Exploring Métis Landscapes: A Historic Archaeo-geophysical Study of Métis Sites

by

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ABSTRACT

Métis archaeological sites are heavily understudied, and when they have been studied in the past the focus was often on Métis material culture. This thesis looks at Métis sites themselves through the lens of landscape archaeology, utilizing a variety of different archaeological techniques. I investigate the ways in which the Métis organized and laid out their sites both within the constriction of colonial land parcels and in more open spaces while on buffalo hunts. To do this I compare the layout of a Métis River Lot site in St. Albert, Alberta—River Lots 23 & 24 (FjPj-107)—with the overwintering site *Chimney Coulee* (DjOe-6) in the Cypress Hills of Saskatchewan. I use a combination of geophysical technologies and historical records supported by excavations to determine the layouts of these two sites. The resulting site layout maps are then compared to various other Métis sites that have been archaeologically studied to look for patterns and broader implications about the ways Métis sites are influenced by Métis cultural values like geography, mobility, kinship, and the practice of visiting.

Throughout this thesis, I argue for the increased use of remote sensing and geophysical technologies like LiDAR, multispectral imagery, ground penetrating radar, and magnetic gradiometry for studying Indigenous sites in less invasive manners than traditional archaeology. I also highlight the benefit of combining these technologies with historical records when available to get the best overview of a site possible. Lastly, after comparing River Lots 23 & 24 and Chimney Coulee to other known Métis sites, I argue that the layouts of Métis sites are influenced by cultural values, particularly kinship and the practice of visiting—a practice that continues to be important in contemporary Métis communities.

PREFACE

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I also want to acknowledge the support of my family; my mom, my dad, and my sister Shannon, and my friend Em. Even though we were in different cities and provinces their support from afar helped me immensely to always keep going when the road ahead seemed daunting.

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LIST OF ABBREVIATIONS

ALS	Airborne Laser Scanning
ANN	Average Nearest Neighbour
DEM	Digital Elevation Model
EMITA	Exploring Métis Identity Through Archaeology
EU	Excavation Unit
GIS	Geographic Information System
GPR	Ground Penetrating Radar
HBC	Hudson’s Bay Company
HRIA	Historical Resource Impact Assessment
IPIA	Institute of Prairie and Indigenous Archaeology
LiDAR	Light Detection and Ranging
NAPL	National Air Photo Library
NDVI	Normalized Difference Vegetation Index
NWMP	North-West Mounted Police
RGB	Red Green Blue

RS	Remote Sensing
RTK/GNSS	Real-time Kinematic/ Global Navigation Satellite System
TLS	Terrestrial Laser Scanning
UAV	Unmanned Aerial Vehicle (also known as a ‘drone’)

CHAPTER 1: Introduction

Archaeology, like many fields of research, is always changing. Over time new techniques and technologies get invented or applied in new ways that help archaeologists develop a deeper understanding of the past. One of the rapidly evolving and changing subfields of archaeology is landscape archaeology. Archaeologists have always been interested in the way past and present peoples interact with their landscape but the use of geophysical technologies in archaeology to ask these questions in particular has increased in popularity in the last thirty years (Gaffney 2008). Technologies including geographic information systems (GIS), ground-penetrating radar (GPR), unmanned aerial vehicles (UAVs) with multispectral and LiDAR sensors, and magnetic gradiometry are being used at sites all over the world to assist in traditional archaeological investigations as well as allow for more non-invasive research to be conducted (McCoy 2021). The ability to do non-invasive archaeology is of particular importance when working with Indigenous communities in sensitive contexts where invasive excavations in the past have caused irreparable damage or may disrupt community endeavors in preserving sites and landscapes (Sanger and Barnett 2021; Warrick, Glencross, and Lesage 2021). Despite this, many of these technologies have only just begun to be used within the lens of Indigenous archaeology, and only limited testing has been done to investigate which techniques may be best suited for Métis archaeology specifically, and the different geographic contexts of the Métis homeland (Supernant 2017, 2018; Wadsworth, Supernant, and Kravchinsky 2021).

Historic archaeology is another field of study in a state of change. A field once synonymous with colonial or settler archaeology in North America, as opposed to the pre-European contact archaeology of Indigenous sites (Orser 2010; Gould et al. 2020), it has begun to shift to also study the ways in which Indigenous communities were affected by colonialism and continued to persevere into the present day (Rubertone 2000; Äikäs and Salmi 2019; Gould et al. 2020; Montgomery 2022; Black Trowel Collective et al. 2024). This subfield of Indigenous historic archaeology also uniquely encompasses the archaeological study of the Métis in Canada, an Indigenous group born out of European contact.

One of the major benefits of historic archaeology is the presence of historical documentation that can be used to inform archaeological investigations. While written histories are often from the white male perspective, they provide excellent starting points for archaeological studies that can help tell the stories of those often left out of written records. Historic archaeology has long used records to inform excavation but these sources work exceptionally well in tandem with emerging geophysical technologies (Branton 2009). Old maps and written accounts are invaluable resources for locating the best places for targeted geophysical surveys.

Métis sites are the ideal sites for exploring the benefits of the combined use of historic documentation and geophysical technologies to tell often-overlooked stories in less-invasive ways due to the status of Métis sites as post-contact/historic Indigenous sites. The goal of my research is to gain a better understanding of what the combination of geophysical techniques and historical research can tell us about Métis sites. Further, by comparing the results of multiple different techniques at two different types of Métis sites—one settlement and one wintering site—the goal is also to determine whether some techniques are better suited to different types of sites than others. Using a combination of these techniques I then aim to see whether noticeable differences are visible between the layouts of different types of Métis sites. Lastly, I am interested in seeing whether Métis cultural values influence the organization of their sites in visible ways. My research questions are:

1. Can geophysical technologies be used to accurately locate where buildings/features once stood on Métis archaeological sites?
2. What can the layouts of Métis sites tell us about Métis kinship ties and cultural values?
3. Do the layouts of Métis River Lots differ from the layouts of Métis *hivernant* sites?
4. What cultural and colonial factors impact the creation of these two different types of sites?

Chapter 2 begins by defining who the Métis are and providing a brief history of the Métis Nation in Canada. I then discuss the history of archaeological research focusing on the Métis and describe how these approaches have changed over the last few decades. This chapter also defines the different types of Métis archaeological sites and highlights some gaps in Métis archaeological research that this thesis aims to fill.

In Chapter 3 I discuss more broadly some of the methods and theories in spatial archaeology that are drawn upon in this thesis. A brief history of spatial archaeology is provided alongside an explanation of the main theoretical branches of the subdiscipline. The last part of the chapter then turns to describing many of the methodological approaches to studying the landscape at archaeological sites. This includes outlining the fundamental principles of the technologies used in this study; Geographic Information Systems (GIS), Ground Penetrating Radar, (GPR) magnetic radiometry, aerial photography, and unmanned aerial vehicle (UAV)-mounted multispectral imaging and mounted LiDAR.

Chapter 4 brings the ideas introduced in Chapters 2 and 3 together to describe my methodological approach to studying Métis archaeological sites. I describe the methods used to study the two main sites this thesis focuses on—River Lots 23 & 24 (a river lot site) and Chimney Coulee (a *hivernant* site)—and outline my approach to studying and analyzing these sites from a Métis-inspired landscape perspective.

In Chapter 5 the results of the methods of study outlined in Chapter 4 are presented. All previous research done at both Chimney Coulee and River Lots 23 & 24 is presented and combined to make maps of the sites. These maps are then compared to maps created of other Métis archaeological sites and the results and observations made on the comparisons of all of these sites are noted. Lastly, the *hivernant* sites are statistically analyzed for evidence of clustering, and the results of those statistical analyses are presented.

Chapter 6 then discusses the results of the analysis of the different Métis sites. The results of the statistical analysis done on the *hivernant* sites are discussed as are the similarities and differences between all of the Métis sites studied. It is also in this chapter that potential explanations for the patterns seen are provided drawing from Métis cultural values and ethnographic sources.

Lastly, Chapter 7 summarizes the results and hypotheses of this thesis. My research questions are each addressed and I provide recommendations for further research at both sites focused on in this study as well as in the study of Métis sites as a whole.

I would also be remiss not to acknowledge my own place in this research. I am of settler ancestry and despite working closely on this thesis with my supervisor, Dr. Kisha Supernant, who is a member of the Métis Nation of Alberta, as well as other Métis colleagues in the

Exploring Métis Identity Through Archaeology (EMITA) project, my research is still fundamentally from an etic perspective. While I have tried to incorporate as many aspects of Métis ideology into my research as possible and cite Métis scholars, I am still an outsider to the community and my interpretations likely reflect this positionality. I only hope it is made clear that this research comes from a place of respect and a desire to see more Métis archaeology done in a way that reflects Métis cultural values.

CHAPTER 2: The Métis and Archaeology

In order to understand the different ways in which the Métis lived and modified the landscape one first needs to understand who the Métis are and how they have been studied by historians and archaeologists in the past. This chapter begins by briefly outlining Métis history and defining the Métis as a distinct Indigenous group. I then discuss the history of archaeological research focusing on the Métis and describe how these approaches have changed over the last few decades. I also outline the different types of Métis sites. This chapter ends by discussing the current gaps in archaeology on the Métis and describes the ways in which this thesis hopes to fill some of those gaps.

2.1 Defining Métis

The Métis are a post-contact Indigenous group in Canada that emerged during the late eighteenth and early nineteenth centuries due to the mixing of Indigenous and European traders during the fur trade (Burley and Horsfall 1989; Macdougall and St-Onge 2013; Supernant 2018). As descendants of both European and Indigenous people, the Métis developed a distinct cultural identity that mixed elements of both of their inherited cultures (Peterson and Brown 1985; Burley and Horsfall 1989; Andersen 2014a). The term Métis itself means *mixed* in French and was originally used by French colonists to describe the French and Cree descendants of the Métis from the Red River Region (Peterson and Brown 1985). The term was rarely used to describe people without French heritage despite the prevalence of offspring between the Indigenous people and the Scottish and English, until the 1970s when Métis was used to describe any mixed-European and Indigenous offspring in Canada (Peterson and Brown 1985). This usage creates the assumption that Métis people are mixed race rather than being their own group of Indigenous peoples with unique cultural traditions and histories (Andersen 2014a). Thus, most Métis scholars today capitalize the term Métis to indicate that the Métis are a distinct cultural group rather than simply the offspring of two races.

On top of the debate surrounding the capitalization of Métis*,* there is some debate on whether the term should have the accent over the *e* that is present in the French term. Some scholars choose not to accent the *e* in acknowledgment of the Métis' European ancestors being not just French, but also Scottish, English, or Orcadian (Macdougall, Podruchny, and St-Onge 2012). While it is true that Métis European ancestors were not just French, other scholars argue that historical Métis communities likely used the accent and in turn include both the capitalized *M* accented *e* when discussing the Métis as a distinct cultural group (Andersen 2014a). While both spellings are technically correct, in this thesis Métis is both capitalized and accented as that it is most in line with the ways Métis peoples in the regions being studied referred to themselves historically and today.

Beyond questions regarding the spelling of Métis*,* there has also been some confusion on who exactly is Métis (Gaudry and Leroux 2017). While the Métis were originally the mixed offspring of Europeans and Indigenous peoples, they quickly evolved into a distinct cultural group with their own material culture, traditions, and history (Macdougall, Podruchny, and St-Onge 2012). Rather than being defined by their "mixed-ness," Métis lineage is traced back to the ethnogenesis of the Métis Nation in the Red River region (St-Onge et al. 2012; Andersen 2014). Despite this, there has been a recent attempt to return the definition of Métis to one of mixed heritage and an uptick in people claiming Métis ancestry, particularly in French-speaking regions of Canada, to try to gain Indigenous rights and protections (Gaudry and Leroux 2017). These claims, however, ignore the complex histories of the Métis Nation and undermine hard-fought Indigenous rights because being Métis is about much more than being descendants of a union between Indigenous peoples and French colonists. This thesis aims to further highlight the longstanding history and traditions of the Métis Nation.

2.1.1 Métis Ethnogenesis

As most Métis scholars argue what makes a person Métis is grounded in the history of the Métis Nation's ethnogenesis rather than their mixed ancestry, it is important to understand how the Métis Nation came about (St-Onge et al. 2012; Andersen 2014b; 2014a). The story of the Métis begins in the 18th century during the fur trade which brought waves of European traders to the lands that would become Canada. After arriving in North America, it was common for male traders to form unions with Indigenous women to make connections with the Indigenous communities who traded their fur (Dickason 1985). The children of these unions then tended to marry children of similar unions, having children of their own (Sealey and Lussier 1975). Subsequent generations connected via kinship ties began to create individual pockets of Métis families scattered around fur trade posts who became vital players in the fur trade by supplying pemmican and furs and acting as liaisons between First Nation and European traders (Sealey and Lussier 1975; Payne 2004).

By the 19th century, Métis families were active participants in the fur trade which in large part facilitated the success of both the Hudson Bay Company (HBC) and North West Company (NWC; Burley, Horsfall, and Brandon 1992; Supernant 2018). However, the economic importance of the area near the Red River being inhabited by many of the Métis led to an influx of European settlers in the region and the establishment of the Selkirk colony and the Red River settlement by Lord Selkirk and the HBC (Payne 2004). As the Red River settlement grew, the HBC began to limit Métis trade in the region in hopes of disrupting NWC trading (Payne 2004). These trade limitations led to the first Métis political uprising which resulted in the Battle of Seven Oaks in 1816 and the establishment of the Métis Nation (Ens 2012).

Following the battle, HBC and NWC merged into one company in 1821, still called the HBC, and the Métis continued to operate as traders at the Red River settlement transporting goods to surrounding regions and creating well-established trade routes (Payne 2004; Supernant 2018). The merger between the two trading companies brought peace to the area, leading to the gravitation of more Métis to the Red River settlement (Ens 2012). As their population increased, the Métis continued to hunt bison, trade furs, produce pemmican, and transport goods, while also farming at the settlement. Bison hunting in particular grew in importance as the Métis began to produce more pemmican in the wake of the merger (Payne 2004). The increased need for bison meat to make pemmican led to a decrease in bison near the Red River region, causing hunting brigades to travel further from the settlements, often spending winters away in overwintering sites throughout the prairies (Burley, Horsfall, and Brandon 1992; Macdougall and St-Onge 2013).

Life for the Métis changed once again in 1867 with the formation of the Dominion of Canada and their subsequent acquisition of HBC territories (Payne 2004). The Métis of the Red River region, led by Louis Riel, formed a resistance in 1870 to the land transfer, leading to the establishment of the Manitoba Act and a 1.4 million acre land grant for the Métis (Payne 2004; B.-J. Teillet 2008). This land grant, along with the extremely diminished number of bison left on the prairies, caused many Métis to leave the Red River region and establish more permanent settlements elsewhere (Ens 1988; Burley, Horsfall, and Brandon 1992). Some of these Métis communities included Batoche and Duck Lake in Saskatchewan, where another resistance led by Louis Riel began in response to the Canadian government's disregard for Métis land rights and culture (Andersen 2014b). This North-West Uprising resulted in several battles against Canadian military forces concluding with the defeat of the Métis at the Battle of Batoche in 1885 and the hanging of Louis Riel (Andersen 2014b). For many Métis, this defeat combined with the implementation of the Métis scrip system around the same time, which made it difficult for Métis people to own land, drove Métis culture underground. While Métis culture survived in small pockets throughout the country, the large-scale organization of the Métis as a nation remained dormant for almost 100 years (Supernant 2018). Today the Métis are once again fighting for recognition and reclaiming their history.

2.2 Métis Culture

While the history of the Métis outlined above is vital to understanding the Métis as a people, it is equally important to understand Métis culture and ways of knowing. Métis culture can roughly be divided into three main characteristics – geography, mobility, and kinship (Macdougall, Podruchny, and St-Onge 2012). These elements are found in other cultures, including the First Nation and European cultures of which the Métis are descendants, but it has been argued that these elements are fundamental to the way Métis people view the world (Macdougall, Podruchny, and St-Onge 2012; Supernant 2021). Thus I briefly outline some of the ways these elements uniquely influence Métis culture in the rest of this section.

2.2.1 Métis and the Landscape

The first two primary elements of Métis culture—geography and mobility—go hand-in-hand and can be broadly discussed when describing how the Métis interact with their landscape. The Métis consider a large portion of Western Canada extending from the Rocky Mountains to eastern Manitoba to be their homeland (Figure 2.1: Supernant 2017, 2021). The homeland is the traditional area of Métis mobility and occupation during the 19th century due to their role in the fur trade along with historically important places including the Red River settlement, Batoche, and Fort Edmonton (Supernant 2017). While the homeland is scattered with Métis sites and places, it is important to understand the Métis landscape as a holistic entity that is more than the sum of its parts. As described by Supernant a "Métis landscape encompasses a set of relations with lands, waters, and non-human beings, as well as other humans" (Supernant 2021, 363). To understand the landscape from a Métis perspective one needs to understand how the Métis moved across and interacted with it.

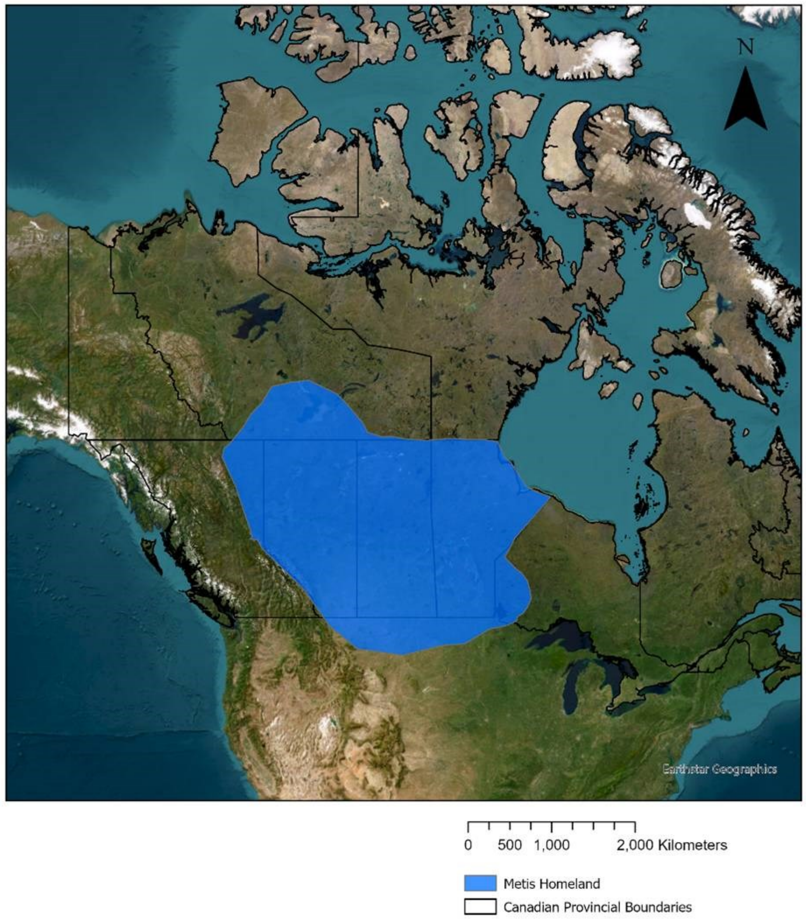

Figure 2.1 Map showing the extent of the Métis Homeland. This map was created by the author in ArcGIS Pro using data freely available from Native Land Digital available at https://native-land.ca/maps/territories/ Métis /.

One major driver in Métis mobility during the 19th century was bison hunting and the practice of overwintering. As has already been described, the increased demand for pemmican following the merger of the HBC and NWC led to the organization of large bison hunts and the practice of Métis hunting brigades traveling farther distances and spending the winters in temporary settlements called overwintering or *hivernant* sites (Burley and Horsfall 1989; Supernant 2017). Overwintering became a social practice as well as an economic one with whole families setting out in brigades together, following bison herds until they found a good place to build a few temporary cabins where they spent the winter hunting and socializing away from major settlements (Burley 1988; 1989; Burley and Horsfall 1989). Some overwintering sites would only be used for one winter while others would be returned to for multiple years (Burley, Horsfall, and Brandon 1992). The locations of these overwintering sites would have been expertly chosen based on proximity to bison wintering areas, shelter from the weather, and access to resources including wood and water (Burley and Horsfall 1989).

During the summer some brigades continued to hunt and were a lot more mobile than during the winter (Supernant 2017). Using Red River carts—modified European wagons that were made entirely of wood so they could be repaired away from settlements—Métis hunting brigades traversed the homeland (Macdougall, Podruchny, and St-Onge 2012; Macdougall and St-Onge 2013). The concept of mobility was central to Métis culture (Supernant 2017). For the Métis, the homeland was a network of interconnected territories with various anchor points rather than a single territory with divided sections of land (St-Onge and Podruchny 2012). This mobility however often meant that the Métis were left out of scholarship tied to large settlements. While there is mention of Métis brigades and voyagers leaving and arriving at sites, few historical sources document the bulk of Métis lives that took place on the road (Macdougall and St-Onge 2013).

While stationary, the Métis were integral parts of the Red River Settlement's economy, but as more Europeans immigrated to Canada and settled in the region some Métis left the Red River region to join *hivernant* hunting bands or establish agricultural settlements throughout the homeland. As more and more Métis left the Red River region following Louis Riels' 1870 resistance and joined agricultural settlements, the settlements grew into new communities (Burley and Horsfall 1989; Payne 2004). Many of the Métis settlements which were formed along rivers, including the Red River Settlement, were divided into narrow plots of land, sometimes called *rangs* (Teillet 2021, 268). This system of land division, sometimes termed the 'River Lot System,' meant that each lot had river access and land for agriculture, and originated in Normandy as the Seigneurial system (Mathieu 2013; Payment 2009; Teillet 2021). The Seigneurial system was brought to Canada by French settlers who used it in New France (modern-day Quebec) before it was adopted at the Red River Settlement (Ens 1988; City of St. Albert and Engineering and Land Services 2010; Teillet 2021). As the Métis migrated from the Red River region they took the river lot system with them and established narrow lots along the Saskatchewan River as well as many smaller rivers across the homeland (St-Onge 1985; Iseke-Barnes 2009; Thompson 2020). These settlements would be threatened again by colonialist forces leading to a final resistance in 1885, and only some still exist, throughout the Canadian Prairies. Many others disappeared leaving only archaeological evidence behind (Burley and Horsfall 1989).

2.2.2 Visiting and Kinship

Kinship is the third vital part of Métis culture, which is intrinsically linked with mobility and geography. From the very beginning Métis life has resolved around kinship. The first Métis families grew out of the unions of children with similar mixed parentage who had children of their own who went on the marry children of similar unions (Supernant 2021). These communities of families eventually grew into the Métis Nation. Kin groups formed during the fur trade and the ethnogenesis of the Métis remain today (St-Onge and Podruchny 2012). As Métis people spread out across the homeland, their kin networks expanded like a web of interconnected kin (St-Onge and Podruchny 2012). The resulting landscapes of connections have been called a kinscape, a term that aims to encompass the widespread relations the Métis had with each other and the land all throughout the homeland (Supernant 2021).

Another important part of Métis culture tied to kinship and community is the practice of visiting (*kiyokewin*). Community is vital to Métis culture, particularly in established Métis settlements in the early 1900s, where the Métis would regularly visit each other's homes (Gaudet 2018; Flaminio, Gaudet, and Dorion 2020). Visiting in the Métis tradition is about more than just getting together, it is a reciprocal practice that allows for the sharing of knowledge, strengthening of kinship ties, and honouring community (Flaminio, Gaudet, and Dorion 2020; Wildcat and Voth 2023). It was often the women who would visit with each other during the day and strengthen the kinship ties in the community while the men worked (Flaminio, Gaudet, and Dorion 2020). Visiting is one of the many ways that Métis women were vital to the inner workings of Métis communities and what in turn links Métis communities across the homeland.

2.3 Métis Approaches to Archaeological Research

Only nine Métis archaeological sites have had published research done on them—six *hivernant* (overwintering) sites and three river lots. Similar to early historical research into the Métis, archaeologists have also been interested in studying the ethnogenesis of the Métis as trying to protect heritage threatened by development (Supernant 2018). When Métis archaeology has been done for the purpose of studying the Métis it has often focused on the way Métis material culture and architecture reflect the supposed hybridity of Métis culture.

A few Métis archaeologists in recent years however have moved away from the topics of ethnogenesis and hybridity and turned towards studying the three key aspects of Métis culture—

geography, mobility, and kinship—as well as Métis economy and daily life (Supernant 2021). A study of Métis use of space was used to distinguish Métis sites from other contemporary communities, with researchers paying particular attention to site placement, architecture, and cabin and site characteristics (Supernant 2018). Much of this research is focused on *hivernant* sites even though the Métis interacted with the landscape on a much larger scale than can be represented by only studying individual sites. The methods and theories of landscape archaeology facilitate more holistic studies of the way past peoples interacted with the landscape and are the main focus of Chapter 3, but the few studies that have applied some of the theories and technologies of landscape archaeology toward studying the relationship between the Métis and the landscape to which they are deeply connected are discussed here.

One study that highlights this relationship between Métis families and the landscape analyzed demographic records for Lac Ste. Anne, Alberta, a Métis site of pilgrimage. Birth, marriage, script, census, and death records were analyzed using GIS for 71 Métis individuals from five families in the 19th century. About 80% of the individuals were only found in records within the borders of Alberta (with around 50% found only in the areas surrounding Lac Ste. Anne), while the other 20% appeared to travel throughout the Métis homeland. These results were determined to highlight the Métis connection to and importance of specific places and regions (Supernant 2021). Another study using GIS to investigate Métis connection to the land focused on Métis mobility. Supernant (2017) tested the application of least-cost models to predict Métis mobility by comparing the models to known historic cart trails. The study however determined the least-cost paths were not able to accurately model mobility across a landscape because the model lacks a personal connection to the landscape that underlies Métis movement (Supernant 2017).

GIS is not the only geospatial technology to be applied to Métis archaeology. Remote sensing technologies including GPR, magnetic gradiometry, and UAVs with Multi-spectral and LiDAR sensors were used to survey the Métis overwintering site Chimney Coulee, near Eastend, Saskatchewan (Wadsworth, Supernant, and Kravchinsky 2021). This study used GPR and magnetic gradiometry to locate the walls and chimney of a Métis cabin and then confirmed the location of these features via excavation. The success of the study shows the value remote sensing can have for investigating Métis culture and its relationship to the landscape. A more in-depth discussion about the use of these technologies can be found in Chapter 3.

2.3.1 Métis Overwintering Sites

Overwintering sites are some of the most recognizably "Métis" sites to exist in the archaeological record and are in turn the most studied Métis sites. Overwintering was an almost exclusively Métis practice and overwintering sites are some of the few places where Métis material culture can easily be found and studied (Supernant 2018). These sites usually had a few single-room cabins made of wood and clay, each with a stone fireplace and a thatched roof (Supernant 2018). Overwintering sites are often identifiable archaeologically by the presence of cultural depressions resulting from borrow pits, cellars, refuse pits, and sometimes latrines, as well as mounds created by stone chimneys of cabins (Burley, Horsfall, and Brandon 1988; Doll, Kidd, and Day 1988; Supernant 2018).

Despite oral histories and accounts suggesting the presence of many overwintering sites scattered throughout the prairies, only a small number have been located and only six have had published archaeological research done on them (Figure 2.2; Burley, Horsfall, and Brandon 1988; Supernant 2018). Of these six, four are in Saskatchewan and two are in Alberta. The

Saskatchewan overwintering sites are Four Mile Coulee, Chimney Coulee, Kis-sis-Away Tanner's Camp and Petite Vill (Burley, Horsfall, and Brandon 1988; Supernant 2018). Buffalo Lake and Kawjeski Cabins are the two known sites in Alberta (Elliott 1971; Doll, Kidd, and Day 1988). Another known overwintering site in Saskatchewan, Wood Mountain, is the largest overwintering site in the province and is believed to have been the most used site with the most historical documentation but it is also the most disturbed so it has never been the focus of any archaeological studies (Burley, Horsfall, and Brandon 1988).

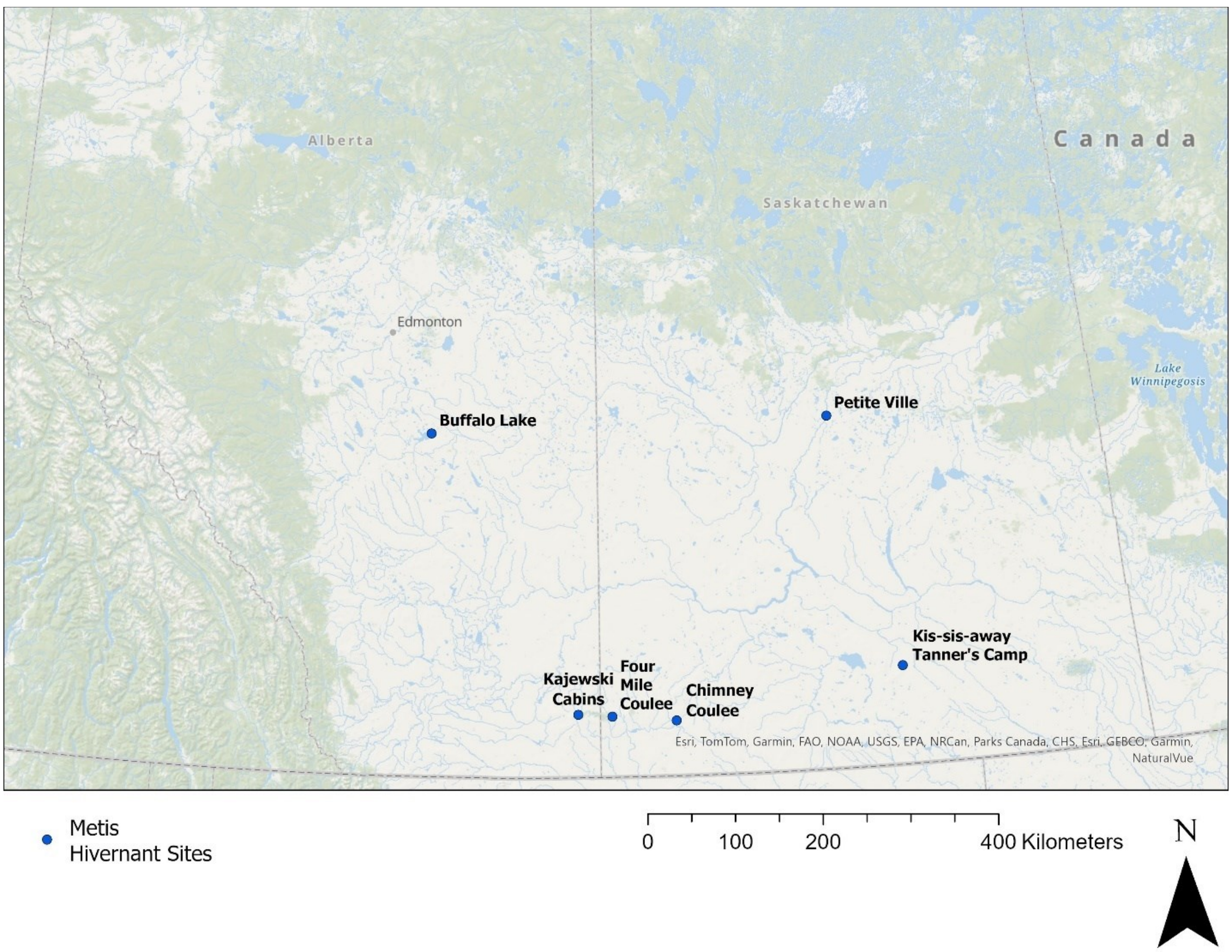

Figure 2.2 Map showing the location of the six excavated Métis hivernant sites.

Cabins have been found and excavated at all six of these Métis overwintering sites yielding various pieces of material culture (Supernant 2018). This study, however, is more interested in the cabins themselves and their locations on the sites compared to other cabins and the rest of the site than the material remains that have been focused on by other scholars. While material culture can help to determine to locations of cabins since often little of the cabins themselves are preserved at these sites, cabins have also been successfully located at some sites through geophysical technologies (Coons 2017; Wadsworth 2020; Wadsworth, Supernant, and Kravchinsky 2021). This thesis focuses primarily on the excavations and geophysical surveys done at Chimney Coulee in the Cypress Hills of Saskatchewan but also refers to the other known overwintering sites when discussing site layout.

2.3.2 Métis River Lot and Farmstead Sites

The locations of many Métis settlements, similar to overwintering sites, were sometimes recorded, but unlike with most overwintering sites, many continue to be occupied by Métis people in the present day making them easily identifiable. These settlements were divided into individual plots of land in the form of river lots and farmsteads (St-Onge 1985; Iseke-Barnes 2009; Thompson 2020). Thus, river lots and farmsteads are their own sites within a larger settlement.

As was previously discussed, the river lot system was a system of land division adopted from the Seigneurial System of New France that ensured that each plot of land in a settlement had equal access to the river, while also having a small amount of land available for agriculture and the construction of housing (Payment 2009; J. Teillet 2021). This system was used in the Red River settlement as well as many other Métis settlements along the Saskatchewan River and many smaller rivers across the homeland (Burley and Horsfall 1989; Iseke-Barnes 2009; Thompson 2020). These sites are then characterized by their identifiable nature in historic city and land records that show the individual narrow plots of land along the river. These lots were described as being "six to twelve chains wide and up to two miles deep" (Payment 2009, 205). Historical records also show that Métis river lots tend to have similar organizations with houses positioned near the middle, farther from the river, barns and garden plots closer to the water, and hay and woodlots in the back two miles (Payment 2009; Burley and Horsfall 1989).

Before this thesis, three Métis river lots had been excavated and published on, all in the Red River region of Manitoba (McLeod 1985). As part of this thesis and an associated Field School run by the Institute of Prairie and Indigenous Archaeology (IPIA) at the University of Alberta, a fourth river lot site (River Lot 23 & 24) in St. Albert, Alberta, just outside of Edmonton, was surveyed and excavated in 2023. The three river lots on the Red River are associated with the Red River settlement (Supernant 2018), making the excavation and survey in St. Albert in 2023 the first archaeological study on a Métis river lot outside of the Red River Settlement.

Beyond Métis river lots there have also been a few archaeological studies done on Métis farmsteads. Burley and Horsfall (1989) identified 22 Métis farmsteads dating from 1882 to 1940 along the South Saskatchewan River, based on the presence of Métis vernacular houses. Like with river lot sites, these farmsteads are associated with nearby settlements (the settlements of Duck Lake, St. Louis, St. Laurent, Batoche, Petite Ville, and Fish Creek). Despite almost all of the farmsteads being located on the river, these sites do not appear to be in the organized river lot system seen in other Métis settlements and were thus classified as farmsteads by the scholars studying them (Burley and Horsfall 1989). While both Métis river lots and farmsteads differ greatly in use and structure from overwintering sites, these sites are still intrinsically 'Métis' and often organized in different ways than surrounding European farmsteads and lots (Burley and Horsfall 1989). They can also help scholars understand different aspects of Métis life and culture than can be gained through researching only overwintering sites. While overwintering sites can provide insight on the uniquely Métis cultural practice of overwintering, river lots and farmsteads allow for a look at the ways the Métis' more sedimentary lifestyles differed from those around them as well as allowing researchers to study Métis culture post-fur trade.

2.3.3 Gaps in Métis Archaeology

Métis archaeology as a practice is still relatively underutilized, with only a few Métis sites having been studied—most being overwintering sites—and most studies focusing on the ways in which Métis material culture and architecture reflect their hybrid nature between First Nations and Europeans (Supernant 2021). This approach ignores much of what makes Métis sites uniquely Métis, and what Métis material culture can tell us about the Métis themselves. Instead, a Métis approach to archaeology that centers on Métis ways of knowing is required (Supernant 2021). As argued by Supernant (2021), a Métis approach to archaeology is one that weaves together five important threads of Métis culture—geography, mobility, kinship, economy, and daily life. It is with this approach that I try to approach the study of both Métis overwintering and river lot sites, focusing primarily on geography and kinship, but acknowledging that all five threads are impossible to completely separate from each other, nor should they be. The next chapter discusses the various methods I used to study Métis ways of life from a spatial perspective.

CHAPTER 3: Methods and Theory in Landscape Archaeology

The goal of this thesis is to gain a greater understanding of Métis' use of space, particularly as it relates to the ways in which their sites were laid out, using geophysical technologies. This focus on space and the relationship the Métis had and continue to have with their landscape requires an understanding of landscape archaeology from a theoretical perspective as well as a background in geospatial archaeology. This chapter aims to lay out a brief history of landscape-based studies in archaeology and demonstrate the ways in which different geophysical techniques are being utilized by archaeologists. I begin by focusing on theoretical approaches to understanding the way past peoples interacted with their landscapes. I then move into discussing how technology has helped archaeologists visualize and study landscapes in ways they were unable to before, focusing on the geospatial revolution caused by the application of Geographic Information Systems (GIS). This chapter then concludes by discussing how various remote sensing technologies, including Ground Penetrating Radar (GPR), magnetic radiometry, aerial photography, unmanned aerial vehicle (UAV)-mounted multispectral imaging, and mounted LiDAR can be used to study archaeological sites. A discussion of how I used these theories and technologies to study Métis sites follows in Chapter 4.

3.1 Landscape Archaeology Theory

Landscape archaeology is fundamentally the study of past cultures through the study of the landscape in which these cultures inhabited. While the early foundations of landscape archaeology trace back to the 1920s (Anschuetz, Wilshusen, and Scheick 2001), Lewis Binford's

(1982) *The Archaeology of Place* was one of the first major archaeological publications to suggest that understanding past cultures requires a certain understanding of a culture's relationship to their landscape (Supernant 2022). In this paper, Binford (1982) argues that archaeologists must be able to understand the relationship past peoples had with the landscape in order to understand the cultural systems of those people.

After Binford, other archaeologists began to explore different approaches to studying cultural landscapes (Crumley and Marquardt 1990; Ingold 1993; Tilley 1994). One such approach advanced by Christopher Tilley (1994) was phenomenology. Phenomenology is a philosophical study of *phenomena* from an objective standpoint. It seeks to understand how people instinctively experience the world without trying to explain why the world is the way it is (Moran 2002). Tilley (1994) applied this idea to landscape archaeology, arguing that since phenomenology focuses on the ways in which people experience the world around them, a phenomenological perspective on space and place allows space to be seen "as a medium rather than a container for action, something that is involved in action and cannot be divorced from it" (Tilley 1994, 10). As people interact with the world around them, they in turn create landscapes of "relational places linked by path, movements and narratives" that when analyzed can provide insight back into the people and their culture (Tilley 1994, 34).

Around the same time as Tilley suggested studying landscapes through a phenomenological approach, Tim Ingold (1993) argued for the analysis of landscapes in relation to time. For Ingold, time and landscape are linked elements that are essential topics in anthropology and archaeology. He argues that landscapes contain the "lives and times of predecessors who, over generations, have moved around in it and played a part in its formation" so studying the landscape allows a researcher to uncover the stories of those who lived on and shaped it (Ingold 1993, 152). For Ingold, landscapes are the heterogeneous sum of the parts that make them up; including land, nature, and space which can all be individually quantified. In turn, he describes temporality as neither chronology nor history but rather as a perspective from which the passage of time can be viewed (Ingold 1993). Thus, temporalizing the landscape is recognizing the temporality of the landscape, or the ways the landscape exists and changes throughout time, which is what allows us to ascertain meaning from it (Ingold 1993).

Ideas surrounding the meanings applied to and gained from landscapes were further discussed by A. Bernard Knapp and Wendy Ashmore (1999). They highlight three interpretive aspects of landscapes—constructed landscapes, conceptualized landscapes, and ideational landscapes—and identify four themes in landscape archaeology at the time—landscapes as memory, landscapes as identity, landscapes as social order, and landscapes as transformation (Knapp and Ashmore 1999). Knapp and Ashmore argue that landscapes embody all of these themes and aspects at all times and that recognizing these themes may help archaeologists understand the landscapes they study better. They also acknowledge that these are all fundamentally etic archaeological perspectives of the landscapes that may not align with prehistoric and historic perceptions of the landscape. While this does not erase the validity of these perspectives, it does require archaeologists to reflect on the biases in their perspectives and acknowledge that they have "chosen to explore the meaning and legacies of individual ideational landscapes" (Knapp and Ashmore 1999, 21).

Moving into the twenty-first century, the concept of a landscape approach to archaeology had gained traction but the term *landscape* was being used by researchers in conflicting ways to describe natural and cultural aspects of human environments. In an effort to correct any misunderstandings that could result from inconsistent usage of the term, Anschuetz, Wilshusen, and Scheick (2001) set out to review landscape archaeology as it stood in 2001, and defined landscape as a paradigm rather than something concrete. This, however, did not seem to completely solve this issue, as 10 years later Julian Thomas (2012) outlined what he deemed to be two different understandings of the term landscape: a visual territory or the result of the relationship between people and places. Today, some archaeologists still debate over the complexities surrounding the idea of a landscape, but many have turned their focus away from issues surrounding conceptualizing landscape and towards the different ways in which the landscape can be studied (Thomas 2012, Supernant 2022).

While this thesis does not directly rely on any of these theoretical perspectives of the landscape, the ideas put forward by these scholars nonetheless have influenced the way I study and interpret Métis landscapes. Learning from Lewis Binford, this thesis studies Métis sites by trying to understand the connection the Métis had with the land they lived on. It also utilizes Tilley's phenomenological approach by looking for patterns in Métis site landscapes, both natural and manufactured, that may be indicative of the ways Métis people lived at these sites. I also apply Ingold's method of temporalizing the landscape, acknowledging how landscapes have changed over time and how they may have looked when the Métis lived on them; especially when comparing river lots that were lived on for multiple generations, to *hivernant* sites which were occupied for a much shorter period of time. Further, like Knapp and Ashmore, when studying Métis landscapes I try to consider all of the aspects—like memory, identity, social order, and transformation—that play a part in the creation of a cultural landscape. So while this thesis is methodology-focused, my interpretations and understandings of Métis landscape are influenced by the foundational theories of landscape archaeology outlined here.

3.1.1 Spatial Archaeology and Analysis

Landscape archaeology as a field of research exists within a broader discipline of spatial archaeology, which looks at the ways space influences everyday life and archaeology (Gillings, Hacıgüzeller, and Lock 2020). The field of study has roots in the earliest days of archaeology itself with most archaeologists throughout time having some interest in interpreting the spatial associations of the materials they uncover (Kroll and Price 1991; Robertson et al. 2006). As archaeology developed as a discipline, materials, and evidence needed to be structured and cataloged in ways that encouraged interpretation narratives to be made about the past (Gillings, Hacıgüzeller, and Lock 2020). As such, archaeologists began to record the precise location in which things were found and analyze visible site structures and patterns (Kroll and Price 1991). However, they did not pay much attention to the ways in which space influenced, reflected, and embodied sociocultural systems and meanings, or invest much effort in trying to interpret the spatial distributions and relationships they recorded (Robertson et al. 2006).

The beginnings of spatial analysis in archaeology can be traced back to the early 20th century when archaeologists began to adopt more geographical theories and pay attention to the geology, topography, climate, vegetation, coastline, etc. of sites and question how these features may have affected past populations (Gillings, Hacıgüzeller, and Lock 2020). Further ideas and methods around area studies and large-scale settlement analyses began to be proposed, giving birth to the study of regional settlement patterns which attempt to reconstruct past landscapes on larger scales than ever seen before (Kowalewski 2008; Gillings, Hacıgüzeller, and Lock 2020). Regional analysis in archaeology flourished in the 1970s and 1980s, leading to the adoption of multiple new methods and paradigms borrowed from geography, biology, and economics as researchers tried to statistically quantify spatial patterns at and between sites (Johnson 1977;

Kantner 2008). Regional settlement pattern analyses continue into the present day, although approaches have changed slightly as archaeology as a discipline has changed, with previous approaches being criticized due to the uncritical ways in which they were applied, and the advent of new technologies like geographic information systems (GIS) and remote sensing (Kantner 2008; Kowalewski 2008).

Besides regional analyses, local and community forms of analysis also began to be applied to archaeological sites, as did other forms of statistical spatial analysis adapted from geography (Rood 1982; Kolb and Snead 1997; Fotheringham and Brunsdon 1999). While regional analysis focused on larger landscapes of settlements, smaller community approaches allowed for more intensive studies that still looked at whole communities rather than single sites (Kolb and Snead 1997). In turn, local forms of spatial analysis allowed for even more concentrated quantitative studies of archaeological sites and their surroundings (Fotheringham and Brunsdon 1999). Spatial analyses at the regional, community, and local scales all utilized various statistical methods to help quantify spatial relationships, and while modern archaeology has moved away from strictly processional forms of site quantification, many of these methods of analysis still form the foundation of modern spatial analysis in archaeology (Robertson et al. 2006; Gillings, Hacıgüzeller, and Lock 2020).

Nearest Neighbour Analysis

Nearest Neighbour Analysis is one of the most common forms of spatial analysis in archaeology and the only specific methodology of traditional spatial archaeology that will be focused on in detail in this thesis. It is a statistical tool first proposed by Philip J. Clark and

Francis C. Evans in 1954 who used it to measure spatial relationships in plants and objectively describe plant distributions (Clark and Evans 1954). It works by measuring the distance between points and their nearest neighbours and then taking the mean value of these distances to calculate the mean observed distance. This mean observed distance is then compared to a calculated expected mean distance of random points in that population to get a ratio (p-score). If the ratio is 1, the distribution of points is random. If the ratio is less than 1 (the average distance is less than the expected distance), points are determined to be clustered whereas if the ratio is higher than 1 (the average distance is higher than the expected distance), the points are said to be dispersed. For every ratio, the probability of points being randomly placed is calculated (a z-score), and the lower the score, the more likely that the points are either clustered or dispersed. The ratios calculated for multiple populations/sites can then be compared (Clark and Evans 1954).

Nearest neighbour analysis was first applied by archaeologists in the 1970s to analyze site distributions (Zubrow 1971; Washburn 1974; Earle 1976; Rood 1982) but was also used for analyzing artifact distributions (Whallon 1974; Pinder, Shimada, and Gregory 1979). It is, however, important to note that nearest neighbour analysis can only look at a single period of time and therefore requires all points to be contemporaneous, which can be a challenge when looking at archaeological remains or features at sites from various time periods (Rood 1982; Thompson et al. 2022). While one solution is to perform multiple nearest neighbour analyses for features from different periods, another is to perform only one analysis at the height of occupation (Thompson et al. 2022).

Another consideration in the use of nearest neighbour analysis is the “boundary effect.” The boundary effect was first noted by Clark and Evans (1954) and has since been brought up by multiple researchers as a potential problem in the use of the statistical tool (Pinder, Shimada, and

Gregory 1979). The boundary effect is caused by the superimposing of arbitrary boundaries on boundless space which could influence the distances measured between points and their nearest neighbours on the periphery of an area and in turn increase the average observed distance compared to the expected mean distance of points inside the boundary, possibly skewing the resulting ratio (Pinder, Shimada, and Gregory 1979). The boundary effect increases if the number of points being analyzed is small, as a higher percentage of points are closer to the peripheries of the area. To minimize the boundary effect modified formulas can be used and researchers are encouraged to consider the shape and size of their study area compared to the points being studied (Clark and Evans 1954; Pinder, Shimada, and Gregory 1979). Regardless, Nearest Neighbour is a helpful statistical tool for analyzing spatial patterns at archaeological sites that was only made more accessible with the adaption of digital mapping systems and GIS.

3.2 Mapping and Geographic Information Systems (GIS)

While Tilley, Ingold, and their peers were defining landscape archaeology and the subdisciplines' theoretical approaches, others had turned their focus toward the application of Geographic Information System (GIS) technologies (Crumley and Marquardt 1990). GIS was first adopted by some archaeologists in the 1980s primarily for inventory purposes and mapping artifact distributions but the technology has seen a rapid increase in its usage in archaeology since the late 1990s (González-Tennant 2016). As the use of GIS in archaeology has increased in popularity various scholars have published studies detailing the varying ways GIS can be used, including in the study of settlement patterns and cemeteries, and the technologies' ability to facilitate non-invasive archaeology, particularly in association with Indigenous communities (Bevan and Conolly 2005; Löwenborg 2009; Gillings 2012; Supernant and Cookson 2014; Dagg

2022; Shaw, Steelman, and Bullock 2022). GIS has become such a fundamental tool in the toolbelt of so many archaeologists that its rapid increase in usage has been termed the "geospatial revolution" in archaeology – a term that compares the increased use of geospatial technologies by archaeologists to the *radiocarbon revolution* and the ways that the invention of radiocarbon dating fundamentally changed the practice of archaeology (McCoy 2021).

GIS was not immediately accepted as a tool by all landscape archaeologists though. As the use of GIS in archaeological research started to increase during the early 2000s critiques surrounding the way some scholars perceived and used the technology arose (Hacıgüzeller 2012). GIS is essentially a tool that helps to visualize the landscape like traditional map-making and like with any map, the landscape is represented from a particular perspective. Maps have a long history of being made and used by elite and empowered groups of people to influence the ways others see the world. They have been used by landowners and colonial forces to carve up the world into ownable plots of land, and for much of history were the embodiment of the Western gaze on the world (Thomas 2012). Maps are never objective and thus, neither is GIS. It is instead a theory-laden tool that many early archaeologists used without proper theoretical backing and critical thought—instead operating under the assumption that GIS can be used to represent objective truths (Hacıgüzeller 2012). For GIS to be used ethically in archaeological research it needs a strong theoretical backing and to be perceived as it is, a tool that can be used to help recreate the world that is no more valid than other conceptual approaches to studying the landscape.

One major benefit of GIS is its ability to perform statistical spatial analyses that used to have to be calculated manually. ArcGIS has a Nearest Neighbour tool (Average Nearest Neighbour; ANN) that analyzes datasets of points or polygons for the user. While this tool still comes with the limitations of traditional Nearest Neighbour analyses (i.e. points need to be contemporaneous and the boundary effect), GIS makes the application of this tool, and many others, more accessible than ever before allowing for more widespread use of it in archaeology.

While GIS is an extremely valuable geospatial technology used in modern landscape archaeology, it is far from the only tool being applied to the discipline. A whole suite of remote sensing technologies has also begun to be utilized by archaeologists (Gaffney 2008). The more frequently used technologies include various types of airborne cameras and sensors—particularly multispectral and LiDAR—mounted on unmanned aerial vehicles (UAVs)—also known as drones, and ground-based sensors—ground-penetrating radar, and magnetometry (Harmon et al. 2006; Gaffney 2008; Chase et al. 2011; Goodman and Piro 2013a; Zhurbin et al. 2022). The increased development and usage of many of these technologies have led to major changes in the ways landscape archaeology is conducted and increasingly sophisticatedly analyzed, but it is important to note that these technologies cannot replace traditional knowledge. The landscape is fundamentally connected to the people that inhabit it, so while many of the technologies discussed next have been and can be applied to Indigenous archaeology they must be used to support traditional knowledge, not replace it (Supernant 2022).

3.3 Airborne Remote Sensing

Remote sensing is the science of studying something (usually the Earth and its features) from a distance (Wiseman and El-Baz 2007). Remote sensing as a science dates back to the first instances of aerial photography in the late 19th century, and today includes a plethora of types of sensors that record data about the Earth by analyzing the way energy in the visible and invisible electromagnetic (EM) spectrum reflects from the surface or feature being studied (Winterbottom and Dawson 2005; Luo et al. 2019). Remote sensing can be conducted from the air, space, underwater or the ground (Figure 3.1; Wiseman and El-Baz 2007; Cowley 2011). Sensors can also be divided into two distinct types; passive sensors which record reflections from naturally emitted energy, and active sensors which emit their own energy (Winterbottom and Dawson 2005; Luo et al. 2019). In this thesis, both active and passive sensors are used but only aerial and ground-based remote sensing technologies are discussed. I start by outlining the key types of aerial remote sensing used and defer the discussion around ground-based remote sensing to the last section of this chapter.

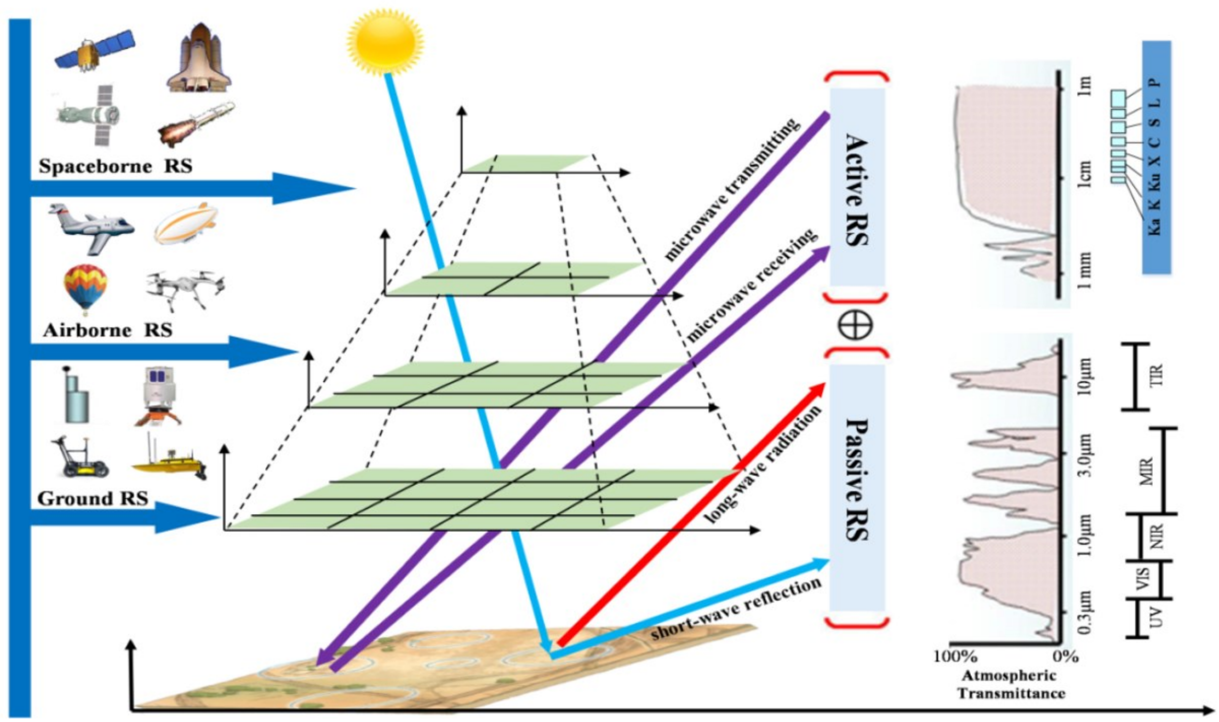

Figure 3.1: A schematic showing the different types of remote sensing (RS) used in archaeology. Imaged taken from Luo et al. 2019: 2. This image is under a Creative Commons CC-BY-NC-DC licence which permits the use of it without adaptation.

The oldest types of remote sensing techniques are airborne, beginning with the first application of aerial photography (Wiseman and El-Baz 2007). Traditionally aerial photography was conducted by taking a camera into the air by mounting it on some sort of aircraft. This was commonly done using airplanes after their invention but also includes cameras mounted to kites, balloons, blimps, birds, helicopters, and most commonly today, unmanned aerial vehicles (UAVs) also known as drones (Schlitz 2004; Aber and Babb 2018; Luo et al. 2019).

Archaeologists have applied aerial remote sensing technologies to their research for almost as long as the technologies have existed because of their ability to provide overviews of sites and study the landscape at a much larger scale than is possible from the ground. While aerial photography was the earliest form of aerial remote sensing applied to archaeology, today archaeologists utilize various types of passive and active sensors including digital cameras for photography and photogrammetry; multispectral sensors; and LiDAR (Luo et al. 2019).

3.3.1 Aerial Photography

Aerial photography is almost as old as photography itself and dates back to the 1850s when photographs of Paris were taken from a hot air balloon by Gaspard-Felix Tournachon (Aber and Babb 2018). It involves taking a functioning camera into the air in order to take pictures of the ground, and this process has remained basically the same since the 19^{th} century, while cameras have improved greatly allowing for better images. What has changed is the ways in which cameras are taken up into the sky.

In the late 1800s aerial photos were either taken by a person in an aircraft (which at the time meant an air balloon) or by a camera mounted to something that was then launched into the air; most often this meant cameras strapped onto pigeons and kites but the movements of the cameras were not always predictable and photos would often be taken at weird angles and variable heights (Wilkinson 2013; Aber and Babb 2018). The invention of the airplane meant that photos could be taken at consistent angles and elevations over a large area of ground much more easily than they could be with previous methods. As airplanes were rapidly improved during the early 20th century due to their military potential, so too was the art of aerial photography. With the improved ease of taking aerial photos, governments realized their potential for surveying, mapping and reconnaissance, and cameras began to be designed specifically for use in the air (Reeves 1936). As technologies improved aerial photography moved away from taking individual photos of an area and towards systematically taking multiple photos that could be later combined to create planimetric maps covering larger areas (Miller 1957).

Airplane-based aerial photography allowed for large-scale mapping of the landscape but can be expensive and time-consuming. Alternatively, satellite photography, which was developed and launched during the Cold War, allowed for even larger scale and more continuous aerial photography monitoring (Luo et al. 2019).While the resolution is much lower in most satellite photography, satellite imagery from Landsat is free and has been consistently collected since 1972 (Rogan and Chen 2004). Today, in order to bypass the low resolution of satellite imagery and high cost of airplane-based aerial photography, many researchers turn towards UAVs when recent aerial photography of a specific area is required (Schlitz 2004). This study used a UAV to collect aerial imagery of sites.

In archaeology, aerial photography saw some use as early as 1880 but did not really become a tool in the archaeologist toolkit until the mid-1900s (Reeves 1936). Some early archaeologists used photos originally taken by the military to assist in their research but the first major instance of archaeologists deliberately taking aerial photographs was in 1930 when Reeves took aerial photos of multiple archaeological sites in Ohio (Reeves 1936). Between the 1930s and 1960s, however, aerial photography was not widely used by archaeologists. In the 1950s Miller (1957) published a paper discussing the uses of aerial photography in archaeology and giving a detailed explanation on how to go about using aerial photos, but it was not until the late 1970s that aerial archaeology began to gain major interest in Europe (Gojda 1997). This is in large part due to the foundation of air photography units in the United Kingdom leading to an increased use of air photos for systematically mapping the landscapes of entire nations (Gojda 1997). Moving into the 21st century, the development and public availability of UAVs has allowed archaeologists to easily take aerial photographs of individual sites and create much more detailed site maps than were ever possible before by combining aerial photos with GIS (Schlitz 2004; Verhoeven 2017).

Today archaeologists utilize aerial photography in two main ways. firstly, for almost a century, archaeologists have been taking current photos of a site or landscape in order to get an accurate map or picture of the present landscape (Schlitz 2004; Verhoeven and Sevara 2016; GVerhoeven 2017). This is still useful for providing detailed maps of sites and their surrounding areas and even locating features or sites that may not be visible from the ground. The second use, however, is when archaeologists use multiple photos of a site taken over the years to understand how the landscape has changed (Cowley and Ferguson 2010; Ferguson 2011; Cowley and Stichelbaut 2012). This practice is referred to as using historic aerial photography. Since the widespread adoption of aerial photography in the early 20th century, many countries began and continued to collect aerial photos documenting the landscape. In Europe some aerial photos date back to the 1910s are available, but they became more widely accessible for the 1940s and beyond (Cowley and Ferguson 2010). In Canada, the National Air Photo Library (NAPL) has photos that date back to the 1920s, (Canada 2011). While these historic photos can be used like modern photos to help locate sites or features, they are arguably most useful in displaying how the landscape has changed over time (Cowley and Ferguson 2010). If the site being studied was still in use in the early 20th century aerial photos could provide valuable insight into what the site looked like during occupation. Even if a site had already been abandoned by the early 1900s, aerial photos from the 20th century may show how a site and its surrounding landscape changed in the last 100 years due to development and rapid urbanization (Cowley and Ferguson 2010). One of the sites in this study, River Lots 23 and 24, was occupied until the 1970s and thus historical aerial photos have been used to track how the site changed in the last years of its occupation and as well as after its occupation. While aerial photos can only provide a snapshot of an area at a single moment in time, combining current and historical aerial photos of a single area can tell us a lot about how the landscape has changed and bring us closer to understanding the historic landscape.

3.3.2 UAV-mounted LiDAR

Light detection and ranging (LiDAR) is an active remote sensing technique that uses lasers to record three-dimensional data points (Historic England 2018). It was developed in the 1970s after the invention of near-infrared pulse lasers that were powerful enough to emit detectable radiation (Harmon et al. 2006). Like GPR sensors, LiDAR Sensors record the time it takes for a laser pulse to travel to the ground and be reflected back before converting time into distance (Figure 3.2). By emitting a continuous wave of laser pulses, LiDAR sensors can record a high number of points per square metre of ground at different heights resulting in a large volume of 3D data points referred to as a ‘point cloud’ (Harmon et al. 2006; Chase et al. 2012). This point cloud is in turn used to create a topographic model of the landscape being surveyed.

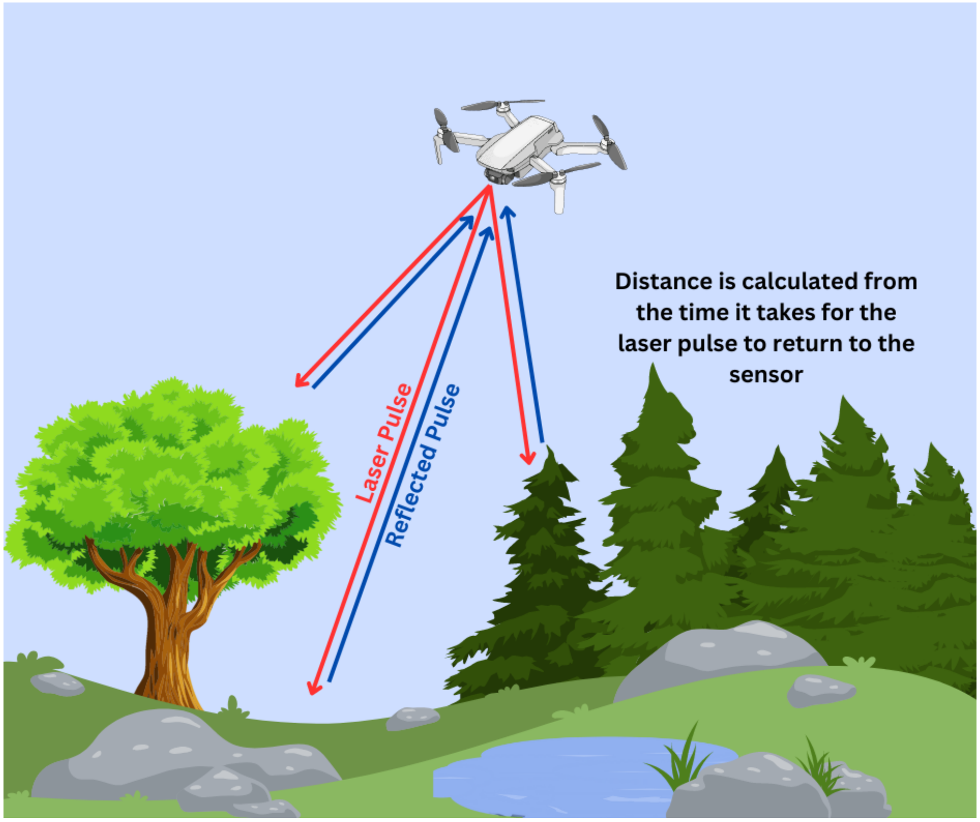

Figure 3.2 Diagram showing how LiDAR data is collected. Image made by the author

LiDAR surveys can be conducted on the ground (terrestrial laser scanning: TLS) or aerially (airborne laser scanning: ALS) from static or moving sensors (Historic England 2018). ALS surveys tend to be most common with sensors mounted on a variety of aerial vehicles including satellites, airplanes, helicopters, and most recently UAVs (Risbøl et al. 2023). UAV-mounted LIDAR has become a common method of surveying for many researchers because of the flexibility of flight parameters but often can only cover a small area due to drone battery capacity. When larger areas need to be covered airplane or helicopter-based LiDAR is still a popular choice (Schroder et al. 2021). This study uses a UAV-mounted LiDAR sensor.

LiDAR became available for commercial use in the late 1990s and began to be used by archaeologists in the early 2000s (Risbøl et al. 2023). Since its introduction, LiDAR has been widely adopted by archaeologists primarily in topography studies and surveys in areas with dense vegetation (Harmon et al. 2006; Chase et al. 2012; Chase et al. 2011; Schroder et al. 2021; Li 2023; Risbøl et al. 2023). LiDAR's ability to penetrate through vegetation is a major feature that sets it apart from other remote sensing equipment archaeologists use and has allowed archaeologists to locate features in thick vegetation (Chase et al. 2011; Chase et al. 2012; Li 2023). Studies using LiDAR to visualize terrains obscured by vegetation have become especially popular in Mesoamerica where dense rainforests and jungles hide large features (Arlen F. Chase et al. 2011; Luo et al. 2019; Schroder et al. 2021) but similar studies have also taken place all over the globe (Devereux et al. 2005; Evans et al. 2013; Luo et al. 2019; Li 2023; Risbøl et al. 2023).

Besides penetrating through thick vegetation, another major use of LiDAR in archaeology has been to create accurate terrain models of cultural landscapes and features. Since LiDAR can detect very minor changes in elevation it allows researchers to identify minor topographic changes that are not easily visible to the naked eye (Harmon et al. 2006). This feature has led archaeologists to successfully use LiDAR to not only collect better elevation data on cultural landscapes but also to locate features like house pits, shell middens, building foundations, and cart tracks (Harmon et al. 2006; Chase et al. 2011; Luo et al. 2019; Risbøl et al. 2023). LiDAR-based digital terrain models (DTMs) can also be visualized through different methods to create hillshade maps, which help visualize slopes; aspect maps, which visualize slope steepness as well as the direction slopes face; 3D models and contour maps (Devereux et al. 2005; Arlen F. Chase et al. 2011; Evans et al. 2013; Luo et al. 2019).

The benefits and potential uses of LiDAR in archaeology in some contexts have changed the way archaeological research is conducted in such an extreme way that some researchers argue it has ushered in transformational change akin to the introduction of radiocarbon dating (Chase et al. 2012; McCoy 2021). LiDAR, however, is not without its drawbacks. LiDAR data can only show what is currently on the surface at the time of the survey (Harmon et al. 2006). If a surface has been changed too much since the time period under study LiDAR will be of little use, and further, there is no way to know just from LiDAR data when changes to a landscape may have taken place which can lead to misinterpretations of features on the surface. Thus, like many of the geophysical technologies used by archaeologists, LiDAR ultimately works best when combined with various other methods of investigating topography, whether that is excavations, pedestrian surveys, or other remote sensors (Harmon et al. 2006; Luo et al. 2019).

3.3.3 UAV-mounted Multispectral Imagery

Multispectral imagery is a passive remote sensing technique that records reflected energy in multiple wavelengths stretching from the visible electromagnetic (EM) spectrum through to the thermal infrared range (Figure 3.3; Winterbottom and Dawson 2005; Luo et al. 2019). Multispectral sensors simultaneously record a set number of non-contiguous spectral bands from across the spectrum, differing from photographic cameras that only collect waves in the visible range (Beck 2011; Luo et al. 2019). By collecting reflected waves from across the EM spectrum, multispectral imagery can be manipulated by researchers to understand changes to the landscape that may not be completely visible to the naked eye. In particular multispectral imagery can be used to understand vegetation variations and health (Luo et al. 2019).

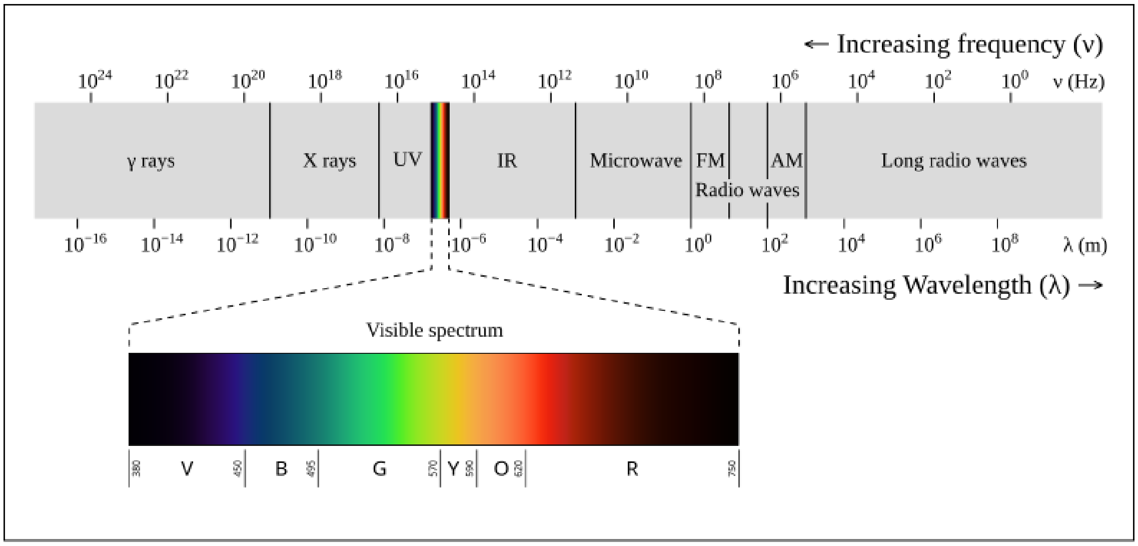

Figure 3.3 The electromagnetic spectrum. Taken from Wikipedia commons (labeled for reuse under creative commons).

Multispectral imagery was developed for and is most commonly used in agriculture and biology for studying vegetation health because of the well-defined differences in reflectance values between different types of vegetation, as well as healthy versus unhealthy vegetation (Aqdus, Hanson, and Drummond 2012). These reflectance values are most evident in the blue-green, red edge, and near-infrared parts of the EM spectrum and can often be seen through the manipulation of imagery bands when changes may not be visible to the naked eye (Aqdus, Hanson, and Drummond 2012; Doneus et al. 2014). The ways in which various bands are manipulated to create false colour images are termed vegetation indices. Different vegetation indices are calculated depending on what is being studied, with the most common one being the Normalized Difference Vegetation Index (NDVI; Bennett et al. 2012).

Most multispectral imagery used for research comes from satellite sensors. Beginning in 1972 the Landsat program has collected multispectral imagery of the Earth via various satellites at a 15m spatial resolution (Luo et al. 2019). Since then, various other satellites with much higher spatial resolutions (up to 50 cm) have been launched, but not all of them have freely available data as Landsat does, and it can be expensive to acquire data from them (Luo et al. 2019). Satellite imagery with lower resolution is in many cases suitable for large-scale vegetation monitoring, but when study areas are smaller and more detail is required, many researchers turn toward UAV-mounted multispectral sensors (Winterbottom and Dawson 2005; Aqdus, Hanson, and Drummond 2012; Luo et al. 2019). Similar to UAV-LiDAR, mounting multispectral sensors on UAVs allows for higher spatial resolution (up to 10 cm) and more targeted studies, but sensors and UAVs are expensive and have limited flight times due to battery capacity (Winterbottom and Dawson 2005; Aqdus, Hanson, and Drummond 2012; Luo et al. 2019; Schroder et al. 2021).

In archaeology, both satellite and UAV-mounted multispectral sensors have been used to investigate vegetation changes believed to be associated with cultural materials. Archaeologists have long noted that visible vegetation differences on the surfaces of sites are often caused by archaeological features (Aqdus, Hanson, and Drummond 2012; Bennett et al. 2012; Agapiou et al. 2014; Zhurbin et al. 2022). Occupation layers of archaeological sites are formed from a build-up of anthropogenic materials, including organic residues which affect the soil formation process and in turn any vegetation on the surface (Zhurbin et al. 2022). This often results in visible crop marks or changes in the non-visible spectrum that act as reflections of archaeological remains under the surface that have been used for years to locate aerially archaeological sites (Aqdus, Hanson, and Drummond 2012; Bennett et al. 2012; Zhurbin et al. 2022).

Various studies in the 21st century have begun to use multispectral imagery to locate and analyze archaeological sites using both satellite (Agapiou et al. 2014; Gennaro et al. 2019; Luo et al. 2019) and aerial/UAV sensors (Winterbottom and Dawson 2005; Aqdus, Hanson, and Drummond 2012; Luo et al. 2019) with great success. Further studies have also delved into the ideal vegetation indices for archaeological investigations (Bennett et al. 2012; Doneus et al. 2014; Gennaro et al. 2019).

3.4 Ground-Based Remote Sensing

As noted in section 3.3, remote sensing can be done from the air, space, underwater, or the ground, although it is most often associated with airborne or spaceborne methods (Wiseman and El-Baz 2007; Cowley 2011). Unlike aerial methods which study the surface of the earth, ground-based methods explore the subsurface (Luo et al. 2019). Since these ground-based sensors penetrate through the Earth's surface and use techniques that measure physical aspects of the ground, they are often discussed separately from airborne and spaceborne remote sensing techniques are simply referred to as geophysical methods. The use of these geophysical technologies in archaeology is referred to as "archaeological geophysics" or "archaeogeophysics" (Kvamme 2001; Conyers 2013).

Geophysical technologies study physical and chemical changes in the ground that can be indicative of cultural remains, making them useful tools in archaeology for locating buried materials (Conyers 2013). By conducting geophysical surveys in set areas (usually marked grids), archaeologists can sometimes pinpoint the locations of features or graves without having to excavate, making these tools valuable for conducting non-invasive archaeology. Common tools used by archaeologists at various sites include magnetometry, electrical resistivity, electromagnetic conductivity, and ground penetrating radar. Below I discuss in detail only the ground-based geophysical technologies used in this thesis—Ground Penetrating Radar and Magnetometry.

3.4.1 Ground Penetrating Radar

Ground Penetrating Radar (GPR) is a form of ground-based remote sensing that collects data by sending a radio detection and ranging (radar) pulse into the ground (Conyers 2012). An antenna sits on the surface and a transmitter sends a cone of radar waves of multiple frequencies into the ground which get reflected back to the antenna (Figure 3.4; Conyers 2012). The reflected wave is recorded along with the time it took for the wave to leave and return to the antenna. This time interval is referred to as two-way time and is recorded in nanoseconds (ns). Depending on the material the waves travel through the velocity of the waves may change. The velocity of the waves can be calculated based on the estimated propagation speeds of different types of sediment (Conyers 2012).

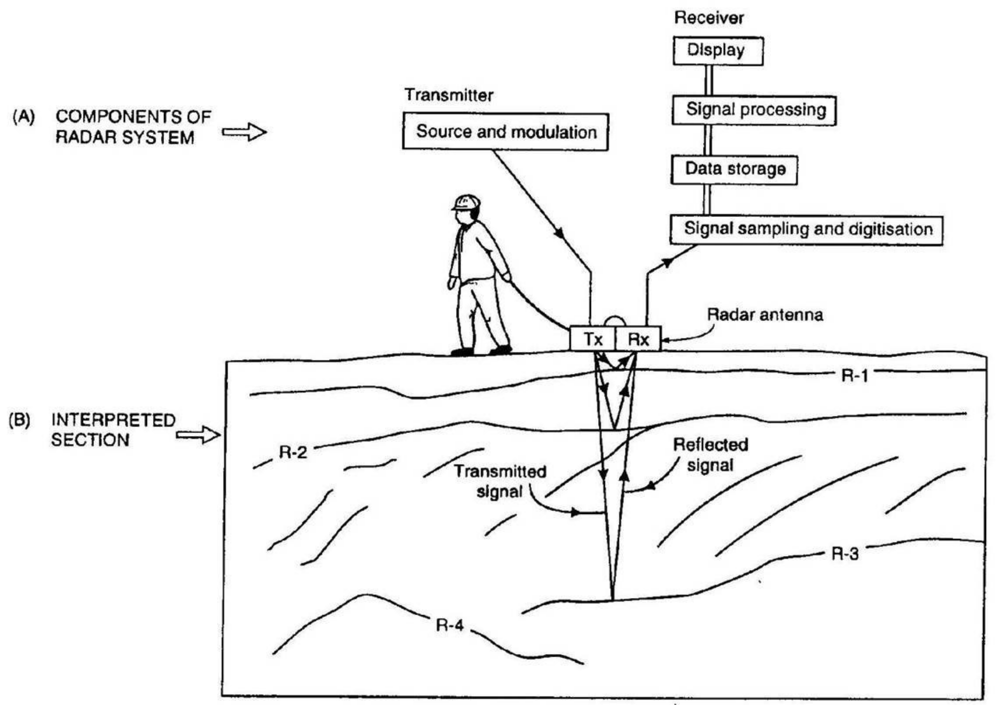

Figure 3.4 Schematic drawing of a ground penetrating radar (GPR) unit. Taken from the open source website, Geophysics for Practicing Geoscientists (Oldenburg et al. 2017).

Once velocity is calculated the two-way time of radar waves is converted into depth below ground, allowing analysts to see at what depth any potential changes in material exist. As radar waves can act quite differently depending on the material they interact with analysts can often see quite visible changes in the subsurface as well as more subtle differences (Goodman and Piro 2013a). Cement or metal for example can be quite obvious in a GPR profile and radar waves have a much more difficult time propagating through these materials. Alternatively, decaying wood or different organic materials will have a more subtle change compared to their surrounding material. It is for this reason that things like metal pipes are much easier to locate using GPR than graves (Goodman and Piro 2013a).

The depth and resolution of GPR depends on the frequency of the radar waves (Conyers 2012). The frequency of a radar wave controls the wavelength of the waves as well as their attenuation. Higher-frequency antennas record signals at a higher resolution but their signals do not reach as deep as antennas with lower frequencies. The lower the frequency the deeper into the ground waves reach but less detailed features are visible (Pérez-Gracia et al. 2009). The antennas often come in standard frequencies, but the antenna frequency should be chosen depending on the goal of the survey (Goodman and Piro 2013a). In archaeology, most surveys are done using a 900 MHz, 400 MHz, or 270 MHz antenna (Conyers 2012). Both a 900 and 400 MHz antenna were used for this thesis.

GPR data is recorded in profiles that when collected parallel to each other in grids can be combined to create 3D cubes of the covered area (Figure 3.5). These cubes can then be examined at chosen depths from a top-down view in ‘timeslices’ or amplitude maps. These timeslices are created by interpolating the radar data at a certain depth allowing for areas of reflections across multiple profiles to be more visible, but because they are created by interpolating data they are not as accurate as the profiles and should not be the basis for most interpretations (Conyers 2012; Goodman and Piro 2013a).

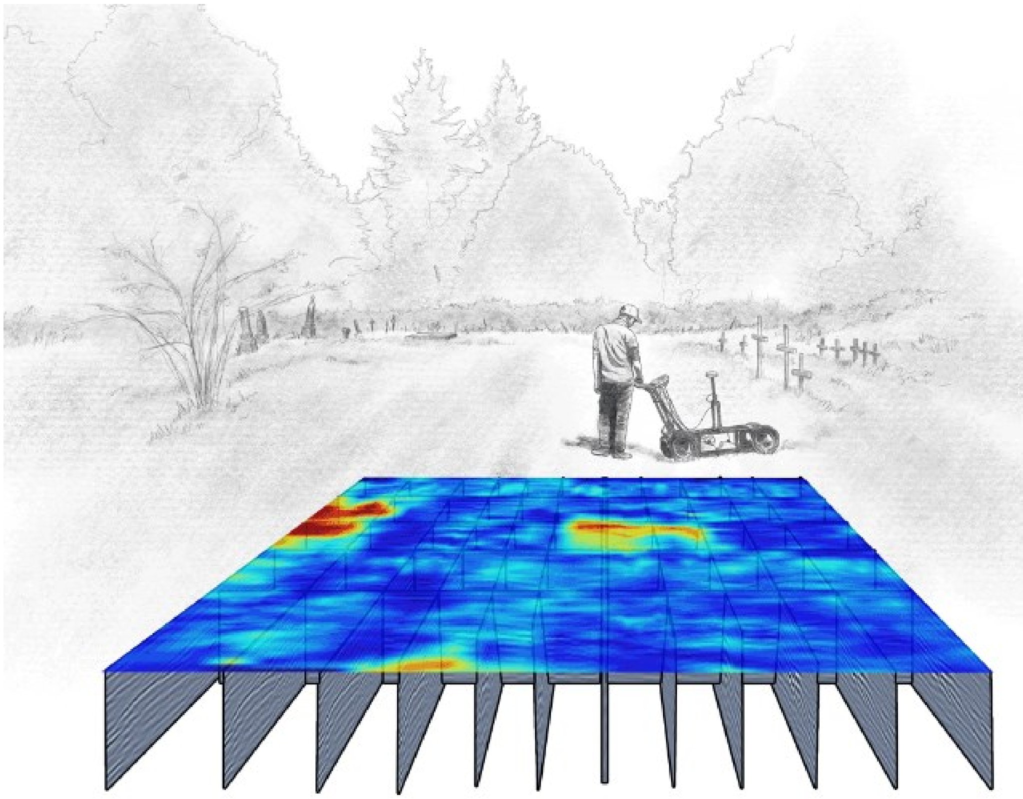

Figure 3.5 An illustration of gridded GPR profiles and an interpolated amplitude map of a timeslice. A illustration drawn by Eric Simons under A Creative Commons license taken from the University of British Columbia's illustrated guide on locating burials using GPR.

While these timeslices should not be the primary basis for interpretation, they are still useful, as is the method of collecting GPR lines in set grids. Covering areas in set grids of transects spaced equal distances apart allows for the most accurate locating of potential features found in the data (Conyers 2012). The spacing of these transects will depend on the size of the target features. Lines can also be run either bi-directionally or unidirectionally with bi-directional lines snaking across a grid and unidirectional lines always beginning on the same side of the grid.

In archaeology, GPR first came into use during the 1970s under the belief it could provide X-ray-like images of below the surface and do away with the need for excavations (Gaffney 2008; Conyers 2012; Goodman and Piro 2013a). Many researchers soon realized that GPR could not actually see under the ground with perfect clarity and some gave up on using GPR altogether (Goodman and Piro 2013a). However, as technology improved and it became easier to process and display GPR data and GPR began to be applied to various subsurface studies to assist with the locating of archaeological features (Kvamme 2001; Gaffney 2008; Dalan et al. 2011; Goodman and Piro 2013a). GPR was found to be particularly useful at Roman sites because of the high reflectivity of the remains of Roman buildings but it has also been used in North America to help locate building foundations (Vaughan 1986; Nishimura and Goodman 2000; Conyers 2012; Goodman and Piro 2013a; Wadsworth, Supernant, and Kravchinsky 2021).

Another common usage for GPR in archaeology is the locating of unmarked graves (Goodman and Piro 2013b; Conyers 2012; Gaffney et al. 2015; Wadsworth et al. 2020; 2021). Early studies using GPR to locate graves focused on areas where graves were to be excavated in the future (Vaughan 1986), or were conducted within cemeteries to locate graves without markers (Conyers 2006; Doolittle and Bellantoni 2010; Goodman and Piro 2013b). More recently scholars working with Indigenous communities in Canada have been using GPR to locate potential unmarked graves of community members and children who died during the Indian Residential School period, where excavation of these graves is to be avoided (Wadsworth et al. 2021; Martindale et al. 2021).

Despite its uses and benefits in archaeological investigations, GPR is not without its limitations. In order to interpret the results of a GPR survey an analyst requires sufficient knowledge of what archaeological and geological changes may look like in the data, which can be a challenge as the same type of feature may look different depending on the material surrounding it (Conyers 2012). Further, even if features are identifiable, it is often impossible to determine exactly what a reflection is without excavating it or directly comparing it to a known example in a similar context. Another consideration is that GPR will simply not be effective in certain environmental conditions. If the ground is too wet, contains too much clay, or is covered in too much vegetation the GPR will not work as well as if the ground is dry, sandy, and sparsely vegetated (Conyers 2012). These considerations must be taken into account when conducting and interpreting a GPR survey.

3.4.2 Magnetometry

Magnetometry or Magnetic Gradiometry is possibly the most common geophysical technique used in archaeology (Gaffney 2008). Like all other magnetic methods of survey, magnetometry works by measuring the magnetic field of the Earth. It is a passive sensor, meaning it does not emit energy like a GPR does, but rather monitors and measures existing energy and magnetic frequencies of the Earth (Oswin 2009; Mccullough 2016). Since the Earth's magnetic field magnetizes materials in a predictable manner, minor fluctuations caused by materials being heated or subjected to new magnetic fields are identifiable (Figure 3.6; Oswin 2009).

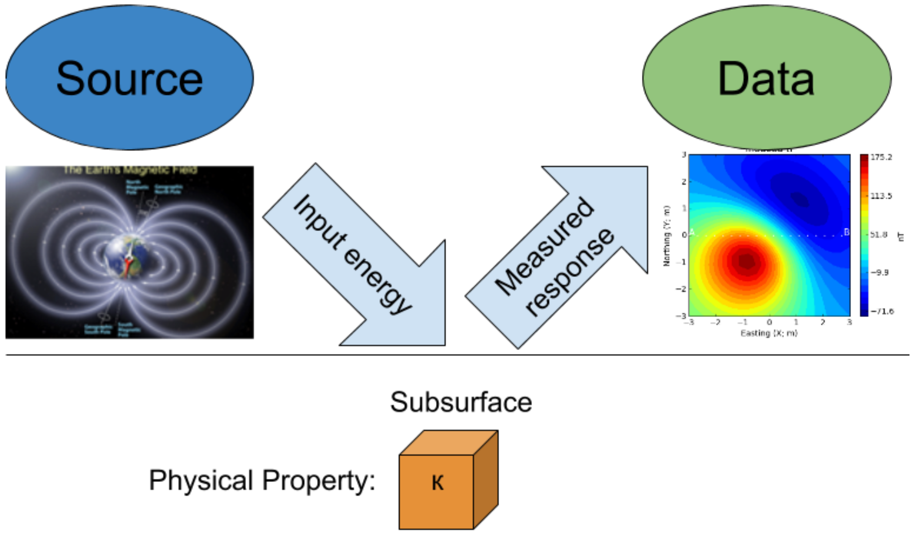

Figure 3.6 A simple depiction of a magnetic target receiving energy from the earth's magnetic field and a sensor picking up the emitted energy from the target. Taken from the open source website, Geophysics for Practicing Geoscientists (Oldenburg et al. 2017).

Early magnetometers only had a single sensor, but today most set-ups have two sensors, one to record the broad magnetic field and another to record any anomalies. A magnetic map of anomalies is then created by subtracting the measured value of one sensor from the other (Kvamme 2001; Gaffney 2008; Oswin 2009). Surveys themselves are conducted in a similar manner to GPR surveys, by marking out a grid with transects at set intervals (Fassbinder 2017).

Magnetometry is often used in archaeology because it can identify subtle magnetic fluctuations caused by some archaeological materials, including traces of iron or materials with differing magnetic susceptibilities and materials that have been heated and cooled causing thermoremanent magnetization, (Kvamme 2001; Mccullough 2016). Since different soils and materials have varying degrees of magnetic susceptibility, unnatural variations caused by anthropogenic activities, such as the introduction of iron or the filling of a hole with a different material than the surrounding soil, can often be detected by magnetometers (Mccullough 2016).

Further, if soils or rocks are heated to a high enough temperature (500-700 °C) their magnetic particles will realign to the Earth's magnetic field and will remain that way as the object cools, meaning these objects' magnetic fields will differ from that of those around them, making them detectable by magnetometry (Mccullough 2016).

The ability of magnetometry to locate heated materials like ceramics or firepits, along with the presence of magnetic anomalies caused by metal or other archaeological materials, has made it a favourite technology for the locating of archaeological sites (Kvamme 2001; Mccullough 2016; Fassbinder 2017). These benefits are only furthered by magnetometry's fast data acquisition rate and high spatial resolution which allows a large area to be surveyed in a relatively short amount of time (Asăndulesei 2011). It is for these reasons, that magnetometry has seen significant use in Europe (Belshé 1957; Gaffney 2008; Keay et al. 2000) as well as North America(Garrison 1996; Gaffney 2008; Hodgetts, Dawson, and Eastaugh 2011; Mccullough 2016).

Despite its great success in many archaeological contexts, magnetometry is not without its faults. Anomalies may be caused by non-anthropogenic materials like rocks or disturbed soils. Further, nearby metal can distort results which greatly limits the locations in which the technique can be used. Lastly, magnetometry does not always provide a good understanding of the depth of anomalies (Hodgetts, Dawson, and Eastaugh 2011; Mccullough 2016). Like any geophysical technology, the results of magnetometry surveys alone should not be trusted without further investigations using other techniques.

While all of these theoretical approaches and geophysical technologies can help us study the landscape, they are simply tools in an archaeologist's toolbox. Individually they can provide only a piece of the puzzle and work best when multiple technologies are combined together with cultural knowledge. Theory provides a framework for studying and understanding the landscape and multiple methodologies to be added on top to learn as much as we can but ultimately these methods and theories need to be combined with Métis ways of knowing in order to make sense of the Métis sites being studied. In the next chapter, I will combine the ideas introduced in Chapters 2 and 3 to describe my methodology for studying Métis sites.

CHAPTER 4: Methodology: Applying Landscape Archaeology to Métis Sites

While the previous two chapters discussed Métis history and archaeology as well as common theories and methodologies for landscape archaeology, this chapter brings these ideas together to outline my approach to studying Métis landscapes. Since this thesis focuses primarily on two Métis archaeological sites—one *hivernant* site (Chimney Coulee) and one River Lot site (River Lots 23 & 24)—I first go over how both of these sites were studied and analyzed. I outline my approach to studying and analyzing these sites from a Métis-inspired landscape perspective, discussing how various research methodologies when combined, can provide an overview of historical landscape use. While I was directly involved with the surveying at the River Lots, Chimney Coulee was surveyed by other scholars (Wadsworth et al. 2021; Mallet Gauthier and Wadsworth 2023). As such, while many of the survey methods applied at the River Lots follow similar processes to those at Chimney Coulee, there are some notable differences in the types and amount of data collected. Thus, while this chapter is broken into sections based on different survey and analysis techniques, there are discussions on how these methods differ between the two sites and how these differences affect the overall analysis of the landscapes of these sites.

4.1 Bringing it all Together: A Métis-inspired Approach to Landscape Archaeology

As discussed in Chapter 2, much of Métis archaeology has historically focused on questions of Métis ethnogenesis but more recent scholars have begun to focus on studying the Métis through the lens of different branches of Métis culture—geography, mobility, and kinship (Macdougall, Podruchny, and St-Onge 2012; Supernant 2021). Using these important aspects of

Métis culture as a lens for archaeological investigations allows for a more holistic understanding of a site and its importance to the people who inhabited it. It is also important to note that while different archaeological studies may focus on one or two branches, the branches are intrinsically entwined and cannot be fully separated from one another (Supernant 2021). Thus, a study into the way the Métis interact with their landscape may on the surface appear to only need to draw from the "geography" branch, but mobility and kinship are still vital pieces to consider. That is why this thesis aims to study the landscapes of different Métis sites by not only analyzing where buildings were geographically located, but also how mobility and kinship play a role in the locations.

The only other archaeological study that has tried to take a Métis approach to studying the landscape of Métis sites took place at Chimney Coulee (Wadsworth, Supernant, and Kravchinsky 2021). This study suggests that one approach to studying Métis sites is to combine multiple geophysics techniques in order to paint a better picture of the ways in which the landscape was used by the Métis living on it. GPR, Magnetometry, and Multispectral Imagery were used in conjunction with each other to identify Métis cabin locations at the *hivernant* site to gain a better understanding of the Métis way of life, and for future archaeological excavations (Wadsworth, Supernant, and Kravchinsky 2021). While this study offers a workflow for locating Métis structures with geophysical technologies that were applied and modified for the River Lot site, it does not go beyond locating potential structures to analyze how the building locations may be reflections of the branches of Métis culture.

For this thesis, I combine historical records, geophysics, and archaeological excavations to create maps of Métis sites which are then analyzed through the lens of landscape archaeology and Métis cultural values discussed in Chapters 2 and 3 (Figure 4.1). Using multiple types of sources to create site maps allows for a better overall idea of the landscape to be formed. Historic records of sites including settlement maps, air photos, oral accounts, and early archaeological site maps provide a great framework of what buildings were on the site, what they were used for, and a rough indication of where the buildings were located. The more sources that can be layered, the better idea of what a site looked like at a particular time can be gained. These sources provide great overviews of sites when available but can not always provide detailed information on exact locations. For this, we need geophysical technologies and excavations.

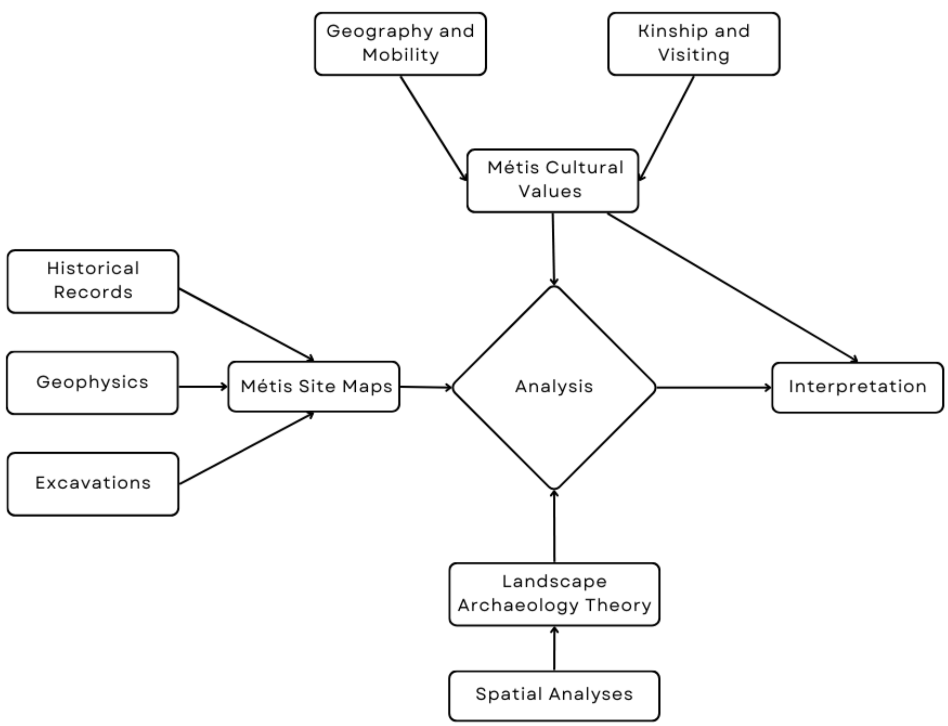

Figure 4.1 Schematic showing my Métis-inspired approach to landscape archaeology at Métis sites.

Like with historical records, the more geophysical sources that can be combined, the better overall understanding of the site can be gained. Starting with aerial remote sensing via UAVs allows for a detailed birds-eye view of a site. Orthophotography provides detailed base maps that can have historical records and other remote sensing surveys layered on top of them. LiDAR can further help visualize the current surface of a site in more detail than can be gained from orthophotography. It may also allow some features under vegetation to be identified and help features in other sources (including air photos) be more accurately located. Lastly, while Orthophotography and LiDAR can be helpful at almost every site, multispectral imagery works best at sites with different forms of vegetation that may related to features under the surface. Multispectral imagery can only show changes in vegetation and needs to be combined with other sources to determine what might be causing the changes in vegetation. These aerial sources can cover larger areas (often an entire site) and be combined with historical records to highlight areas of interest for more detailed searches like GPR, magnetic gradiometry, and finally excavations, which are the most accurate sources for locating features on sites.

The site maps made from these sources provide overviews of the site, but for any meaning to be gained from the maps they need to be analyzed. For this, I use the frameworks of landscape archaeology theory and Métis culture. Landscape archaeology theories like those of Binford, Tilley, and Ingold influence the ways building placements are interpreted and spatial analysis like nearest neighbour analysis provides significance to site layouts. This is then combined with hallmarks of Métis culture like geography, mobility, kinship, and visiting to understand how the Métis who lived on these sites interacted with the landscape and in turn what the layouts of these sites can tell us about Métis culture.

4.2 Site Layouts: Locating Buildings

In order to analyze the layouts of buildings on Métis sites, building locations need to be identified. This is done via three different types of archaeological research that when combined provide the best information to identify where all the buildings on sites were once located. The first way to find building locations is through historical research that relies on archives, historic photos, oral histories, and secondary sources that compile much of these histories. The next method is via non-invasive remote sensing and geophysical surveys. As was touched on in Chapter 3, archaeologists are increasingly using geophysical technologies to locate buried remains—like features, artifacts, or graves—on archaeological sites without having to excavate entire sites. This study used a variety of technologies to help locate where buildings once were on the sites. Lastly, some excavations took place in potential building locations that had been located via the previous two methods, or through visible evidence on the surface. These excavations in some cases uncovered actual building walls, which allowed for the verification of building locations. In other cases artifact types and frequencies indicated whether excavation units were likely inside or outside buildings. However, excavations are limited and only able to verify a small number of buildings, so much of our understanding of sites as a whole relies on larger geophysical surveys and historical records. It is also important to note that while combining these three methods will provide more opportunities for locating buildings than any one method could find on its own, it is still possible that not all buildings will be located, and this may never be due to preservation issues, landscape types, and sparse historic records.

4.2.1 Historical Research: Archives and Oral Histories

The presence of recorded documents is one of the major benefits of doing historic archaeological work, as this research often provides a great preliminary overview of the history of a site which allows archaeologists to focus less on understanding the history of a site and more on understanding the actual people who occupied the sites. Both Chimney Coulee and River Lots 23 & 24 are registered heritage sites with some historical documentation. Chimney Coulee's status as a Provincial Historic Site recognizes its historic value but much of the documentation associated with the site focuses on Hudson's Bay Company (HBC) post operated by Isaac Cowie and a North-West Mounted Police (NWMP) post at the site (Parks Canada, n.d.).Conversely, River Lots 23 & 24 are owned and operated as a museum by St. Albert Arts and Heritage and Musée Héritage Museum, resulting in the availability of many more historical documents focused on the Métis who lived on the site ('River Lots 23 + 24', n.d.). Both sites also had previous excavations done on them before the involvement of the Exploring Métis Identity Through Archaeology (EMITA) project whose reports contribute to the historical knowledge of the sites. Further archival research relating specifically to the layout of each site was also conducted for this thesis.

Chimney Coulee

Chimney Coulee is an archaeological site (DjOe-6) within the Chimney Coulee Provincial Historic Site located in the Cypress Hills, just north of the town of Eastend, Saskatchewan (Figure 4.2). The site was a Métis *hivernant* village situated in an important environmental, historical, and cultural region for many Indigenous peoples (Wadsworth, Supernant, and Kravchinsky 2021).While some evidence suggests pre-contact use of the site, most archaeological research has focused on the site's use by the Métis, NWMP, HBC traders, and whiskey/fur traders during the late nineteenth century (Burley, Horsfall, and Brandon 1992; Brandon 1995; Wadsworth, Supernant, and Kravchinsky 2021; Tebby 2023).

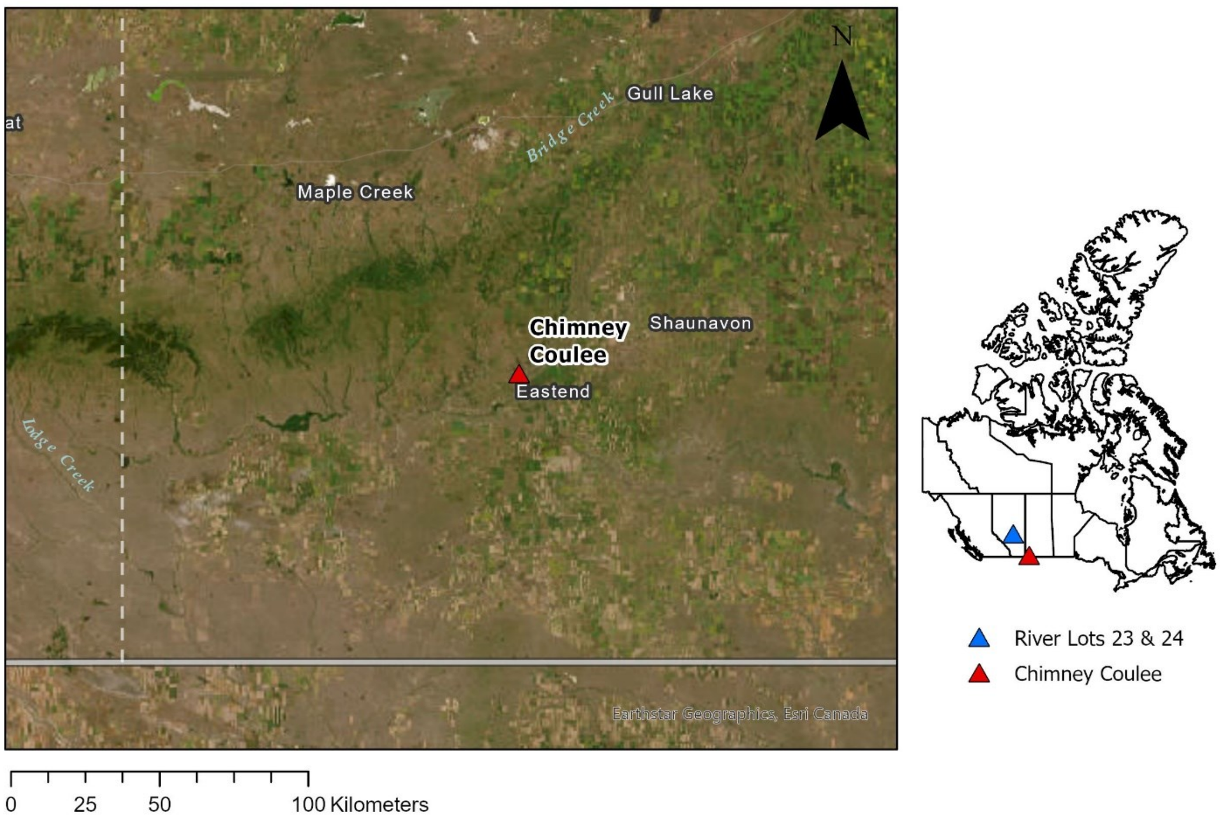

Figure 4.2 Map showing the location of the Métis hivernant site Chimney Coulee in Saskatchewan, Canada. This map was created by the author.

During the 1860s, Chimney Coulee was a regular camping site for Métis hunting brigades (Brandon 1996). Then in 1871-1872 Isaac Cowie, an HBC fur trader, established a trading post at the site, building a large longhouse (Burley, Horsfall, and Brandon 1992). Métis families then settled more permanently in the area in the mid-1870s and built multiple cabins and chapels

(Brandon 1996). Lastly, an NWMP post was built in 1877. This post was occupied only seasonally at first but then became a permanent post until June 1880. During the 1880s most of the site's occupants left leaving only a few remaining by the 1890s and nothing but stone chimneys by the early twentieth century. The remains of these chimneys inspired the site's name, along with its location along a 'coulee'—a river-cut ravine (Burley 1988).

The site's history was largely forgotten until the settlement of the current town of Eastend in 1902, despite many Métis families likely continuing to inhabit the area after the village stopped being used (Wadsworth, Supernant, and Kravchinsky 2021). Prior to the research conducted under the EMITA project beginning in 2013, most of the historical and archaeological research done at Chimney Coulee focused on the Issac Cowie and the NWMP post at the site. Chimney Coulee was first formally recorded by researchers in 1967 by Bonnichsen (Bonnichsen 1967; cited by Tebby 2023) and his crew during a study of the Cypress Hills' late historic period. The site was then formally documented by David Burley and his crew in 1986 for an archaeological survey of multiple *hivernant* sites in Saskatchewan (Burley, Horsfall, and Brandon 1988). As part of this survey, the site of Chimney Coulee was mapped in detail and the authors wrote the first real summary of the history of the site using the oral testimony of Harold S. "Corky" Jones, a longtime landowner near the site (Burley, Horsfall, and Brandon 1988: 246-257). Burley, Horsfall, and Brandon (1988) focused on the physical documentation of the site, the creation of a site map and an assessment of the integrity of features but did not conduct any formal excavations. These maps provide the earliest documentation of potential building locations on the site.

Chimney Coulee was first excavated in the mid-1990s in a public archaeological dig run by John Brandon (Brandon 1996). Excavations took place over the summers of 1994 and 1995 but were focused on locating the longhouse of Issac Cowie. Further excavations took place during a Regina Archaeological Society field project in 1998 and a field school in 2000 (Brandon 2001). These excavations focused on the area of the site occupied by the North West Mounted Police (NWMP) and were able to locate the NWMP barracks as well as the burnt remains of Cowie's longhouse, but little attention was given to locating the houses of the Métis who used the site (Brandon 1995; 1996; 2001).

The EMITA project shifted the focus back to the Métis and a significant amount of historical research on the Métis occupation of the site was conducted by Eric Tebby (2023). In his thesis on the Métis at Chimney Coulee, Tebby identifies three main periods of occupation at the site between 1870 and 1882: small groups of Métis hunters and traders (1870-1874), large groups of extended Métis families (1874-1878), and the Laframboise family plus some small traders (1878-1882; Tebby 2023). He further provides a detailed timeline for the various traders and families who occupied the site based on primary historic sources from various archives, and includes multiple historic photos which help to paint a picture of who exactly occupied Chimney Coulee (Tebby 2023).

Lastly, some early historic aerial photos were purchased for the Chimney Coulee area for this thesis. While the height of Métis occupation at Chimney Coulee pre-dates the earliest air photos taken in Canada, these photos help show how the site changed over the course of the 20th century due to construction and vegetation growth. Unfortunately no buildings are visible as most of the buildings at the site associated with the Métis occupation were gone by the advent of widespread aerial photography in Canada.

River Lots 23 & 24

River Lots 23 & 24 are remnants of the River Lot system in Alberta preserved at the St. Albert Heritage Site *St. Albert Grain Elevators + Historic River Lots* located in the City of St. Albert, Alberta, just outside of Edmonton (Figure 4.3). The site is north of the Sturgeon River and covers the southwest portion of the historical river lots (Figure 4.4). On the site today are multiple historic buildings, some of which are *in situ* (remain where they historically were located) while others were moved to the site from other locations. The area was likely used by Indigenous peoples pre-contact as a hunting ground or wintering site but the structures that remain today are from a Métis farmstead on Lot 24, a grain elevator constructed by the Alberta Grain Company in 1906, the St. Albert train station built in 1909, and various houses that were occupied by Métis and other settlers (Buckingham 2000; City of St. Albert and Engineering and Land Services 2010).

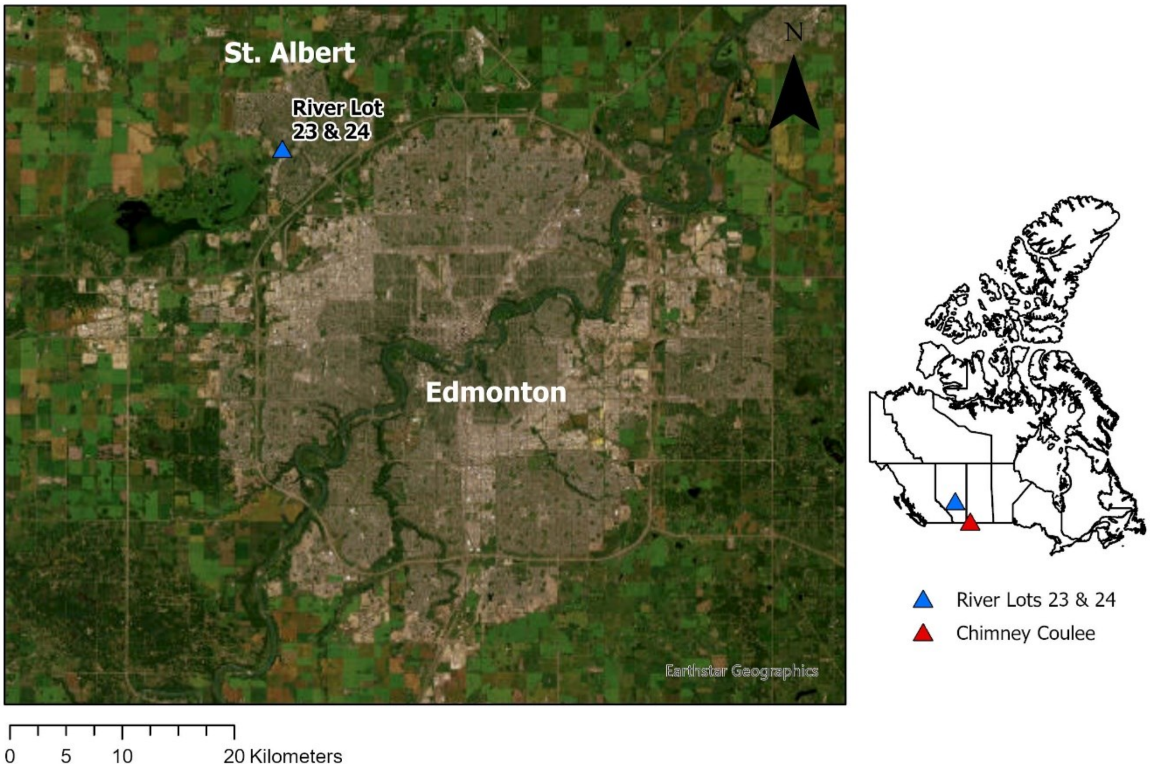

Figure 4.3 Map showing the location of the River Lots 23 & 24 is St. Abert, Alberta. This map was created by the author.

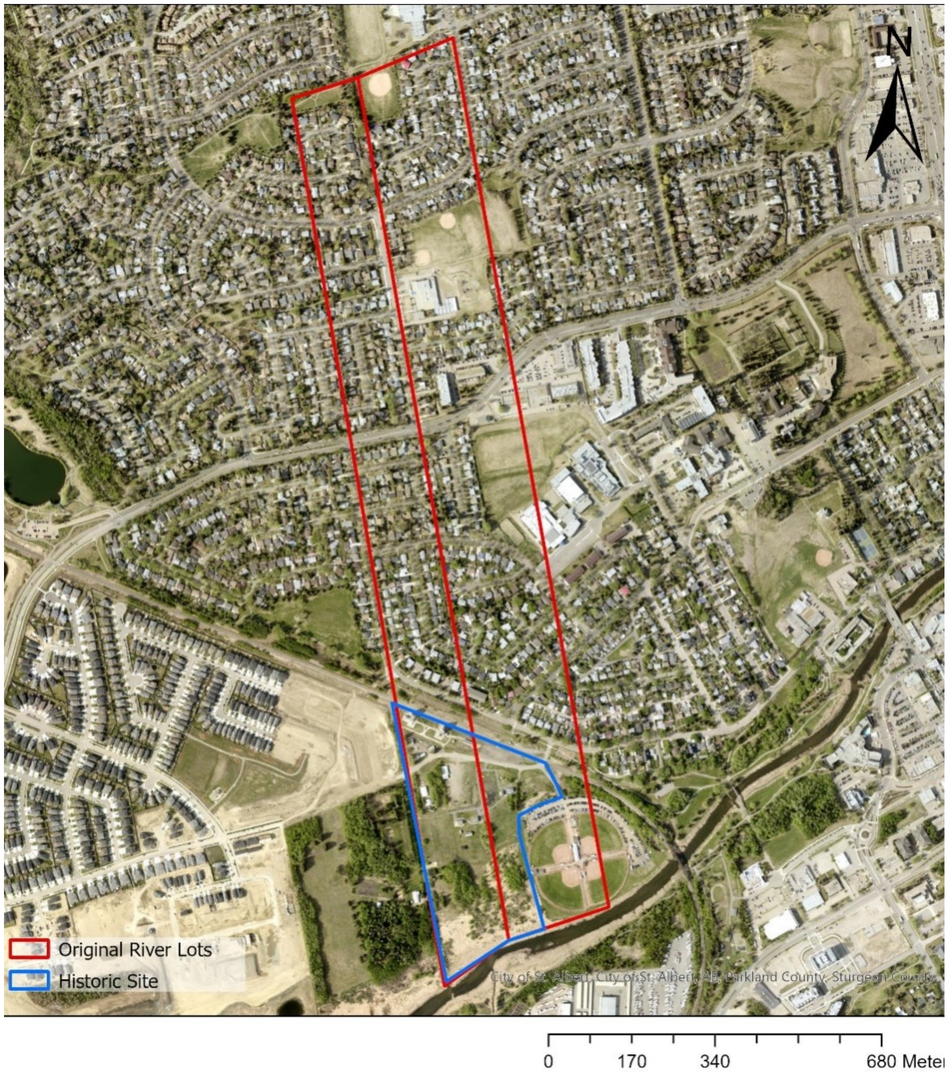

Figure 4.4 Map showing the historic and current boundaries of River Lot 23 and 24 in St. Albert. This map was created by the author in ArcGIS Pro using modified data from maps in the St. Albert Heritage Site Functional Plan for the historic site (City of St. Albert and Engineering and Land Services 2010).

The city of St. Albert grew out of a settlement established in association with the nearby HBC fort, Fort Edmonton, and a mission established by Father Lacombe in 1861 along with many Métis families (City of St. Albert and Engineering and Land Services 2010). Father Lacombe utilized the French river lot system when he established the mission, creating a series of long strips of land along the Sturgeon River (Buckingham 2000). As the settlement grew and trade with Fort Edmonton prospered, a bridge was built across the Sturgeon which further increased trade through St. Albert. This increase in trade led to the construction of an HBC outpost in the northern portion of River Lot 23 in 1866 run by John Cunningham, an HBC employee who died in 1868 on a buffalo hunt (City of St. Albert and Engineering and Land Services 2010). Following the death of Cunningham, the outpost was run by Louis Chastellain who lived on the land adjacent to the post on River Lot 24. Chastellain is the first recorded occupant of Lot 24 and while he left HBC sometime around 1875 he continued to live on Lot 24, working at Fort Edmonton and then opening a store on the lot in 1878 (Buckingham 2000). Descendants of Chastellain continued to live on the lot until the 1990s when it became a historic site.

Much of what is known about the site comes from various historical reports that have been conducted on the Heritage Site and its structures in preparation for and after the site's designation as a historic site, as well as one archaeological excavation and oral histories from the local Métis community. The earliest historical report on the site was conducted by Laura Buckingham (2000) for Musee Heritage Sites. This report focused on Lot 24 specifically and the Métis occupants of the lot throughout history, using oral histories and primary sources (Buckingham 2000). Following this report, two structural assessments on buildings on River Lot 24 were then conducted in the mid-2000s (Earth Tech 2005; Ramsden 2008). These reports detail the condition of a house called "Bean's House" and a barn, both located on Lot 24, which were both determined to no longer be structurally sound and subsequently demolished. Then in 2009, a Historical Resource Impact Assessment (HRIA) was conducted by ISL Engineering and Land Services in preparation for a later Heritage Site plan and design. As part of this HRIA, an archaeological excavation was conducted by the *Archaeology Group* along with some major historical research into the potential locations of buildings on the site (Younie 2009).

A functional plan for the newly opened heritage site with further historical background was produced in 2010 (City of St. Albert and Engineering and Land Services 2010) and an updated version was produced 10 years later (City of St. Albert and Engineering and Land Services 2020) which both provide overviews of the site's history. Lastly, in the 2010s two other reports were produced: one on the structure and material history associated with the two historic buildings on Lot 24 (Larmour 2017); and a revised report on the historical context of the site (Larmour 2019). Additional research done for this thesis involved locating aerial photos showing the site of River Lots 23 and 24 during the 20th century while it was still active. From all of these sources, a fairly accurate understanding of what buildings used to exist on the site can be formed, but we don't always know exactly where they were located. The small resolution of most historic aerial photos combined with the inaccuracies of historic maps and rough memories of community members allows for an estimate of where buildings once were, but for exact locations, we need to turn towards geophysical and archaeological methods of locating features.

4.2.2 Geophysics

Multiple different types of remote sensing and geophysical surveys were conducted at both Chimney Coulee and River Lots 23 & 24 in order to gain a broader understanding of the sites than could come from just foot surveys, and to locate features. Geophysical surveys have the ability to investigate a lot more ground in a shorter time period than could ever be fully explored via traditional archaeological methods. This makes them ideal for locating larger features like buildings which can later be excavated depending on the aim of the project. It is also important to note that while any one of these technologies may show some aspect of the site and have the potential to locate buildings, they work best in conjunction with each other. What follows is a detailed explanation of how multiple different technologies were used to survey both sites and locate features, but the results of these surveys are not discussed until future chapters (Chapters 5 and 6).

Ortho Photography

Modern Aerial photography was taken via UAV at both the River Lots and Chimney Coulee to provide high-resolution aerial images and to create detailed maps of the sites and archaeological work conducted on them in ArcGIS Pro. A DJI Phantom 4 Pro UAV was used to capture imagery at both sites using the Phantom's onboard Red-Green-Blue (RGB) camera and Drone Deploy on an iPad as a controller. The UAV had been flown at Chimney Coulee in both 2019 and 2022 and the photos from both flights were combined into an orthomosaic in ArcGIS Pro using the orthomapping workshop tool. The same UAV was flown in 2023 at the River Lots at an altitude of 65 m taking 106 photos covering just over 100,000 m^2 or 10 hectares, which were again combined into an orthomosaic in ArcGIS Pro.

Multispectral Imagery

Multispectral imagery was taken via UAV at the River Lots and Chimney Coulee. At both sites, imagery was collected via a Micasense Altum multispectral/thermal sensor mounted on a DJI Matrice 600 UAV. Micasense Altum collects data in five electromagnetic bands; Blue (455-495 nm), Green (540-580 nm), Red (658-678 nm), RedEdge (707-727 nm), and NearInfrared (800-850 nm). While the Micasense Altum sensor also captures thermal imagery during its use it was not flown at the ideal time for thermography (dusk or dawn) (Casana et al. 2017) at either site so only the multispectral imagery was analyzed. At both sites, the multispectral survey was intended to help identify archaeological features on the site to guide future geophysical surveys and archaeological excavations.

In 2019 the drone was flown at Chimney Coulee using and iPad with Drone Deploy as a console at 50 m above ground and was flown by Wadsworth and the EMITA team (Wadsworth 2020). A different application was used in 2023 to fly the drone at the River Lots due to an app update making Drone Deploy no longer compatible with the DJI Matrice 600. At the River Lots the drone was flown using an iPad with DJI Ground Station Pro as a console. This application however was unable to directly control the Altum sensor, so automatic triggering was set up in Overlap Mode which tells the sensor to capture imagery at the target altitude (60 m) every time the drone traveled enough distance to ensure all imagery had a 75% overlap ('Automatic Triggering Options for MicaSense Sensors' 2023). The data from the 2023 River Lot flight was processed directly in ArcGIS pro while the data from Chimney Coulee was processed in Pix4D first before being imported into ArcGIS Pro.

At Chimney Coulee the multispectral drone flight covered approximately 90,000 m^2 or 9 hectares (Wadsworth 2020). The imagery was viewed in multiple formats including as a True Colour, False Colour, and NDVI image as well as undergoing a supervised classification via the ArcGIS Pro Classification wizard (Wadsworth, Supernant, and Kravchinsky 2021). The Multispectral drone flight at the River Lots covered about 80,000 m^2 or 8 hectares and the imagery underwent similar processing to the imagery taken at Chimney Coulee.

LiDAR

LiDAR was taken via UAV at River Lots 23 & 24 and Chimney Coulee to provide more detail on the topography of the sites and help identify potential features in heavily forested areas of the sites. The imagery was collected at both sites with a Zenmuse L1 Lidar sensor mounted on a DJI Matrice 300 UAV using the UAV's integrated controller. The Zenmuse L1 Lidar sensor is three-return sensor with a 3 cm ranging accuracy which was set to repetitive sampling mode at a rate of 160 KHz.

LiDAR data was collected in April of 2021 at Chimney Coulee with a side overlap of 50%, a 25 m margin, and a course angle of 180 degrees. The UAV was flown at an altitude of 60 m at 6 m/s covering 180,000 m^2or 18 hectares (Wadsworth 2022). At the River Lots, the LiDAR survey took place in May of 2023 with a side overlap set to 70%, a 10 m margin, and a course angle of 346 degrees. This flight was flown at an altitude of 50 m at 6 m/s covering about 150,000 m^2 or 15 hectares. For both sites, the raw data was processed in DJI Terra and then the point cloud was imported in ArcGIS Pro where the ground points were separated from the last returns to create a DEM of the ground surface.

Ground Penetrating Radar

Multiple GPR surveys have been conducted at Chimney Coulee over the course of various field seasons and one survey was conducted at River Lot 23 & 24 during the Field School there in 2023. At both sites a GSSI SIR 3000 system was used, and surveys were conducted in staked-out grids with 25 cm transects.

The first GPR survey at Chimney Coulee took place in 2018 when a GSSI SIR 3000 system was used with both a 400 and 900 MHz antenna in order to test the use of the GPR at the site and locate more of a wood trench (believed to be a cabin wall) that was uncovered during an excavation (Wadsworth, Supernant, and Kravchinsky 2021). Three grids of various sizes were surveyed in 25 cm bidirectional transects with both antennas and the 900 MHZ antenna was determined to be more successful than the 400 MHZ sensor in identifying shallow building remains at the site, and thus was used for the remainder of the surveys at the site. Unfortunately, this test was the first time the team had used the 900 MHz antenna, resulting in the antenna being improperly set up (it had to be set up to measure in time rather than distance) resulting in the data collected in 2018 being less than ideal. However, the data collected did suggest that the GPR worked in the area, leading to the team returning in 2019 with the GSSI SIR 3000 system and 900 MHz antenna to survey three 10 x 10 m grids. Grids were staked out with plastic pegs and measuring tapes that had their locations recorded via a RTK-GNSS. The three grids were then surveyed with 25 cm unidirectional transects. The GPR was set to 1024 samples per scan and a time range of 20 ns (Wadsworth, Supernant, and Kravchinsky 2021).

After the data was collected it was processed on the computer. A program called *GPRViewer* was used to conduct a hyperbola fitting analysis in order to determine the dielectric permittivity of the site. The data was then further processed in *GPRViewer* and *GPR Process* where profiles were time-zeroed and had background noise removed. The outputted profiles were then viewed in *Surfer* (19.2.213). Grids themselves were also sliced into 2 ns thick timeslices in *Paraview* before being interpolated via the kriging method in *Surfer* (Wadsworth, Supernant, and Kravchinsky 2021).

A third GPR survey was then conducted at Chimney Coulee in 2022 ahead of an upcoming excavations season. During this survey four more girds of various sizes were surveyed using the GSSI SIR 3000 GPR and 900 MHz antenna (and Magnetic Gradiometry) which were again staked out with plastic pegs and measuring tapes and surveyed in 25 cm unidirectional transects. The GPR was set to 1024 samples per scan and a time range of 30 ns. This time the data was processed in an open-source Python-based software, *GPRPy* (Plattner 2020). Hyperbola fitting analysis determined the velocity of the radar waves to be roughly 0.07 m/ms and the profiles were processed by being time-zeroed, and undergoing mean trace removal, dewow, agc gain correction, and f-k migration. The GPR grids were then sliced in *Paraview* at selected depths and imported into *Surfer* where they were interpolated via the kriging method and visualized to create amplitude maps (Wadsworth 2022). A total of 10 grids were surveyed at Chimney Coulee between 2018-2022, although it is important to note that the three 2018 and three 2019 GPR grids overlap due to the quality of the data collected in 2018 (Figure 4.5).

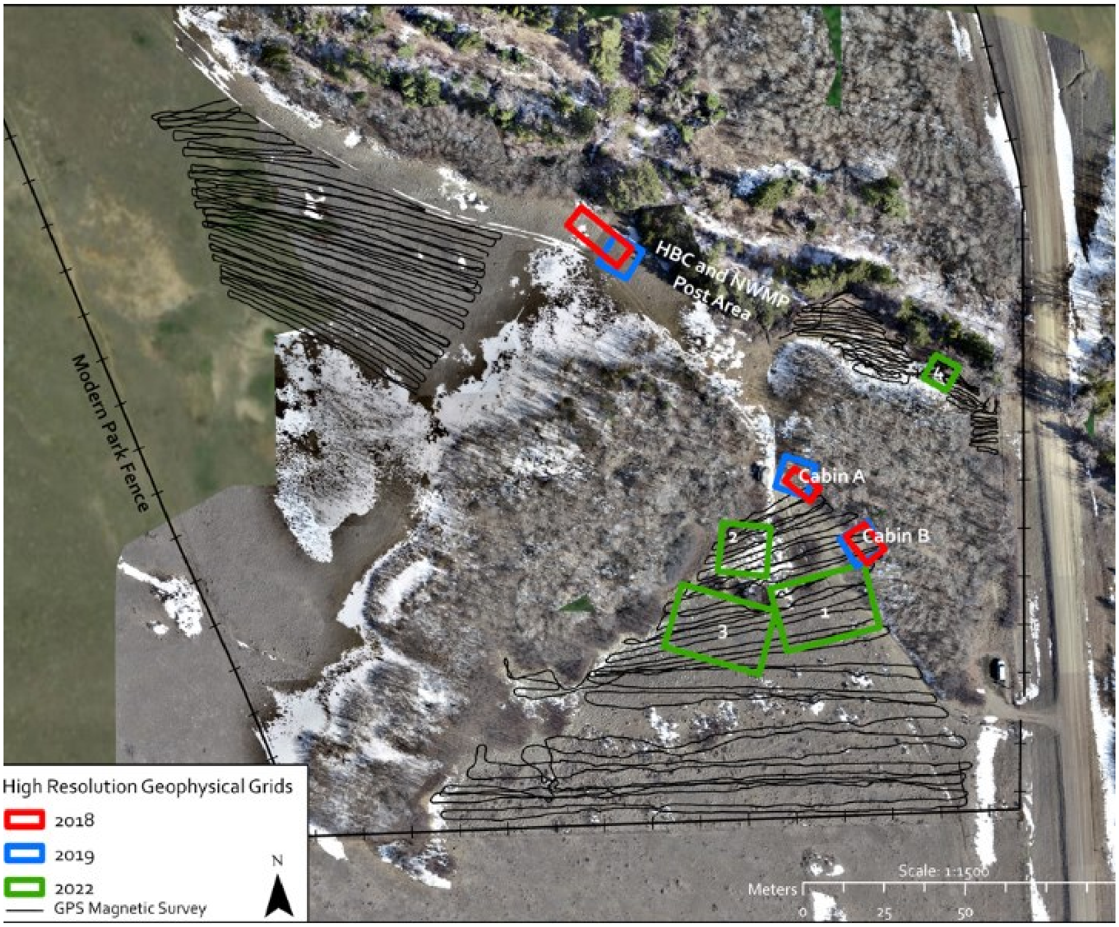

Figure 4.5 Map showing the location of all the GPR and magnetic gradiometry surveys at Chimney Coulee (Map from Mallet Gauthier and Wadsworth 2023, 77).

Only one season of work has been conducted at River Lots 23 & 24 to date as part of the IPIA field school in May and June of 2023. During the field school students were split up into groups over multiple days and helped to conduct a larger scale GPR survey of the site before excavations began. A total of 11 grids of various sizes were surveyed (Figure 4.6). A GSSI SIR 3000 with a 400 MHz antenna was used with samples per scan set to 1024 and a time range of 80 ns. All 11 grids were also surveyed in 25 cm unidirectional transects. Data was processed the same way as it was after the 2022 survey at Chimney Coulee. In total, 850 m^2 of land was surveyed.

Figure 4.6 Map showing the location of GPR grids on River Lots 23 & 24 in St. Albert, Alberta. This map was created by the author in ArcGIS Pro.

Magnetometry

Two detailed and one coarse magnetic gradiometry surveys have been conducted at Chimney Coulee to help locate potential areas of interest before excavations and to corroborate GPR data. The detailed surveys were conducted in 2019 and 2022 over the same grids that GPR data was collected and a larger survey was conducted in 2022 in GPS mode over three areas.

The first of the two detailed magnetic gradiometry surveys at Chimney Coulee took place in 2019 over the same grids that GPR was collected that year with the same 25 cm transects using a GEM Systems GSM-19 Overhauser magnetic gradiometer. The sensor was set to a height of 15cm and 70cm above ground and an AC filter of 60 HZ was used with a 0.002 cycling time.

Lines were collected bidirectionally, differing from the unidirectional collection of the GPR lines over the same grids. Data was processed in MATLAB to create magnetic maps that when combined with the GPR and Multispectral data collected at the site helped identify potential features (Wadsworth, Supernant, and Kravchinsky 2021).

In 2022 before any GPR or detailed magnetic gradiometery surveys were conducted a coarse survey took place to help identify areas to for GPR and Mag grids to be placed. The GEM Systems GSM-19 Overhauser magnetic gradiometer was used again with the sensor being set to a height of 15 cm and 70 cm above ground. Like in 2019, an AC filter of 60 HZ was used with a 0.002 cycling time. The sensor was autotuned and "zeroed" away from the site and a sensor was attached. Data was then collected in bidirectional parallel lines in three different areas of the site where potential archaeological features were possibly located (Figure 4.5). The detailed magnetic gradiometry survey was conducted with the same machine and settings but in 25 cm unidirectional transects in the same four grids that GPR was collected. All of the data was then processed in MATLAB where it was de-spiked, detrended, interpolated and filtered using a two-dimensional wave number bandpass.

No magnetometry survey was conducted at the River Lots due to the amount of surrounding metal fences that would have interfered with the data, and time constraints associated with the field season being associated with a field school.

4.2.3 Supporting Excavations

On top of having multiple different geophysical surveys conducted, both Chimney Coulee and River Lots 23 & 24 have had some excavations done. However, Chimney Coulee has been an active archaeological site under the EMITA project for multiple years resulting in multiple excavation seasons, while the River Lots have only had one excavation season under the EMITA project during the 2023 IPIA field school. At Chimney Coulee excavations began years before any geophysical survey was conducted and previous researchers were able to locate cabins via surface depressions shown on Burley et al's (1992) map of the site. Other excavations took place after geophysical surveys suggested more areas of interest and some of these excavations were then able to confirm the locations of buildings through physical evidence—often artifacts associated with the interior of buildings or uncovering the walls of buildings themselves. At River Lots 23 & 24, EMITA excavations did not take place until after Orthophotography was taken and LiDAR and GPR surveys were conducted and were placed in locations of interest based on the results of the GPR and archival data on the site. Unfortunately the Multispectral survey did not take place at the River Lots until partway through excavations due to technical difficulties with the drone and operating applications, so multispectral data was not considered when choosing locations for excavations.

The EMITA project first began research at Chimney Coulee in 2013 when Dr. Kisha Supernant led a digital mapping survey of the site and performed five test excavations. A concentration of artifacts was found near a few cultural depressions leading to the team's return to the site for five more years (2017, 2018, 2019, 2022, and 2023) of excavations and surveys. Over these 5 seasons 25 units were excavated (Figure 4.7), most being 1 x 1 m with a few exceptions, leading to the archaeological identification of 3 distinct cabins labeled "Cabin A," "Cabin B," and "Cabin C" (Wadsworth 2020; Mallet Gauthier 2023a; 2023b; Tebby 2023). The Excavation of "Cabin A" was the main focus for most of the 2013, 2017, 2018, and 2019 field seasons (Wadsworth 2020; Wadsworth, Supernant, and Kravchinsky 2021; Wambold 2021;

Tebby 2023). In 2022 excavation units were opened in the “Cabin B” area that had been identified via geophysical surveys, and the previously unstudied “Cabin C” area (Mallet Gauthier 2023a). In 2023, further excavations were carried out in both the “Cabin A” and “Cabin C” areas (Mallet Gauthier 2023b). On top of the 25 full excavation units, 5 shovel tests were excavated in 2013, one of which was expanded to become the first excavation unit (EU1), and another 5 were conducted in 2022 to test out potential cabin locations. While there have been various project leads and research projects conducted at Chimney Coulee under the EMITA project, most of the excavations have focused on identifying cabins and locating belongings both inside and outside of the structures in order to learn more about the Métis who inhabited the site (Tebby 2023; Mallet Gauthier 2023b; 2023a).

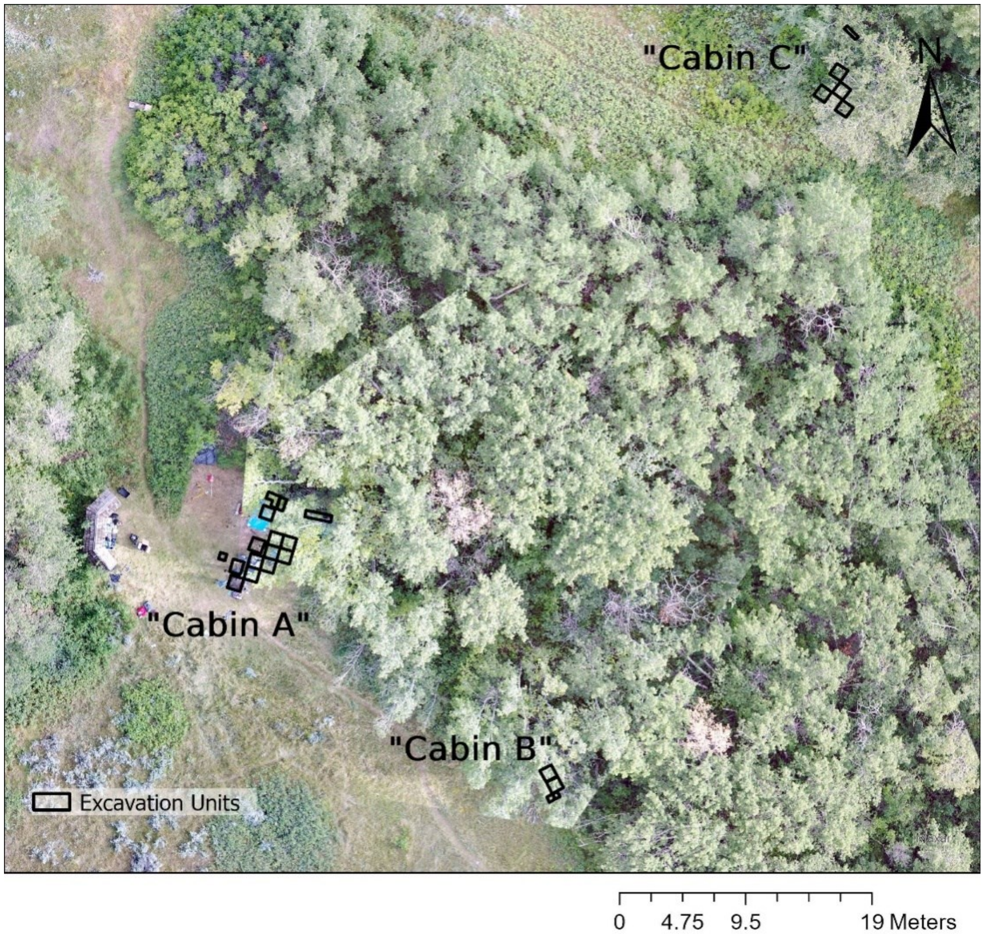

Figure 4.7 Map showing the location of excavation units at Chimney Coulee. This map was created by the author in ArcGIS Pro.

Unlike Chimney Coulee which has had five full field seasons of excavations under EMITA, 2023 was the first year River Lots 23 & 24 had any major excavations conducted. Excavations were part of a field school with 15 students resulting in the opening of seven excavations units, none of which have been fully excavated, and 11 shovel tests (Figure 4.8). Of these seven excavation units six are 1 x 1m and located in an area with visible cultural deposits on the surface of what is believed to be a trash deposit for people on both lots and possibly the cellar of a building. The seventh unit (EU5) is 1 x 2 m and located down the slope from the other units, where a barn was believed to be based on archival records and a potential feature identified in the GPR survey. Since all of the excavations were in two discrete areas, many of the locations of buildings that are believed to have been associated with the Métis have not been archaeologically verified. Thus, historic aerial photos and the results of the various geophysical surveys conducted on the site were more heavily relied on for creating a map of where Métis buildings likely were on the site.

Figure 4.8 Map showing the excavation units at River Lots 23 & 24 in St. Albert, Alberta. This map was created by the author in ArcGIS Pro.

4.2.4 Summary of Study Methodologies and Building Locations

Despite both Métis sites being focused on in this study having had similar types of research and surveys conducted at them, much more archaeological work has been done at Chimney Coulee than at River Lots 23 & 24 (Tabel 4.1). While both sites have had ortho photography taken plus LiDAR and multispectral imagery collected, Chimney Coulee has had more GPR surveys over multiple years and a magnetic gradiometry survey, which was unable to be conducted at the River Lots. There have also been many more archaeological investigations at Chimney Coulee. However, the later time period of occupancy at the River Lots compared to Chimney Coulee, plus the more urban location, means there area lot more historical records available. Historic air photography from the 1920s-2000s shows many of the buildings that once were on the River Lots and no longer exist allowing for a fairly accurate map of the site's buildings to be created.

Table 4.1 Summary of the types of historic and archaeological investigations done at each site.

Site	Historical Research	Geophysics	Area Covered by Geophysical Surveys	EMITA Excavations	Area Excavated
Chimney Coulee	Archival Research, Some Historic Photos	Orthophotography, Multispectral Imagery, LiDAR, GPR, and Mag	2048 m^2 (does not include the course magnetic gradiometry survey)	6 excavation seasons, 25 excavation units, and 10 shovel tests	19 m^2
River Lots 23 &24	Archives, Historic Air Photos, Historic City Maps, Oral Histories	Orthophotography, Multispectral Imagery, LiDAR, and GPR	846 m^2	1 excavation season, 7 excavation units, and 11 shovel tests	8 m^2

4.3 Understanding Layouts Through the Lens of Métis Cultural Values

Once understandings of the sites' layouts were established through the archaeological methods discussed above, the focus could be turned toward understanding why the sites were organized the way they were. In this section layout my approach to analyzing the locations of buildings on Métis sites, but I do not discuss the results of my analysis until Chapters 5 and 6. I theorize that buildings were placed on Métis sites in ways that reflect Métis cultural values of geography, mobility, and kinship. In order to test this theory I looked at where buildings were located on sites in relation to the sites' geography (i.e. are they close to water or on hills?) as well as where buildings were located in relation to others. When the information was available I also looked at who may have been living in different buildings and how the inhabitants of the buildings may have affected their locations.

It is at this stage in my research that I also brought in examples of site layouts from other documented Métis sites (both *hivernant* and River Lots/farmsteads) as well as urban settings to compare to the layouts of Chimney Coulee and River Lots 23 & 24. These sites included the 5 other *hivernant* sites that have been excavated and documented in the literature: Buffalo Lake (Doll 1988; Burley 1989; Coons 2017), Petite Ville (Weinbender 2003), Four Mile Coulee (Burley, Horsfall, and Brandon 1988), Kis-sis-away Tanner's Camp (also called Dirt Hills Camp; Burley, Horsfall, and Brandon 1988), and Kajewski Cabins (Elliott 1971); the three Métis River Lots in Manitoba associated with the Red River region (McLeod 1985); three Métis farmsteads identified by Burley and Horsfall (1989) along the South Saskatchewan River; and two Métis farmsteads that used to be *hivernant* sites in the Lauder Sandhills of Manitoba (Hamilton and Nicholson 2000).

4.3.1 Geography and Landscape

The first aspect of analyzing the location of buildings on Métis sites is geography or where buildings are placed in comparison to the landscape around them. This involved looking for similarities in landscape features at multiple sites, like the presence of a nearby water source, and the location of buildings in relation to these features. I also looked at how buildings were placed in relation to each other. This included looking at their configuration and if there was any prominent clustering of particular buildings. Some identification of building locations could be done by simply visually comparing the ways in which buildings were laid out between different Métis sites as well as how buildings were laid out on non-Métis sites from similar time periods (i.e. Ukrainian or French sites). Other analyses, like looking for evidence of clustering, were done in ArcGIS by performing a nearest neighbour cluster analysis to determine whether clustering was statistically different from that found at non-Métis sites. While these types of analyses were done to determine whether differences exist between Métis sites and non-Métis sites, they do not necessarily provide direct evidence of what Métis cultural values influence building locations. To do that I turned towards looking for evidence of building locations based on Kinship and Visiting.

4.3.2 Kinship and Visiting

As discussed in Chapter 2 and early in this chapter, kinship is a major branch of Métis culture that bleeds into multiple aspects of everyday life. Thus, it is not much of a stretch to suggest kinship ties, and the practice of visiting with kin, may have influenced the locations where buildings were placed on Métis sites. There is also documented evidence of Métis family members building houses near each other at River Lots 23 & 24 as well as in urban settings (Zeilig and Zeilig 1987; E. J. Peters 2018), so it is equally possible that houses clustered together at other river lots and *hivernant* sites belonged to members of the same family. Finding evidence of this in the archaeological record, however, can be challenging. Archival documents on who owned and lived in which buildings can help but do not exist for every site. To get around this I looked at the configurations of buildings on sites for which demographic data does exist and compared it to sites that do not have the same documentation, to look for similarities. I also looked at building orientations and how these orientations could be indictive of visiting practices (i.e. buildings facing each other or in a line to make visiting between them easier). While these methods of analysis may not be able to say exactly why buildings were located in the ways that they were, by analyzing the location through a Métis lens we at least have a better chance of understanding the sites than could be gained through a purely objective viewpoint.

CHAPTER 5: Results

Whereas the previous chapter outlined my methodologies for studying the layouts of Métis sites, this chapter describes the results of these analyses. In this chapter I discuss the results of the various elements of my research and bring them all together to create a map of my two main research sites: River Lots 23 & 24 in St. Albert, Alberta and Chimney Coulee in southern Saskatchewan. I then outline the results of the GIS analysis conducted on the layouts of these sites and how their layouts compare to those of other known Métis sites across the homeland. While this chapter outlines the results of various methods used to study Métis sites, I do not dive deeper into a discussion on what these results mean until the next chapter (Chapter 6).

5.1 Chimney Coulee

5.1.1 Historical/Oral Documentation

In Chapter 4 a brief history of Chimney Coulee and the archaeological work that has been done on the site was outlined. The earliest spatial recordings and maps drawn of the site were made in 1966 by Burley, Horsfall, and Brandon (1988). Their maps show a detailed representation of the physical features and the integrity of these features on the surface of the site. 56 cultural features were identified and mapped in nine clusters, with 50 of these features being surface depressions believed to be cellars or storage pits, and the remaining six representing sandstone slabs believed to be the remains of chimneys (Burley, Horsfall, and Brandon 1988). When the road that cuts through the site was built in the early 1970s it is likely that certain features were destroyed and today only the western portion of the site surveyed by Burley and colleagues is part of the Heritage Site and accessible. Intact remains appear across the road but have not been fully mapped.

The first excavations at Chimney Coulee took place in the mid-1990s and focused on locating the longhouse of Issac Cowie and the area of the site occupied by the North West Mounted Police (NWMP) (Brandon 1996). They were able to locate the NWMP barracks as well as the burnt remains of Cowie's longhouse which have been mapped, but the location of the Métis cabins on the site was only guessed at based on the presence of chimney stones and cultural depressions. The other historical documentation to exist on the location of the Métis cabins comes from a handful of historic photos taken of the chimney stones still present on the site in the early 20th century, which show some of the landscape but do not show the exact location of the chimney stones (Figure 5.1).

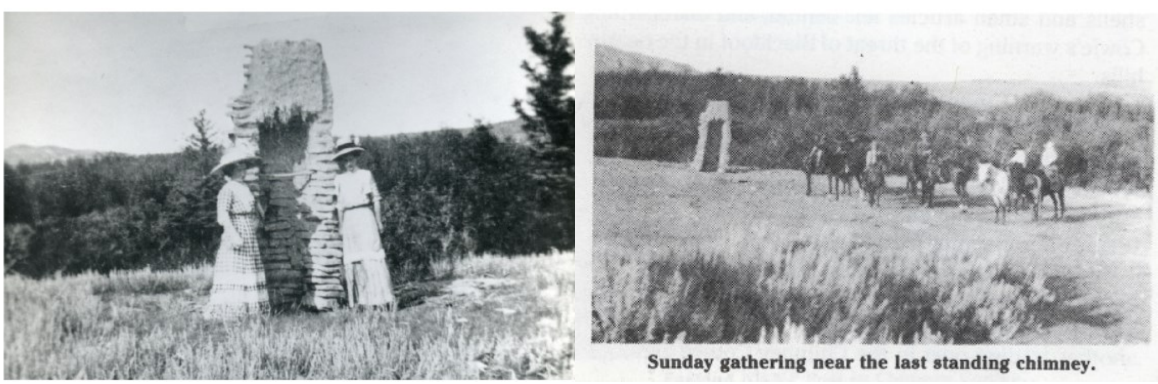

Figure 5.1 Pictures showing the last standing Chimney at Chimney Coulee, photographers unknown (Eastend Historical Society 1984, cited in Tebby 2023, 92-93).

Historical aerial photos from the mid-20th century were another form of historical documentation consulted when trying to locate where the Métis cabins on the site. However, as the height of Métis occupation at Chimney Coulee long predates the earliest of these photos, the earliest of which is from 1938, they did not show any of the cabins themselves, and were instead referenced more to show what the site looked like before the earliest researchers visited it, and before the road was built through the middle of the site (Figure 5.2).

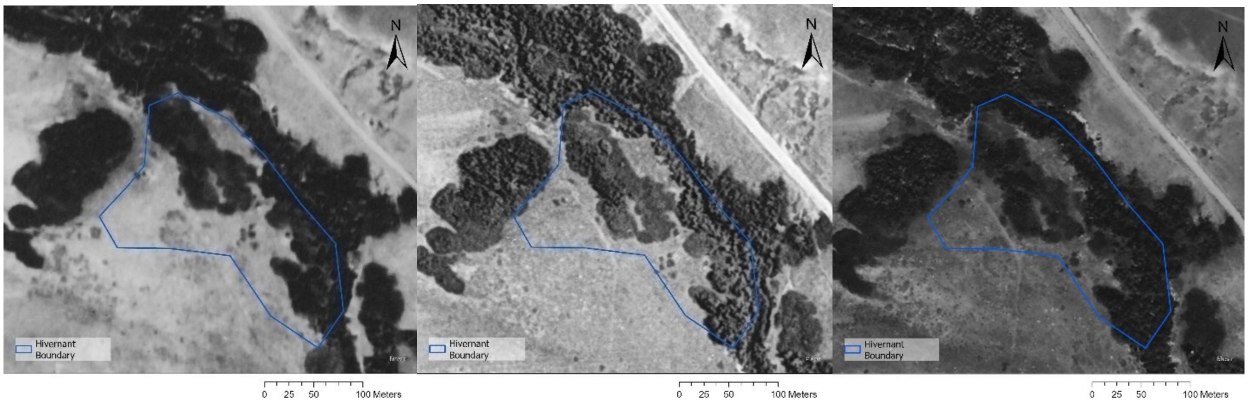

Figure 5.2 Air photos showing Chimney Coulee in 1938, 1945, and 1962 with the presumed boundary of the hivernant site marked out. Photos purchased from the National Air Photo Library of Canada.

Based only on these historical sources, a map of Chimney Coulee was created showing the locations of the NWMP, Cowie's longhouse, and potential areas where the Métis cabins were located (Figure 5.3). The locations of the NWMP and HBC buildings have also been archaeologically verified through excavations and while this study is mainly interested in the locations of the Métis cabins, the locations of these buildings are important to note for the role those settlers played in interacting with the Métis at the site.

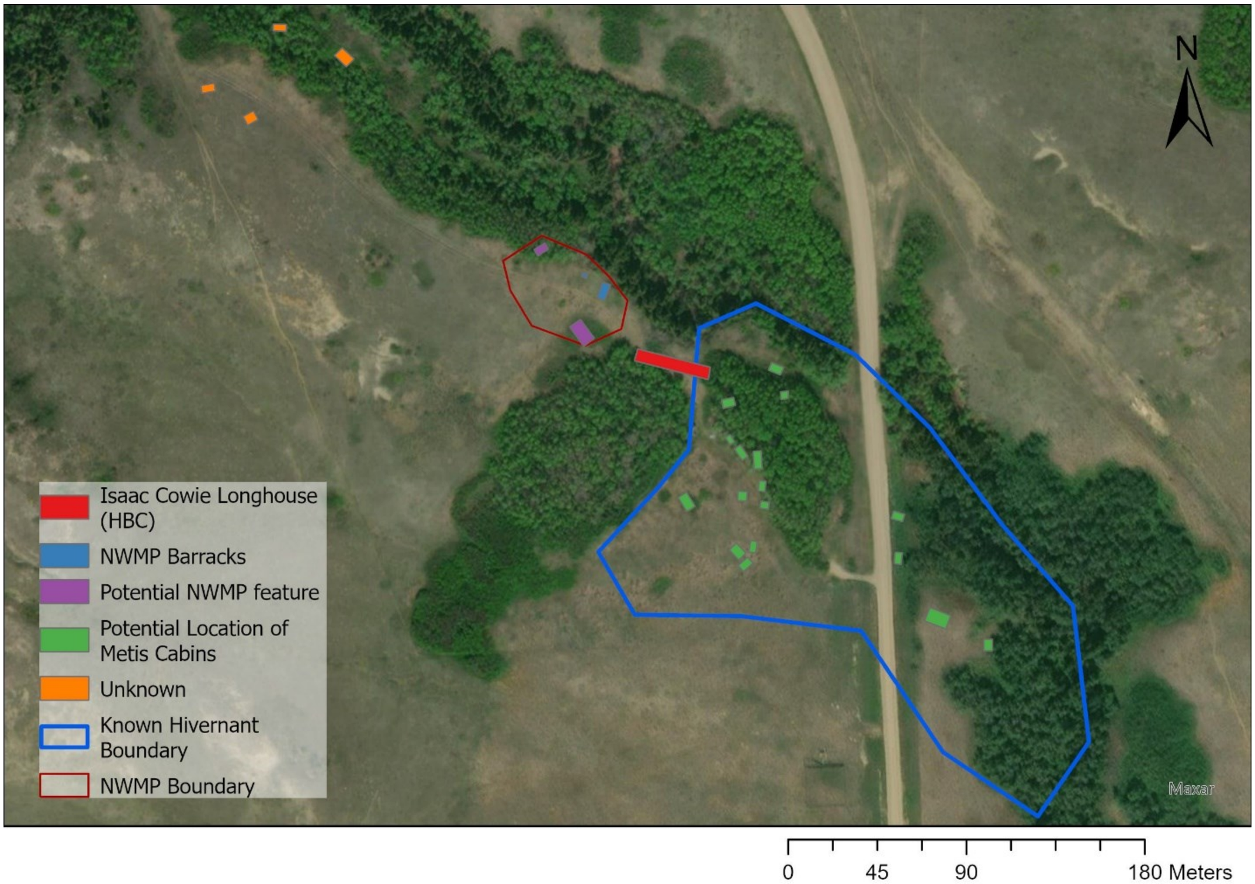

Figure 5.3 Approximate building locations based on features identified by Burley and Brandon. Map made by author.

5.1.2 Geophysics Results

As described in detail in Section 4.2.2, a variety of different geophysical techniques were used to survey and locate areas of interest associated with the Métis occupation of Chimney Coulee over multiple field seasons. Early surveys by the EMITA team in 2013 consisted of using a GNSS RTK to map the locations of interest based on the feature noted by Burley et al. (1992) but the first real geophysical survey conducted on the site did not take place until 2018 after one full season of excavations had already taken place in 2017. This survey used GPR and magnetic gradiometry to try and locate more Métis cabins on the site. A second survey was conducted the following season in 2019 to further locate Métis cabins using a GPR, a Magnetic Gradiometer, and prototype EM conductivity and magnetic susceptibility meter, and a multispectral drone mounted on a UAV. In 2022 a third geophysical survey of the site was conducted using Orthoimagery, LiDAR mounted on a UAV, a magnetic gradiometer, and GPR. The results of the 2018 and 2019 surveys were used to create a map of potential building locations for Wadsworth's 2020 thesis and Wadsworth, Supernant, and Kravchinsky's 2021 study of the site(Wadsworth 2020; Wadsworth et al. 2021). For this thesis, I combined the results of the previous surveys and excavations to create an updated map of potential Métis buildings at Chimney Coulee (Figure 5.14).

Ortho Photography

Modern Aerial photography was taken via UAV at Chimney Coulee in both 2019 and 2022 with a Phantom 4 Pro UAV to provide high-resolution aerial images and to create detailed maps of the sites and archaeological work conducted on them in ArcGIS Pro. While the 2022 flight shows a more recent overview of the site, the images were taken in April while there was still snow on the ground at Chimney Coulee so the 2019 orthomosaic from a flight in July has been used more for mapping purposes.

Multispectral Results

Multispectral imagery was collected at Chimney Coulee in July of 2019 via a DJI Matrice 600 with a Micasense Altum multispectral/thermal sensor mounted on it. For his thesis (Wadsworth 2020) and a subsequent paper (Wadsworth, Supernant, and Kravchinsky 2021), Liam Wadsworth processed the imagery in ArcGIS Pro viewing it in multiple formats to try to identify archaeological features (Figure 5.4). He found that viewing the imagery as a False

Colour image as well as an NDVI image and after undergoing a supervised classification allowed for the best visibility of potential archaeological features (Wadsworth, Supernant, and Kravchinsky 2021).

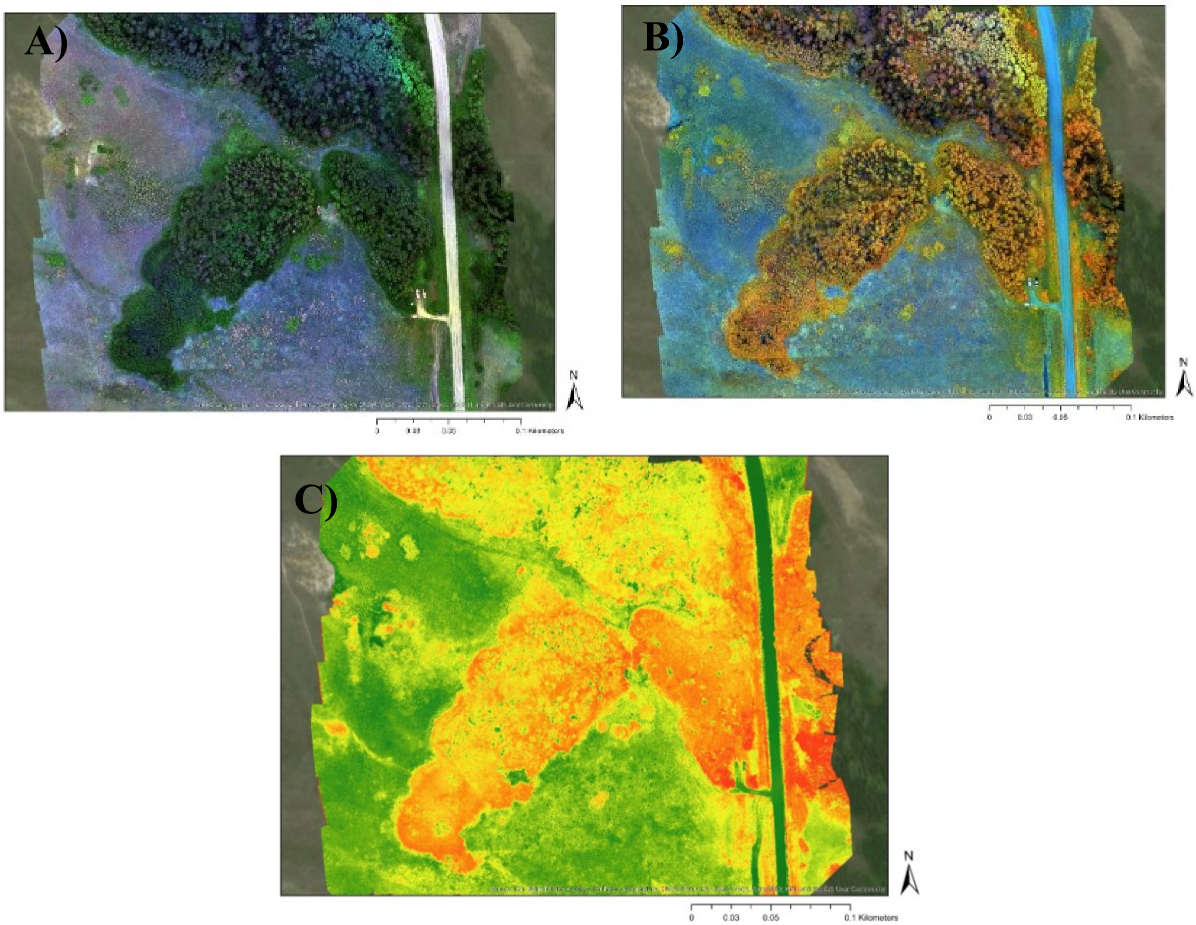

Figure 5.4 Multispectral maps from Chimney Coulee. A) True Colour: Bands 1, 2, 3, B) False Colour: Bands 5, 4, 3, C) Vegetation Index: NDVI (Images from Wadsworth 2020, 154 and 156).

Analysis of these images led to the identification of two potential areas of interest: an area northwest of the NWMP post and an area believed to be associated with the Métis occupation (Figure 5.5). Three potential structures were located in the first area; one larger potential structure (approximately 20 x 20 m) and two smaller potential features (8 x 10 m and

15 x 12 m). Wadsworth, Supernant, and Kravchinsky (2021) argued that these structures are too large to be associated with the Métis and were likely not associated with the NWMP post due to their absence in historical photos of the NWMP portion of the site.

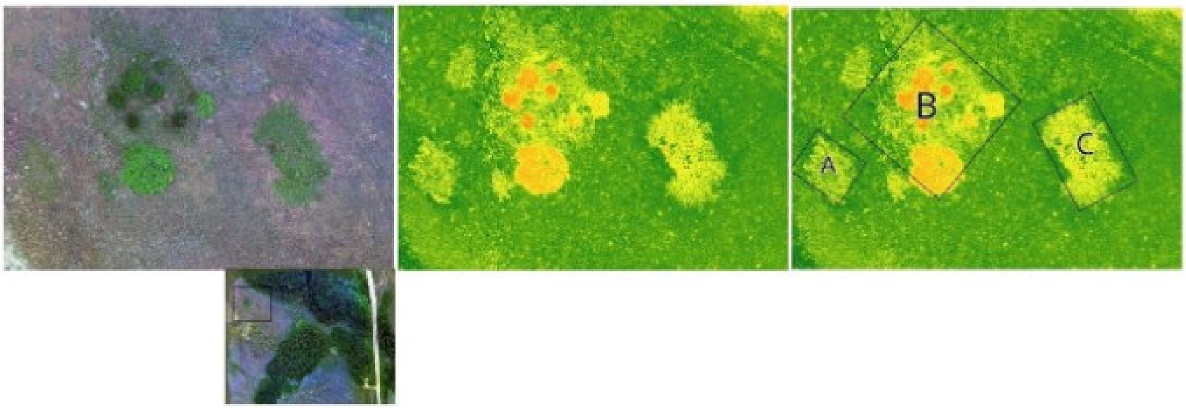

Figure 5.5 Three possible structures that were identified in the True Colour and NDVI multispectral imagery in the northwest portion of Chimney Coulee (Image from Wadsworth 2020, 156).

The second area of interest in the imagery is closer to where excavations of known Métis cabins are and are of a closer size to Métis cabins recorded at other wintering sites (Elliott 1971; Burley, Horsfall, and Brandon 1988; Doll 1988). Wadsworth, Supernant, and Kravchinsky (2021) identified five potential features all sized around 6 x 10 m and located near known Métis cabins, making them good candidates for potential cabins (Figure 5.6).

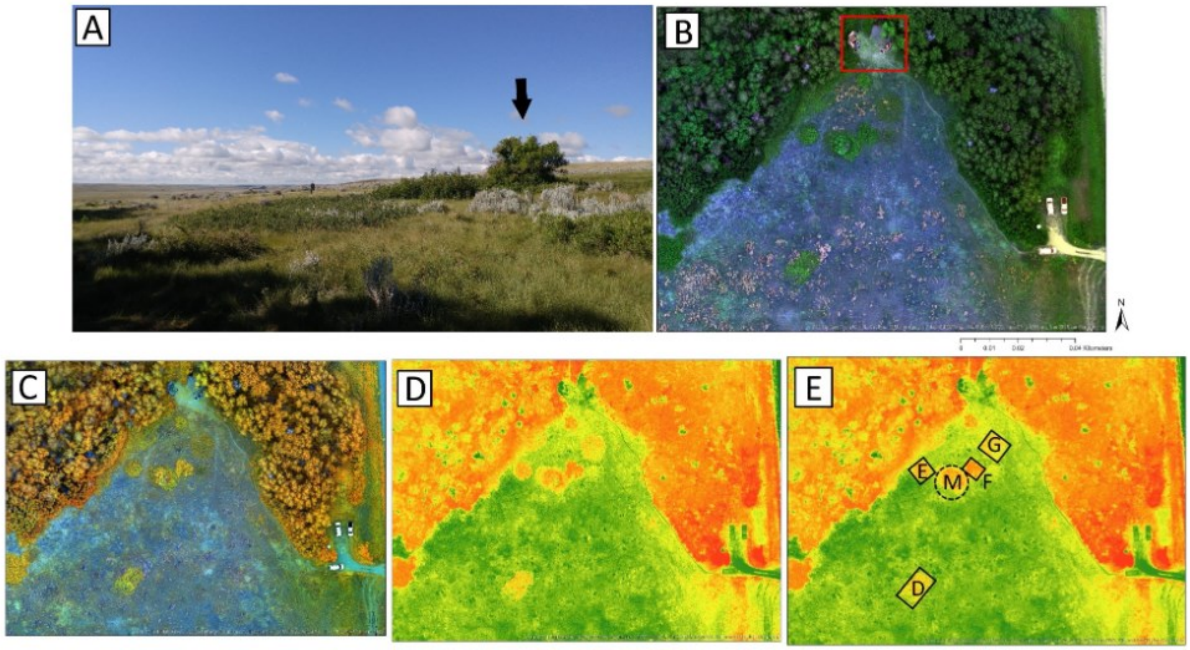

Figure 5.6 Possible Métis structures in the southern area of Chimney Coulee. A) a photograph of the site showing the Manitoba maple growing inside a large depression. B) a True Colour map depicting the active archaeological excavation and area of interest to the south. C) a false colour image (bands 5, 4, 3) of the area. D) an NDVI image of the area. E) interpreted images of the possible structures with the Manitoba maple marked by the M (Images from Wadsworth 2020, 158).

While the multispectral survey was able to highlight multiple potential structures at the site, that were identified by both my colleagues and I, the results needed to be compared to other geophysical surveys or archaeological excavations in order to access to accuracy of the results.

Lidar Results

At Chimney Coulee LiDAR data was collected in April of 2021 with an Zenmuse L1 Lidar sensor mounted on a DJI Matrice 300 UAV. The processed LiDAR data proved useful for identifying depressions that had originally been recorded by Burley, Horsfall, and Brandon (1992) and were then verified by the EMITA team (Mallet Gauthier and Wadsworth 2023). It also allowed for the surveying of land that was inaccessible leading to the identification of a small terrace where a structure could have been built, but showed little evidence of depressions associated with structures in the forested areas of the sites where it had been previously suspected cabins may be located. While Wadsworth (2022) found that the LiDAR was somewhat useful for identifying and confirming the locations of depressions as well as historic trails and terraces at the site, it was unable to detect any actual cabin structures due to their lack of physical remains left on the site. LiDAR can only detect what is on the surface. To locate evidence of structures below the surface further geophysical surveys are required.

GPR and Magnetic gradiometry results

GPR data at Chimney Coulee were collected in three different field seasons (2018, 2019, and 2022). The first survey in 2018 focused on surveying three potential Métis cabins, the first of which was partially excavated in 2017 by Eric Tebby (2023) (Cabin A area), a second potential Métis cabin (Cabin B) located just southeast of Cabin A, and a third near the NWMP portion of the site, both of which were identified based on the presence of chimney stones on the surface near mounds. In the initial analysis of the data collected in 2018, a linear anomaly was identified in Grid A at around 15-25cm deep which led to the decision that the 900 MHz antenna was more suited to the landscape of the site than the 400 MHz antenna (Supernant et al. In progress). While the settings of the survey made the data unfit for formal analysis, preliminary analysis of the data encouraged the researchers to return and survey the same area in 2019.

The 2019 GPR survey of Chimney Coulee mostly focused on re-surveying the grids surveyed in 2018. Three grids were placed over the same locations that grids were surveyed in 2018 and surveyed by both a GPR with a 900 MHz antenna and a magnetic gradiometer (Figure

5.7). The one grid focused on the partially excavated Cabin A area, while another was placed over the area of Cabin B nearby and the third was placed in the area near the NWMP occupation.

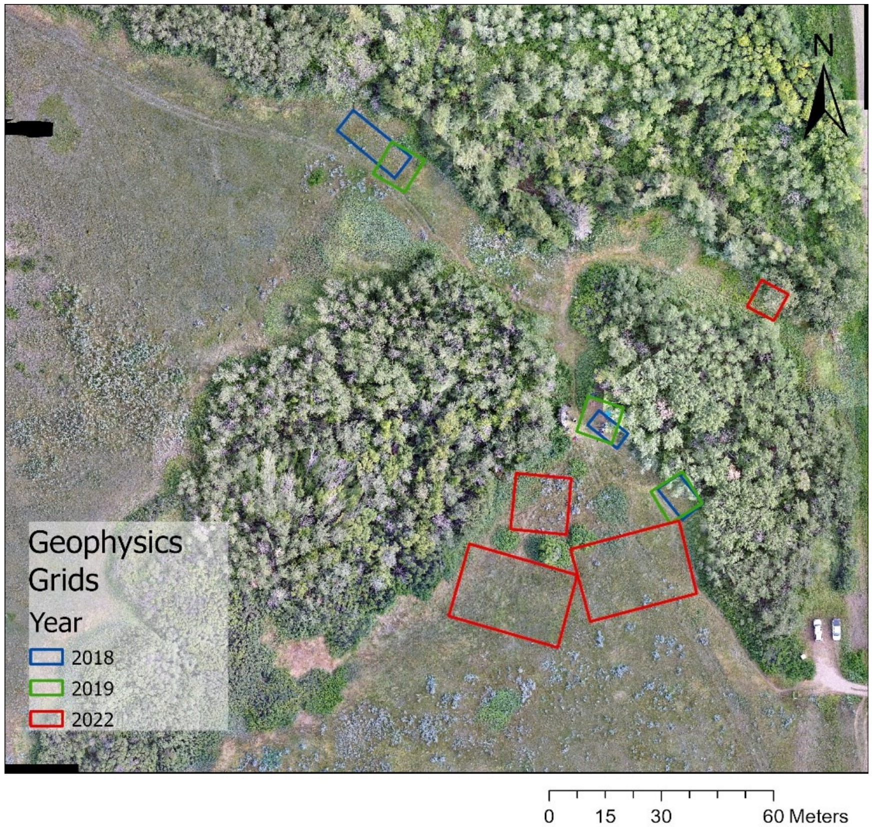

Figure 5.7 Grids surveyed with GPR and a Magnetic Gradiometer at Chimney Coulee. Map made by the author using data from Liam Wadsworth for Mallet Gauthier 2023a.

In the grid over Cabin A, a wood trench was identified that Wadsworth, Supernant, and Kravchinsky (2021) propose are the remains of a cabin wall (Figure 5.8). The chimney and hearth of the cabin were also located on the northern wall where strong point reflections are visible in the GPR and signals and were seen in the magnetic gradiometry. Two small test excavations (50 x 50 cm) were placed inside Grid A to try to confirm the interpretations of the geophysics data, one where the southern wall of the cabin was identified in the GPR (EU11) and one near the chimney (unit 9). While the results of these excavations are described in more detail later in this chapter along with all the other excavation units, both test units did corroborate the interpretations made from the geophysics results (Wadsworth, Supernant, and Kravchinsky 2021).

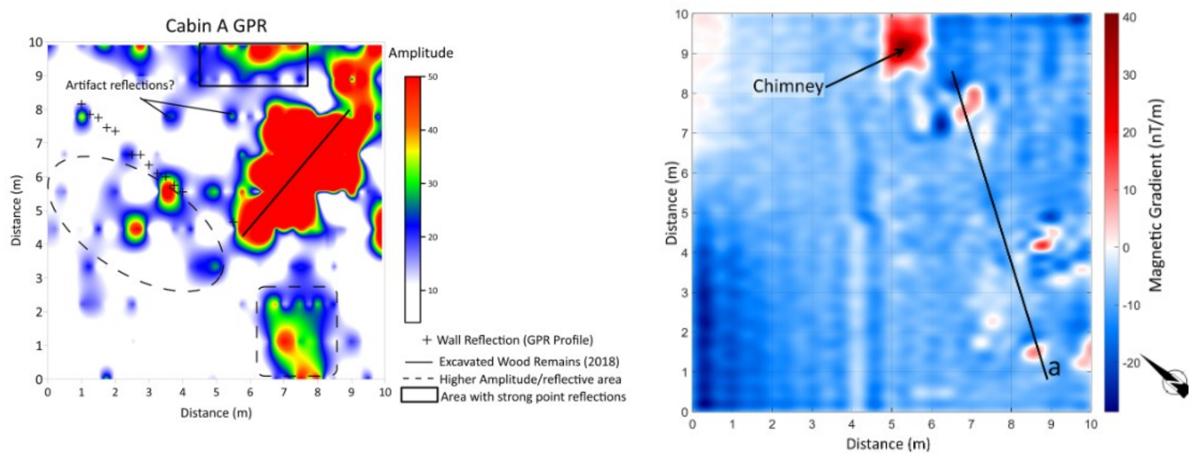

Figure 5.8 GPR amplitude map and Magnetic gradiometry map with interpretations for Cabin A (Image from Wadsworth, Supernant, and Kravchinsky 2021, 327-328).

The Cabin B area had not been excavated prior to geophysics surveys, and the location was chosen based on its proximity to Cabin A and the presence of chimney stones and a depression on the surface. This grid produced very similar radar reflections to Cabin A showing a possible wall and chimney (Figure 5.9: Wadsworth, Supernant, and Kravchinsky 2021). The magnetic data from the grid was also similar to that of the Cabin A area, showing a large positive magnetic anomaly that corresponded to a small mound on the surface and high amplitude signals in the GPR and is believed to be the location of a hearth and chimney. The similar appearance of signals to those seen over Cabin A and the similar dimension of the structure to Cabin A after the features were plotted (both around 5 x 7 m) led Wadsworth, Supernant, and Kravchinsky (2021) to infer that Cabin B is a second Métis cabin on the site.

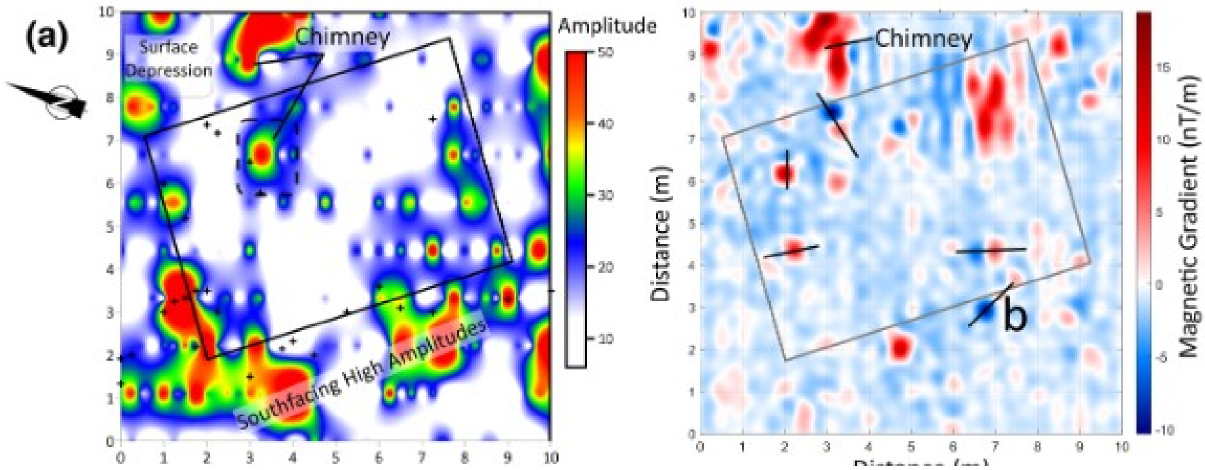

Figure 5.9 A GPR amplitude map and a magnetic gradiometry map with interpretations for Cabin B (Images from Wadsworth, Supernant, and Kravchinsky 2021, 330).

The third grid, in the NWMP area of the site, had similar GPR results to the grids over Cabins A and B but unfortunately, the magnetic gradiometry survey of the grid was inconclusive due to the presence of metal scattered in the area by John Brandon in the 1990s to deter looters (Brandon 1996) that were not able to be removed by the team in 2019 (Brandon 1996; Wadsworth, Supernant, and Kravchinsky 2021). Despite the abundance of noise in the grid, two linear anomalies inside the feature are visible but were not able to be consistently seen in the GPR data. The slight differences in the signals seen in the grid compared to the grids over Cabins A and B, along with the location, led to the interpretation that this was likely a building that was contemporary to the Métis Cabins but associated with the NWMP post rather than the Métis occupation at Chimney Coulee (Wadsworth, Supernant, and Kravchinsky 2021).

A third GPR survey and second magnetic gradiometry survey of Chimney Coulee took place in April of 2022 and was focused on locating more Métis cabins on the site that could be excavated in July of 2022 (Wadsworth 2022). A coarse magnetic gradiometry survey was conducted first to identify locations best suited for grids for more detailed geophysical surveys

(Figure 5.10). This survey was conducted in three areas of interest: the area near Cabins A and B that it was believed could have more Métis cabins, a smaller area near the coulee where a few negative shovel tests had been dug in 2013 but was identified as an area of interest by Brandon (1996) and Burley et al (1992), and the area associated with the HBC and NWMP occupation of the site to see if more features west of their structures could be located. In the first area near Cabins A and B only a few areas had magnetic anomalies, the small area near the coulee was more positively magnetic than the southern area near Cabins A and B and found strong anomalies near a chimney stone on the surface and a cultural depression as well as a few other anomalies associated with modern debris. The survey in the western portion of the site over and around the NWMP and HBC structures was inconclusive like it had been in 2019, due to the abundance of metal in the area spread by Brandon (1996) making the area unsuitable for magnetic gradiometry surveys (Wadsworth 2022).

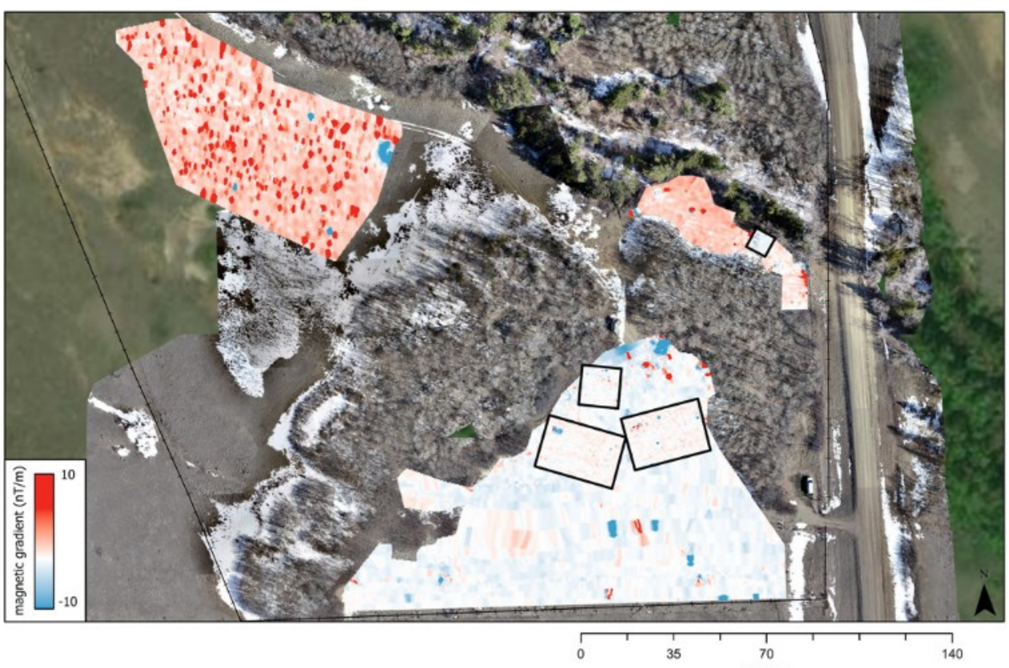

Figure 5.10 A map of the magnetic gradiometry surveys at Chimney Coulee. The black grids show the locations of 25 cm grid data (Map from Mallet Gauthier and Wadsworth 2023, 75).

Based on the coarse magnetic gradiometry survey of the site, four grids were formally surveyed with GPR and magnetic gradiometry: one near the coulee where strong signals were seen associated with a chimney stone and depression; and three near Cabins A and B (Figure 5.8). The grids placed near Cabins A and B found a few possible signals associated with potential archaeological features as well as an old road or cart trail on the site, and one potential Métis cabin based on GPR reflections noted in a rough rectangle shape near some small magnetic anomalies, but no strong anomalies indicating the presence of a chimney and hearth like the ones seen over Cabins A and B were seen (Figure 5.11). While the presence of long grass and snow on the ground led to poor contact with the ground making the results of the GPR surveys uncertain, one area was noted by Wadsworth (2022) as a good candidate for further investigations and the possible location of another Métis Cabin.

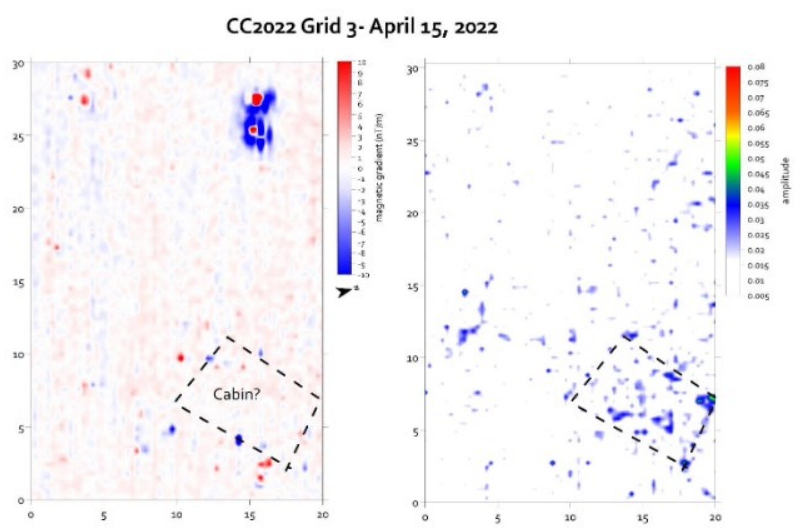

Figure 5.11 GPR amplitude map and magnetic gradiometry map with interpretations map for Grid I (Image from Wadsworth 2022, 113).

The last grid surveyed in 2022 in the eastern portion of the site near a chimney stone also found a potential Métis cabin (Figure 5.12). The remains of a possible structure at 15-20cm deep can be seen in the GPR data and just outside of what may be the wall are large and strong magnetic anomalies (Wadsworth 2022). The associated presence of a chimney stone and depression on the surface makes this another possible location of a Métis cabin that has been labeled "Cabin C".

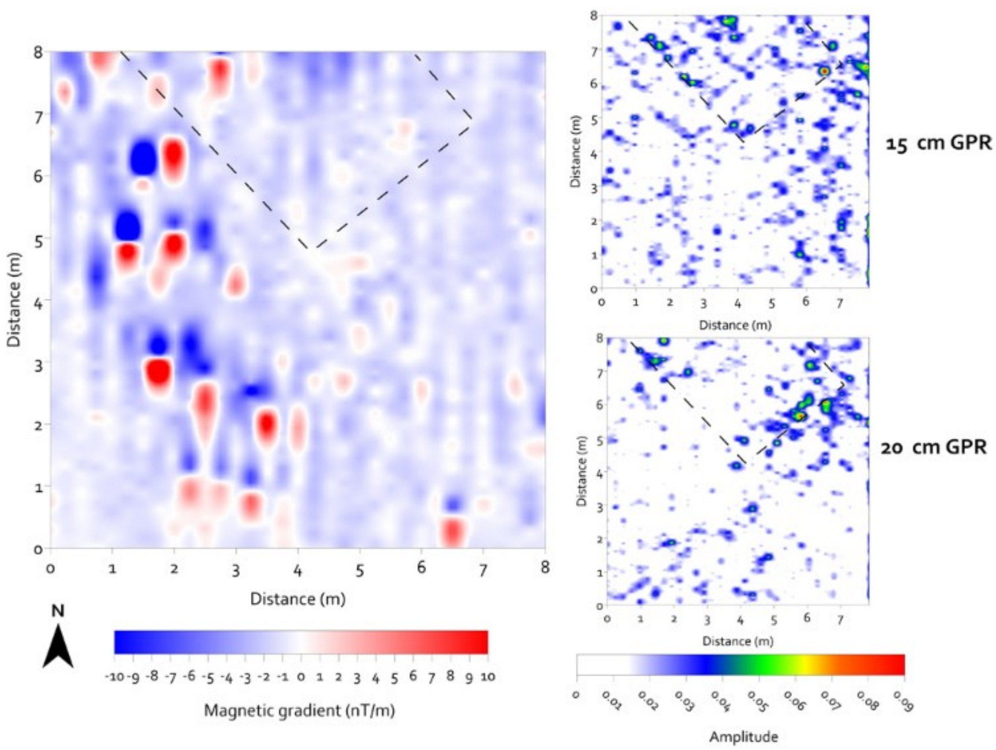

Figure 5.12 GPR amplitude map and magnetic gradiometry map with interpretations map for the grid over Cabin C (Image from Mallet Gauthier and Wadsworth 2023, 78).

Based on three years and ten geophysical grids, four potential Métis cabins have been identified at Chimney Coulee. Prior to any geophysical surveys being conducted only Cabin A had been archaeologically investigated, but GPR and magnetic gradiometry helped to provide a better understanding of the size and placement of the cabin. Of the other three potential cabins, two have since been partially excavated (Cabins B and C) and the results of the excavations at all three cabins will be discussed in the next section. The fourth potential cabin located near the Manitoba Maple has not been excavated at all but is near where Burley et al (1992) noted some features believed to be associated with the Métis occupation.

5.1.3 Archaeology Results

Three potential Métis cabins have been identified and partially excavated through the EMITA project. While a whole myriad of artifacts have been excavated over six field seasons at Chimney Coulee, this thesis is mostly interested in what these excavations say about the location and orientation of the cabins. Thus, only a brief summary of the archaeology at the site as it relates to building locations is discussed here. More in-depth studies on different aspects of the archaeological assemblage at the site can be found elsewhere (Wambold 2021; Tebby 2023; Mallet Gauthier 2023a; 2023b; Supernant et al. In progress).

As has been previously discussed, the first Métis cabin identified at Chimney Coulee, Cabin A was originally identified through excavation in 2013 when a 'wood trench' was located in the test unit (EU1) and was determined to be the remains of a cabin wall based on the distribution of artifacts found on either side of the feature during excavations in 2017. In 2017 EU 1 was expanded into a full 1 x 1 m unit and two more excavation units (EU 2 and 3) were opened next to EU 1 to further investigate the potential cabin wall (Figure 5.13). Overall, more artifacts believed to be associated with the interior of a house, including beads, sewing equipment, ceramics, and other domestic housewares were found on the west of the wall leading to the conclusion that the west of the wall was likely the interior portion of the cabin (Tebby 2023; Supernant et al. In progress).

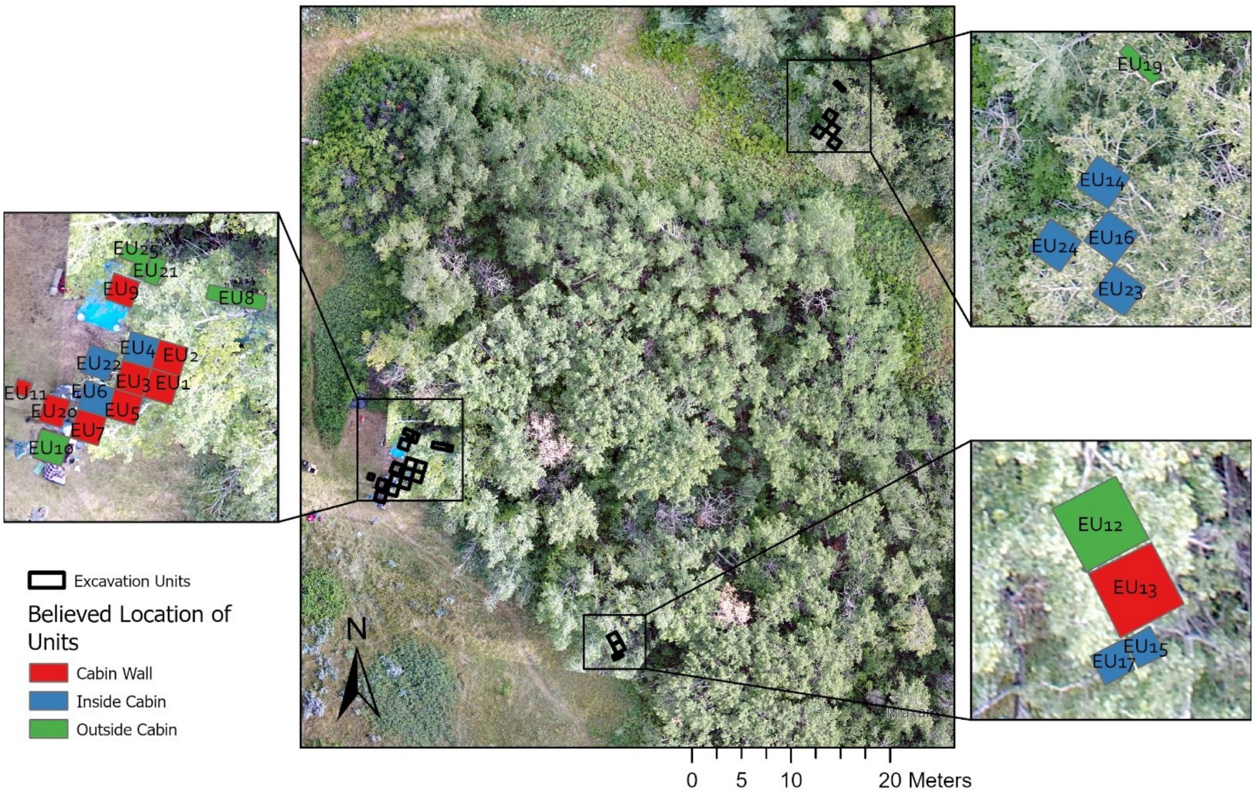

Figure 5.13 Map showing the location of excavation units at Chimney Coulee. This map was created by the author in ArcGIS Pro.

Another four units were opened in 2018 (EUs 4-7): one completely inside the cabin (EU4) and three overlapping the wall (EUs 5-7). Artifacts found in EU4 corroborated the interpretation that the unit was placed inside the cabin while EUs 5-7 continued to uncover pieces of the wood wall (Tebby 2023; Supernant et al. In progress)

2019 saw the opening of four more excavation units (EUs 8-11) in an attempt to further understand the cabin following the geophysics survey over the area. EU8 measured at 2 x 0.5 m and was placed northeast of EUs 1-7 in order to test a large pit just outside the cabin. Based on the assemblage of artifacts this unit is believed to be outside of the cabin (Supernant et al. In progress). EU9 was a standard 1x1m unit placed where the chimney was believed to be based on the results of the geophysics surveys. Chimney stones and other artifacts associated with a hearth were uncovered in this unit effectively confirming the interpretation of the GPR and Magnetic gradiometry surveys. EU10 was another 1x1m unit placed in line with EUs 1-8 and a variety of artifacts and fauna was uncovered but did not contain more of the wood wall. EU11 was only 0.5 x 0.5 m and was placed where the southern wall of the cabin was seen in the GPR survey. This test unit uncovered more wood believed to be from the cabin's wall which also confirmed the location this wall in the GPR (Supernant et al. In progress).

No excavations took place at Chimney Coulee in 2020 or 2021 due to the COVID-19 pandemic, and when they started up again in 2022 no new units were placed in the Cabin A area where the previous excavations had taken place. Instead, seven units were placed in two new potential cabin locations that were identified during geophysical surveys in April of 2022. Four of these excavation units (EU12, EU13, EU15, and EU17) were placed in and around Cabin B while the other three were placed around Cabin C. Excavations in Cabin B were able to locate a chimney/fireplace and a potential cabin wall (both in EU12) but fewer artifacts than expected were uncovered and no real distinguishable indications of the cabin's association with the Métis occupation at Chimney Coulee have been found at this point (Mallet Gauthier 2023a, 83). The chimney/fireplace was identifiable by the presence of large chimney stones, hard clay, reddened soil, charcoal, and ash in a half-circle (Mallet Gauthier 2023a, 77-80). The potential cabin wall is represented by a log that runs at an angle through the EU12 and is believed to be a wall not only due to its similarity to the wall pieces uncovered around Cabin A, but also due to differences in artifacts and stratigraphy on either side of the log (Mallet Gauthier 2023a, 76-77).

The other three excavation units (EU14, EU16, and EU19) were placed around where Cabin C was identified in the geophysical survey. The cabin's chimney/fireplace was uncovered in EU14 while EU16 found the floor layer of the cabin based on the presence of chimney stones and ash in EU14 and a high concentration of artifacts at the bottom of a layer in EU16 (Mallet Gauthier 2023a, 82). EU19 is not directly related to the structure and was instead placed in a large depression nearby believed to be a mudding pit where mud was harvested during the construction of the cabin (Mallet Gauthier 2023a, 81). No cabin walls were uncovered during the 2022 excavation to give an indication of the cabin's orientation.

The most recent field season at Chimney Coulee took place in July 2023 and saw seven units being excavated, five back in the Cabin A area and two more in the Cabin C area. In the Cabin A area, EU9, which was first excavated in 2019 was re-opened, and four new units were placed near the existing units. Two new units (EU21 and EU25) were placed over the chimney/fireplace and more of the cabin floor was excavated in EU9, EU20, EU22, and EU25 (Mallet Gauthier 2023b, 47). While EU20 was placed where the southern wall of the cabin is believed to be based on the cabin floor layer's outline, the wall's presence in EU11, and the GPR grid over the area, no more wood was found, leading to the hypothesis that EU20 is over where the door to the cabin was (Mallet Gauthier 2023b, 47).

The two units near Cabin C that were excavated in 2023 uncovered more of the cabin's floor as well as a wood feature. This wood feature was probably a structural element of the cabin but likely not a wall due to its short distance from the chimney/fireplace and the relatively equal amount of artifacts found on both sides and under the feature (Mallet Gauthier 2023b, 48). Like with Cabin B, the lack of walls uncovered in the excavations means that the cabin's size and orientation are hard to determine.

5.1.4 Full Building Map of Chimney Coulee

The locations of buildings at Chimney Coulee were mapped using a combination of historical records, the results of the remote sensing surveys, and the excavations that have located buildings on the site (Figure 5.14). 27 buildings from all the different data sources were mapped in ArcGIS Pro and then given a confidence rating on a scale of 1 to 5 based on the type and number of corroborating data sources for that building's location (Table 5.1). Buildings located with remote sensing or geophysics only were given lower confidence ratings (1, 2, or 3 depending on the number of corroboration technologies) whereas building locations based on early site maps of chimney mounds and depressions made by Brandon (1995) and/or Burley et al. (1992) were given a medium rating of 3 as chimney mounds have been found through excavations to almost always be associated with cabins (Burley, Horsfall, and Brandon 1988; Weinbender 2003; Wadsworth et al. 2021). If a mapped chimney mound location was verified through a geophysical or remote sensing method the rating was increased to 4. Lastly, any building that has been excavated was automatically given a rating of 4, and the rating was increased to 5 if the location was also verified via geophysics as geophysics in concert with excavations provides the most accurate idea of the orientation of a building and its walls. Based on these criteria nine buildings were given a confidence rating of 1, none were given a rating of 2, ten were given a rating of 3, five were given a rating of 4, and three were given a rating of 5 (Table 5.2).

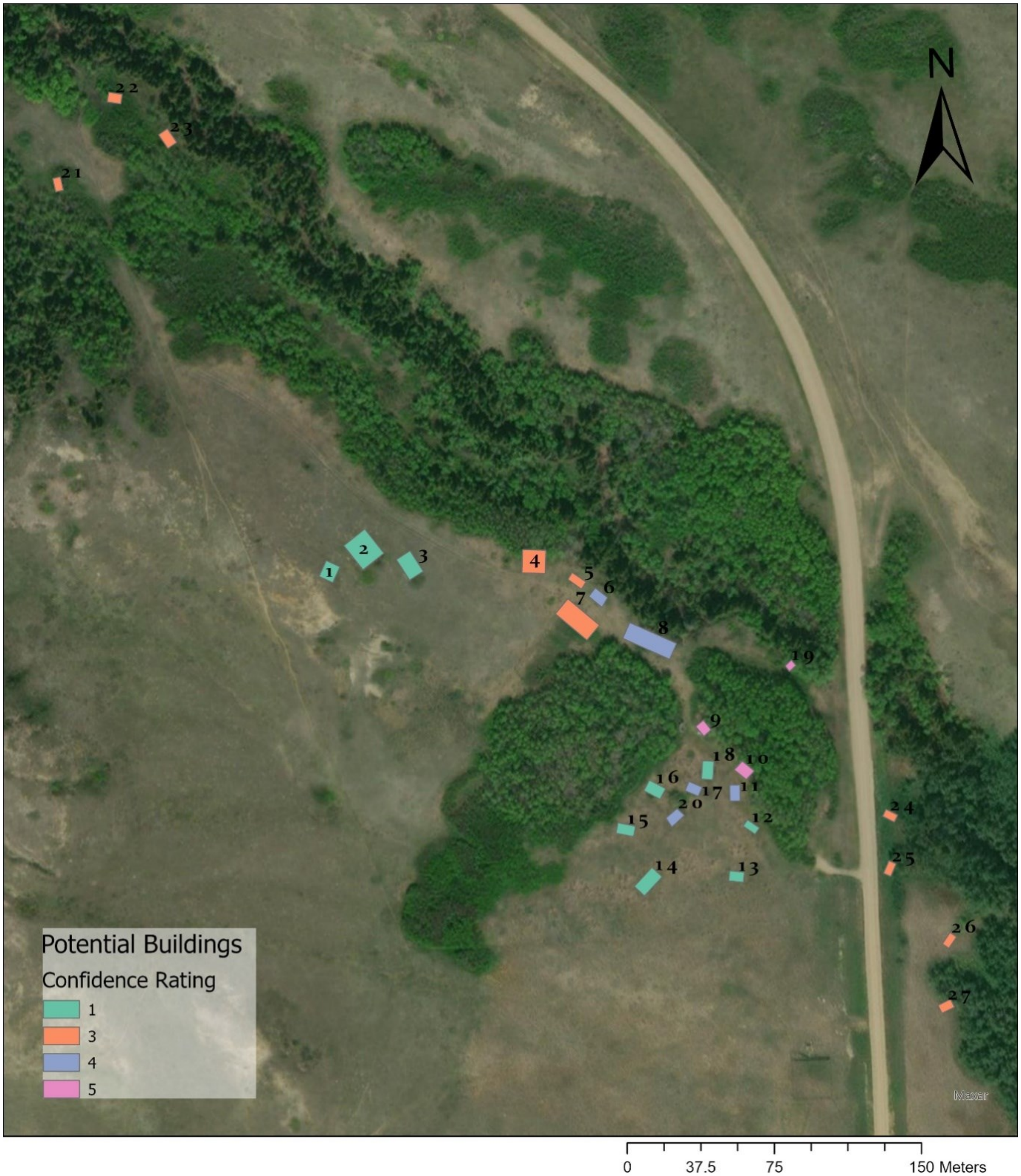

Figure 5.14 Approximate building locations based on features identified by Burley and Brandon, geophysical surveys, and archaeological investigations with a confidence rating based on the evidence source. Buildings are labeled with their Building ID, refer to Table 5.2 for building types. Map made by the author.

Table 5.1 Buildings Confidence Matrix for Chimney Coulee Buildings.

Confidence Rating	Type of Evidence
1	One type of geophysical evidence
2	Two types of geophysical evidence
3	Mapped location of a chimney mound and associated depressions Or Three or more types of geophysical evidence
4	Excavated Or Mapped chimney mound with location verified via geophysics
5	Excavated and identified via geophysics

Table 5.2 The Building Confidence Matrix applied to Chimney Coulee Buildings.

Building ID(s)	Building Identification	Confidence Rating	Evidence Types
1-3	Unknown Buildings	1	Located with Multispectral Imagery
4-5	NWMP Building	3	Mapped by Brandon (1995)
6	NWMP Building	4	Mapped by Brandon (1995) and located with GPR and Mag
7	NWMP Building	3	Mapped by Brandon (1995)
8	Isaac Cowie's Longhouse	4	Excavated by Brandon (1995)
9	"Cabin A"	5	Excavated by EMITA team and located with GPR and Mag

10	"Cabin B"	5	Excavated by EMITA team and located by GPR and Mag
11	Potential Métis Cabin	4	Mapped by Burley et al (1988) and located with multispectral imagery
12-16	Potential Métis Cabins	1	Located with Multispectral Imagery
17	Potential Métis Cabins	4	Mapped by Burley et al (1988) and located with multispectral imagery
18	Potential Métis Cabins	1	Located with Multispectral Imagery
19	"Cabin C"	5	Excavated by EMITA team and located by GPR and Mag
20	Potential Métis Cabin	4	Mapped by Burley et al (1988) and located with GPR and Mag
21-23	Unknown Buildings	3	Mapped by Burley et al (1988)
24-27	Potential Métis Cabin	3	Mapped by Burley et al (1988)

5.2 River Lots 23 & 24

5.2.1 Historical/Oral Documentation

River Lots 23 & 24 have a lot more historical documentation relating to the locations of buildings than Chimney Coulee does due to the site's location in an urban settlement, and the later occupation period. From historical records and oral histories, it is known that Lot 24 was occupied by Louis Chastelain and his descendants from the 1870s up until the 1990s with multiple houses and other buildings being built throughout the years (Buckingham 2000). The earliest map of the lots is an unofficial 1878 map made from the notes of the Dominion Topographical Surveyor William F. King that shows the rough location of Chastelain's house and store and Chastellian's son-in-law John Roland's house on Lot 13, which would later become Lot

24, as well as the location of the HBC store and stable on the lot next door (lot 14 and later 23) (Figure 5.15). This map also has John Roland (spelt Rowland in most records) listed as the owner of Lot 14. The official survey map of St. Albert from 1884 also shows river lots 23 and 24, with Chastellain as the owner of Lot 24 but has less detail about the lots than the 1878 map (Figure 5.16). This map shows three buildings clustered together in roughly the same location Chastellain and Rowland's houses and Chastellian's store are shown to be in 1878 but no other buildings or features on the lot are depicted.

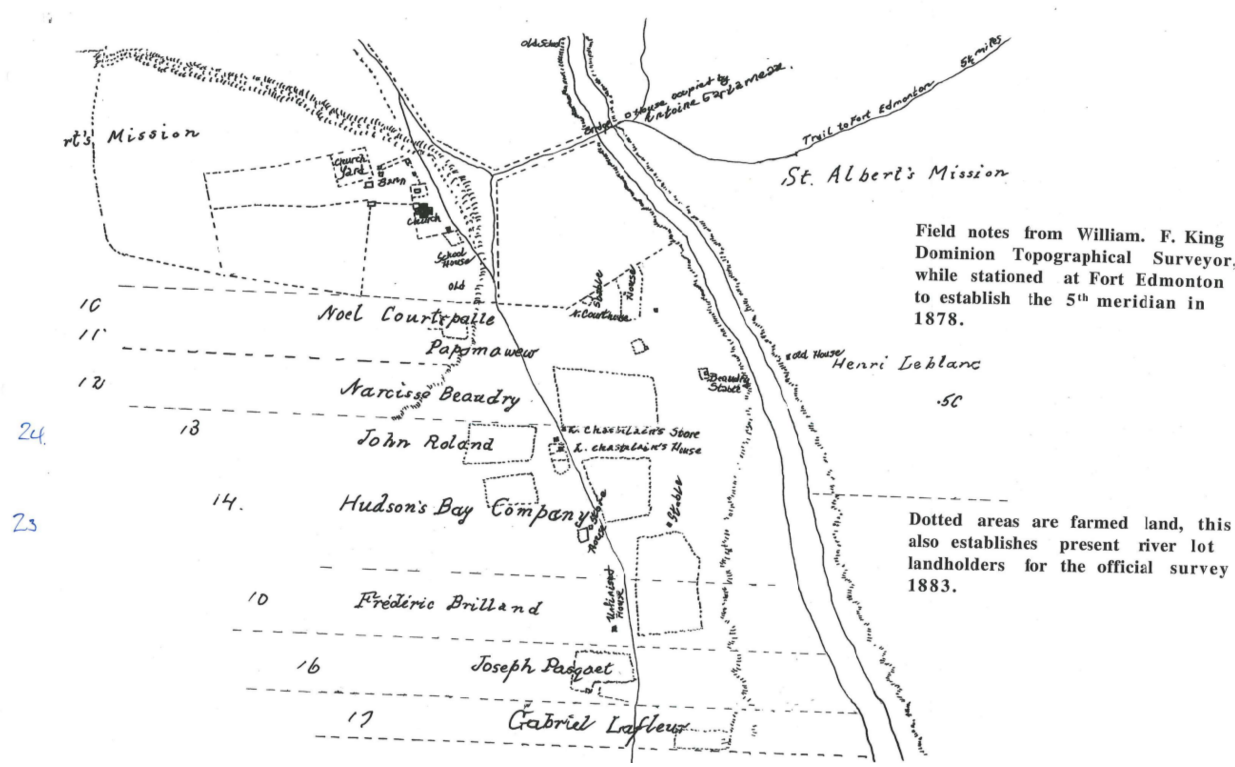

Figure 5.15 "King's Map." A 1878 map of St. Albert showing the location of L. Chastellain's house and store on Lot 13 (later called Lot 24 and marked as being owned by John Roland). Map from the City of Edmonton Archives.

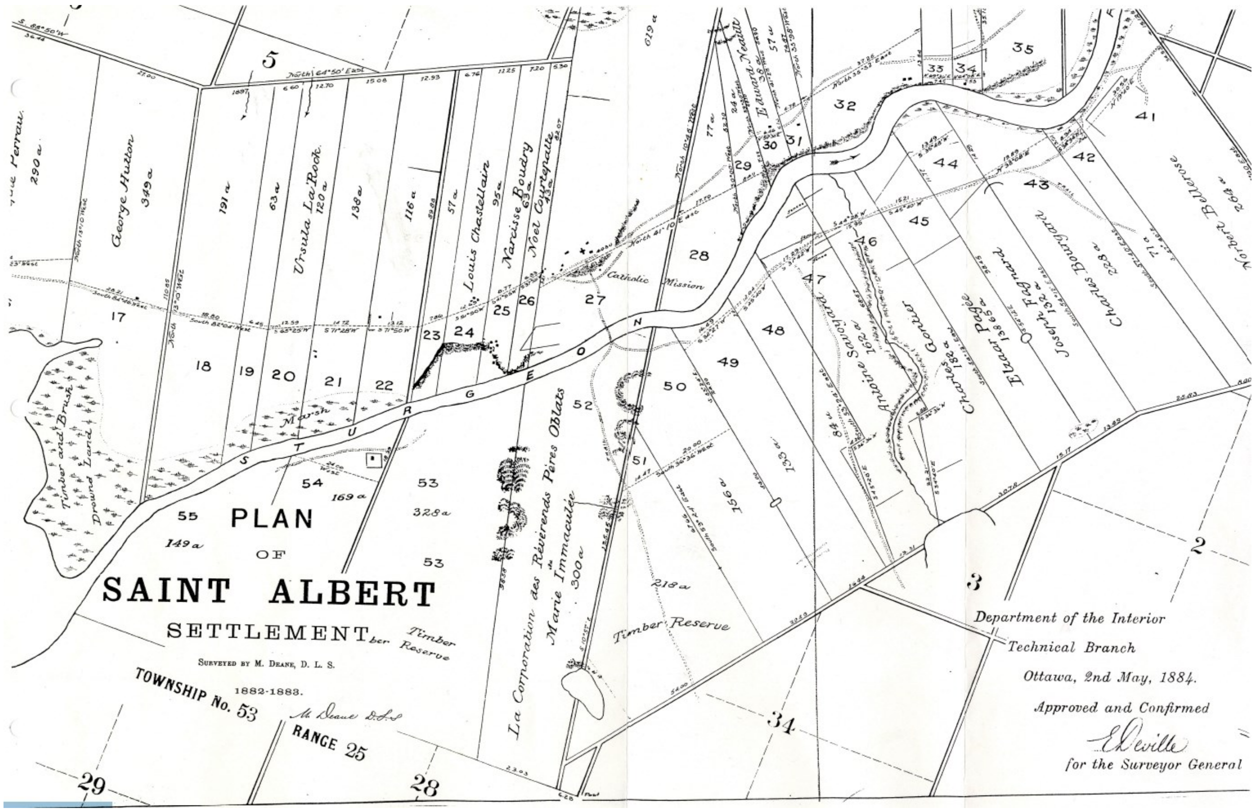

Figure 5.16 The official survey map of St. Albert from 1884 showing the River Lots 23 & 24. Lot 24 is labelled as being under the ownership of Louis Chastellain. Map from the City of Edmonton Archives.

Following Louis Chastellian's death in 1884, the ownership of Lot 24 passed to his daughter Sophie Rowland (nee Chastellain). Sophie and John had multiple children but seven survived out of childhood and two of their daughters, Amelia and Mary married the twin sons of John Cunningham, the man who ran the HBC post on Lot 23 before his death when Louis Chastellain took over (Larmour 2017). Amelia (Rowland) Cunningham, and her husband Alfred Cunningham, had a house on Lot 24, although it was only a winter home as Alfred had a farm on another lot. Construction of this house is believed to have been finished around 1912, and it is still on the site today in its original location (City of St. Albert and Engineering and Land Services 2010; Larmour 2017). Another of Sophie and John's daughters, Louisa (Rowland)

Belcourt, began to live in the former washhouse of the Youville Convent with her family who moved on to the site sometime before 1924 (Larmour 2017). In the 1950s Louisa's son Albert Belcourt moved the Hogan house onto Lot 24 from Lot 3 and lived there with his family until the 1990s. Albert's brother lived in the washhouse after his mother's death until 1996. The washhouse was demolished in 1998 but the Hogan house is still on the site alongside the Cunnigham house and are today two of the oldest historic houses in St. Albert (Figure 5.17; City of St. Albert and Engineering and Land Services 2010).

Figure 5.17 The Cunningham House (left), Hogan House, and part of the Youville Convent Wash House (right) in 1980 (City of St. Albert and Engineering and Land Services 2010, 22-23).

Other known historical buildings on River Lot 24 include a train station, a log barn, a timber residential building called "Bean's House," two sheds, and five smaller sheds/structures, all of which were located in the lower portion of the lot and torn down in the early 2000s (Earth Tech 2005). The train station on the lot was built when the Canadian Northern Railway track was laid through St Albert in the 1900s. The land for the station was recorded to have been bought from the Grey Nuns and likely came from a part of the lot owned by the Youville Convent (Buckingham 2000). The log barn was the next oldest of the buildings. It was associated with the Métis houses on the site dating to the early 1900s and was used to stable horses. However it was torn down after two structural assessments in 2006 and 2008 deemed it unstable (Ramsden 2008). The two sheds and five small sheds/structures date to the 1950s to 1970s and had not been used for many years when assessed in 2005 (Earth Tech 2005). Lastly, “Bean’s House” dates to the 1960s and was a single-level timber structure on timber blocks and an unprepared base suggesting it may have been moved from somewhere else onto the site (Earth Tech 2005). Not much is known about who lived there or their connection with the Métis on the site.

There are also a handful of other buildings that were on the site and can be seen in air photos but do not have any historical documentation surrounding them. A 1924 photo of the site shows the Cunningham house and the washhouse where Louisa Belcourt and her family lived as well as two smaller structures south of the houses whose use is unknown and only appear in the 1924 photo of the site (Figure 5.18 A). There is also a small building in the far southern portion of Lot 23 but it is likely not associated with the Métis on Lot 24. A 1957 air photograph of the site shows the newly relocated Hogan house along with the Cunningham house and Belcourt washhouse, and some new buildings including the barn, three small structures just behind the houses, and one potential structure near the border between Lot 23 and Lot 24 (Figure 5.18 B). There is also a building associated with a small farmstead in the far southern portion of Lot 23 where a different building was seen in 1924. The building on the border between Lot 23 and Lot 24 is likely the building whose cellar was partially excavated in both 2009 and 2023 which will be discussed in more detail in a later section.

A 1978 air photo of the site shows the Cunningham house, Hogan house, Belcourt washhouse, and barn seen in earlier photos along with three or four new buildings in a fenced-in area near the barn, a house with a row of trees on either side of it, and a small building to the west of the barn closer to the border between the two lots (Figure 5.18 C). The building between the rows of trees is in the location where Bean's house is said to have been but look like a different building than the one in pictures of Bean's house from 2005. The three buildings near the houses and the one building on the border between the lots are gone and a few more buildings associated with the farmstead in the south of Lot 23 are visible. The last air photo, from 1988 shows almost all the same buildings as are seen in 1978 with the exception of one of the small buildings near the barn (Figure 5.18 D). The house between the trees has been replaced with a different building that now looks like the description and pictures of Bean's house from 2005 (a T-shape; Earth Tech 2005). There is also a new building at the farmstead in the south of Lot 23. Only a few of the sheds and small structures that were on the site until they were torn down in the early 2000s are potentially visible in the air photos, although pictures of them show a few to be right against the barn which would make them hard to see in air photos (Earth Tech 2005).

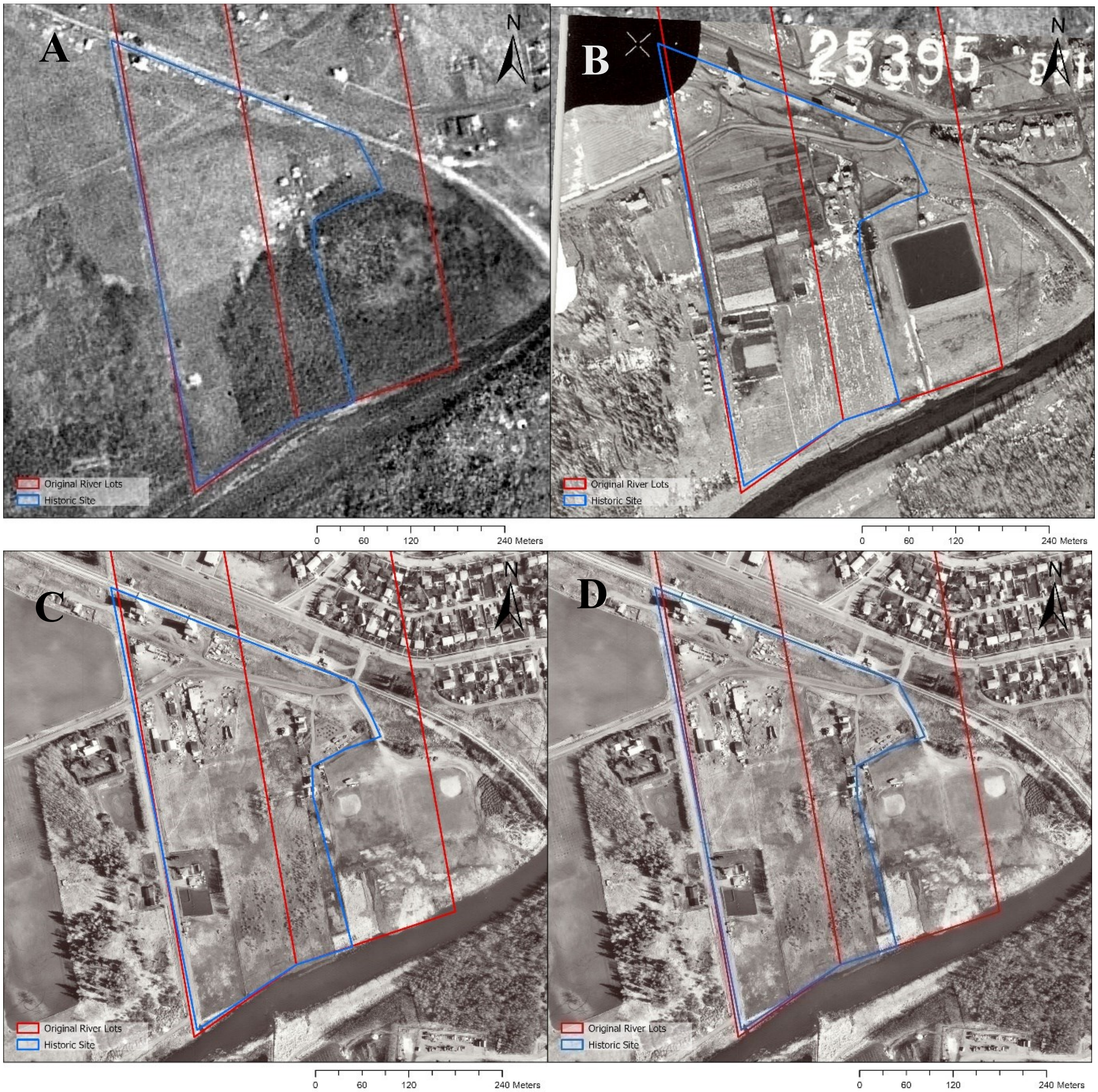

Figure 5.18 Historic air photos of River Lots 23 & 24 from (A) 1924; (B) 1957; (C) 1978; (D) and 1988. Photos purchased from the National Air Photo Library of Canada.

Based on the abundance of historical documentation on buildings on the site a fairly accurate idea of what buildings existed on River Lots 23 & 24 can be gained along with a rough estimate of where they were located (Figure 5.19). However, the exact locations of these buildings are harder to determine from just historical sources. The two maps of the river lots from the late 19th century show only rough locations of Lous Chastellain and John Roland's houses and Chastellian's store and while the air photos can show where buildings were in relation to each other, their scale and the geolocation of historic air photos being imprecise means the exact locations of buildings are hard to determine. While some building locations can be verified through geophysical surveys and archaeological excavations, the site has also been significantly disturbed by urban growth in the city of St. Albert and the construction of baseball diamonds on a portion of Lot 24, among other things, making it likely that many of the older building are impossible to locate on the ground.

Figure 5.19 A map of historic buildings that once existed on River Lots 23 & 24 based on the survey maps and historic air photos. Map made by the author.

5.2.2 Geophysics Results

Unlike at Chimney Coulee where multiple field seasons have been conducted and geophysical techniques were only used to survey the site after a few seasons of excavations had taken place, 2023 was the first year River Lots 23 & 24 were the focus of full archaeological investigations (one minor excavation took place in 2009 which is discussed in a later section). This allowed the site to be surveyed before any major excavations began. I was also there to administer or oversee all of these surveys and the analysis of all the surveys is entirely my own. It is however important to note that due to the site being surveyed and excavated as part of a field school there was only a small period of time available to conduct surveys resulting in less thorough coverage of the site than at Chimney Coulee. The magnetic gradiometer was also not used at River Lots 23 & 24 despite being used at Chimney Coulee due to the amount of historic metal scattered on the surface, the metal fence around the site, and the short time allotted for surveying the site.

Orthophotography Results

Like at Chimney Coulee, modern aerial photography was taken via UAV at the River Lots via a Phantom 4 Pro UAV to provide high-resolution aerial images. These images were processed in ArcGIS Pro using the Ortho Mapping workshop and then used to create detailed maps of the sites and archaeological work conducted on them.

Multispectral Imagery Results

At River Lots 23 & 24 Multispectral imagery was collected via a DJI Matrice 600 with a Micasense Altum multispectral/thermal sensor mounted on it. The imagery was processed in ArcGIS Pro and viewed in multiple formats to see if any buildings or other archaeological features could be located. Unfortunately, the data was not able to be collected until after excavations had already begun due to technical difficulties with the UAV and control software, so the open excavation units and other changes made to the site during fieldwork are visible in the imagery.

The multispectral imagery was viewed as a true colour, false colour, colour infrared, and NDVI image but little difference between vegetation types was seen in any of the formats (Figure 5.20). Man-made features including the buildings on the site and gravel paths are clearly distinguishable from the vegetation, as are the disturbances done to the site during fieldwork (excavation units, tarps with back-fill, trampled footpaths) but the vegetation across the site all had similar reflectance values. As such, no major areas of interest for archaeological features were identified. The imagery also, did not undergo supervised classification like the Chimney Coulee imager did because of the similar reflection values of all the different types vegetation which made them indistinguishable by the software.

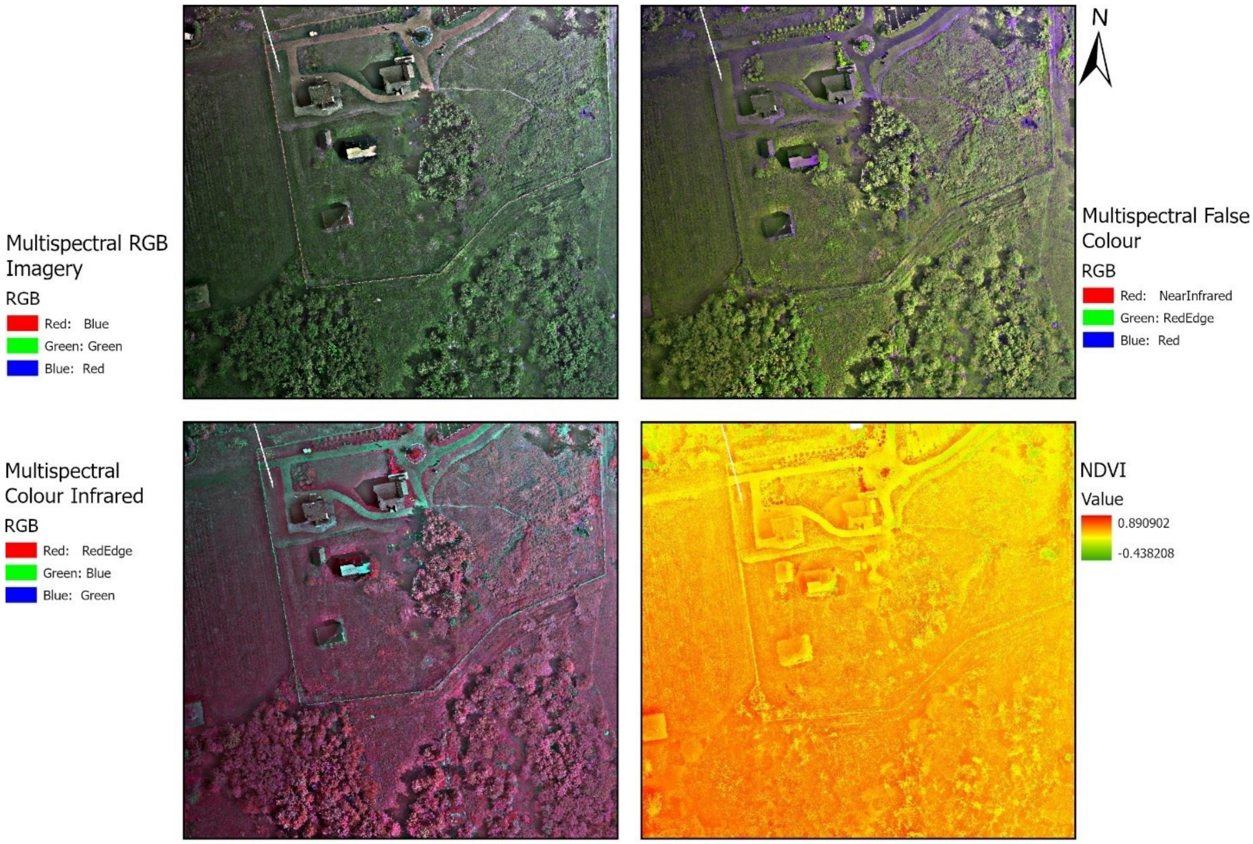

Figure 5.20 Various formats of the multispectral imagery taken at River Lots 23 & 24.

One potential reason for the similar reflection values for all of the vegetation is the recent rainfall at the site. In their study evaluating the uses of vegetation indices to identify archaeological crop marks Agapiou et al (2012) found that multispectral data collected just after the first rainfall of a crop's lifecycle had similar vegetation indices values in archaeological and non-archaeological areas, making vegetation indices not suitable for detecting archaeological features. However, the data collected in the next period after the rainfall had noticeable differences in vegetation indices values in archaeological versus non-archaeological areas (Agapiou, Hadjimitsis, and Alexakis 2012). The multispectral data at River Lots 23 & 24 was collected in mid-June, just after a few days of heavy rainfall. If future work is done at the site, taking new multispectral imagery in a dryer period may yield better results.

Lidar Results

At the River Lots, a LiDAR survey was conducted primarily to survey the lower, more forested section of the site and to create a DEM showcasing the entire site's topography. While the processed LiDAR imagery was able to highlight the slope of the site, particularly in the lower section nearing the Sturgeon River, no major depressions or features were identified in the areas of high vegetation (Figure 5.21). Rather the LiDAR mostly picked up surface features on the site including the present buildings, paths and gardens. However, the isolated ground surface image that was produced did not completely remove all of the vegetation, and as such were another LiDAR survey to be conducted at the site with a more powerful sensor or different settings, other features or depressions may become more visible.

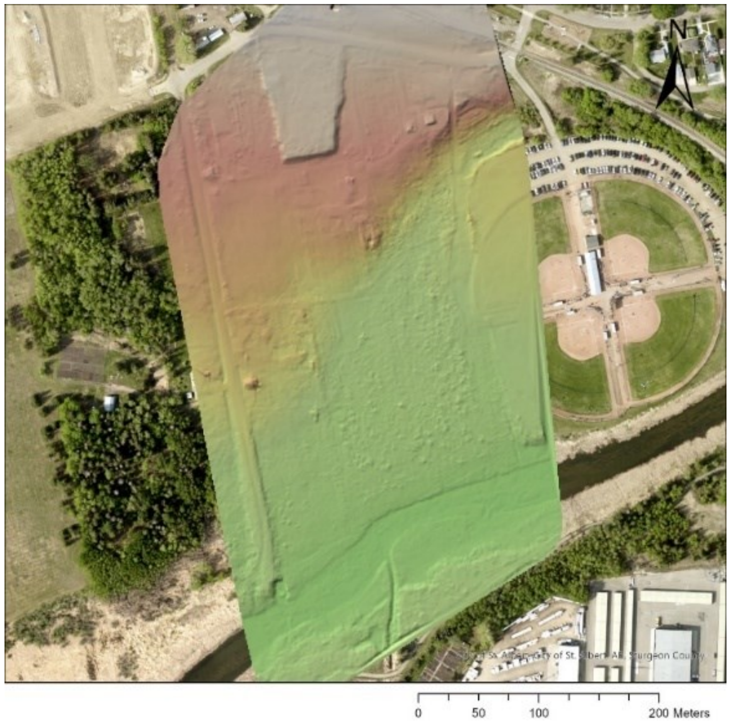

Figure 5.21 A DEM made from the LiDAR data collected at River Lots 23 & 24.

GPR Results

GPR data at River Lots 23 & 24 was collected during the 2023 field school by the field students under my supervision, who were split into three groups to learn different surveying techniques. Over four days, 11 GPR grids of various sizes were surveyed with a GSSI SIR 3000 with a 400 MHz antenna, focusing on the area around the cellar and the area near the barn (Figure 5.22). Four grids were placed near the cellar (Grid A, B, J, and K), while seven were placed down the hill near the barn (Grid C, D, E, F, G, H, and I). Of note, most of the site that was surveyed with the GPR was covered by long grass which is not ideal for collecting GPR data as long grass can cause the antenna to not make direct contact with the ground. All of the areas that were surveyed were stomped down as much as they could be before the GPR was used as the grass was not able to be cut before the surveying began.

Figure 5.22 The location of GPR grids survey at River Lots 23 & 24 in 2023. Map made by author.

For the four GPR grids placed near the cellar, nothing really conclusive stood out when the profiles and depth slices were analyzed. Grid A was placed right inside the treed area over where the cellar was excavated and near where two different buildings appear in the historical air photos. In Grid A there were a couple of possible signals that lasted for a few profiles, two that spanned most of the grid and could be from a wall but did not line up with high amplitude areas on the depth slices. There was also a lot of noise in general in the grid likely due to the mixed-up nature of the trash deposit being surveyed. Grid B was placed in a clearing near the cellar area. It also contained a lot of noise near the surface but did have a large signal at around 75 cm depth that showed up in the profiles and as a somewhat high amplitude area that could be a feature like a wall or a large object (Figure 5.23). Grid J was placed a little bit further from the trees and cellar but still contained a lot of noise. It did have a few strong hyperbolic signals as well as a possible signal from metal but nothing that looked like it could be from a building. The last grid in the area, Grid K, was placed closer to the cellar again, possibly right over it, and contained a handful of strong and large signals in the profiles at varying depths as well as a lot of noise but again no indication of building walls. It is important to note however that four excavation units were placed in this grid and found various large items including a part of a tire, part of a ceramic sink, and multiple large cow bones, so large objects that were dumped in the area could be the cause of the various large signals in the GPR (Figure 5.24).

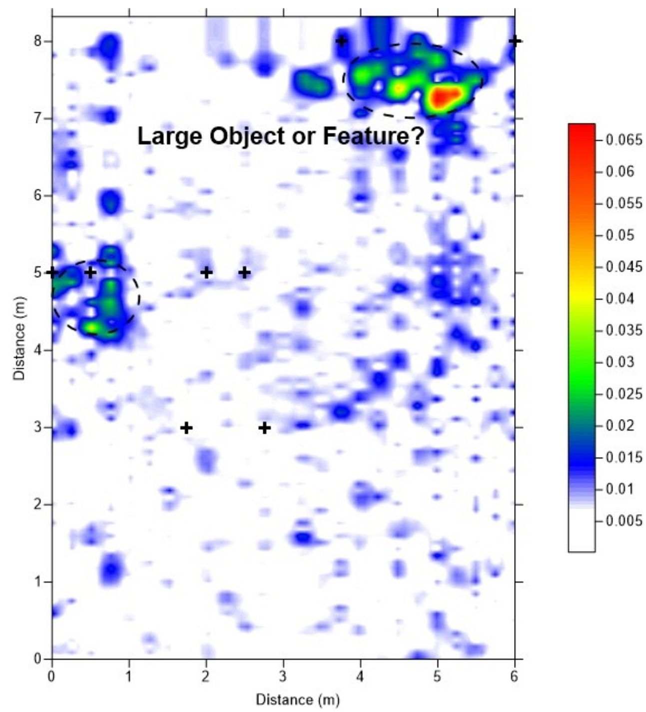

Figure 5.23 The GPR amplitude map from GPR Grid B.

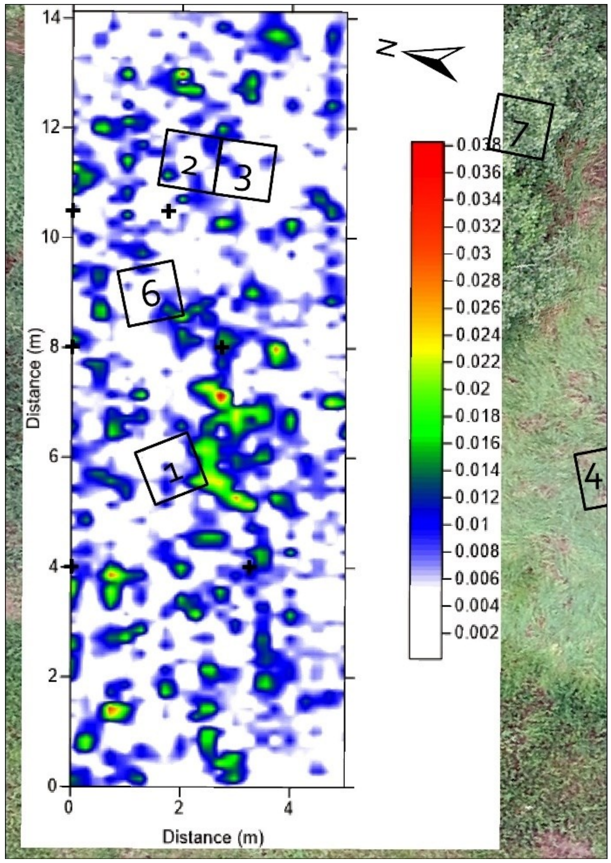

Figure 5.24 The GPR amplitude map from GPR Grid K with the location of the excavation units that were placed in it.

Of the seven GPR grids that were placed down near where the barn and other small buildings were located on Lot 24, five were clustered together near the fence as this area was flatter and easier to survey, and two smaller grids were placed just north of them closer to the trees and where Bean's house was. The first of the grids, Grid C had a handful of small signals and some areas with high amplitudes at 25-50 cm deep but nothing that stood out as being related to a structure. Grid D also had some small signals and noise near the surface and few signals that spanned over a metre. One high amplitude area at 75 cm depth corresponded to the signals seen in the profiles and could be from a wall or buried object (Figure 5.25). A lot of the noise in the grid that was near the surface could have been caused by the long grass.

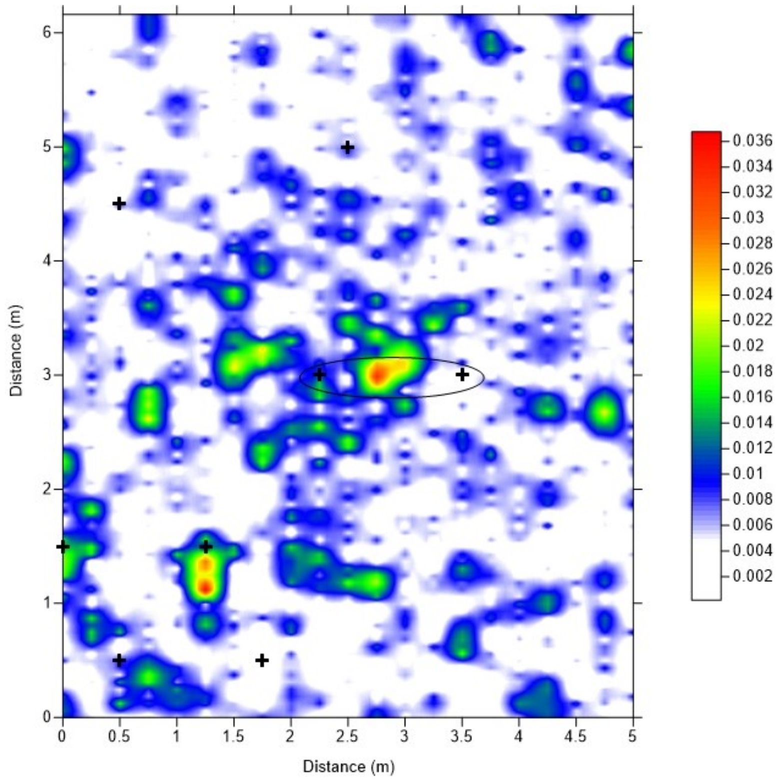

Figure 5.25 The GPR amplitude map from GPR Grid D.

The cluster of five grids near the corner of the fence is where the best evidence for a building can be seen in the GPR data. Grid E has a few signals throughout the profile as well as noise near the surface, again likely caused by the long grass. Grid F also has a lot of noise at the surface but has a very notable signal at 6 and 7.5 m into the grid that was likely caused by metal in the ground (Figure 5.26). Then in Grid G, despite there not being many notable signals in the profiles, a very rectangular feature appears in the amplitude map at 25 cm deep (Figure 5.27). Grid H does not have any signals as obvious as Grid G, but there is a possible depression near the beginning of the grid and a few smaller signals. Lastly, Grid I has one higher amplitude area that corresponds with a few signals in the profiles but nothing major. While Grid G and F have the most obvious signals that point towards a structure being in the area, when the five grids are viewed together in their correct spatial orientation the possible outline of a building area appears (Figure 5.28). Lastly, a 1 x 2 m exaction grid was placed inside Grid G along the rectangle signal and did find artifacts that could be associated with a barn or shed as well as having distinct stratigraphy changes that further suggest the area is a border or wall of some sort.

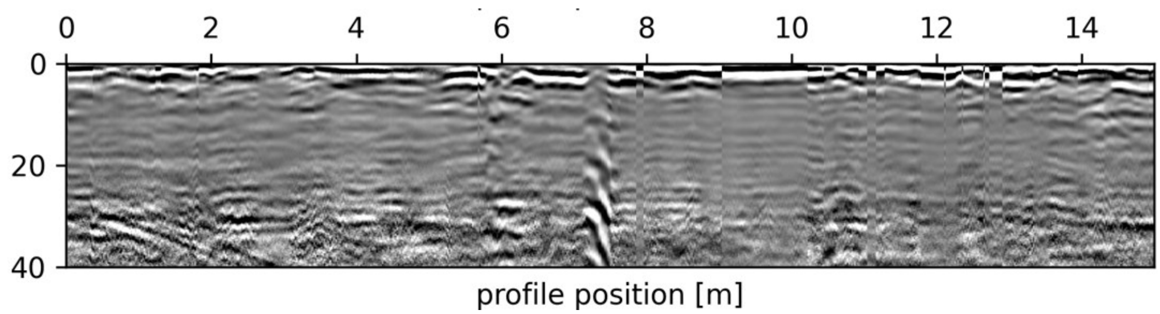

Figure 5.26 A filtered GPR profile from Grid F showing two signals likely caused by metal at 6 and 7.5m (x=4.5), the y-axis is in time (ns).

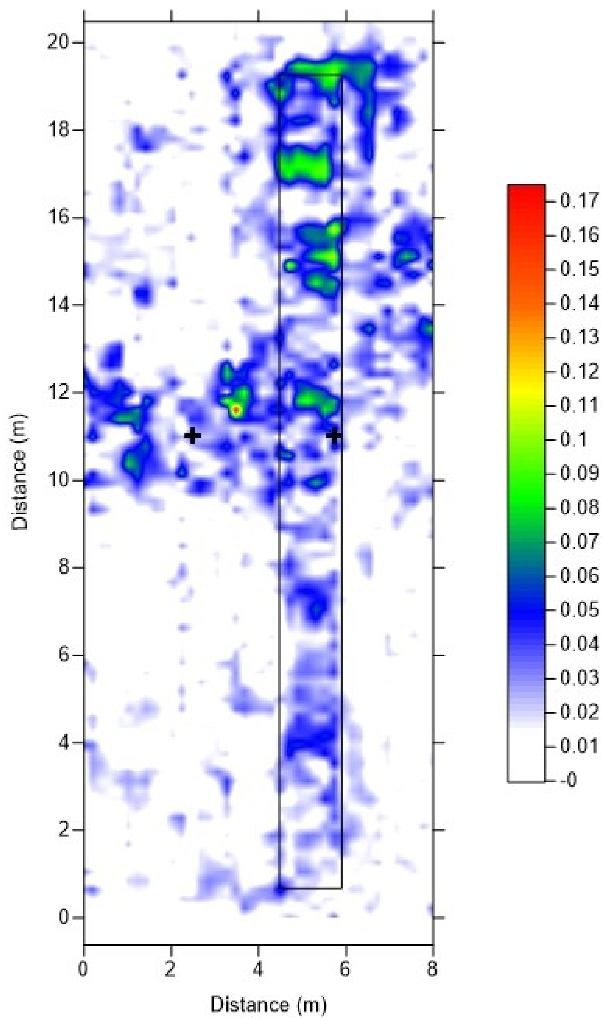

Figure 5.27 The GPR amplitude map from GPR Grid G with a rectangular feature.

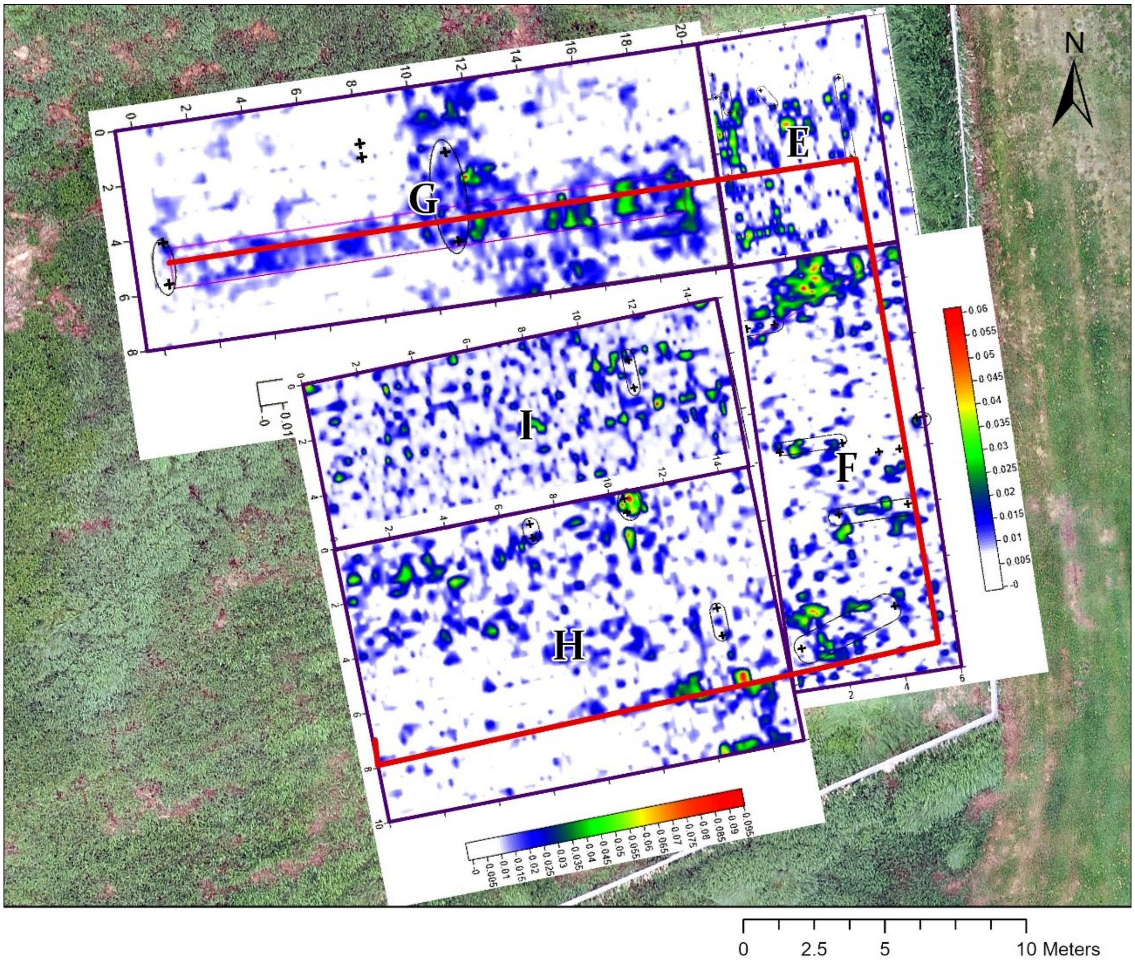

Figure 5.28 The barn area GPR grids with potential building area marked with a red line.

The GPR survey at River Lots 23 & 24 was not able to locate as clear evidence for the presence of buildings under the surface as the GPR surveys at Chimney Coulee could, but 2023 was also the first time the River Lots were surveyed so feature depths were relatively unknown. Due to time constraints and trying to teach field school students multiple smaller grids were surveyed in only two areas instead of surveying larger grids that could provide a better overview of certain areas of the site. Further, only the 400 MHz antenna was used, and while some signals around the cellar area were 75 cm-1m deep, a larger antenna like a 900MHz one may be better suited to the barn area of the site where features may not be as deep. Lastly, longer grass may have caused a lot of the noise seen near the surface of the grids so should the site be surveyed again in the future I would recommend having the grass cut first. While the GPR survey at the River Lots was not able to pinpoint the exact location of any buildings, the grids placed in the barn area do somewhat align with the location of a fenced-off area with the barn and a few sheds seen in the 1978 and 1988 air photos making it an interesting area for future investigations.

5.2.3 Archaeology Results

The 2023 IPIA field school at River Lots 23 & 24 was the first and only major field season of excavations to take place at the site to date. The only other archaeological excavations on the site were conducted in 2009 by the *Archaeology Group* for a Historic Resource Impact Assessment (HRIA) conducted by ISL Engineering and Land Services in preparation for a Heritage Site plan and design (Younie 2009). The *Archaeology Group* team conducted a foot survey of the site, photographed and mapped historic buildings, and performed subsurface testing in areas of proposed development. They dug 13 shovel tests, 40 backhoe tests, and three backhoe trenches in areas where the believed buildings could be and located a building cellar with 680 artifacts (Younie 2009). The entire west wall and parts of the north and east walls of the cellar were uncovered during excavations (Figure 5.29). Through the artifacts found, archives, and a few interviews the cellar was dated between the early 1900s and the 1940s and is understood to have been used as a garbage dump in the 1930s and 1940s by the Cunninghams on Lot 24 (Younie 2009).

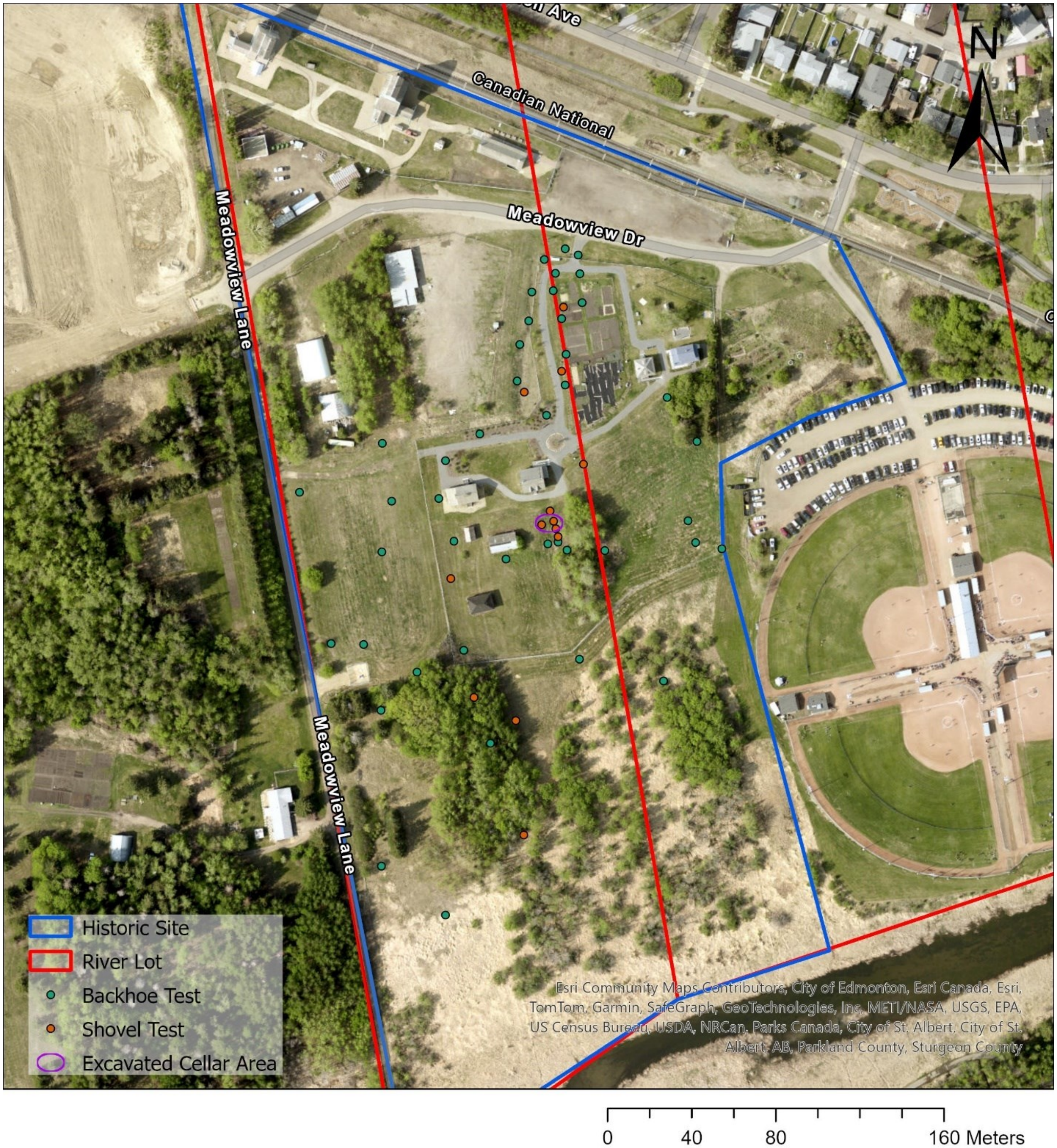

Figure 5.29 Map of areas on River Lots 23 & 24 archaeologically tested in 2009 and the location of the cellar excavated in 2009 (Map made by author based on Younie 2009, 52; City of St. Albert and Engineering and Land Services 2010, 10).

When the IPIA ran a field school at River Lots 23 & 24 14 years later with a goal of better understanding the Métis who lived on Lot 24, 11 shovel tests and seven excavation units were opened with six units being placed near the area excavated in 2009 (Figure 5.30). The seventh unit (EU5) was 1 x 2 m and placed in the lower portion of Lot 24 where the barn was believed to be based on the air photos of it and the results of the GPR survey. All 7 excavation units found historic period artifacts that date from the time the site was occupied by the Métis and one unit (EU2) relocated a wall of the cellar partially excavated in 2009 while EU3 possibly found one of the backhoe trenches from that previous excavation (Younie 2009). Four of the units are believed to be at least partially in the cellar, while the other two are likely just outside of it. The unit in the barn area (EU5) may have straddled the wall of the barn or an associated building based on the stratigraphy of the unit, but unfortunately flooded part way through the field school halting work there so further excavations are needed to confirm this theory (Hemmingsen 2023).

Figure 5.30 Map of Excavation Units at River Lots 23 & 24. Map made by the author.

5.2.4 Full Building Map of River Lots 23 & 24

Combining all the historical sources on buildings at River Lots 23 & 24 with the geophysical surveys and archaeological excavations in 2023 allowed for the earlier map (Figure 5.31) of buildings on the site to be updated (Figure 5.31). However, the location of the vast majority of the buildings visible on the maps and air photos have yet to be verified with geophysics or excavations. Some of the buildings like Lous Chastellain and John Roland's houses, Chastellian's store, and the HBC store may not ever be excavated or surveyed as they were likely destroyed by the construction of houses on the northern portions of the original lots. Other buildings may be able to be located through more GPR surveys or targeted excavations in the future. Nonetheless, a map of the buildings on the site was made primarily based on the air photos and maps, and a similar confidence rating to the one that was applied to the map of Chimney Coulee buildings was applied to the building map for River Lots 23 & 24 (Tables 5.3 and 5.4). This map also does not include the location of buildings in the southwest of the site associated with a Second World War homestead present in Figure 5.20 due to their separation from the rest of the Métis buildings.

Figure 5.31 Updated Map of Historic Buildings on River Lots 23 and 24 related to the Métis occupation with a confidence rating based on the evidence source. Buildings are labeled with their Building ID, refer to Table 5.4 for building types. Map made by the author.

Table 5.3 Buildings Confidence Matrix for River Lot 24 and 24 Buildings

Confidence Rating	**Type of Evidence**
1	One type of geophysical evidence
2	Two types of geophysical evidence Or the location is based on geolocated historic maps
3	Location is based on geolocated historic air photos
4	The building has been partially excavated And/or A location based on air photos was verified via geophysics
5	The building is still *in situ*

Table 5.4 The Building Confidence Matrix applied to the River Lot 23 and 24 Buildings.

Building ID(s)	**Building Identification**	**Confidence Rating**	**Evidence Types**
1-2	Unknown outbuildings	2	Visible in the 1957 air photo
3	Alberta Grain Company Elevator	5	Visible in the 1924, 1957, 1978, and 1988 air photos and still on site
4	Alberta Wheat Pool Elevator	5	Visible in the 1924, 1957, 1978, and 1988 air photos and still on site
5	Canadian Northern Railway Station	3	Visible in the 1924, 1957, 1978, and 1988 air photos

6	Washhouse/Belcourt Residence	3	Visible in the 1924, 1957, 1978, and 1988 air photos
7	Cunningham House	5	Visible in the 1924, 1957, 1978, and 1988 air photos and still on site
8	Hogan House	5	Visible in the 1957, 1978, and 1988 air photos and still on site
9	Unknown outbuilding	2	Visible in the 1957 air photo
10	Unknown Building & Bean's House	3	Unknown Building visible in the 1978 air photos and Bean's House visible in same location in 1988 air photo
11	Unknown building	2	Visible in the 1924 air photo
12	Unknown building	3	Visible in the 1978 and 1988 air photos
13	Barn	3	Visible in the 1957, 1978,and 1988 air photos
14	Unknown building possibly associated with barn	4	Visible in the 1978 and 1988 air photos and partially excavated
15	Unknown building possibly associated with barn	2	Visible in the 1978 air photo
16	Unknown building possibly associated with barn	3	Visible in the 1978 and 1988 air photos

17	John Roland's House	1	Visible in the 1878 and 1884settlement maps
18	Louis Chasteline's House	1	Visible in the 1878 and 1884 settlement maps
19	Louis Chasteline's Store	1	Visible in the 1878 and 1884 settlement maps
20	Unknown building	2	Visible in the 1924 air photo
21	Cellar/dump	4	Visible in the 1957 air photo and partially excavated
22	HBC store	1	Visible in the 1878 settlement map
23	HBC Stable	1	Visible in the 1878 settlement map

5.3 Other Métis Sites Layouts

While Chimney Coulee and River Lots 23 & 24 are the main focus of this thesis, site maps of other known Métis *hivernant* Sites, river lots, and farmsteads were created to act as comparative samples and to be analyzed statistically through ArcGIS for evidence of clustering Figure 5.32). Maps of buildings at all five known Métis *hivernant* sites, other than Chimney Coulee, that have been archaeologically researched were created based on published field surveys done by other researchers. For many of the sites, building locations were estimated based on the presence of mounds, which have been most accurately linked to the presence of cabins (Doll 1988; Burley, Horsfall, and Brandon 1988; Mallet Gauthier and Wadsworth 2023). Building maps of eight other excavated Métis sites, including the three other excavated Métis

River Lots, three Métis farmsteads, and two potential Métis hivernant sites that later became Métis homestead sites were also located to compare with the *hivernant* sites.

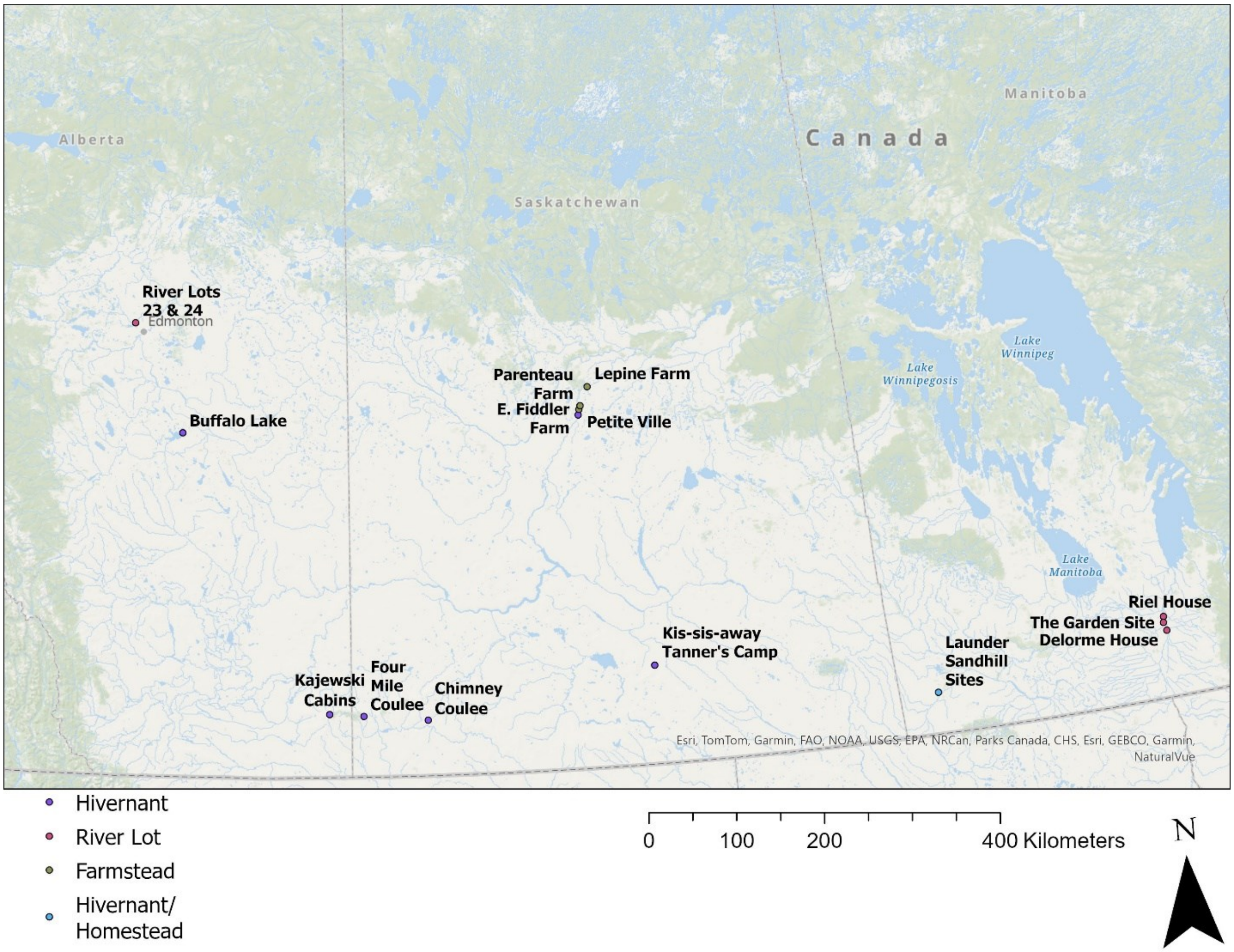

Figure 5.32 Map of Métis archaeological sites used in this study. Map made by author.

5.3.1 Métis *Hivernant* Sites

Buffalo Lake

Buffalo Lake is a Métis *Hivernant* site located in the central parkland region of Alberta near Buffalo Lake which attracted multiple Métis families in the 1870s (Tebby 2023). It was first recorded as a historic site in 1959 and excavated in the 1970s and 1980s by various researchers including Robert Kidd, David Crone, Kendal Arnold, and Maurice F. V. Doll (Doll, Kidd, and Day 1988). Two disturbed cabins were excavated beginning in 1971 and surface surveys of the site in 1974 identified 36 depressions, eight fireplace mounds, and nine other mounds in 19 clusters believed to represent 19 buildings (Doll, Kidd, and Day 1988, 4). Subsequent excavations of three of these clusters in the following years found archaeological evidence of buildings furthering the interpretation that the previously recorded unexcavated clusters did represent buildings. By 1983, more than 80 potential cabins were located based on the clustered presence of mounds and depressions, despite only five cabins having been excavated (Doll, Kidd, and Day1988, iii).

Further research on the Métis at Buffalo Lake was conducted in 2014 for the EMITA project during a field school led by Dr. Kisha Supernant which involved further excavating one of the previously excavated cabins (Cabin 3) and surveying the site with magnetometry and GPR to try to locate more cabins (Coons 2017). Unfortunately, the geophysical surveys of the site were inconclusive and no new cabins were located; however, an updated map of the 88 cabins previously identified was created in ArcGIS and was modified for use in this study (Figure 5.33).

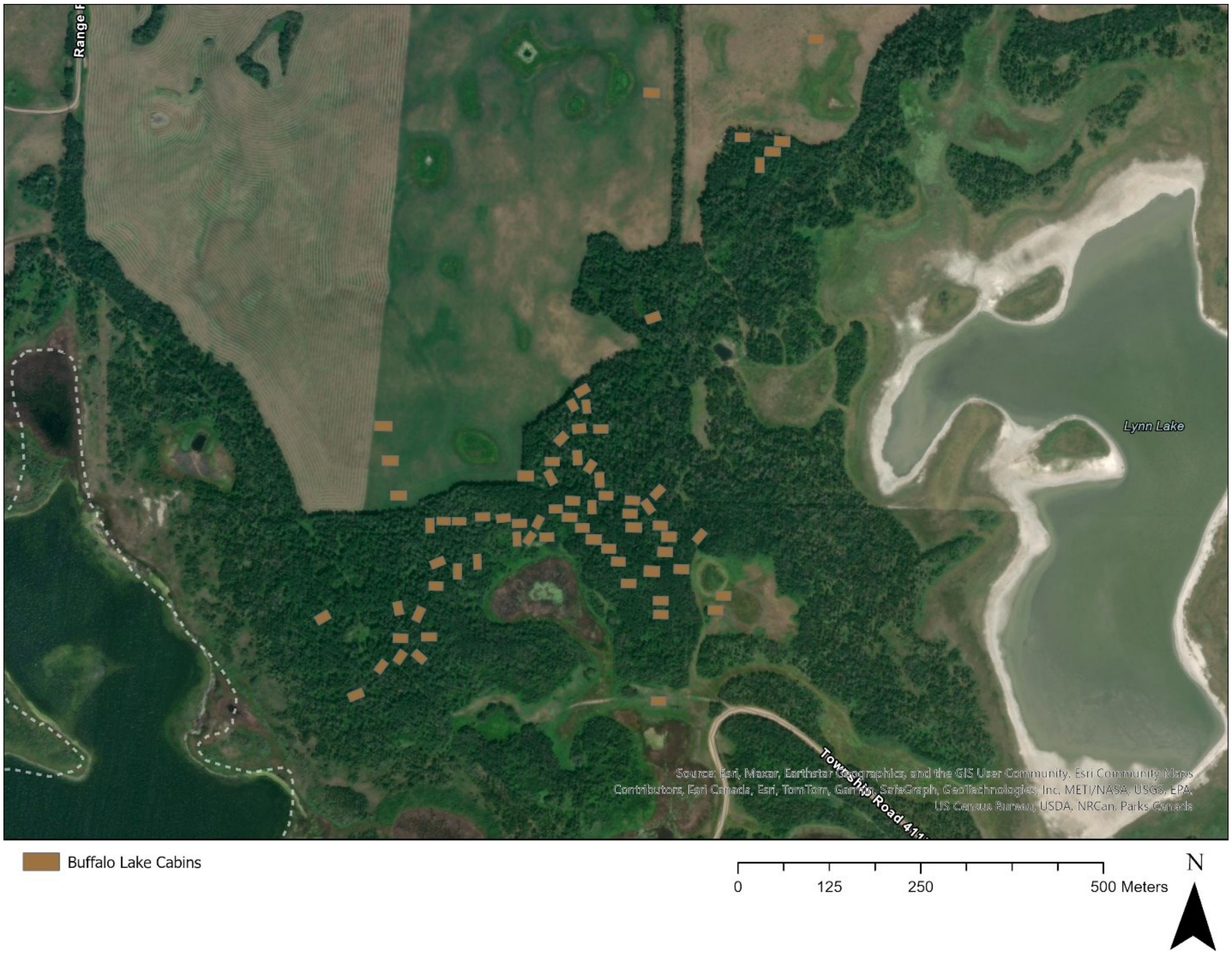

Figure 5.33 Buffalo Lake cabin map. Map made by author based on maps from Doll et al 1988; Coons 2017.

Petite Ville

Petite Ville is on the south Saskatchewan River in the central Aspen Parklands region of Saskatchewan, only 15km from Batoche. It was first surveyed in 1979 and then resurveyed by Burley and his crew in 1986 (Burley, Horsfall, and Brandon 1988). 177 features including depressions, mounds, and parts of chimneys were mapped in 26 clusters. After being surveyed a number of trenches and test units were excavated near a cluster of features that had two chimney remains and a large cabin was uncovered in cluster A (Burley, Horsfall, and Brandon 1988). More of the cabin A feature was excavated in 1998, 1999, and 2000 during a field school run by

Margaret Kennedy and the University of Saskatchewan and another survey of the site in 1999 re-examined other clusters and found various new depressions and mounds were recorded (Weinbender 2003). The approximate locations of the cabins were mapped based on the locations of the mounds and surrounding clusters and the one excavated cabin on the site (Figure 5.34).

Figure 5.34 Map of potential cabin locations at Petite Ville. Map made by author based on maps in Weinbender 2003; D. Burley, Horsfall, and Brandon 1988.

The Kajewski Cabin Site

The Kajewski cabin site is located in the northwest of the Cypress Hills and was the first Métis *hivernant* site to be surveyed and excavated (Tebby 2023). It was first documented in 1966 by Bonnichsen and his field crew who found three cabins and returned in 1967 to excavate one of the cabins (Cabin A). It was then further surveyed in 1969 by Elliot who located and mapped 16 more cabins at the site in five clusters and excavated two more cabins (Cabin B and E) in the same cluster as Cabin A (Elliott 1971; Tebby 2023). While Elliot did not map the cabin locations in much detail he describes the cabins as being in five clusters defined by their close proximity to each other; "each cabin in a cluster is within 100 yards of another, while the clusters are more than 100 yards apart" (Elliot 1971, 4). Elliot further describes the cabins as being "longitudinally oriented southwest-northeast in relation to true north" (Elliot 1971, 25). Of the two cabins that were excavated by Elliot (1971, 26), one measured about 15 by 30ft (approximately 5 by 9m) while the other was 19 by 16.5ft (or about 6 by 5m). The size of the cabin excavated by Bonnichsen is not recorded and his original report has unfortunately been lost (Tebby 2023).

A much later report by Elliot from a short 2010 study that tried to relocate the cabins at the Kajewski cabin site provides an updated and more accurate map of the cabins that could be relocated (Elliott 2010). However, one cluster of five cabins was destroyed between 1971 and 2010, and only the rough location of the cluster is mapped, not the individual cabins. Based on Elliot's maps of the cabin locations and his descriptions of the site a more detailed map of the 19 cabins was created for the purpose of this study (Figure 5.35).

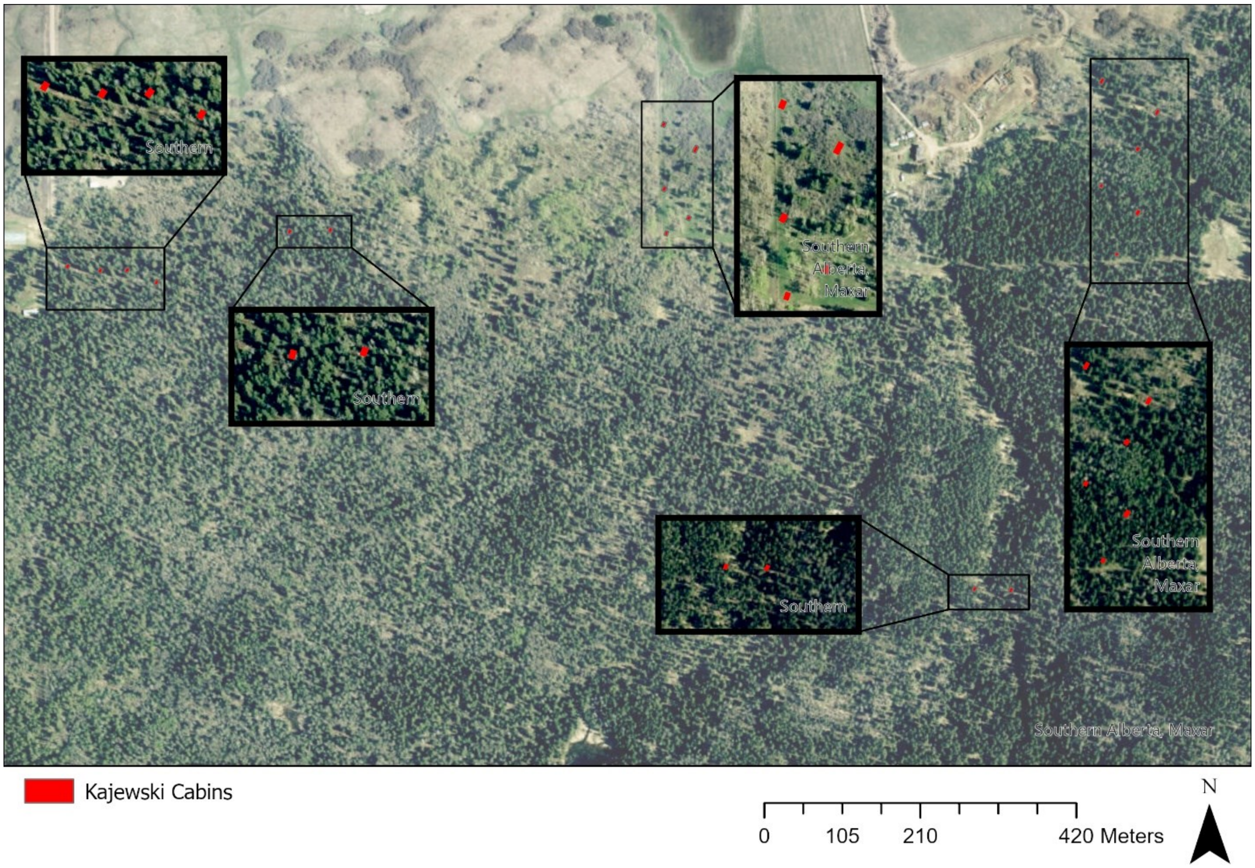

Figure 5.35 Map of Métis cabins at Kajewski. Map made by the author using maps in Eliot 1971; 2010.

Four Mile Coulee

Four Mile Coulee is another Métis *hivernant* site located in the western portion of the Cypress hills near Fort Walsh. It was first surveyed by Burley and his crew in 1986 who mapped out the depressions and features visible along the coulee. Burley et al (1992) mapped 8 mounds and over 100 depressions which they grouped in 10 clusters. Some test units were dug locating various artifacts commonly associated with Métis *hivernant* sites but no cabins were formally located. For this study, the 8 mounds mapped by Burley et al (1992) were treated as cabins (Figure 5.36).

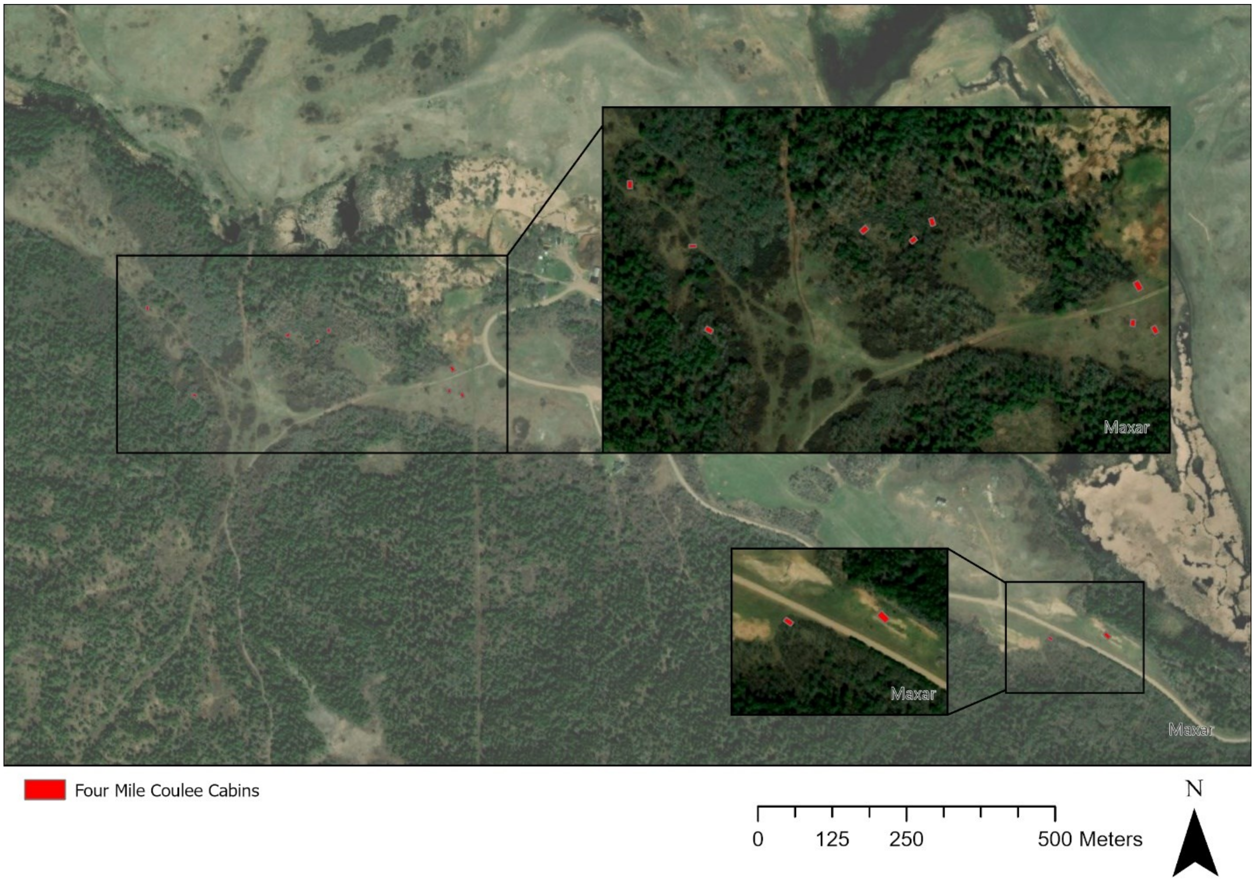

Figure 5.36 Map of potential cabins at Four Mile Coulee. Map made from maps in Burley et al 1988.

Kis-sis-away Tanner's Camp

Kis-sis-away Tanner's Camp is located in the Dirt Hills southwest of Regina. It was first recorded in 1971 and resurveyed by Buley and crew in 1986. Burley et al (1992) mapped over 20 features and depressions grouped into five clusters. Test units excavated some of the depressions and features believed to be associated with cabins and did potentially locate a cabin although no full-scale excavation has been conducted to confirm. This site however lacked many of the characteristic chimney mounds used to locate cabins in the past, but based on the one excavated cabin that did not have any associated mounds, similar clusters of depressions were used to estimate five cabin locations (Figure 5.37).

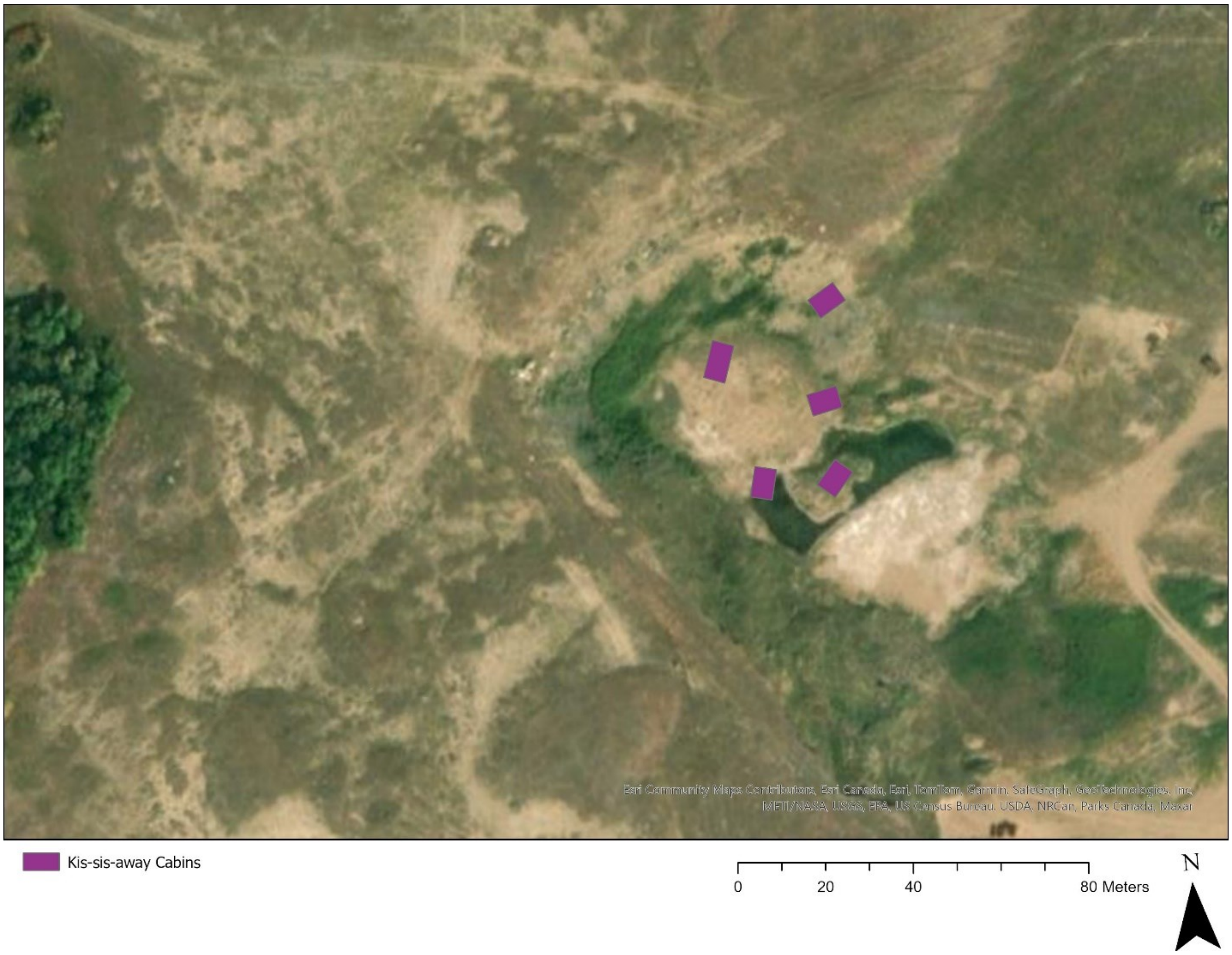

Figure 5.37 Map of potential cabins at Kis-sis-away Tanner's camp. Map made from Burley et al (1988) site maps.

5.3.2 Métis River Lots and Farmsteads

Reil House

The first Métis River Lot to be excavated was Lot 51 in the Parish of St. Vital, after the site's designation as a National Historic Site in 1969 in order to learn more about the cultural history of the Riel family (Forsman 1977). The site was excavated in 1976 by Parks Canada. Three structures and ten other features were identified and investigated (Figure 5.38). All three structures are associated with the Riel house and others that represent buildings include a post office and another small house on the lot called the "Bonne" House (Forsman 1977).

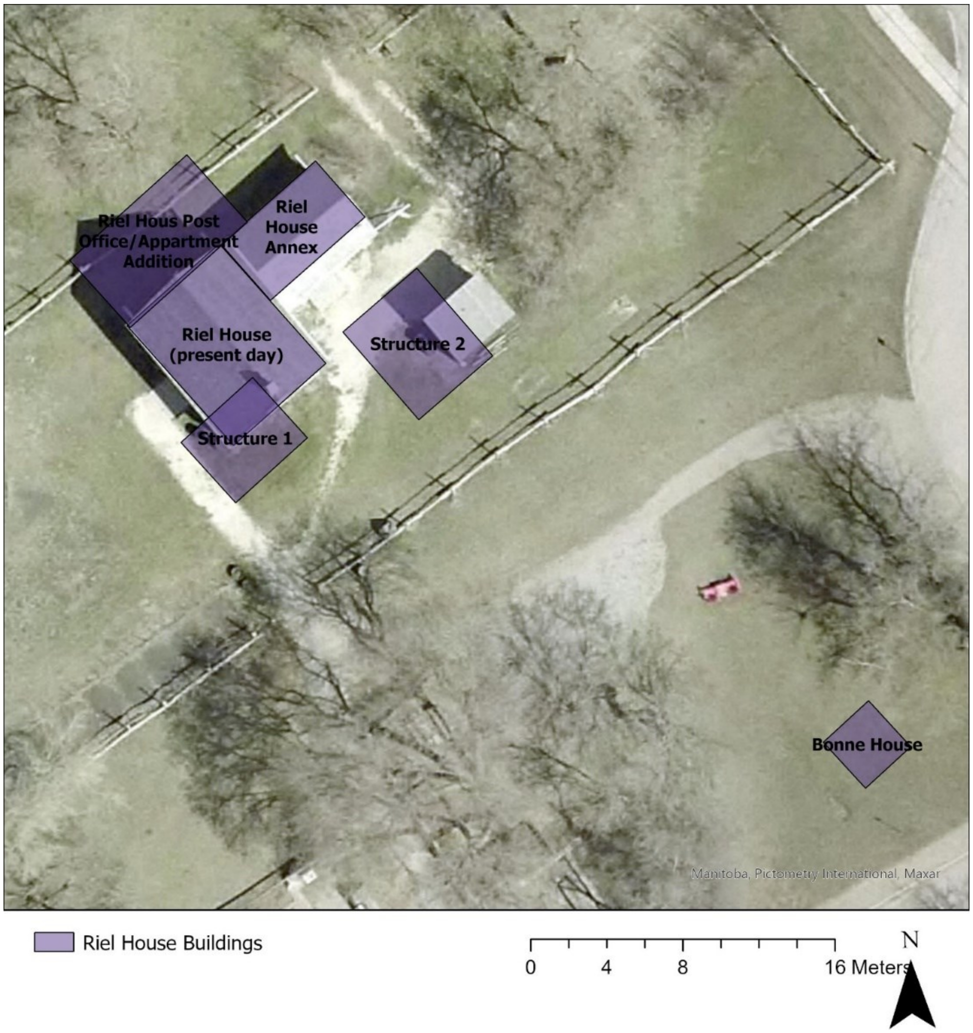

Figure 5.38 Map of structures archaeological located at Riel House made by the author from the Parks Canada site map in (Forsman 1977).

The Garden Site

The Garden Site, DkIg-16, is another Métis River Lot site located in Lot 81 of the Parish of St. Norbert in the Red River region of Manitoba. It was excavated in 1979 and three features were identified, all middens, however, historical records show there were three structures on the site from around 1845-1865 that were said to be "located in virtually a straight line, oriented north to south parallel to the Sale River (McLeod 1985: 46). While no map of these structures could be found, this description was used to make a rough map of the buildings on the site in order to have more examples of Métis river lot sites in this study (Figure 5.39).

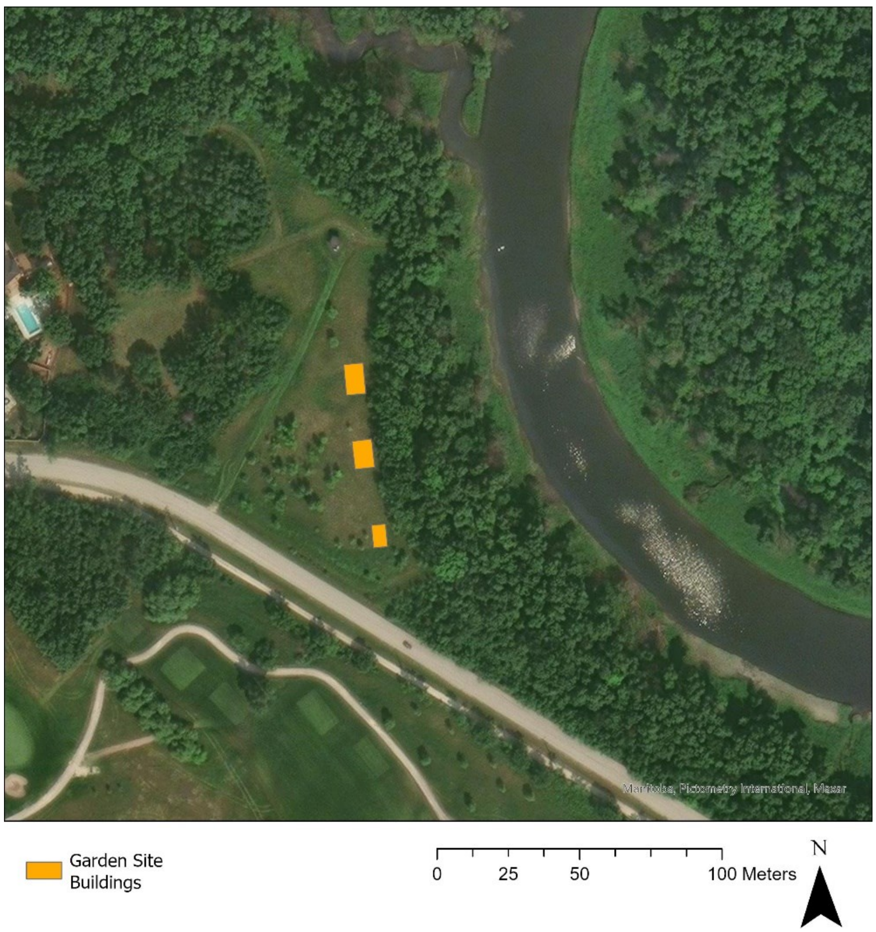

Figure 5.39 Map showing an estimated location of structures at the Garden Site based on site descriptions in McLeod (1985).

Delorme House

Delorme House was the third Métis River Lot to be excavated in the Red River Region. It is located on Lot 21 of the Parish of St. Norbert and was excavated in 1981 by the Manitoba

Department of Cultural Affairs and Historic Resources Branch (McLeod 1985). Historical records on the site record its occupation by Pierre Delorme and his wife Adelaide Beauchemin and the presence of at least one house and four outbuildings on the site in the mid-19th century. Like with the Graden Site, no site map was able to be located but McLeod describes the five buildings as being "oriented north-south with the widest portion of the structures faced toward the river" in a presumably linear arrangement (McLeod 1985, 51). This description was used to make a rough map of the site for comparison purposes (Figure 5.40).

Figure 5.40 Map showing an estimated location of structures at the Delorme House Site based on site descriptions in McLeod (1985).

Three Métis Farmsteads

In a 1989 study on Métis vernacular houses and farmsteads Burley and Horsfall mapped 22 Métis farmsteads along the South Saskatchewan River and compared their layout to two nearby Ukrainian farmsteads (Burley and Horsfall 1989). They found that the Métis farmsteads they studied were all laid out similarly, with houses in somewhat linear arrangements and much more open than Ukrainian farmsteads that were built with buildings facing inward (Burley and Horsfall 1989). While 22 Métis farmsteads were mapped and analyzed, the maps of only three, plus one Ukrainian farmstead, were included in their paper and were visually compared to the other sites in this study (Figure 5.41). That being said, Burley and Horsfall's (1989) overall observations on the similarities between the Métis farmsteads they mapped helped form the basis of my own analyses and are discussed more in Chapter 6.

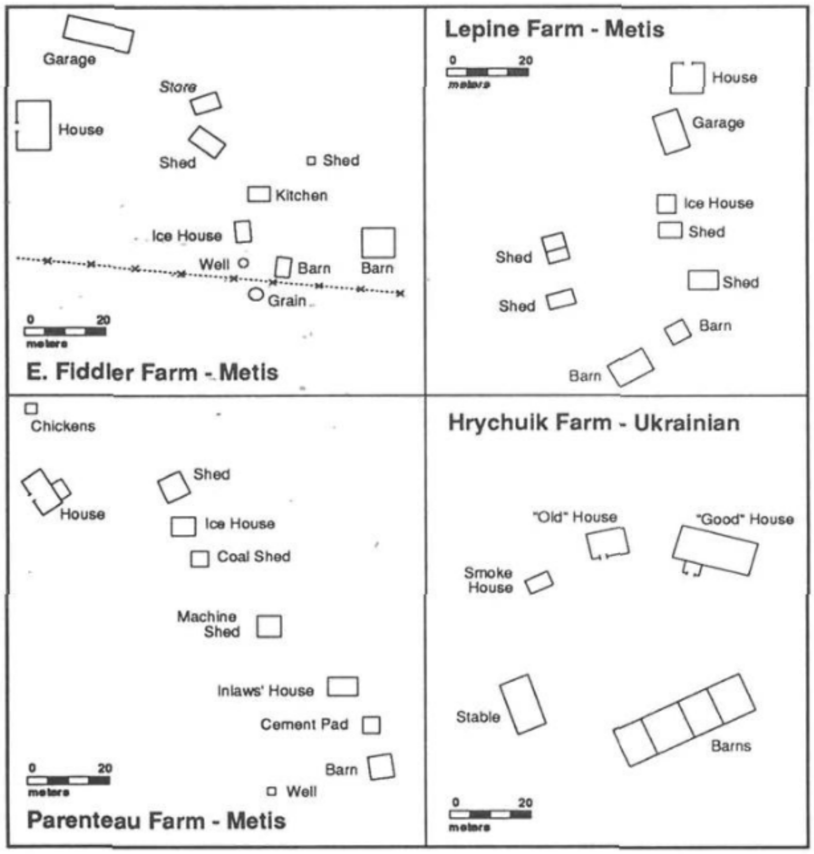

Figure 5.41 Maps of three Métis farmsteads and one Ukrainian farmstead from Burley and Horsfall (1989, 28).

Launder Sandhills: The Vera Site and the Twin Fawns Site

Lastly, two Métis sites in Manitoba that were mapped in 1997 were included in the study (Hamilton and Nicholson 2000). These sites, called the Vera Site and Twin Fawns Site, are located in Launder Sandhills in southern Manitoba and are believed to be Métis *hivernant* sites that later became homestead sites (Hamilton and Nicholson 2000, 251). Three large structures and three small depressions were found at the Vera Site, and the large structures are hypothesized to be houses (Figure 5.42; Hamilton and Nicholson 2000, 252). The Twin Fawn Site has two dug-out features, with the larger one likely representing a house structure based on the results of a few shovel tests and a test excavation and the smaller being a root cellar (Figure 5.43; Hamilton and Nicholson 2000, 254).

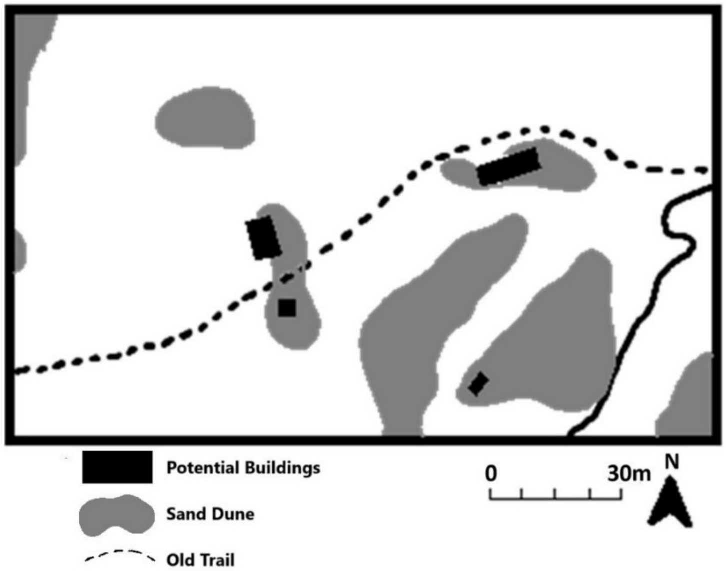

Figure 5.42 Map of the Vera Site. Sketch map made by the author based on Hamilton and Nicholson (2000, 254).

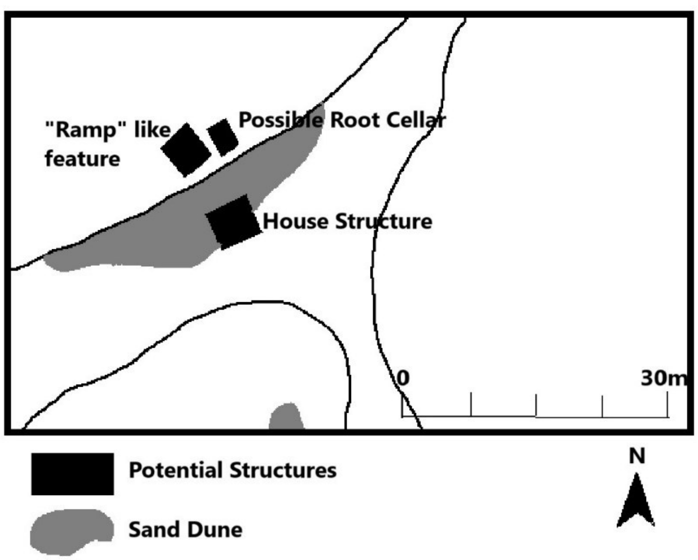

Figure 5.43 Map of features at the Twin Fawns Site. Sketch map made by the author based on Hamilton and Nicholson (2000, 255).

5.4 Analysis of Site Layouts

The layouts of River Lots 23 & 24 and Chimney Coulee, and more broadly Métis sites in general, were analyzed in two ways. Firstly, the maps of all of the sites were visually compared to look for identifiable patterns and similarities in building locations. Secondly, the maps of all six of the Métis *hivernant* sites were analyzed in GIS for evidence of clustering using Average Nearest Neighbour and then compared to maps of other Métis sites. Only *hivernant* sites were statistically analyzed due to the number of features present on the sites and due to the multi-family nature of *hivernant* sites, unlike river lots and farmsteads which were usually only lived on by one family at a time.

Just visually comparing the different sites finds that first, most *hivernant* sites had more buildings than river lots, farmsteads, and homesteads. Second, when only a few buildings are on a site they are usually placed near each other, but when more buildings are present they are more spread out and sometimes in separated locations of a site and only rarely is one building placed completely alone from others. Third, evidence of outbuildings is only really seen at Métis farmsteads and river lots, not *hivernant* sites, and the outbuildings tend to be in line with houses rather than behind or facing them. Lastly, most sites are near a water source (mostly rivers but also lakes) but the few that are not tend to be placed in higher elevation areas.

Next, the *hivernant* sites were statistically analyzed using the Average Nearest Neighbour (ANN) tool in ArcGIS Pro. The analysis was applied to the cabins at each site individually using Euclidian distance and tool-generated areas. The ANN tool found three of six sites to have clustered cabins, two had cabins randomly placed, and one had cabins in a dispersed pattern (Table 5.5). For Chimney Coulee, the analysis was applied to all of the potential Métis buildings, despite some being outside of the known *hivernant* boundary, in order to have a larger sample size and area covered to try to minimize the boundary effect. The results of the Nearest Neighbour analysis will be compared in Chapter 6.

Table 5.5 Average Nearest Neighbour results for Métis hivernant sites.

Site	**Number of Cabins**	**Site Area**	**Nearest Neighbour Ratio**	**z-score**	**p-value**	**Diagnosis**
Chimney Coulee	22	81120.53 m^2	0.849719	-1.348482	0.177504	Random
Buffalo Lake	72	585305.92m^2	0.745113	-4.137572	0.000035	Clustered
Petite Ville	28	103278.63m^2	1.040488	0.409865	0.681905	Random
Kis-sis-away	5	1034.71m^2	2.759632	7.527276	0.000000	Dispersed
Four Mile Coulee	11	283479.04m^2	0.725489	-1.741752	0.081552	Clustered
Kajewski	19	940240.38 m^2	0.464479	-4.465648	0.000008	Clustered

CHAPTER 6: Discussion: Organization at Métis Sites

The results of surveys at River Lots 23 & 24 and Chimney Coulee have been outlined, as has the analysis of the layout of these sites compared to other similar Métis sites, but these analyses have been strictly archaeological. Understanding the similarities and differences between the sites requires returning to a Métis perspective of the land. In this chapter, I try to use the three branches of Métis culture—geography, mobility, and kinship—as a lens to understand the patterns and differences seen. I discuss the results laid out in Chapter 5 and argue that the locations of buildings on Métis sites were influenced by cultural practices like visiting rather than just a preference for "openness" as hypothesized by Burley and Horsfall (1989, 27-29).

6.1 Spatial Organization at Métis Sites

Prior to this thesis, the only known archaeological study on Métis site organization was conducted by Burley and Horsfall (1989), who surveyed and mapped 22 Métis farmsteads along the South Saskatchewan River in Saskatchewan to analyze their layouts and the construction of buildings on the site, as discussed in the previous chapter. While a large portion of the study was concerned with trying to identify whether the Métis had a distinct vernacular house type, the layout of buildings on sites was compared to layouts of two nearby Ukrainian farmsteads to determine whether there were noticeable differences in the layouts of the different farmsteads. Burley and Horsfall (1989) found that Métis farmsteads did differ notably from Ukrainian farmsteads in the ways the sites were laid out. They noted that most Métis farmsteads had open layouts with little boundary markers between properties and buildings in linear or "string" arrangements (Burley and Horsfall 1989, 27). Further, most farmsteads had houses placed in higher elevations, on top of hills or knolls, with outbuildings that did not appear to be placed in any predictable patterns other than the barn which was always the furthest from the house (Burley and Horsfall 1989, 27).

Similar patterns appear at the other Métis homesteads and river lot sites used in this study. At River Lot 23 & 24, the main houses are all clustered together higher up from the river than the outbuildings, which are placed in a somewhat horseshoe pattern. At Riel House, the main structures are again placed further up from the river than the privies and sheds, while being in a less notable "string pattern" than at other sites. While the exact locations of the buildings at the Graden Site and Delorme House site are not known, McLeod (1985) describes the structures at the Garden Site as being in a "virtually straight line" (McLeod 1985, 46) and at the Delorme House site as being "orientated north-south with the widest portion of the structures faced toward the river" (McLeod 1985, 51) implying another somewhat linear formation. Lastly, the two Métis sites in the Launder Sandhills have house structures placed in higher elevation areas and outbuildings in curved lines.

Burley and Horsfall (1989) compare these open layouts of Métis farmsteads to Ukrainian farmsteads with buildings that all face inwards in courtyard plans and argue the Métis arrangement of buildings reflects cultural values of openness and a connection with the landscape. They also argue that "openness" is seen at Métis *hivernant* sites, citing the lack of property boundaries and "rigidly structured special use areas," but the general layout of *hivernant* sites differs greatly from farmsteads and river lot sites (Burley and Horsfall 1989, 28).

As seen in the maps of the six archaeologically excavated Métis *hivernant* sites, these sites usually had many more buildings to house multiple families—some believed to have as many as 50-60 families—and rarely had outbuildings associated with houses (Burley, Horsfall, and Brandon 1988). Instead, we see mostly single-room cabins spread out along the landscapes of *hivernant* sites. These cabins are not placed in quite as obvious string patterns as buildings on river lots and farmsteads are but still have fairly open arrangements with no real boundaries between cabins.

Another major difference between *hivernant* and other Métis sites is visible clustering of buildings in different areas of many of the sites. Kajewski Cabins and Four Mile Coulee both have very defined clusters of buildings that are separated from other clusters, while Buffalo Lake and Petite Ville have larger main clusters of cabins with other cabins separated on the peripheries. While only five cabins were located at Kis-sis-away Tanner's camp, the cabins themselves are placed close together in a cluster. Lastly, Chimney Coulee, like Kajewski Cabins and Four Mile Coulee, appears to have a few separated clusters, but the road that destroyed a portion of the site goes in between the main group of cabins and another smaller cluster so it is unknown if Chimney Coulee may have previously looked more similar to Buffalo Lake and Petite Ville in spatial layout. Because some of the hivernant sites have very visible evidence of clustering, a statistical cluster analysis was applied to all of the sites to determine if the any of sites have statistically verified clustering.

6.1.1 Clustering at *Hivernant* Sites

Only the hivernant sites were statistically analyzed for evidence of clustering due to them having a higher number of buildings that could be analyzed over a larger area in order to reduce the boundary effect (Pinder, Shimada, and Gregory 1979). Further one site, Kis-sis-away, only had five known structures in a relatively small area and as such is likely strongly influenced by the boundary effect, causing the Nearest Neighbour ratio to be much higher than it should be, so while it was statistically analyzed, the results of the Average Nearest Neighbour (ANN) analysis are not being considered when comparing the other *hivernant sites*. Using the ANN analysis on the other five sites, three of the five sites were found to have clustered cabins and two had cabins randomly placed (Table 5.5).

It is however important to note the differences in cabin numbers at each site, the size of each site, and the preservation at each site. Buffalo Lake and Petite Ville have both had extensive archaeological research done at them and little disturbance at the site resulting in a much higher number of potential cabin locations. Chimney Coulee has also had extensive archaeological work done on it, but the road that was built in the 1970s and cut the site in half is believed to have destroyed part of the site on top of making part of the site currently inaccessible for archaeological investigations as it is no longer included in the protected park. Further Chimney Coulee has multiple buildings on it that are known to be associated with groups other than the Métis despite existing contemporaneously so the placement of these buildings may have played a part in the placement of the Métis cabins. Alternatively, Four Mile Coulee and Kajewski have only been briefly archaeologically investigated. While Kajewski was extensively surveyed and had three cabins excavated, no formal excavations have taken place at Four Mile Coulee beyond the initial surveys conducted by Burley et al (1989). Further, Four Mille Coulee, like Chimney Coulee, has been disturbed and it is likely a section of the site was destroyed by a sawmill and ranching activities (Burley, Horsfall, and Brandon 1988, 246).

That being said, three of the five sites analyzed showed strong evidence of clustering and the Chimney Coulee site appears to be visibly clustered if not statistically, especially when the presence of the HBC and NWMP buildings on the site in between some of the Métis cabins is acknowledged. That leaves only Petite Ville which, interestingly, differs from other Métis *hivernant* sites in other ways as well. The main structure excavated at Petite Ville remains the largest structure excavated at any *hivernant* site, with its three rooms not fitting any historic descriptions of Métis cabins and other houses at the site being described as more similar to houses at St. Albert in size and construction (Weinbender 2003, 40). Further, the site's proximity to the contemporary St. Laurent Settlement and Batoche has led to theorizing on its similarities to river lots and the correctness of the site's status as a strictly *hivernant* site (Weinbender 2024, personal communications). While nothing can be proven, there are certainly some similarities in building sizes on river lots at St. Albert, and the site's layout could be argued to be more linear like we see at river lots, than clustered like is seen at many *hivernant* sites.

6.2 *Hivernant* Sites versus River Lots

A topic of interest for this study is the difference between *hivernant* sites and other Métis sites like River Lots and whether these differences may be reflections of the different histories of these spaces. Some of the main visible differences between River Lots and *hivernant* sites have already been noted, including the differences in the numbers of buildings/cabins associated with the different amounts of people who lived on these sites and the subsequent clustering of cabins on *hivernant* sites versus the linear arrangement of buildings on river lots. When looking at these differences the context within which they existed is important to acknowledge. River Lots are more permanent single-family Métis sites that existed as part of larger settlements from the inception of the Métis nation into the late 20th century. In contrast, *hivernant* sites were larger but more isolated simi-temporary sites that were only used for a short period in the 19th century and the layouts of these different sites seem to reflect these histories. *Hivernant* sites tend to have mostly cabins but not a lot of other identifiable building features like barns and sheds that are seen on more permanent sites. Further, the cabins on *hivernant* sites were usually smaller than those at river lots, possibly due to the resources available to build them and in order to preserve heat in the winter (Carpenter 1977).

Alternatively, Métis River Lots existed both during and after the height of the fur trade and buffalo hunting. They are more transitional spaces with generations of buildings and uses. During the fur trade, they were stable places to return to after a long winter hunting and as the number of buffalo in the prairies decreased, the lots of land were safety nets for more sedentary subsistence practices like farming and ranching. Often located in the hearts of developing urban centers, they also saw more disturbance from the rapidly expanding settlement of the West by Europeans (Haines 2024). The river lot land parceling system went against the English square lot system and as such was not always respected by land surveyors (Iseke-Barnes 2009; Benoit 2021). Many lots were cut in half or sold off in pieces due to financial troubles and urban developments (Thompson 2020; Benoit 2021). Thus, the Métis river lots that survived to be examined today were irreparably changed with even the most protected lots like Riel House and River Lot 23 & 24 representing only a portion of the original lots lived on by the Métis. These colonially enforced changes are visible in the sites themselves. At River Lots 23 & 24 only the southern portion of the lots, which were cut in half by the construction of a railroad, remain and we can only estimate the location of the lots' original buildings like Louis Chastellain and John Roland’s houses and the HBC store from early settlement maps. Further, the buildings below the railroad may have been somewhere completely different had the railroad not cut the lot in half in 1907, right around the time the oldest houses to still sit on the site were built (Buckingham 2000).

The different histories of the different types of sites are important to consider when discussing how the layouts of the sites compare as there is no telling how many ways these outside forces may have influenced site layouts. Both Métis River Lots and *hivernant* sites were irrevocably shaped by colonialism and urbanism in different ways. While *hivernant* sites were essentially abandoned due to decreases in buffalo and the decline of the fur trade (Burley 1988; 1989; Burley and Horsfall 1989), river lots were physically altered by the influx of settlers into Métis settlements leading to the parceling off of lots and the destruction of many Métis spaces in urban environments (Iseke-Barnes 2009; Thompson 2020; Benoit 2021).

6.3 Listening to Métis Stories: Possible Reasonings for Site Layouts

In order to try to understand why sites are laid out the way they are, I tuned to Métis personal accounts and teachings. Ethnographic reports and interviews with Métis elders who lived in the 19th and 20th centuries provide firsthand accounts of many *hivernant* camps and settlements. Books like *The Last Buffalo Hunter* (Welsh and Weekes 1994), *Fifty Dollar Bride* (Carpenter 1977), *Vanishing Spaces: Memoirs of Louis Goulet* (Charette 1976), and *Buffalo Days and Nights* (Erasmus and Thompson 1999) record stories of Métis' lives during the era these sites were being used. More recent historical research by Métis scholars gives further background from Métis perspectives and allows for glimpses into the way traditions that may have affected Métis site organizations continue into the present (Macdougall 2011; St-Onge et al. 2012; Macdougall and St-Onge 2013; Andersen 2014a; Flaminio, Gaudet, and Dorion 2020; L. Forsythe and Markides 2024). While very few of these sources directly discuss sites or the reasonings behind the ways sites are laid out, they do provide slivers of information on the way people lived on these sites.

In *The Last Buffalo Hunter* (Welsh and Weekes 1994)*,* Mary Weeks records stories told to her by Norbert Welsh, a Métis buffalo hunter. Welsh describes many of the trading trips and buffalo hunts he went on in the 19th century and discusses his time at *hivernant* camps. While he does not directly mention anything about how these camps were organized, he does describe the houses he built at some of the camps. According to Welsh, storehouses were built to store goods, and other houses were built to store clothing and housekeeping items but the houses were not slept in unless they had chimneys (Welsh and Weekes 1994, 15). He built a winter house and a storehouse at Four-Mile Coulee, in the Cypress Hills, with about 60 other families in his brigade and later describes building a Log Chapel in the Cypress Hills for a visiting priest (Welsh and Weekes 1994, 84-85, 88, 95). He describes his wintering house as having two bedrooms and one big room for a kitchen and talks about himself having at least “twenty wintering houses on the Saskatchewan plains” (Welsh and Weekes 1994, 96-115). The existence of storage houses and wintering houses without chimneys would explain why some features at the excavated *hivernant* sites could be buildings despite not appearing to have associated chimneys. The lack of chimneys associated with these buildings could however also lead to many being ignored in the archaeological record since most cabins are identified through the presence of chimney mounds.

The direct reference to Four Mile Coulee and the 60 families who spent the winter there is another important piece of information as there are currently only 11 potential cabins that have been identified in the archaeological record at the site. While part of the site is known to have been disturbed by the construction and use of a sawmill, likely causing some Métis cabin remains to be destroyed, there still does not seem to be enough cabins to house 60 families (Burley, Horsfall, and Brandon 1988). It is possible that there could have been multiple families living in the same cabin but Welsh does not make any mention of sharing his cabin with any other families so even if some families shared cabins, not all cabins were shared. This implies that a large number of cabins are not seen in the current archaeological record for this site but could possibly be located upon further investigation, especially if some of the cabins did not have chimneys.

Another useful tidbit Welsh provides is when he describes going on various hunting trips and trips to nearby camps during the winters while his wife and mother-in-law stayed behind in houses at wintering sites (Welsh and Weekes 1994, 76-77). While it was often the men who built cabins, it was the women who spent more time living in them, which may have influenced cabin placements. Unfortunately, Welsh does not really talk about the role of women at wintering camps and we must turn to female accounts like *Fifty Dollar Bride* for a better idea of the role women played in buffalo hunts and at *hivernant* sites.

Fifty Dollar Bride tells the story of the Métis woman Marie Rose using a collection of her writing which was compiled by Jock Carpenter (Carpenter 1977). In it, Marie Rose's life at the Red River Settlement, wintering camps, and various other settlements is described, providing a female perspective to compare to Welsh's accounts. Rose begins her story by talking about her childhood at the Red River settlement which she describes as having a population of about 7000 and being made up of "people of like origin who clustered together by choice" (Carpenter 1977, 16). She says that the houses were near the rivers to facilitate the need for both water and travel and that "most lots had river frontage for protection from Indian attacks" (Carpenter 1977, 18). Later she describes the farm she grew up on as having a cabin "built far enough back so the flooding river could not reach it at high water" (Carpenter 1977, 20). The cabin is described as being a low two-roomed structure with a dirt floor, a fireplace made of river stone and clay for heat, a hole in the corner of the floor for milk, and slab benches that acted as beds (Carpenter

1977, 21). The placement of houses on river lots away from the rivers to avoid flooding explains why almost all of the river lots looked at in this study had houses near the back of the lots and at higher elevations to be outside of flood zones.

Later, when discussing buffalo hunting and overwintering, Rose describes a camp near Buffalo Lake where her family's small winter hut made of logs was built. She describes this wintering hut as being smaller than houses at settlements in order to conserve heat in the winter. Rose talks about the role of women in setting up houses at these sites describing how they "fashioned a fireplace with a mixture of mud and grass," traded for animal skins to scrape and stretch over windows, and clear brush from the dirt floors inside the cabin (Carpenter 1977, 50). While Rose does not directly discuss how sites were laid out either, she describes how she passed winters by visiting with neighbors, playing cards, beading, sewing, and tending to her children, implying her cabin was likely situated close enough to others to help easily facilitate these activities (Carpenter 1977, 68).

Buffalo Days and Nights are the written accounts of Peter Erasmus, a Métis buffalo hunter, recorded by Henry Thompson, who was also Métis (Erasmus and Thompson 1999). In it, Peter Erasmus describes his life at the Red River Settlement, at Fort Edmonton, out on buffalo hunts, and his role in the North-West Resistance. Beginning at the Red River Settlement where he was born, Erasmus talks about how the land was divided into narrow lots rather than quarter sections so when the men were away on hunting trips, "the families at home were within easy reach of each other in case of sickness or other needs" and how fences only enclosed cultivated land (Erasmus and Thompson 1999, 3-4). This further explains the similar placement of houses seen at river lots in relative line with each other as more than just being safe from flooding

(Carpenter 1977). Erasmus does not however spend much time describing the places he stayed over the winters while on buffalo hunts.

In *Vanishing Spaces: Memoirs of Louis Goulet,* Guillaume Charette records the stories of Louis Goulet (Charette 1976). While Goulet describes the houses he grew up in the Red River Region and lived in later in St. Albert in similar detail to Welsh and Rose, he does not describe any of the buildings' placements on the landscape or their relation to other buildings. Further, the only real mention he makes of overwintering cabins is that he had multiple of them at different sites. He does, however, talk about journeys to overwintering sites as being "nothing less than picnic lasting weeks and months" and nights at overwintering camps as being full of parties in various houses (Charette 1976, 40-45).

While these Métis accounts provide sparse details regarding the placement of houses at wintering sites, they do offer some valuable explanations for the organizations of river lots relative to each other. Another common thread in many of the accounts is the importance of community at both river lot settlements and overwinter camps, which is not surprising. The importance of community connections in Métis culture is noted by many Métis scholars (Zeilig and Zeilig 1987; St-Onge and Podruchny 2012; Flaminio, Gaudet, and Dorion 2020; Legault 2021; Supernant 2021) particularly as it relates to visiting practices and kinship, and I argue likely to have influenced site organization much more than it may appear at first glance.

6.3.1 Kinship

Kinship is a major branch of Métis culture that bleeds into multiple aspects of everyday life and has been documented as a reason behind the placement of buildings on some sites.

According to Elliot (1971), citing Hatt (1969), extended families were the dominant social institution at overwintering sites, and "residence patterns were related to kinship" (Elliot 1971, 118). "Each family resided in an area of the colony [site] defined (by the colony) as its own. The larger extended families tended to maintain large neighborhoods; the smaller families had their own limited neighborhoods. Nuclear families with no kin tended to live in the most isolated areas of the colony" (Elliot 1971, 118). Not only does clustering based on kinship ties explain why there is so much clustering of different sizes at Métis *hivernant* sites in general, but also the isolation of families with no kin at sites would explain why there are some singular cabins removed from others at Chimney Coulee, Buffalo Lake, and Petite Ville.

There is also documentation on the clustering of houses based on kinship for river lots although these sites have less clustering in general due to often only being lived on by one family. River Lot 24 is one of the few Métis river lots with multiple houses on it and we know the houses were lived in by siblings and their families (Larmour 2017). Amelia Cunningham and Luisa Belcourt, two daughters of Sophie and John Roland, lived on Lot 24 with their families at the same time in houses right next to each other. Amelia and her husband Alfred built a house on the lot in 1912, although their house was only a winter home as they had another on Alfred's farm, while Lousia and her family moved the former washhouse of the Youville Convent to the site right next to Amelia's house in the early 1920s. Both families lived in the site together during the winters and in the 1950s one of Louisa's sons moved a third house onto the site (the Hogan House) next to his mother's and aunt's houses. After Lousia died another of her sons lived in her house while the Cunningham house continued to be occupied by the Cunninghams (Larmour 2017).

This is the most detailed documentation on the inhabitants of individual houses at any of the sites discussed in this thesis, and while not all of the buildings on the site have equal documentation, these three houses show a deliberate placement of houses near each other based on kinship ties. It is also important to note that Amelia and Lousia have different last names from their husbands which could lead to the surface-level assumption that their families were not related. It is only with genealogical knowledge about these women and their families that we realize they are sisters. This is unfortunately not information that is always available as it is often the men and their families who are focused on in the historical record (Iseke-Barnes 2009; Macdougall and St-Onge 2013; Wambold 2021). This means that even for sites where some demographic data is available it may be hard to track kinship ties if they are in the female line.

There is also documented evidence of Métis family members building houses near each other in urban settings. In *Rooster Town* Peters et al (2018) discuss the Métis community of Rooster Town on the outskirts of Winnipeg in the early 20th century. They describe Rooster Town as being a community rooted in kinship and how Métis families tended to place their houses in noticeable clusters based on family connections. While Peters et al suggest this could be because of the similar low socio-economic status of many Métis families at the time they also state that "living near each other allowed [the Métis] to maintain their language, as well as their ways of socializing and of community support" (Peters, Stock, and Werner 2018, 154). The maintaining of cultural traditions is particularly important in larger, more white, urban settings but the idea that close proximity of houses helped facilitate socializing and community support can certainly be applied to early river lot settlements and *hivernant* sites.

Lastly, kinship does not necessarily only include relations by blood. In *Vanishing Spaces* Goulet describes family ties among the Métis as "stretching to infinity" (Charette 1976, 43). He says "If two grandfathers traded dogs one day that was enough for their grandchildren to call themselves relatives. Children of cousins two or three times removed turned into uncles and aunts" (Charette 1976, 43). Thus, kinship ties that are impossible to detect in any genealogical record likely also influenced building placement. Based on these sources, it could be argued that most cases of clustered houses at Métis sites, either *hivernant* or river lots and farmsteads, could be due to kinship ties between the occupants of the houses.

6.3.2 Visiting (*kiyokewin*).

If kinship influenced building placement, so could have visiting (*kiyokewin*). Visiting practices are intrinsically linked with kinship for the Métis. Visiting strengthens kinship ties and community and allows for the sharing of knowledge (Flaminio, Gaudet, and Dorion 2020). At both *hivernant* sites and river lots, women and children were often left behind while men went on hunting and trading trips (Carpenter 1977; Welsh and Weekes 1994; Erasmus and Thompson 1999). While visiting is not an exclusively female practice in Métis culture, women were often the ones who visited with each other during the days while men were busy and played a large part in the strengthening of kinship ties and the building of communities (Hogue 2015; Flaminio, Gaudet, and Dorion 2020). Building placements that helped facilitate visiting would have allowed the women to visit with each other more easily while the men were away, strengthening bonds between families.

In *Buffalo Days and Buffalo Nights,* Peter Erasmus talks about how the river lots at the Red River Settlement allowed houses to be within easy reach of each other in case of sickness or other needs which could include visiting (Erasmus and Thompson 1999) while the men were away on hunts. We also see in the sites used for this study that many river lots had houses near the top of the lots, further from the river, which if multiple neighboring lots had similar placements of buildings would have allowed for easy movement between the houses, especially since most lots did not have fences or physical boundaries between them. In *Fifty Dollar Bride* the practice of visiting is brought up multiple times, but never in direct association with building locations (Carpenter 1977). More often, visiting is discussed in relation to the size of houses as visitors would often travel great distances and stay "until tea and tobacco ran out before moving on to a new source of supply" and houses needed to have space for people to stay (Carpenter 1977, 20). That being said, Marie Rose does talk about her mother "visiting neighbors to barter for provisions if they had an extra" shortly after their new cabin was built at Buffalo Lake, suggesting a much shorter-term version of visiting (Charette 1976). Rose and Goulet also both describe visiting with neighbors as one of the main ways the winters were passed at settlements and wintering camps (Charette 1976; Carpenter 1977).

So while visiting is not directly referenced as a reason for house placements it is clear that it was an important part of Métis culture both at settlements and while overwintering. As Métis scholars Flaminio et al (2020) argue, visiting was and continues to be complex and embedded in everyday ways of life for the Métis. It was "a method of survival, of dialogue and deliberation, of decision-making, of responsibility, of celebration, and of sharing and caring for our relatives" (Flaminio, Gaudet, and Dorion 2020, 56). While everyone visited it was often the women who carried out and taught the practice, strengthening the bonds between families and "anchoring families in a specific region" (Gaudet 2018, 53).

The practice of visiting continues to be an important part of Métis culture, particularly for women (Gaudet 2018; Flaminio, Gaudet, and Dorion 2020; Forsythe 2022; Tuck et al. 2023;

Forsythe and Markides 2024). Visiting today allows the Métis to rebuild and reconnect with their community and culture across long and short distances and some Métis scholars even evoke visiting as a research methodology (Gaudet 2018; Flaminio, Gaudet, and Dorion 2020; Forsythe 2022; Tuck et al. 2023; Paul 2021). Theorized by Gaudet, Flaminio, and Dorion, the Visiting Way *(keeoukaywin*) encourages Métis scholars to practice research with relationality at the core (Gaudet 2018; Flaminio, Gaudet, and Dorion 2020) not only with other people but also with the land and belongings of Métis ancestors (Wambold 2021).

Fundamentally, visiting for the Métis has always built and strengthened relationships and kinship bonds which have been directly referenced as influencing building placements and site layouts (Elliott 1971; Larmour 2017; E. Peters, Stock, and Werner 2018).Thus, I argue that visiting itself, with the land and with others, may have been a primary motivator for the Métis settlement patterns we see today.

6.4 Concluding Thoughts on Métis Sites

It is clear from looking at all of the Métis sites included in this thesis that sites were laid out and buildings were placed with some sort of purpose. From a phenomenological perspective (Tilley 1994), the ways in which Métis people interacted with their communities are visible in the landscapes of their sites. Buildings were likely placed to facilitate movement between them, creating landscapes of places linked by movement. The influence of kinship in the placement of buildings is clearly highlighted in historic documentation of both *hivernant* and river lot sites so based on the strong association between kinship and visiting practices, it is likely that visiting did influence building placements.

The landscapes of these Métis sites should also be viewed in relation to time. *Hivernant* sites were only occupied by the Métis for short periods whereas river lots were often lived on by multiple generations over a longer period of time. These different histories help to explain some of the differences seen between *hivernant* sites and river lots. The landscapes of both river lots and *hivernant* sites can be studied in the present day but for any true comparison to be made between the sites, the temporality of them needs to be considered.

Lastly, the differences in site layouts between *hivernant* sites and river lots/farmsteads are also likely due to the number of families that lived on them. Most river lots and farmstead sites were only lived on by one or two generations of a single family at a time, who would have had a long and deep connection with a smaller piece of land. Alternatively, *hivernant* sites were more temporary and lived on by multiple families for shorter periods. Thus, their landscapes reflect the mobility and relationality between the occupants. The presence of multiple related families on River Lots 23 & 24 at different times leads to the landscape of the site deviating slightly from many of the other river lots and farmsteads and having some more similarities with *hivernant* sites, in that houses are placed close together based on kinship ties, while still being fundamentally a river lot site with generations of history.

Chapter 7: Conclusions

One goal of this thesis was to gain a better understanding of the ways in which geophysical technologies could be combined with landscape archaeology theory and historical records to study Métis sites. This is building on the work of other scholars who have argued for the adaption of less invasive research methodologies at archaeological sites, particularly Indigenous sites (Supernant 2017, 2018; Wadsworth, Supernant, and Kravchinsky 2021). While the use of geospatial technologies including GIS, GPR, UAVs with multispectral and LiDAR sensors, and magnetic gradiometry in archaeological studies has certainly seen an increase in the last decade there is still a lot of work to be done to understand the suitability of these technologies for different sites and research goals.

This thesis is focused specifically on applying these methods to Métis sites in combination with historical research and minimal excavations to test the suitability of these methods for future research in Métis archaeology. Two Métis sites of different types (Chimney Coulee and River Lots 23 & 24) were surveyed and mapped using a combination of methods and techniques to further try to understand the differences between the types of the sites and the suitability of research methods at these different site types.

The second major aim of this thesis was to investigate the ways in which the layouts of Métis sites may be influenced by Métis cultural values. This was done by comparing the two sites mapped in this study to other archaeologically investigated Métis sites to look for commonalities between the layouts of Métis sites and then turning to memoirs of Métis elders and works of Métis scholars for possible reasoning behind the common layouts seen. While I am operating as a non-Métis scholar, I tried to approach the study of these Métis sites through a

Métis lens using the three main pillars of Métis culture—geography, mobility, and kinship—to guide my analysis. I also paid particular attention to the practice of visiting, a practice that remains an important part of Métis culture and something I theorized could have influenced the placement of buildings at Métis sites.

Due to the twofold nature of this research straddling between an exploration of methodologies and an analysis of Métis sites, I address each of my research questions individually in the following paragraphs.

Can geophysical technologies be used to accurately locate where buildings/features once stood on Métis archaeological sites?

In this thesis, the results of geophysical surveys at two different types of Métis sites are presented. The first site, Chimney Coulee, represents a Métis *hivernant* site that was surveyed using UAV-based aerial photography, multispectral imagery, and LiDAR as well as GPR and magnetic gradiometry over multiple field seasons. The second site, River Lots 23 & 24, is a Métis river lot site that was surveyed with UAV-based aerial photography, multispectral imagery, LiDAR, and GPR over the course of only one field season. While the geophysical surveys at Chimney Coulee were able to successfully locate a couple of Métis cabins whose locations were verified via excavations, the surveys at River Lots 23 & 24 were less successful.

At Chimney Coulee multiple potential Métis cabins were identified in the multispectral imagery and promising signs of four buildings appeared in the GPR and magnetic gradiometry data, leading to excavations at three different cabins on the site. While LiDAR helped to visualize the landscape of the site and identify a couple mounds and depressions, it was not able to locate any buildings due to the lack of physical remains of the structures on the surface of the site. However, combining the results of the geophysical and aerial surveys with site survey maps from the 1960s led to the identification of 16 potential Métis cabins within the known hivernant boundary, four buildings associated with the NWMP post on the site, one HBC longhouse occupied by Isaac Cowie, and six other buildings of unknown association that could be connected to the Métis occupation of the site. While locations of these buildings have varying levels of confidence associated with them, it is clear that combining geophysics with traditional site survey methods and excavation is a useful method for locating buildings at less disturbed Métis *hivernant* sites.

This was not the case for River Lots 23 & 24. LiDAR, like at Chimney Coulee, was only really helpful for visualizing the landscape of the site but not for locating any buildings in the vegetated areas of the site. Multispectral imagery was also not helpful with most of the site appearing quite homogeneous, although this may have been partially due to the timing of the flight directly after a heavy rainfall which likely affected the reflectance values of the vegetation making archaeological features harder to identify. Further, the GPR survey at the sites was also not able to locate any clear evidence for the presence of buildings although it did potentially identify part of a barn in the lower portion of the site which was unfortunately unable to be completely verified via excavations due to complications with the exaction unit located in the area flooding part of the way through the field season.

Ultimately, these technologies can be used to locate where buildings/features once stood on Métis archaeological sites but may work better at some sites than others due to multiple factors. Geophysical technologies were not able to locate buildings at the river lots as well as they did at Chimney Coulee and the most useful method for locating buildings on River Lots 23

& 24 ended up being the historic air photos and settlement maps of the site. While this is likely due in part to the higher level of disturbance and development at River Lots 23 & 24 compared to Chimney Coulee, better results may be able to be gained from geophysical techniques after a second season of surveying. Due to time constraints with the survey taking place during a field school, some locations where buildings appear in air photos were never surveyed with the GPR and only the 400 MHz antenna was used which may not be the best antenna for identifying buildings in this location. Further, the grass in many parts of the site survey with the GPR was longer than ideal but was unable to be cut in time, and re-doing the survey with shorter grass may yield better results in the future.

What can the layouts of Métis sites tell us about Métis kinship ties and cultural values?

The results of the geophysical surveys at both Chimney Coulee and River Lots 23 & 24 alongside other available sources like site survey maps, historic air photos, historic maps and excavations, were combined to make building maps that could be analyzed. These maps were then compared to maps of buildings at other known Métis sites including *hivernant* sites, river lots, and farmsteads which found similarities in site layouts across many of the sites. River lots and farmsteads were found to have similar linear arrangements of buildings when only one house and multiple outbuildings were present. When multiple houses were present they appeared to be clustered together, a pattern that was also seen on a larger scale at many of the *hivernant* sites. While nearest neighbour analyses only found three of the five *hivernant* sites analyzed to be statistically clustered, the other two still appear to have some visually identifiable clustering, and the six site that was not analyzed due to having a much smaller number of buildings, has all of its buildings placed close together.

This clustering seen at many Métis sites has been tied to kinship by scholars in the past (Elliot 1971; Peters, Stock, and Werner 2018), and documentation on the occupants of the houses at River Lots 23 & 24 being related further points to the placement of houses near kin (Larmour 2017). While less directly supported by documentation, visiting also likely played a role in building locations. Visiting is closely intertwined with kinship and community in Métis culture and multiple Métis memoirs from the fur trade era make reference to the importance of visiting at both river lot settlements and *hivernant* camps. Reference is also made to the placement of buildings on river lots in similar locations to facilitate support from neighbours while men were away which is just as likely to have been the case at *hivernant* sites as women and children were often left behind at sites while the men went on short hunting trips visiting (Erasmus and Thompson 1999). So while there is no direct evidence of visiting influencing building placements at Métis sites, kinship has been linked to clustering and building placements, and visiting plays an important part in the building and strengthening of kinship bonds in Métis communities, I argue visiting also influences the organization of Métis sites.

Do the layouts of Métis River Lots differ from the layouts of Métis hivernant sites?

Comparing the layouts of *hivernant* sites and river lots/farmsteads did find a few notable differences between the sites. Most river lots/farmsteads had fewer houses and more other buildings associated with only one family (or extended family) whereas *hivernant* sites were occupied by multiple Métis families, so they have much more houses/cabins and we see fewer other buildings like barns and sheds. Buildings on river lots and farmsteads all tend to follow a somewhat linear or “string” pattern and are placed in similar locations on the lots—houses in higher elevation areas back from the river and barns placed the furthest away from the house. When multiple houses are on river lots like at River Lots 23 & 24, we see more clustering of buildings like is seen at many *hivernant* sites. The clustering of buildings is still much more visible at *hivernant* sites than it is at river lots. Some sites like Kajewski Cabins and Four Mile Coulee have very separated and defined clusters of buildings while Buffalo Lake and Petite Ville have larger main clusters of cabins with other cabins separated on the peripheries. Further, despite ANN classifying buildings at Chimney Coulee as randomly placed, the buildings do appear to have some visible clustering with most potential Métis buildings situated close together and a few other buildings in smaller clusters, or alone, separated by vegetation or NWMP and HBC buildings. So yes, based on the sites studied in this thesis, Métis river lots and *hivernant* sites do generally appear to have different layouts from each other.

If they do is this a reflection of cultural and colonial factors involved in the creation of these two different types of sites?

While there are visible differences between the layouts of *hivernant* sites and river lots, questions on whether these differences may be reflections of the different histories of these spaces are a bit harder to answer. It is of course important to acknowledge the different histories of these types of sites but it is harder to determine how much the slightly different colonial histories of the sites influenced building placement. River lots were more permanent single-family Métis sites compared to the more isolated semi-temporary *hivernant* sites. While *hivernant* sites were only used for a short period during the height of the fur trade and buffalo hunting days, in the 19th century, river lots most often existed as part of larger settlements that were inhabited by Métis during and after the fur trade into late 20th century in some cases. These different histories can help explain the presence of more permanent outbuildings and buildings associated with on farming on river lots that are absent at *hivernant* sites as well as the smaller cabin sizes at *hivernant* sites.

River lots may also show more effects of colonialism and urbanization than many *hivernant* sites which were abandoned due to colonialist forces (over-hunting of buffalo and the increased pressure to become farmers) but remained relatively untouched after being abandoned due to their more isolated locations. Dissimilarly, Métis river lots were usually associated with settlements that became urban centers resulting in the lots being parceled up and sold off as these urban centers grew. The Métis river lots that survived today are thus modified versions or only small parts of the original lots which means only the buildings on the existing lots can be studied and even if the original layout of buildings on these sites were not influenced by colonialism the current building placements likely were. Ultimately, both Métis River Lots and *hivernant* sites as we study them today were likely shaped by colonialism and urbanism in different ways and compare as there is no way to tell exactly how many ways these outside forces may have influenced site layouts.

Final Thoughts and Future Recommendations

With this thesis, I set out to investigate Métis site layouts through a variety of methods, which I accomplished even if some of the technologies did not work well at River Lots 23 & 24.

However, future geophysical surveys at River Lots 23 and 24 would benefit from focusing on more of the areas where buildings appear in historical air photos and testing other GPR antennas besides the 400 MHz antenna to determine what antenna is best suited for the area. Cutting the grass more in the intended survey area may also result in better GPR data. The use of magnetic gradiometry in the future may also be able to help locate buildings on the site more accurately and collecting multispectral imagery at a drier time in the future may also yield better results.

I also hope I sufficiently showed the benefit of combining multiple technologies not only with each other but also with historic documents when working at historic sites, and with excavation when suitable. While ideally some of these technologies will be used more to study sites in completely non-invasive ways in the future, excavations can still be useful for verifying the results of these techniques while we continue to test new technologies. Historical sources like maps and photos are also extremely useful tools for analyzing sites in concert with geophysics that when available could help eliminate the need for excavation. Furthermore, future archaeological research on Métis sites could benefit from combining many of the methods used in this thesis with Métis cultural values in order to ensure interpretations of Métis sites align with Métis ways of living on the landscape. I hope this research has helped shed light on some of the methods best suited to study Métis landscapes in the future as well as highlight the importance of considering the cultural values of the people who lived on any landscape when making interpretations of historic landscapes.

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