



PR 391 TO LYNN LAKE, MB

OUT OF SIGHT

REVEALING THE RESTORATIVE NATURE
OF NORTHERN MANITOBA

BY VANESSA VERMEULEN

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REVEALING THE RESTORATIVE NATURE OF NORTHERN MANITOBA

PR 391, MB

By Vanessa Vermeulen

A Practicum submitted to the Faculty of Graduate Studies of
The University of Manitoba
in partial fulfilment of the requirements of the degree of

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture
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Winnipeg



Figure 0-1: The boreal forest.



FOR LEAH

"Always remember how far you have come, and not just how far you have to go, you may not be where you want to be but neither are you where you used to be."

-Rick Warren

ABSTRACT

This landscape architecture practicum proposes a restorative trail adjacent to Manitoba Provincial Road (PR) 391, the most northern all-season highway in Manitoba, connecting the town of Lynn Lake to the city of Thompson. The project examines the crucial role that the route plays in the transportation of northern Manitobans to health care facilities and their wellbeing while travelling. An application and expansion of Ian McHarg's mapping layers of value systems from his book *Design with Nature* is used to correlate relationships and implement design strategies in the landscape. The values of economic, environmental, and socio-cultural elements reveal a history of the north that is rooted in a healthy landscape, resource exploration, and Indigenous culture. Anecdotal excerpts from the author's personal experience dealing with cancer and the healthcare system have guided the practicum to explore the restorative nature of the landscape, where the landscape is considered as an important component in healing the mind, body, and soul. Landscape theories of restoration aid in identifying the benefits for both physical and mental health. The potential economic, environmental, and social benefits are considered and best practices are applied to the design of a healing landscape along PR 391.

ACKNOWLEDGEMENTS

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Karen, these past few years have been a personal rollercoaster ride, but your guidance and support has remained constant throughout. Your compassion, knowledge, and consideration has helped shape the practicum and helped me grow as a designer. Thank you for challenging me when needed, and for your understanding during the difficult moments. I would not have made it to this point without you.

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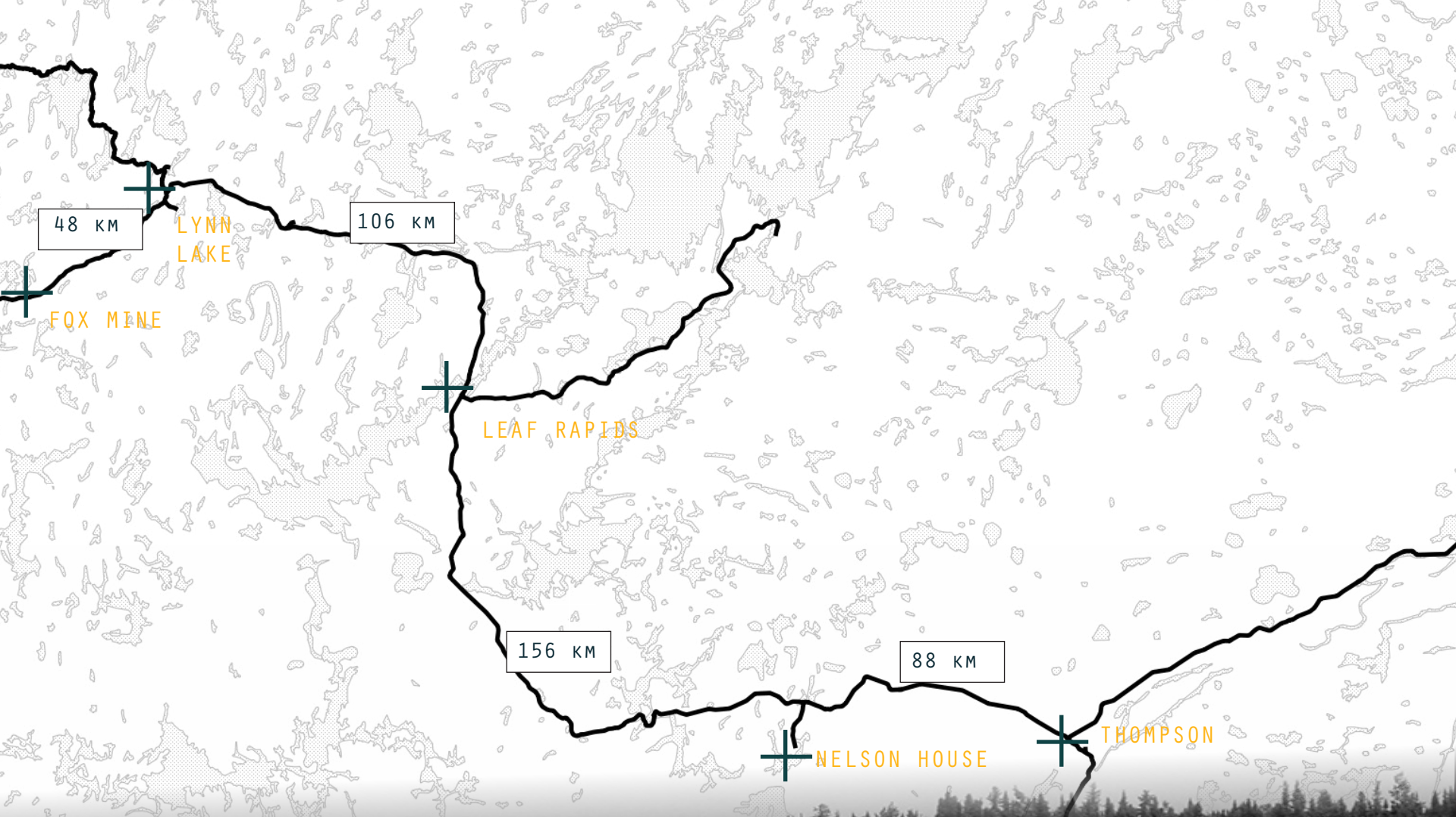
Figure 0-2: PR 391, northern Manitoba.

INSPIRATION

This practicum was inspired by an intrigue with the northern landscape and my health care journey as the mother of a daughter who was diagnosed with cancer in 2019, and the observations I made of the health care journey of cancer patients and the impacts of treatment on patients and caregivers. At the time of her diagnosis I found myself looking towards the environment to find the reason for the cause of my daughter Leah's cancer, and then to understand how I could begin to heal from the impacts her treatment had on my mental health. My familiarity with the landscape of northern Manitoba, through my travels to Churchill and a road trip to Lynn Lake, heightened my awareness of the challenges rural communities face when accessing the healthcare system. Reflecting on Leah's treatment schedule and considering our family regimen in light of the hurdles northern Manitobans would face for a similar diagnosis, the practicum began to address the barriers of the northern landscape and the integration of environmental healing practices into the design.

The connection between spirituality and the landscape is fundamental to Indigenous culture and the research led to the recognition of this route as a restorative landscape with great potential.

In my personal experience, PR 391 is beautiful and unique as it passes through the relatively untouched boreal forest. As the most northern all season highway in the province, it is important to socio-cultural values regarding health related issues found in northern Manitoba. In its current state, the road lacks an accessible connection to the restorative properties of the landscape that is so vital to the psychological healing process of patients who are using the road for healthcare. The design of a healing trail along PR 391 merges the ideas of accessibility to landscape, history of the environment, and health of the people, and together inspires healing, restoration, and reflection.



INTRODUCTION

The landscape of northern Manitoba is unique and home to the diverse flora and fauna that form the boreal forest ecosystems. Spanning across northern Manitoba, the boreal forest contains one of the largest wetlands in the world and the largest continuous areas of forest coverage on earth (Wells, 2011). The dense foliage and wetlands create conditions that make it difficult to traverse and challenging for humans to inhabit permanently. Under this fascinating landscape, northern Manitoba boasts an abundance of minerals and metals found within its geomorphological layers. These resources attract industrial speculation that has historically sacrificed the stability of the landscape and through exploration and excavation processes that form a cycle of more exploration and development in pursuit of more resources and profit.

Indigenous presence and settlement pre-date the colonization of northern Manitoba, and these settlements utilize the northern landscape for sustenance and hold the gifts of the earth sacred to their culture and livelihood (Booth and Skelton, 2011). Indigenous culture and beliefs embrace the landscape, and they believe the earth holds healing and restorative properties that aid in balancing the health of the environment, including human inhabitants.

Figure 0-3: PR 391, road verge.

Figure 0-4: GIS map showing PR 391.

Lynn Lake, a mining town located within the Marcel Colomb First Nation in northern Manitoba, is the endpoint of the last northern all-season highway in Manitoba and provides access for other northern communities to reach transportation for broader healthcare resources. Presently the highway is a lifeline for communities who, in addition to isolation, experience the physical and mental health related consequences of degraded landscapes and the effects of mining exploration. My personal experience with transportation to healthcare for my daughter's cancer treatments emphasizes the importance of the highway and surrounding environment. The comfort and familiarity of the landscape that comes with the repetitive cycle of commutes to healthcare facilities is one of the only consistencies within treatment. The commute lends itself to a time of tranquility and reflection in a time otherwise plagued by rapid changes. For this reason, I view the purpose of PR 391 as so much more than a thoroughfare – it is a lifeline.

**Yellow text, within the writing of this document, herein depicts my anecdotal experience travelling northern Manitoba and Manitoba's healthcare system.*

GOALS The goal of this practicum is to use design to reveal the restorative properties of the landscape and show how restoration of degraded landscapes can aid in the healing process of cancer patients in northern Manitoba. Acknowledging Indigenous healing processes, along with restorative psychological theories, the final design is structured in the form of recreational trails and rest stops adjacent to PR 391. The intention of the practicum is to develop a non-motorized trail route from Thompson to Lynn Lake that is woven into the fabric of the landscape surrounding the highway, with four rest stops that follow recognized steps to restorative health and utilize Indigenous healing processes.

The **OBJECTIVES** are to:

- Highlight the importance of transportation to healthcare resources for residents in northern Manitoba.
- Identify key processes that aid in the restorative health of people and the environment.
- Reveal the layers of economic, environmental, and socio-cultural values that are crucial to the health of the northern Manitoba landscape and people, specifically along PR 391.
- Communicate the importance of mindfulness in industrial extraction and the implications on the physical and mental health of northern communities.
- Design a trail system and rest stops that follow the healing steps of restorative theories and Indigenous healing practices.

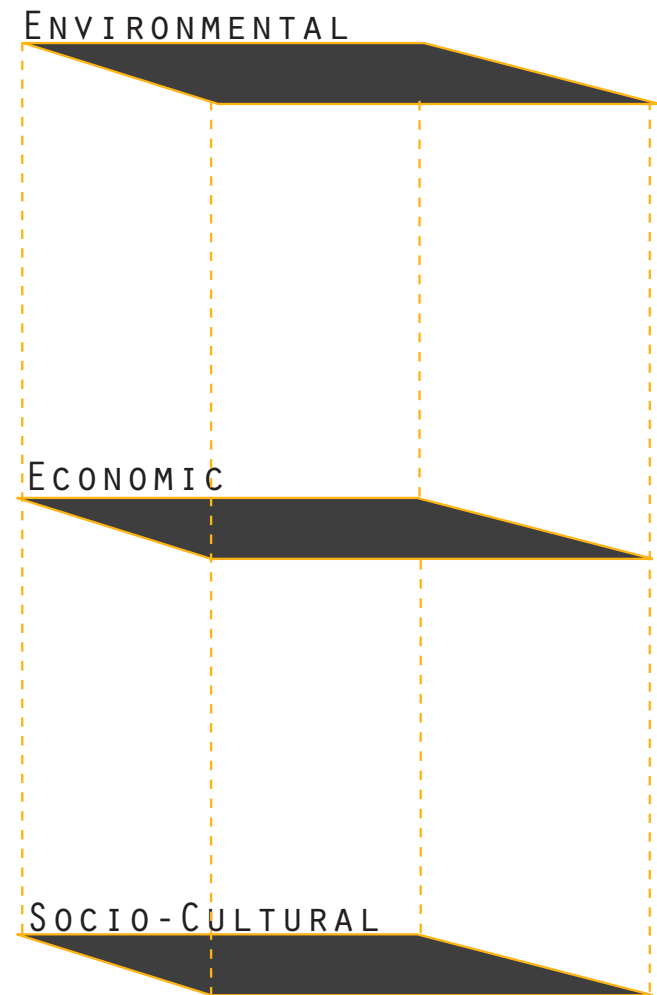


Figure 0-5: Diagram of value systems.

MATTER, of this is the cosmos, sun, earth, and life
 made.
SUN, shine that we may live.
EARTH, home.
OCEAN, ancient home.
ATMOSPHERE, protect and sustain us clouds, rain, river
 and streams, replenish us from the sea.
PLANTS, live and breathe that we may breathe, eat, and
 live.
ANIMALS, kin.
DECOMPOSERS, reconstitute the wastes of life and death
 so that life may endure.
MAN, seek the path of benign planetary enzyme, aspire to
 be the worlds physician. Heal the earth and thyslf.

–lan Mcharg (Design with Nature, 1992)

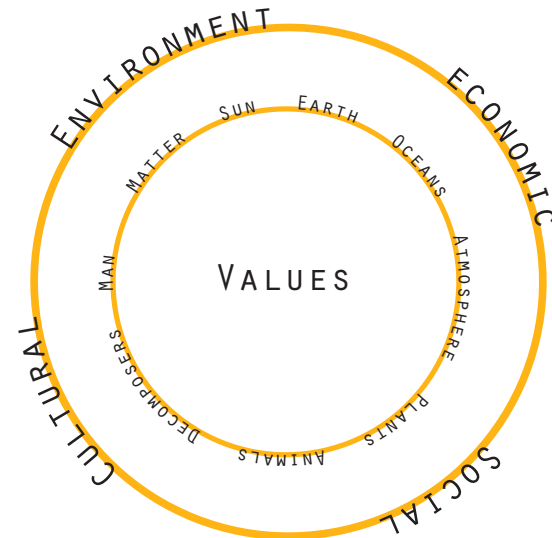


Figure 0–6: Diagram of values.

APPROACH In this practicum, Geographical Information Systems (GIS) is used as the communicative tool for the inventory and analysis of the site by identifying the characteristics and features of the landscape, due in part to the remoteness of the site (Esri, n.d.). This information is then managed layer by layer following the observational ideas of lan McHarg’s regional planning and layering of natural systems in his book, *Design with Nature* (1992). Each layer is the horizontal segment of parallel material arranged on top of one another which, when combined, represent the studied landscape in two dimensions.

McHarg’s “layer cake” method creates a framework for a theoretical lens that is helpful in identifying the critical components of the northern landscape, and is essentially a step-by-step instruction on how to break down a region into its parts (McHarg, 1992). The exploration of these individual

layers and the potential networks that have been formed between them helps delineate potential hazards and define a value system based around the economic, environmental, and socio-cultural components of northern Manitoba (Jepson-Sullivan, 2016).

The research of McHarg’s techniques, in consideration to the design along PR 391, reveals the complexity of layering information. With the addition of each layer, the map of the site evolves and begins to illustrate how each of the economic, environmental, and socio-cultural components of the value system intertwine and support one another. By applying the core values of McHarg’s theory, the framework for the creation of a trail system and rest stops within the landscape adjoining PR 391 is established, and best practices for the design may be applied.

LIMITATIONS An acknowledgement of the limitations of the document is necessary for the understanding of the design process engaged. These limitations are present due to the remoteness of northern Manitoba, my lack of community involvement, the limits of GIS and mapping techniques, and tensions between knowledge systems resulting from anecdotal perspectives.

REMOTENESS The remote environment of northern Manitoba poses an issue to accessibility. With limited accessibility, physical data and site specific information is difficult to gather for detailed design analysis.

COMMUNITY INVOLVEMENT Community involvement in the practicum has been limited, again because of the remoteness of the site. Community involvement must take

place in the design process of any design application, in order for final design approaches to be inclusive of anecdotal and oral knowledge of local conditions. Understanding the functions of ecosystems and the history of these systems can be found in peer-reviewed literature, but to be robust they should be critiqued and understood through full community engagement.

I acknowledge that I am not an Indigenous person, and that I am from Winnipeg and that I do not live in the north. I believe that for this practicum it is important to discuss Indigenous practices of healing, because there is a large Indigenous presence in the community of study. Due to constraints already discussed, I provide minimal documentation of the specific healing practices of the communities surrounding PR 391.

Concepts proposed in this practicum are interpretations of the healing practices that were found in peer-reviewed literature. I acknowledge that these healing practices may be different for the communities surrounding PR 391 and reinforce the importance of initiating collaboration with the communities if the implementation of the proposed design was to progress.

GIS MAPPING In this practicum, mapping is used as a tool for inventory, analysis, and communication. When mapping key information, it must be acknowledged that there is a degree of inaccuracy to mapping. Objects on maps are skewed and the true locations of elements are not always represented accurately through digital mapping. Maps are also scaled to various sizes to allow for legibility, which can also obscure data at the same time (Jepson-Sullivan, 2016). Through this practicum, mapping is used to visualize the landscape and to offer theoretical perspectives on knowledge of the types

of landscapes that may be found within the region, and to communicate specific aspects of these landscapes.

TENSIONS BETWEEN KNOWLEDGE SYSTEMS

Throughout the document are references to Manitoba's healthcare system provided by means of the personal experiences of one individual, and therefore my perspective is subjective. Different experiences of the health care system by different individuals will yield many variable perceptions.



Figure 1-1: Moss forest carpet.

CHAPTER 1

SITE ANALYSIS

This section examines the health of the landscape, through analysis of the physical layers of the boreal forest ecosystem and the effects of historical extraction on the land. The degraded landscape caused by mining extraction in Lynn Lake prompted an environmental assessment to address the adverse physical and mental health implications experienced by residents. Locally noted physical health concerns included an increase in cancer diagnoses as well as a decline in the mental health of the community. I have applied my personal experiences navigating the healthcare system as the mother of a daughter diagnosed with childhood cancer to extrapolate the difficulties families face throughout the journey. Through the examination of health, particularly as it relates to cancer, this section uncovers the importance of transportation for the communities that reside along PR 391 to access healthcare resources.

This section is divided into four parts:

1. Health of the Land
2. Health of the People
3. The Highway
4. *Out of Sight – A Mothers Perspective*

HEALTH OF THE LAND



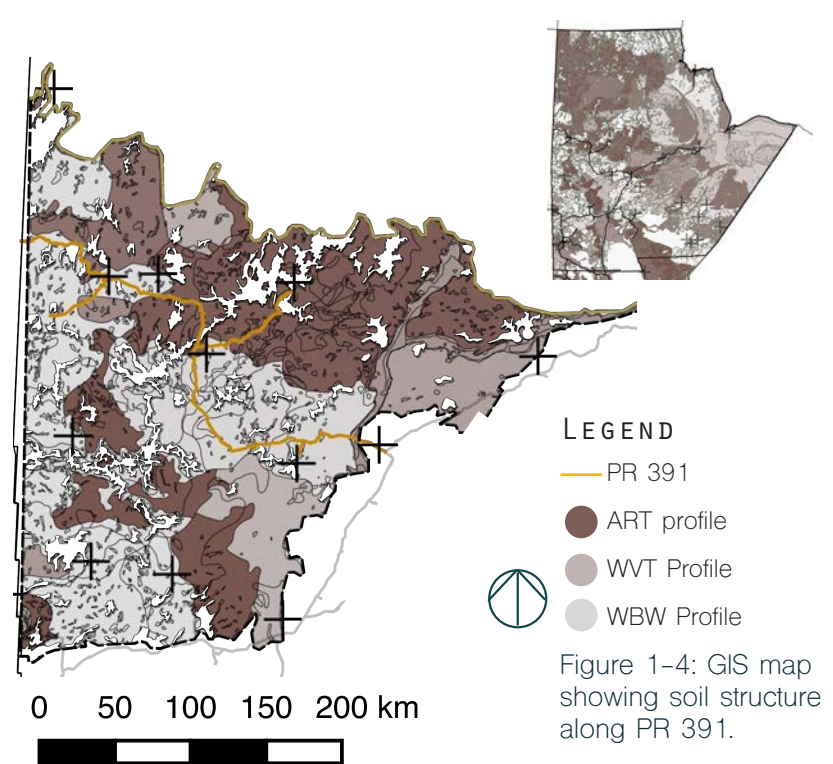
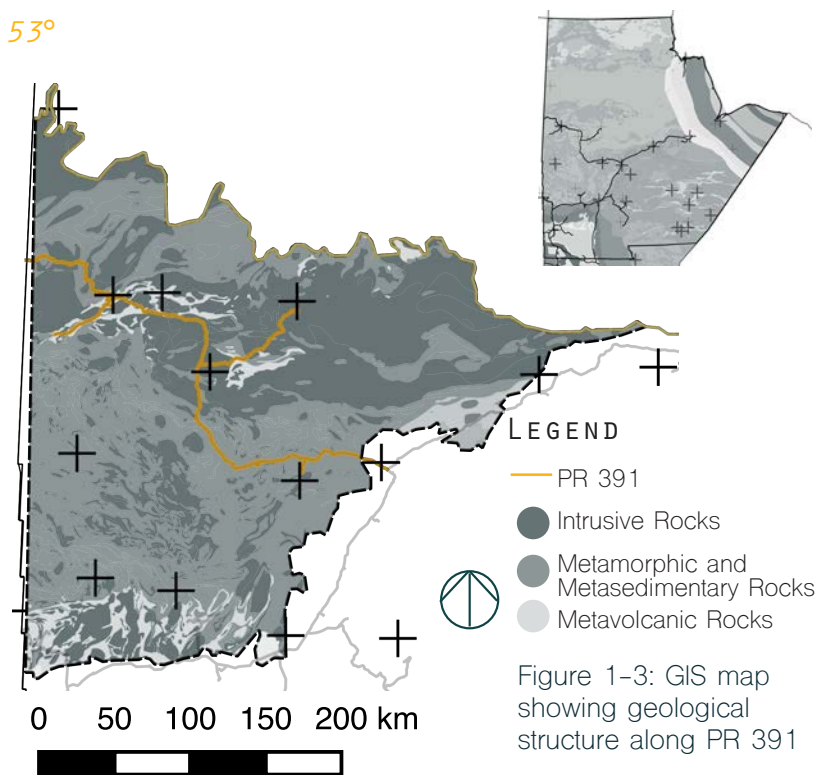
PHYSICAL FORMATION OF THE LANDSCAPE

THE BOREAL FOREST The boreal forest, located in the boreal shield, extends along Canada's western coast, arching across the central prairies and beyond. It is among the most intact forests on Earth, comprising seventy-five percent of Canada's forest and woodland area and hosting the richest biodiversity (Wells, 2011). It is named the "blue forest" for its immense collection of freshwater wetlands, which contains 200 million acres of surface water, accounting for twenty-five percent of the world's wetlands and a third of its peatlands (Wells, 2011). This forest contributes to air quality, habitat diversity, and algae production for marine consumption and stores over 147 billion tons of carbon between its waterlogged layers (Wells, 2011). It is a critical ecological system of global significance.

Continuous conifer forests characterize the Boreal forest. Spruce is the dominant vegetation, particularly in the area surrounding the town of Lynn Lake (Department of Mines,

Resources and Environmental Management, 1968). White spruce (*Picea glauca*) grows on dryer well-drained sites, whereas black spruce (*Picea mariana*) grows in wetter, marsh-like patches (Department of Mines, Resources and Environmental Management, 1968). Jack Pine (*Pinus banksiana*) are also typical of the Boreal forest and are commonly found on the post-glacial eskers formed by meltwater underneath the large moving ice-sheets (Scott, 1996). Covering the forest floor are carpets of sedge species and wet peat deposits that feed into the Boreal ecosystem's hydrological network (Scott, 1996). Rows of poplars and white birch line the forest's edges throughout the vast wetland (Department of Mines, Resources and Environmental Management, 1968). Amidst this waterlogged wetland is where Lynn Lake and PR 391 are located, in a sub-humid to humid climate, marked by short cool summers and long cold winters (Department of Mines, Resources and Environmental Management, 1968).

53°



SOIL STRUCTURE The Cryoboreal soil climate with its continuous freeze-thaw cycles contributes to the formation of permafrost that requires continuous subzero temperatures under the soil surface (Canadian Society of Soil Science, 2020). The soil structure is predominantly a glacial drift compound mainly composed of clay and found in localized depressions that are overlain by peat (Department of Mines, Resources and Environmental Management, 1968). The visible exposure of bedrock and peat is of the transition type – podzolic – tundra (Department of Mines, Resources and Environmental Management, 1968). This podzolic soil is acidic and found below the forest floor where aluminum and iron oxides have accumulated (Department of Mines, Resources and Environmental Management, 1968). The tundra soil profile is classified by the underlying permafrost, where there is little soil profile development under the cool, wet ground (Department of Mines, Resources and Environmental Management, 1968).

GEOMORPHOLOGY Deposits of the Precambrian era have formed the landscape of broad sloping uplands and lowlands surrounding Lynn Lake (Manitoba Energy and Mines, n.d.). These rock formations are predominantly granite and granitic gneisses –volcanic rock formed through intense heat and pressure (Department of Mines, Resources and Environmental Management, 1968). They are sedimentary and intrusive rock formations created by the great weight of melting ice-sheets of the Pleistocene era (Department of Mines, Resources and Environmental Management, 1968). These rock formations found in Lynn Lake form a large greenstone belt, the term applied when these compact formations hold an abundance of chlorite, actinolite, and basalt, creating a green colour in the bedrock (Springer, 2011).

The development of shears across the landscape, formed by compressive stress related to the ice sheets of the ice age era, hold precious minerals and metals and has helped form

the eskers and kames characteristic of the northern landscape (Scott, 1996). Elevation changes between 1,000 feet above sea level, to 1,500 feet above sea level, with a slope that leads east and north to the Churchill River, the primary riverine system flowing into Hudson Bay (Department of Mines, Resources and Environmental Management, 1968).

In the shears and fractures formed from the melting ice-sheets of the Pleistocene era, ore deposits were formed through metamorphic reactions localizing the sulphide deposits (Manitoba Energy and Mines, n.d.). The Pleistocene period lasted from 2.58 million years ago until as early as 11,700 years ago, and included the most recent Ice Age that covered northern Manitoba forming Lake Agassiz's basin (Zimmerman, 2017). The minerals and metals generally found within ore bodies are tin, zinc, gold, lead, iron, nickel, and copper (Manitoba Energy and Mines, n.d.). For Manitoba, nickel is essential to the production of stainless steel, and copper is an integral part of building construction and the manufacturing industry (Mudd, 2010; MiningWatch Canada, 2004). These metals are fundamental and have aided in building today's cityscape.

Historically, nickel and copper have been the main metals found in the landscape of northern Manitoba (and more recently the exploration of gold) with large accumulations found at Thompson, Lynn Lake, and Flin Flon (Manitoba Energy and Mines, n.d.). After Thompson, the Lynn Lake area is considered the second-largest region in Manitoba to contain ore minerals (Manitoba Energy and Mines, n.d.). These deposits accumulate at depths of up to 3,000 ft. and have been successfully mined throughout the region (Science, Technology, Energy and Mines, 2003). Minerals and metals found in the Lynn Lake area are copper, nickel, zinc, cobalt and gold (Science, Technology, Energy and Mines, 2003). The extraction of these minerals and metals is speculated to have adverse effects on the environment due to the leaching of highly toxic metal byproducts into the soil and water sources (MiningWatch Canada, 2004).

A HISTORY OF SETTLEMENT AND RESOURCE EXPLORATION

NORTHERN COMMUNITIES AND CULTURE With its unique culture and environmental characteristics, the north encompasses a significant part of Manitoba's identity as a province (McNiven and Puderer, 2000). In recent years, human movement and resource extraction have fragmented the land, affecting the health of the landscape, all of which is considered sacred by Indigenous cultures (McNiven and Puderer, 2000). Rich with natural non-renewable resources, the wealth contained in this remote and largely inaccessible environment is sought after by large-scale industrial companies for mining and other industrial processes.

Extraction practices span across the northern landscape with a concentration of mining activity in the area around Thompson's Nickel Belt, which is a large portion of land rich with ore minerals (Vale, 2017). Along the belt are towns that were built to entice workers to settle near the mines in order to meet the demand of the industry's growth. Thompson, Lynn Lake, the Pas, Flin Flon, and Gillam are all settler communities that were built around the extraction industry (Figure 1-8). In these towns, employment is contingent on the mines that "boom" in wake of mineral potential, then "bust" when the resources are depleted. The boom and bust cycle causes a dramatic increase and decrease in population, which has created many "ghost towns" in northern Manitoba.

Prior to the creation of environmental regulations, the exploitation of these valuable resources was neglectful of northern communities and the landscape. This has caused significant impacts on the environment including melting permafrost, forest degradation, and habitat loss for at-risk species, such as the Woodland Caribou (Coates and Abel, 2001).

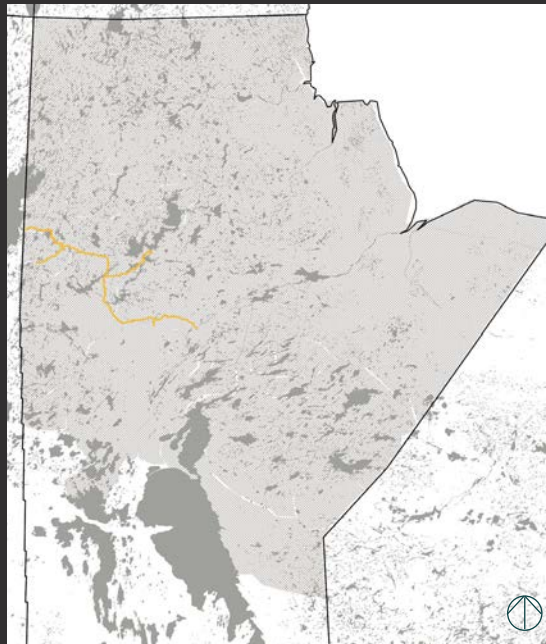


Figure 1-5: GIS map showing permafrost extent.

LEGEND

- Permafrost
- Waterbodies
- PR 391

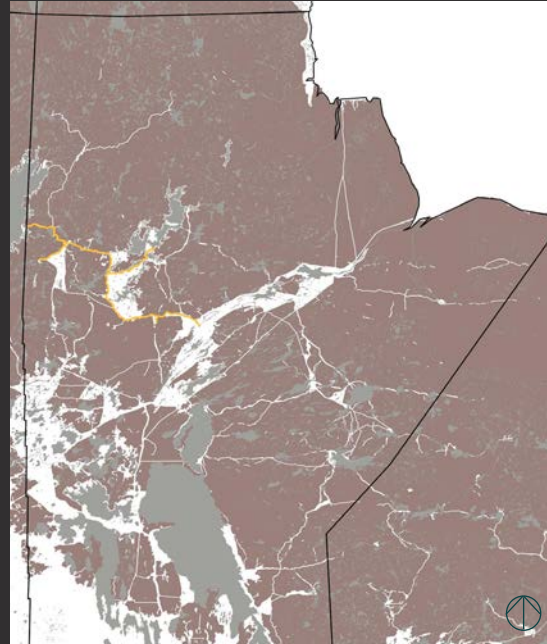


Figure 1-6: GIS map showing intact vegetation.

LEGEND

- Intact Vegetation
- Waterbodies
- PR 391

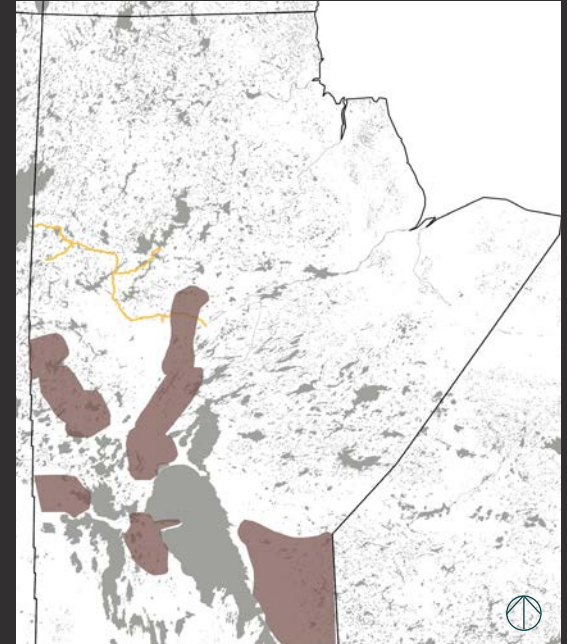


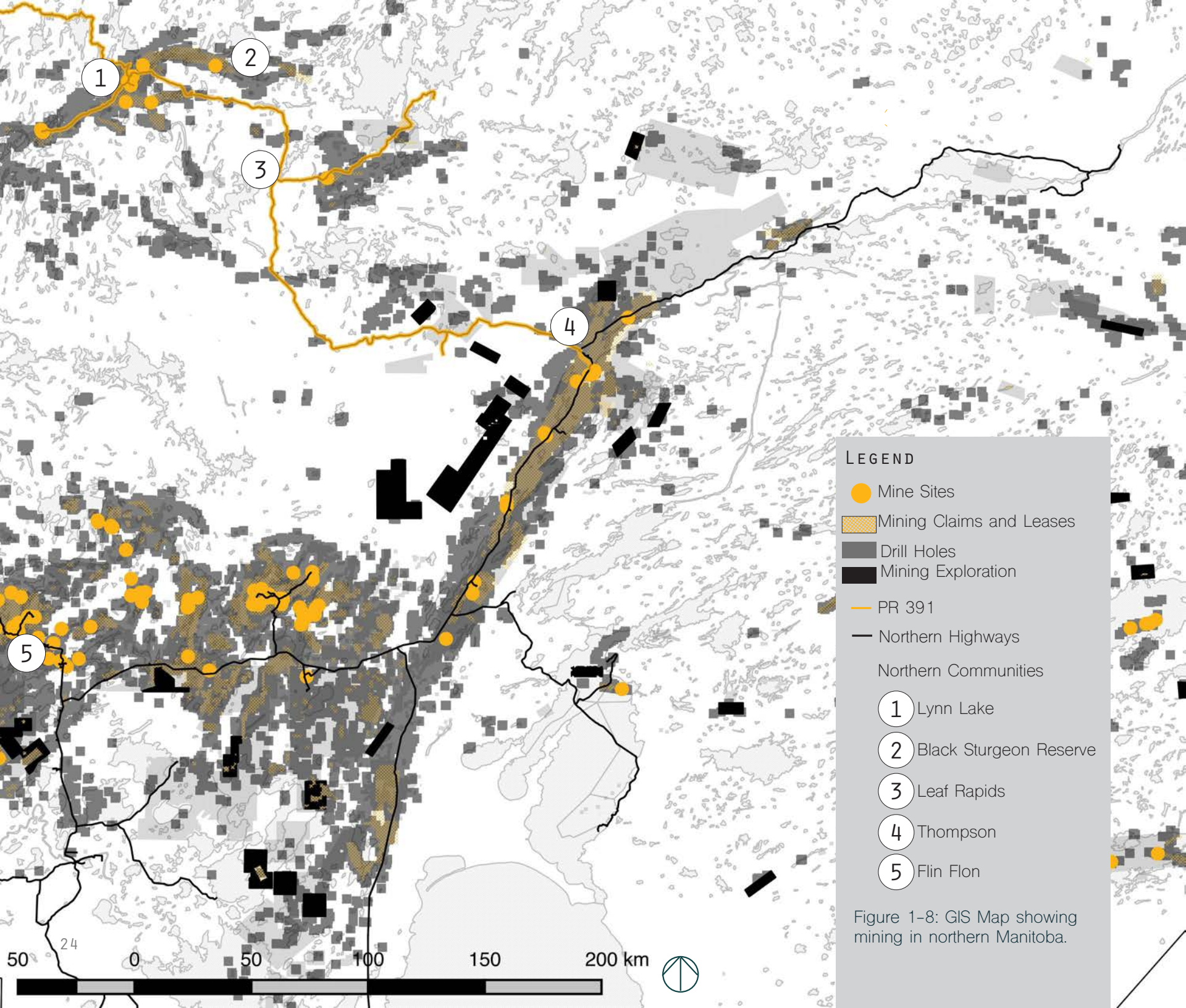
Figure 1-7: GIS map showing woodland caribou range.

LEGEND

- Caribou Range
- Waterbodies
- PR 391

100 0 100 200 300 400 km



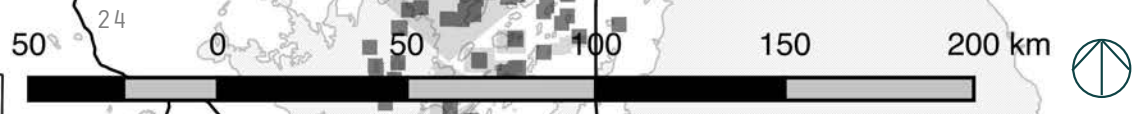


LEGEND

- Mine Sites
- Mining Claims and Leases
- Drill Holes
- Mining Exploration
- PR 391
- Northern Highways
- Northern Communities

- 1 Lynn Lake
- 2 Black Sturgeon Reserve
- 3 Leaf Rapids
- 4 Thompson
- 5 Flin Flon

Figure 1-8: GIS Map showing mining in northern Manitoba.



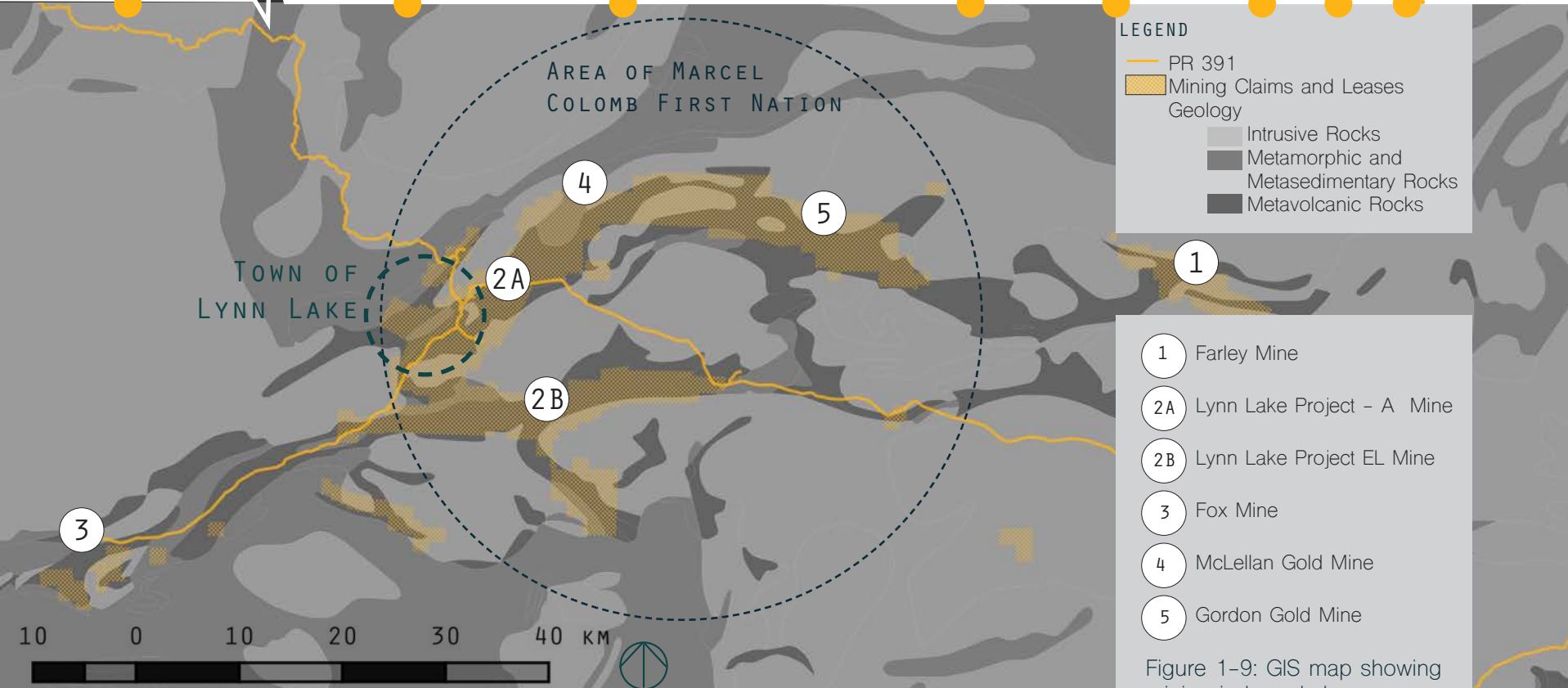
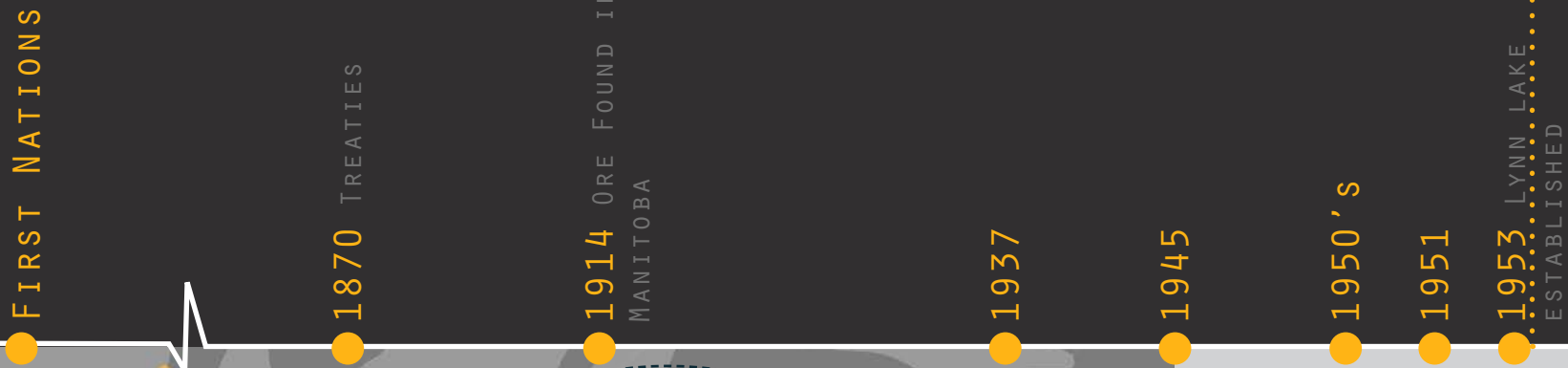
The concurrence of exploited lands and economic support for megaprojects in the north reflects a misunderstanding of its limits and stability. The northern environment is lush with green forests and freshwater and provides abundant and diverse habitat for wildlife (Coates and Abel, 2001). This at-risk, unstable, ecosystem can be seriously affected by miniscule changes, and its ability to thrive may diminish if even small parts of it degrade or are alienated (Coates and Abel, 2001).

Disregard of the unique northern culture and landscape have impacted the northern environment and social structures. While the mining industry has brought numerous jobs to Manitobans who have temporarily relocated to the north, once the mines close the Indigenous communities remain, and their culture is adversely affected by the consequences industrialization has on the landscape (Docherty, 2011). These consequences include impacts to livelihood, particularly for those who

maintain a traditional relationship with their land through fishing, hunting, and trapping, and are only a few of the socio-cultural aspects impacted by environmental exploitation (Booth and Skelton, 2011; Government of Manitoba, n.d.).

Physical impacts to Indigenous communities include the loss of land rights to industrial corporations, which have allowed companies the ability to self-manage mining waste products that have often ended up contaminating lakes and rivers (Docherty, 2011). These impacts on the environment by resource extraction industries carry social and psychological implications, which can be linked to an increase in health-related issues (Docherty, 2011).

REGIONAL HISTORY (IMPORTANT DATES)



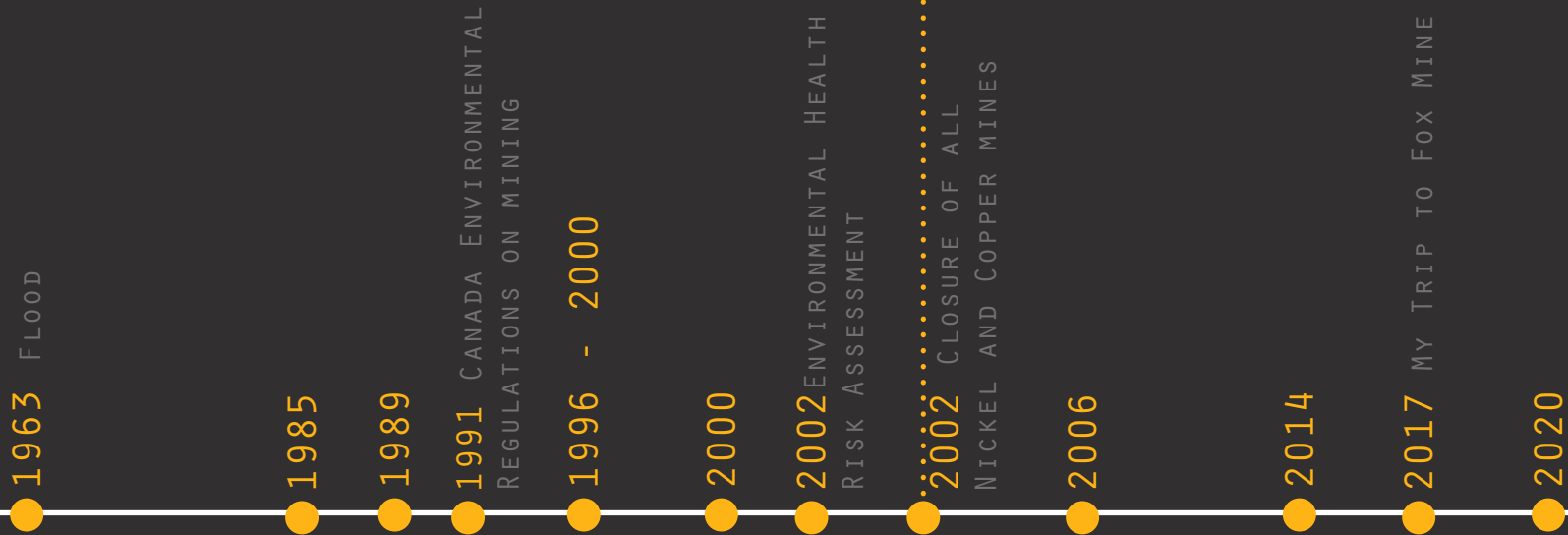
LEGEND

- PR 391
- Mining Claims and Leases
- Geology
 - Intrusive Rocks
 - Metamorphic and Metasedimentary Rocks
 - Metavolcanic Rocks

- 1 Farley Mine
- 2A Lynn Lake Project - A Mine
- 2B Lynn Lake Project EL Mine
- 3 Fox Mine
- 4 McLellan Gold Mine
- 5 Gordon Gold Mine

Figure 1-9: GIS map showing mining in Lynn Lake.

LYNN LAKE COPPER AND NICKEL MINES



PRIOR TO 1870 NORTHERN HISTORY/

SETTLEMENT Previous to 1870, northern Manitoba was occupied by settlements of Indigenous people including Cree, Dene, Ojibway, Ojibway-Cree, and Dakota (Statistics Canada, 2011). These Indigenous settlements engage with the landscape and have developed specific lifestyles around hunting, gathering, and fur trading and featured variations of culture and languages.

1870 In 1870, as European settlers' gained access to the north, treaties were formed that constrained Indigenous people's mercantile economy (Tough, 1996). Transcribed in non-Indigenous languages, the documents written for these treaties required signatures as a binding contract which, was an untraditional approach for agreements amongst Indigenous communities who traditionally bound their agreements through conversation and good faith (University of Manitoba, 2020).

This process led to contracts that were equivocal and written in a manner that was biased towards European settlers gaining access to the northern landscape's resources (University of Manitoba, 2020).

The area of Marcel Colomb First Nation is affiliated with the Swampy Cree Tribal Council and a signatory of the Treaty 6 adhesion, formed in 1876 (SICC, n.d.). The Swampy Cree Tribal Council advocates that the Cree understood the agreement to be a rental of land whereas the English understood it as a complete land surrender (SICC, n.d.). This discrepancy resulted in the English interpretation taking precedence, and following the formation of these Treaties, Indigenous settlements were displaced and the culture of individual communities was diminished.



Figure 1-10: Aerial image of Lynn Lake tailing ponds.

BEFORE EXTRACTION IN LYNN LAKE In 1937, Sherridon located 193km south of what is now the town of Lynn Lake, was a mining community that originated as the service center for Sherritt Gordon LTD., a major mining company that acquired land for extraction in northwestern Manitoba (Government of Manitoba, n.d.). The inevitable closing of the mine due to exhaustion of resources prompted Sherritt Gordon industries to identify new prospecting areas (Government of Manitoba, n.d.). In 1945 the company discovered the rich ore minerals at Lynn Lake and began the process of relocation and the abandonment of the Sherridon mine (Government of Manitoba, n.d.). Workers that were settled in Sherridon were uprooted and moved to what is now the town of Lynn Lake (Government of Manitoba, n.d.).

MINING IN LYNN LAKE 1953 - 2002 Before the mine, Lynn Lake was a landscape of evergreen vegetation and clear water flowing through its lakes and rivers. Upon their arrival, Sherritt Gordon LTD. opened three new primarily open-pit nickel and copper ore mines (Lynn Lake Project, Farley Mine, and Fox Mine), and eventually two additional gold mines (MacLellan Mine, and Keystone Mine) on the perimeter of the current townsite (Science, Technology, Energy and Mines, 2003). The nickel and copper ore mines operating in Lynn Lake produced over 36 million tonnes of metal between the period of 1953 to their final closures in 2002 (Science, Technology, Energy and Mines, 2003).

Construction of Lynn Lake began with a milling processor located on the east end of the town (Science, Technology, Energy and Mines, 2003). The mill was used by Sherritt Gordon and a related company (Black Hawk Mining) to

Mineral exploration in Manitoba began in 1914 after Indigenous trapper, David Collins, showed explorer and prospector, Thomas Creighton, the mineralized outcrop near what is now known as Flin Flon, located 234 km southwest of Lynn Lake. (Manitoba Energy and Mines, n.d.)

1914

1937

Sherridon, located 193km south of Lynn Lake, was a community that originated as the service center for Sherritt Gordon LTD.

1945

Ore is discovered at Lynn lake by Sherritt Gordon LTD. (Government of Manitoba, 2016).

1950's

Lynn Lake Project and Farley Mine Open

1953

1951

When the mine at Sherridon officially closed in 1951, the mine left behind 7.4 million tons of acid-generating waste across 47 hectares polluting the lakes and rivers of the nearby First Nation settlements (CBC News, 2017).

separate tailings from the metals, and produced 22 million tonnes of tailings during its operation (Science, Technology, Energy and Mines, 2003). During ore mining, production tailings are the rejected portion of the ore body that is not considered valuable in the ore extraction process, and are discarded into 'tailing pits' (Manitoba Energy and Mines, n.d.). The careful removal of tailings should follow strict environmental protection measures, as they are highly toxic once extracted from the earth and exposed to the elements (Winterhalder, 1996).

In the town of Lynn Lake two tailing ponds were constructed that were engineered by dyke and dam systems that release water onto the discarded tailings (TetrES, 2008). This enabled the water to further break down the deposits, rendering these ponds highly toxic to animals and aquatic organisms (Manitoba Energy and Mines, n.d.). The tailing

ponds in Lynn Lake are called the East Tailing Management Area (ETMA) and the West Tailing Management Area (WTMA), spread out over an area of approximately two square kilometers, or roughly twenty football fields (TetrES, 2008). The ETMA is located on Eldon Lake's shore and was secured by multiple dams to protect the nearby river system (TetrES, 2008). The WTMA was built later, west of the original site near the towns' wastewater treatment facility.

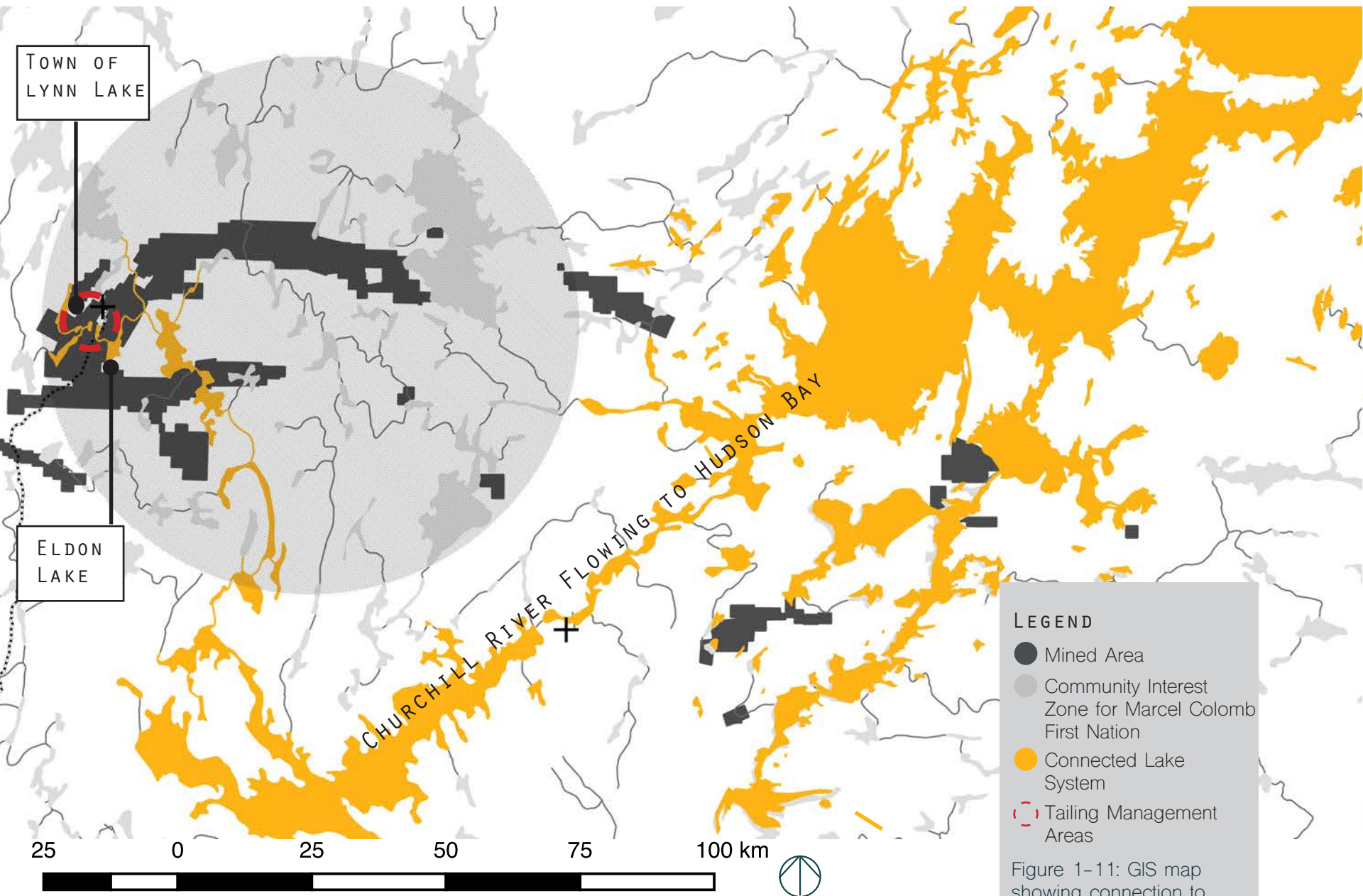


Figure 1-11: GIS map showing connection to Churchill River.

Major Flooding breaks dam system and tailings contaminate Eldon Lake

1963

Sherritt Gordon, after changing name and ownership once again, sold the EL mine in order to lower their massive debt (Science, Technology, Energy and Mines, 2003).

1985

Keystone Gold uses A Mine Shaft for discarding of tailings

1996 - 2000

1970 - 1974

Construction of PR 391

Then owned by Lynngold, the company would do no further work on the mine but went bankrupt in 1989 abandoning the site and leaving behind millions of tonnes of toxic waste (Science, Technology, Energy and Mines, 2003).

1989



1963 In 1963, major flooding broke portions of the dam system connected to the ETMA, and tailing contaminants washed into Eldon Lake (Department of Mines, Resources and Environmental Management, 1968). Eldon Lake is the fifth lake in a river system that connects to the Churchill River, thus posing as a hazard to the immediate area and northern Manitoba's entire wetland and marine ecosystem. The 1963 flooding and tailing leakage also caused contamination to the town's wastewater treatment center that would later generate an investigation into the potential health risks to the environment and the people (MiningWatch Canada, 2004).

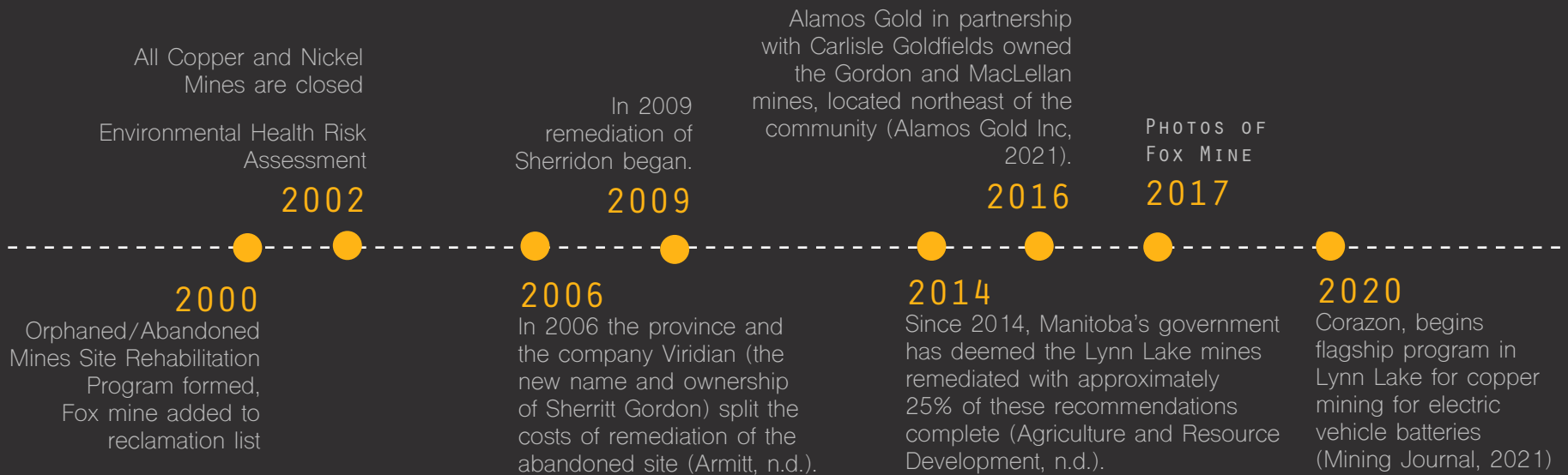


Figure 1-12: Oil barrel pile at Fox Mine.

POST-EXPLOITED LANDSCAPE Following the mining industry's boom and bust cycle, all Lynn Lake copper and nickel ore mines would officially be closed in 2002 (Science, Technology, Energy and Mines, 2003). Those who remained in the town remained in the center of a degraded environment with contaminated soils, water quality issues, and associated health issues resulting from the damaged landscape (Froese, 2019).

In the early 2000's Manitoba established the Orphaned/Abandoned Mine Site Rehabilitation Program to address post mine sites' public safety and environmental concerns (Agriculture and Resource Development, n.d.). The program listed Lynn Lake as a high priority and a high-hazard post mine site recommending clean up guidelines for the sites of the Lynn Lake tailing ponds (Agriculture and Resource Development, n.d.).



Figure 1-13: Fox Mine (1).

Recommendations for the ETMA are (Agriculture and Resource Development, n.d.):

- Construction of a diversion ditch for clean rainwater
- Installation of a permeable reactive barrier to treat the contaminated grounds
- Re-vegetation trials
- Installation of an engineered wetland to remove contaminants
- Review of options to physically cover toxic tailings

Recommendations for the WTMA are (Agriculture and Resource Development, n.d.):

- Demolition of all infrastructure
- Review of water management options
- Remediation of the mill area

Lynn Lake, once bountiful in employment opportunities and a rich landscape with a wealth of minerals and metals, is now an abandoned community suffering from unemployment, a degraded environment, and socio-environmentally triggered health issues. When mining in Lynn Lake first began, the community and industry did not anticipate the negative impacts of the economic benefits, and environmental regulations were not in place to protect the people and landscape. Today, the scarred landscape leftover from the mining industry threatens Lynn Lake's prosperity and has left the town adjacent to a toxic wasteland and the community burdened with substantial health implications. Clusters of cancers and increased occurrence of diseases such as Crohn's are prevalent, signifying possible contamination of the environment and human health from mining activity (Health, Healthy Living and Seniors, n.d.; Fernandez-Navarro et al., 2012).



Figure 1-14: Fox Mine clean-up.



Figure 1-15: Fox Mine water contamination.

LYNN LAKE ENVIRONMENTAL HEALTH RISK ASSESSMENT

COMMUNITY CONCERNS In the years following the mining of Lynn Lake, residents had concerns over the increased diagnosis of cancers in the community, and were worried it was due to the mine tailings in the community soil (CBC News, 2013a). These concerns stem from anecdotal evidence of residents' observations of ill community members and the history of homes that have been built on a landscape backfilled with tailing materials (CBC News, 2013a; Health, Healthy Living and Seniors, n.d.).

Multiple residents have commented that within a twenty year period, an estimated thirty to forty people within a two block radius to one another have been diagnosed with cancer (CBC

News, 2013a). Cancer types that have been found include various digestive and respiratory cancers, including colorectal and lung cancer, and have been diagnosed in residents as young as sixteen years of age (CBC News, 2013a). In response to these concerns an Environmental Health Risk Assessment was issued in 2002, identifying important and emerging environmental health issues to reduce environmental risks to public health (Health, Seniors and Active Living, n.d.a).

Findings of the Environmental Health Risk Assessment found several chemicals that exceeded the Canadian Council for Ministers of Environments (CCME) guidelines, therefore the assessment was moved to the Human Health Risk Assessment (HHRA), which is required when the additional assessment of human exposure to contaminants in soils is a possibility (Health, Healthy Living and Seniors, n.d.).



Figure 1-16: Lynn Lake playground.



Figure 1-17: Lynn Lake sport-fishing capital.

HUMAN HEALTH RISK ASSESSMENT The Human Health Risk Assessment (HHRA) for Lynn Lake occurred later in 2002, its purpose is to predict and calculate the health risks for people in regards to exposure to certain chemicals (Health, Healthy Living and Seniors, n.d.). For Lynn Lake, criteria followed in the assessment are the dangers of each chemical, the sensitivity of humans to these chemicals, how contact is initiated, and the length of exposure (Health, Healthy Living and Seniors, n.d.). The assessment conducted was adequate as it followed the assessments criteria of selecting chemicals of concern and estimating how much exposure people had for each substance through sample analysis. The types of samples collected were soil, sediment, surface water, ground water, vegetation, produce, and air (Health, Healthy Living and Seniors, n.d.). In addition to these samples the study identified community habits through surveys of lifestyle, eating, and general demographic data; however, this assessment is limited

in that human specimen samples were never investigated (Health, Healthy Living and Seniors, n.d.). Tom Hutchinson, an environmental sciences professor from Trent University who studied Lynn Lake in 2005, argues the tailings in the community likely contain carcinogens of nickel and arsenic (CBC News, 2013a). He postulates that the town assessment remains incomplete without an epidemiological study, as this type of study looks at human health through specimen samples and this is the only assessment that can confirm or rule out elevated cancer rates (CBC News, 2013a).

Analyzing the possible impacts the post-exploited landscape may have on residents, I have organized the main findings and constraints of the assessment into the four key elements that are essential to life and important to Indigenous culture. These elements are Air (exposure to dust storms), Earth (chemicals in soil), Water (water treatment plant), and Fire (forest fires).

“SOMETIMES YOU FEEL LIKE YOU’RE JUST
WAITING IN LINE”. - LARRY SKOMOROWSKI

A RESIDENT OF LYNN LAKE IN RESPONSE TO THE RISING CLUSTERS OF
CANCER IN THE TOWN (CBC NEWS, 2013A).



Figure 1-18: Abandoned homes, Lynn Lake.

AIR The HHRA found traces of toxic chemicals in the soil of the surrounding environment, but the toxicity levels were not considered high enough to be a threat to residents (Health, Healthy Living and Seniors, n.d.). This is contradictory as the assessment also states that levels were more than triple the allowable concentrations of toxic particulate matter during dust storms and in these conditions there is the potential to cause respiratory ailments (Health, Healthy Living and Seniors, n.d.). Dust storms are common in open space areas where vegetation is minimal, like the open-pit mine site of Lynn Lake, which was not a factor considered in the assessment (Fernandez-Navarro et al., 2012).

The assessment did not go into further detail regarding the interactions between dust storms, the environment, and human health but studies have shown that the ingestion of these particles have significant adverse effects on cell development (Tchounwou et al., 2012).

A study conducted in the United States on the effects of environmental pollution to human health broke down the components of ore mining, that when disturbed, have adverse biological effects in humans (Tchounwou et al., 2012). Copper, nickel, zinc and cobalt are all minerals found in Lynn Lake that have the potential to generate excessive amounts of biological reactive oxygen species, otherwise known as ROS's, in the body. When metabolized by humans in hazardous concentrations, these minerals interact with ROS's to cause cell damage that interferes with cell survival, death, differentiation, and signaling (Tchounwou et al., 2012). This cell damage has been linked to a range of diseases including cancer, neurodegenerative diseases, respiratory, and digestive disorders (Tchounwou et al., 2012).

EARTH In the tailing filled overburden of Lynn Lake, seven chemicals were found during the assessment that exceeded the Canadian Councils for Ministers of Environment (CCME) guidelines (Health, Healthy Living and Seniors, n.d.). These chemicals were aluminum, iron, copper, lead, nickel, manganese, and other particulate matter (Health, Healthy Living and Seniors, n.d.). Some of these minerals, such as nickel, are known to be human carcinogens causing lung, renal, and colorectal issues (Fernandez-Navarro et al., 2012). Chemicals that were not investigated at the time, but are of concern to the residents, are the possible contaminants of arsenic and cyanide that are known to be found at ore mining sites (MiningWatch Canada, 2004).

Samples from the community playground administered by Manitoba Mineral Resources claim there are areas within the park where tailings have been exposed (Health, Healthy Living and Seniors, n.d.). As recently as 2013 the Mayor of Lynn Lake, James Lindsay, has noted to the media the observations of ants pushing these tailings out of the ground within the community playground (CBC News, 2013b). Research supported by the National Institute of Health in Heavy Metal Toxicity and the Environment (2012) articulates that toxic elements such as arsenic could be transferred to the human body through the uptake of airborne soil particles and through the plant food chain (Tchounwou et al., 2012). This is particularly risky for children who are more likely to ingest the soil at the playground (Tchounwou et al., 2012).

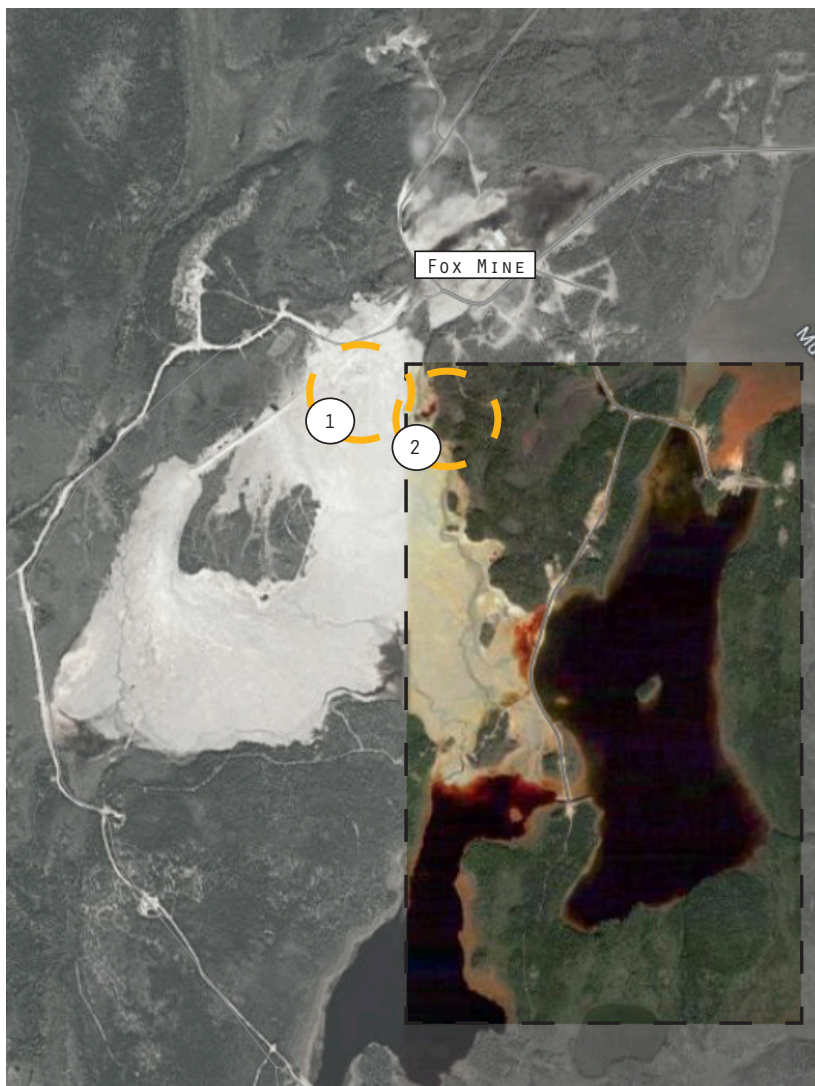


Figure 1-19: Aerial of Fox Mine contamination.

WATER An investigation of the 1963 overflow of the WTMA to the contamination of the water treatment center was not conducted in the assessment, leaving reasonable doubt among the residents that this was a fair assessment. In areas where tailings and dam systems are located, polluted water sources can run off during the extraction process, or by mechanical failures and reach the water table (Fernandez-Navarro et al., 2012). This is problematic as it allows the contaminants to reach beyond the designated secured tailing area and leach into soils and large water bodies (Fernandez-Navarro et al., 2012). This is what happened in Lynn Lake, rendering the treatment pond unfit for use.

Lynn Lake was granted a new water treatment facility in 2011 adjacent to a different body of water because of the contamination from the WTMA overflow (Froese, 2019). The new location of the facility cannot sufficiently support the community's water consumption and as a result Lynn Lake lives under a boil water advisory to this day (Froese, 2019).

FIRE Forest fires are a natural occurrence of the boreal forest; they are crucial to the rejuvenation of plant species and overall health of biodiversity, however, the mined landscape of Lynn Lake poses a risk to this natural process. During my time in Lynn Lake, although, unsubstantiated, I talked with some water bomber pilots who were in the area fighting a growing forest fire that was moving in the direction of Fox Mine. My understanding from that conversation was that if this fire were to reach the toxic soils of the abandoned mine site it would have a potential explosive outcome due to the volatile nature of the backfill material.



Figure 1-20: Toxic waters, Fox Mine.

A study in Madrid Spain (Fernandez-Navarro et al., 2012) was conducted in 2012 on post-industrial Spanish communities. Areas within the vicinity of 120 mine sites were investigated, and a correlation between types of mining activities and related cancer types was discovered (Fernandez-Navarro et al., 2012). In all studied areas, the results revealed increased mortality rates due to an increase of cancer cases in the respiratory and digestive systems linked to environmental exposures and employment at a mine (Fernandez-Navarro et al., 2012). The study supports Lynn Lake residents concerns regarding health issues and reveals an urgency for the need of further investigations into the physical and mental health of residents.

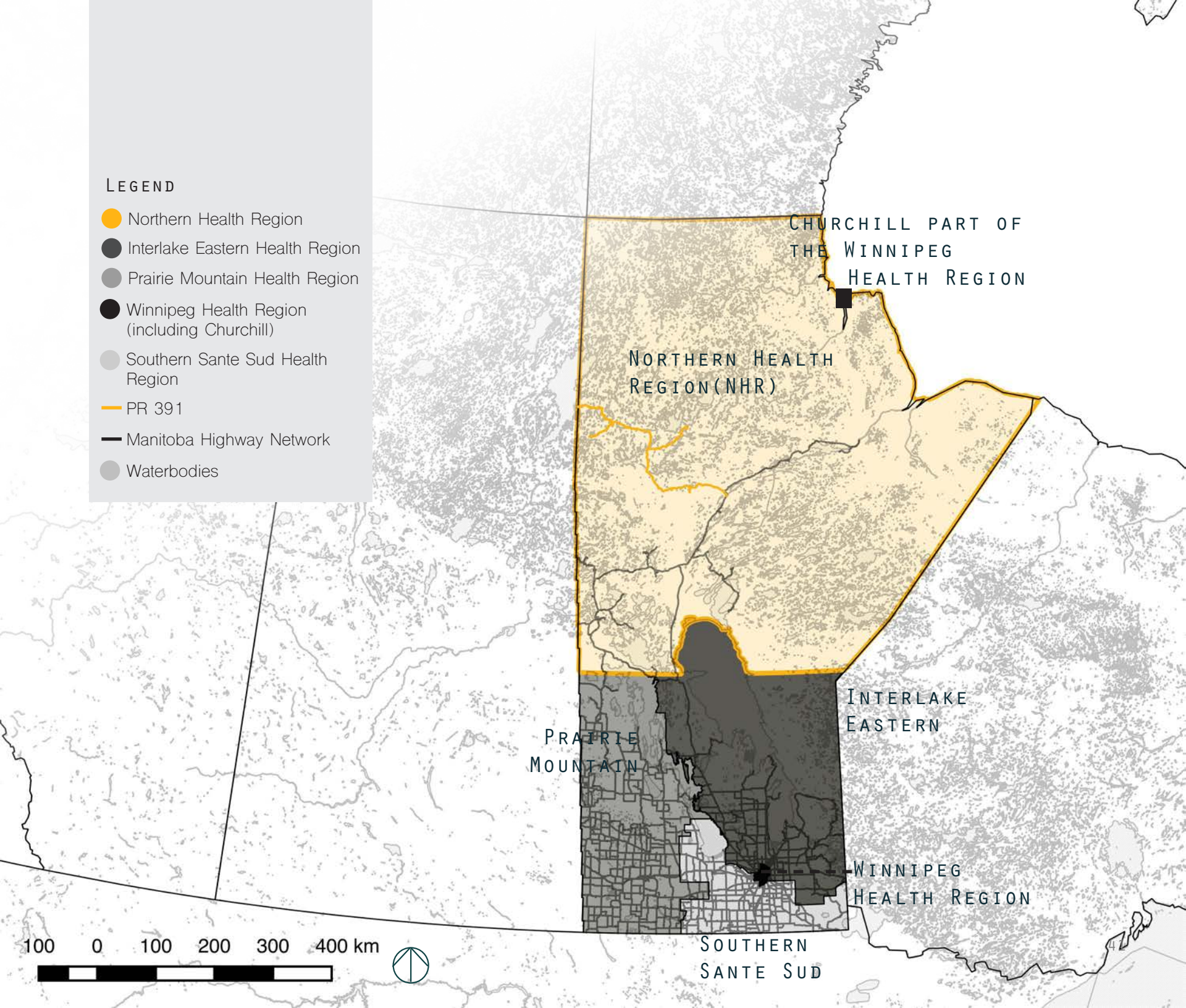
In Lynn Lake the HHRA concluded with no risk management recommendations (Health, Healthy Living and Seniors, n.d.). A reason for the lack of recommendations is that environmental

exposures are complex to identify due the challenges of other correlating factors that can contribute to related illnesses (Environmental Protection Agency, 2020). For the areas of Lynn Lake and Fox Mine the visually degraded, unhealthy landscape in contrast to the healthy vegetation outside the mined area remains a fragmented piece of the otherwise supportive ecosystem of the land, wildlife, and people. The degradation of the landscape has adverse effects on the socio-cultural values of the people supported by a rise in physical and mental health issues in Lynn Lake. These issues should not go unnoticed.

Figure 1-21: GIS map showing health regions.

LEGEND

- Northern Health Region
- Interlake Eastern Health Region
- Prairie Mountain Health Region
- Winnipeg Health Region (including Churchill)
- Southern Sante Sud Health Region
- PR 391
- Manitoba Highway Network
- Waterbodies



100 0 100 200 300 400 km



CHURCHILL PART OF THE WINNIPEG HEALTH REGION

NORTHERN HEALTH REGION (NHR)

PRAIRIE MOUNTAIN

INTERLAKE EASTERN

WINNIPEG HEALTH REGION

SOUTHERN SANTE SUD

HEALTH OF THE PEOPLE

THE HEALTHCARE SYSTEM

Healthcare in Manitoba is separated into five regions: the Winnipeg Health Region, Interlake–Eastern, Prairie Mountain, Southern Health/Sainté Sud, and the Northern Health Region as shown in Figure 1-21 (Health, Seniors and Active Living, n.d.b). These regions are determined by the provincial government and deliver public healthcare services to residents within their geographical locations (Health, Seniors and Active Living, n.d.b). Within Manitoba, public healthcare facilities range from small nursing stations to large hospitals with emergency departments (Figures 1-22 - 1-25) The large hospitals are often situated in cities and host broader healthcare resources such as specialized physicians, mental healthcare, and long-term care homes.

In the Northern Health Region (NHR) there are three large hospitals servicing the entire region which are located in Thompson, Flin Flon, and The Pas (Health, Seniors and Active Living, n.d.c). When combined, the four other Manitoba health regions share a similar land size as the NHR, however, boast a total of 26 large emergency hospital facilities (Health, Seniors and Active Living, n.d.c). Population densities are greater in the four regions, but the North has a greater land mass and therefore greater travel times for all northern Manitobans to access broader healthcare facilities.

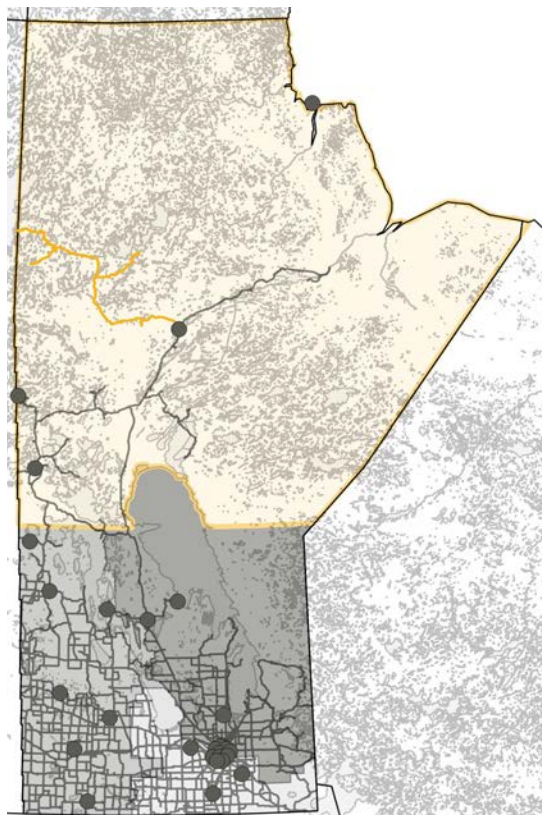


Figure 1-22: GIS map showing hospitals.

LEGEND

- Hospitals
- Northern Health Region
- Waterbodies
- PR 391

100 0 100 200 300 400 km

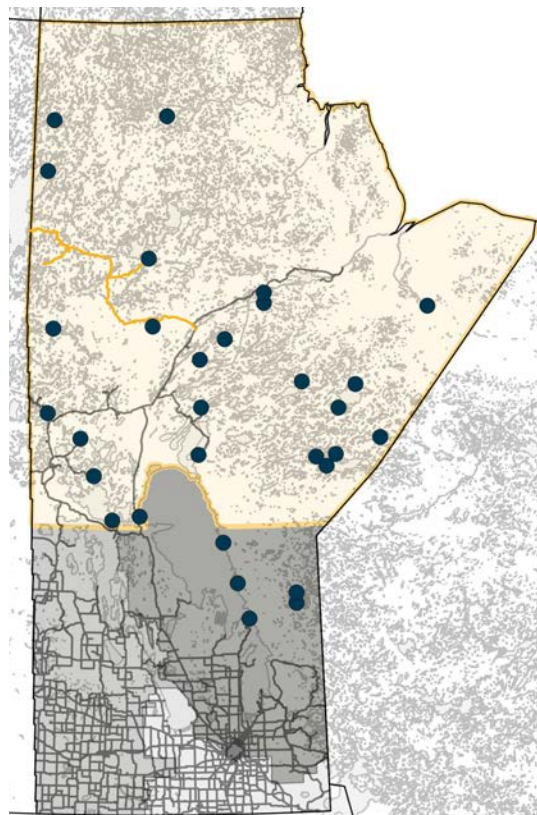


Figure 1-24: GIS map showing nursing stations.

LEGEND

- Nursing Stations
- Northern Health Region
- Waterbodies
- PR 391

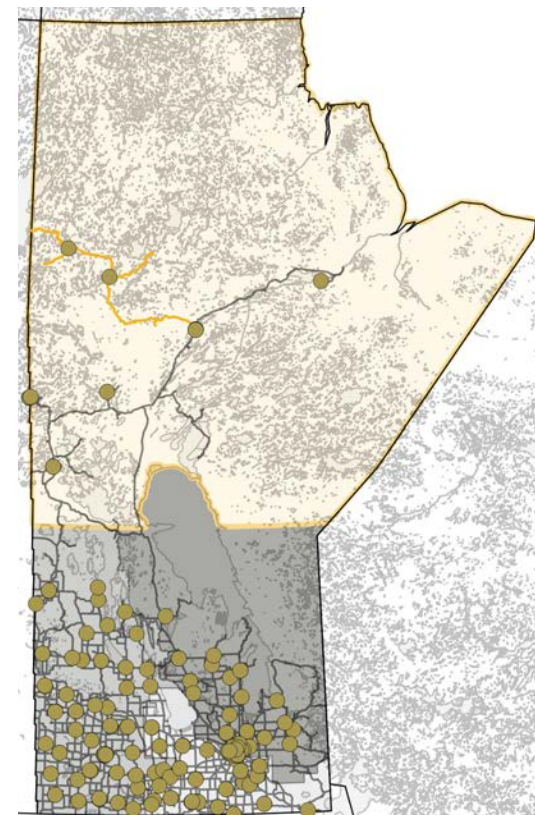
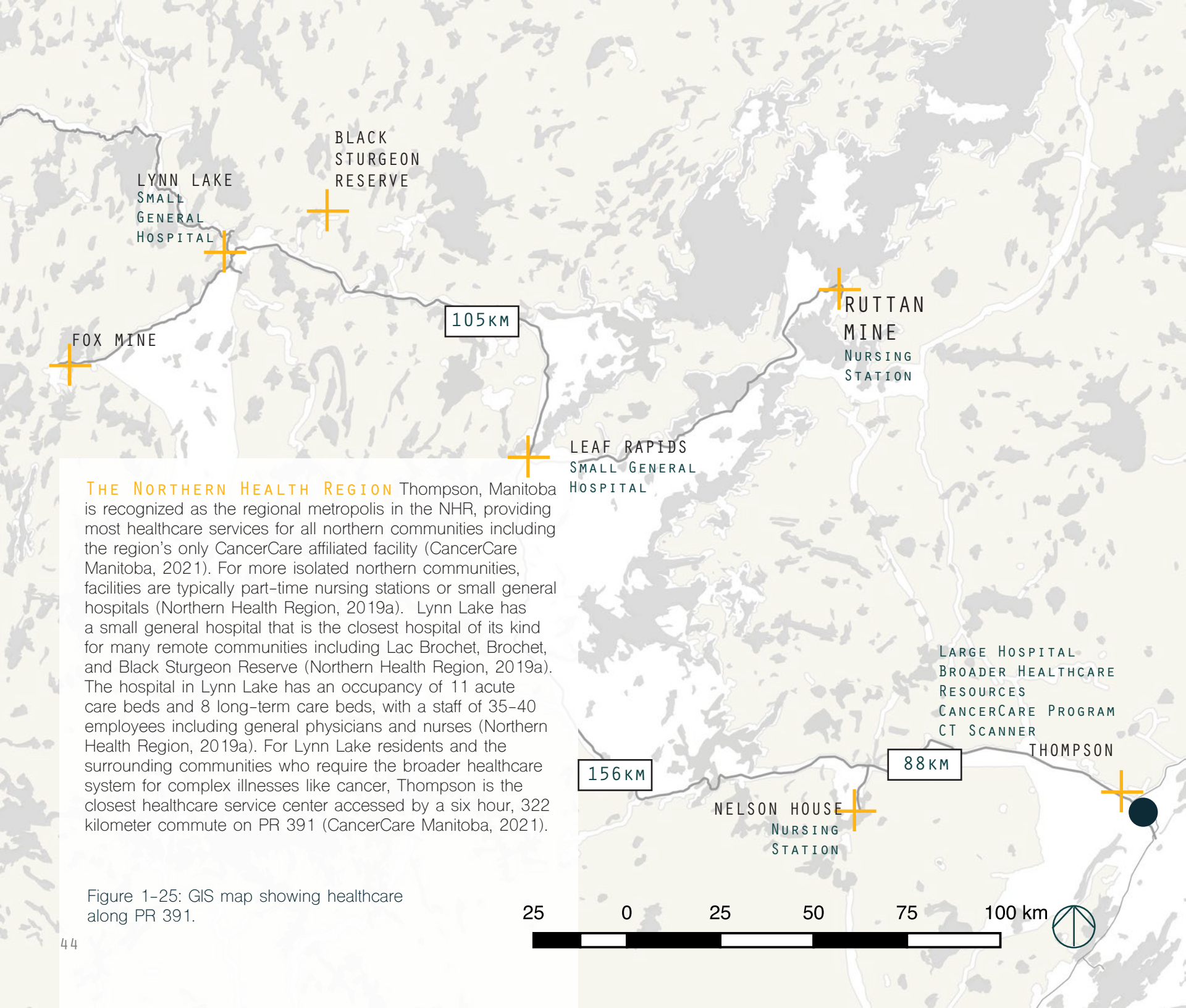


Figure 1-24: GIS map showing Healthcare Facilities

LEGEND

- Healthcare Facilities
- Northern Health Region
- Waterbodies
- PR 391



LYNN LAKE
SMALL
GENERAL
HOSPITAL

BLACK
STURGEON
RESERVE

FOX MINE

105 KM

RUTTAN
MINE
NURSING
STATION

LEAF RAPIDS
SMALL GENERAL
HOSPITAL

THE NORTHERN HEALTH REGION Thompson, Manitoba is recognized as the regional metropolis in the NHR, providing most healthcare services for all northern communities including the region's only CancerCare affiliated facility (CancerCare Manitoba, 2021). For more isolated northern communities, facilities are typically part-time nursing stations or small general hospitals (Northern Health Region, 2019a). Lynn Lake has a small general hospital that is the closest hospital of its kind for many remote communities including Lac Brochet, Brochet, and Black Sturgeon Reserve (Northern Health Region, 2019a). The hospital in Lynn Lake has an occupancy of 11 acute care beds and 8 long-term care beds, with a staff of 35-40 employees including general physicians and nurses (Northern Health Region, 2019a). For Lynn Lake residents and the surrounding communities who require the broader healthcare system for complex illnesses like cancer, Thompson is the closest healthcare service center accessed by a six hour, 322 kilometer commute on PR 391 (CancerCare Manitoba, 2021).

LARGE HOSPITAL
BROADER HEALTHCARE
RESOURCES
CANCERCARE PROGRAM
CT SCANNER

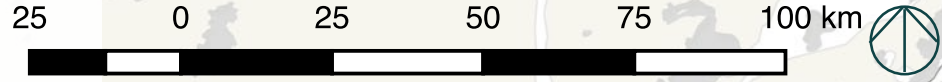
THOMPSON

156 KM

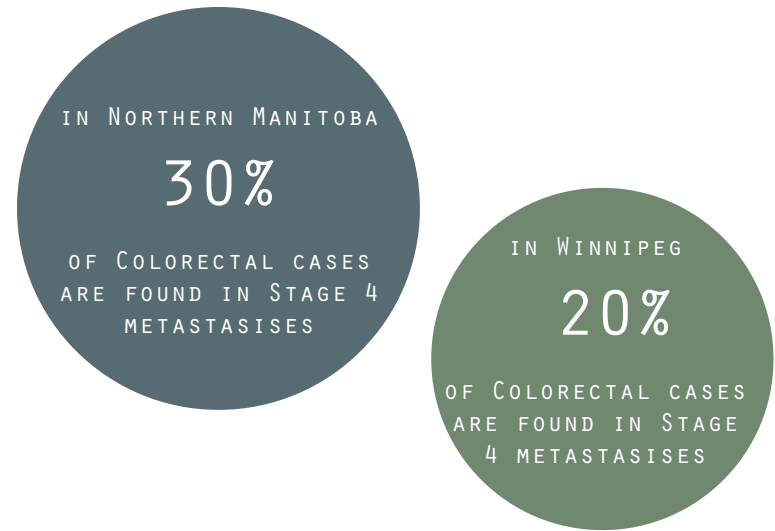
88 KM

NELSON HOUSE
NURSING
STATION

Figure 1-25: GIS map showing healthcare along PR 391.



WITHIN THE TOTAL POPULATION OF THE 89,000 RESIDENTS IN NORTHERN MANITOBA AN AVERAGE OF 99 PEOPLE WILL DIE FROM CANCER PER YEAR
(CANCERCARE MANITOBA, 2019)



CANCER IN THE NORTH AND ITS PHYSICAL AND MENTAL HEALTH IMPLICATIONS A common theme among all cancer types in the NHR is the late-stage diagnosis of cancer patients and a decreased positive outcome after treatment (CancerCare Manitoba, 2019). Between 2014 and 2016 the percentage of lung, breast, and colorectal cancer cases was significantly higher in the NHR compared to all other Manitoba Health Regions (CancerCare Manitoba, 2019). According to CancerCare Manitoba (2019) residents of northern Manitoba are statistically more likely to be diagnosed with stage four cancer than any other health region in Manitoba. An example of this can be seen in colorectal cancer diagnoses in the NHR where 30% of cases are found in stage four metastasis. (2019) This is in stark contrast to the Winnipeg Health Region where only 20% of colorectal cancer diagnoses are found in stage four metastasis. (2019)

Along with these late stage reports is an increased risk of mortality among patients in the north. (2019) According to

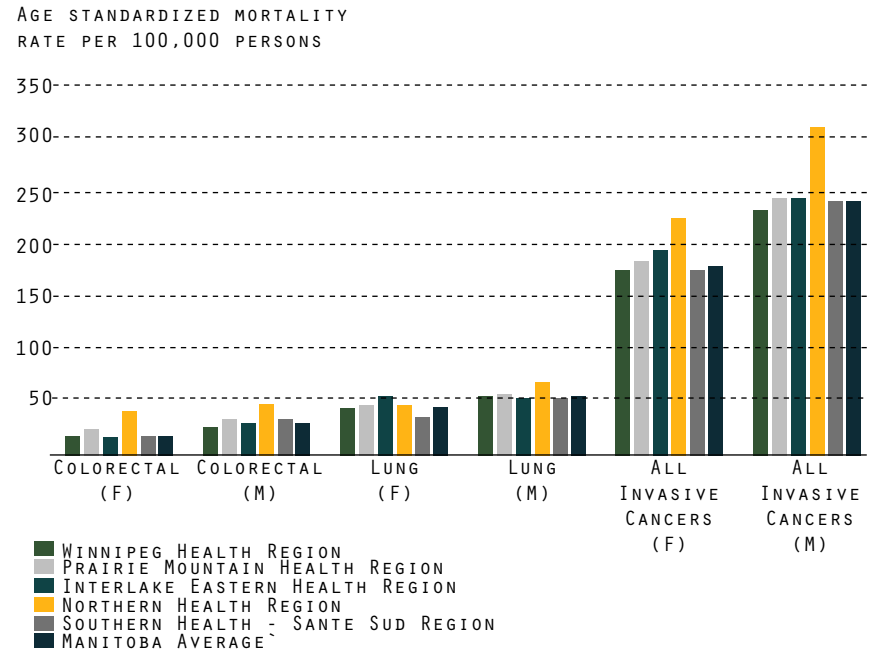


Figure 1-26: Diagram of standardized mortality rate per 100,000 persons (CancerCare Manitoba, 2019).

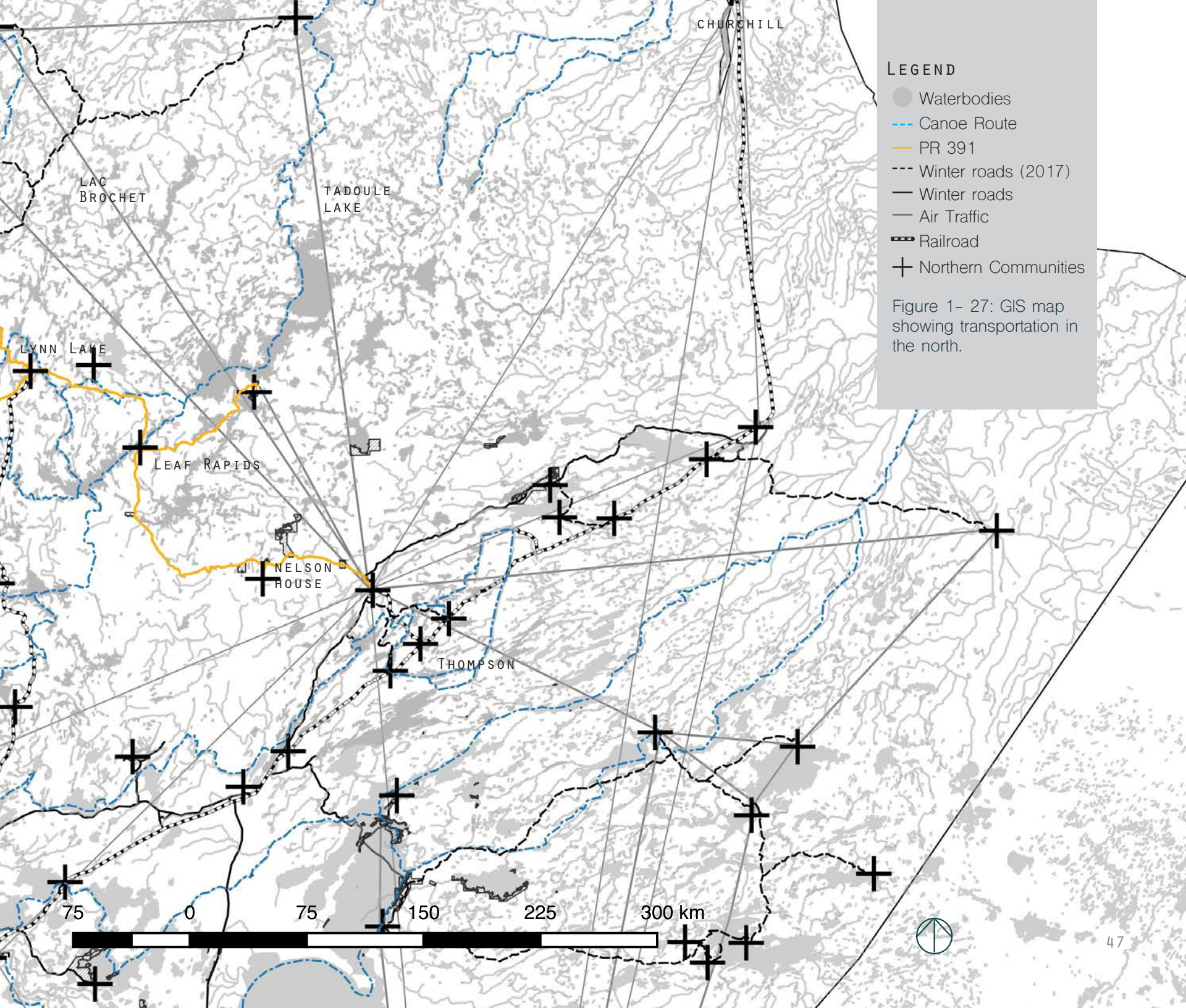
CancerCare Manitoba within the total population of the 89,000 residents in northern Manitoba an average of 99 people will die from cancer per year (Statistics Canada, 2016a; CancerCare Manitoba, 2019). When considering population size (defined by the rate of death divided by population) and the stage at which a diagnosis is determined, healthcare quality and access in the NHR is underserved (CancerCare, 2019).

A difference between the NHR and other Health Regions is access to transportation infrastructure, because in northern Manitoba not all communities are connected by land-based modes of transportation. Natural barriers of the boreal forest landscape include waterbodies (lakes, rivers and wetlands), topography, and dense vegetation that create geographic isolation of communities. Infrastructure is required to overcome these landscape barriers in order to access distant healthcare resources.

Minimal options for transportation and lack of broader healthcare facilities in the north both play a role in increased travel times. With respect to Lynn Lake, and the increased cancer diagnoses, PR 391 is the most consistent mode of transportation to CancerCare resources. Transportation to healthcare resources is challenging for patients and caregivers as the long travel times are exacerbated by stress related to inconsistent conditions of the infrastructure, natural disasters

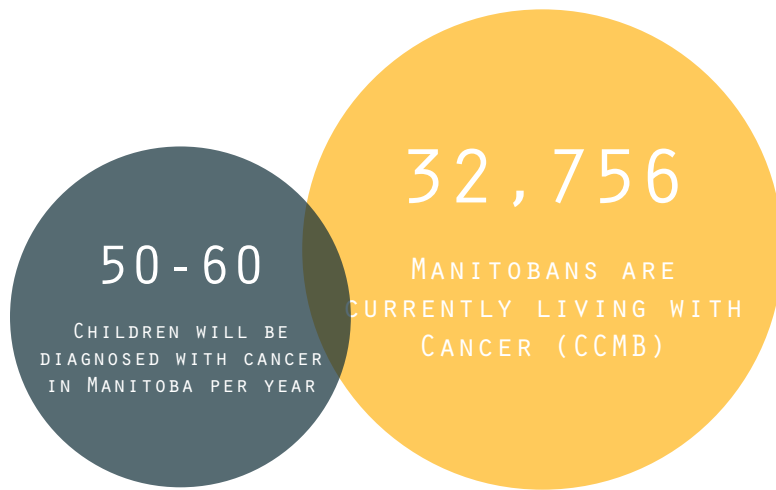
(forest fires and flooding), and the general uncertainty of health related issues common to all cancer patients.

COMMUNITY SUPPORT Caring for individuals with cancer involves caring for the entire family (Shepherd, 2010). During cancer treatment, challenges that individuals face include, but are not limited to, changes to nutritional needs, relationships, hormonal imbalances, changes to sexual activity, dental issues, hearing loss, and other communicative features (CancerCare Manitoba, 2019). These physical health implications can contribute to a decrease in mental health that can persist long past the initial diagnosis and final outcomes of treatment. Cancer often requires extended stays in hospital or away from home due to surgeries, chemotherapy, radiation, and low immunity (Shepherd, 2010). This period of change from a normal lifestyle, to a rigid schedule of constant appointments and uncontrollable circumstances adds mental, emotional, and physical stressors for patients and includes adverse effects on the mental health of caregivers (Shepherd, 2010). For northern Manitoba families accessing CancerCare the relocation increases the likelihood of feelings of isolation, which can lead to emotional, social, and mental health impacts such as depression (CancerCare Manitoba, 2019).



“CANCER IS A HUMAN EXPERIENCE. LIVING WITH CANCER IS ABOUT DEALING WITH THE UNKNOWN. IT IS ABOUT TRYING TO GRASP THE NEWS AND STARTING TO UNDERSTAND ITS LIFE-CHANGING EFFECT. IT IS ABOUT WONDERING IF THE TREATMENT IS WORKING AND WHETHER THE SIDE EFFECTS WILL GO AWAY SOON. IT IS ABOUT QUESTIONING WHETHER ANYTHING ELSE CAN BE DONE TO OVERCOME THIS ILLNESS. AND IT IS ABOUT FIGURING OUT WHAT LIFE WILL BE LIKE WHEN TREATMENT IS OVER WHILE HAVING HOPE FOR THE FUTURE. SOMETIMES, IT IS ABOUT LEARNING TO LET GO OF THE POSSIBILITY OF A CURE”.

-CANADIAN PARTNERSHIP AGAINST CANCER (CPAC) (CANCERCARE MANITOBA, 2019)

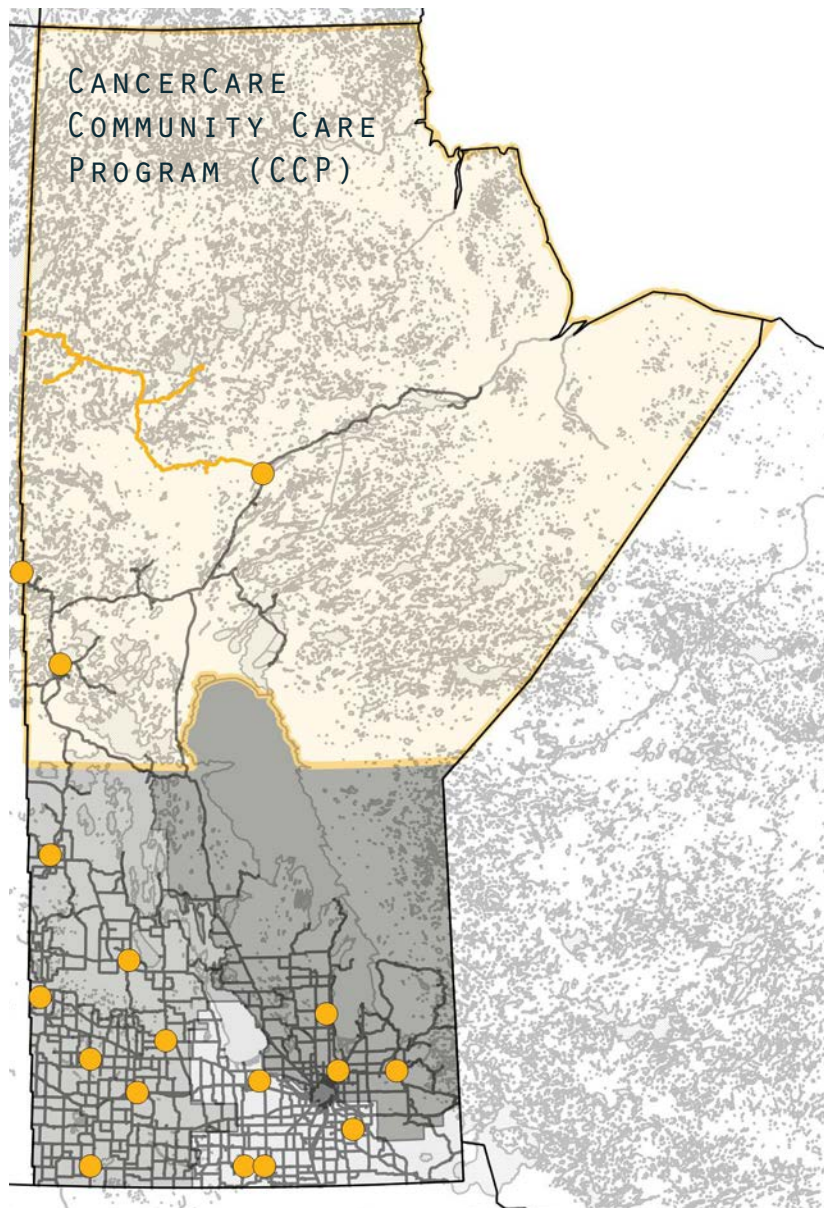


(CancerCare Manitoba, 2019)

CANCERCARE MANITOBA CancerCare Manitoba's main site operates out of downtown Winnipeg at the province's largest healthcare facility, the Health Science Center (HSC) (Shared Health, 2021). All provincial clinical-based services such as CancerCare, diagnostic imaging services and pediatric care are located at HSC, meaning the majority of Manitobans' highly specialized medical care is managed in one place (Shared Health, 2021). For CancerCare this means that all specialized teams such as oncologists (doctors who provide specific care to cancer patients), and supportive staff are located in Winnipeg.

A diagnosis of cancer involves a specialized treatment plan tailored to the specific cancer and age of the patient at diagnosis (CancerCare Manitoba, 2019). Options for treatment include, but are not limited to, surgery, systemic treatments such as chemotherapy and radiation therapy, and palliative care (CancerCare Manitoba, 2019). A typical treatment plan for patients involves being assigned to an oncologist in Winnipeg

(Northern Health Cancer Navigation Services, n.d.). Diagnostic imaging including MRI's, CT scans, ultrasounds, and X-Ray's are often necessary throughout the entirety of the treatment plan and are only accessible at Health Science Center (Shared Health, 2021). Although having care teams and treatment resources centralized in Winnipeg is convenient for much of Manitoba's population, it is a very long journey to the city for northern residents.



LEGEND

- Community Care Programs
- PR 391
- All Season Highways
- Waterbodies
- Northern Health Region

CANCERCARE IN NORTHERN MANITOBA For communities who are limited by location in this highly centralized healthcare system, regional sites have been implemented across the program under the Community Cancer Program (CCP), shown in Figure 1-28 (CancerCare Manitoba, 2021).

COMMUNITY CANCER PROGRAM Through the regional CCP, the bridge to partnership between specialists, regional partners, and community primary care providers is created (CancerCare Manitoba, 2021). In Manitoba there are 16 CCP's that deliver cancer services closer to communities (CancerCare Manitoba, 2021). These programs are responsible for training and educating healthcare providers on cancer care with the goal to improve access to quality care (CancerCare Manitoba, 2021). In Lynn Lake, the closest Community Cancer Program is located in Thompson. The Thompson site facilitates cancer treatment to all northern communities, not including The Pas and Flin Flon (CancerCare Manitoba, 2021).

Figure 1-28: GIS map showing Community Cancer Program (CCP) locations.

(CT) SCAN

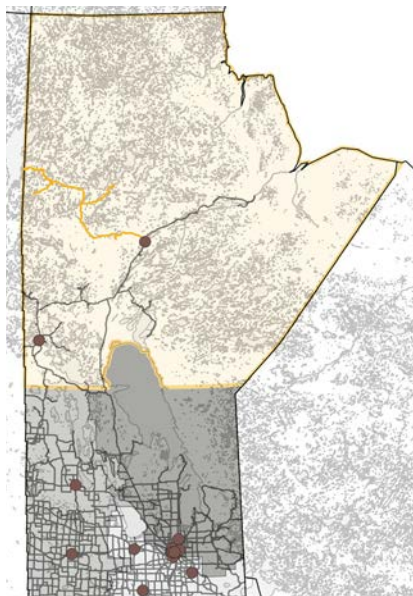


Figure 1-29: GIS map showing diagnostic imaging CT scanner locations.

MAGNETIC RESONANCE IMAGING (MRI)

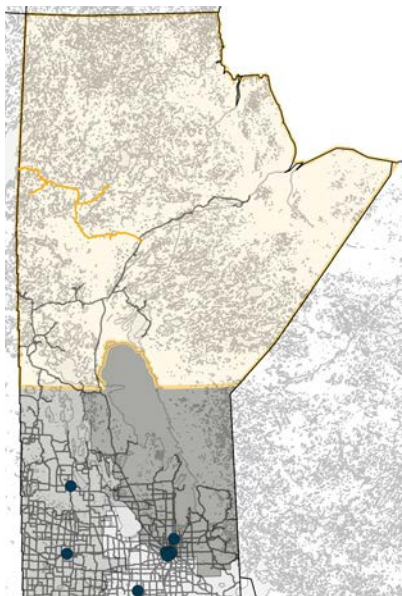
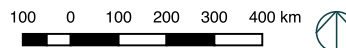


Figure 1-30: GIS map showing diagnostic imaging MRI locations.

LEGEND

- Northern Health Region
- CT Scanner
- Magnetic Resonance Imaging (MRI)
- PR 391
- Waterbodies



In traditional CancerCare practices, patients are assigned an oncologist that they work with through CancerCare Manitoba from initial diagnosis, through treatment, and into aftercare. For those living in remote communities in northern Manitoba, nurses or family doctors work closely with the oncologist to aid an individual in their healthcare journey (CancerCare Manitoba, n.d.). Although Thompson provides a more localized clinic, some forms of diagnostic imaging still remain at a distance. Magnetic resonance imaging (MRI) is integral to the diagnosis of illnesses and monitoring ongoing treatments, but there is no MRI scanner in northern Manitoba and residents must travel to Winnipeg for this service (Health, Seniors and Active Living, n.d. d).

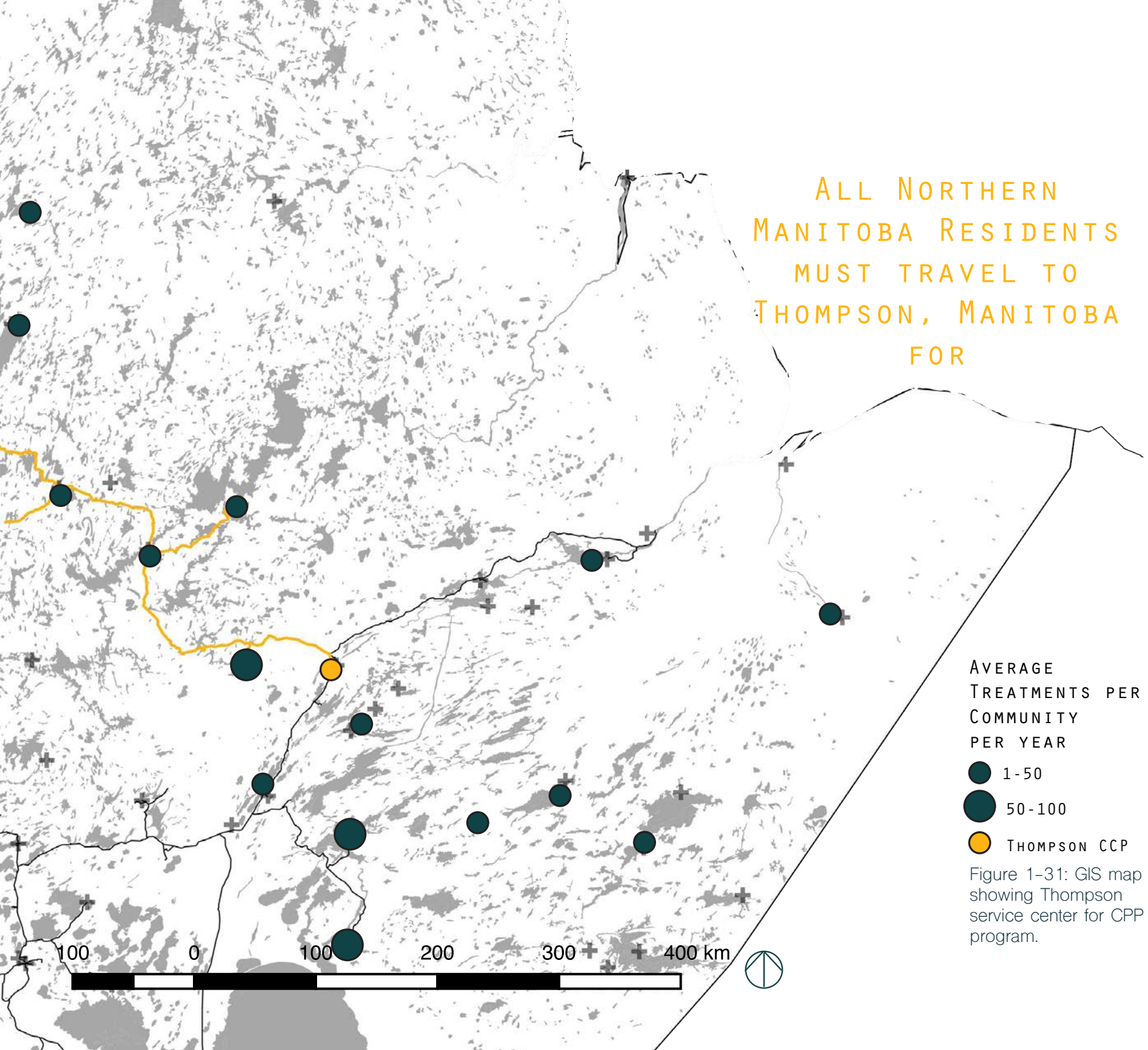
CancerCare Manitoba recognizes different community approaches to health and wellness and offers these practices to all individuals who request this level of care (CancerCare Manitoba, n.d.). Indigenous health and wellness can be

generalized as a holistic approach to medicine, and these views are supported in the CancerCare community.

NORTHERN PATIENT TRANSPORTATION PROGRAM

In Manitoba, the average person will spend \$14,000 a year on cancer treatment necessities including transportation (CancerCare Manitoba, 2019). Due to the additional obstacles faced in the NHR, CancerCare offers a Northern Patient Transportation Program to help subsidize travel costs related to living in remote communities (Northern Health Region, 2019b). Local providers decide on the mode of transportation that is best suited to the patient's condition and for Lynn Lake residents accessing Thompson's Community Cancer Program the most direct route is PR 391. The frequency and reason for which residents take this long and repetitive commute mean that the highway has evolved from simply a piece of physical infrastructure into a valued socio-cultural route.

ALL NORTHERN
MANITOBA RESIDENTS
MUST TRAVEL TO
THOMPSON, MANITOBA
FOR



AVERAGE
TREATMENTS PER
COMMUNITY
PER YEAR

- 1-50
- 50-100
- THOMPSON CCP

Figure 1-31: GIS map showing Thompson service center for CPP program.

THE HIGHWAY

TRANSPORTATION IN THE REGION

Typical modes of transportation for northern communities include rail-line, all season roadways, winter ice roads, air traffic, snow mobile, and active transportation. Prior to mining exploration in the 1970's and the construction of PR 391, the communities listed in Figure 1- 40 were only accessible in the winter by ice roads or active transportation (Government of Manitoba, n.d.). At the time, communities were self-sustaining and the surrounding landscape supplied resources for food and shelter (Dakin, Jackson and Johns, 1973). Due to the rapid community development that accompanied resource exploration in the area, roads were carved into the landscape to facilitate the economic profitability of transporting industry equipment and resources (Manitoba Government Information Services Branch, 1969). With the evolution of exploration came fragmentation of this resource rich landscape, after which communities were forced to rely on the mining towns for the basic human needs of food security, employment, and healthcare.

HISTORY OF PR 391 The natural, “untouched” landscape surrounding Lynn Lake meant there were minimal access points in the early years of the town’s development.

Following the accelerated phase of advanced resource extraction was an increase in recreational activities of hunting, fishing, and lodging that grew the attention of visitors moving deeper into the northern landscape (Dakin, Jackson and Johns, 1973). As the community of Lynn Lake developed, transportation infrastructure expanded the rail-line from Flin Flon northwards to accommodate the mining industry (Government of Manitoba, n.d.). The all-season highway, PR 391, leading from Thompson to Lynn Lake was constructed in four phases with the first phase linking Lynn Lake to Leaf Rapids in 1969 (Manitoba Infrastructure, n.d.). The following year phase two would extend road construction farther south to the Swwanee River (Manitoba Infrastructure, n.d.). Phase three occurred between 1971-1973 connecting Thompson north to Nelson House (Manitoba Infrastructure, n.d.). The final phase of construction, in 1974, connected phases one and two to phase three, finalizing the connection between Thompson and Lynn Lake (Manitoba Infrastructure, n.d.). This valuable connection would eventually augment the region’s growing economic value and provide accessibility to healthcare.

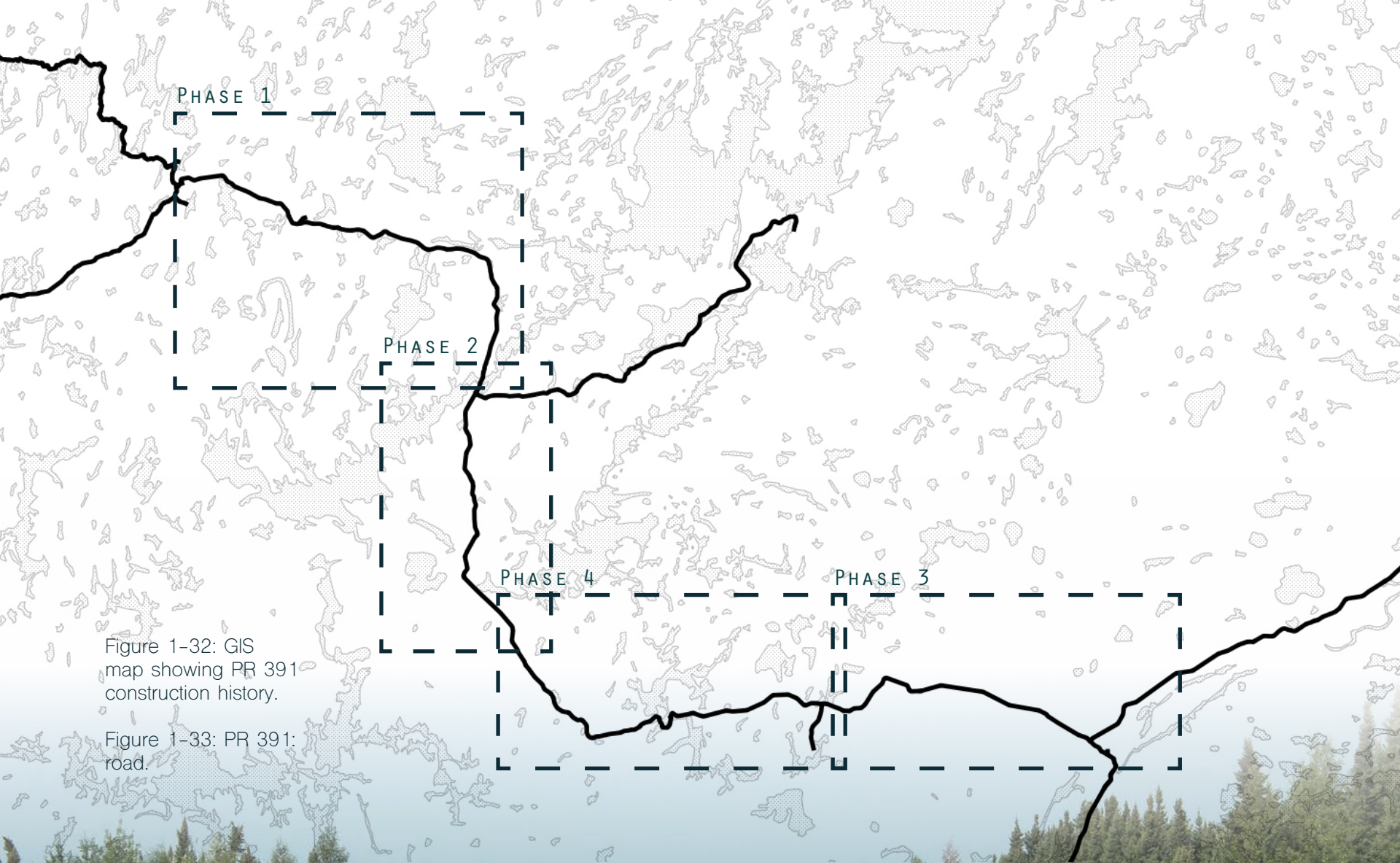


Figure 1-32: GIS map showing PR 391 construction history.

Figure 1-33: PR 391: road.





Figure 1-34: Fox Mine ruins.



Figure 1-35: PR 391: dam system.



Figure 1-36: PR 391: north.

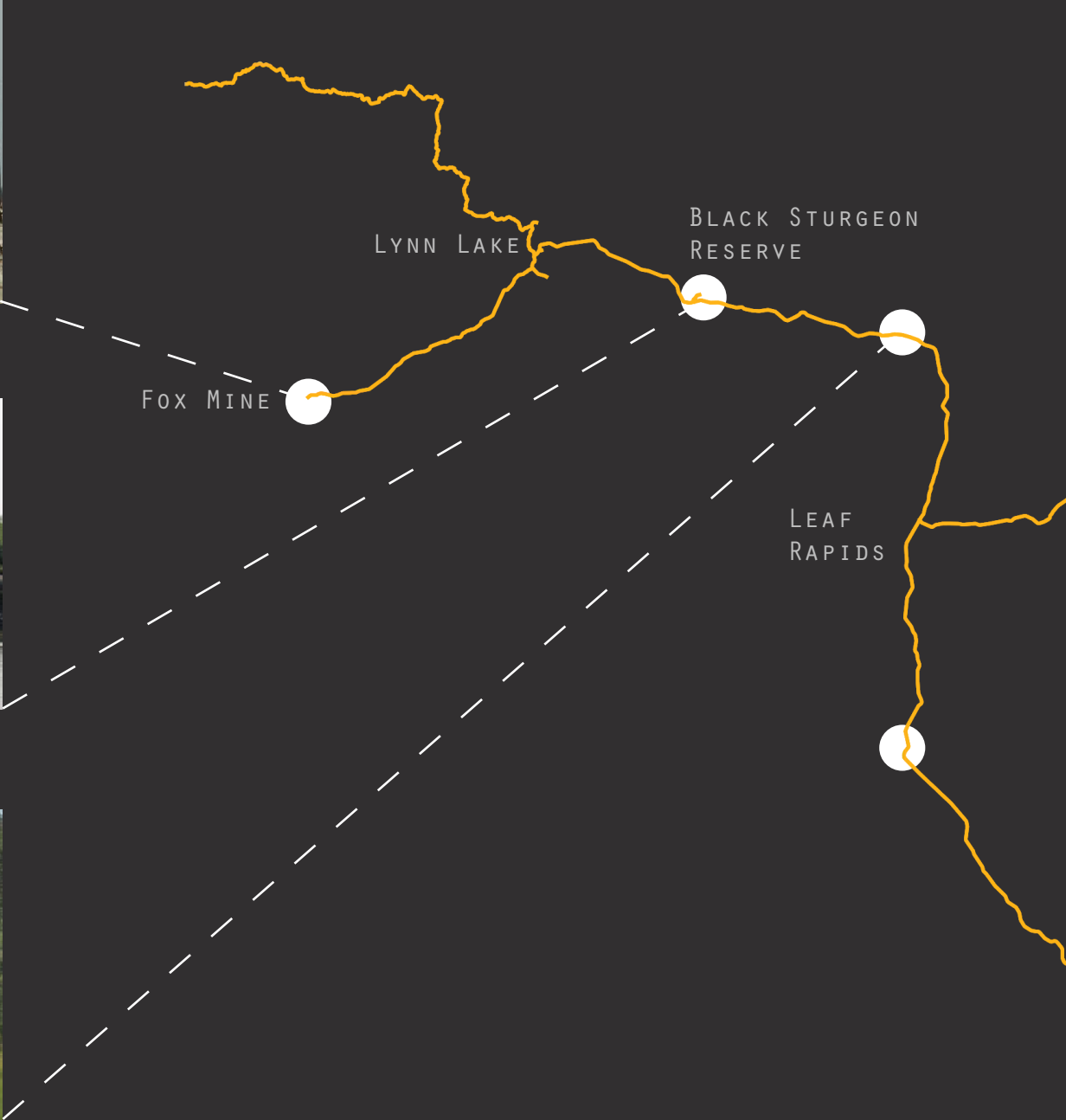




Figure 1-37: PR 391: elevations.



Figure 1-38: PR 391: Nelson House.



Figure 1-39: PR 391: wetlands.



Figure 1-40: GIS map of PR 391 features.

FEATURES OF THE HIGHWAY At a glance the highway appears to be formed around the landscape's wetland features and outcrop formations, and where possible, it moves along the landscape with minimal degradation of the environment. Intermittent breaks in the scenic landscape reveal how this human-made feature navigates these wetland and outcrop barriers with visible areas of blasted rock and bridges. These interventions along the highway provide access and views into the layers of the environment that make up the boreal forest, and are key elements in connecting communities.

Along the highway are road verges which are areas of mown grass that are designed to reduce fire risk and promote safety, drainage, soil stability, weed control, access, aesthetics, and conservation of biota along the route (Rydren and Austad, 2015).

These verges have potential for increased wildlife biodiversity and areas for potential plant species succession (Forman and Sperling et al., 2003). The road verge of PR 391 features colourful purple flowers called Fireweed (*Chamerion angustifolium*), a prominent herbaceous species that thrives along roadsides, and is a key succession species to the northern Manitoba environment.

During my visit to Lynn Lake driving along PR 391, I observed patches of young forested landscapes that were clearly di regenerating from previous disturbance. Wildfires are a natural occurrence in northern Manitoba during the summer months and are crucial to the rejuvenation of plant species and overall health and biodiversity (Scott, 1996). Jack pine (*Pinus banksiana*) tree cones respond to heat from wildfires by releasing seeds and after a wildfire has devastated an area, and are the first conifer species typical of the boreal forest to appear in the succession process (Scott, 1996).

Driving on PR 391 reveals the dichotomy of the opposite sides of the highway, where one side often consists of mature forest, while the other an initial growth phase of regeneration. The sand road surfacing is a known fire barrier, and PR 391 acts as a long, human-made firebreak. The road allows service vehicles to access fires before they get out of control or endanger residents and their property.

Figure 1-40 shows the unique and significant spaces along PR 391 that are significant to the health of the environment and to the social values of northern residents.

CONDITIONS OF THE HIGHWAY The material of the highway is mostly sand and gravel, with portions of areas surfaced in asphalt. Since construction of PR 391, local residents of Nelson House have expressed concerns towards the maintenance of the highway during extreme weather conditions (CBC News, 2018). During rainstorms the precipitation causes depressions in the gravel, creating potholes, whereas in hot and dry weather, gravel is kicked up by large vehicles and creates 'white-out' conditions where dust can reduce a driver's visibility (CBC News, 2018). These issues increase the commute times for residents, with careful navigation required and reduced speeds often necessary (CBC News, 2018). New gravel and dust control programs are provided annually, and local contractors provide routine maintenance along the highway, but are unable to keep up with the demand (CBC News, 2018). With these prolonged periods of problematic conditions, emergency transport vehicles have increased response times (CBC News, 2018).



Figure 1-41: PR 391: washboard.



Figure 1-42: PR 391: grading.

CURRENT TOPICS SURROUNDING PR 391

- In 2017, Highway PR 391 was fittingly nick-named “Life is a Highway” after the hit song of the same name by musician Tom Cochrane, who grew up in Lynn Lake (CBC News, 2016). This name is suitable for the highway, which remains a lifeline for the communities to access healthcare.
- In 2020 SARS-CoV-2 (Covid-19) began to spread across Manitoba. The isolation of northern Manitoba meant it was the last health region to be affected by the virus and testing for Covid-19 was only available in Thompson, The Pas, and Flin Flon (Northern Health Region, 2021). This meant that potentially infected residents of Lynn Lake were required to travel the six hour commute of PR 391 to be tested for the virus. In January 2021, the virus reached the town of Lynn Lake and within a couple weeks one third of the community had contracted the virus and an outbreak was declared in the general hospital (CBC News, 2021).



Figure 1-43: PR 391: road verge 2.



OUT OF SIGHT

A MOTHER'S PERSPECTIVE ON THE IMPORTANCE OF TRANSPORTATION TO HEALTHCARE

On May 14th 2019, at the age of nine months, my daughter Leah was diagnosed with a rare form of childhood liver cancer known as Hepatoblastoma. Prior to diagnosis Leah was hitting every developmental milestone and was starting to show signs of beginning to walk. She exhibited no symptoms of pain or illness. On the day of her diagnosis, Leah fell down while attempting to walk and afterwards a noticeable bump the size of an orange appeared on her abdomen (I later learned this was common due to blood rushing to the tumor that was now taking up over fifty percent of her liver). We drove fifteen minutes to our pediatrician's office located at the Health Science Center and that is where our cancer journey began.

The next three days were the most grueling time of our lives. Constant scans were performed in order to identify the treatment plan that would take over Leah's life for the foreseeable future. At her age, sedation was needed to be able to perform certain tests and in those first days Leah would undergo an X-ray, CT Scan, MRI, EKG test, hearing base-line test, and would be seen by countless specialists.

By May 16th 2019, her team of specialists presented us with two treatment options. One option using a regime of chemotherapy drugs commonly used in the United States was known to be responsive to her type of cancer; however, they were also known to cause long-term kidney damage and heart disease in children. The second treatment was a lesser known chemotherapy drug treatment being used in the United Kingdom and showed promising results when it came to long-term effects in children. After extensive research and discussions with her healthcare team, our family chose the latter method. In those three days, from diagnosis to the

decision on a treatment plan, we did not leave the hospital.

For the next several months (May to September) Leah was on a treatment cycle plan that would be repeated every two weeks. Treatment would be completed when the tumor shrunk to an appropriate size for surgical removal, which was determined through repeated diagnostic imaging. On days that we were not at CancerCare we spent time outside in our neighbourhood. We never strayed far from home because Leah had an open chemotherapy port (a tube leading to her heart for treatment purposes of administering chemotherapy) that increased the risk of infection, which required her to stay in the cleanest possible environment.

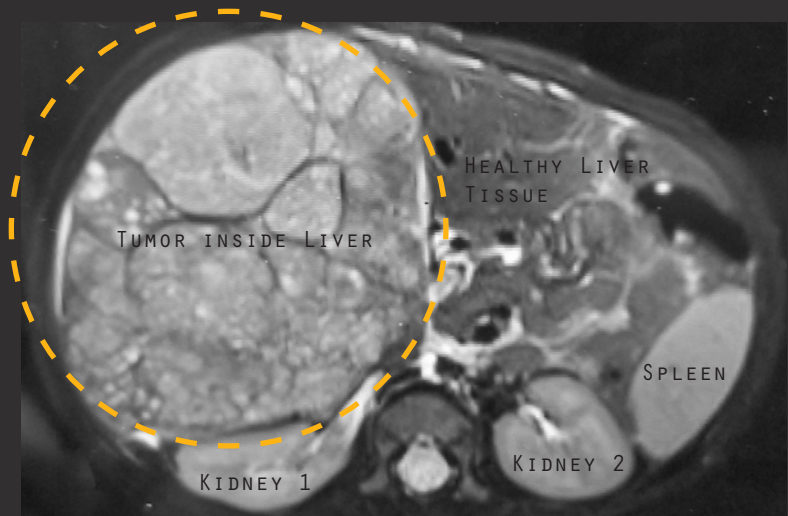


Figure 1-44: Leah's tumor.

In June, after Leah's third chemotherapy treatment, we noticed a small pungent red dot on her chest while she slept. We called the emergency contact given to all patients that gave direct access to her oncology team, who then instructed us to let her rest and keep an eye on it. Two hours later I found the infection rapidly spreading along her port line, and after reporting the development, we were directed to come to the hospital right away. At the hospital she presented with a staphylococcus aureus (staph) infection, a dangerous bacterial infection that can very quickly spread to her blood through her open port.

Blood cultures were taken and the results showed that the infection had fortunately not spread to her blood. Living close to the hospital was the difference between fighting a skin infection and fighting a blood infection. Leah's body was immunocompromised due to the chemotherapy and could not fight the infection alone, so another surgery was required to replace her port line. The infection, antibiotics regime, low-immunity, and extra surgery would mean we would spend the next five weeks in the hospital, and Leah's next chemotherapy treatment would be postponed. Finding Leah's staph infection had me terrified that I might miss other signs that might negatively affect her health.

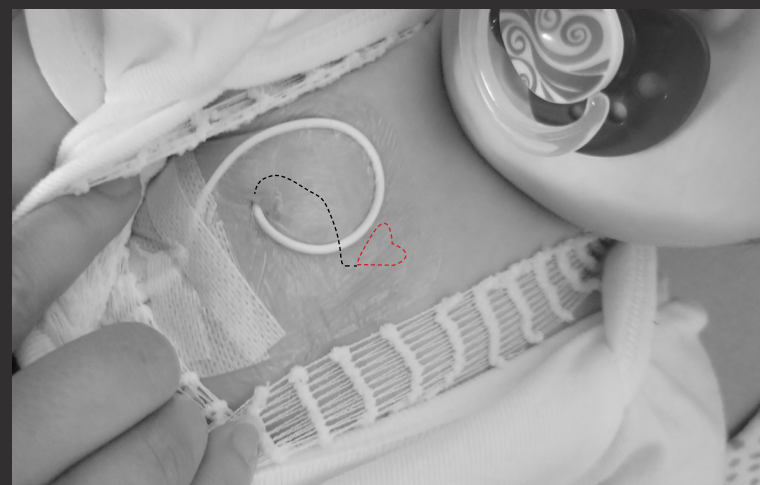


Figure 1-45: Leah's port.



Figure 1-46: Leah's infection.

TRANSPORTATION TO HEALTHCARE
RESOURCES FOR A LYNN LAKE FAMILY(KM)
USING LEAH'S TREATMENT SCHEDULE

1,100 km = Travel from LYNN LAKE to WINNIPEG
322 km = Travel from LYNN LAKE to THOMPSON

LEGEND

- X-ray
- ◆ Baseline Audiology
- CT Scan
- MRI
- ◆ Oncology Appt
- Chemotherapy
- Port Maintenance

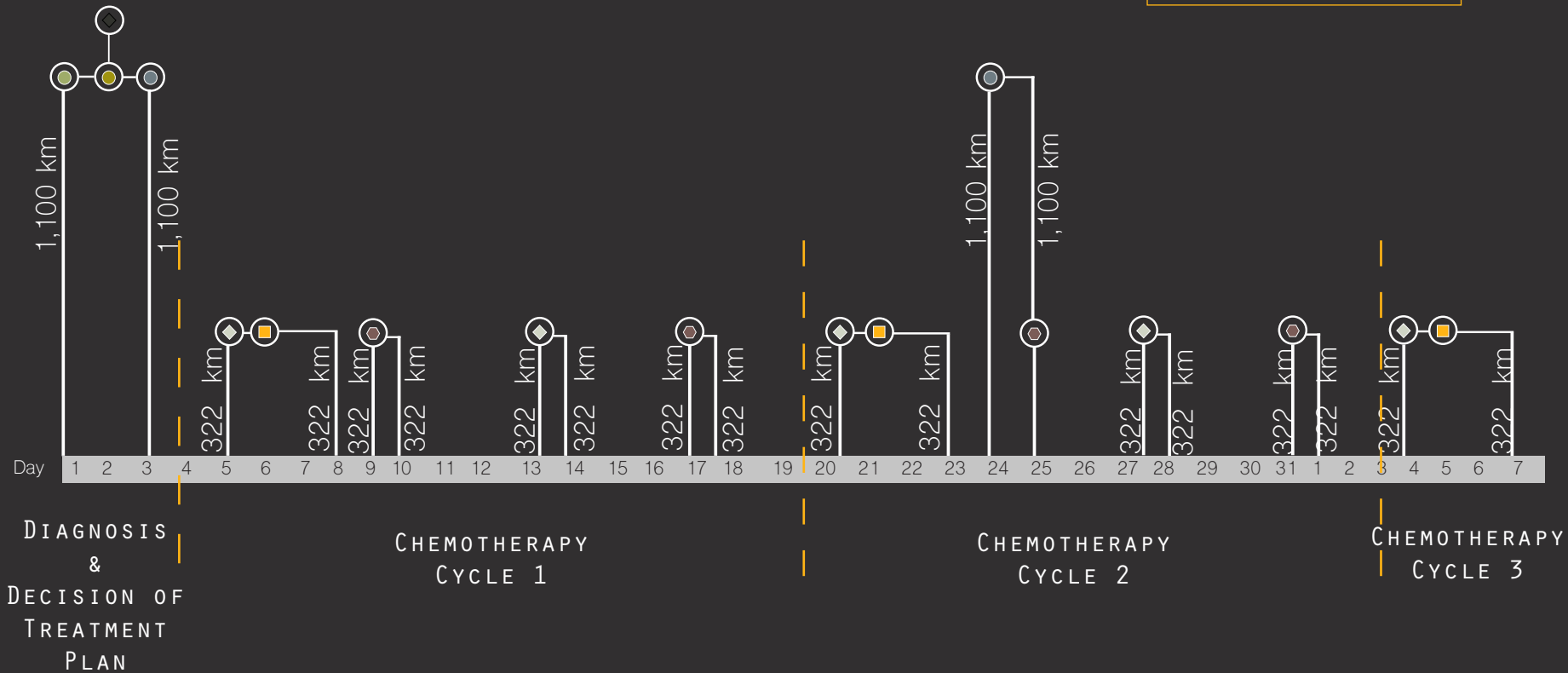


Figure 1-47: Diagram of healthcare travel timelines.



CONCLUSION

The site analysis for the practicum reveals the health of the physical landscape and the impacts resulting from the extraction industry. In my observations of the Lynn Lake human health risk assessment, I found the health of the actual residents was overlooked. By relating the elements that are essential to life (air, water, earth, fire) to the health of the residents and the environment, there is a clear indication that the degraded landscape has impacted residents' physical and mental health. There is anecdotal evidence of an increase in ill residents with respect to cancer, which prompted the analysis into the northern healthcare system, which reveals the importance of transportation, and PR 391 to the regimen of treatment and healing.

Isolation from the environment while travelling in motor vehicles creates a disconnection with the landscape and its restorative properties for people travelling along the highway. There is a need for points of connection to the landscape along the highway to immerse individuals in the fabric of the landscape and realign with its restorative properties. This can be accomplished with a proposed non-motorized trail system and corresponding rest stops.

Figure 1-48: PR 391: smooth sand.



Figure 2-1: PR 391: along the highway.

CHAPTER 2

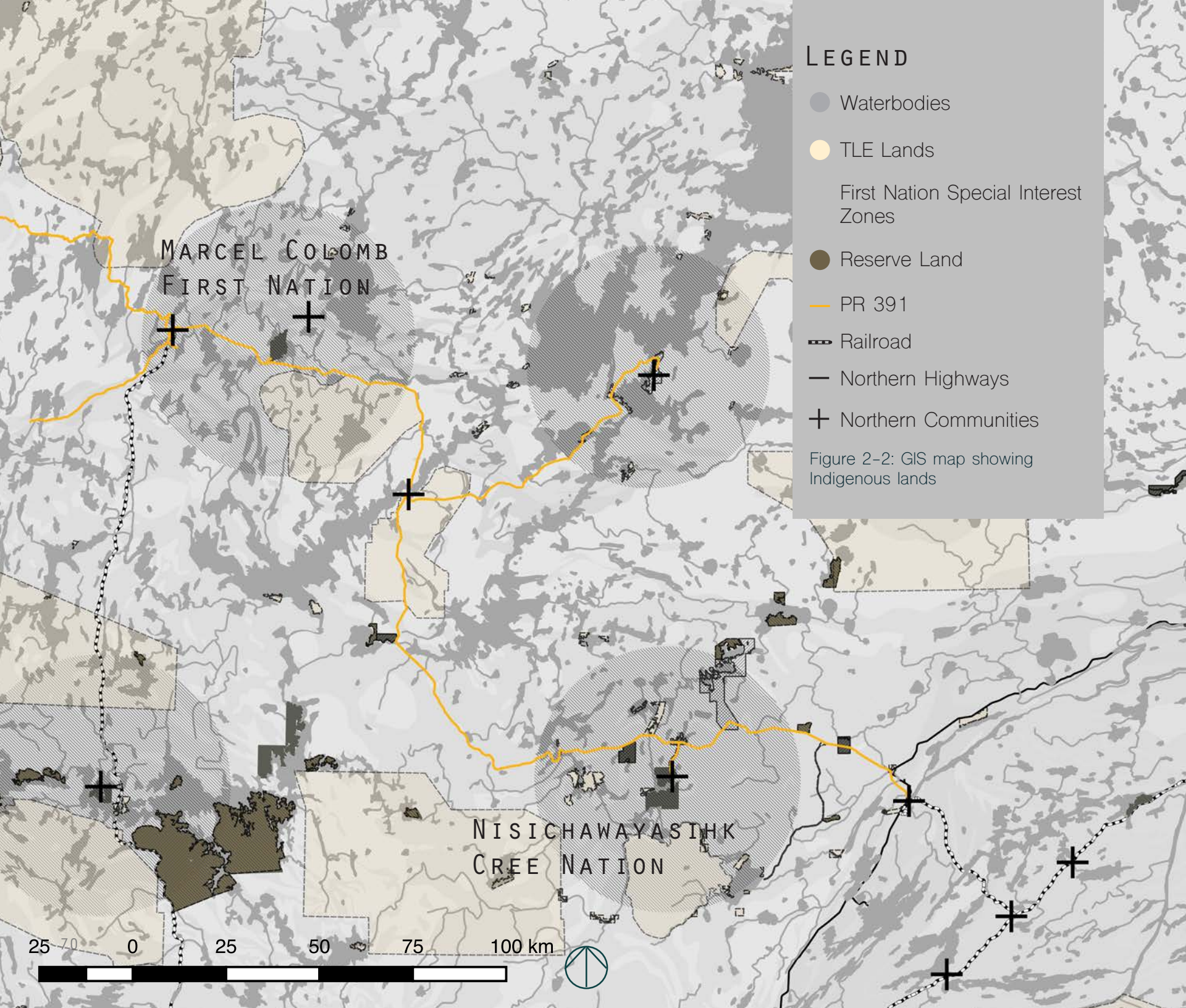
INDIGENOUS HEALTH AND WELLNESS

In this section the healing practices of Indigenous communities are explored in order to understand the northern Manitoba residents' culture and beliefs in holism, health, and wellness, specifically when compared to the western-based healthcare system. The Cree healing practices of a healer in northern Alberta, Canada are discussed in order to convey the overarching practices and principles of the demographic of communities represented along PR 391. Botanical medicines of the northern Manitoba environment are identified for their benefits in treatment and healing practices.

This section is divided into three parts:

1. Indigenous views of Health and Wellness
2. Cree Healing Practices
3. Botanical Medicine

The research was conducted by studying several journal articles from Indigenous communities across the Canadian provinces. It is important to note that these communities may differ in approaches from other communities on healing and wellness. I am not Indigenous and this section portrays my understanding of the connections between healing processes and views on medicine.



LEGEND

- Waterbodies
- TLE Lands
- First Nation Special Interest Zones
- Reserve Land
- PR 391
- Railroad
- Northern Highways
- Northern Communities

Figure 2-2: GIS map showing Indigenous lands

MARCEL COLOMB
FIRST NATION

NISICHAWAYASIHK
CREE NATION

25 0 25 50 75 100 km



The northern landscape can be viewed as sacred for many Indigenous cultures resulting from experiences and memories shared with, and on, the land. Traditional knowledge and ways of living are embedded through ceremonies and customs of healing and medicinal practices (Docherty, 2011).

Marquina- Marquez, Virchez and Ruiz-Callado (2016) describe the views of healing in Indigenous reserves as the search for a physical space where healing practices and visual cultural symbols can be expressed and how they help to maintain social value. These spaces include multi-sensory aspects that have a strong connection to mental and spiritual health that differs from the conventional medicines of a typical western healthcare system (Marquina-Marquez, Virchez and Ruiz-Callado, 2016). The medicine wheel in Indigenous culture symbolizes the dimensions of health and the cycle of life and embodies the four ordinal directions (U.S. National Library of Medicine, n.d.). The four directions can also be interpreted as elements of nature, animals, seasons, ceremonial plants, and the aspects of life (emotional, mental, spiritual, and physical health) (U.S. National Library of Medicine, n.d.). The

four aspects of life as described by the British Columbia First Nations Health Authority (FNHA) (2021) are seen as the key elements in terms of values for Indigenous health and wellness. The only Canadian provincial health authority of its kind, the FNHA (2021) perspectives on health and wellness encompasses holism and emphasizes balance and nurturing the four health components in order to live a strong and healthy life.

INDIGENOUS VIEWS OF HEALTH AND WELLNESS

Overlaying the four health components with healing practices as suggested by the FNHA, reveals a type of health model for healing processes and perspectives on medicine that align with the healthcare delivery of most First Nation communities (First Nations Health Authority, 2021). Pimatisiwin is the Ininew or Cree notion of 'the good life', which fits within the FNHA's healing processes as it informs a code of conduct or philosophy as described by Ramona Neckoway from Nisichawayasihk First Nation, Nelson House (Konefall, Kulchyski and Neckoway 2020).

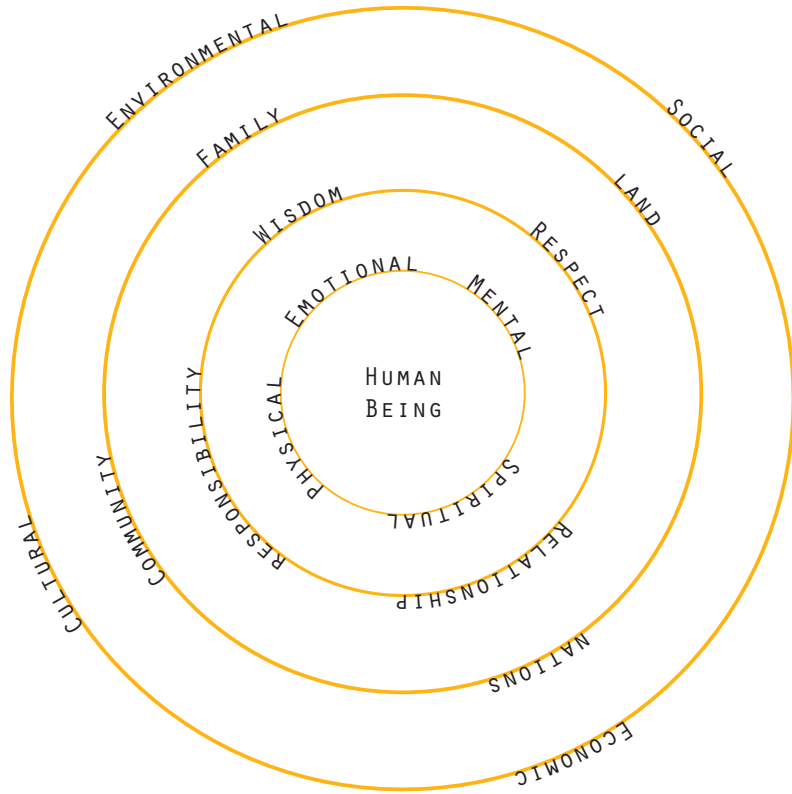


Fig 2-3: Diagram of the British Columbia First Nation Health Authorities health model

THE MODEL (First Nations Health Authority, 2021)

With human beings at the center and working outward.

The Second Circle

Mental, Emotional, Spiritual and Physical

Healthy, well-being, and balanced life – It is critical that these elements are balanced and important they are nurtured together (First Nations Health Authority, 2021).

The Third Circle

Respect, Wisdom, Responsibility and Relationships

Together form the base for overall wellness. Through honouring where you come from through culture and passed down knowledge of traditions and medicine, responsibility to yourself, family, and land, and the relationships that sustain us (First Nations Health Authority, 2021).

The Fourth Circle

Nation, Family, Community and Land

Past experiences of people can be used as positive or negative learning experiences that can be applied to ones present and future (First Nations Health Authority, 2021).

Land - “The land, sustains us physically, emotionally, spiritually and mentally we use the land for hunting, fishing and gathering. The land is where we come from and is our identity... It is more than just the earth. It includes the ocean air, food, medicines and all of nature... Land and health are closely intertwined because land is the ultimate nurturer of people. It inspires and provides beauty and nurtures our souls”. -FNHA (First Nations Health Authority, 2021)

The Fifth Circle

Social, Cultural, Economic, and Environmental

Are the determinants of our health and wellbeing. We all have a duty to sustain, maintain, and grow economic and environmental resources for future generations to thrive. The environment must be cared for in order to sustain health (First Nations Health Authority, 2021).

This model is adapted from available sources found online. It is important to reiterate that I am not Indigenous and that the diagrams portray my understanding of the connections between healing processes and views on medicine.

INDIGENOUS HEALING PRACTICES (CREE)

It is important to acknowledge the Indigenous practices of healing and health, and particularly important to understand the healing practices of the Cree people.

Statistics Canada (2016b) states that there are approximately 130,000 First Nations people in Manitoba, making up 18% of the population. Within this demographic, of the ten most abundant First Nation mother tongues, Cree and Cree dialects were the most significantly used within the population (Statistics Canada, 2016b). In the area surrounding PR 391 are communities of Cree people that carry the belief that humans are intimately linked with the environment (Statistics Canada, 2016b; SICC, n.d.). A key value held also embraces the sharing of valuable resources like hunting and fishing (SICC, n.d.).

As most Indigenous histories are relayed through oral means, there is minimal first hand documentation of the healing practices. This factor meant that my practicum needed to broaden its scope to include northern Albertan Cree healing practices as shared by a Cree healer in the article Cree Indian Healing Practices and Western Health Care: A Comparative Analysis by Morse, Young and Swartz (1991).

My observation of the Cree healing process is that there is significant emphasis on the individual, guided by a healer, with substantial importance given to the spiritual component of health. Healers facilitate the treatment process of patients and incorporate concepts of holism, where the patient is treated as a whole, recognizing mental and social factors on health, not just the physical symptoms of ailments (Morse, Young and Swartz, 1991). Family and community are important support systems that are included in the ceremonial aspects of an individual's treatment (Morse, Young and Swartz, 1991). The western approach to healthcare focuses mainly on physical and mental health, missing out on values important to the Indigenous aspects of culture and well-being as they relate to health, so critical to northern Manitoba residents.

The Cree healing practices shared by the northern Alberta healer demonstrate a focus on the five stages of a healing treatment process that follows the concept of holism (Morse, Young and Swartz, 1991). These five stages were noted as ritual/purification, contract, treatment, didactic, and closure components of the treatment regime (Morse, Young and Swartz, 1991).



1. RITUAL PURIFICATION

Key Indicators: Active participation, Smudging ceremony, Maintaining a balance with nature, and Opening the door to the Spiritual World.

The purification process begins with a cleansing of the body through a ritual ceremony called smudging, typically involving four sacred medicinal plants; sweetgrass, tobacco, sage, and cedar (Morse, Young and Swartz, 1991). A healer, in combination with the Great Spirit, performs the smudging ceremony and with active participation and receptivity of the patient the cleansing rids the body of negative thoughts and bad energy that may be detrimental to the healing process (Morse, Young and Swartz, 1991). A local example of this ritual process is a healing circle in Peguis First Nation located in Manitoba. The ceremony involves items that represent the four elements that sustain life (fire, air, water, and earth) consisting of the medicinal herbs tobacco, sweetgrass, sage, and cedar (earth), a candle (air and fire), and an abalone shell filled with water (water) (Stevenson, 1999). The incorporation of items in the ritual process represents the balance of nature and a connection to these elements (Stevenson, 1999; Morse, Young and Swartz, 1991).

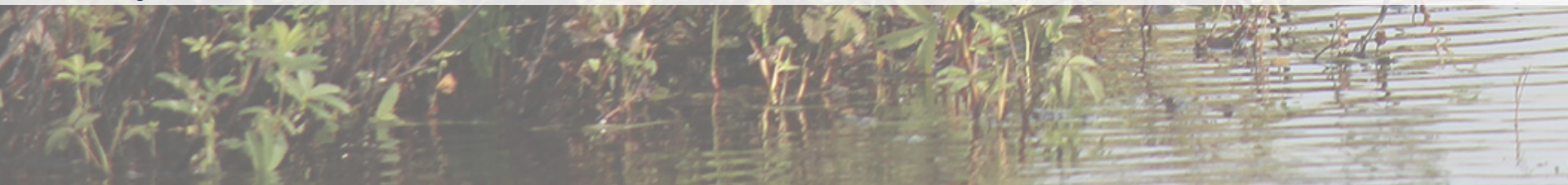
2. CONTRACT

Key indicators: Request healing, Gift of Tobacco, Presentation of colored print, Placement of the combined print and tobacco in the environment.

The next phase of the healing process described by the northern Albertan healer is when the individual is ready to listen and discuss their health (Stevenson, 1999). Letting go of stifled emotions is an important aspect of this component. The unwell individual presents the healer with a gift of tobacco signifying the request for healing. For the Alberta Cree community, prints of white, yellow, red, blue, or green cloth are given to the healer, each colour representing the treatment path they are seeking and which spirit helper will assist in healing.

The healer facilitates the individual to face the ordinal direction dictated by the coloured print, and then the ceremony proceeds with the individual standing on the print and tobacco sprinkled on the cloth at their feet (aiding in passing the disease through the body to the feet and into the tobacco and print). The tobacco is then gathered and secured inside the print and the newly formed bag is placed in a tree. From there it is expected that the bag of tobacco will be taken by the elements, casting away the disease (Morse, Young and Swartz, 1991).

Figure 2-4: Reeds.



3&4. TREATMENT AND DIDACTIC

Key indicators: Herbal tea, Solution of herbs and animal parts applied to visible wounds, Sweatlodge ceremony, Center and focus, Instructional selfcare.

In the third and fourth components, the healing process is performed through sweatlodge ceremonies and a herbal tea is given to the patient to cleanse the blood and force the disease to the surface (Morse, Young and Swartz, 1991). During the fourth healing phase, the healer educates the ill individual on self-care when they return home from treatment (Morse, Young and Swartz, 1991).

5. CLOSURE

Key indicators: healing process continues with Great Spirit, Trigger the body to take over and complete healing, reciprocity, Reflection on what a cure means personally.

In this final component, the healing process continues without the healer, and is between the individual and the Great Spirit (Morse, Young and Swartz, 1991). The treatment stimulates the immune system in the body to take over and heal, and this is the time for the ill person to reflect on what a cure means to them personally (Morse, Young and Swartz, 1991).

The interconnections of values to specific practices such as smudging ceremonies, sweatlodges, and healing circles places emphasis on the spiritual and emotional aspect of healing. This differs from western knowledge systems that structure clinical assistance in Canada, in which sensory and spiritual health is rarely taken into account (Marquina-Marquez, Virchez and Ruiz-Callado, 2016). More attention should be placed on Indigenous healing processes where they are part of the local culture, and these views on medicine could be core values that extend into western healthcare practices. This approach can be applied to design and how we approach healing a sick or degraded environment and the people who live in and on the landscape (Morse, Young and Swartz, 1991).

70-80% OF PEOPLE WORLDWIDE
RELY ON TRADITIONAL HERBAL
MEDICINE TO MEET THEIR PRIMARY
HEALTHCARE NEEDS (Upret et al., 2012).

BOTANICAL MEDICINES Many First Nations acknowledge that traditional teachings on health are influenced by the lifestyles and environment of surrounding communities (Hart-Wasekeesikaw, 1996). The First Nation Health Authority notes that health and wellbeing are dependent on the land since the environment is what sustains individuals physically, emotionally, spiritually, and mentally (First Nations Health Authority, 2021). The landscape of northern Manitoba and health must be considered closely intertwined. The medicinal plants of the landscape are important to the survival and wellbeing of First Nation communities and have been transmitted from generation to generation as part of oral and ceremonial traditions (Upret et al., 2012). In northern Manitoba there are 546 plants used for medicinal purposes, and they can be used to treat 28 types of diseases. These plants are used in a variety of ways – turned into pastes, poultices, juices, powders, chewed, infusions and decoctions – to help in the healing process (Upret et al., 2012).

Mentioned earlier, Fireweed (*Chamaenerion angustifolium*) is used as a medicinal plant in holistic practices, in the Cree language it is called Ihkapaskwa (Rogers, 2014). The edge conditions along PR 391 host some of the richest biodiversity in the area and includes the flourishing of succession species like Fireweed (*Chamaenerion angustifolium*, Ihkapaskwa in Cree). A plant native to the boreal forest, fireweed is used as a medicinal herb in pain and swelling management. The plant also prepares soils after forest fires for willows and poplars to follow (Rogers, 2014). Other medicinal aspects of the plant include lowering inflammation induced by certain ulcer, colitis, and arthritis drugs, a potentially significant resourceful plant for Lynn Lake with the known rise in cases of Crohn's Disease (Rogers, 2014).



Figure 2-5: PR 391: Fireweed.

CONCLUSION

The overarching practices of Indigenous health and well-being identified by the First Nations Health Authority reveal the importance the health of the landscape has on the healing practices of the people. The importance of physical space to the connection of mental and spiritual health has been revealed throughout the research, but is found to be missing from conventional medicines and the western healthcare system.

The Indigenous practice of holism requires a healthy environment in order to restore the health and well-being of the people. Where holism is restorative to the person, we also need to be restorative to the landscape. The health model described by the First Nation Health Authority reveals layers to the health and well-being of Indigenous populations that emphasize respect, community, and landscape (First Nations Health Authority, 2021). The prominence of Cree communities along PR 391 led to research into the practices of a northern Alberta Cree community (the nearest available written document) and included the steps to their healing practice.

Indigenous people have substantial knowledge of medicinal plants and the quality and quantity of these plants are affected by anthropogenic degradation of in the environment, presenting challenges and indicating the need for restoration (Rudolph and McLachlan, 2013).

From my personal travel on PR 391, the purple swaths of Fireweed blanketing the road verges enticed me to leave the confines of our vehicle to explore the landscape and examine this amazing flower in more detail. Upon further research, the medicinal properties of fireweed were discovered. My decision to leave my car to explore the northern environment more closely on foot is significant and at the heart of this practicum. The highway provides a practical jumping off point to discover the healing properties and cultural values of the landscape.



Figure 3-1: Burge Lake, dock
Figure 3-2: Burge Lake, log

CHAPTER 3

RESTORATION

This section examines restorative measures in the landscape, through healing the environment and its people. The identification of the environment's restorative properties emphasizes its importance in the healing of residents, with specific reference to cancer patients travelling along PR 391. A case study of the once degraded landscape of a mine in Sudbury, Ontario guides the restorative steps to repairing the landscape of Fox Mine. My personal experience navigating mental health issues after my daughter's cancer diagnosis emphasizes the psychological restorative theories in personal health and is applicable to how the landscape surrounding PR 391 can begin to heal those who are commuting to healthcare. The expansion of Kaplan's steps of restorative theory begins to shape the design of the trail system and rest stops along PR 391.

This section is divided into four parts:

1. Restorative Landscapes
2. Restoration of Land
3. Out of Sight - A Survivors Perspective
4. Restoration for People

RESTORATIVE LANDSCAPES

RESTORATIVE LANDSCAPES Restoration is the process of assisting the recovery of health, regarding the environment and individuals, that have been degraded or damaged (Society for Ecological Restoration, 2021). By improving the conditions of the northern environment's degraded landscapes, ecological restoration can begin, and psychological methods of restoring the body can be discovered and applied. Landscape architecture can act as the bridge between restoring the landscape and its people.

Design aids in the healing of the environment and guides those seeking its natural healing properties. Studies of the relationship between green space and health show that having green space near one's home can protect people from the negative health implications of stressful events, and conversely, restricting access to green space may increase people's vulnerability to stress (van den Berg et al., 2010). Stress management studies show that natural environments that are dominated by green vegetation exhibit relatively high success rates in restoring human health (Berto, 2014).

Through the recovery of depleted resources, restoration can improve the physical and mental health of individuals during cancer treatment. Bernardine Cimprich, professor and researcher at Michigan College, studied alterations of cognitive development in cancer patients and peoples experiences (Ackerman, 2020). Cimprich found those with cancer who spent time in natural environments showed improvement in overall health and returned to daily living earlier than cancer survivors who were not immersed in nature, thus, regaining their quality of life quicker (Ackerman, 2020).

Restorative landscapes are also known as therapeutic and healing landscapes as they relate to healthcare (Gesler, 2003). Wilbert Gesler, a medical geographer and author of *Healing Places* (2003), discusses restorative theories of landscapes and how they affect humans' physical, mental, spiritual, and emotional health, placing

critical attention on the design and creation of landscapes to bring about healing. Gesler shows that place and healing are inherently linked, and for therapeutic landscapes to work, they require environmental, individual, and societal factors that can aid in the healing process (Gesler, 2003).

Well-designed therapeutic landscapes are proven to reduce stress, inspire emotional stability, and support recovery of health (Therapeutic Landscapes Network, 2021). This information is critical to understanding the value of people's relationship with the environment and to incorporate current practices into the regional setting of northern Manitoba. These same restoration practices in landscapes can restore the human body by providing a sense of security, identity, and connection to family, and creating aesthetically pleasing experiences (Therapeutic Landscapes Network, 2021).

Serving as sanctuary, a place of refuge, and a place of healing, the northern landscape surrounding PR 391 is an

example of a restorative landscape with a connection between land and health (Therapeutic Landscapes Network, 2021). The designing of restorative spaces in this landscape can promote wellness, ecotourism, and a more meaningful connection to nature. These natural environmental settings in Manitoba are the unique landforms, bedrock, flat and flowing waters, and the growth of healthy native vegetation. Connecting with the northern environment and fostering a personal relationship with open space, culture, and beliefs are imperative to the experience of healing both the physical and mental well-being of the people driving along PR 391 (Therapeutic Landscapes Network, 2021).

RESTORATION OF THE LAND

RESTORATION To restore the health of the mined landscape of Lynn Lake, there must be restoration efforts made to the scarred landscape. In northern Manitoba, landscape architecture can provide a bridge to connect the post-mine landscape with the need for environmental protection measures, forming a framework for a designed environment. Landscape architecture can analyze, plan, design, manage, and nurture the environment surrounding PR 391, and bring to fruition a landscape that balances the ecological, environmental and socio-cultural values of the North. In coordination with ecologists and the incorporation of ecological restorative techniques such as remedial planting concepts, landscape architects create sustainable landscapes and environments that encourage positive responses in people's physical and mental health (Society for Ecological Restoration, 2021). These techniques, applied to regional planning, produce functional public spaces and are a precedent for the restorative design of the mined landscape of Lynn Lake, in particular to the post-exploited environment of Fox Mine.

The damage that Fox Mine has left in the physical environment has destroyed the natural restorative properties of the landscape, reducing the potential for coping resources for residents, thus perhaps heightening personal stress levels. Restorative environments are achieved when natural landscapes provide resources of self-efficacy, resilience, and adaptive resources that provide solutions for managing self-processes such as stress (Berto, 2014). With the completion of restoration measures, the landscape should enhance forest ecology, encourage pollinators, provide healthy habitats for fish and wildlife, and ensure safe environments in which people may live (Berto, 2014). Relevant types of restorative features for the site include constructed wetlands, neutralizing soil conditions, and revegetation of degraded landscapes.



Figure 3-3: Duck family at Burge Lake.

CASE STUDY OF SUDBURY, ONTARIO

A DESTRUCTIVE LANDSCAPE REVIVED Sudbury, Ontario hosts Canada's largest and oldest nickel mining site. Sudbury's landscape, like Fox Mine, has resembled a moonscape of barren land resulting from decades of various environmental factors of industrial exploitation (Smith, 1996). The area of the post-mined landscape has experienced acid rain, biodiversity decline, vegetation dieback, and massive soil erosion due to the mining process for ore minerals and metals (Smith, 1996). Over many years, tailings from the ore mine have released sulphur contaminants that acidified the soils, rendering it inhospitable to tree growth (Smith, 1996). The toxic by-products of the ore mineral, such as sulphur and arsenic, leached into the wetlands, creeks and lakes of the area (Smith, 1996). The removal of these contaminants from soils is a long, difficult, and expensive process, but necessary

for environmental restoration, as they have severe effects on animals feeding within the area (Smith, 1996).

In 1969 the effects of contaminants on the health of the Sudbury landscape and human health alarmed the surrounding community, sparking a demand for restoration (Smith, 1996). Previous to 1969, explorative measures showed germinating seeds died on contact with the soils, leaving thousands of tree plantings unsuccessful (Winterhalder, 1996). After pressure from the community, more explorative measures were taken and lime was applied to the site and the neutralization of the soil was successful, giving rise to a thriving landscape of grasses and clovers (Winterhalder, 1996).

FIRST SUCCESSION PLANTS

Metal Tolerant Grasses

Caribou Lichens *Cladina rangiferina*

Tickle Grass *Agrostis hyemalis*

Moss *Pohlia nutans*

Tufted Hair Grass *Deschampsia cespitosa*

Redtop *Agrostis gigantea*

Canada Blue Grass *Poa compressa*

Ovales *Carex aenea*

Wool Sedge *Scirpus cypernius*

Willows (Balsam, prairie, meadow, shining)
Salix (pyrifolia, humilis, gracilis, lucida)

Rattle Snake Grass *Briza Maxima*
Glyceria canadensis

Peatland

Cattails *Typha latifolia*

Broadleaf Plants

Sheep Sorrel *Rumex acetosella*

Horsetail *Equisetum arvense*

Wood Horsetail *Sylvaticum*

Bog birch *Betula pumila*

Aquatic Environment

Algae

SECOND SUCCESSION PLANTS

Metal Tolerant Grasses

Wavy hairgrass *Deschampsia flexuosa*

Poverty grass *Dantonina spicata*

Roce grass *Oryzopsis asperifolia*

Woody Species

Red Maple *Acer rubrum*

Trembling Aspen *Populus tremuloides*

White Birch *Betula papyrifera*

Large Conifers

Jack Pines *Pinus banksiana*

Late Colonists

White Spruce *Picea glauca*

Black Spruce *Picea mariana*

Blueberry *Vaccinium angustifolium*

Red Elderberry *Sambucus racemosa*

Northern Wild Raisin *Viburnum cassinoides*

(Winterhalder, 1996)

Once these fields were well established, wildflowers, shrubs, and softwoods of birch and poplar began to grow in succession (Winterhalder, 1996). Today the landscape of Sudbury has been restored to a wetland and wildlife sanctuary (Smith, 1996). Amongst the positive initiatives of the restoration program was the creation of green job opportunities (Smith, 1996). These job opportunities affirm that the restoration purposes aided in the transformation of the environment and also benefitted the socio-cultural values of the landscape. As a result of the restoration efforts, the company Vale, who owned the land, began to change how they handled the air pollutants that were causing damage to the landscape (University of Winnipeg, 2016). Additionally, Vale furthered the reclamation process by initiating a tree-planting program and wastewater treatment to reduce emissions and control acidity in the area

(University of Winnipeg, 2016).

In the past 25 years Sudbury's landscape has been transformed, and is the largest successfully restored landscape in the world (Hudson, Fox and Plumlee, 1999). Sudbury is an example of a scarred landscape, that despite its historically degraded condition, restoration has been effective in bringing the environment back to a healthy, even thriving, condition. Sudbury's situation creates a standard to meet the demands of mineral and metal exploration and satisfy the expected increased demands for environmental protection, offering a precedent that can be explored for Fox Mine and the environment surrounding Lynn Lake. By restoring the northern Manitoba environment, we can begin to restore the people's connection to the land.

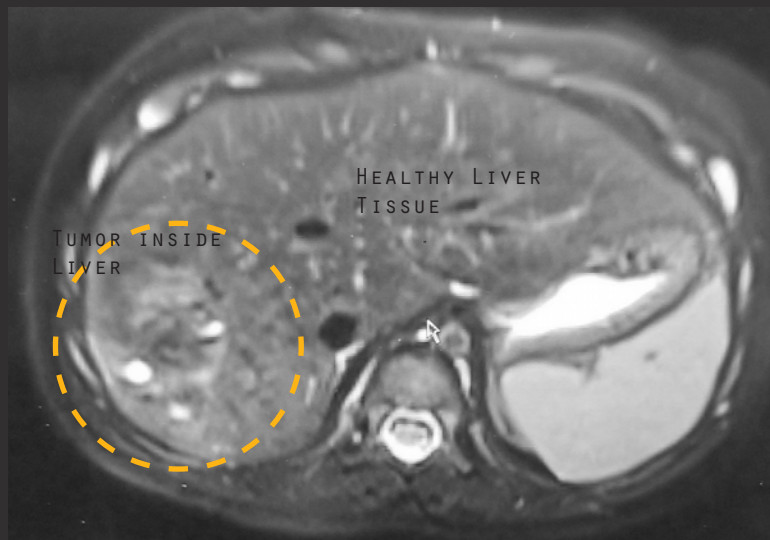


Fig 3-4: Leah's tumor (2).

OUT OF SIGHT

A SURVIVORS PERSPECTIVE

Following months of treatment and four chemotherapy cycles, Leah's tumor (located inside her liver) was significantly smaller and she was approved for her liver resection surgery. On July 22nd 2019, fifty percent of her liver and the remaining tumor were removed. Her abdomen, a human pin cushion as the medical staff called it, would slowly begin to heal and required our family to stay in the Pediatric Intensive Care Unit (PICU) for one week. After surgery treatment continued with two clean-up chemotherapy cycles to ensure all cancer cells were destroyed.

On September 9th, 2019 Leah's MRI registered no evidence of disease and she was considered to be in remission.

During Leah's journey we learned that the chemotherapy had damaged her hearing, leaving her with permanent high frequency hearing loss. This has broadened the healthcare resources required beyond that of cancer treatment and shifted towards other

specialized care such as audiologists and speech therapists.

After Leah finished treatment I began to show signs of post-traumatic stress disorder (PTSD) with symptoms of anxiety, muscle weakness, and paranoia leading to panic attacks. With no more stays at the hospital, there was no longer the constant reassurance that Leah's health was moving in a positive direction. With fewer tests and imaging, what was happening internally for Leah remained out of sight, and I was fearful of not recognizing the signs of a relapse.

It is very common for patients and caregivers to develop PTSD upon finishing treatment. It is called a "thawing of emotions", and it is due to an individual's adrenaline causing the "fight or flight" response. When the individual experiences trauma, their overall mental state "freezes" in order to focus on the task at hand. The physical health of the patient and their care

becomes all-consuming, at the expense of mental health.

For me, walking became a therapeutic outlet, both during treatment and afterwards. Walking during treatment gave us a few precious opportunities to be outside and take in the sunlight and fresh air. Through my education in landscape architecture, I had a rudimentary understanding of Kaplan's Restoration Theory, and continued to explore the theory in more detail as I dealt with Leah's and my own health issues. I applied these techniques to my own therapy and journaled how each step was achieved through a road trip to the Whiteshell in Manitoba. During my trip I practiced each restorative step through various activities such as sitting by a campfire, hiking, fishing, and reflecting in the natural forested environment. These achievements would become the overall design ideas for the rest stops along PR 391.

A photograph of a man in a dark shirt, shorts, and a red cap fishing from a wooden dock on a large body of water. The dock is made of wooden planks and extends from a grassy shore into the water. The background shows a vast expanse of water and a distant, hazy shoreline with trees under a clear sky.

RESTORATION FOR PEOPLE

RESTORATION THEORY In 1980, environmental psychologists Rachel and Stephen Kaplan outlined the Attention Restoration Theory through their research into the relationship between humanity and nature (Ackerman, 2020). The restoration theories methodology restores attention, priorities, and goals, accompanied by taking steps towards reflection on life (Pansnen et al, 2018). Further studies of restorative therapies have proven that natural settings can induce sensations of tranquility in patients (Pansnen et al, 2018).

Kaplan's Restoration Theory identifies four sequential steps to restoring oneself. These steps are identified as Clear Headed Mind, Mental Fatigue Recovery, Soft Fascination, and Reflection, and they follow the states of attention that (in theory) individuals need to experience in order to achieve restoration (Ackerman, 2020).

Figure 3-5: Ryan fishing at Burge Lake.

1. CLEAR HEADED MIND

The first step, a clear-headed mind, proposes that when worries and emotions are allowed to surface and then be released, it improves focus and ability to concentrate (Ackerman, 2020). The theory states that by spending time in nature, or looking at nature, a person can increase feelings of joy and release emotions and improve the state of mind (Pansnen et al, 2018).

2. MENTAL FATIGUE RECOVERY

Mental fatigue recovery focuses the mind to recover after physically exerting activities, and through this step the idea is to improve and direct attention effectively (Ackerman, 2020). Examples of activities that exert energy in the landscape are activities that induce an increase in heart rate such as advanced hiking and cycling. In northern Manitoba, the many foot-hills and eskers of the landscape set the stage for more vigorous cardiovascular activities.

3. SOFT FASCINATION

Through soft fascination via low-stimulating activity, the body reduces internal noise and creates space for relaxation and replenishing the health of the mind (Ackerman, 2020). Examples of low-stimulating activity in Manitoba are guiding a canoe or kayak or fishing among the many rivers, lakes, and wetlands of northern Manitoba.

4. REFLECTION

Reflection is central to the recovery method of the restoration theory because it causes positive changes in an individual's emotional state (Ackerman, 2020). Research shows that engaging with nature helps to improve overall health and spending long periods in natural environments can aid in recovering from stress (Pansnen et al, 2018).

Restoration Theory describes the potential for nature to improve a person's state of mind and informs opportunities for guiding people to rest, reflect, and restore (Pansnen et al, 2018). In Kaplan's theory, a certain kind of environment can facilitate the recovery of depleted resources in humans (Ackerman, 2020). Applied to northern Manitoba, these theories lead to considerations of how the landscape can renew attention through the natural characteristics of the boreal forest.

In Winnipeg, these vast areas of potential restoration are not readily accessible and alternatively people in cities and peri-urban areas have access to smaller-scale parks. The problem of the metropolis area is an increased level of stimulation that is typical of the urban environment that places taxing demands on residents who experience cognitive overload (Berto, 2014). Manitoba's northern landscape provides an opportunity for a unique, undeveloped setting that allows Kaplan's steps to create an impactful restorative state in an individual's healthcare journey.

CONCLUSION

The integration of restorative measures and the application of successful landscape revival can aid in restoring the overall health of the environment and, together with restorative and spiritual healing practices, can benefit the physical and mental health of cancer patients and caregivers. To benefit from the healing powers of the landscape, the time spent in the natural environment does not need to be a conscious effort; the environment only needs to be accessible. Landscape architects can design for the accessibility of pathways that facilitate an exploration of emotions and an exchange of spirit between humans and the landscape.

PR 391 has become a lifeline for those travelling along the route for healthcare. With principles of restoration and Indigenous practices, a design along the highway can aid in the ability for cancer patients to access and experience the surrounding landscape during the repetitive and monotonous commute to healthcare. The highway then transforms from a void space between home and treatment and becomes a designed environment of health and wellness that aids in reflection and restoration. The land surrounding the highway is sacred land in Indigenous culture, and a community-driven landscape. It is important to preserve the quality of landscape for the environment and the healing powers it possesses in Indigenous cultures.

For those travelling along PR 391 the confined space of the car keeps commuters from interacting with each other. A design for a trail and rest stops along the route of PR 391 draws travellers out into the landscape, and creates opportunity for exchanges with the environment and other travellers.



Figure 4-1: Sunset along PR 391.

CHAPTER 4

MAPPING VALUES

Guided by the value systems of McHarg (1992) the layers of the north are revealed and are crucial to the balance of environmental, economical, and socio-cultural systems. In this practicum, the balance of these systems are revealed through the selected layers as they pertain to the health of northern communities, and can be further broken down into risk levels. Layers investigated include special interest zones such as previous forest fire sites, communities, and waterbodies of northern Manitoba.

Recognizing the economic, environmental, and socio-cultural values of northern Manitoba and integrating each value into a GIS mapping exercise, allows for the layering system of McHarg to provide context and inform design for a trail along PR 391.

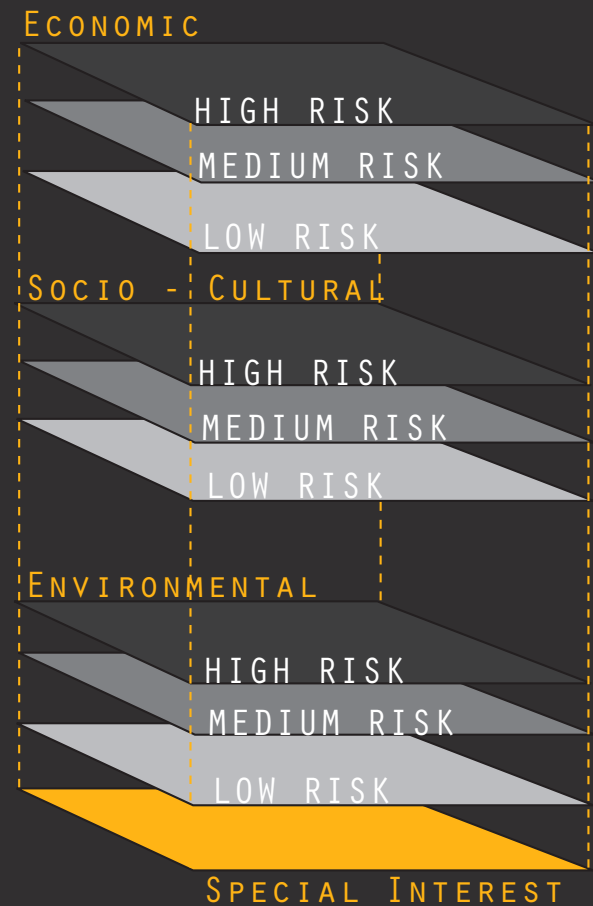
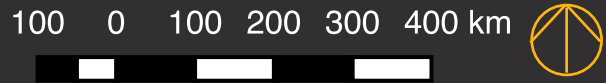


Figure 4-2: Diagram of layer risks and special interest areas.

ECONOMIC LANDSCAPES



ECONOMIC



CLASSIFICATION:







-  MINING CLAIMS AND LEASES
-  MINING LICENCED AREAS
-  DRILL HOLE SITES OF EXPLORATION
-  WATER POWER RESERVE AND INDIGENOUS AGREEMENT PERMITS
-  WASTE WATER TREATMENT FACILITIES
-  POWER CORRIDOR AND TRANSMISSION LINES

Figure 4-3: GIS map showing mining claims.

Figure 4-4: GIS map showing mining licence.

Figure 4-5: GIS map showing drill hole sites.

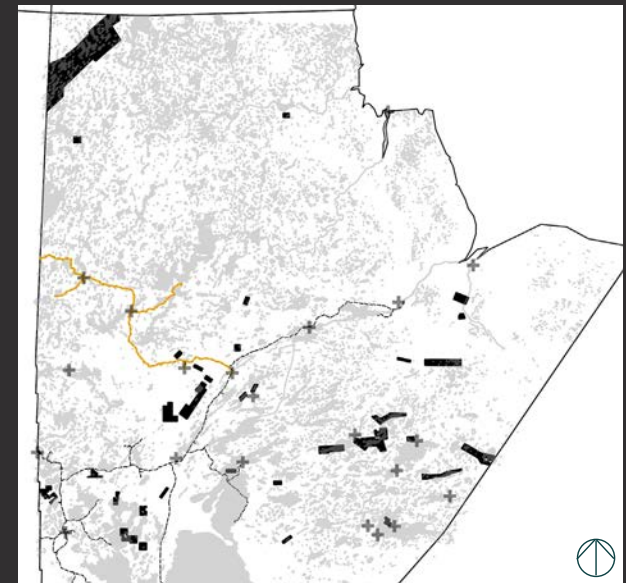
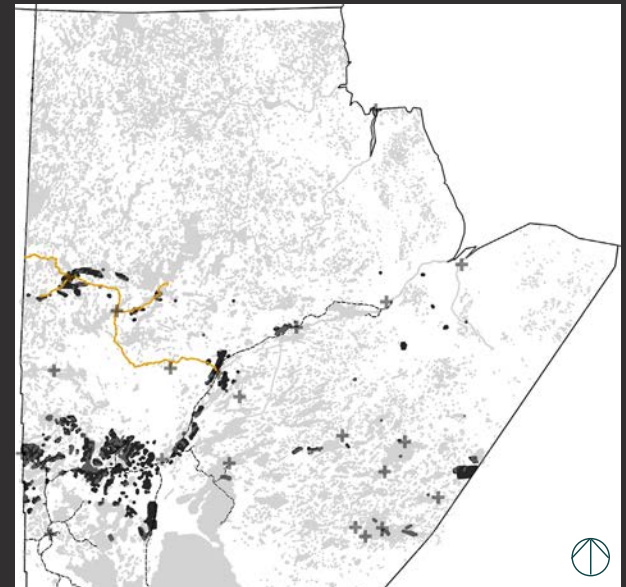
Figure 4-6: GIS map showing water power reserve and Indigenous agreement permits.

Figure 4-7: GIS map showing waste water treatment facilities.

Figure 4-8: GIS map showing power corridor and transmission lines.

MINING CLAIMS AND LEASES

HR

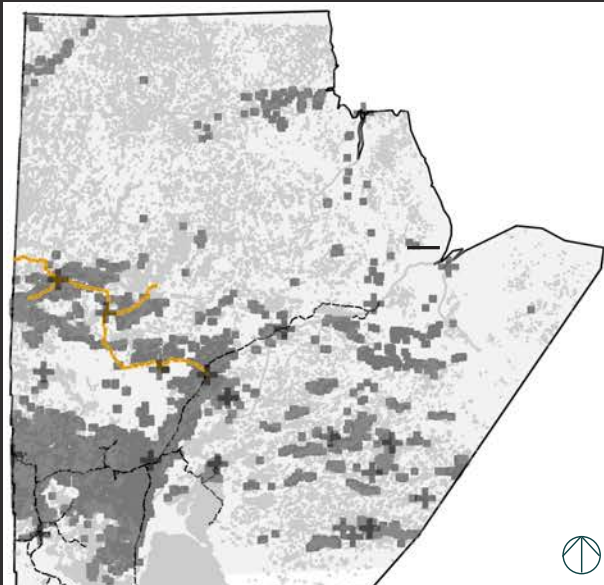


MINING LICENCED AREAS

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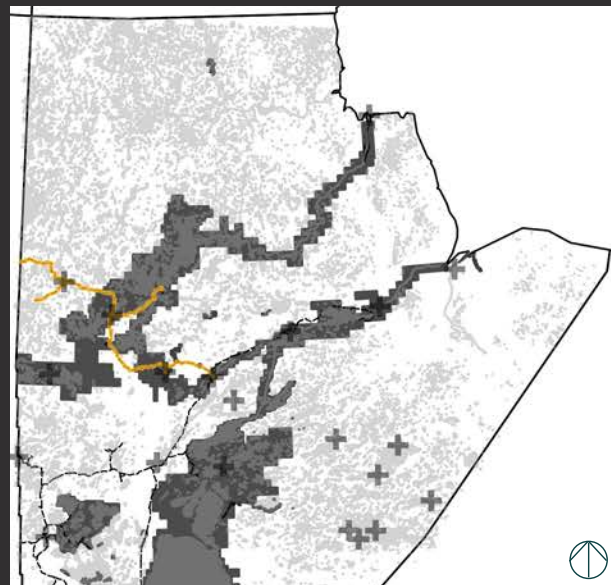
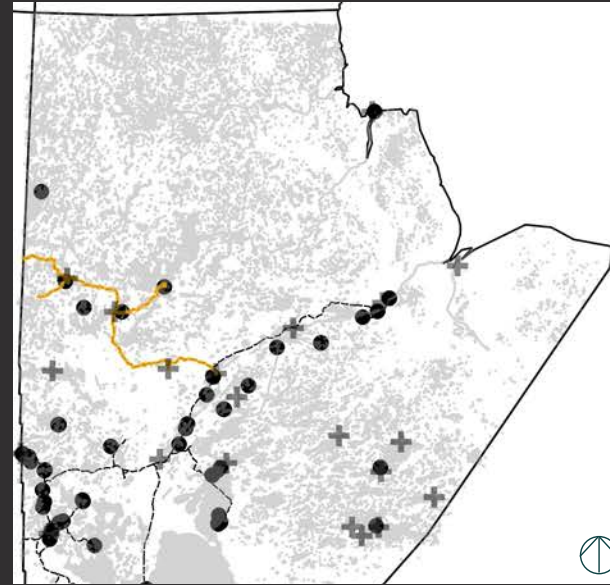
DRILL HOLE SITES
OF EXPLORATION

MR



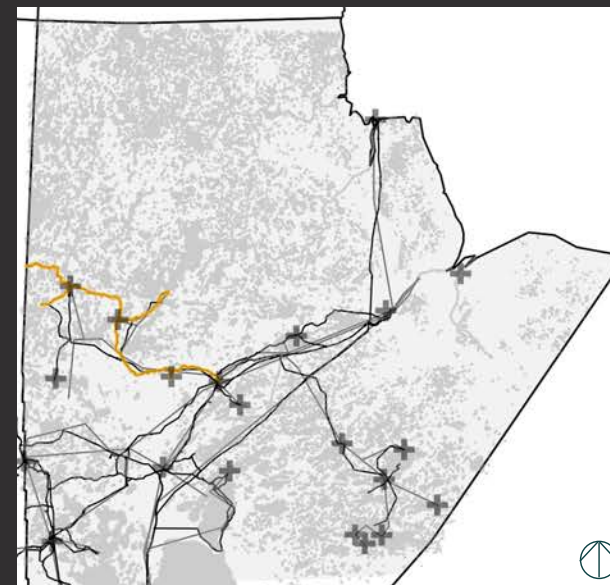
WASTE WATER TREATMENT
FACILITIES

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WATER POWER RESERVE AND
INDIGENOUS AGREEMENT
PERMITS

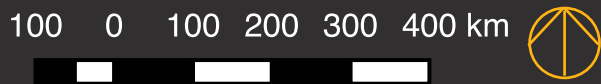
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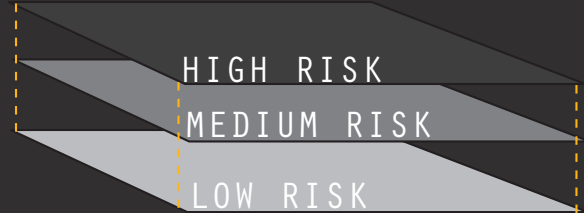
POWER CORRIDOR
AND TRANSMISSION LINES

HR

LANDSCAPES OF SOCIO-CULTURAL SIGNIFICANCE



SOCIO-CULTURAL

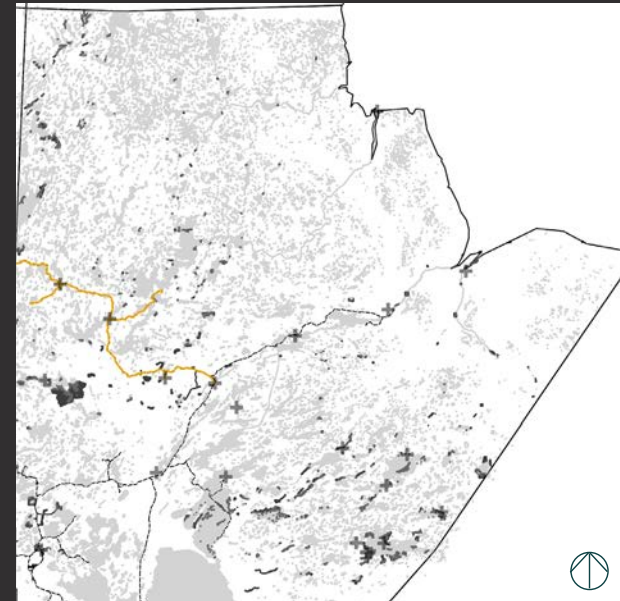


CLASSIFICATION:

-  RESERVE LANDS
-  INDIGENOUS COMMUNITY INTEREST ZONES
-  TRANSPORTATION
-  NORTHERN COMMUNITIES
-  TRADITIONAL LAND ENTITLEMENT
-  PROTECTED AREAS

- Figure 4-9: GIS map showing reserve lands
- Figure 4-10: GIS map showing Indigenous community interest zones
- Figure 4-11: GIS map showing transportation
- Figure 4-12: GIS map showing northern communities
- Figure 4-13: GIS map showing traditional land entitlements
- Figure 4-14: GIS map showing protected areas

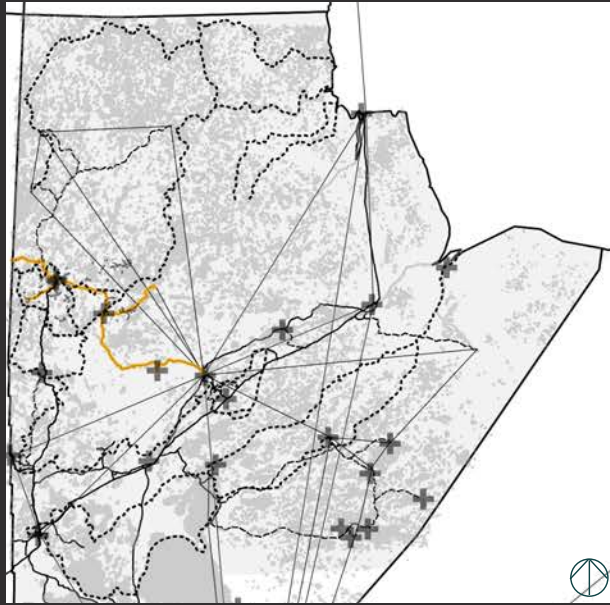
RESERVE LANDS HR



INDIGENOUS COMMUNITY INTEREST ZONE MR

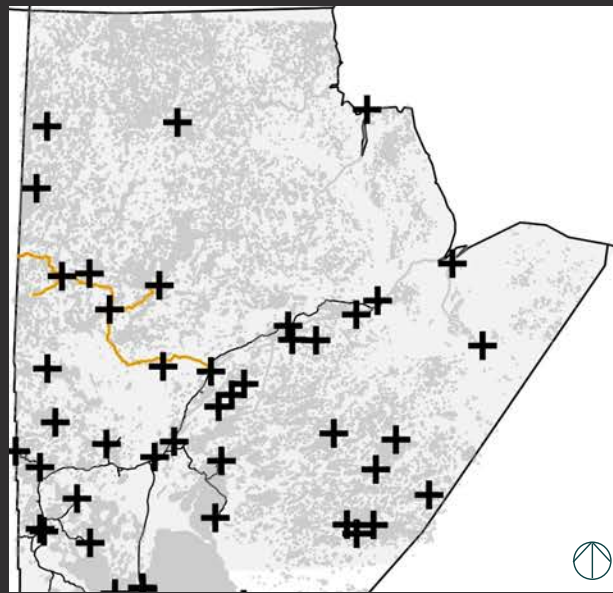
TRANSPORTATION

MR



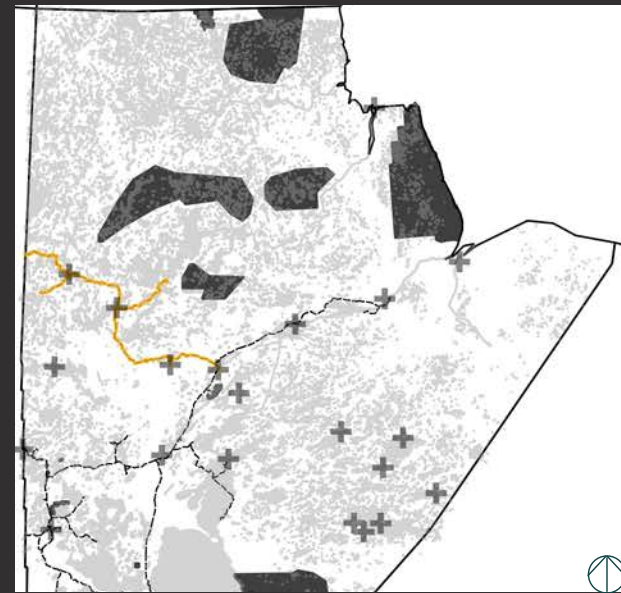
TRADITIONAL LAND ENTITLEMENTS

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NORTHERN COMMUNITIES

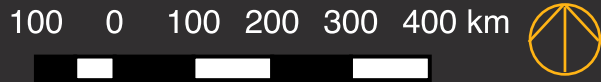
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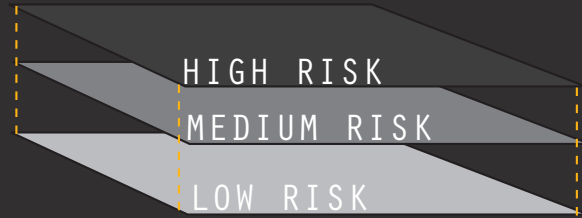
PROTECTED AREAS

HR







ENVIRONMENT SENSITIVE LANDSCAPES



ENVIRONMENT

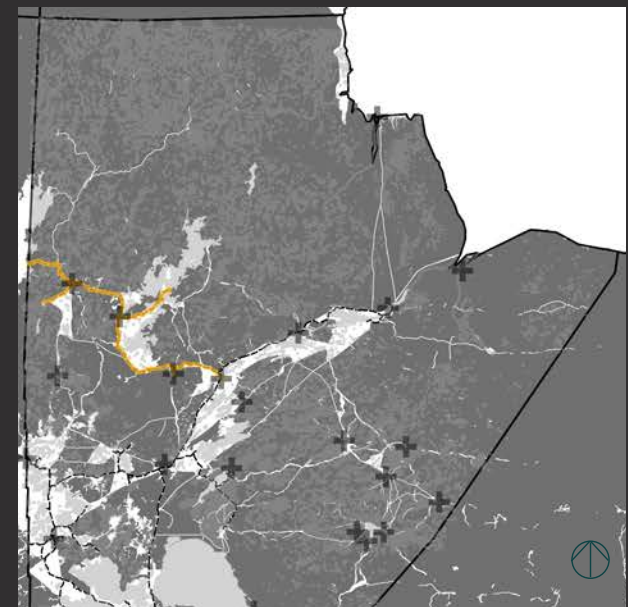
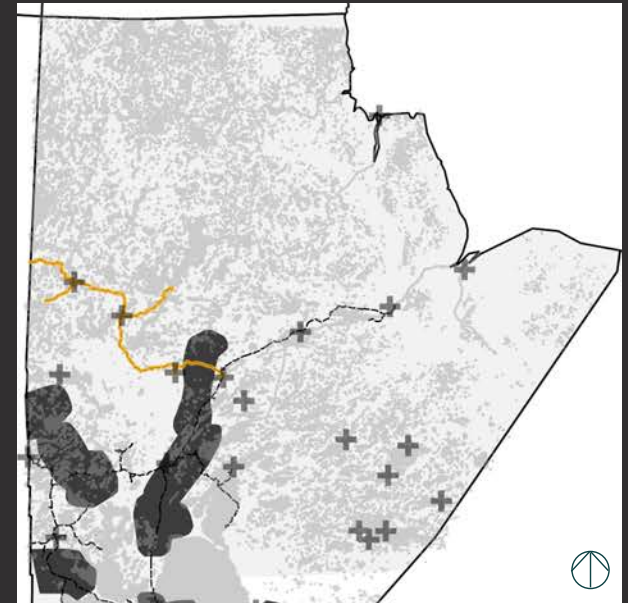


CLASSIFICATION:

-  CARIBOU MIGRATION RANGE
-  INTACT FOREST VEGETATION
-  CONTAMINATED SITES
-  WILD FIRES
-  RISK OF PERMAFROST THAW
-  SOIL STABILITY

- Figure 4-15: GIS map showing caribou range
- Figure 4-16: GIS map showing intact forest vegetation
- Figure 4-17: GIS map showing contaminated sites
- Figure 4-18: GIS map showing wild fires
- Figure 4-19: GIS map showing risk of permafrost thaw
- Figure 4-20: GIS map showing soil structure

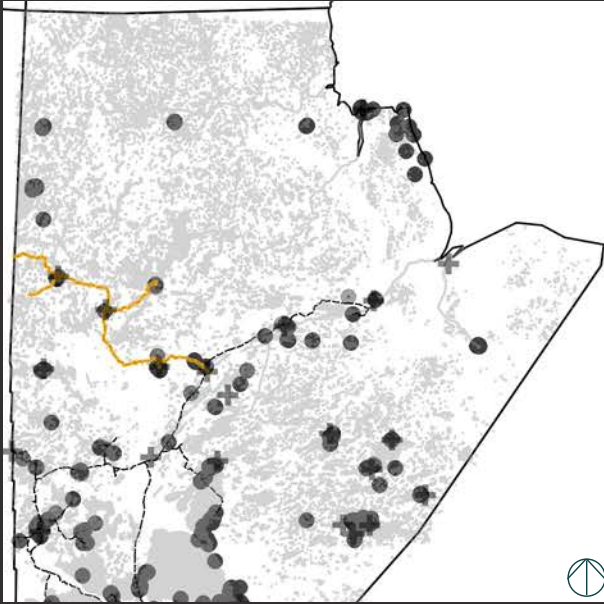
CARIBOU MIGRATION RANGES HR



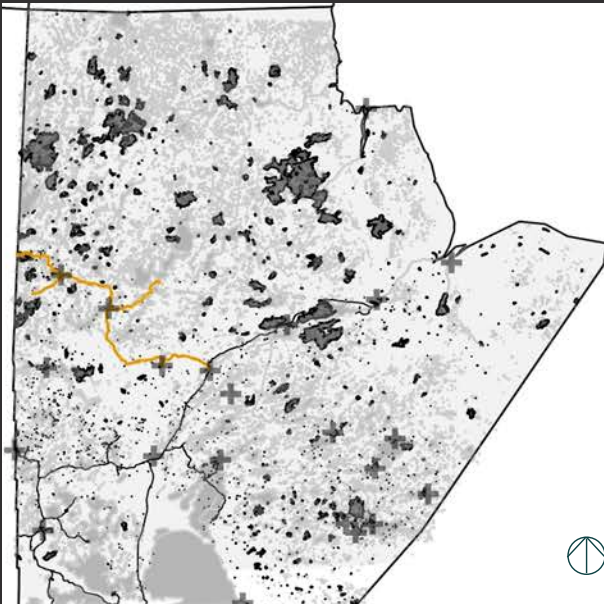
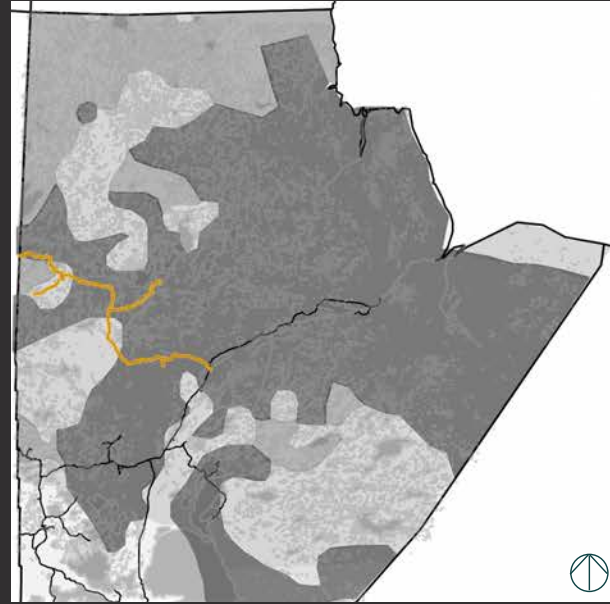
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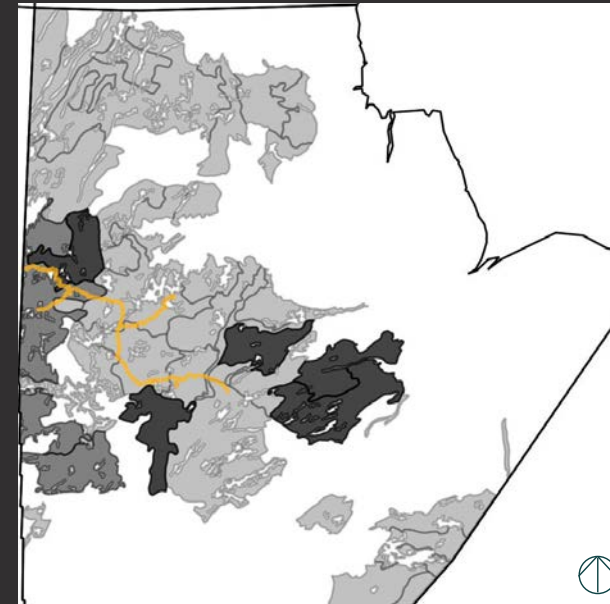
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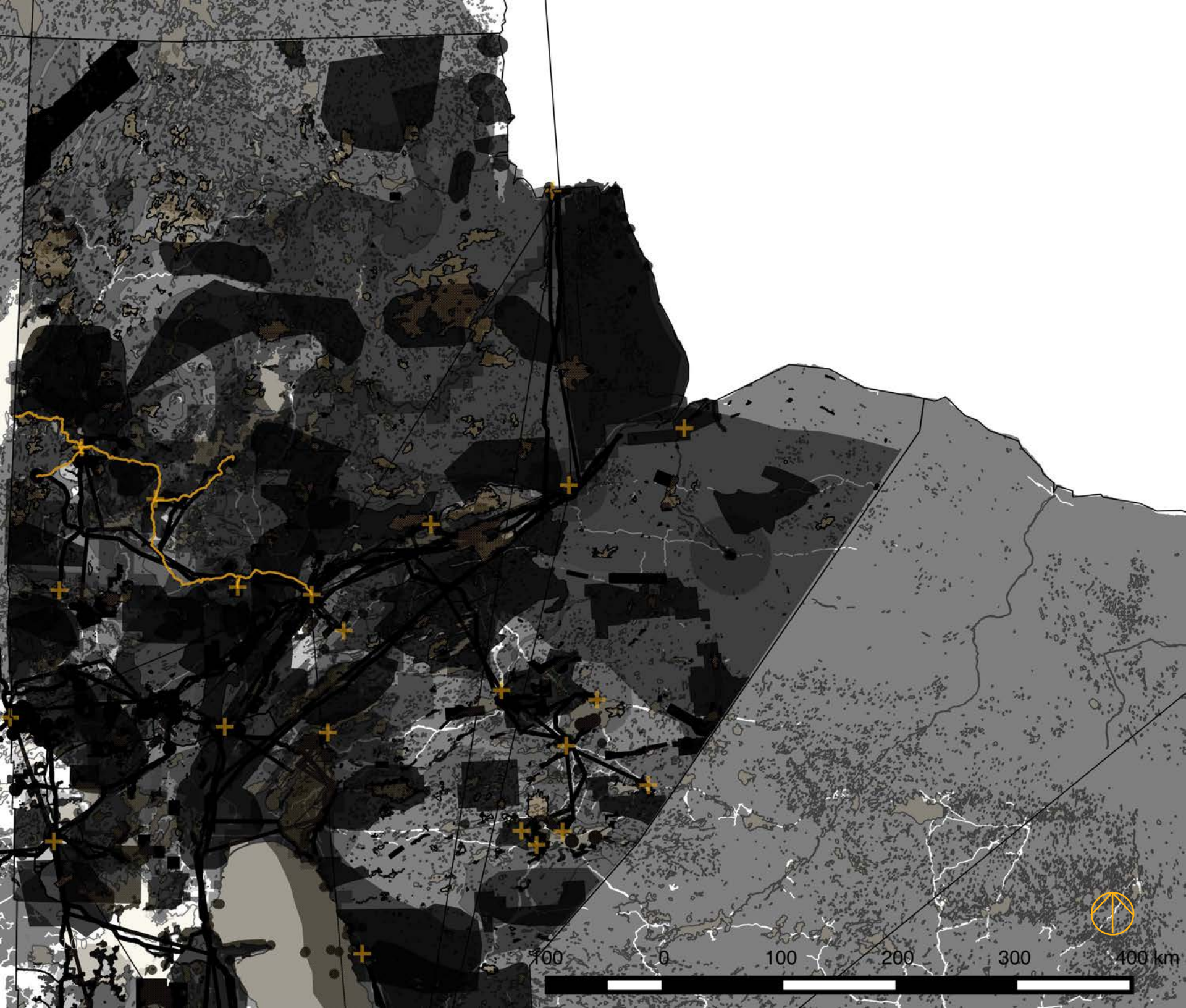
RISK OF PERMAFROST THAW



WILD FIRES SI



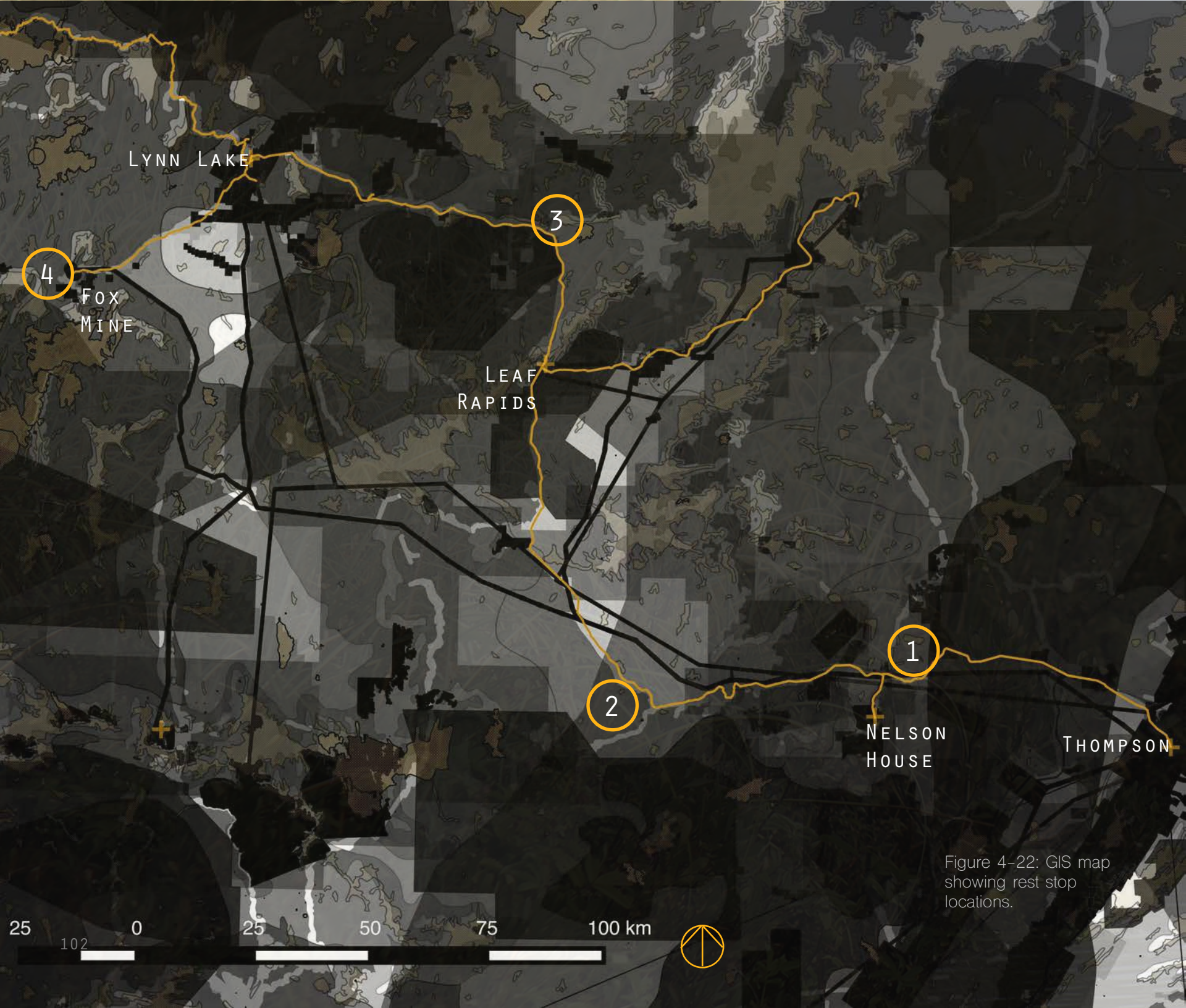
SOIL STABILITY HR
MR
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Applying Ian McHarg's theory, once all of the grey layers are superimposed with their risk factors, the ideal location for design is revealed. His views were that the lightest portions of the compiled map are the ideal spaces for design because they have the least number of factors acting upon them (McHarg, 1992). Upon further inspection, each risk factor can be used to inform the final design intention for the landscape and the consideration of risk factors depends on the type of design intervention implemented. Due to the overall low impact on the environment of the trail system and rest stops, features that would be considered at high risk to loss can be otherwise considered low risk. For example, the intact vegetation would be considered undesirable for invasive designs, but it is less impacted by a trail system that can work with present conditions of the site, and promote sustainability through material and placement. With consideration of amendments to the layers specific to this design and the knowledge of landforms and topography encountered while travelling the highway, the areas for the rest stops and trail system are formed.

Figure 4-21: GIS map showing all values.



LYNN LAKE

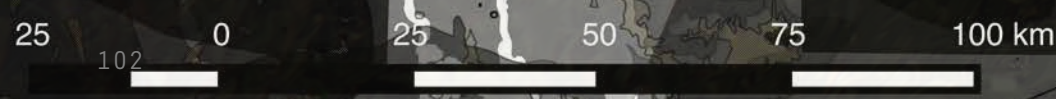
FOX
MINE

LEAF
RAPIDS

NELSON
HOUSE

THOMPSON

Figure 4-22: GIS map showing rest stop locations.



KEY CONSIDERATIONS

PR 391

The trails meet with the highway at various points as a reminder of the importance of the highway to the health of communities and to facilitate access to the trail at intermediate points.

Other Modes of Transportation:

Summer: Walking and Cycling

Winter: Snowshoes, Skiing

INDIGENOUS PRESENCE

The design intent recognizes a holistic view of healing, as well as the Indigenous culture of the region with an emphasis on Cree healing processes and the healing properties of the landscape.

**I acknowledge this is my personal view and it was not undertaken in collaboration with the communities of PR 391. However, if the implementation of the design were to progress, it would be very important to initiate collaboration with the communities prior to starting design. The design is a suggested starting point.*

RESTORATION THEORY METHODS

Restoration Theory methods are applied to each rest stop. Recognizing the steps to restoration for individuals physical and mental health.

HEALTH CONSIDERATIONS AND ACCESSIBILITY

Long and short routes are present within the trail system providing different levels of accessibility for different health journeys.

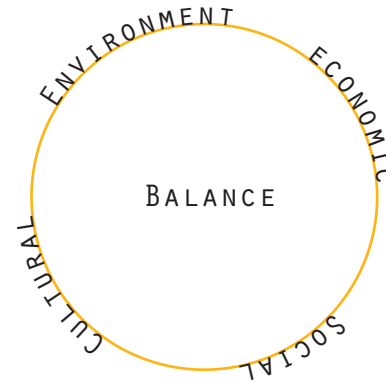


Figure 4-23: Diagram of the balance of value systems.

PATHWAYS

The pathways utilize the desire lines found in the landscape for accessibility to the northern environment to ensure minimal impact on the site. Types of pathways considered are compacted soil trails and boardwalks. These pathways are interchangeable depending on the level of protection and sustainability required for an area.

COMMUNITY

Important to the application of the design is working together with the communities surrounding PR 391 (Thompson, Nelson House, Leaf Rapids, and Lynn Lake). Viewpoints of the various users create a community of wellness along the trail system, as well as bringing economic benefit to the communities through ecotourism. It also has the potential to provide employment opportunities for people in the area during both the construction and maintenance phases of the trail development.



Figure 5-1: Pathways.

CHAPTER 5

DESIGN INTERVENTIONS

ALONG PR 391

CONNECTING PEOPLE TO LANDSCAPE

Through consideration of function and the application of innovation and intention, landscape design can facilitate interaction with the landscape for people travelling PR 391. A sensitive and considered treatment can reflect the sustainability, appropriateness, and attractiveness of the environment. Good design highlights the ecology of the environment and allows for humans to access nature in a safe and respectful manner. Pathways and trails play an important role in protecting habitats, native plants, and animals. They are an access point for humans and raise awareness of ecosystems and possess the potential to encourage proper care for the environment (Hike Ontario, 2021).

DESIRE LINES



COMPACT SOIL TRAIL

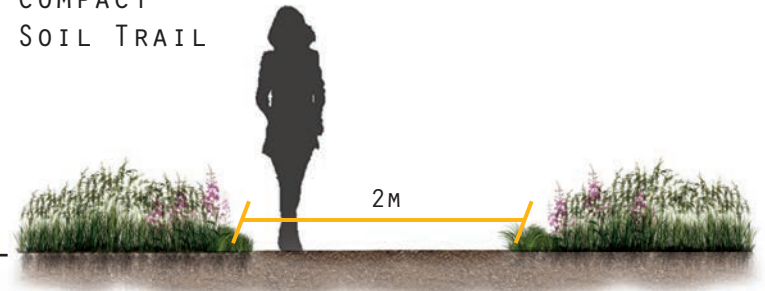


Figure 5-2: Diagram of desire paths.

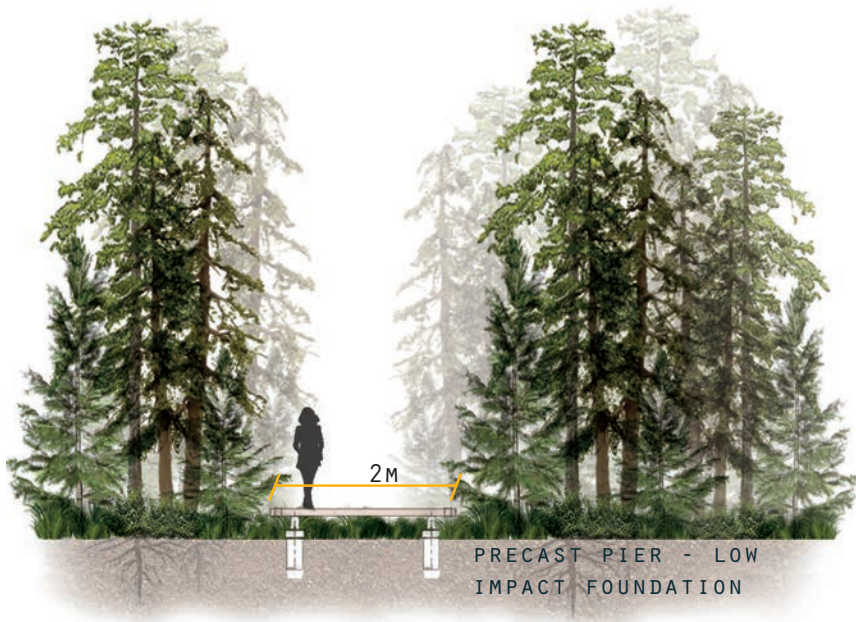
PATHWAYS

DESIRE LINES Desire lines, a natural form of pathways that are evidence of movement across the landscape, frame the environment surrounding PR 391. Tracks and trail routes left behind by humans and wildlife influence and contribute to the proposed pathways that occur in both large and small scales. Examples of trails are those that often begin by people following wildlife trails or old forestry roads that have become hiking, cycling, snowmobile and all-terrain vehicle (ATV) routes. These pathways form around and within the dense forest edges, in continuous fluid routes, and typically reveal the “path of least resistance”, a mixture of the accessibility of the land and opportunities to progress past obstacles (Bramley, 2018).

The desire line is a rare moment where diverse populations potentially converge, they are indicative of where people and wildlife have chosen to walk the same path at different times (Luckert, 2013). The desire lines of northern Manitoba are historical records allowing the past to directly inform present

travellers of the history of social use on the northern landscape for the purposes of hunting, fishing, trapping, and a sustenance existence.

The boreal forest presents a vast landscape where, through conscientious design, an emphasis can be placed on locally meaningful approaches to the environment, advocating for its protection and sustainability. Using the desire lines of the northern environment, the planning of the landscape may begin to frame a design that enhances the natural northern environment. The desire lines, where possible, will be used for the placement of the trail system and be expanded to accommodate foot traffic.



BOARDWALK TRAILS



Figure 5-3: Diagram of boardwalk.

MATERIALITY OF PATHS There is a change in a person's perception of a landscape depending on the surface material of a pathway. In the way that identifiable landforms can influence our experience, so too can the feeling of walking on non-uniform path materials such as grass, compacted soil, and autumn leaves (Therapeutic Landscapes Network, 2021). The general material of the trail system is composed of compacted soil, unless in an area where special considerations must be met due to environmental conditions or accessibility purposes.

The environment of the north is a landscape formed by eskers, wetlands, and dense vegetation, a variety of landforms that change the experience along the pathway. In areas where natural vegetation cannot be maintained or provide stable access to the environment, pathways can be designed to be integrated into the landscape with minimal change to the surface. For example, on the steep slopes of the eskers the pathway would curve between the slopes on the accessible inclines, utilizing rock surfaces and human-made railings

for safety. In areas of wetland and soft marshland, elevated boardwalks would protect the natural water systems. In areas of degradation, where larger coniferous trees are absent and succession species are emerging across the landscape, pathways may be elevated above the succession species by boardwalk in order to avoid disrupting the cycle of the forest recovery.

Working with the landscape, pathways then become intentionally designed elements that highlight the many beautiful attributes of the northern landscape. Ericka Luckert described pathways for landscape architects in *Mapping Desire Lines* in Edmonton (2013) as the opportunities for charting new territories and opening up paths to places that otherwise may not be visible or accessible. A designed pathway system along PR 391 it allows for the interaction of users with the landscape while managing the sustainability and ecological systems of the environment.

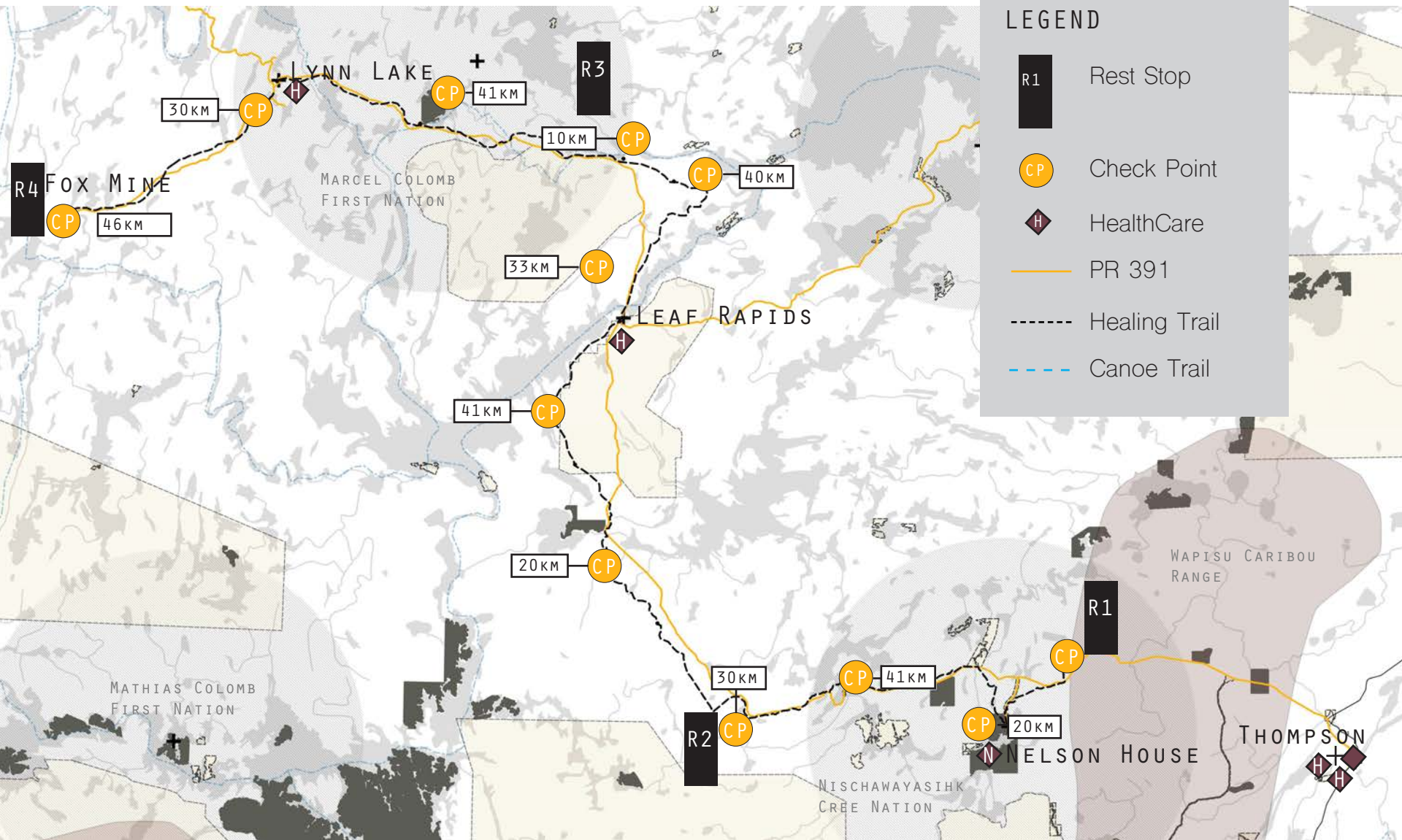


Figure 5-4: GIS map showing healing trail.



HEALTH AND WELLNESS TRAIL

THE HEALING TRAIL Pathways in landscapes are created for a multitude of reasons. They can have cultural or spiritual significance, such as the Camino De Santiago in Spain, or they can be designed to emphasize education, where trail markers can be found explaining historical and ecological importance. The common theme among pathways is the interaction between physical space and human beings, and the healing powers of the landscape. This healing power between landscape and people forms the basis of the design along PR 391.

Topophilia is a strong sense of place. This feeling can lead individuals to experience a sense of cultural identity or fondness for a certain aspects of said place (Ueyama, n.d.). Pathways may offer hope for a new life, or a renewed opportunity that makes humans feel better about life, themselves and their bodies. The extended path along PR

391 from Thompson to Lynn Lake presents itself like a spiritual path, embodying the idea of health, and healing in the landscape.

Accessibility along the site includes the incorporation of both short paths and long paths in order to service all individuals who are at in different stages of their health journey.

The full length of the healing trail is approximately an eleven day hike for those who are in the strongest stages of their health journey. The trail passes through different features of the landscape starting from the flat portion of the boreal forest with many patches of grassland, into the eskers characteristic of the boreal shield, around the many lakes and rivers of the north, and concluding at the degraded landscape of Fox Mine. This path includes wayfinding signage, and informative signs for check stops for each day of the journey.

SIGNAGE

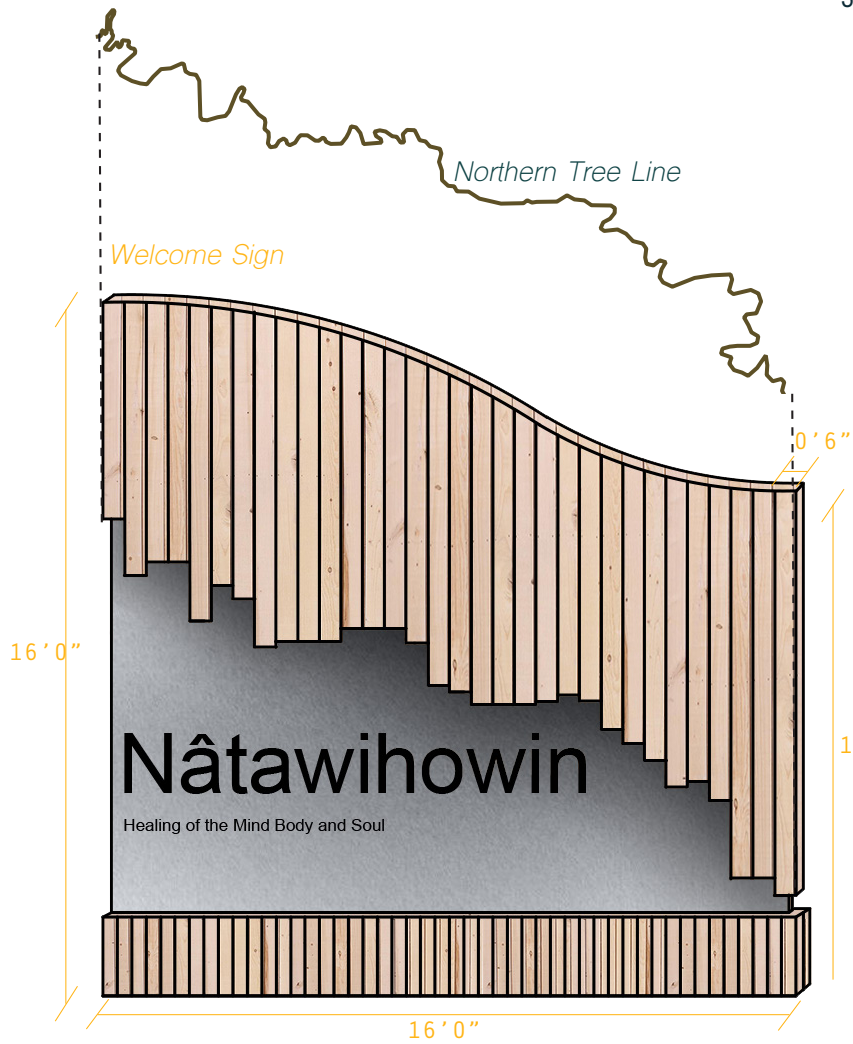


Figure 5-5: Diagram of signage along trail.

SIGN ANCHORING DETAIL



Fig 5-6: Diagram of sign detail.



Informative Signs

Wayfinding Signs

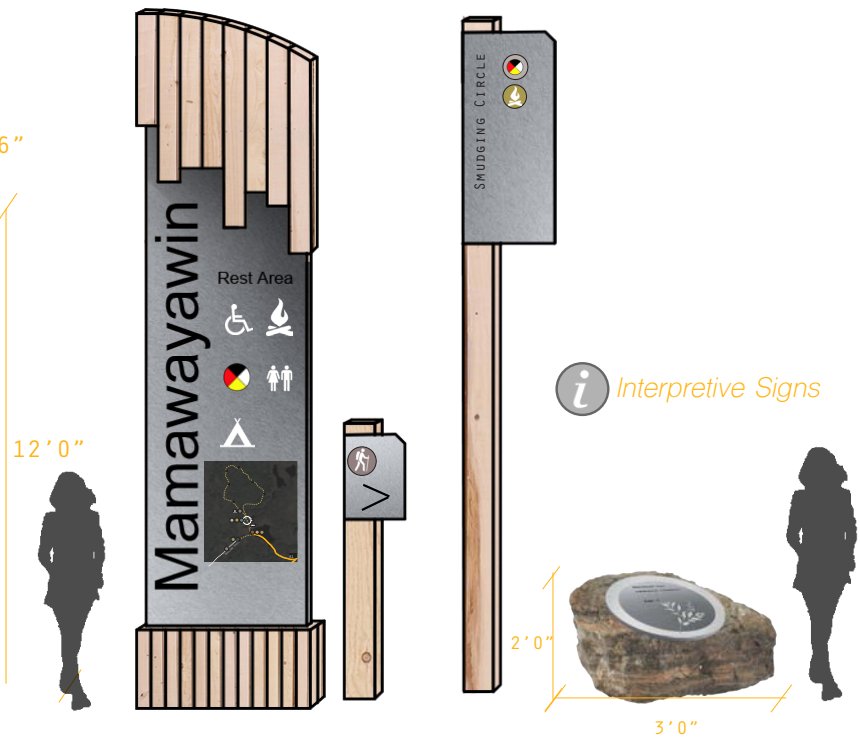


Figure 5-7: Welcome sign.



Wayfinding and interpretive signage was designed for the rest stop sites and at strategic points along the trail. In addition, a larger “welcome” sign was included to greet people arriving at the start of the trail at either end, as well as each rest stop site along the route.

WELCOME SIGN The geometry of the welcome signs is derived from the border of the Northern Health Region, approximated and abstracted in a meandering line across the surface. The materials chosen, pine and brushed nickel, are a reference to the predominant materials found above and below the ground plane of the landscape, while the placement of the pine boards above recognize the outlines of the northern tree line. The pine boards are installed over top of the brushed nickel to emphasize this layering of the surface materials, with the nickel exposed in the same way this non-renewable resource is exposed during mine exploration.

INFORMATIVE SIGNS Informative signs are located at the beginning of each rest stop trail, giving an overview of the restorative and healing practices that are programmed at each site. Materiality is similar to the approach used for the welcome sign.

INTERPRETIVE SIGNS Interpretive signs are printed on brushed nickel in keeping with the palette of materials, and then fastened to flat topped granite boulders found throughout the landscape. Each interpretive sign location is strategically chosen to explain a specific aspect of the site and it's environment or a key feature visible nearby.

WAYFINDING SIGNS Found throughout the landscape are two size wayfinding signs. The larger placemarking signs signify to trail users when they have reached a programmed site/rest stop as part of the formal healing process. Smaller wayfinding signs with a similar aesthetic help to guide travelers along the trail.

PROGRAMMING



PARKING

Parking is located at each rest stop entrance and follows the same material choices as PR 391 with gravel and aggregate compounds.



ACCESSIBILITY

Each rest area trail is equipped with accessible routes. The understanding that those on a healing journey have different levels of energy, or may need require wheelchairs to access the site.



TRAIL

Trailhead markers note the directions of the pathways and inform the travellers of how many kilometers are left before the next rest area.



INTERPRETIVE SIGNS

Interpretive signs are fastened to boulders found throughout the landscape, each interpretive sign strategically chosen to explain a specific aspect of the site and its location.



FIRE PIT AND COMMUNITY AREA

At rest stop one a fire pit and community area is at the beginning of the trailhead. This community area is to be utilized by travellers, and community members, at the beginning and the end of the journey.



INCLINE TRAIL

Rest stop two is located within the rocky eskers characteristic of the northern environment. One trail at this rest stop requires high cardio activity.



CHECK STOP

Each checkstop spot is located between 30–40 kilometers (approximately one marathon). These areas are equipped with food storage containers, however it is up to the traveller to create accommodations.



BENCHES

Benches are located every 250 meters along the rest stop trail loops.



FORMAL CAMPING

At each rest stop area is a formal camping area. These camping areas are located close to a trail head, and washrooms are provided. Each formal camp ground is located near a body of water.



WASHROOM FACILITY

Washroom facilities are only located at rest stop areas.



FISHING/ ICE FISHING

There are many lakes and rivers along PR 391 and at rest stop three the trail leads to a designated fishing area, part of the third phase of restoration theory. This lake is also part of the provincial canoe route.



CANOE ROUTE

The provincial canoe route can be accessed by multiple spots along the trail, however it is marked at the third rest stop as it is part of the phase of restorative theory.



INDIGENOUS HEALING PRACTICES

Each rest stop hosts part of the Indigenous healing processes for disease and ailments. These areas consist of smudging circles, ceremonial circles, healing rituals, and sweatlodges.



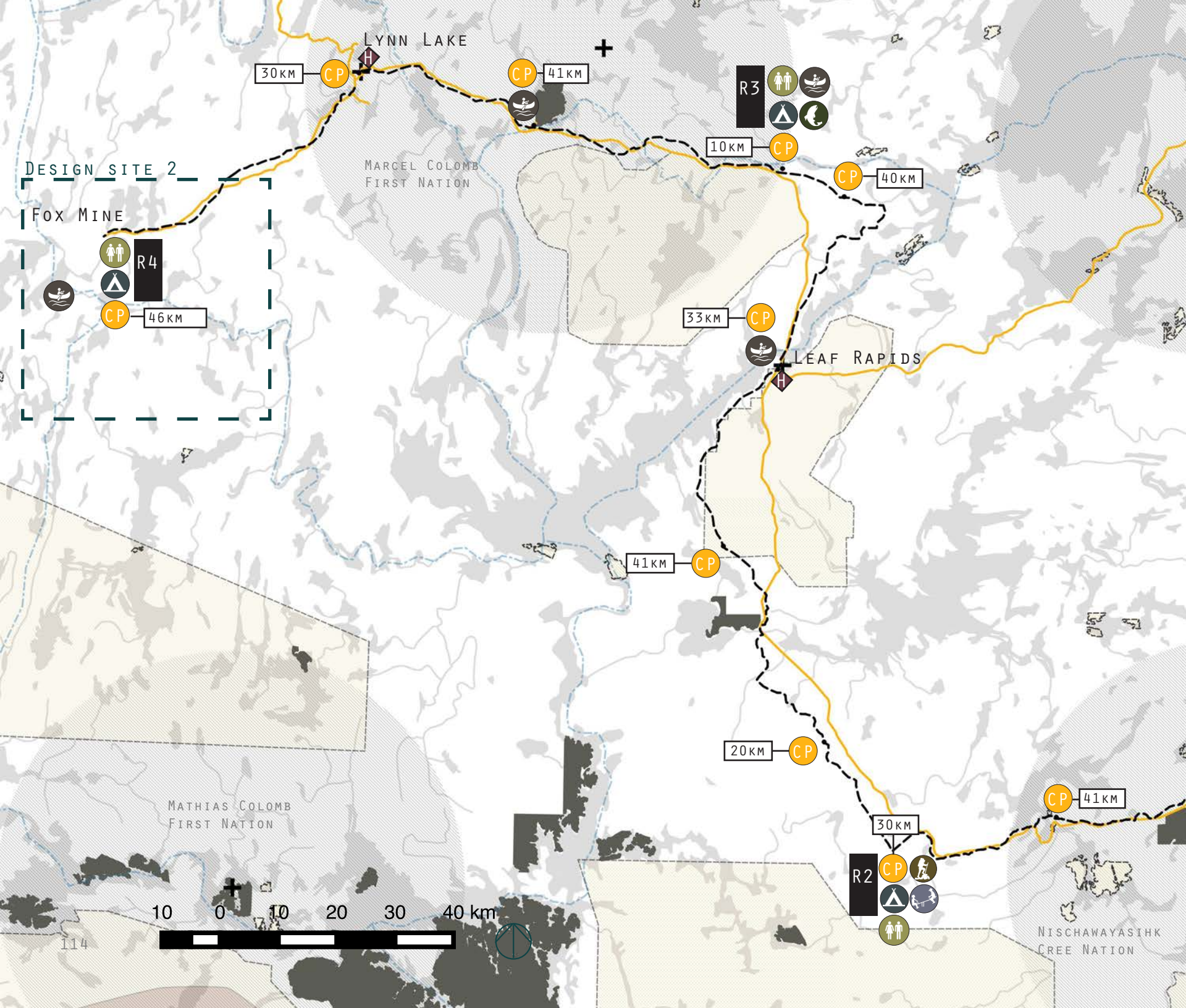
REST AREA TRAIL INFORMATION

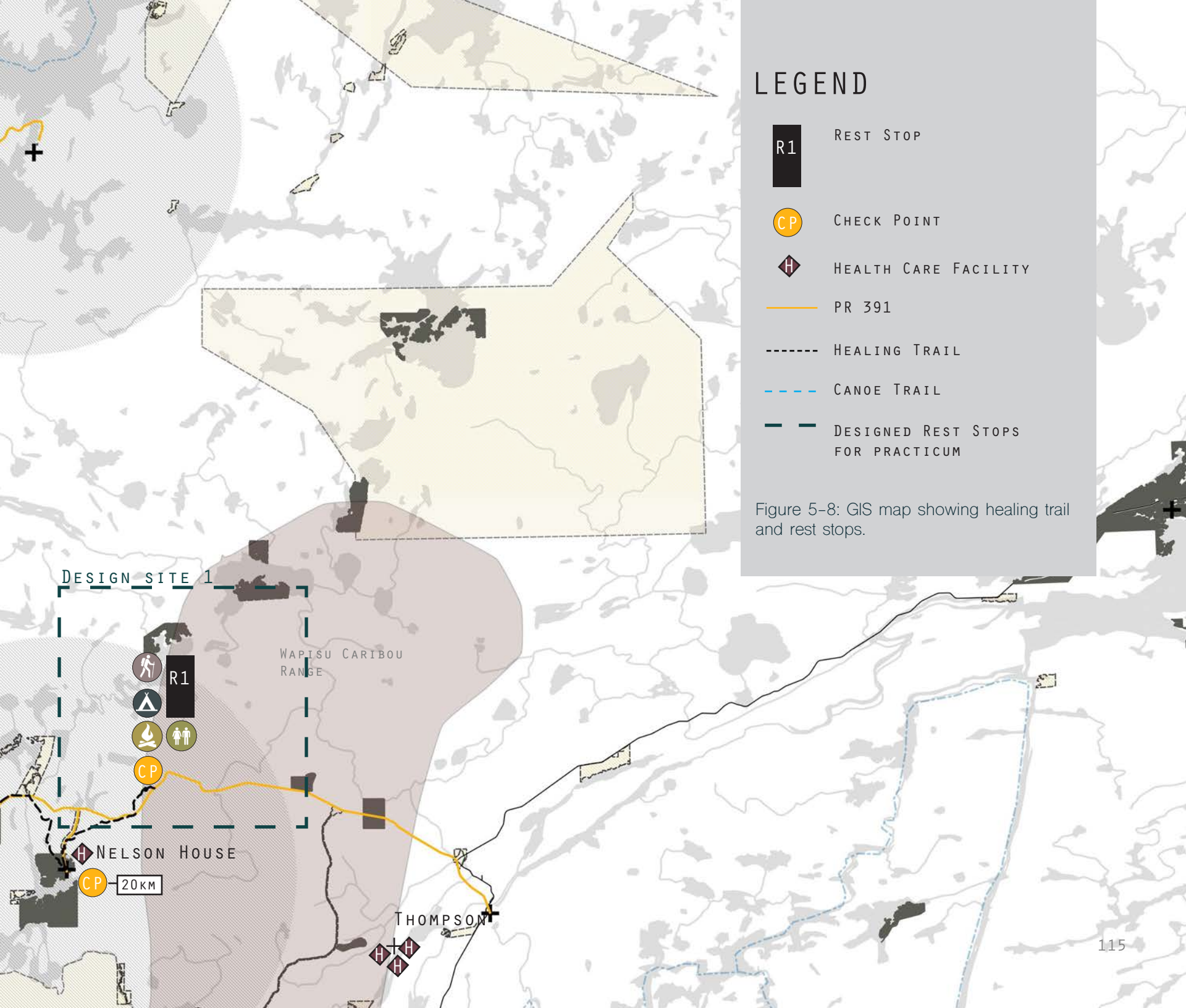
Each rest stop has a trail information bulletin that explains the healing process of that rest stop.



PLAYGROUND

A playground, as part of the second rest stop, also the second phase of restoration theory *Mental Fatigue*, engages children in the healing process, also provides a clean safe playground.





LEGEND

- R1** REST STOP
- CP** CHECK POINT
- H** HEALTH CARE FACILITY
- PR 391
- - - HEALING TRAIL
- - - CANOE TRAIL
- - - DESIGNED REST STOPS FOR PRACTICUM

Figure 5-8: GIS map showing healing trail and rest stops.

DESIGN SITE 1

WAPISU CARIBOU RANGE

- R1
-
-
-
- CP**

NELSON HOUSE

CP 20KM

THOMPSON

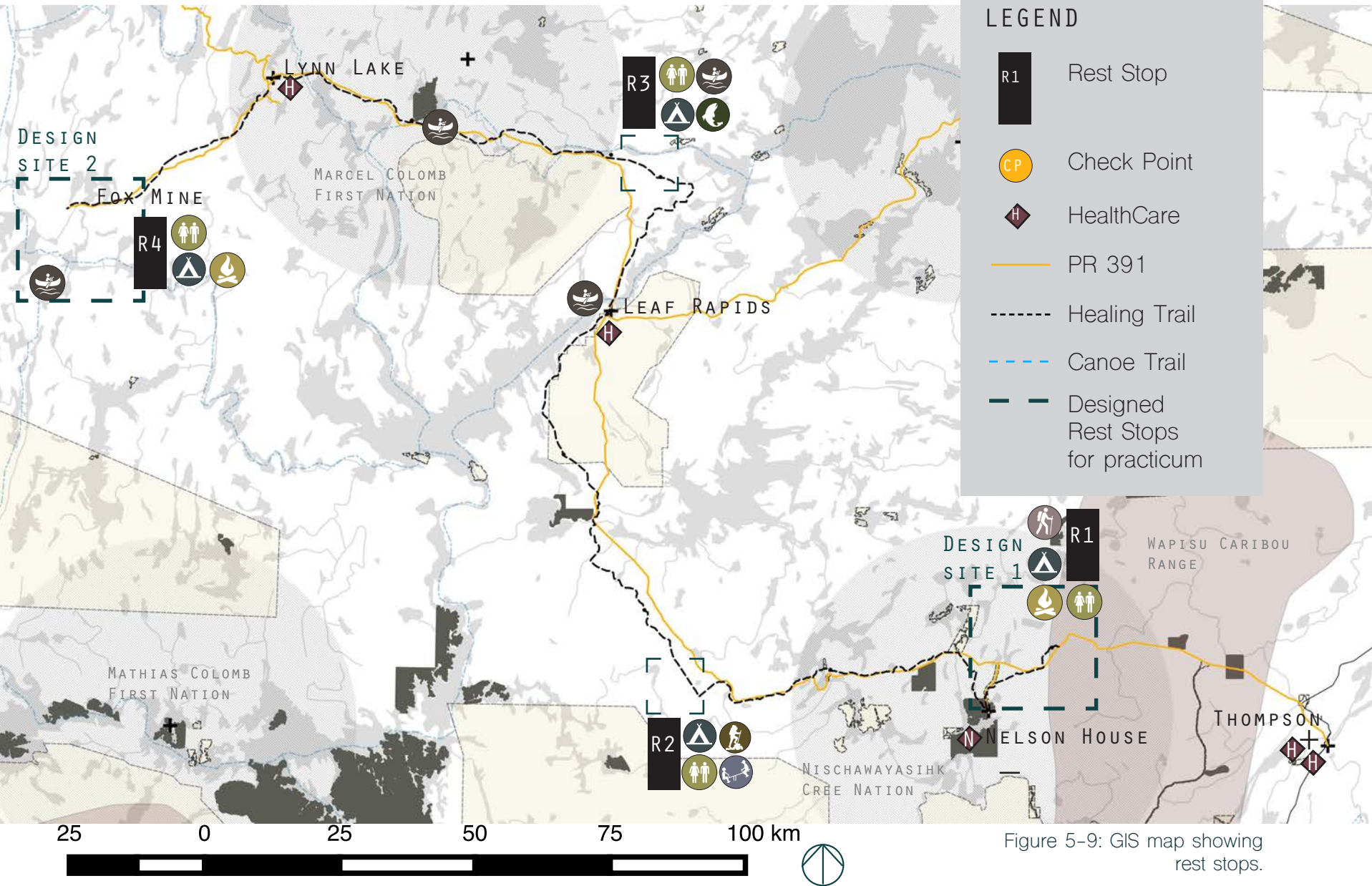


Figure 5-9: GIS map showing rest stops.

REST STOP - DESIGN INTENTIONS

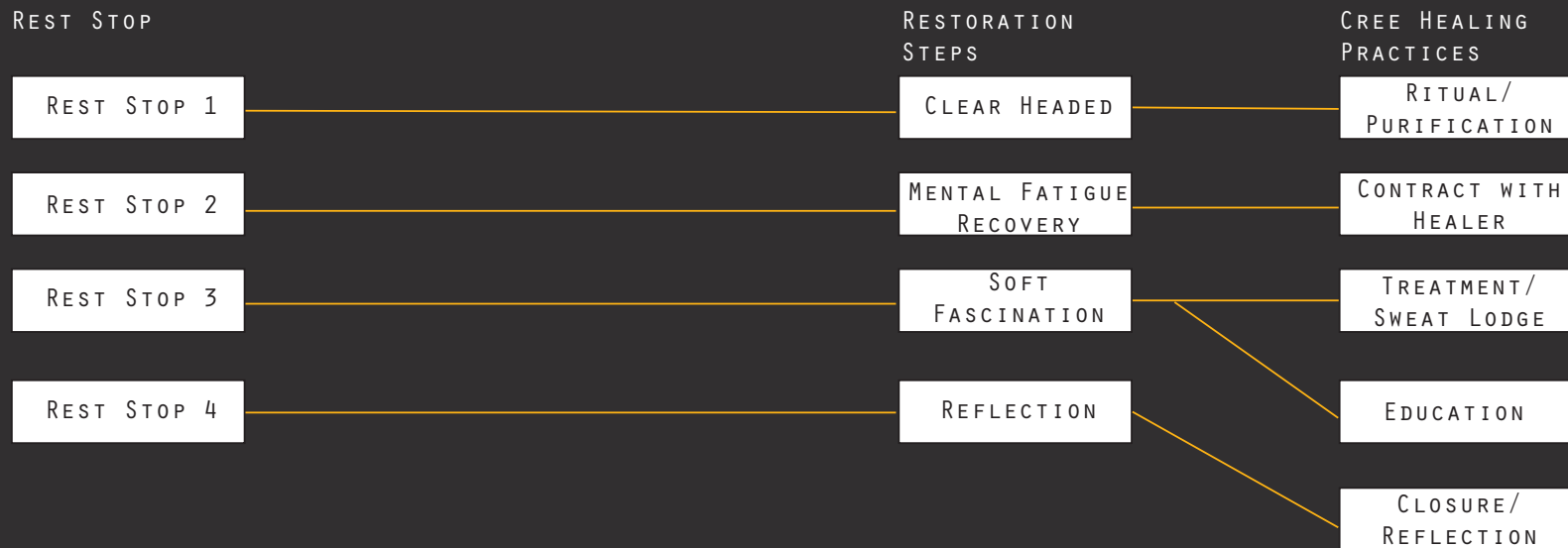


Figure 5-10: Diagram of rest stop and restorative practices.

At each rest stop connecting the healing trail to PR 391 are shorter paths, and each rest stop focuses on one phase of Kaplan's Restoration Theory and the Cree healing practice.

REST STOP 1 MĀMAWĀYĀWIN //COMMUNITY//

KAPLAN'S RESTORATION THEORY:

CLEAR-HEADED MIND

CREE HEALING PRACTICES:

PURIFICATION

REST STOP 2 MĪNOPAŶIW //BALANCE//

KAPLAN'S RESTORATION THEORY:

MENTAL FATIGUE RECOVERY

CREE HEALING PRACTICES:

CONTRACT WITH HEALER

REST STOP 3 KISKIHTAMOWIN //KNOWLEDGE//

KAPLAN'S RESTORATION THEORY:

SOFT FASCINATION

CREE HEALING PRACTICES:

TREATMENT AND EDUCATION

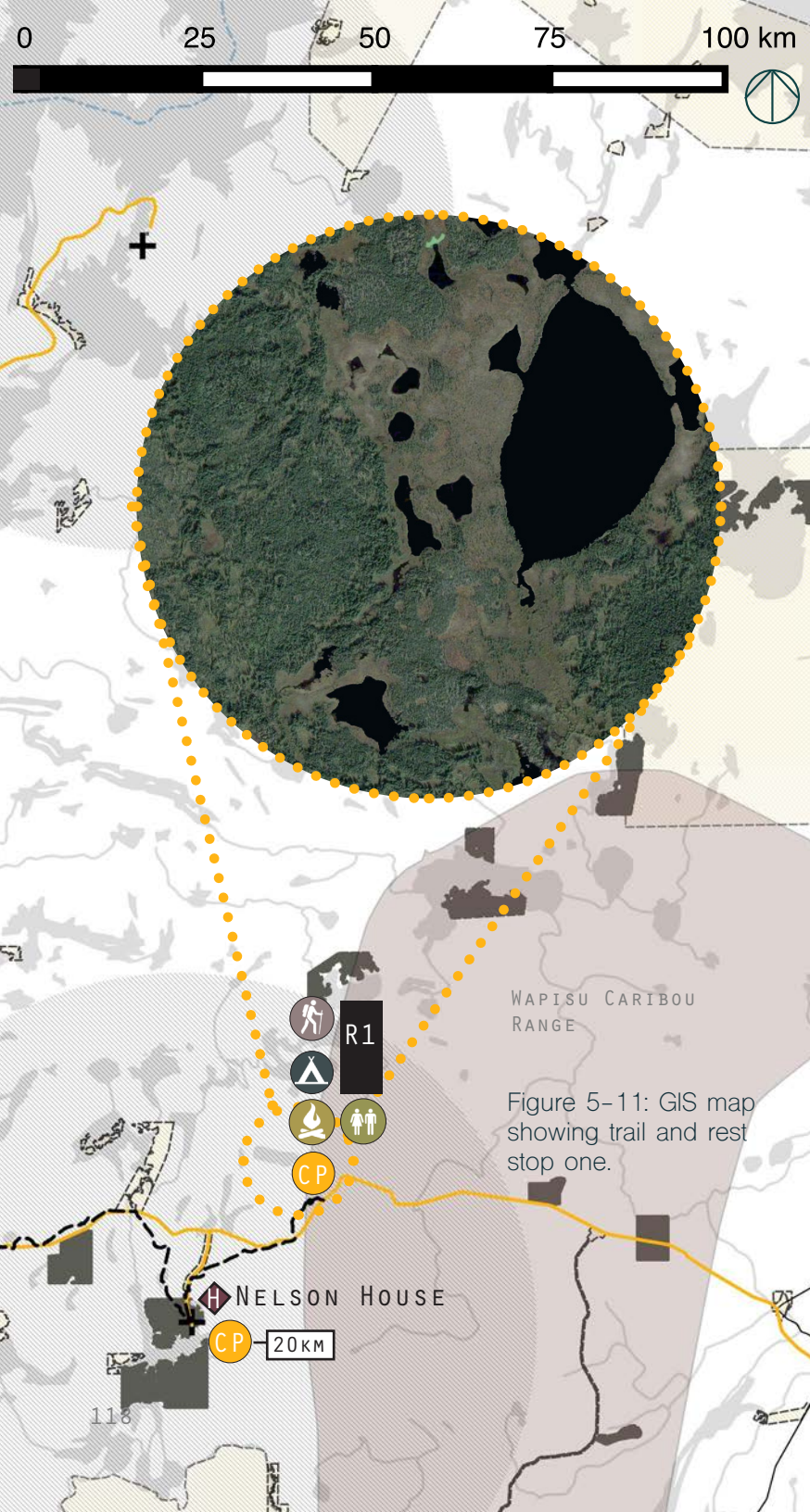
REST STOP 4 TĀPISINOWIN //A WAY OF SEEING//

KAPLAN'S RESTORATION THEORY:

REFLECTION

CREE HEALING PRACTICES:

CLOSURE/ REFLECTION



PROPOSED REST STOP 1 MÂMAWÂYÂWIN // COMMUNITY //

(Lazarowich, 2019)

SITE CONTEXT

Rest stop one, located between Thompson and Nelson House is the actual start of the healing trail, and is located in the more flatter area of the boreal forest.



*Example of potential site characteristics

Figure 5-12: PR 391: grassland.

KEY PROGRAMMING

ATTENTION RESTORATION THEORY:

Clear Headed Mind

Key:

- Clearing the Mind
- Bringing Emotions to the Surface

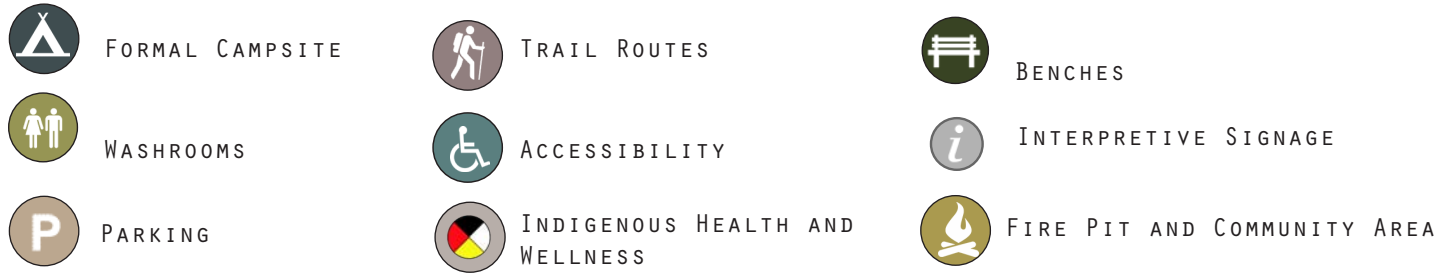
CREE HEALING PRACTICES:

Ritual Purification

Key:

- Smudging Ceremony

TRAIL ELEMENTS



LAYERS SURROUNDING THE SITE

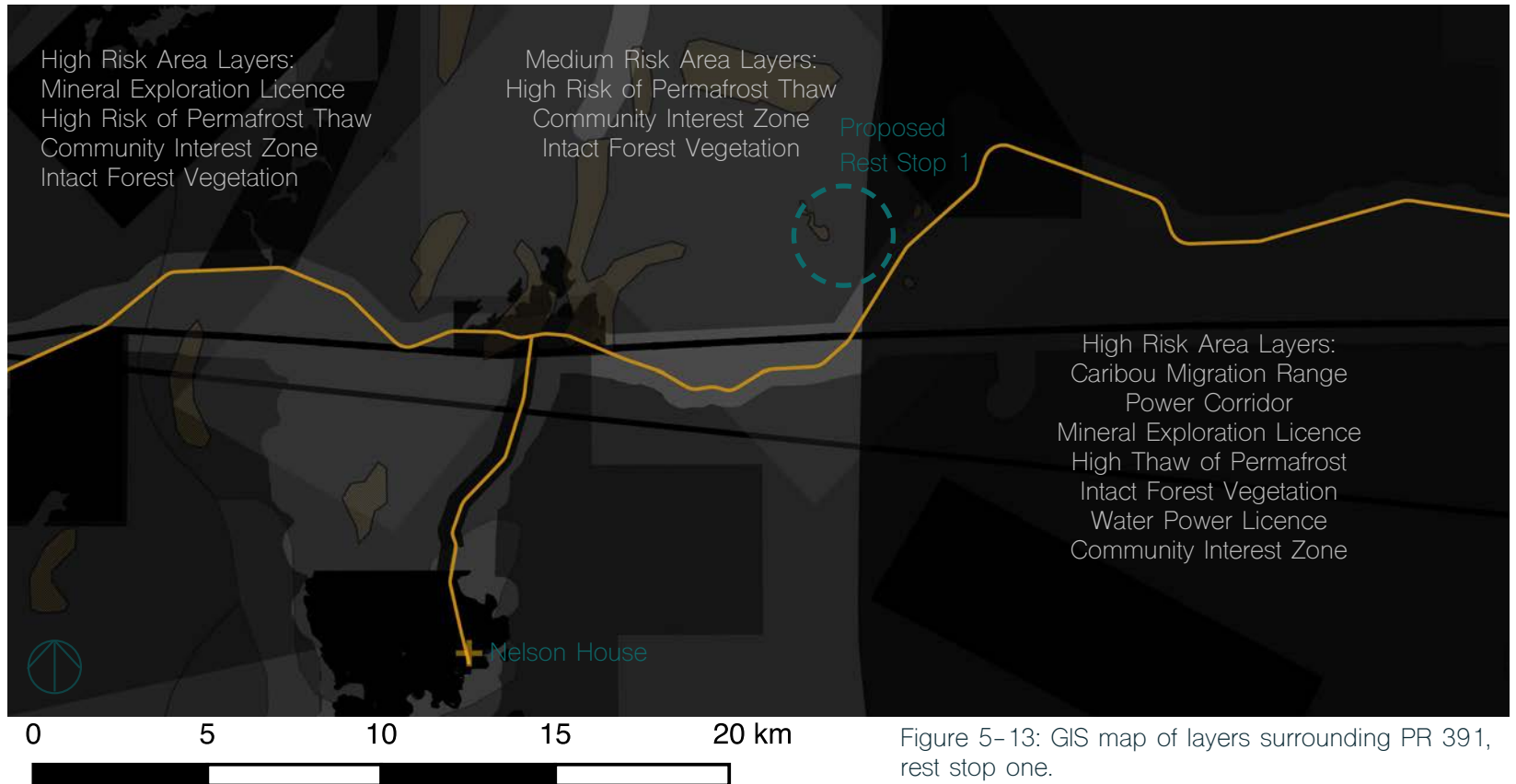


Figure 5-13: GIS map of layers surrounding PR 391, rest stop one.



LEGEND

- Compact Soil Trail
- Boardwalk Trail
- Healing Trail
- (i) Interpretive signage
- (B) Bench

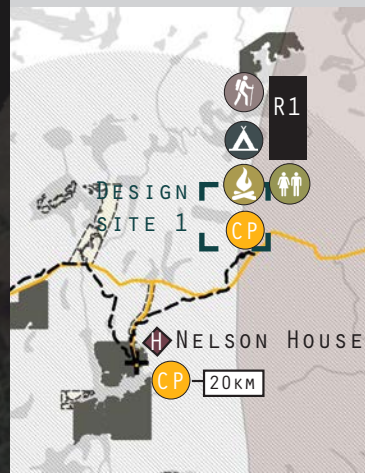


Figure 5-14: Aerial of rest stop 1 plan design



R1

PR 391

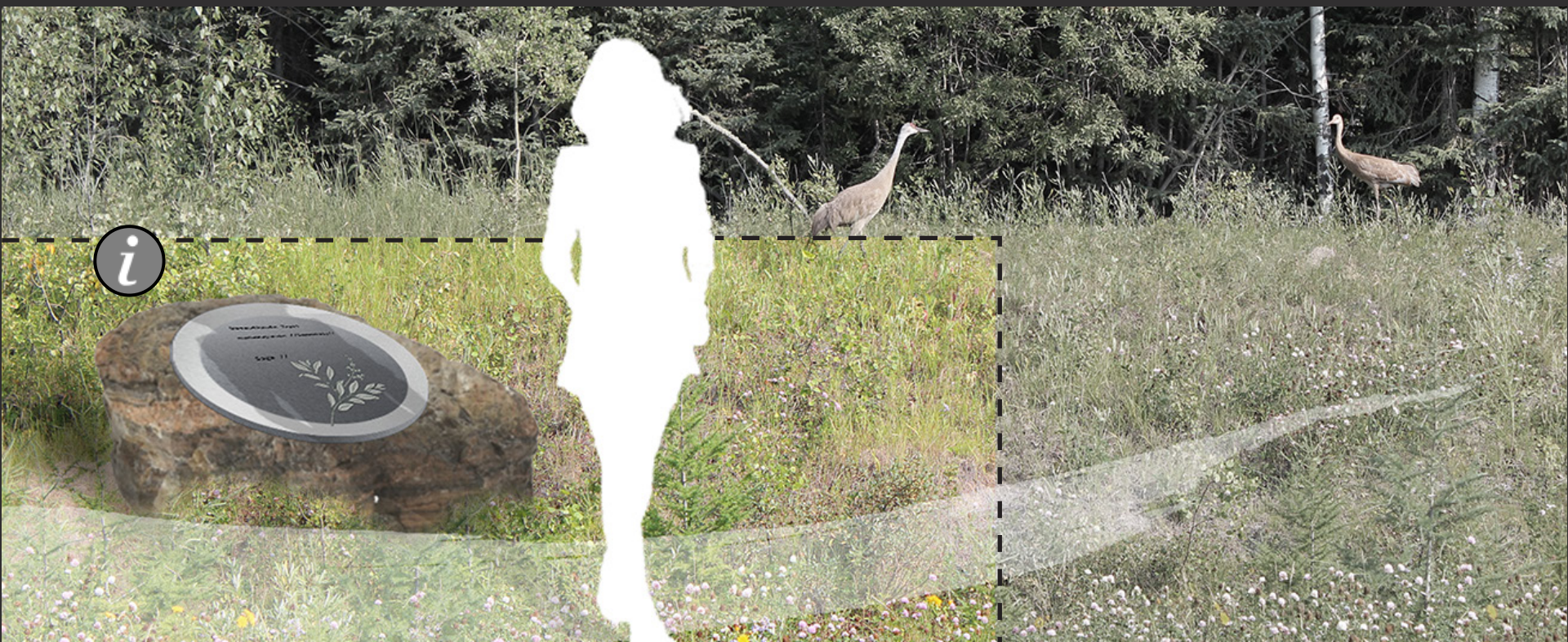
The trail enters into dense vegetation areas and open grassland patches, and is surrounded by lakes characteristic of the wetland ecosystem. The rest stop includes the first phase of the restoration theory, and Cree healing practice, with an overall encompassing goal of clearing the mind and ridding the mind of negative thoughts.

For those on their health journey, a clear-headed mind helps thaw the emotions that can come at the end of cancer treatment or post-traumatic stress disorder. For this rest stop, a circular community gathering area and space for holding smudging ceremonies is located at the beginning of a relatively short two kilometer trail loop through the boreal forest.

INTERPRETIVE SIGNS Along the path are interpretive signs that will inform those on their journey of historical and ecological aspects of the northern Manitoba landscape including the history of northern exploration and medicinal plants found in the landscape.

- ① *History of Landscape and People*
- ② *Importance of Resources found in the Landscape*
- ③ *Importance of Wetlands to the Boreal Forest*
- ④ *Accessibility of Northern Manitoba*
- ⑤ *Wildlife*
- ⑥ *Indigenous Healing Processes and Medicinal Plants*

Figure 5-15: Interpretive signage perspective.



LEGEND

- Extend of Forest
- Boardwalk Trail
- Compact Soil Trail
- Waterbodies
- Grassland
- Cut Lawn
- Picnic Tables
- Sweetgrass planting
- Sage planting
- Boulders
- Smudging toolbox

A Extend of Designed Area

B Community Area Perspective

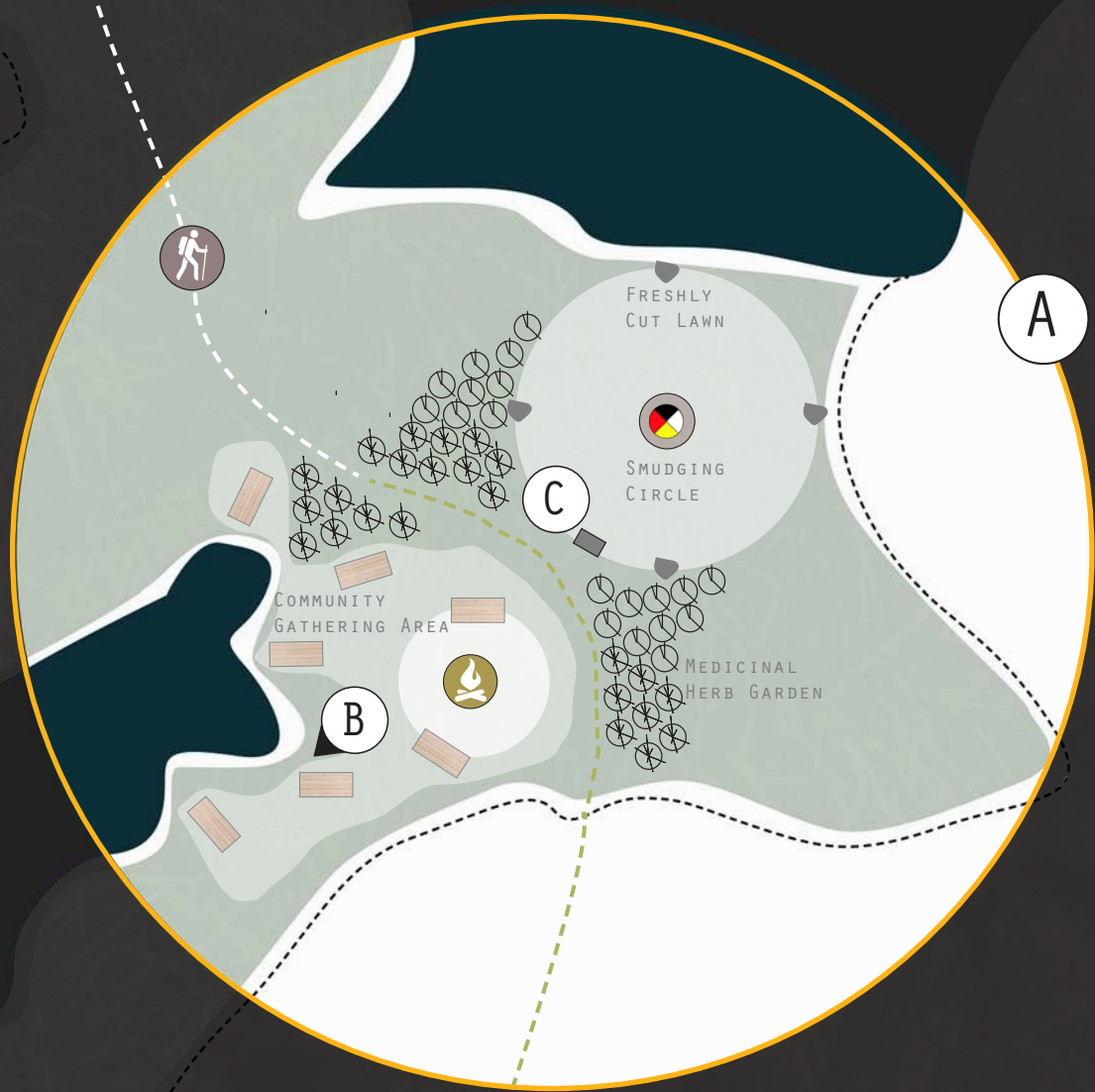


Figure 5-16: Rest stop detail plan.

COMMUNITY GATHERING AREA In the context of northern Manitoba, ideas for clear-headed mind activities that may result in improving focus are mildly strenuous activities such as sitting by a fire, watching the sky change and conversing with others with the goal of opening up emotionally.

The idea of the community gathering area is that those on their journey of healthcare can meet others who are on their own journey and potentially share in the healing process. Surrounding the community area are plantings of sweetgrass and white sage that can be used in a smudging circle.

This rest stop is close to Nelson House, where community members can access the site close by and share their knowledge of the environment and the importance the landscape has to their culture.

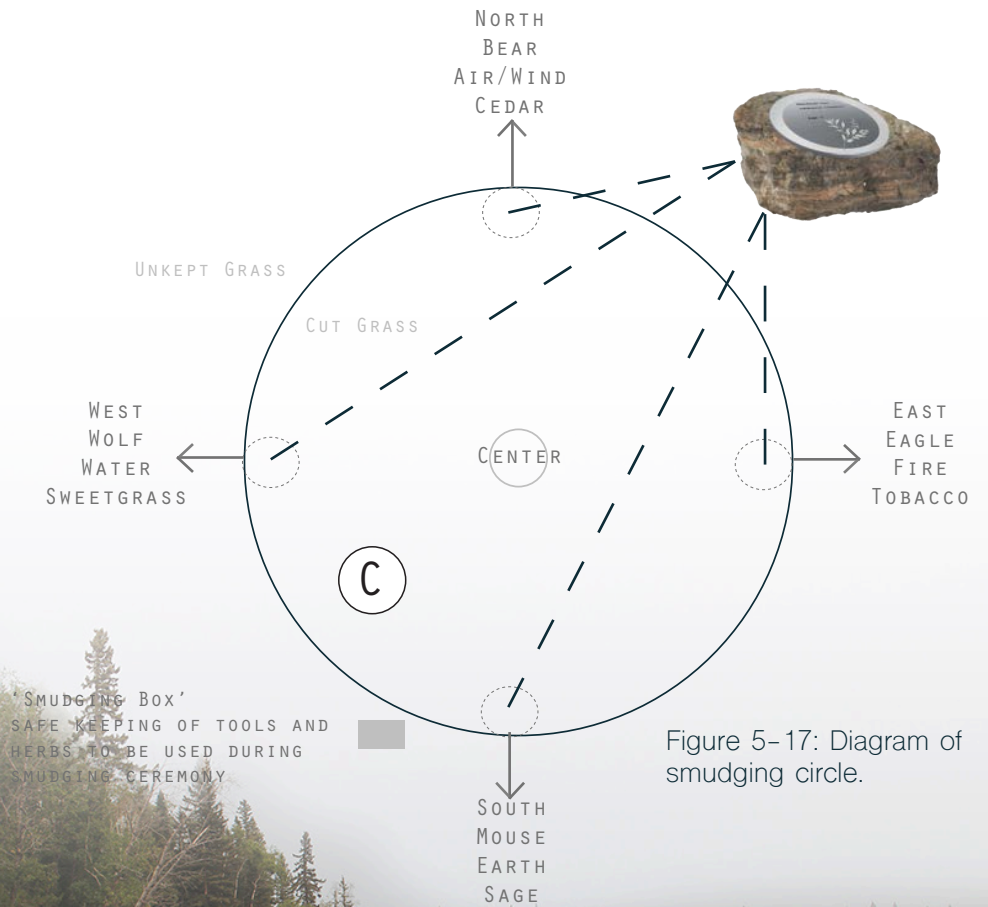
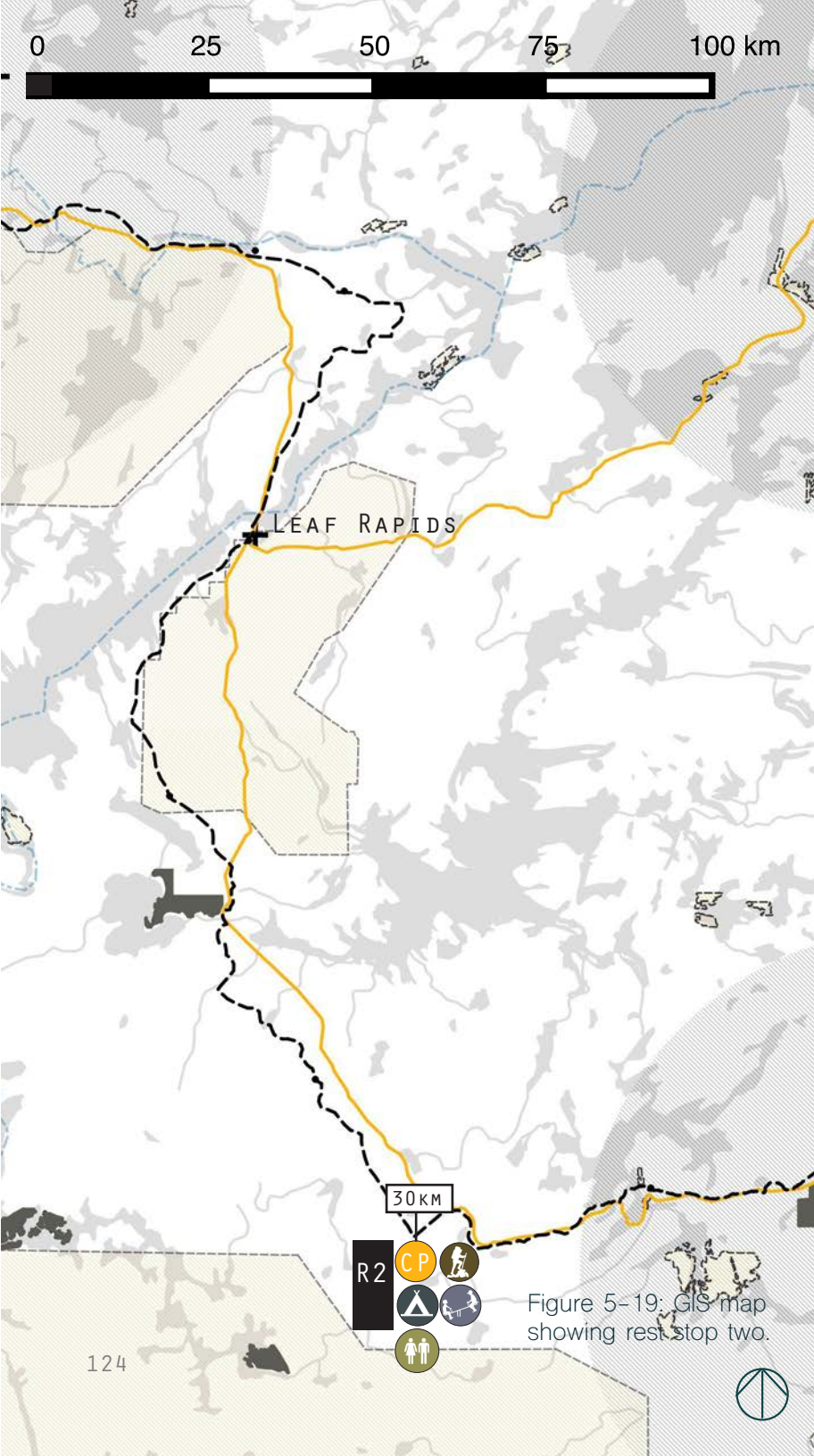


Figure 5-17: Diagram of smudging circle.



Figure 5-18: Community gathering area perspective.



TÂPITAWOPANIW //BALANCE//

(Anderson, Kakekespan, and Kakekespan, 2011)

SITE CONTEXT - PROPOSED REST STOP TWO PROGRAMMING OF SITE

Site two follows the phases of restorative theory dealing with mental fatigue recovery and the second phase of the Cree healing practices, the contract.

It is hard to quiet the mind and turn one's attention from the rapid changes, physical and mental, that a person experiences during and after treatment. By engaging in higher levels of physical activity, the release of energy prompts the mind to focus attention on the task at hand, and away from overriding health concerns (Berto, 2014). This practice exerts excessive energy and restores the body to a state of normalcy to advance to the third step of the theory, soft fascination (Ackerman, 2020).



**Example of site characteristics*

Figure 5-20: PR 391: elevations (2).

KEY PROGRAMMING

ATTENTION RESTORATION THEORY:

Mental Fatigue Recovery

Key:

- Directing Attention
- Coherent Scope
- Fascination

CREE HEALING PRACTICES:

Contract with Healer

Key:

- Request Healing
- Gift of Tobacco
- White, Yellow, Red, Blue or Green Print
- Hanging of Print In tree to carry away disease

LAYERS SURROUNDING THE SITE

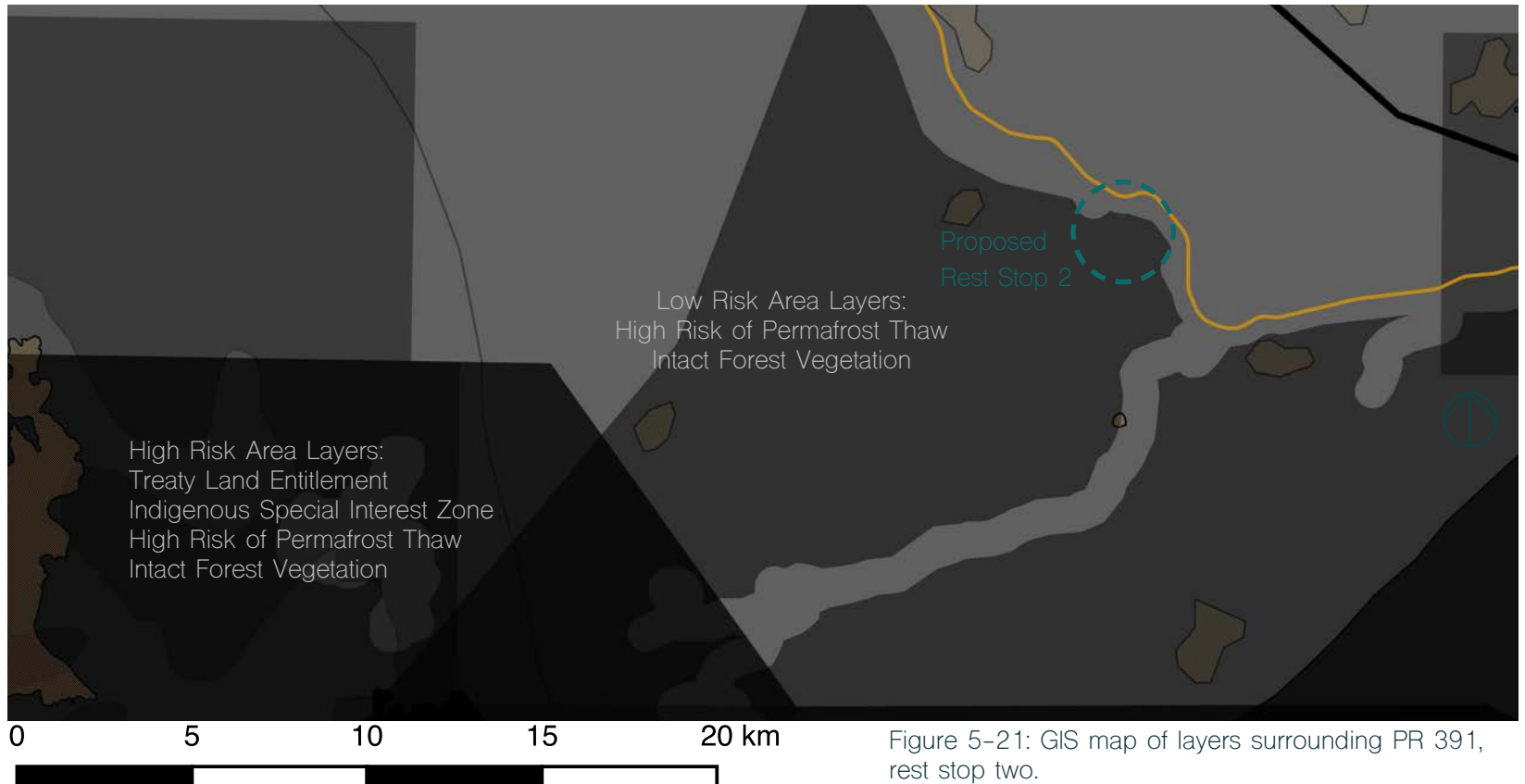


Figure 5-21: GIS map of layers surrounding PR 391, rest stop two.

100 0 100 200 300 400 m



HEALING TRAIL

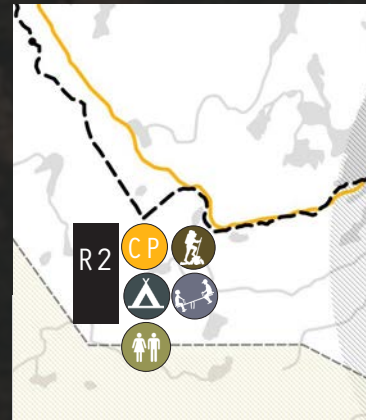
2KM

5KM

HEALING TRAIL

PR 391

R2



LEGEND

- Compact Dirt Trail
- Boardwalk Trail
- Healing Trail
- Interpretive signage
- Bench

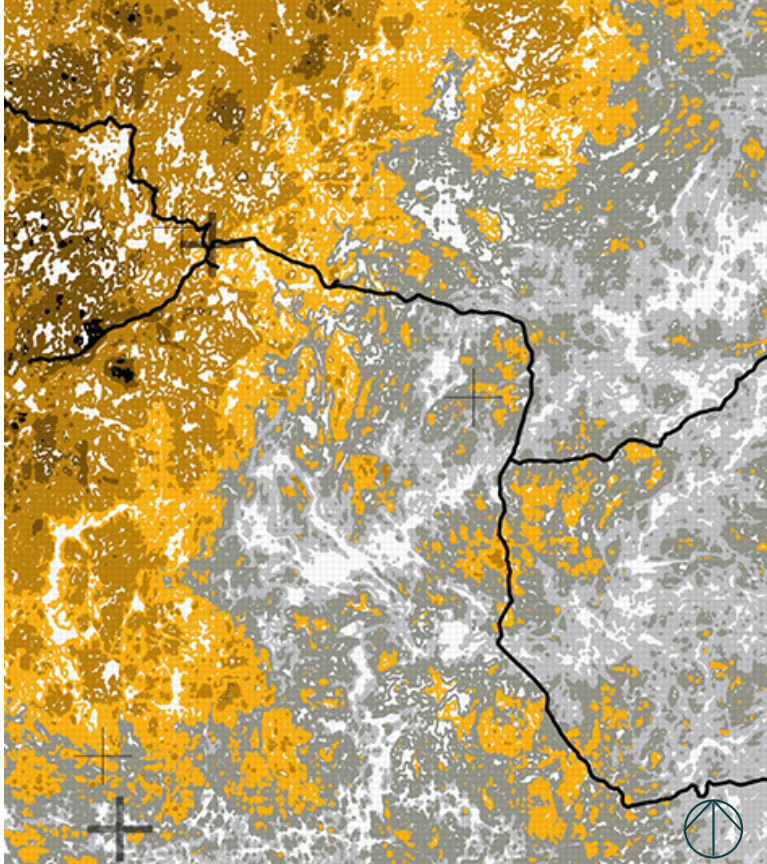


Figure 5-23: GIS map showing elevations.

SCALE

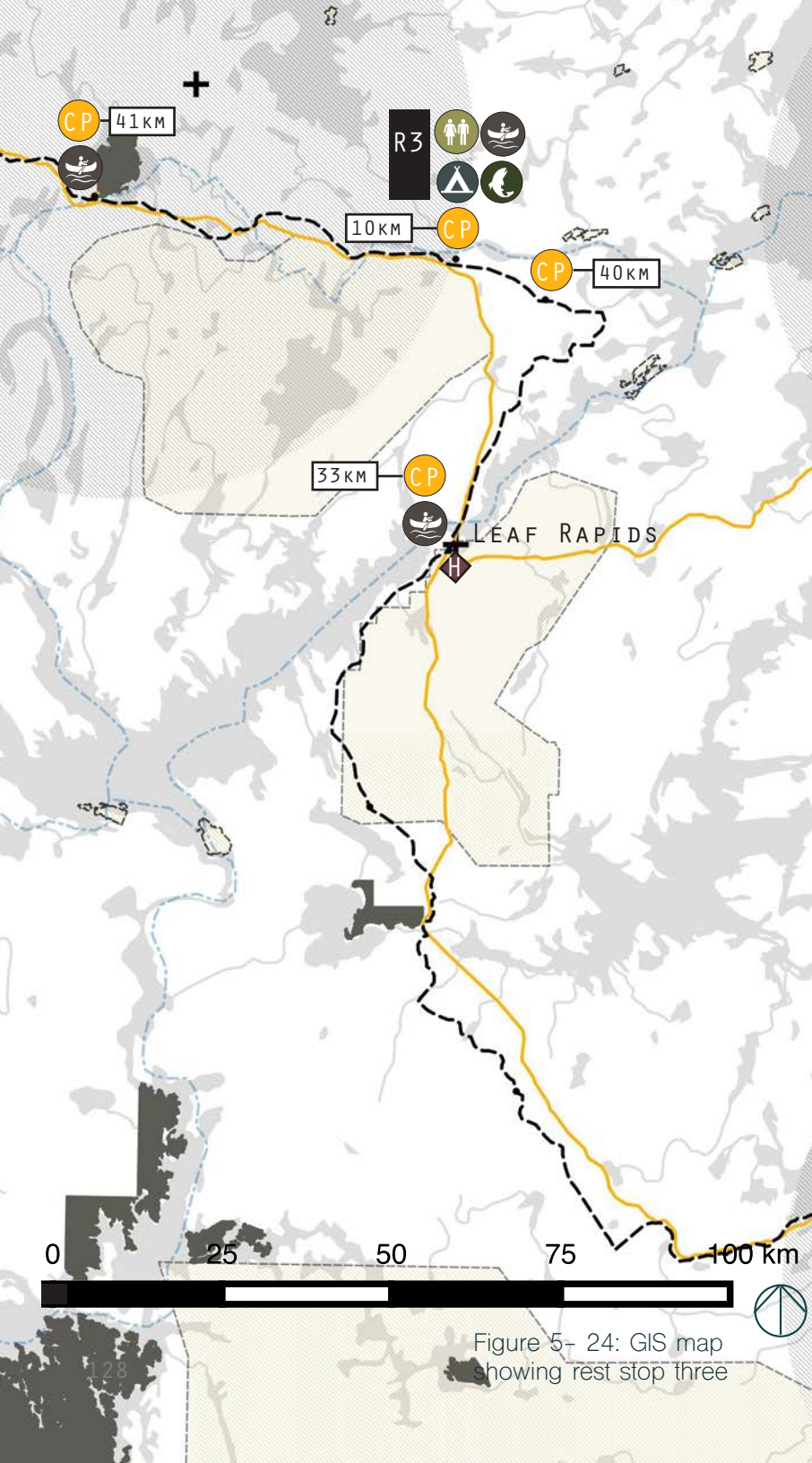


TRAIL ELEMENTS



Figure 5-22: GIS map showing rest stop two design plan.

TRAIL LOOP Located in an area of changes in topography, the site promotes more strenuous activity on longer, five kilometer loop, and provides access points into the areas of dense vegetation for the practice of leaving tobacco pouches discussed in the Cree healing process. A shorter, two kilometer path is also available for people with less energy or mobility. This gradually sloped pathway curves through some less dramatically sloped eskers and creates a loop that returns to the trail head. Other programmed spaces on site include a campsite with non-modern washrooms. To accommodate children on a journey of recovery, or those supporting parents who are dealing with health issues, the vision for the rest stop is to include a playground that will allow children to expend some energy and forget about the difficulties they are going through for a time.



KISKIHTAMOWIN // KNOWLEDGE //

(Napoleon, 2014)

SITE CONTEXT - PROPOSED REST STOP THREE

Site three continues with the next phase of restorative theory, soft fascination (relaxation), and the third phase of the Cree healing practices, Sweatlodge ceremonies.



*Example of site characteristics
Figure 5-25: PR 391 north (2).

KEY PROGRAMMING

ATTENTION RESTORATION THEORY:

Soft Fascination

Key:

- Relaxation
- Being Mentally Detached from Everyday Worries
- Facing Challenges in the Mind










CREE HEALING PRACTICES:

Treatment and Education

Key:

- Herbal Tea
- Solution of Herbs and Animal parts
- SweatLodge Ceremony ' center and focus'
- Instruction on Self Care

TRAIL ELEMENTS

- | | | |
|---|--|--|
|  FORMAL CAMPSITE |  INDIGENOUS HEALTH AND WELLNESS |  BENCHES |
|  WASHROOMS |  TRAIL ROUTES |  FISHING/ ICE FISHING |
|  PARKING |  ACCESSIBILITY |  KAYAKING/ CANOEING |

LAYERS SURROUNDING THE SITE

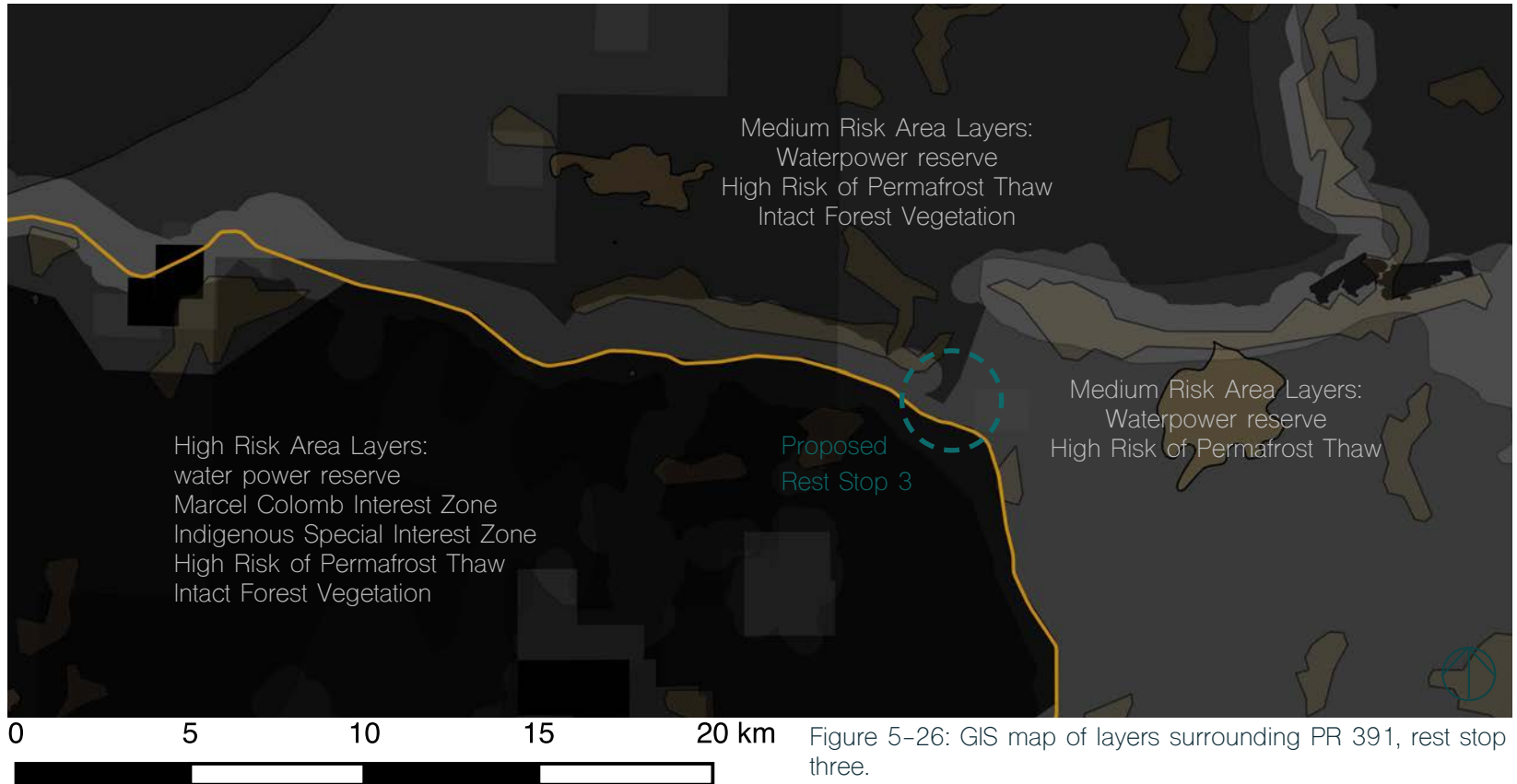


Figure 5-26: GIS map of layers surrounding PR 391, rest stop three.



i P

B

2KM

PR 391

HEALING TRAIL

130 100 0 100 200 300 400 m



LEGEND

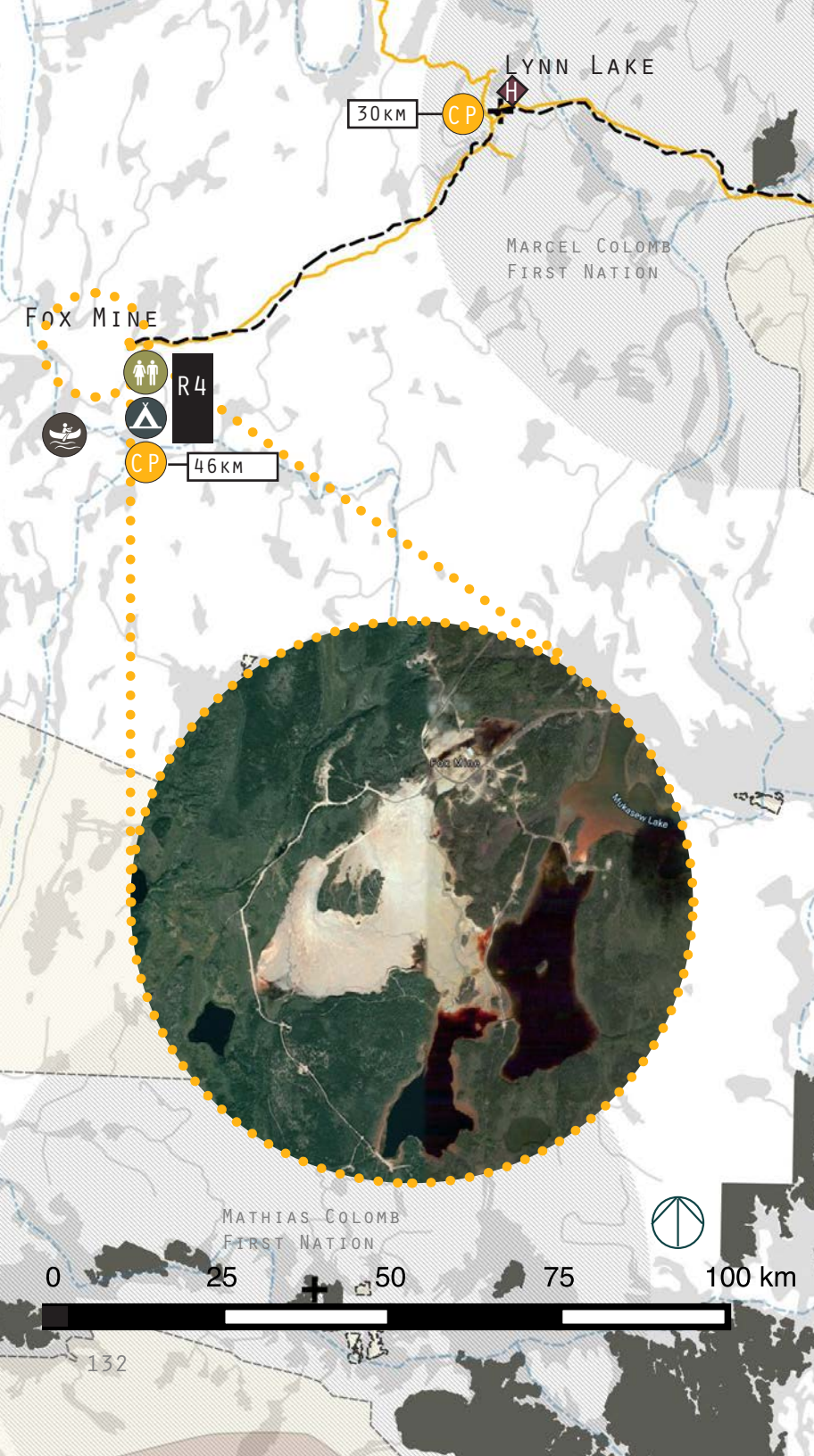
- Compact Dirt Trail
- Boardwalk Trail
- Healing Trail
- Canoe Route
- ⊞ Bench



Figure 5-28: Perspective of rest stop three.

TRAIL LOOP Here, relaxation is achieved through engagement with the river and lake system. Located near the provincial canoe route, activities include kayaking, fishing, or winter ice fishing, as well as a space dedicated for the construction of a sweatlodge. Through relaxation, the landscape's restorative nature alleviates anger, aggression, and fear, and may begin to replace negative, harmful emotions with positive effects such as acceptance. This can also help to further reduce anxiety caused by post-traumatic stress disorder and improve pain control in cancer patients.

Figure 5-27: GIS map showing rest stop three design plan.



TÂPISINOWIN //A WAY OF SEEING//

(Napoleon, 2014)

SITE CONTEXT - PROPOSED REST STOP FOUR

Rest stop four is the same phase for both the restoration theory and Cree healing practices. It is the phase of reflection/restoration. The goal of rest stop four is to restore the landscape and the people.

For the scarred landscape of Fox Mine, restoration strategies are imperative to its health and restoring the structure of the landscape. The damage that the mine has done to the physical environment has eliminated any potential restorative properties of the landscape and in doing so has reduced the potential for residents to make use of that healing power.



*Example of site characteristics
Figure 5-30: Fox Mine ruins (2).

Figure 5-29: GIS map showing rest stop four.

KEY PROGRAMMING

ATTENTION RESTORATION THEORY:

Reflection

Key:

- Reflection
- Novel Activity
- The Environment matches ones needs for Restoration

CREE HEALING PRACTICES:

Closure/ Reflection

Key:

- Individual is guided to reflect on what a cure would mean to them
- Healing process continues with Great Spirit
- Body is triggered to take over and complete healing process.

LAYERS SURROUNDING THE SITE

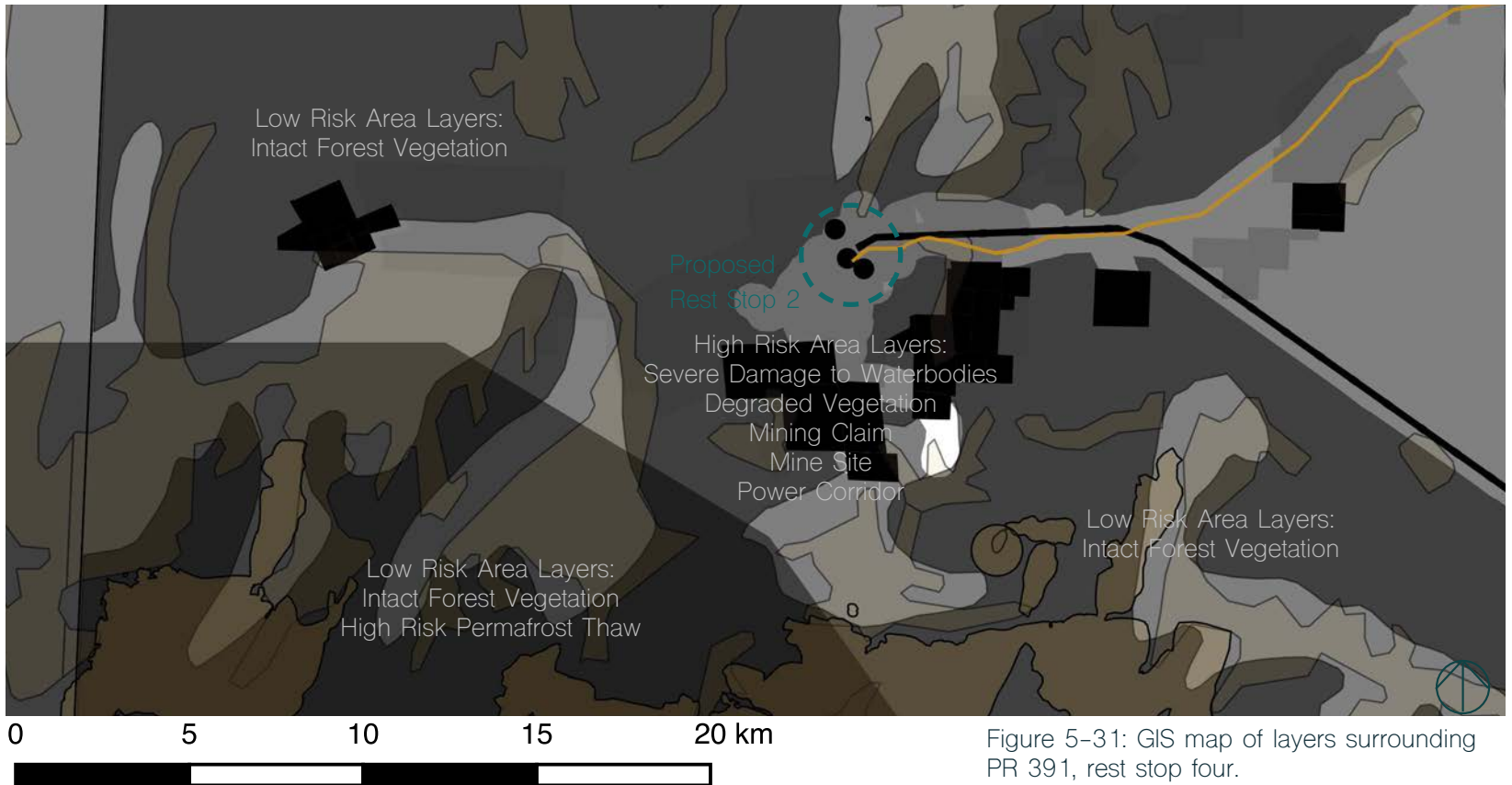


Figure 5-31: GIS map of layers surrounding PR 391, rest stop four.

Building on the case study of the post-extracted site of Sudbury, Ontario, the steps needed to achieve restoration of Fox Mine are incorporated. This includes application of lime to the site, neutralizing of soils, and plant succession using metal tolerant plants. It is important to note that the climate of northern Manitoba is quite different from that of Sudbury, so although many are still relevant, some of the succession plants found in Sudbury would not be appropriate for use in Fox Mine.

EXISTING SITE FEATURES Current conditions of Fox Mine include road access surrounding the post-extracted site, streams flowing through the site to nearby polluted waters, and the absence of vegetation.

DESIGN INTERVENTIONS Design interventions required to restore the site to its previous health levels include neutralizing of soils to begin revegetation of the site, constructed wetlands to begin filtering contaminants out of the soil runoff, establishing connectivity to and through the site using similar short, and long loop trail systems found throughout the other rest stops. In this way, the site incorporates the final phase of the restorative theory and Cree healing practices of reflection.



Figure 5-32: Aerial image of current conditions, Fox Mine.

LEGEND




-  Road access surrounding post-extracted site
-  Streams flowing through site and Polluted Waters
-  Absence of Vegetation



Figure 5-33: GIS map of Fox Mine, constructed wetlands.

LEGEND

- Constructed Waterbodies
- - - - Restoration Extent
- Existing Water Bodies
- ==== Highway

CONSTRUCTED WETLANDS

Following restorative guidelines, constructed wetlands are incorporated into the design, connecting all stream systems on-site and using metal tolerant plant species, like cat-tails to help filter the water systems that have been damaged by metal leaching.

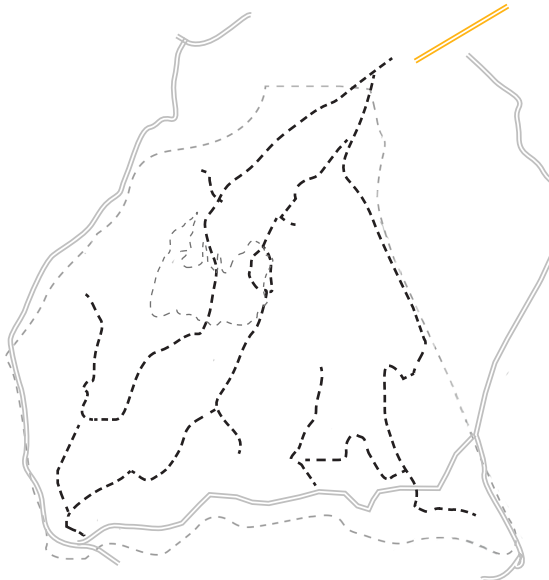


Figure 5-34: GIS map of Fox Mine, constructed paths.

LEGEND

- - - - Restoration Extent
- - - - Trails
- Access Roads from Mining
- ==== Highway

CONNECTIVITY

Pathways connecting spaces throughout the site are implemented. Connecting to the accessible road surrounding the site allows for visitors to choose where they would like to begin their journey.

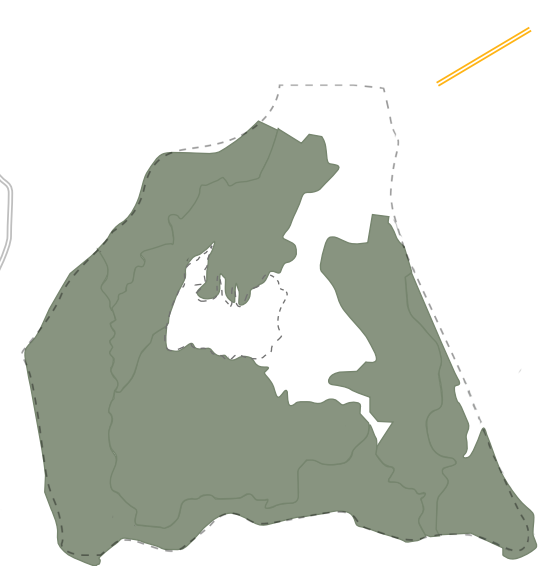


Figure 5-35: GIS map of Fox Mine, re-vegetation.

LEGEND

- Revegetation Areas
- - - - Restoration Extent
- ==== Highway

RE-VEGETATION

Following the principles set up by Sudbury's successful restoration of the post-extracted site, the soils of Fox Mine are neutralizing through the application of lime, once soils are neutralized metal tolerant plants can begin a series of succession juxtaposing the previous conditions of the site.



Figure 5-36: GIS map of Fox Mine, phase one.

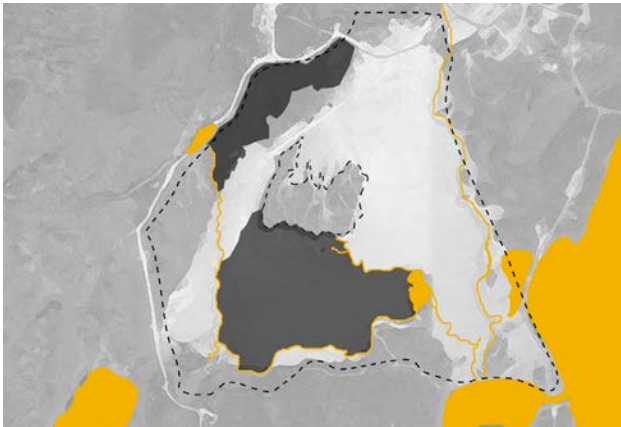


Figure 5-37: GIS map of Fox Mine, phase two.



Figure 5-38: GIS map of Fox Mine, phase three.

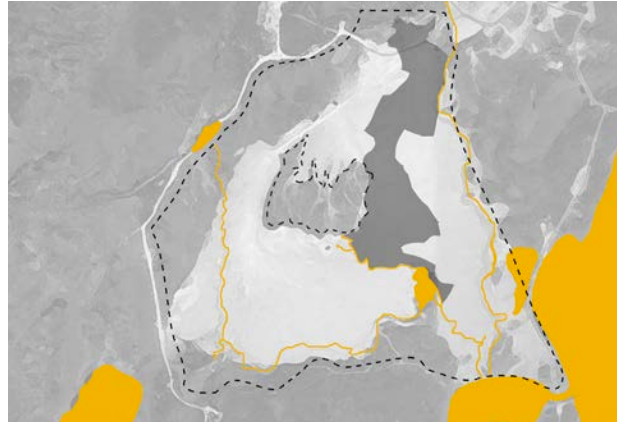








Figure 5-39: GIS map of Fox Mine, phase four.

LEGEND

- | | |
|--|--|
|  Existing Waterbodies |  Restoration Extent |
|  First Planting Area |  Third Planting Area |
|  Second Planting Area |  Fourth Planting Area |

PLANTING PHASES The sites revegetation plan is separated into four phases. These phases begin from the edges of the site moving inwards towards the center, in the same manner that scars on our body heal from the edges of the damaged tissue inwards (Grubbs and Manna, 2020).

Separating planting phases by multiple years visually shows the healing of the landscape through the succession species that occupy a phased area. For instance, the first year of the phase one area will include metal tolerant ground cover and mosses. By the second planting phase, approximately five years later, phase one will begin to include shrubs and low lying herbaceous plants, where the second phasing area will be the same metal tolerant ground covers. By the final years of the first planted area Jack Pines will have sprouted in the third phase and the fourth phase is concluded when spruce trees dominate the landscape, the final species in the succession phases.



Figure 5-40: Phased areas by year.

**PLANTING GROWTH IN EACH PHASE
AT 15 YEARS**

- Phase four in year one of planting: *Ground cover present*
- Phase three in year five of planting: *Low lying plants present*
- Phase two in year ten of planting: *Jack pine trees present*
- Phase one in year fifteen of planting: *Spruce trees present*

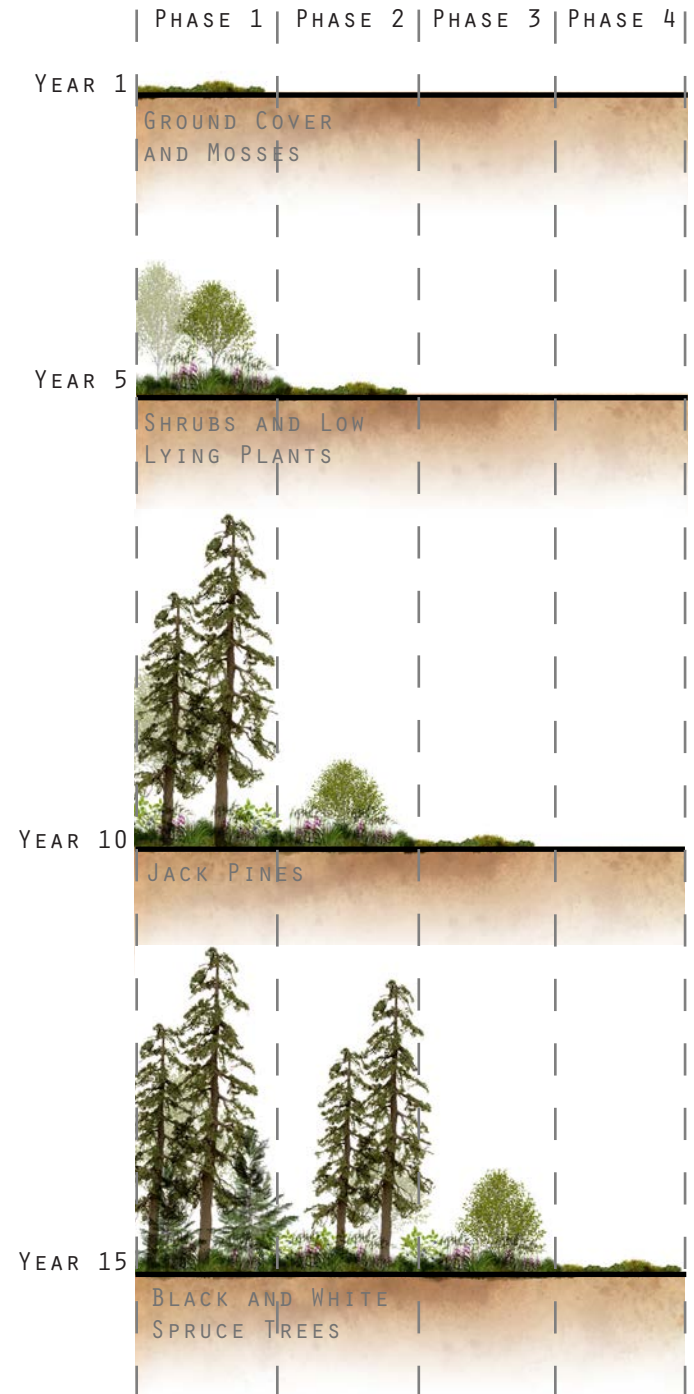


Figure 5-41: Succession planting.

A

INTERPRETIVE SIGNS These areas will also include interpretive signage. For example, a sign may be placed in an area describing how the presence of a white spruce indicates that the area is likely in the final stages of healing. aling.



Figure 5-42: Interpretive signs at rest stop four, perspective.



B

REFLECTIVE REST AREAS The final element of the designed landscape is the integration of reflection areas that facilitate the fourth phasing of the restorative theories and Cree healing practices. For the healing journey, rest stop 4 (reflection/restoration) may mean reflection on the change that has occurred in a person's life, or understanding the long succession of feelings one deals with over the course of their treatment. These changes are evident in the changing landscape of Fox Mine, which can be described to the visitor using before and after images of the site.

Figure 5-43: Reflection areas, perspective.

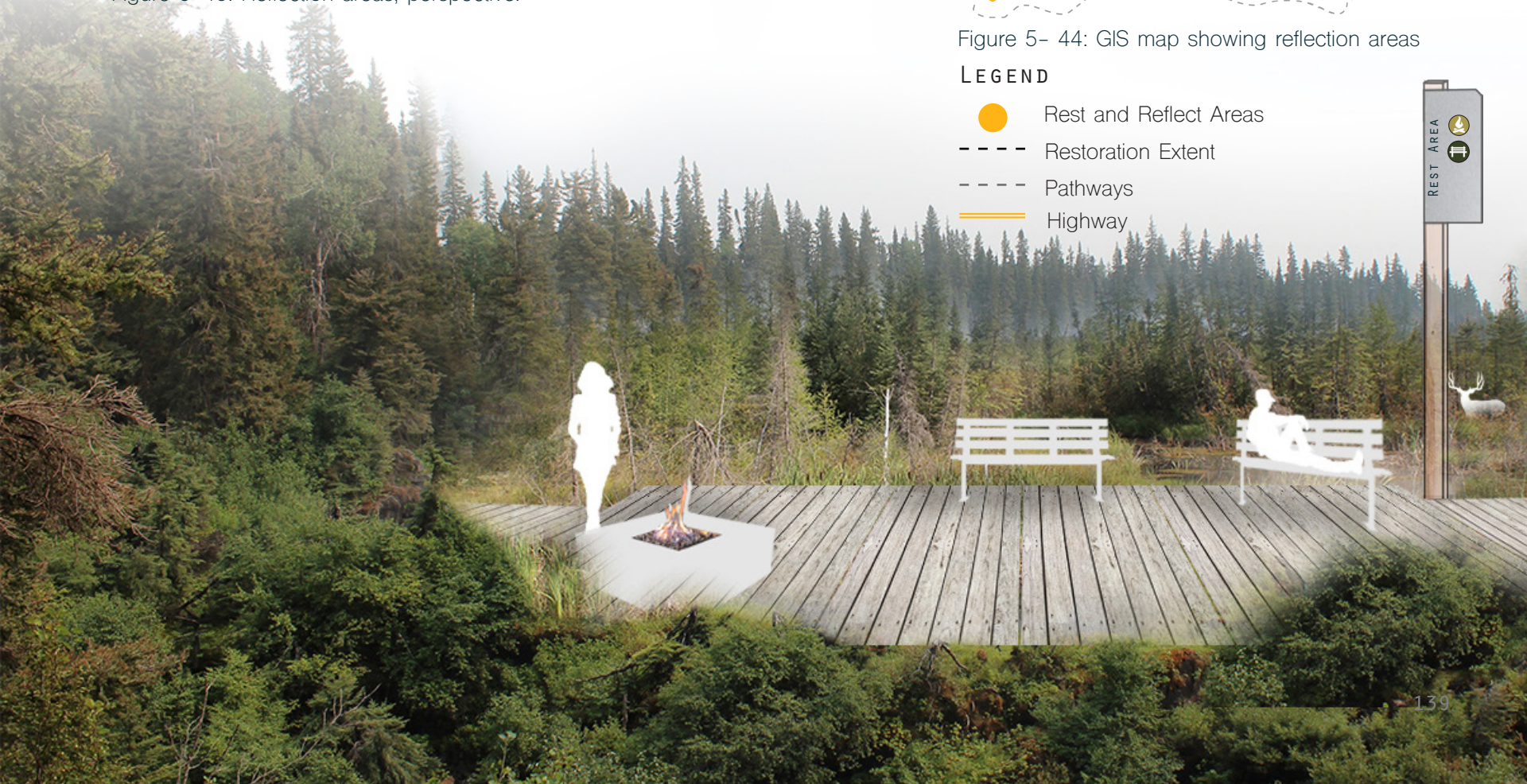


Figure 5- 44: GIS map showing reflection areas

LEGEND

- Rest and Reflect Areas
- - - Restoration Extent
- - - Pathways
- == Highway



The final trail map of Fox Mine reveals a landscape that once again possesses the restorative properties of the northern environment. A visual proof of the healing of the landscape is presented to the visitor, and is a powerful image that can be used as a reflection into one's own healing journey.

TRAIL ELEMENTS



FORMAL CAMPSITE



WASHROOMS



PARKING



TRAIL ROUTES



ACCESSIBILITY



INDIGENOUS HEALTH AND WELLNESS



BENCHES



INTERPRETIVE SIGNAGE



FIRE PIT AND COMMUNITY AREA

LEGEND







-  Compact Soil Trails
-  Boardwalk Trails
-  Healing Trail
-  Road access
-  Reflective Rest Areas
-  Benches

Figure 5- 45: GIS map showing Rest Stop four final design plan.



500 0 500 1000 1500 2000 m

JULY 22ND, 2019



Figure 6-1: Leah after surgery, 2019.

JULY 22ND, 2020



Figure 6-2: Leah one year later, 2020.



Figure 6-3: Final reflection perspective.

CHAPTER 5

FINAL REFLECTION

In this practicum I aimed to make sense of my family's journey with the healthcare system and to see how our process could be used by others in their course of healing. First and foremost, my focus was on healing my daughter through her physical health issues, followed by focusing on healing myself and dealing with my personal mental health issues. In reflecting on my own journey, including those I met at the hospital from all over the province, I expanded to thinking of the barriers those in the north face accessing their own healthcare.

Because my journey was successful, I wanted to be able to do something for others requiring mental and physical healing, but on a larger scale that incorporated the beautiful northern landscape that I visited years prior.

I believe everyone can be aided by well-designed landscapes, and I want to help people understand the importance of landscape in making the ordinary and extraordinary events in their lives more enjoyable.

I believe through landscape architecture we are able to create spaces that emphasize and enhance properties of landscapes that have always existed. I believe the northern landscape is restorative, in and of itself, and can help facilitate the healing journey of others.

The designed trail system and rest stops along the route of PR 391 creates a true healing trail. This project has the potential to extend a person's healing journey beyond the confined car ride that patients and caregivers are using to access healthcare facilities. The trail makes the landscape surrounding PR 391 more inviting and accessible for people to experience the holistic restorative properties of the landscape as part of their own healing journey.

Through this experience, I have learned how much just one year can change a person in their healing journey. One year after Leah's surgery, the scar from her surgery is almost unrecognizable. For my personal journey to restore my mental health, I can see how the time has also helped me to heal. The healing trail ending with the final phase of reflection creates an environment that better the quality of life for residents, while at the same time enhancing the restorative properties of the northern landscape. As the healing journey is for people, so it is for the landscape.

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METADATA

Geographical Information System (GIS) mapping created in QGIS version 3.4.12- Madeira available through <https://qgis.org/en/site/forusers/download.html>. QGIS is licensed under the GNU General Public License available at: <http://www.gnu.org/licenses>. Layers that were used in this practicum through mapping are listed as follows

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Layer: surficial geology

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Layers: lakes, rivers, streams, railway lines, roads, city limits, towns and villages in Manitoba.

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Layers: Lake, rivers, streams, marshes, contours, and elevations of surrounding land. Additionally, roads, railways lines, towns

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Layers: Land Settlements Agreements Including TLE (Community agreements, community interest zones, First Nation Non TLE agreements, Treaty Land Entitlement Sites), Natural Regions, Natural Ecological Regions, Natural Ecological Zones, Northern Affairs Communities, Northern Affairs Regions, Parks and Park Reserve, Provincial, Areas of Special Interest, Protected Areas, Provincial Boundary, Water Power Licence areas, Water Power Reserves Wildlife Management Areas.

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