author, August 2017.

32. Chad Cowan (geotechnical engineer), discussion with the author, August 2017.

PART 04

AN INDETERMINATE INDEX OF FOUNDATIONS

CONCLUSION: A SHIFTING LAND

re-levelling foundations

As I visited built sites in Vuntut Gwitchin territory and met the people whose minds and hands had made them, I became more attuned to the subtle realities of this changing place. I was a visitor here, who came with only an attentiveness and sense of gratitude. And yet, I was invited by friends and elders into their homes and camps. In listening to people and buildings, it seemed as though many of the movements that occurred in the negotiation between a structure and the land are translated into the realm of everyday experience through foundations. Manifested in the physical experience of a building, these voiceless dialogues are seen in undulating floorboards, heard when buildings hum in a strong wind, and felt when doors refused to close. Change can be noticed by attentive listening.

Many technical reports in Canada generalize foundation systems by separating them into two groups. *Surface foundations* shift with the land, floating on the active soil. These requiring varying degrees of attention and re-leveling. *Deep foundations* resist all but the most extreme movements, attempting to separate a building's structure from the active soil beneath by connecting to a more solid substratum.[1] While the latter group can move in extreme situations, the land's shifts are more often felt in buildings built upon the former: floating foundations that connect to the ground's skin.

In Old Crow, each approach I learned of to build upon this shifting land was entangled in a meshwork of dynamic human and non-human forces. These relationships formed part of the everyday experience of many buildings grounded in surface foundations. The community's typical timber block foundations move with the land, embodying the environment's constant modulation. As they shift to accommodate the heaving and settlement of the ground, they also move with the seasonal cycles that intermittently freeze and thaw the surface of the earth, or 'active layer.' These foundations might be re-balanced during warmer months when the ground is relatively stable.[2]

The Canada Mortgage and Housing Corporation suggests houses grounded on surface foundations might be re-leveled periodically depending on the nature of the ground beneath them. The land's varying speeds and slownesses of movement might necessitate the structure's re-leveling quite frequently for ice-rich soils or every few years for more 'competent' thaw-stable permafrost. While re-leveling is required in order to minimize significant deformation of the building, more general building experience referenced by the CMHC

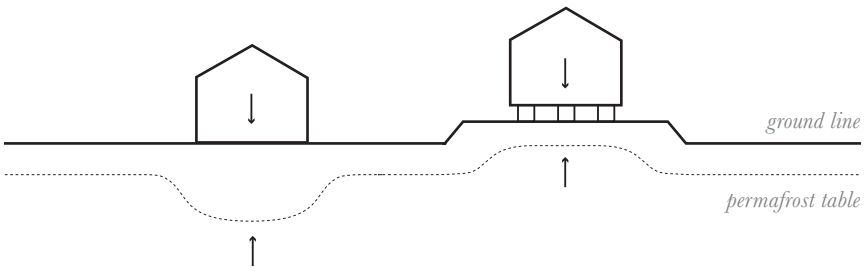


fig. 4.1 Diagram showing the permafrost table lowered due to transmission of heat from the building and rising permafrost table with raised structure on compact granular foundation. Note that typically in warm permafrost regions the permafrost table does not rise. (Adapted from Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions.*)

has suggested that forces focused on the structure during re-leveling may be damaging.[3] Long after the visiting architect has left, the land's movements are registered by the building.

Euro–North American architectural culture struggles to express depth and change, finding difficulty in embracing the messy complexity of the ground. Similarly, many technical reports distinguish singular 'symptoms' of a changing ground plane, identifying plants that point to the presence of unstable ice-rich soils, or cracks in the walls of a home's interior that indicate the structure is shifting. Ice-rich soils can experience differential movements and shifts caused by the forces of thaw settlement, where the land moves as ice in the soil melts, and frost heaves as water in the soil freezes and expands. These movements can be transferred through the foundation system to a building's structure.

The Canadian Mortgage and Housing Corporation's report *Residential Foundation Systems for Permafrost Regions* (2000) lists the following symptoms as potential indicators of unstable ground beneath buildings in permafrost regions – traces of movements caused by permafrost degradation, thaw settlement and frost heave:

cracked concrete, masonry, wood and drywall

distorted windows, doors and floors

separated roofs and walls[4]

Many of these symptoms might be related to seasonal frost heave issues or more permanent permafrost degradation.[5] These indications of movement are not merely articles confined to the paper of reports. As manifestations of shifts in the ground, they form part of the reality of living on a dynamic ground plane. However useful these fragmented pieces of information might be, they do not clearly express the entangled nature of the land we build with. The ground is not a 'solid and pre-existing substrate.' *Earth is always becoming.* The ground can change to rebalance itself with the web of relationships with human and more-than-humans in which it is enmeshed above, below, and within the land's surface. Earth is blown by the wind, moulded by water, consumed in human and non-human land use, fed by decaying organic matter, built up over time, and softened by rain.[6]

Many knowledgeable builders who work with foundations have their own

stories of the land's movements. These are known from experience and from the stories of Elders.[7] When leveling buildings, workers flatten gravel pads and shim timber blocks that have been altered in an exchange between the site's settlement and the building's physical presence (figs. 4.2-4.5). In the process, the building creaks and groans, telling its own narrative of change.

Technical building knowledge and knowledge of a place, its history, and the stories told about it are significant in these processes of re-leveling. Sites, after all, are places. They are intertwined with many different forces – social, cultural, political, and environmental. Buildings and foundations, like people, are tied to these forces and can be considered extensions of them. We must learn to pay attention to these underlying relationships.

To do good work, the designer's understanding of the land cannot be reduced to the technical report's extrapolated data or the site survey's distanced projections. Architecture can form connections to a place that are grounded in the foundations of relationships, observations, experiences, and conversations:

Picking berries with an Elder and feeling the ground where different plants like to grow offers a foundation.

Feeling the clammy depth of the earth that gives you support as you crawl under houses with levellers offers a foundation.

Learning to jig with a belly full of caribou meat and two left feet offers a foundation.

Travelling out on the river that floods, moulds, and erodes the land offers a foundation.

Opening yourself to a homeland and to those who have known its changes, while allowing yourself to be changed in the process, offers a foundation.

Learning the land involves listening to the foundational stories that teach how to engage with place and with each other. This thesis has considered the practices of foundation design, selection, and construction as forms of dialogue with people and the land. It is through listening and conversing that both literal and metaphorical foundations emerge for the visiting architect to build on with a community.[8]

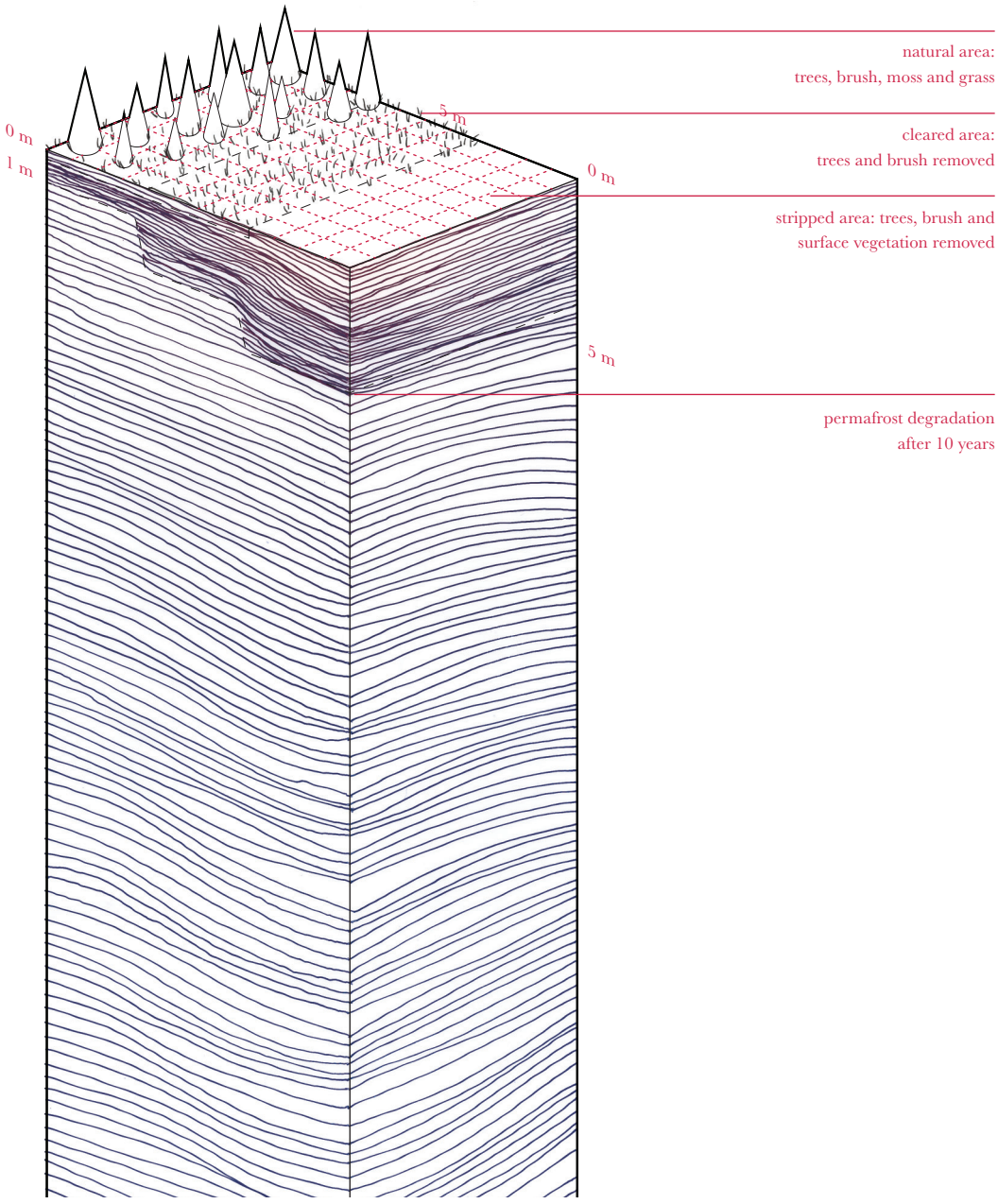
fig 4.2 Knowledgeable builders work to level the foundations beneath a house. The building sits on a gravel pad that can shift.
fig 4.3 (opposite) A hand jack is used to temporarily raise the beams so that the individual foundation units can be re-levelled

fig. 4.4 Detail of gravel fill and building materials
fig. 4.5 (opposite) The ground is levelled and evened out

DISTURBED GROUND

fig. 4.6 (opposite) Conceptual drawing showing permafrost degradation under different surface treatments over a period of ten years. *Source:* Adapted from Linell, "Long-term effects of vegetative cover on permafrost stability in an area of discontinuous permafrost."

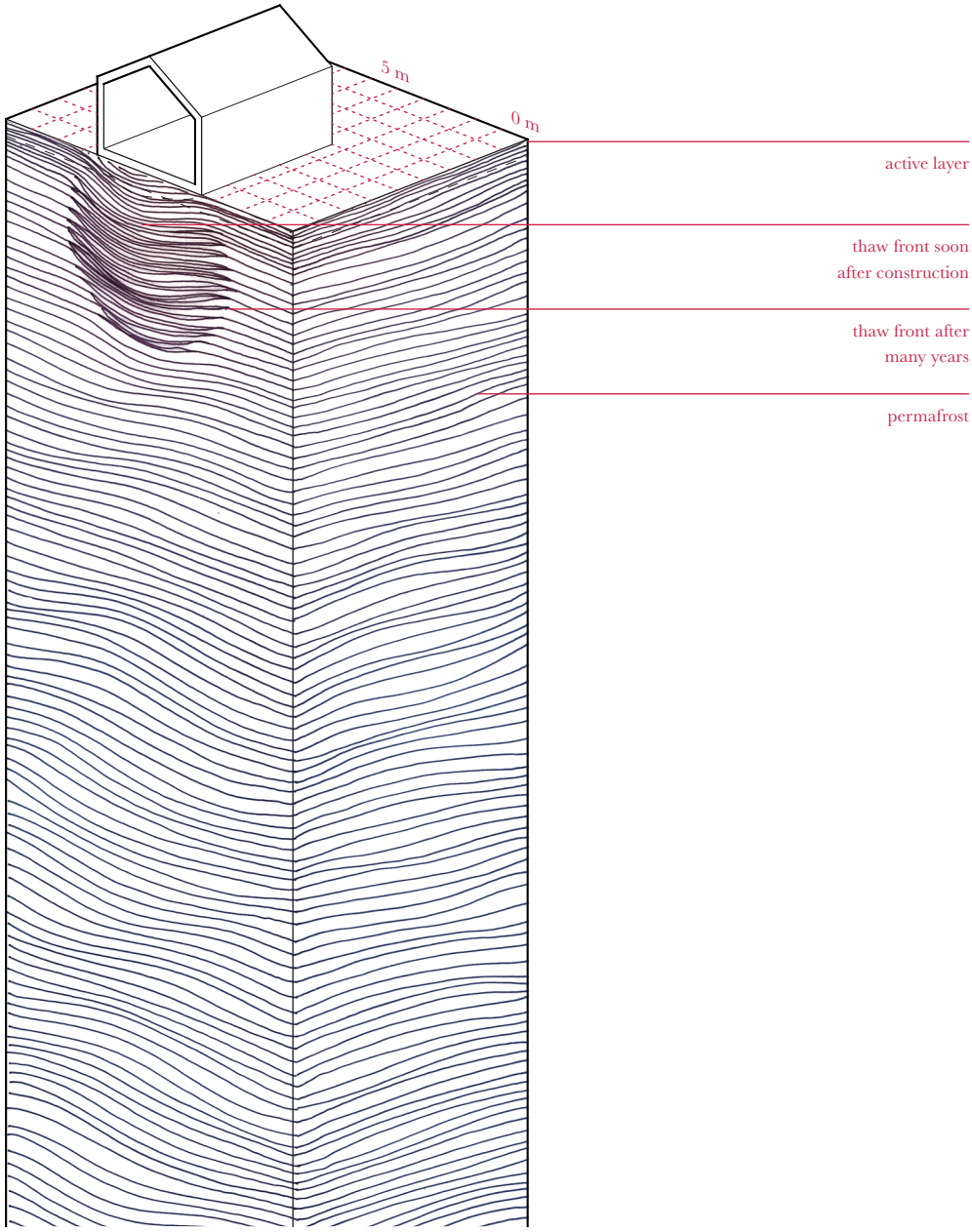
For many new building projects built on ice-rich permafrost, the active layer deepens through the simple act of building upon it. Noticeable changes to the land might occur within months or years of a building's erection on a site.[1] While preparing a site for construction, often vegetation clearing and removal or compression of the organic top layer of ground cause soil temperatures to rise. This removal of vegetation from a site allows water to permeate the soil, and transfer heat to the permafrost. Plantings and natural drainage from sites that slope away from the building can help direct water away from a building's foundation, while ventilation beneath the structure can encourage evaporation.[2]


natural area:
trees, brush, moss and grass
cleared area:
trees and brush removed
stripped area: trees, brush and
surface vegetation removed
permafrost degradation
after 10 years
0 m
1 m
5 m
0 m
5 m

HEAT TRANSFER

fig. 4.7 (opposite) Conceptual drawing development of permafrost degradation after building construction, where a thaw bulb beneath a building can form when a site is disturbed, particularly if heat is transferred from the building to the ground. *Source:* Adapted from U.S. Department of Housing and Urban Development and U.S. Army Corps of Engineers, *Building Under Cold Climates and on Permafrost*.

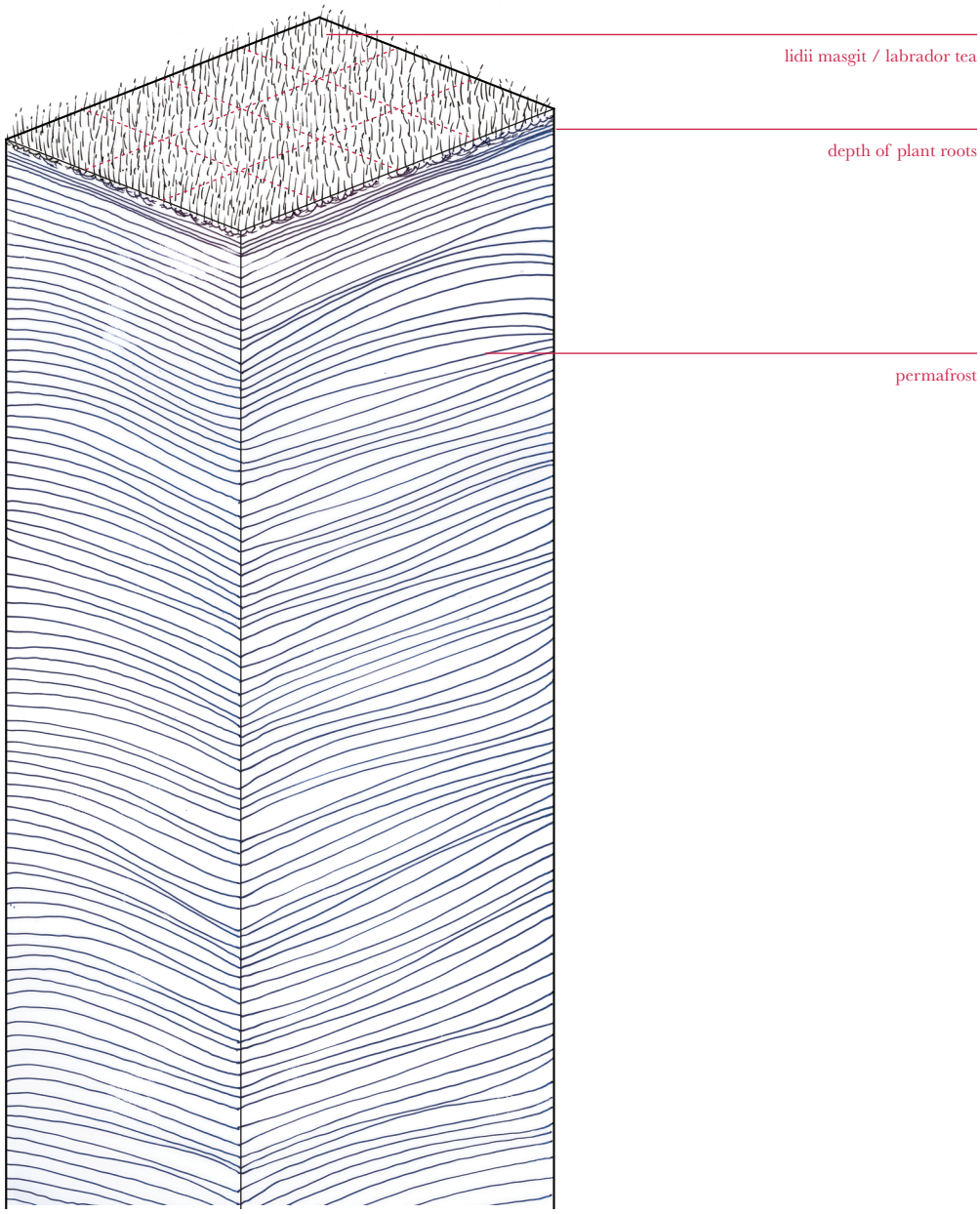
Buildings are sometimes constructed directly on the ground, placed on surface foundations like timber sills. If a thermal break between a building's floor and the land is not present, heat transferred from the building to the land can melt the active layer and impact the permafrost.[3] Insulating layers take many forms, ranging from extruded polystyrene to urethane foam to materials such as sawdust and wood chips found beneath older log cabins.[4]


5 m
0 m
active layer
thaw front soon
after construction
thaw front after
many years
permafrost

IDENTIFYING WHAT IS BENEATH THE SURFACE

fig 4.8 (opposite) A conceptual drawing of labrador tea and its root system in a shallow active layer above permafrost demonstrates that permafrost can exist very close to the ground's surface

When building on the shifting ground, many technical experts and guidebooks recommend developing an awareness of the 'visible clues' of the land's movements. These symptoms, they suggest, can help inhabitants better understand the land's behaviour and its potential.[5] The growth of certain plants like stunted black spruce, willows, labrador tea, especially where soil is peaty or spongy, might point towards permafrost's otherwise invisible presence beneath the land's surface.[6] Mosses and peat impact the thickness of the active layer by moderating the transfer of heat to and from the soil. Vegetation can also impact the accumulation of snow. Warmer permafrost is usually found where willows and other shrubs have gathered snow in the winter season.[7]

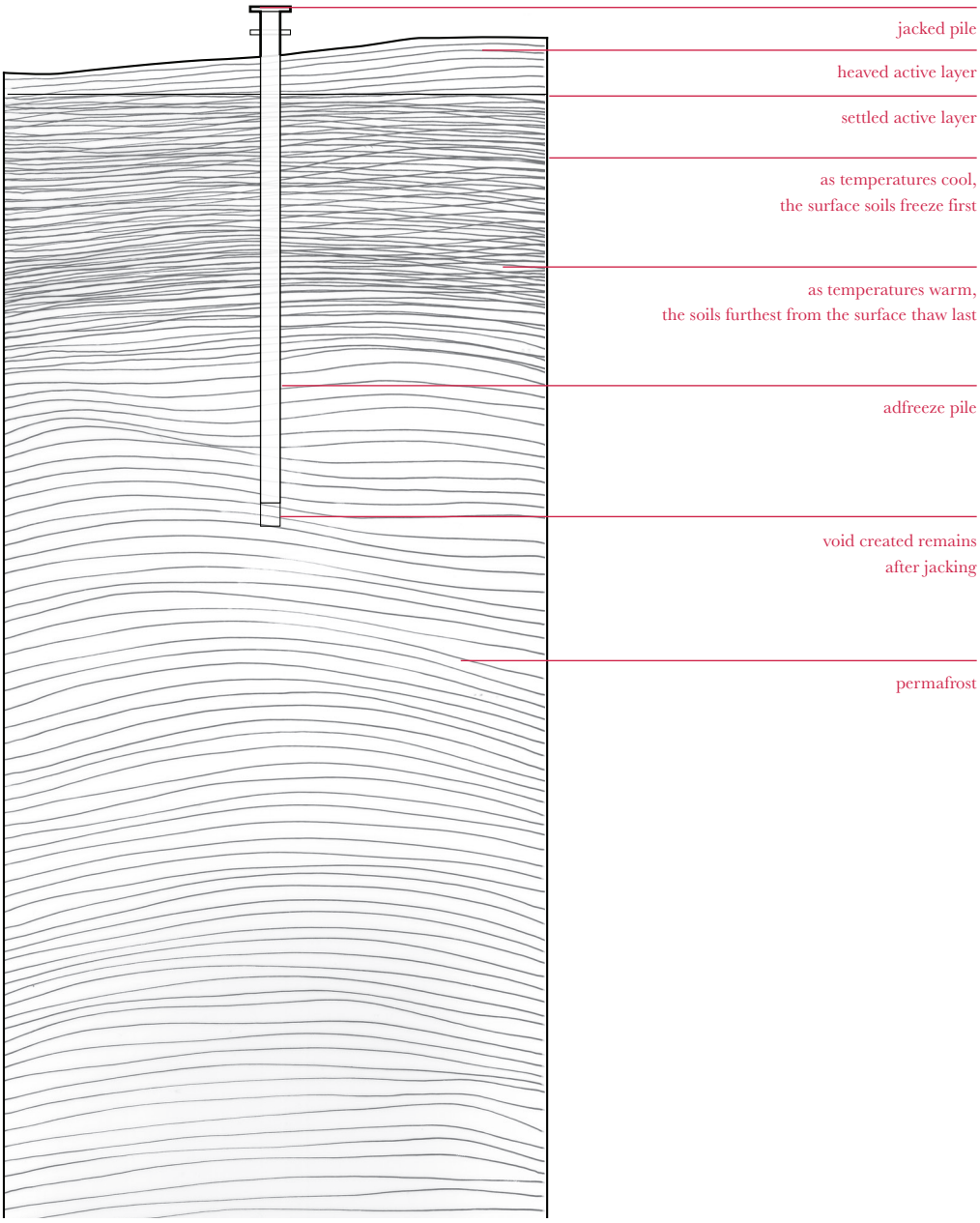

lidii masgit / labrador tea
depth of plant roots
permafrost

THE FREEZE-THAW CYCLE

fig. 4.9 (opposite) Conceptual section drawing showing frost heaving in the ground, that can translate to the vertical displacement of adfreeze pile foundations

In the summer months, the unsetting polar sun warms the land. This heat thaws the active layer of the ground's surface, and can also melt the permafrost beneath. Once disturbed by construction, dark soil that is free of vegetation is often exposed to the sun's rays. Heat might also be reflected by the building onto the land, or directed towards the ground through exhaust vents.[8] Some technical experts suggest preventing this type of warming by shading the south side of the building with plantings and the installation of temporary skirting in the summer season.[9] In addition to the settlement of the thawed active layer, thermal degradation of permafrost can also occur, weakening the soil and melting any ice contained within it.[10]

In the winter season, when the days become shorter, the land is transformed. Rivers and lakes freeze over, temperatures drop, and the active layer and even some of the permafrost can re-freeze. Permafrost itself is relatively impermeable, resulting in much water being retained by the active layer.[11] While coarse gravels and sands allow for the drainage of water, fine silt and clay soils retain moisture which can freeze into ice lenses. The latter soils are often more dynamic, causing the land's surface to deform and undulate as the ice-rich soils freeze and expand in winter and contract as they melt in summer.[12] Seasonal frost heave and thaw settlement can result in vertical shifts of 5 to 15 cm throughout the year.[13]

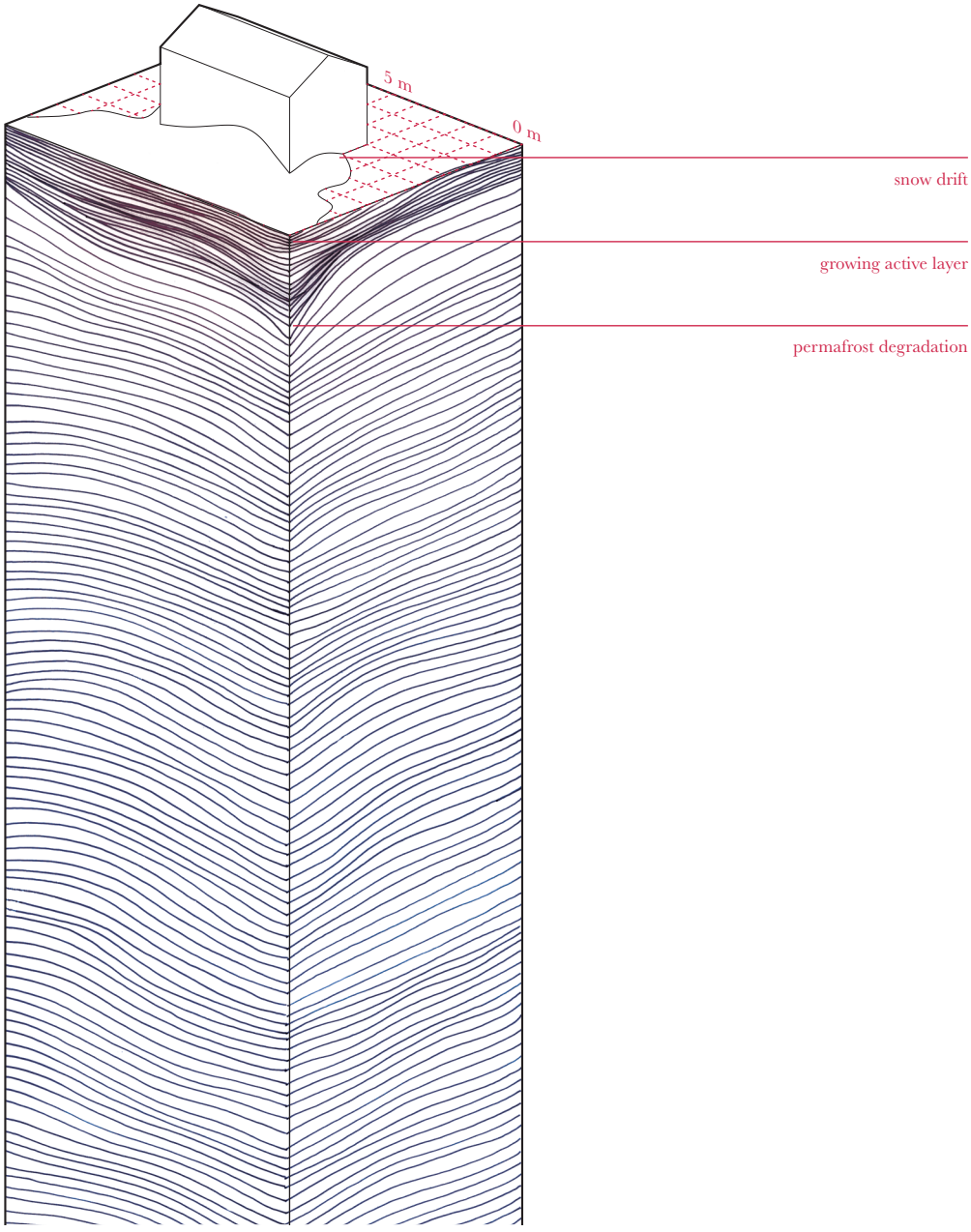

jacked pile
heaved active layer
settled active layer
as temperatures cool,
the surface soils freeze first
as temperatures warm,
the soils furthest from the surface thaw last
adfreeze pile
void created remains
after jacking
permafrost

VENTILATION

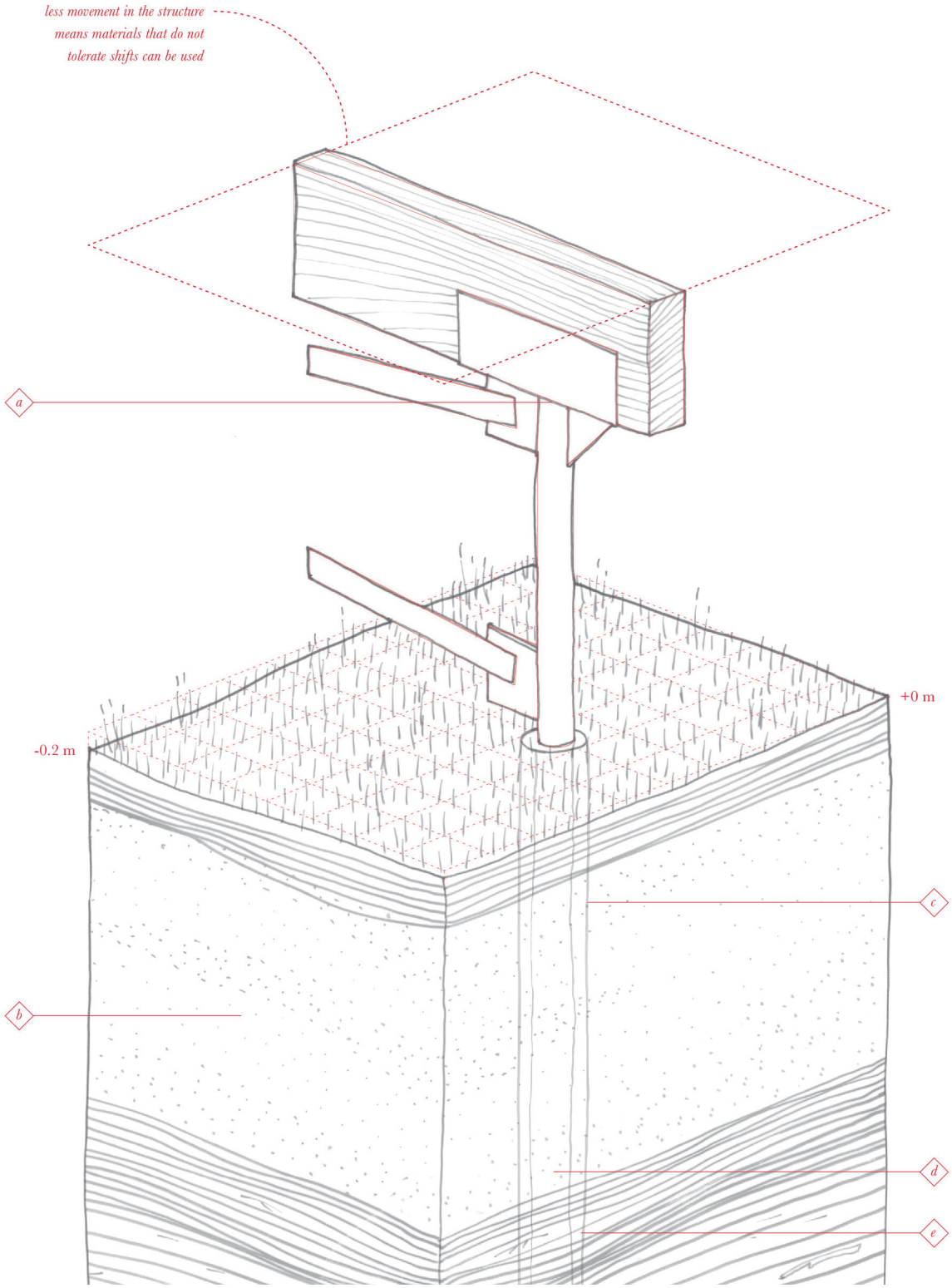
fig. 4.10 (opposite) Conceptual axonometric showing the accumulation of insulating snow drifts that can impact the frozen soils beneath, and prevent freeze-back of the permafrost in the fall and winter months. Source: Adapted from Sladen, *Permafrost*.

Many foundations raise buildings above the surface of the land.[14] The purpose of this space created beneath the structure is twofold: it protects the building from the land, while also protecting the frozen ground from the heat of the house above by reducing the transfer of heat from the building interior to the earth, which would alter the permafrost table.[15] This air space reduces the impact on the site that the simple presence of a building might have, inviting the atmospheric forces such as the wind to interact with the ground plane. In the summer, wind passing over this air gap helps to evaporate excess moisture, while reducing the build up of snow in the winter. In colder temperatures, the air and earth can meet in the formation of snowdrift. The space below allows the wind to blow snowdrifts across the ground plane. These drifts might otherwise form against the side of a building. This creates an insulating blanket over the ground that reduces the amount the active layer freezes back in the winter by keeping the soil much warmer than it would be if exposed to the cold winter air.[16]

If this ventilation gap is blocked by walls of skirting or by equipment stored under a building, the building's presence can be altered. These changes can be understood at another scale by looking at the development of snowdrifts against new shrub cover, where the permafrost degrades as the vegetation alters the distribution of snow, creating snowdrifts where none existed previously. While the wind can be helpful in maintaining the permafrost, it can move small structures that are not securely anchored and that produce too much resistance to it. This air space also provides an area for humans to see, access and maintain foundations, and is designed to allow for a person to move through with ease in order to re-level the building as the ground shifts.[17]


5 m
0 m
snow drift
growing active layer
permafrost degradation

This collection of drawings has been prepared for diagrammatic purposes only to provide a visual reference and overview of foundation types, and the following are not technical drawings. Each site we build on is unique and should be carefully studied before selecting an appropriate foundation. This process is often complicated and can involve many technical experts such as geotechnical engineers. See bibliography for technical manuals and other sources referenced in the process of completing these drawings.


less movement in the structure
means materials that do not
tolerate shifts can be used
a
+0 m
-0.2 m
c
b
d
e

DEEP: ADFREEZE PILE

The adfreeze pile foundation aims to stabilize a building by thermally decoupling it from the ground. Its load-bearing capacity relies on the bond formed between the frozen soils and the pile's surface.[1]

Adfreeze piles are the most ubiquitous deep foundation type in permafrost regions.[2] They are often fabricated in the South from steel. Timber piles are rarely used as they are vulnerable to wood-eating insects, and can rot where they touch a fluctuating water table.[3]

Steel pile installation often requires technical expertise and the use of heavy equipment such as steam jets and pile drivers.[4]

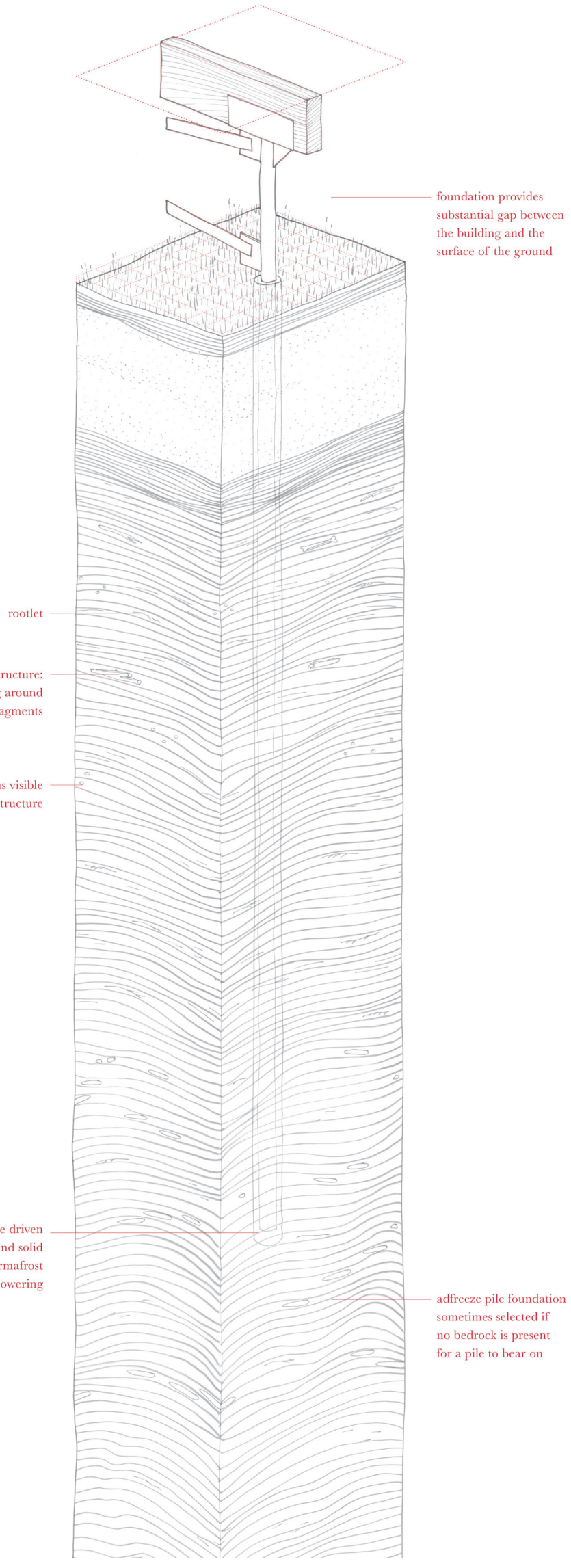
Typically, the adfreeze bond slowly deforms and creeps at a predictable rate that can increase if soils warm. With permafrost degradation, this bond can weaken and the active layer can deepen, accentuating frost heaving effects where ground water is available. As the active layer freezes seasonally, it can bond to the pile. Uplift forces from soil expansion can overcome the pile's resistance. In the summer, as the active layer settles, the structure can remain elevated, supported by the frozen ground.[5] Adaptive design accommodates for this potential degradation and the ground's latent instability.[6]

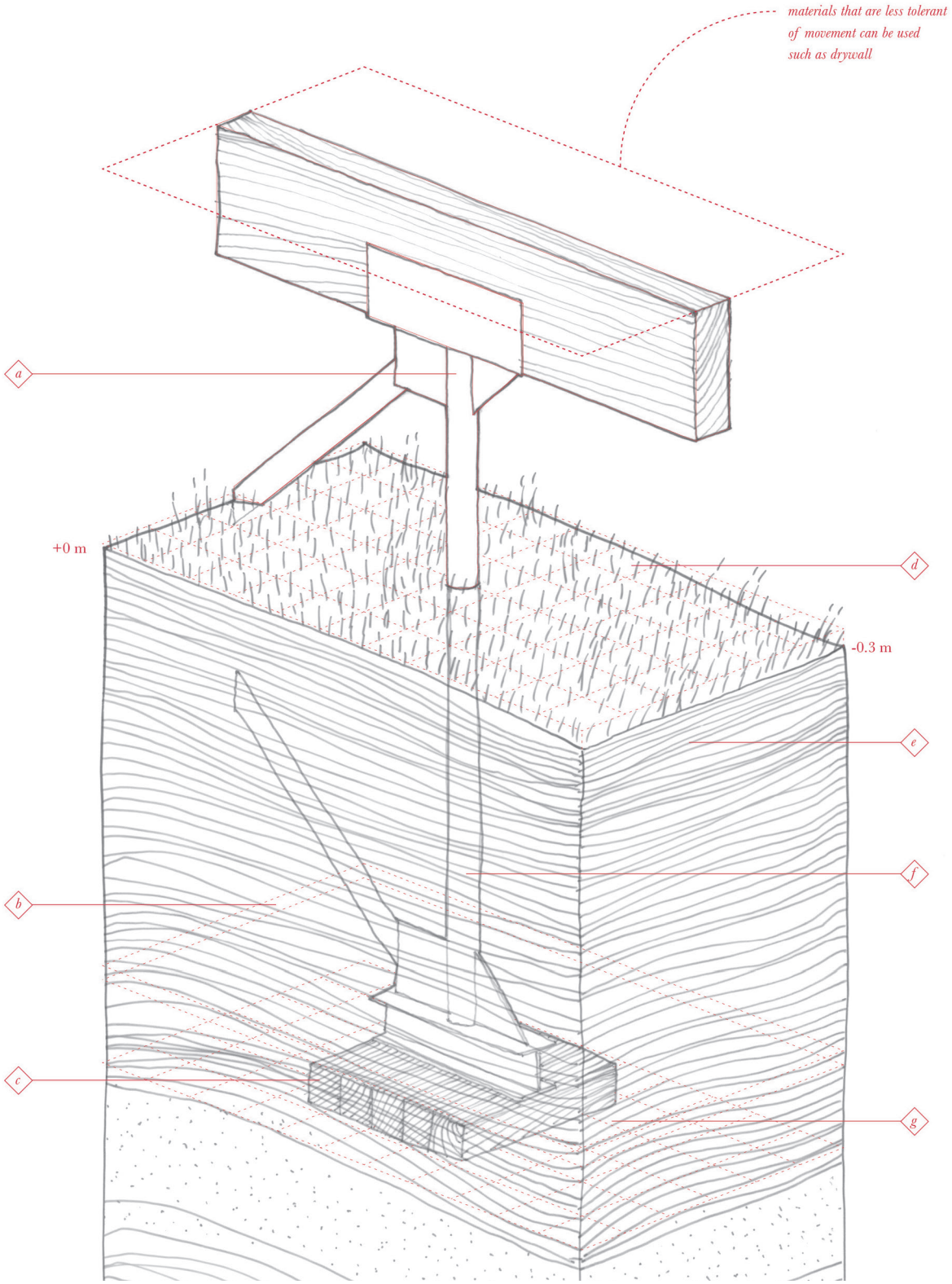
Many pile foundations have been designed by engineers for use in northern military and resource extraction projects with low tolerances for movement, such as D.E.W. Line stations and the Trans-Alaska Pipeline System.[7]

fig. 4.11 (opposite) Deep adfreeze pile foundation unit detail drawing depicting materials, movements and surface-subsurface relationships with notes:

- *a* adjustable structural connections are sometimes suggested to help the system tolerate anticipated movement
- *b* granular fill (often non-frost-susceptible) can maintain positive site drainage
- *c* as the pile can jack if it forms a bond with the freezing active layer, frost heave protection can be used in active layer
- *d* length of adfreeze pile often relates to greater thickness of active layer
- *e* clean sand slurry

fig. 4.12 Deep section showing an adfreeze pile foundation unit, and subsurface qualities and characteristics of the ground based off of a bore hole log. This and all of the following deep sections are loosely based on bore hole logs from Benkert et al., *Old Crow Landscape Hazards.*




materials that are less tolerant
of movement can be used
such as drywall
a
+0 m
d
-0.3 m
e
f
b
c
g

SHALLOW: BURIED SPREAD FOOTING

The buried spread footing foundation does not 'float' a structure above the ground nor does it completely 'separate' it from unfrozen soils. Instead, it finds stability by resting on or in the permafrost's surface below the active layer.

This foundation can be constructed in a number of material and structural variations, including concrete, steel and preserved wood foundation (PWF) pads – many of which are shipped up from the South.[8]

While its construction methods are relatively accessible, this foundation system requires some excavation equipment.[9]

As the act of excavating can 'disturb' the ground during construction, it can be difficult to prevent degradation in sites with warm permafrost – where the ground temperature is over -2°C – and soils that are not thaw stable.[10]

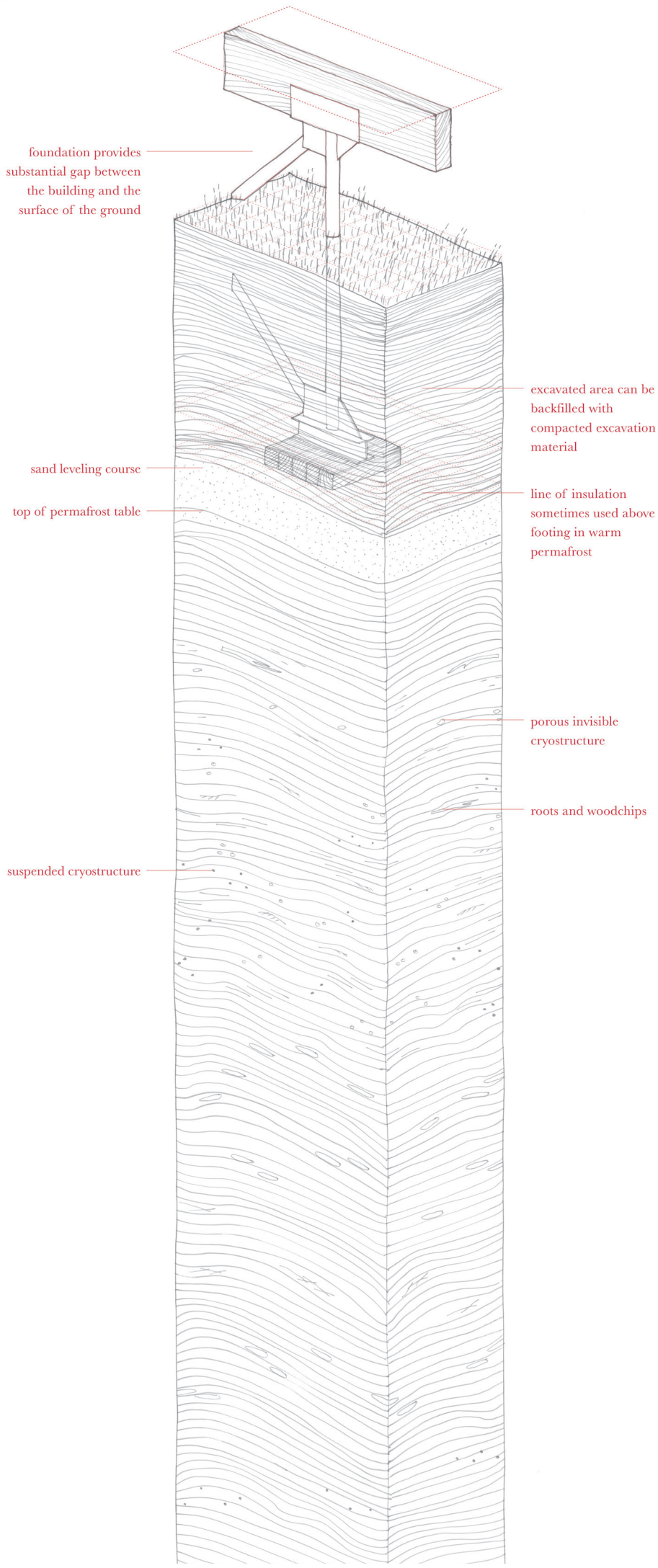
The foundation's bearing surface is located below the seasonal frost heave and settlement zone, and if appropriately designed and installed, should experience very little movement.[11] Adjustable connection fittings can be included to adapt to future shifting subsurface conditions.[12]

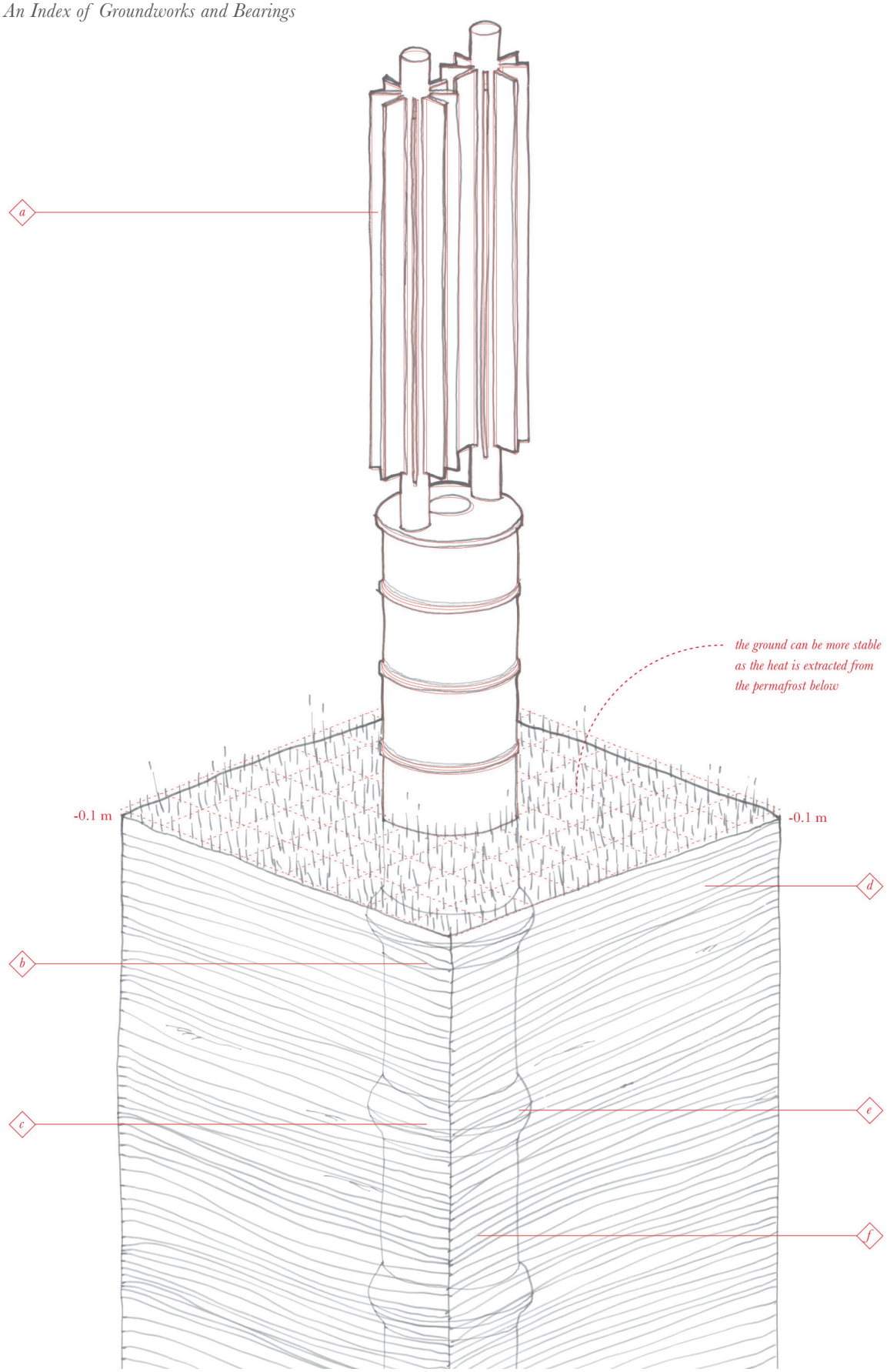
As with many foundation types, the challenges faced in the construction and maintenance of buried spread footings are inextricably linked to the introduction of Euro-North American housing strategies in the North.

fig. 4.13 (opposite) Shallow buried spread footing on permafrost foundation unit detail drawing depicting materials, movements and surface-subsurface relationships with notes:

- *a* adjustable structural connections are sometimes suggested to help the system tolerate anticipated movement
- *b* sometimes insulation is placed above the footing (warm permafrost) or below (cold permafrost)
- *c* structure rests on pressure treated timbers in the surface of the permafrost table
- *d* vegetation can assist with site drainage
- *e* active layer can freeze and thaw seasonally, and support vegetation above
- *f* depth of footing sometimes suggested to relate to active layer thickness
- *g* ponding and / or improper drainage can lead to permafrost thaw and / or seasonal frost-related movements

fig. 4.14 Deep section showing a buried spread footing foundation unit, and subsurface qualities and characteristics of the ground based off of a bore hole log




a
the ground can be more stable
as the heat is extracted from
the permafrost below
-0.1 m
-0.1 m
d
b
c
e
f

HEAT EXCHANGER: THERMOSYPHON

A thermosyphon is a passive refrigeration device that works to transfer heat out of the soil to the air under certain temperature differentials. Unless combined with a foundation system, it is not typically load-bearing.

Thermosyphons are typically used in buildings that require at-grade access. They require significant technical expertise to investigate, design, install, monitor, and occasionally maintain.[26] Serious failures can be difficult to detect until it is too late to easily mitigate them.

Thermosyphons can stabilize a separate foundation system, such as *sloping* and *flat looped evaporator* systems but in Alaska are more commonly combined with structural elements such as *thermopiles*.[27]

The *evaporator* end of the thermosyphon pipe(s) touches the ground below grade while the *condenser* touches the air. The system works to maintain thermal equilibrium. When the air is colder than the soil, the working fluid that fills the evaporator vaporizes, and precipitates on the condenser wall, releasing the heat from the ground into the ambient cool air.

Thermosyphons have been used in Canada since the mid-1970s in continuous and discontinuous permafrost.[28] The first sloped system was installed under a school in Ross River, YT, which failed shortly after and had to be rebuilt.[29] Thermosyphons are also used in infrastructural and resource extraction projects such as the Giant Mine Remediation Project located in Yellowknives Dene First Nation, Tlicho and North Slave Métis traditional territory and land use areas around Yellowknife, NT where the federal government is using them to keep mine waste materials frozen.[30]

fig. 4.15 (opposite) Thermosyphon heat exchanger unit detail drawing depicting materials, movements and surface-subsurface relationships. This drawing shows a vertical thermosyphon ('thermoprobe') within a pile support system, based off of units used in the Trans-Alaska Pipeline System (TAPS). Note:

- *a* condensor (radiator) section releases heat to ambient cool air
- *b* pile support system contains evaporator pipes and saturated soils
- *c* in other thermosyphon systems, the evaporator section can attach to an evaporator pipe that loops beneath a building to extract heat from ground beneath its foundation
- *d* active layer
- *e* thermosyphons can help maintain the temperature of permafrost below but can fail
- *f* evaporator pipes inside receive heat gain from ground

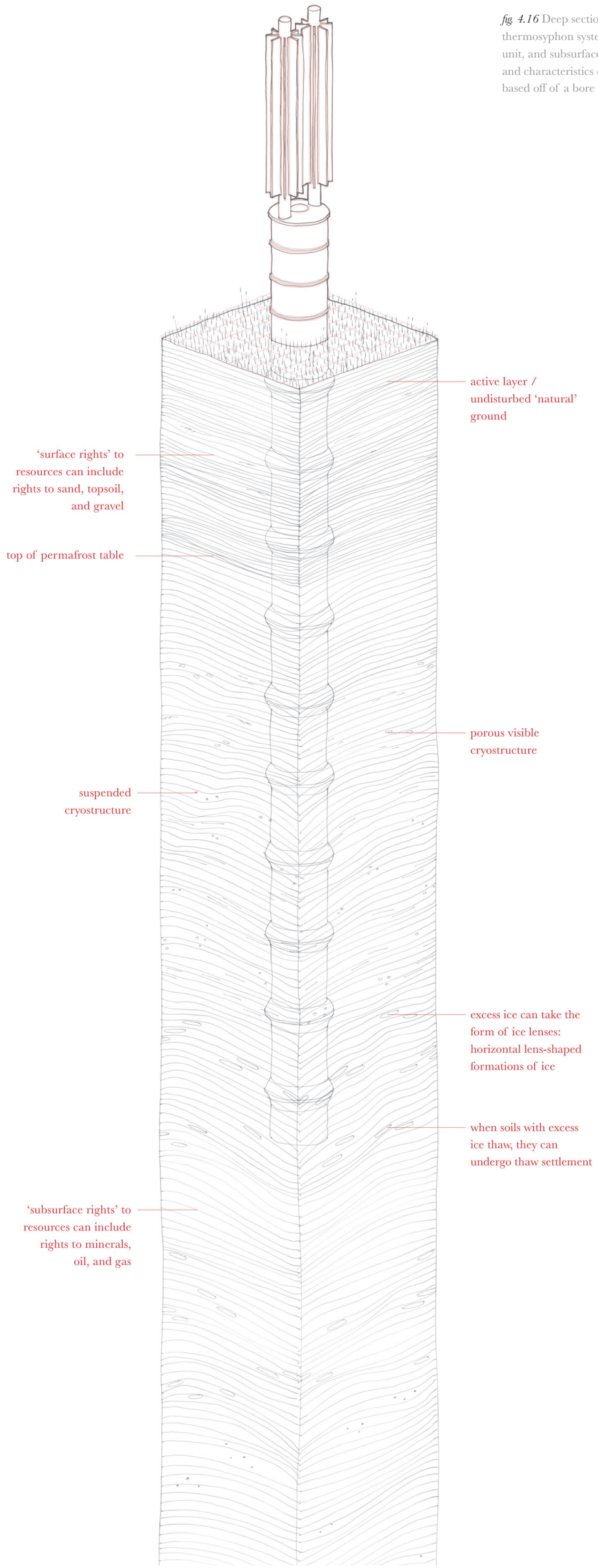
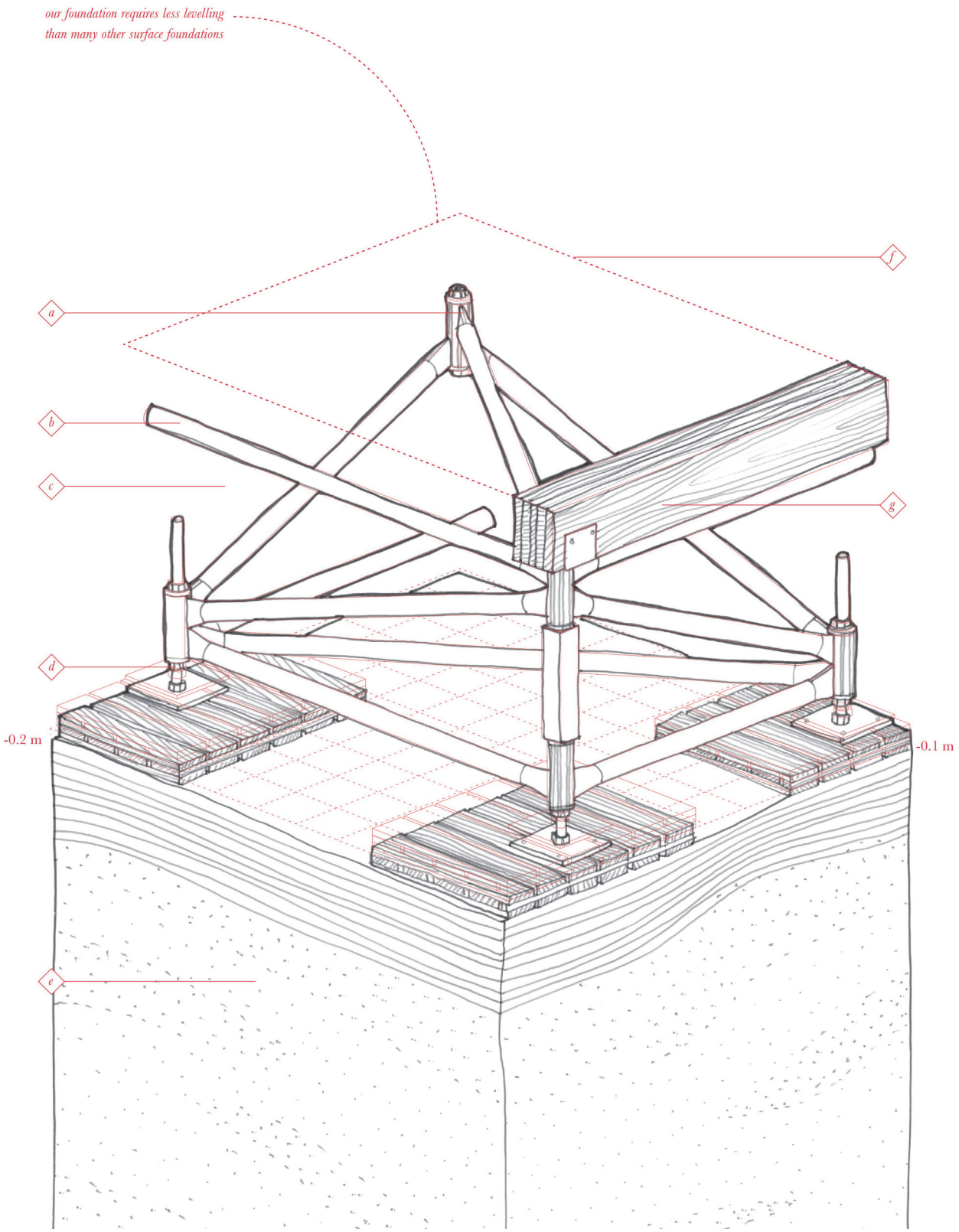


fig. 4.16 Deep section showing thermosyphon system in a pile unit, and subsurface qualities and characteristics of the ground based off of a bore hole log


our foundation requires less levelling
than many other surface foundations
a
b
c
d
e
f
g
-0.2 m
-0.1 m

SHALLOW: SPACE FRAME

A space frame is a multipoint surface foundation system assembled from a framework of prefabricated metal trusses.[18] This rigid structure behaves as one entity, tolerating local differential movements in the ground by distributing their impacts throughout the unit as a whole while maintaining a planar connection to the building.[19]

The framework is typically prefabricated to custom-fit the structure in the South from steel, aluminum or alloy members.[20] The space frame is often installed on non-frost susceptible engineered fill or a granular pad.[21]

The frame is designed to produce a compact and dense shipping volume. The ends of each member are pressed to form a coined edge that slot into the system's nodes, forming a three-dimensional grid framework that can be assembled onsite with relative ease, requiring no technical expertise or heavy machinery.

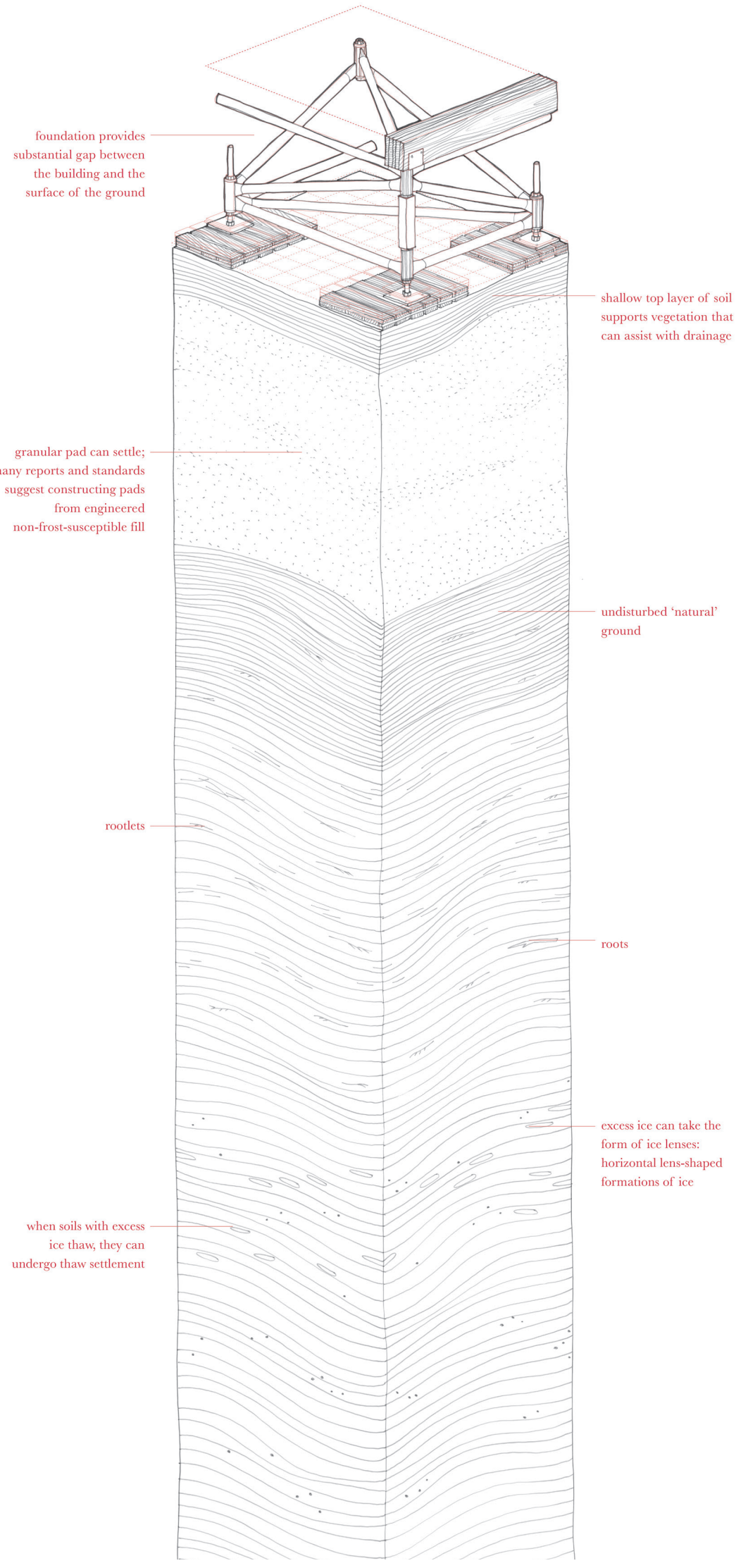
This type of foundation is often used on unstable permafrost sites. While the entire building can tilt as the space frame moves with the ground, few damaging stresses from differential movement are transferred to the structure. This system can be relevelled without causing much damage to the structure, and requires less periodic levelling than other surface foundations.[22]

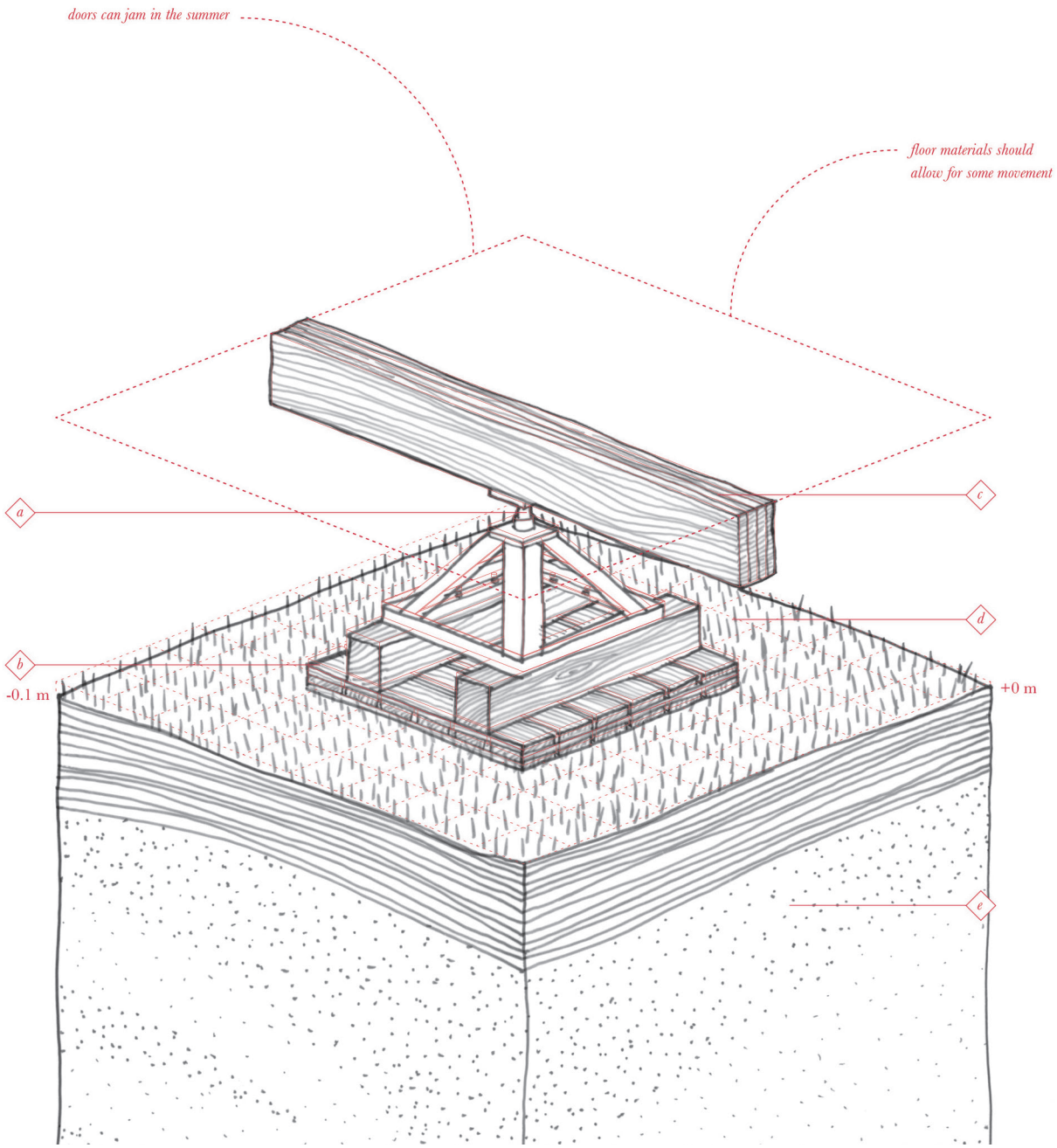
Patented Triodetic foundation technology was developed in Southern Canada in the 1980s.[23]

fig. 4.17 (opposite) Shallow space frame foundation unit detail drawing depicting materials, movements and surface-subsurface relationships with notes:

- *a* metal tube sections with flattened ends are keyed into connectors
- *b* top chord
- *c* substantial gap allows for air circulation but can create accesibility issues
- *d* adjustable bearing plate
- *e* often constructed on a bed of non-frost susceptible gravel fill
- *f* a rigid plane is maintained where the foundation connects to the building
- *g* beam connects to floor joists above

fig. 4.18 Deep section showing a space frame foundation unit, and subsurface qualities and characteristics of the ground based off of a bore hole log




doors can jam in the summer
floor materials should
allow for some movement
a
b
c
d
e
-0.1 m
+0 m

SHALLOW: SCREW JACK

The screw jack foundation system derives its load-bearing capacity from a series of mechanical jacks that float on the land's surface.

A bed of non-frost susceptible engineered fill or an elevated granular pad that can be placed directly on the ground's surface typically underlies this system. The metal jacks themselves must often be shipped to communities from the South. They are then seated upon wooden or concrete footings, running along the building's floor beams and supporting them at intervals.[24]

Screw jacks can be installed with relative ease, requiring no specialized labour or heavy equipment.

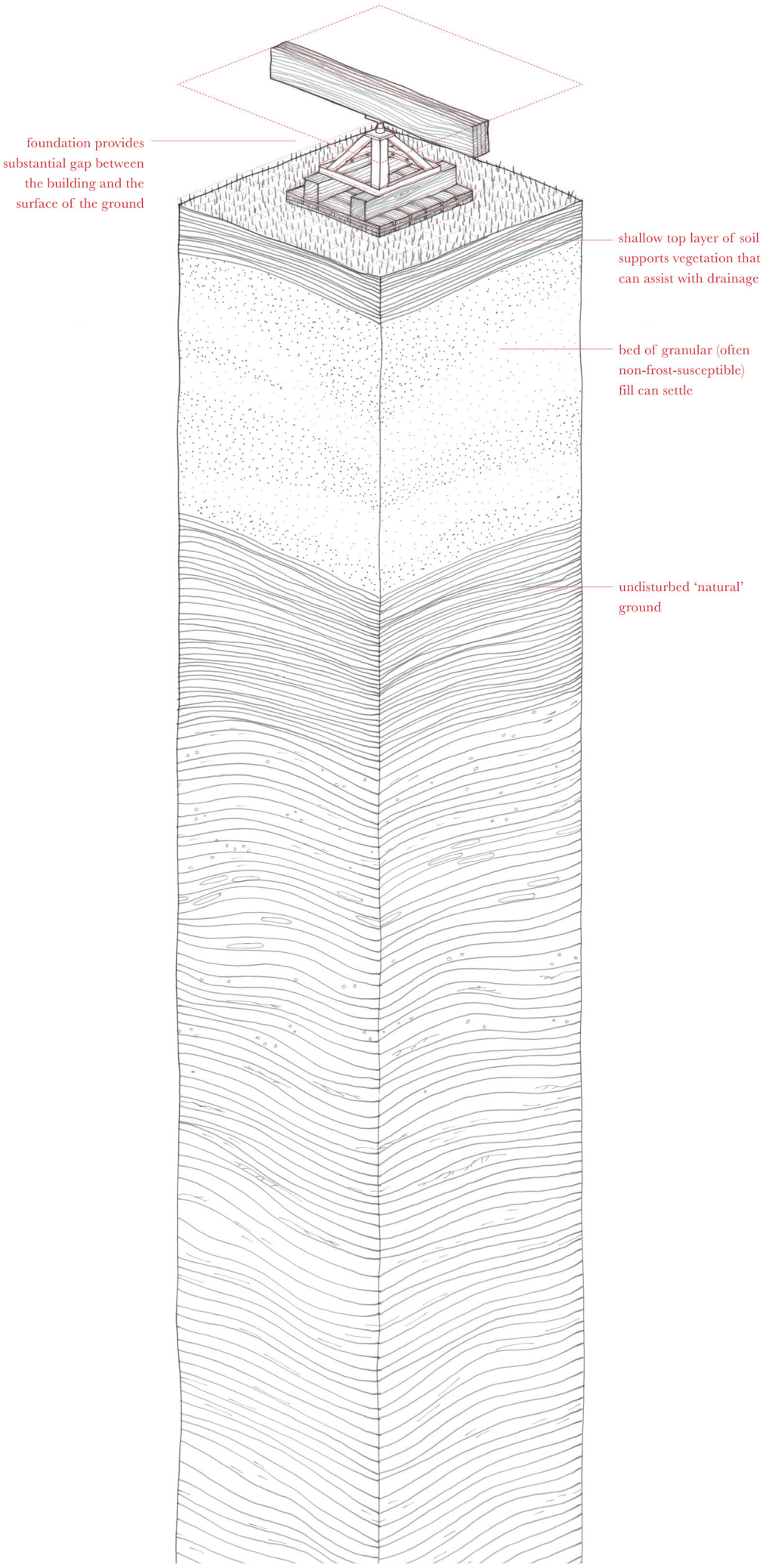
Screw jacks create an air gap beneath the building, providing a space that allows for relatively unobstructed air circulation beneath the building that people can occupy while adjusting the jacks. These connection points often require relevelling as they can shift with the ground below as it settles or moves seasonally. The individual sections can be jacked up and down to accommodate for this differential settlement. This process of re-levelling is simpler and less labour intensive than many other forms of surface foundations. However, the structure can deform with these movements, shortening its lifespan.[25]

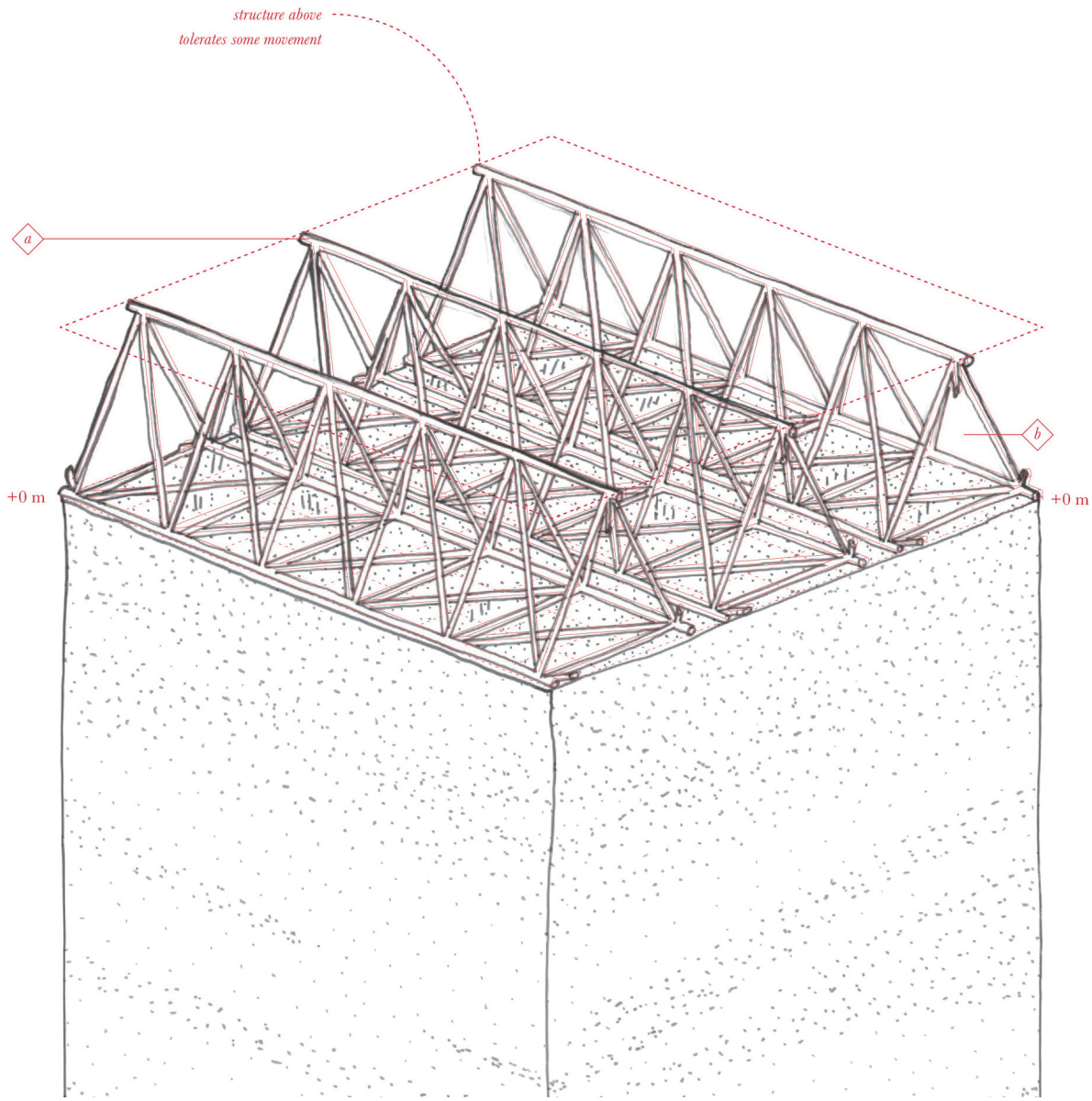
Screw jack foundations (*vérins métalliques ajustables*) were developed in the 1980s by the Société d'Habitation du Québec.

fig. 4.19 (opposite) Shallow screw jack foundation unit detail drawing depicting materials, movements and surface-subsurface relationships with notes:

- *a* mechanical screw jack can be adjusted with relative ease to level building
- *b* preserved wood foundation (PWF) pad
- *c* beam connects to floor joists above
- *d* porous air gap allows for some air circulation
- *e* often constructed on a bed of non-frost susceptible gravel fill

fig. 4.20 Deep section showing a screw jack foundation unit, and subsurface qualities and characteristics of the ground based off of a bore hole log




structure above
tolerates some movement
a
b
+0 m
+0 m

SHALLOW: COMMUNICATIONS TOWER

Vuntut Gwitchin First Nation citizen Allan Benjamin designed and built this communications tower foundation that floats on the ground's surface.

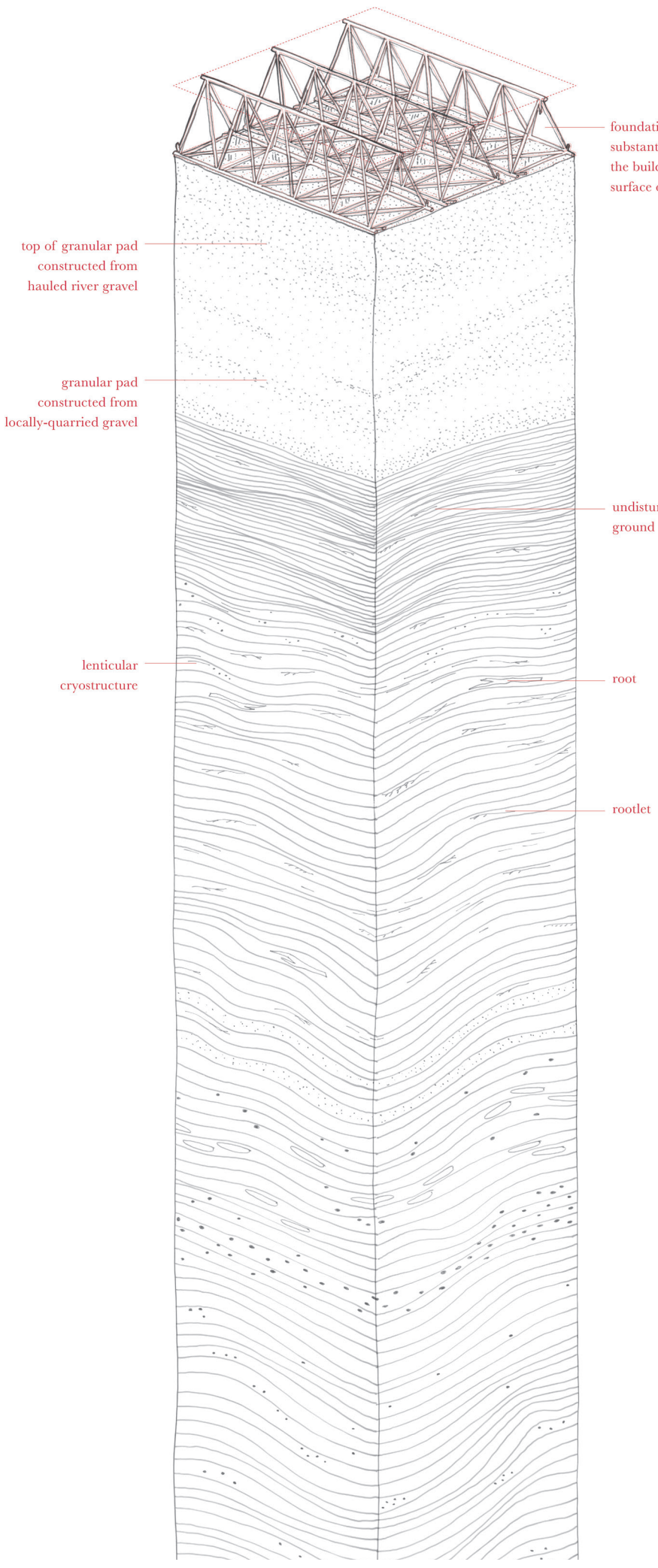
Locally sourced materials are used in the construction of this foundation. A decommissioned Nav Canada communications tower made of galvanized steel poles reclaimed from the community dump was repurposed to support and distribute the weight of the structure over a pad of river gravel.

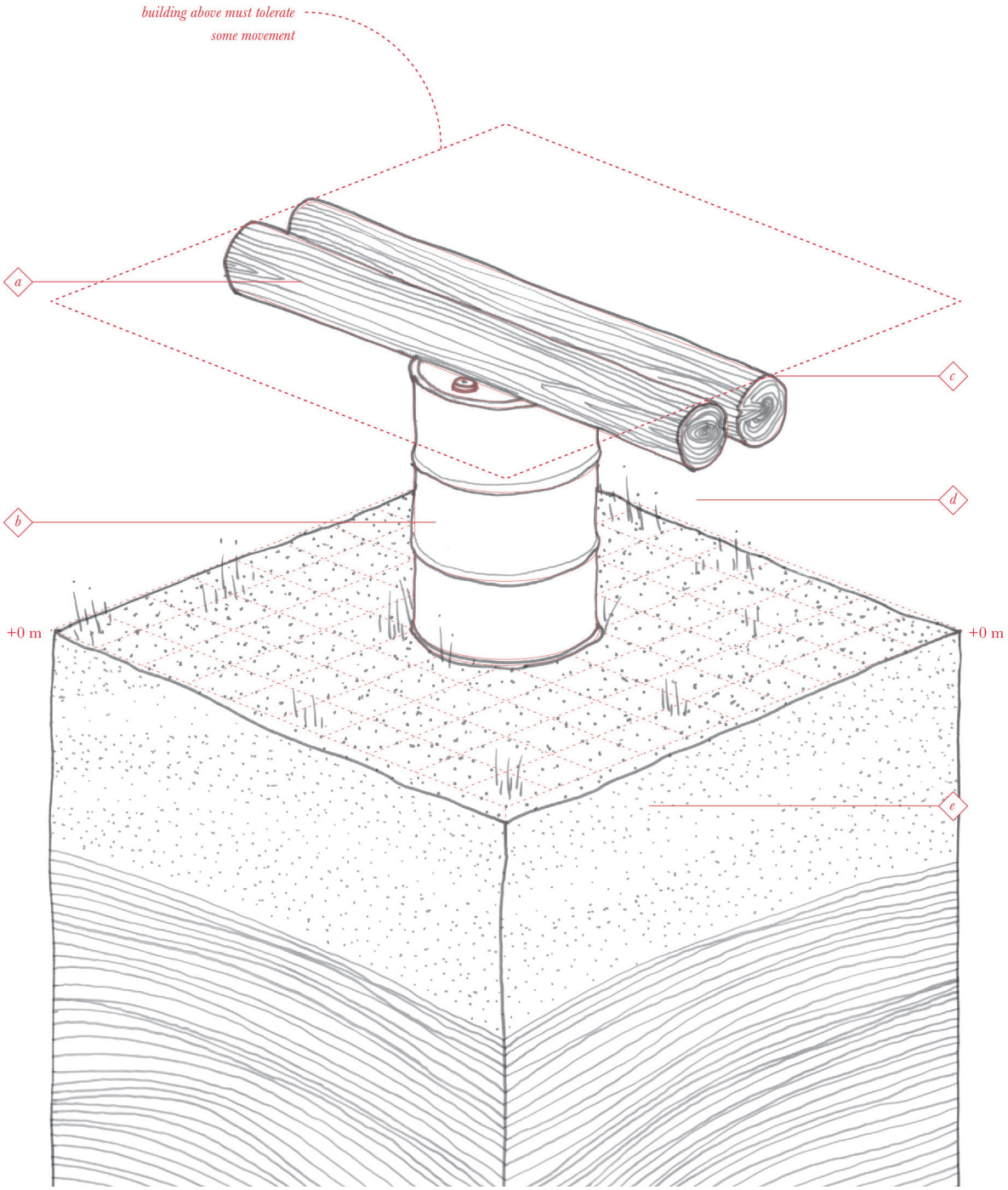
The space beneath the structure invites air circulation and provides some thermal decoupling from the ground.

fig. 4.21 (opposite) Shallow communications tower foundation unit detail drawing depicting materials, movements and surface-subsurface relationships with notes:

- *a* decomissioned communications tower salvaged from local dump
- *b* porous air gap allows for some air circulation

fig. 4.22 Deep section showing a communications tower foundation unit, and subsurface qualities and characteristics of the ground based off of a bore hole log




building above must tolerate some movement
a
b
c
d
e
+0 m
+0 m

SHALLOW: OIL DRUM AND TIMBER

Vuntut Gwitchin First Nation citizen Allan Benjamin designed and built this oil drum and timber foundation system that rests on the surface of the ground.

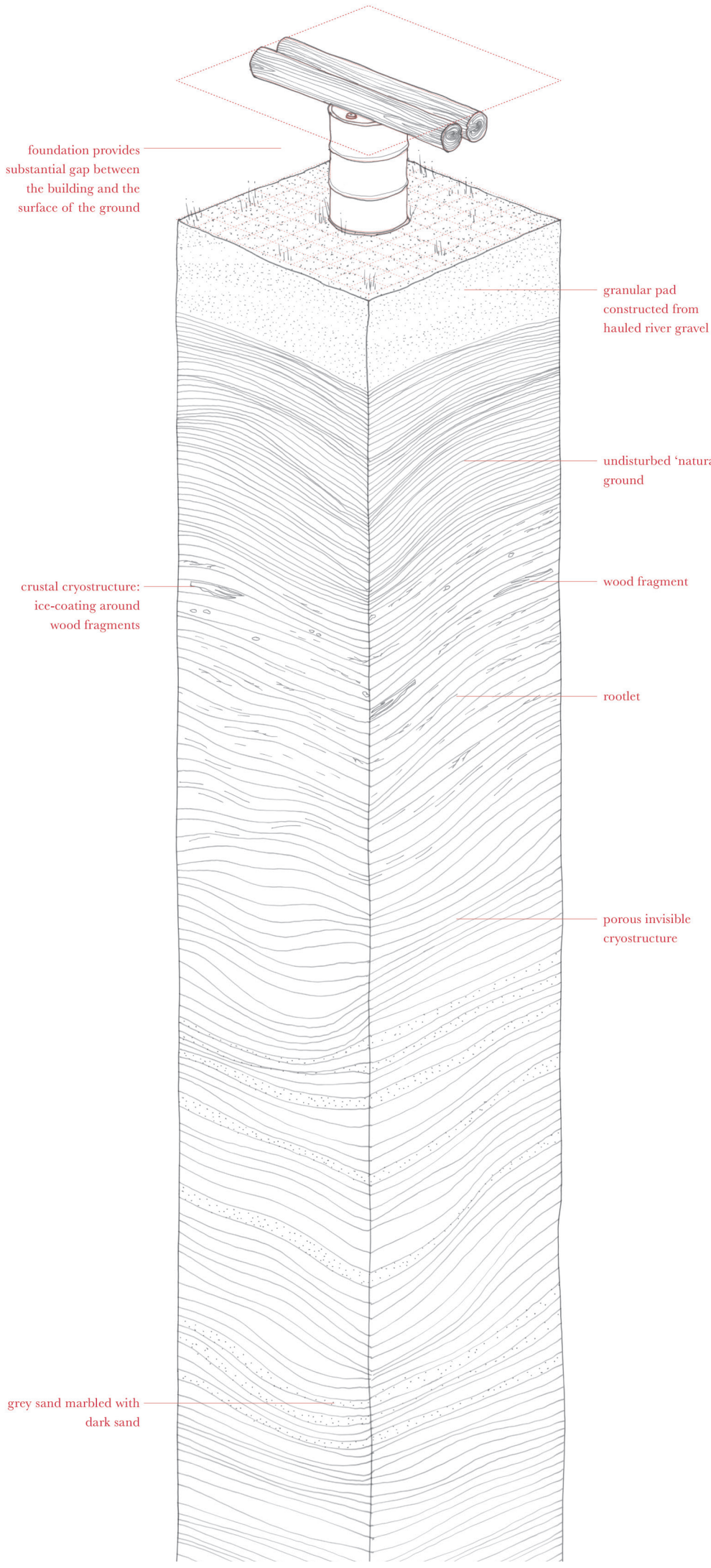
Like the communications tower system, locally sourced materials are used in the construction of this foundation. At each connection point, a reclaimed forty-five-gallon oil drum supports two sill logs harvested from the land that run longitudinally beneath the building. The foundations sit on a pad of river gravel.

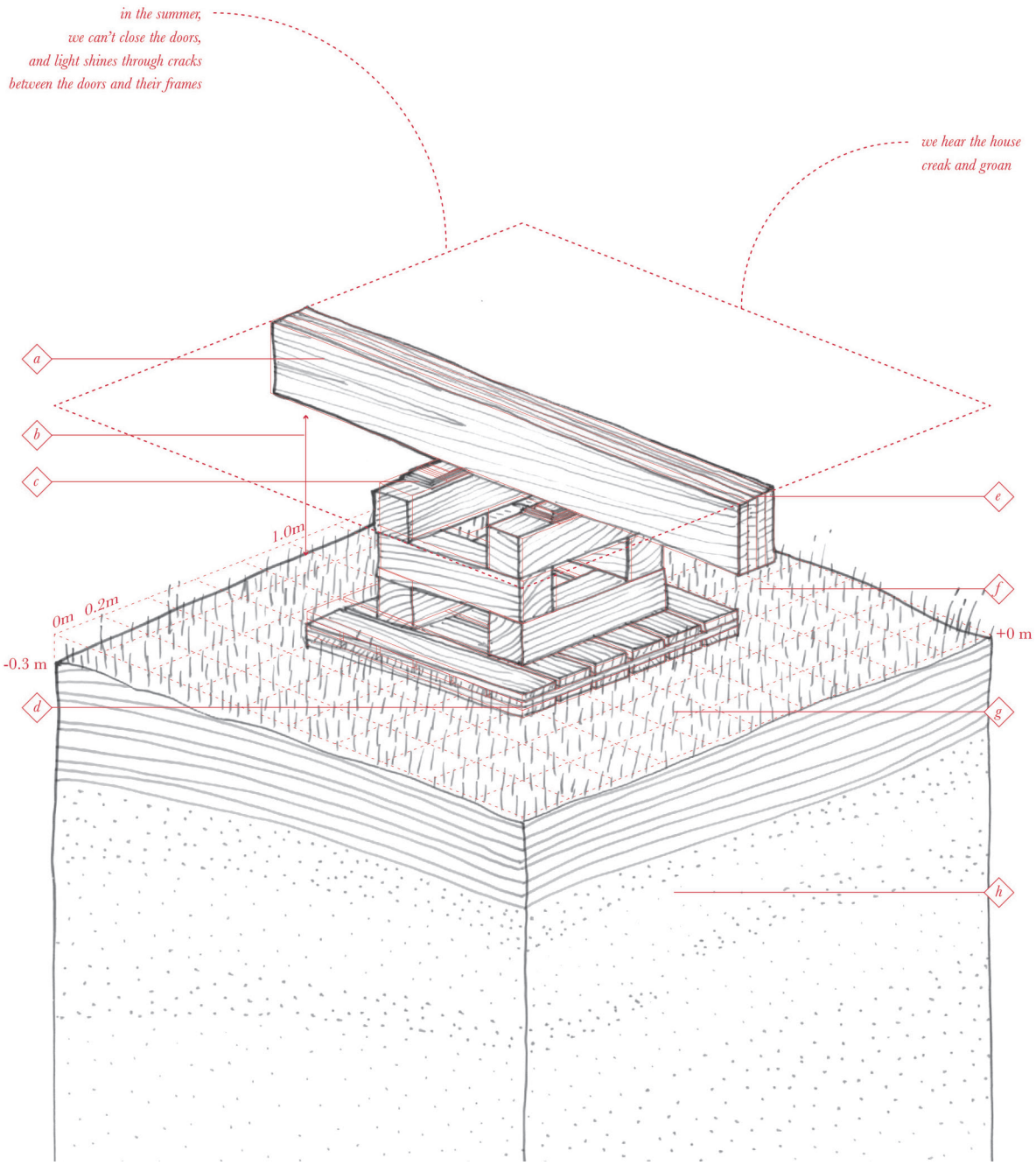
The height of the oil drums provides space beneath the structure that invites air circulation and allows for some thermal decoupling from the ground.

fig. 4.23 (opposite) Shallow oil drum and timber foundation unit detail drawing depicting materials, movements and surface-subsurface relationships with notes:

- *a* peeled logs harvested locally
- *b* repurposed fourty-five-gallon oil drum
- *c* timber beams support floor joists of structure above
- *d* gap allows for air circulation
- *e* constructed on a bed of hauled river gravel

fig. 4.24 Deep section showing an oil drum and timber foundation unit, and subsurface qualities and characteristics of the ground based off of a bore hole log




in the summer,
we can't close the doors,
and light shines through cracks
between the doors and their frames
we hear the house
creak and groan
a
b
c
e
f
g
h
d
1.0m
0.2m
0m
+0 m
-0.3 m

SHALLOW: WOODEN CRIBBING / 'PAD, CRIB AND BEAM'

This system floats at above the active layer, and can shift with the land's seasonal movements and possible settlement.[13]

Supports are constructed from pairs of horizontal preserved wood foundation timber blocks stacked in alternating directions on PWF pads. These are typically installed on engineered non-frost-susceptible (NFS) granular fill (like gravel or crushed rock) to help level the ground and provide drainage.[14]

While installation does not typically require heavy machinery or technical expertise, local builders can hold significant knowledge of the permafrost and its behaviour.[15] The initial cost of this foundation is economical, its lifespan is relatively short and its re-leveling can be quite labour-intensive.

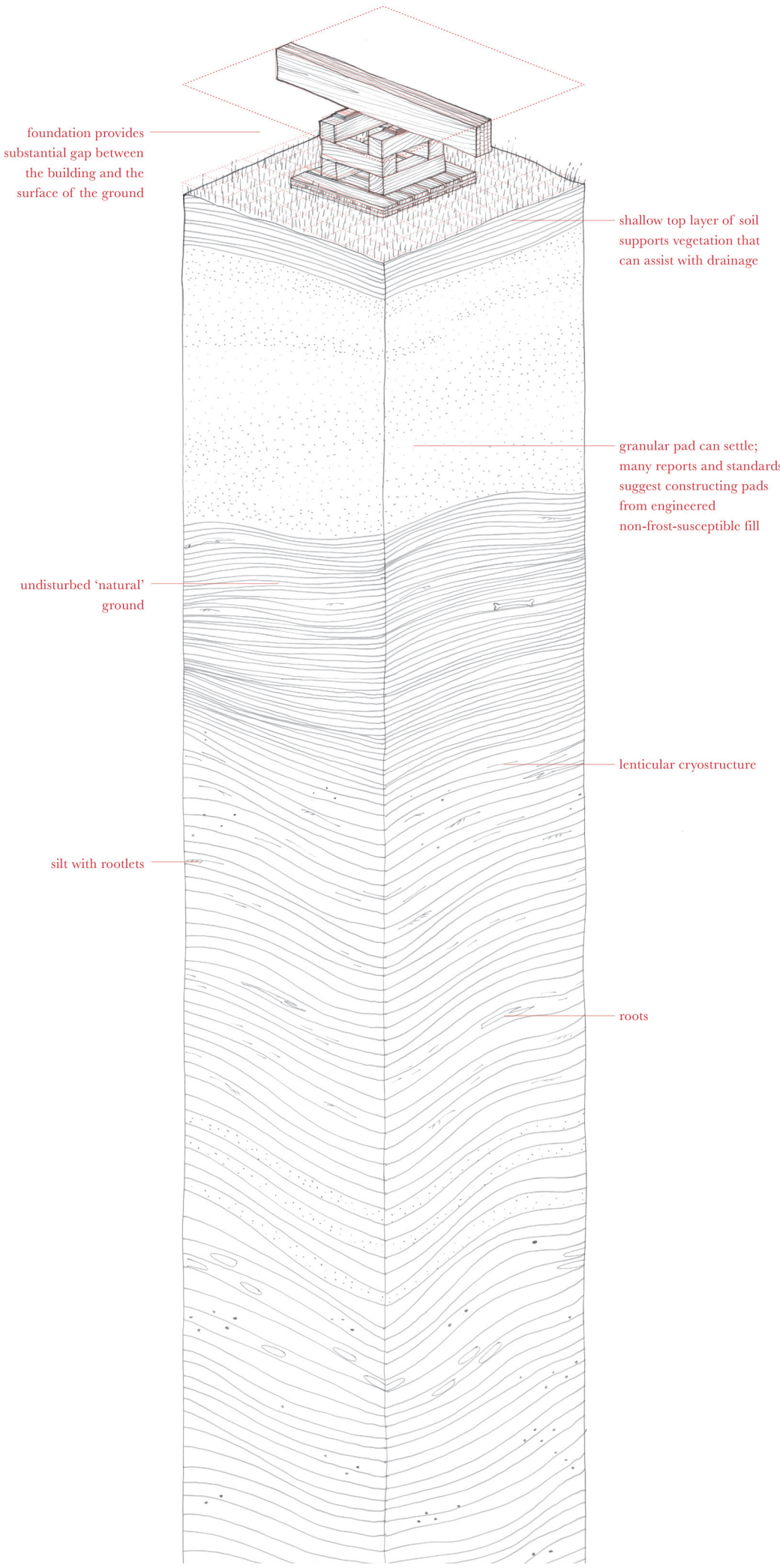
The air space between the building and the land prevents the transmission of heat from the structure to the underlying soils while inviting air circulation and providing a working space that accommodates the movement of humans in their rituals of re-levelling the structure.

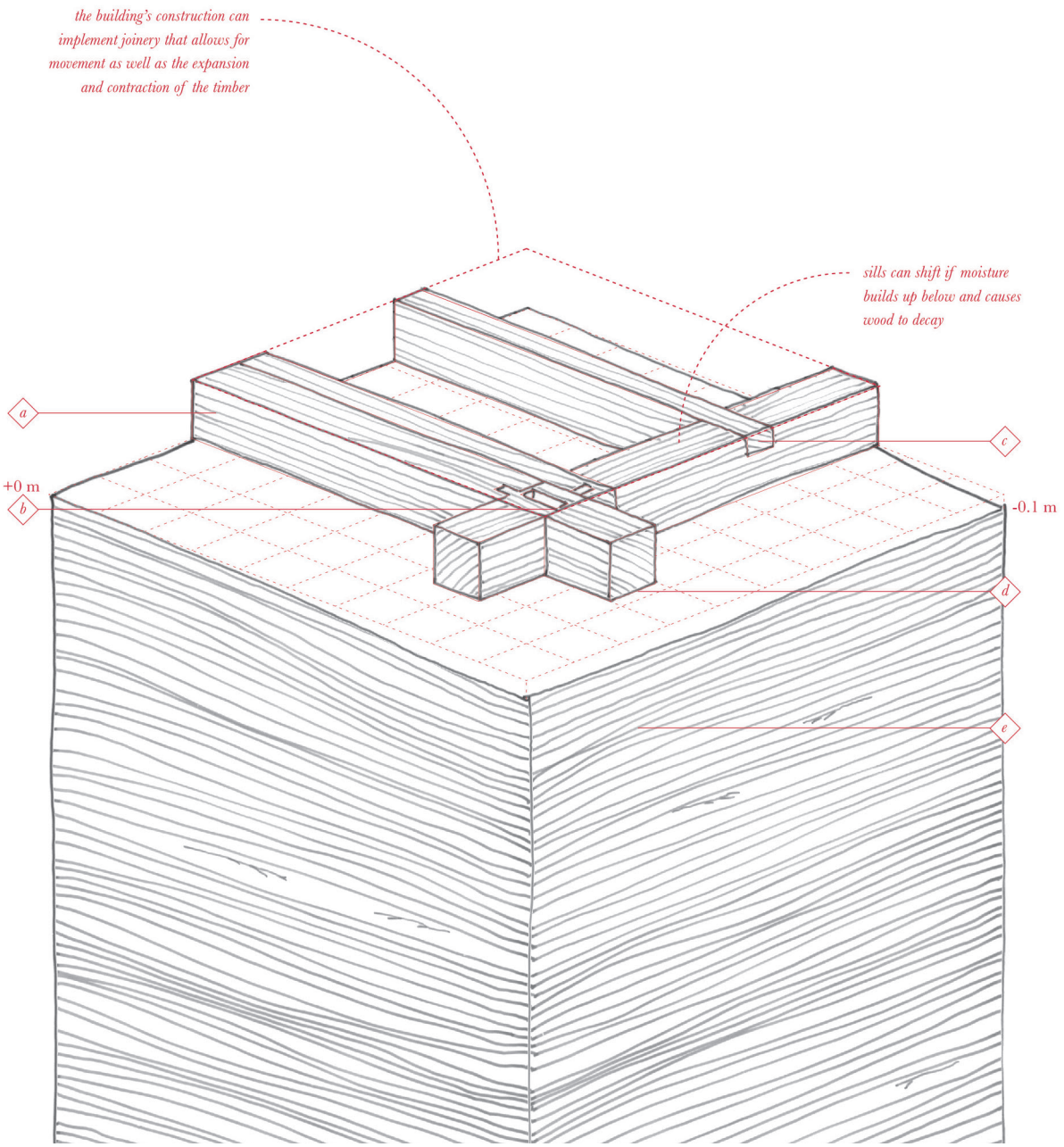
While these foundations can be adjusted, the buildings they support must be able to tolerate some movement. Movements can permanently damage the building structure and periodic re-levelling is often required – typically annually or bi-annually – depending on soil 'competency.'[16] This system is ubiquitous across the Canadian North, appearing under many Euro-North American housing models imported from the South. This foundation type is used in residential construction in many communities in continuous and discontinuous permafrost regions.[17]

fig. 4.25 (opposite) Shallow wooden cribbing foundation unit detail drawing depicting materials, movements and surface-subsurface relationships with notes:

- *a* beam can deflect with major settlement and certain field studies suggest it might deform with stress over time
- *b* periodic levelling is often required and can be done by re-leveling timber cribbing and pad while temporarily supporting the beam with equipment such as a jack
- *c* shims can loosen
- *d* cribbing and pad can settle
- *e* beam connects to floor joists above
- *f* gap allows for air circulation and movement of workers under building
- *g* vegetation can assist with site drainage
- *h* foundation can sit on a bed of engineered fill on top of the natural ground

fig. 4.26 Deep section showing a wooden cribbing foundation unit, and subsurface qualities and characteristics of the ground based off of a bore hole log




the building's construction can implement joinery that allows for movement as well as the expansion and contraction of the timber
sills can shift if moisture builds up below and causes wood to decay
a
b
c
d
e
+0 m
-0.1 m

SHALLOW: TIMBER SILLS

Timber sills run longitudinally beneath a building, and float on the land's moving surface.

Sills may be made of steel, but they are often constructed from PWF timber and seated on a stable ground surface or atop a pad of compacted granular fill.[33]

While this surface foundation does have a shorter lifespan, it is relatively inexpensive and easy to construct, requiring no specialized labour or heavy equipment.

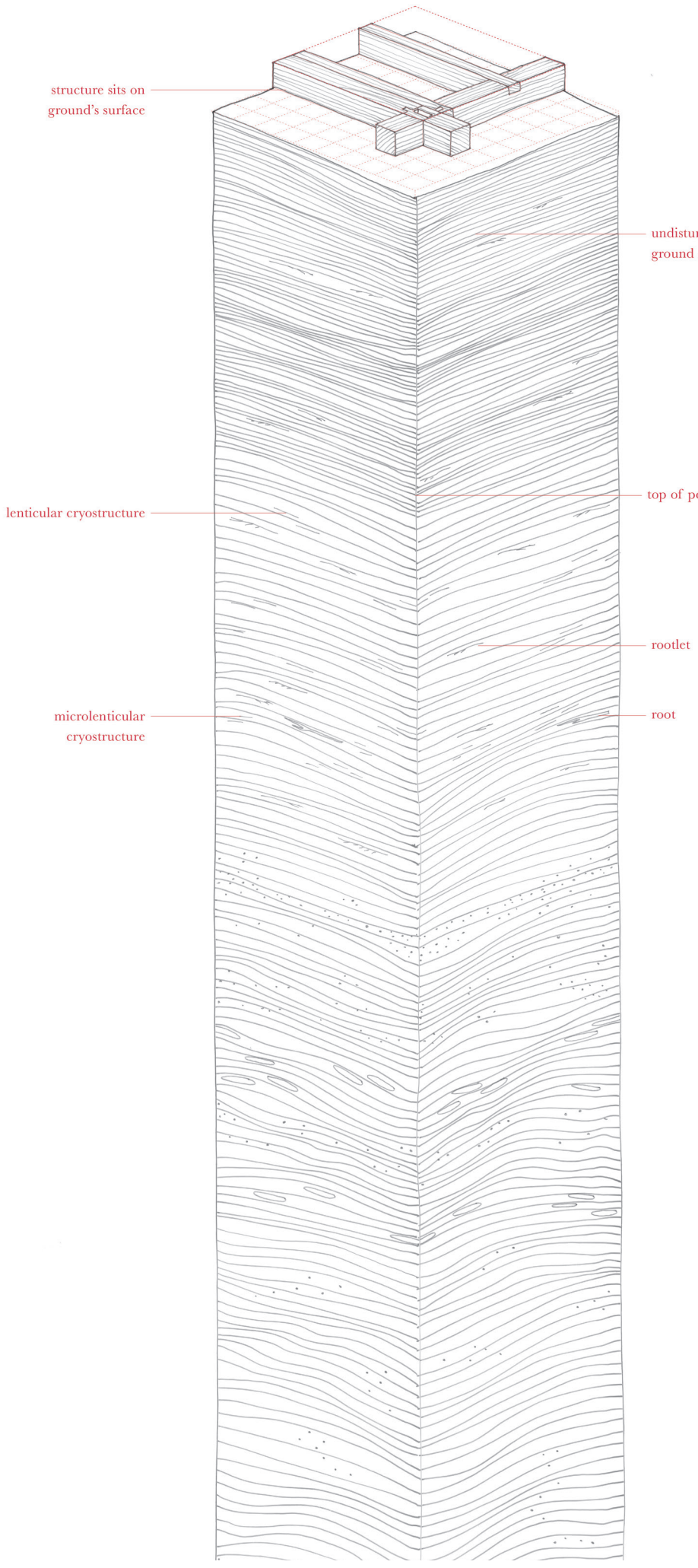
Log cabin construction involves timber sill foundations. Historians have positioned log cabins in Gwich'in territory as a cultural exchange between the Gwich'in – who already used logs and other materials from the land in their traditional architecture – and the Euro-North American newcomers who participated in extractive industries in their territory such as the fur trade. Log cabins index continued actions on the land such as knowing the wood places and how to hunt and harvest 'good' logs.[34]

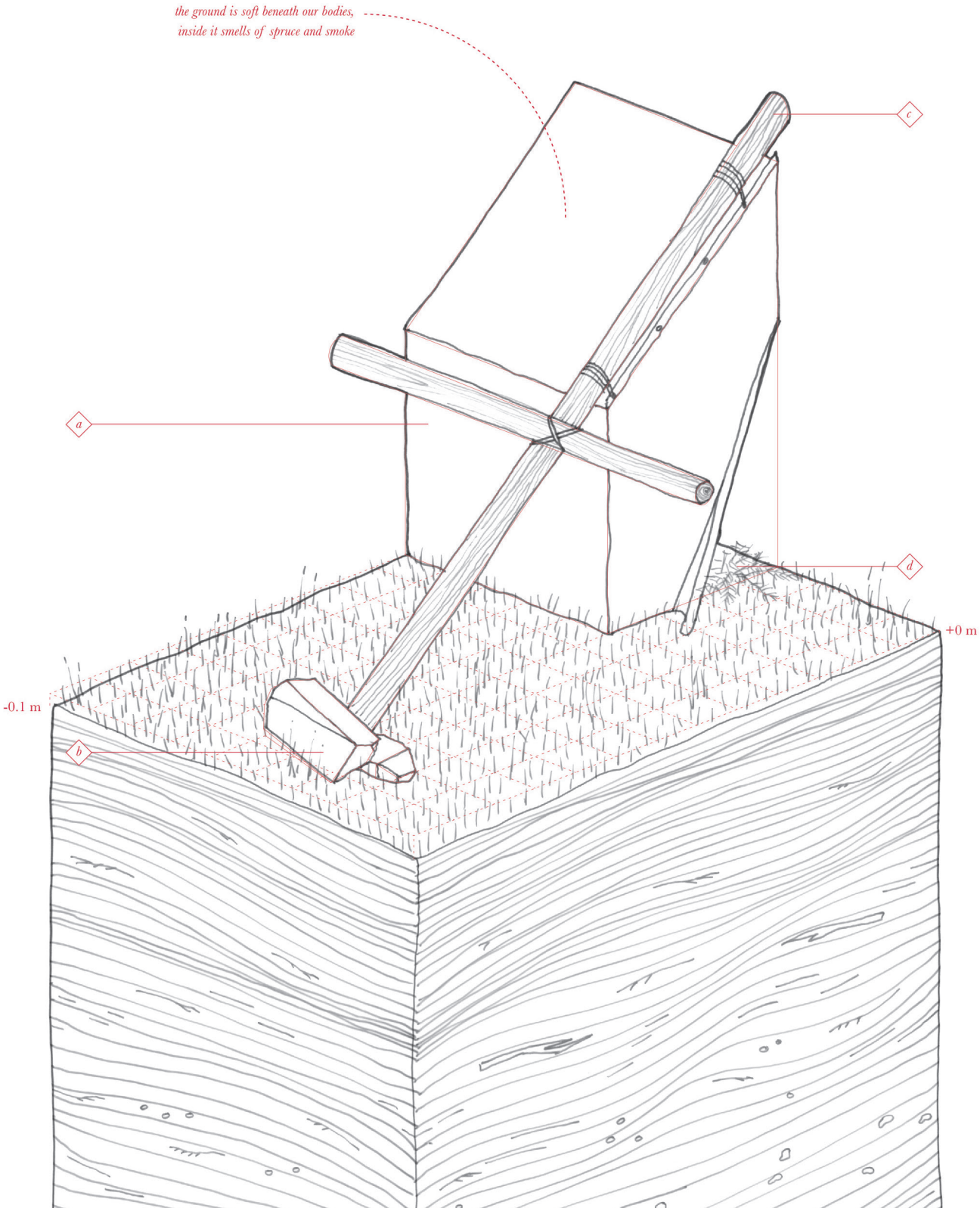
The timber buildings at *Gindèh Chik* (Rampart House), a historic site along the Alaska-Yukon border, reflect the 'pièce sur pièce' construction methods associated with the Hudson's Bay Company Red River Frame style. A crew of restoration carpenters and builders from Old Crow has been rebuilding the structures every summer since 1999. Many of the buildings rest on hand-hewn timber sill foundations.

fig. 4.27 (opposite) Shallow timber sills foundation unit detail drawing depicting materials, movements and surface-subsurface relationships with notes:

- *a* beam can deflect with major settlement and certain field studies suggest it might deform with stress over time
- *b* periodic levelling is often required and can be done by re-leveling timber cribbing and pad while temporarily supporting the beam with equipment such as a jack
- *c* shims can loosen
- *d* cribbing and pad can settle
- *e* beam connects to floor joists above
- *f* gap allows for air circulation and movement of workers under building
- *g* vegetation can assist with site drainage
- *h* foundation can sit on a bed of engineered fill on top of the natural ground

fig. 4.28 Deep section showing a timber sills foundation unit, and subsurface qualities and characteristics of the ground based off of a bore hole log




the ground is soft beneath our bodies,
inside it smells of spruce and smoke
a
b
c
d
+0 m
-0.1 m

SHALLOW: CANVAS-WALL TENT

The canvas-wall tent's foundation rests lightly on the ground, supported by a structure of timber posts.[31]

The Gwich'in adopted the canvas-wall tent during the Klondike Gold Rush.

Like the skin tent used before during travel and more temporary stays, the canvas-wall tent requires carefully 'hunting' and sourcing timber members from the land.

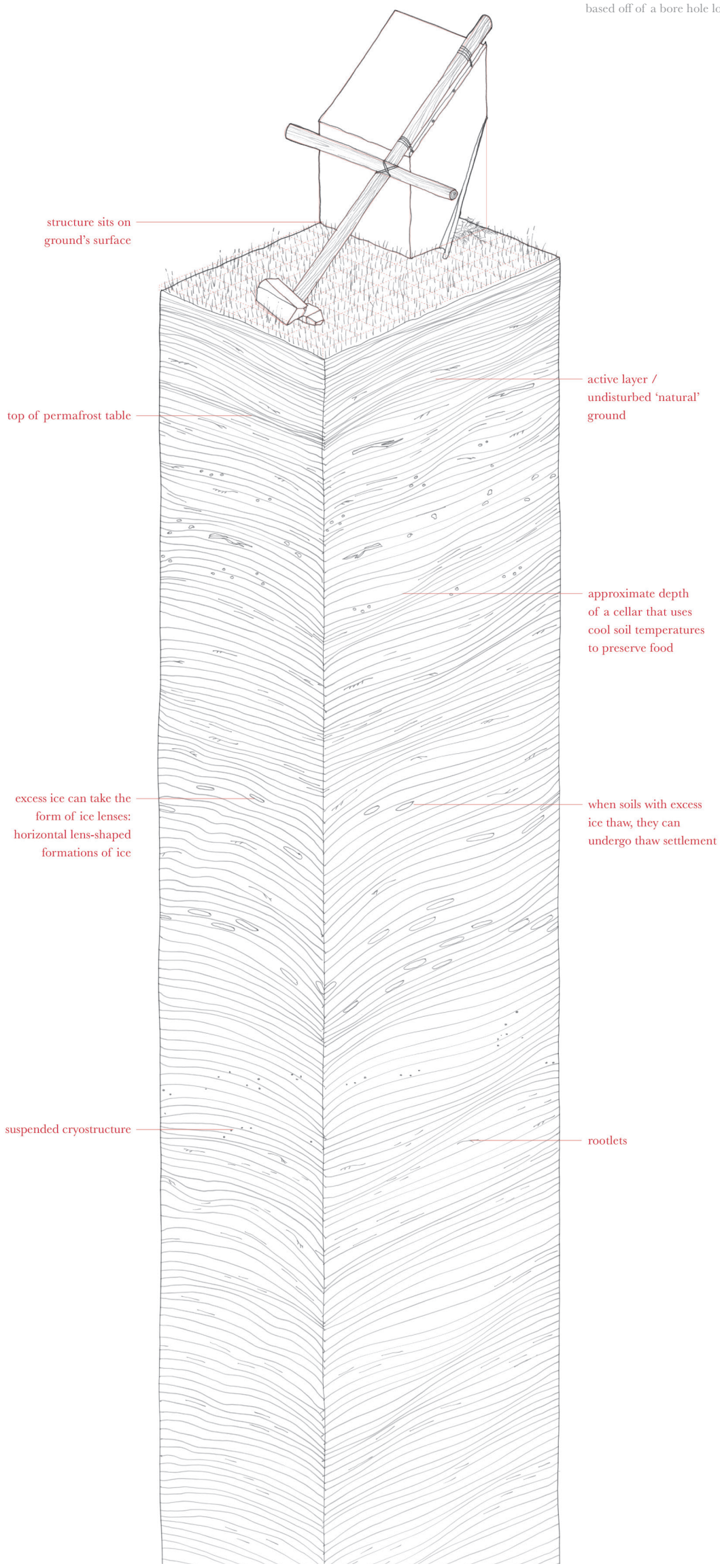
Portable, relatively easy to assemble, smoke-free and warm once set up with a steel wood-burning stove, the canvas-wall tent remains a vital component in life out on the land.[32] The canvas-wall tent is often moved and is not given the same long-term opportunity to seriously degrade the permafrost as more permanent structures build directly on the land.

The *Fort McPherson Tent and Canvas* company in the Teetl'it Gwich'in community of Fort McPherson, NT is one contemporary manufacturer of these tents.

fig. 4.29 (opposite) Shallow canvas-wall tent foundation unit detail drawing depicting materials, movements and surface-subsurface relationships with notes:

- *a* canvas-wall tent from 'Fort McPherson Tent and Canvas'
- *b* poles dig into the ground's surface and rocks serve as anchors
- *c* felled and de-branched spruce poles
- *d* the canvas-wall tent sits lightly on the ground, often with a bed of spruce boughs as the floor

fig. 4.30 Deep section showing a canvas-wall tent foundation unit, and subsurface qualities and characteristics of the ground based off of a bore hole log



NOTES – A SHIFTING LAND

1. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions* (Yellowknife, NT: Canada Mortgage and Housing Corporation, 2000), 5.

2. Howard Linklater (VGFN citizen and VGG Government Services Director), discussion with the author, July 2016.

3. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions*, 36-37.

4. Agra Earth and Environmental Limited, 5.

5. Richard Trimble and Chad Cowan (geotechnical engineers), discussion with the author, August 2017.

6. Tim Ingold, *Making : Anthropology, Archaeology, Art and Architecture* (Milton Park, Oxon: Routledge, 2013), 77.

7. Department of Environment, Government of Nunavut, and Soaring Tortoise Creative, *A Homeowner's Guide to Permafrost in Nunavut* (Yellowknife, NT: Government of Nunavut, 2013), 12.

8. It is important to note that while I use the terms "land" and "ground" interchangeably in places, 'land' can also be used to describe not only the land itself but the animals and non-human communities that inhabit it.

NOTES – RECIPROCAL RELATIONSHIPS WITH THE LAND

1. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions* (Yellowknife, NT: Canada Mortgage and Housing Corporation, 2000), 27.

2. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation* (Mississauga, ON: Canadian Standards Association, 2010), iii-13.

3. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions*, 20.

4. Howard Linklater (VGFN citizen and VGG Government Services Director), discussion with the author, July 2016.

5. Department of Environment, Government of Nunavut, and Soaring Tortoise Creative, *A Homeowner's Guide to Permafrost in Nunavut* (Yellowknife, NT: Government of Nunavut, 2013), 10-12.

6. Canadian Standards Association, *Technical Guide: Infrastructure in Permafrost: A Guideline for Climate Change Adaptation*, 9.

7. Canadian Standards Association, 37.

8. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions,* 30.

9. Environment Division, Department of Environment and Natural Resources Government of the Northwest Territories, *A Homeowner's Guide to Permafrost in the Northwest Territories* (Yellowknife, NT: Government of the Northwest Territories, 2015), 18.

10. Canadian Standards Association, *Moderating the Effects of Permafrost Degradation on Existing Building Foundations* (Mississauga, ON: Canadian Standards Association, 2014), 24.

11. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions*, 30.

12. Department of Environment, Government of Nunavut, and Soaring Tortoise Creative, *A Homeowner's Guide to Permafrost in Nunavut*, 10-12.

13. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions*, 10.

14. A minimum gap of 0.7m is often recommended. See Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions*, 16.

15. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions*, 36.

16. Environment Division, Department of Environment and Natural Resources Government of the Northwest Territories, *A Homeowner's Guide to Permafrost in the Northwest Territories*, 15.

17. Agra Earth and Environmental Limited, *Residential Foundation Systems for Permafrost Regions,* 16.

fig 4.31 Foundation drawings displayed at the John Tizya Centre, Old Crow, Yukon. After documenting building foundations in this region, I returned to Old Crow to share the collection of drawings with community members.

groundings

This thesis has been shaped by a series of conversations with local builders who expressed a pragmatic desire to gain more information about building foundations on permafrost. A collection of drawings has developed through many formal and informal discussions with knowledge holders, local experts and technical professionals. The work is presented in an accessible format in order to offer information that is non-prescriptive. It is not a complete guide: each documented foundation represents my own experience of a specific site overlaid with local knowledge and more general technical information.

While this collection communicates information through the language of my own academic grounding, architectural drawing, the representation has been designed to emphasize the shifting nature of the land and its relationship with specific building foundations. In choosing to be neutral in our professional methods of communication, we risk flattening underlying narratives. Similarly, when we interpret relationships with the land by isolating and fragmenting information through the myopic lenses of objective geotechnical surveys and Traditional Ecological Knowledge, we omit broader ways of being and the associated knowledge that is entangled with spirituality, experience and relatedness.[1] To preserve such depth, the visiting architect cannot prescribe or generalize. She must learn to unground herself from a desire to abstract as a prelude to listening. It is by opening herself to a site's complexity and embracing the living meshwork of relationships in which it is rooted that relevant grounding occurs.

This thesis is grounded in relationships: listening to community members in Old Crow and spending time with knowledge holders while attempting to engage earnestly with local experts and the land itself. These relationships and my own particular experiences of the land have guided the ideas examined in this book. I am only beginning to learn how to unground myself and ground my work in meaningful and reciprocal relationships with the land and the people who live close to it. It is on this shifting foundation that I hope to build.

NOTES - EPILOGUE

1. Vine Deloria, "Civilization and Isolation," *The North American Review* 263, no. 2, 1978, 11–14. http://www.jstor.org/stable/25118003.

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