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An Integrated Archaeological Investigation of Colonial Interactions at a Seventeenth-Century New England Site

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Abstract

The focus of this research is the ways in which interactions between Indigenous peoples and English settler-colonists were manifested in the landscape at a seventeenth-century site in South Glastonbury, Connecticut. Magnetometry and ground-penetrating radar allowed for the location of anthropogenic and geological features on the landscape, and for the seventeenth-century landscape to be recreated. This reconstruction indicated that Europeans and Indigenous peoples may have been cohabitating the site. Archival research helped to uncover what types of interactions may have been occurring at the site. Excavations uncovered "Indigenous" artifacts in a "European" context, leading to the reconsideration of the prevailing perspectives on culture change in the region. All of these data led to the examination of the nuanced relationships that were fostered between Indigenous peoples and English settler-colonists during the first decades of colonialism in the Connecticut River Valley.

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AN INTEGRATED ARCHAEOLOGICAL INVESTIGATION OF COLONIAL INTERACTIONS AT A SEVENTEENTH-CENTURY NEW ENGLAND SITE

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ABSTRACT

The focus of this research is the ways in which interactions between Indigenous peoples and English settler-colonists were manifested in the landscape at a seventeenth-century site in South Glastonbury, Connecticut. Magnetometry and ground-penetrating radar allowed for the location of anthropogenic and geological features on the landscape, and for the seventeenth-century landscape to be recreated. This reconstruction indicated that Europeans and Indigenous peoples may have been cohabitating the site. Archival research helped to uncover what types of interactions may have been occurring at the site. Excavations uncovered "Indigenous" artifacts in a "European" context, leading to the reconsideration of the prevailing perspectives on culture change in the region. All of these data led to the examination of the nuanced relationships that were fostered between Indigenous peoples and English settler-colonists during the first decades of colonialism in the Connecticut River Valley.

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CHAPTER ONE: INTRODUCTION

The Hollister site in South Glastonbury, Connecticut is a remarkable seventeenth-century colonial farmstead, notable for its age, composition, and preservation. In the summer of 2015 four cellars, and numerous other features, were located through a ground-penetrating radar survey. Intersecting lines of evidence indicate that these cellars are part of an early colonial farmstead that was occupied from the mid-1600s through approximately 1715 (Curtis 1928, 21, Glastonbury Records a, 2-3, McNulty 1970, 12). Archaeological sites of this age and composition are uncommon in this region, making research there both unique and compelling. The Hollister family maintained ownership of the land through the period of occupation (Curtis 1928, 21, Glastonbury Records a, 2-3, McNulty 1970, 12). There is also documentary evidence that the Hollisters were interacting with local Native Americans, Wangunks, specifically (Trumbull 1852, 375, 411). Colonialism forces agents to negotiate relationships with each other and to contest power and ownership (Gomez 2010, 165, Ortner 2006b). Contentious land purchases and appropriations caused the Indigenous peoples of the Connecticut River Valley to negotiate relationships with English settler-colonists (Vaughan 1979, 116). These negotiations and power-laden interactions are revealed in artifacts and features on the landscape (Bender 1993, 1-2, Hauser and Hicks 2007, 265-267, Tilley 2006, 7). The colonial landscape and the potential for aggregation at this site makes this research ideal for addressing questions regarding aggregation, interactions, and the manifestations of relationships between Indigenous peoples and English settler-colonists in artifacts and the landscape.

Site History

The land on which the site is situated has been occupied by people of the region for centuries. The site is located on the east bank of the Connecticut River in South Glastonbury, Connecticut (Figure 1.1). Despite its location on a terrace adjacent to the river, the site does not flood habitually. Proximity to the river would have been advantageous for its potential as a food source and in facilitating travel. There is archaeological evidence for the exploitation of freshwater fish and shellfish in the Connecticut River Valley (McManamon et al. 2008). A documented Native American site just to the south of the Hollister site has evidence for four-thousand years of continuous occupation (Marteka 2015). The Indigenous term for the area the Hollister site is located in is Nayaug, which is described as, “a fertile meadow, bounded north by Roaring Brook…westerly by the river” (Adams 1904, 37-38). This term is frequently used to refer to the area where the Hollister farmstead was constructed. During the colonial era, travel and trade between Native Americans, Dutch, and English were facilitated by the river (Andrews 1889, 6, Harper et al. 2013, 22, Hinderaker and Mancall 2003, 29, 36, 38). The proximity of the site to the Connecticut River and its composition of fertile soil indicate that it has a long, rich history of human occupation.

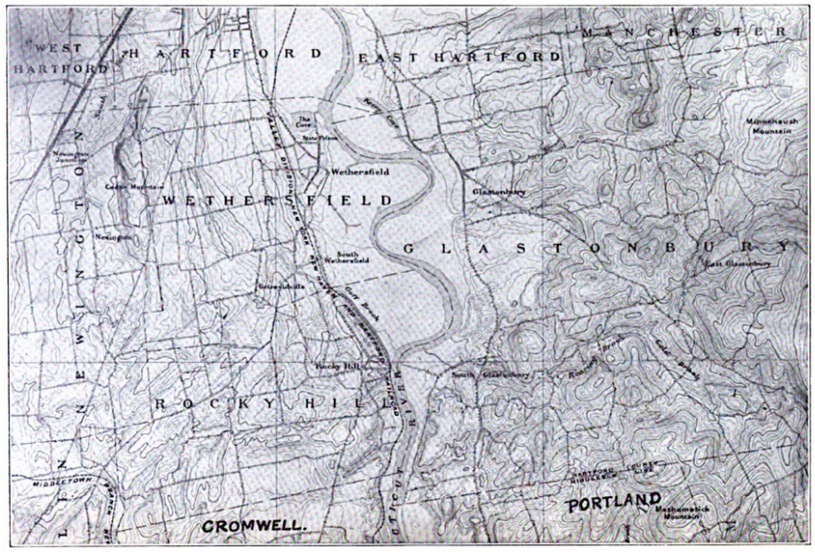


Figure 1.1: Map of Wethersfield and Glastonbury. Glastonbury is located on the east side of the Connecticut River. Nayaug is in South Glastonbury and may be seen in the portion of the map that is south of Roaring Brook and east of the Connecticut River. (Adams 1904, 80).

The colonization of the Connecticut River Valley began in 1633, when the Dutch established a trading post on the river in what is now Hartford (Andrews 1889, 8). As the population increased in areas around Boston in the 1630s, settlers began to spread throughout southern New England, concentrating on land near navigable waterways such as the Connecticut River Valley (Vaughan 1999, 10). In 1672 Nayaug is cited as having been purchased from Sequin and was incorporated into the town of Wethersfield (Adams 1904, 43, 103). The portion of Wethersfield on the east side of the river, which included Nayaug, became a separate town, Glastonbury, in 1693 (Adams 1904, 34). Historical resources note that at that time most of the Native Americans in Wethersfield lived on the east side of the river, in what would become Glastonbury (Adams 1904, 34). This information shows that while Glastonbury was appropriated by European settler-colonists, Indigenous peoples continued to occupy the area of study.

Increasing tensions between Native Americans and Europeans in Southern New England culminated in King Philip's War, which began in 1675 (Grumet 1995, 122). Indigenous peoples of various communities around Southern New England were forced to choose to align with the Wampanoag leader Metacomet (King Philip), or the English (Hinderaker and Mancall 2003, 53, Grumet 1995, 122, Lavin 2013, 332-333). Indigenous peoples in the Connecticut River Valley did not necessarily have a choice as English settler-colonists demanded hostages from them in addition to trying to force the Wangunk tribe to live under a Mohegan sachem (Lavin 2013, 332, Trumbull 1852, 378). Historical and archaeological evidence for different types of interactions manifested at the Nayaug site while these contestations were occurring will illuminate the ways in which individuals were navigating this complex and nuanced political landscape.

There is historical evidence that John Hollister interacted with Wangunks in Nayaug (Adams 1904, 205). In 1675, in the midst of King Philip's War, "the Court did permit him [John Hollister] to hire two or three men to fortify his house and secure his corn on the east side of the Great River" (Trumbull 1852, 375). Hollister is also represented as the intermediary for the Court and Wangunks in the area (Trumbull 1852, 375, 411). It is evident that there was a degree of interaction between Hollister and Wangunks of the area, but the precise nature of these interactions must be explored further. Specifically, the ways that agency and contestation resulting from these interactions were manifested in artifacts and the landscape were examined with this research.

There were two primary periods of occupation at the site by two different families. Lieutenant John Hollister acquired the land in Nayaug around the year 1640 (Glastonbury Records a, 2-3). The land was leased to Josiah Gilbert and his family for twelve years, from approximately 1651 to 1663 (Glastonbury Records a, 2-3, Glastonbury Records 1680, 126). John Hollister (son of Lieutenant) acquired the land in 1665 upon the death of his father (Glastonbury Records a, 2-3). John Hollister and his family lived at the site from 1667 until 1711, when he died (Hollister 1711).

Previous Work

In 2015, ground-penetrating radar data were collected over a small area of the site by Peter Leach of the University of Connecticut. An amplitude slice-map produced from these data depicts where the 100x30 meter grid that was collected for this survey was oriented spatially at the site (Figure 1.2). Profiles and amplitude slice-maps (Figures 1.2, 1.3 and 1.4) produced from these data revealed over a dozen buried features. The rectilinear features that are visible are likely European in origin and are cellars beneath houses (Brian Jones, email to author, January 21, 2016, Conyers 2012, 118-119). The number and variety of features in the data presented the need for a broader analysis of the features on the landscape through integrated geophysical archaeological methods.

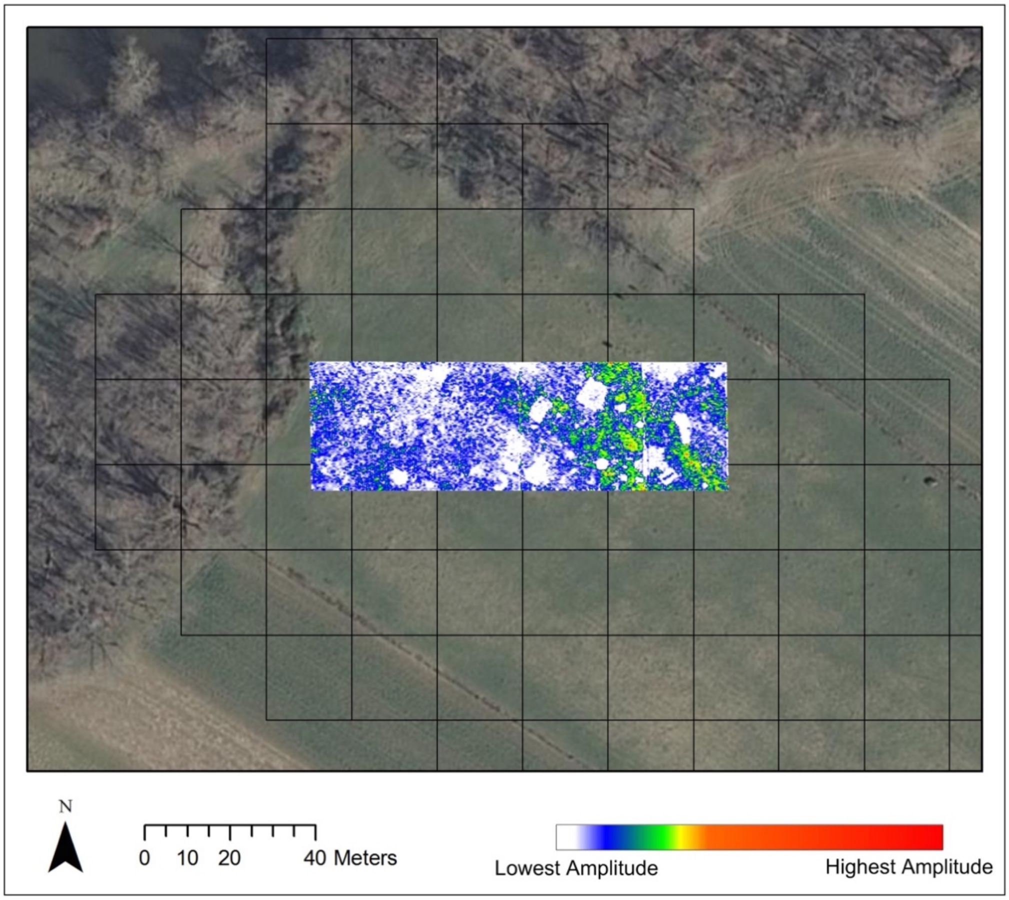


Figure 1.2: An amplitude slice-map produced from Leach's data shows where on the site the 2015 survey was conducted. The grid is a local grid that was established across the site, so that all surveys can be tied into the space in the same way. The color scale shows how values on the map depict relative amplitudes. In this case, areas of low amplitude are cellars and other anthropogenic features. (Basemap from CTECO 2012).

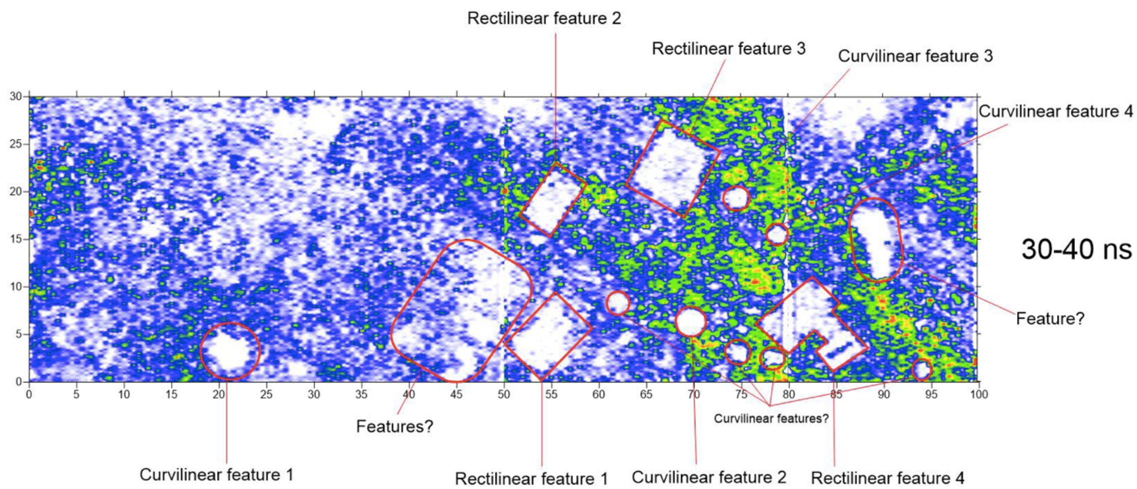


Figure 1.3: Amplitude slice-map from GPR data collected by Peter Leach. The rectilinear features are cellars (Conyers 2012, 118-119). The origins of the curvilinear features are unknown.

In the summer of 2015, eight 1x1 meter excavation units were placed around a rectilinear feature that had been identified in GPR images (Figure 1.4). The excavations yielded a number of pipe stems that were dated to the seventeenth-century, which was interesting because there are very few preserved remains from this time period in Connecticut.

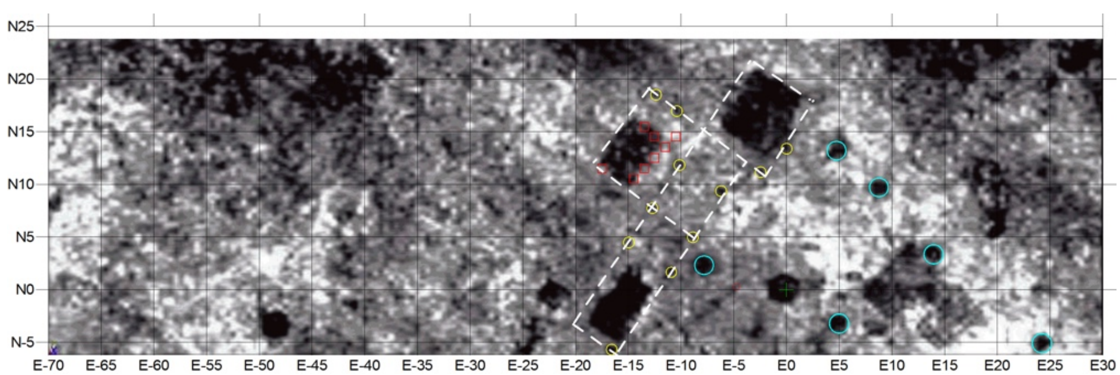


Figure 1.4: Image courtesy of Peter Leach and Brian Jones. Slice-map with excavations conducted August 2015. The red squares represent each test unit. The yellow and blue circles demarcate some curvilinear features, the origins of which are unknown.

Methods

Integrated methods were used to create a comprehensive and diverse data set. The site was located in the summer of 2015 when Peter Leach, a doctoral student at the University of Connecticut, conducted a ground-penetrating radar (GPR) survey. Magnetometry, another geophysical survey method was also used in order to determine the limits of the site, and to locate areas for future GPR survey. Ground-penetrating radar was used to identify the location and form of features, and to position excavation units. Excavations were necessary in order to recover individual artifacts. Units and test pits were placed in and around the cellars, as well as over other features of interest, such as two pit features visible in the GPR data.

We conducted a magnetic survey in the spring of 2016. Magnetic data were collected where Peter Leach had conducted GPR, in order to directly compare the data to the extant GPR data and to determine what certain features look like in both data sets. A magnetometer measures the variability of earth’s magnetic field as a function of objects and features buried in the ground (Kvamme 2006a, 206). Both chemical and thermal processes cause certain features and objects to retain thermoremanent or retained magnetism (Kvamme 2006a). These magnetic materials then modify earth’s magnetic field very slightly, and can be measured by sensors on the surface (Kvamme 2006a). Magnetometry is suitable for large-scale surveys of the landscape as it may be performed over large areas in relatively little time (Kvamme 2003, 2006a). While magnetic data are useful for locating the general areas of certain features, this method is limited because it cannot determine the depth of buried features, and it measures a relatively narrow range of features. Initially, these data were primarily used to determine the extent of the site and to locate areas for GPR survey. Later, they were integrated with the GPR data in order to reconstruct the seventeenth-century landscape.

Ground-penetrating radar surveys were conducted in the summer of 2016, and were based on Peter Leach's previous GPR survey, and the magnetic data. In contrast to magnetometry, GPR can determine the depth of features that are both geological and anthropogenic. The collection of GPR data occurs when electromagnetic waves are transmitted into the ground, reflect off buried discontinuities and return to the surface to be measured (Conyers 2013, 27). The velocity of the wave changes depending on the properties of the buried feature. This change is typically based on differential water saturation, which then produces reflections that may be viewed in images produced by the data (Conyers 2013, 27). Ground-penetrating radar may not be collected in as large an area as magnetic data in the same amount of time, but the level of detail the data provides makes it valuable for archaeological research. Images produced from these data were used to examine features on the landscape, and to determine where to place excavation units based upon the locations of these features.

The locations of excavation units were planned using geophysical data, specifically, images produced from the GPR surveys. Features visible in the GPR data were located in space, and a few were chosen for excavation. Three trenches were placed over three of the cellars. Two units were excavated over features evident in the images produced from the data. In addition to the trenches and units, thirty-six shovel test pits were placed in the areas around the cellars, and over other features, such as an oblong feature and a fourth cellar. These excavations yielded many artifacts, which were used to draw conclusions about the site that relate to the research questions and hypotheses.

Archival data were collected during visits to the Wethersfield library, the Connecticut State Library, the Connecticut Historical Society, the Wethersfield Historical Society, and the Glastonbury Historical Society. These documentary data were used to gain a better understanding of who was living at the site and when. This aided in the interpretation of other types of data recovered at the site.

Theoretical Perspectives

Seventeenth-century South Glastonbury, Connecticut was an ideal location to apply agency and landscape perspectives to the study of relationships between English settler-colonists and the Indigenous Americans, and how they have been manifested in the artifacts and the landscape. These two theories were applied to the site because I examined features on the landscape and artifacts recovered from those features, and the ways that individuals navigated the colonial world. The types of questions that I asked, hypotheses I put forth, and my methodology were informed by landscape and agency theoretical perspectives.

A brief discussion of the terms *colonialism, settler colonialism, colonization,* and *colonist* are necessary in order to clarify how they are being used in relation to research at the Hollister site. *Colonialism* is defined as, “the establishment and maintenance of rule, for an extended period of time, by a sovereign power over a subordinate and alien people that is separate from the ruling power” (Barfield 1997, 69). Specifically, *settler colonialism* is, “a distinct type of colonialism that functions through the replacement of indigenous populations with an invasive settler society that, over time, develops a distinctive identity and sovereignty" (Barker and Battell Lowman 2017). *Colonization* is, "the physical settlement of people (settlers) from the imperial center in the colonial periphery" (Barfield 1997, 69). A *colonist* is "A settler or inhabitant of a colony" (Oxford University Press 2017). During the seventeenth-century, Connecticut was a colony, colonized by settler colonists. While it will be seen that there were complex relationships between these early colonists and Indigenous peoples, English colonists settled the region and implemented laws through the framework of European colonialism.

The colonial landscape of Connecticut was an apt location in which to employ landscape theory. The concept that landscape and colonialism are intimately related has been addressed by numerous theorists (Bender 2002, S104-S105, Gosden 2012, 256, Lydon 2008, 656);

> landscape was an important element in the development of post-medieval European colonialism, which imagined 'empty' landscapes especially through doctrines of *terra nullius* (unowned land): denying Indigenous property rights, creating new planned colonial landscapes and mapping and laying territorial claim to Indigenous land (Hauser and Hicks 2007, 251).

Landscape theory allows the archaeologist to examine the ways in which people, their culture, and their identities shape, and are shaped, by the landscape (Bender 2002, S107). Because social and political environments impact how meaning is mediated through and also shape the landscape, colonial landscapes provide ample opportunity to expose how changing power relationships, contestation, and cultural identity are manifested in the landscape (Bender 1993, 1-2, Hauser and Hicks 2007, 265-267, Tilley 2006, 7).

The perspectives of Stephen Silliman and Sherry Ortner were used to apply agency theory to my research. These two theorists hold that there is a dialectical relationship between agents and structures; actors can act explicitly to challenge and change the cultural structure, but the structure also reinforces and defines the way that action is enacted (Ortner 2006a, 2, 2006b, Silliman 2001). Silliman (2001, 195) provides an example of how agency may be seen in the archaeological record with his discussion of acts of residence; “the attempts of individuals to stake out a claim in their social worlds, even under contexts of oppression and domination, that may have little to do with outright or even impromptu resistance.” Specifically, I use agency theory to discern the ways that actors navigated the colonial landscape by actively resisting colonialism, by sustaining cultural practices, and by forging relationships with colonizers (Ortner 2006b, 147).

Research Questions

The hypothesis that guided research at the Hollister site is as follows: Negotiated interactions between Indigenous peoples and English settler-colonists were manifested in the landscape and material culture, and evidence of those interactions may be revealed by analyzing the form and placement of different features on the landscape, and artifacts (Adams 1904, 205, Bender 1993, 1-2, Gomez 2010, Hauser and Hicks 2007, 265-267, Ortner 2006b, Pauketat and Alt 2005, Silliman 2001, Stone 2016, Tilley 2006, 7). This hypothesis is tested by considering the following questions: How were interactions between Indigenous peoples and English settler-colonists manifested in the artifacts and the landscape? How do features such as domiciles reflect the ways in which interactions between Indigenous peoples and English settler-colonists were manifested in artifacts and the landscape? In what ways do artifacts and the layout of features on the site reflect colonial relationships and interactions?

Habitual interactions between Wangunks and English settler-colonists will have changed the ways members each culture lived, which can be seen in the nature of the features at the site, and the material culture found within them (Stone 2016, 61). The landscape shows evidence of an Indigenous presence that may be coterminous with the English-colonial presence. This illustrates how the landscape was valued by different groups for reasons that will be explored. Evidence for interactions between Indigenous New Englanders and the Hollisters at the site speak to the ways that colonialism may have been contested and negotiated through active agents. Material culture at the site can also be used as evidence to address these contestations. Specifically, artifacts typically categorized as “Native American” that were found within the “European” cellars indicate that agents of these two cultures were interacting and influencing each other.

Results and Conclusion

The data acquired through geophysical surveys and excavations allowed for the colonial landscape to be reproduced, and for a number of conclusions to be drawn regarding the ways that Indigenous peoples were encountering European colonialism. There is evidence that Europeans and Indigenous peoples may have been cohabitating at the site. An Indigenous ceramic vessel recovered from one of the European cellars is also evidence that English settler-colonists may have been adopting elements of Indigenous culture. It also shows that Indigenous peoples of Connecticut were resisting colonialism by producing vessels in anti-colonial ways, and continuing traditional practices despite an influx of brass kettles (Goodby 1998).

Numerous Europeans cellars and other features were found with GPR. The images produced from these data also revealed the colonial living surface. The colonial landscape at the site was reproduced in order to gain an understanding of what it would have looked like during its seventeenth-century occupation. During this process, it was discovered that numerous Indigenous pit houses on the site were probably coexistent with the European cellars. This indicates that Indigenous peoples of the Connecticut River Valley were contesting colonialism and contentious land agreements by continuing to occupy land "owned" by English settler-colonists. Documentary evidence also indicates that rather than "contesting" colonialism, Indigenous peoples and English settler-colonists alike were fostering intercultural friendships in order to survive in the new colonial environment (Trumbull 1852).

Much Indigenous pottery was found throughout the cellars. However, one cellar in particular yielded many sherds that were likely from the same, large vessel. This vessel, which is of the Shantok tradition, was produced in the decades between two wars that disrupted Indigenous life in Connecticut dramatically (Kevin McBride, personal communication 2017, Rouse 1947, Silliman and Witt 2010, 52). The existence of this pottery in itself may be interpreted as political, and indicative of the ways that Indigenous potters of the region were reacting to European colonialism (Mrozowski et al. 2007, 151, Goodby 1998, 171, 177). It is also evidence that the first colonists in New England adopted elements of Native American culture, an aspect of history often forgotten, but not uncommon in the region (Mrozowski et al. 2007, 144-145, 151-152)

CHAPTER TWO: BACKGROUND

Located on a terrace of the lower Connecticut River, the area in which the Hollister site is located has been ideal for human occupation for millennia. The landscape was first shaped by glaciers and post-glacial meltwater (Stone et al. 2005, 3, 10). This created a rocky and topographically variable landscape, which included many environments that may have been exploited by people. In the low areas were initially rivers that flowed from the retreating glaciers to the north (Stone et al. 2005, 10). Over time as meltwater ceased, these low areas became swamps and marshes, finally filling in and creating a dry land surface. About this same time a glacial lake formed, part of which was located in the Hollister area (Zeilinga de Boer 2009, 86, Stone et al. 2005, 10, 12). Some of those glacial sediments are also found in the study area. Once the lake was drained, soils formed, with some addition of sediment from the nearby Connecticut River, slowly leveling the ground surface and producing some areas of rich agricultural soil. This level, fertile ground adjacent to the river rich in food resources was an environment ideal for human habitation.

In this area, Indigenous peoples exploited natural resources by hunting and gathering, and, with the development of agriculture, grew maize and other crops on level, fertile floodplains (Chilton 2002, 292-293, 2008, 54, Stein 2008, 61). Native Americans resided along the Connecticut River in the centuries leading up to European colonization

(Grumet 1995, 153). They would have constructed homes and villages that may have been occupied for more than one season (GTH 2016, Hasenstab 1999, 149, Lavin 1985, 30, 33, Lavin 1985, 27, 2013, 202-203). In the mid-1600s, English settler-colonists moved into the river valley, in search of more farmland, which they found in the Connecticut River Valley (McManis 1975:43-44). When they encountered the Indigenous peoples they first negotiated relationships with each other as a way to contest power and ownership of the land from very different perspectives (Gomez 2010, 165, Ortner 2006b). As much of this negotiation was based on 'ownership' as defined by European standards, the land and environment played a crucial role. In both groups' outlooks, it was the productivity and therefore ability of the land to generate wealth that mattered, but each had their own perspective on both how to exploit the environments present here, but also how ownership was established and maintained (Hinderaker and Mancall 2003, 28, Stein 2008). The placement of these two different groups on this landscape, their interactions, and ultimately how the Indigenous peoples navigated colonialism is the focus of this research.

Geological Background

The bedrock of the Connecticut River Valley is composed of igneous and metamorphic rocks, primarily granite, gneiss, and schist (Lavin and Banks 2011, 2). Approximately 25-20 thousand years ago, during the Pleistocene Epoch, an ice sheet covered Connecticut (Stone et al. 2005, 3). The ice brought with it rocks from the Canadian shield, which were deposited as glacial till (Monroe and Wicander 2008, 496) This glacial till was deposited on the bedrock when the glaciers stagnated approximately

16,000 years ago (Lavin and Banks 2011, 2, Zeilinga de Boer 2009, 86). When the glaciers had stagnated, and were in the process of melting, braided streams flowed southward, filling in the low areas around glacial deposits (Zeilinga de Boer 2009, 86). Above the channels are layers of laminated sand and silt deposits deposited in a post-glacial lake, dammed by moraines. This large glacial lake is called Lake Hitchcock, and covered much of this area of the Connecticut River Valley from about 17,500-13,500 years ago until the moraine dams to the south broke, and the water drained to the Atlantic (Stone et al. 2005, 9-13). The Connecticut River then established itself in the low areas and cut through the lake sediments, beginning a downward cutting phase where the lake units were stranded in high terraces along its margin (Stone et al. 2005, 11-13). There were some wind-blown units of loess deposited on the high topographic areas at this time, which mantled the surface (Stone et al. 2005, 13). Much of this sequence of sediments is overlain by about 20-40 centimeters of soil that has formed in the last centuries. This surface unit has been disturbed and overturned by plowing in the three-hundred years that the site has served as an agricultural field.

This geological chronology contextualizes the landscape of the site now, and in the past. Understanding how the site formed and using this background in collaboration with images and produced from geophysical data will help to envision the colonial landscape, which would have looked quite different than it does three-hundred years later. This allows the people of the past to be placed accurately on the landscape. Thinking about why people lived where they did, and how that may have changed over time is possible once the colonial landscape and features on the landscape have been established. Different types of structures associated with Indigenous peoples and Europeans, and where these are in relation to landscape features and each other may be revealed. This will illuminate the ways that different people were choosing to live in the same, or different, places based on environmental and social factors.

Indigenous History of the Connecticut River Valley

There is a long history of Indigenous occupation of the Connecticut River Valley. The focus of this overview of Indigenous peoples in the region are the periods immediately preceding colonialism in New England. These are the Late Woodland (1000-1500 CE) and the Final Woodland (1500-1633 CE) periods (Lavin 1985, 5). Archaeological evidence of prehistoric occupations of this area, such as campsites, rockshelters, and shell middens indicate that there was a high density of Native Americans inhabiting the Connecticut River Valley (Grumet 1995, 153). The river itself would have served as an important medium for food procuration, travel, trade, and communication (Lavin and Banks 2011, 4). It is likely that hunting, fishing, and gathering activities were supplemented by maize horticulture in the fertile floodplains of the valley (Chilton 2002, 292-293, 2008, 54, Stein 2008, 61). Evidence of horticulture has been demonstrated through the presence of granary pits used to store surplus maize that have been found in the Connecticut River Valley in Massachusetts and Connecticut (Chilton 2002, 290-292, Hasenstab 1999, 142, 145, 147-148).

While there is no evidence of permanent villages in this region, based on the density of artifacts found at certain sites belonging to this period, it is likely that Indigenous peoples occupied some villages for more than one season at a time (GTH

2016, Hasenstab 1999, 149, Lavin 1985, 30, 2013, 202-203). Two primary house forms were used during this period; wigwams, which were typically occupied during the summer, and longhouses, which could house a greater number of people during the winter (Lavin 1985, 33, 2013, 274). Native Americans were also changing the landscape by clearing fields and thinning forests in order to facilitate their subsistence strategies (Berentsen 2015, 186).

There is archaeological evidence for travel and trade facilitated by the Connecticut River. Lucianne Lavin of the Institute for American Indian Studies and archaeologist Marc Banks articulate how clay pots and other artifacts are evidence of trade and communication during the Woodland periods:

> Pots representing ceramic styles from geographic areas outside Connecticut and the presence of non-local artifacts and artifacts manufactured from non-local stone types provide evidence of interregional communication and trade networks throughout the Woodland periods" (Lavin and Banks 2011, 7).

Clay pots were introduced to Connecticut during the Terminal Archaic period (1750-750 BCE), with pottery vessels becoming more prevalent during Woodland periods (Lavin and Banks 2011, 6).

Immediately preceding the European colonization of the Connecticut River Valley there was a shift in Indigenous hegemony in the region (Vaughan 1979, 115). Before this shift, in the late sixteenth or early seventeenth-century, Algonquian-speaking Indigenous groups, such as the Podunks, Wangunks, and Siciaoggs (sometimes referred to as the "River Indians") maintained autonomy in the valley (GTH 2016, Vaughan 1979, 55-56). The Wangunk Chief Sequin is postulated to have been in power up until this point (Adams 1904, 43, Vaughan 1979, 57). However, as a result of conflict elsewhere, another Algonquian-speaking group, the Pequots, moved into the region and gained control over the Indigenous peoples of the valley (GTH 2016, Vaughan 1979, 55-57, 115). This shift in power indicates that the region was already contested prior to European colonization.

There is Indigenous nomenclature for the area where the site is located. The term for the area is *Nayaug*, which is described as, "a fertile meadow, bounded north by Roaring Brook…westerly by the river" (Adams 1904, 37-38). This area is reported to have been more heavily occupied by Native Americans, where there were abundant resources, such as beaver, fish, and fertile soil (Adams 1904, 35). Archaeological evidence supports this substantial Indigenous occupation. Just to the south is the Horton site, which is a well-known and rich prehistoric archaeological site (Marteka 2015). In fact, the earliest date (3600 BP) for an Orient point in Connecticut was derived from a point found at the Horton site (Lavin 2013, 123). Because there is evidence for historical and archaeological evidence for Indigenous habitation nearby, it would be expected that precolonial Indigenous features and artifacts would be found at the Hollister site.

Europeans in the Connecticut River Valley

A number of factors led to the Euroamerican settlement of the Connecticut River Valley. The European presence in the valley began with trade (Freeman 1995, 286). Later, English settler-colonists moved to the interior of Connecticut for reasons ranging from religious rivalries, population booms, and the attraction of agricultural land (Hinderaker and Mancall 2003, 40-41, McManis 1975, 43-44, Vaughan 1999, 10). It will be seen that European colonization of the valley had profound impacts on Indigenous life.

Indigenous peoples of the valley began to trade with Dutch fur traders in 1622 (Freeman 1995, 286). Through trade with Europeans, wampum (shell beads) and fur became commodified, which changed the nature of exchange for Indigenous peoples of southern New England (Grumet 1996, 43, Silliman and Witt 2010, 51). As a result, Dutch traders, English settler-colonists, and Indigenous groups throughout southern New England competed for power and territory through commercial relationships (Hinderaker and Mancall 2003, 29, Vaughan 1999, 10). Exploitative relationships emerged between Indigenous groups as *sachems* (defined by Gladys Tantaquidgeon as "a male leader" and translated as "rock man" (Lavin 2013, 286)) facilitated trade and struggled to acquire wampum (Grumet 1996, 43-44). The Pequots became quite powerful through trade with the Dutch (Hinderaker and Mancall 2003, 29). In 1633, through a treaty made with the Pequots, the Dutch established a trading post in what is now Hartford (Figure 2.1) (Freeman 1995, 286). This delicate mercantilism was further disrupted when English settler-colonists came to the valley;

> Land ownership, conveyance, and especially political jurisdiction caused far greater furor in the Connecticut Valley, where the founding of several English towns in the mid-1630s unsettled existing patterns of Indian suzerainty and commercial relations among various Indian groups and with Dutch traders from New Netherland" (Vaughan 1999, 10).

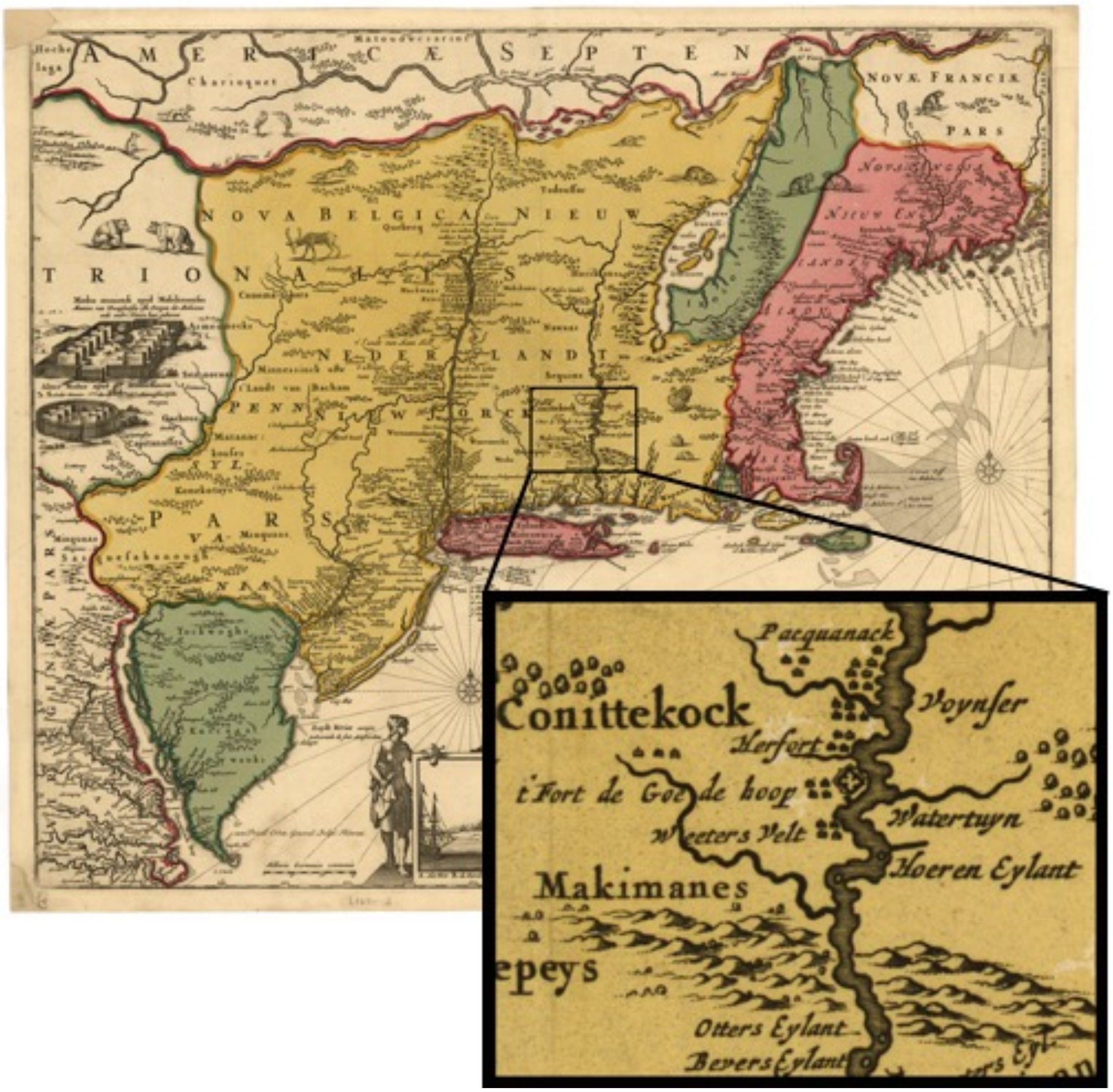


Figure 2.1: Map of New Netherlands and New England. The inset map shows the portion of the Connecticut River where the Hollister site is located. Visible in the inset is "t'Fort de Goede hoop," which is the trading post, the House of Good Hope, that was established by Dutch fur traders in 1633 (Freeman 1995, 286). Map from the Library of Congress (Visscher 1685).

Religious rivalries and population growth in the Massachusetts Bay Colony led many English settler-colonists to relocate to the enticing land along the Connecticut River (Vaughan 1999, 10, McManis 1975, 43-44). The town of Wethersfield was established in

1634 by colonists who migrated from Watertown, in the Bay Colony (Adams 1904, 19-20). Wethersfield spanned both sides of the river (Case 1886, 22). In 1672 Nayaug is cited as having been purchased from Sequin and was incorporated into the town of Wethersfield (Adams 1904, 43, 103). The portion of Wethersfield on the east side of the river, which included Nayaug, became a separate town, Glastonbury, in 1693 (Figure 1.1) (Adams 1904, 34). Historical sources note that at that time most of the Native Americans in Wethersfield lived on the east side of the river, in what would become Glastonbury (Adams 1904, 34). This information shows that while Glastonbury was appropriated by European settler-colonists, Indigenous peoples continued to occupy the area where the Hollister site is located.

Navigating the Colonial Landscape

The ways that Indigenous peoples of the Connecticut River Valley reacted to English colonialism were diverse. Colonialism inherently forces agents to navigate new relationships with each other and the land (Gomez 2010, 165, Ortner 2006b). In these settings, power and ownership were often contested, and power-laden interactions are manifested in various ways (Gomez 2010, 165, Ortner 2006b). In the area under study, Indigenous peoples used, among other strategies alliances, violence, and moves that allowed them to "'go on' in the world" (Silliman 2001, 192). These strategies are most evident in documentation of alliances, material culture, land conflicts, and wars.

European Christians, who colonized Connecticut, moralized the other; "The Christian writers…moralized them, treating the monsters sometimes as morally degenerate pagans, sometimes as signs of divine power and displeasure" (Grafton 1992, 40). For Christians, “civilized” peoples were also Christian, and the “uncivilized” were non-Christians. Broadly, the conceptualization of New England and its native occupants by English colonizers reflects the European Christian worldview and idea of “others.” In his petition on behalf of the colony of Connecticut to the King in 1662, John Winthrop says:

> petitioners have not had any opportunities, by reason of the late sad times, to seek for Letters Patent from his Majesty to to encourage them to go on through all difficulties and expenses in so great a work of plantation in a place so remote from the Christian world, and a desert so difficultly subdued and far separated from the other English plantations, not only by the vastness of the mountains of a dismal wilderness, but also by the habitations of the greatest nations of the heathen Indians of these parts, and where besides is much that hath been expended by their fathers and some of their associates yet surviving, for purchasing, building, culturing, and improving the place of their present abode (Winthrop 1662).

The imagery of Christian settlers, far from the Christian world, “improving” the vast “desert” amongst “heathen Indians,” reflects the ways that Christians had moralized not only foreign peoples, but foreign lands. The landscape and people are both depicted as in need of Christianization. The colonized people and land are folded into the existing canon of theological knowledge, guided by the Bible. It is evident from Winthrop’s petition and that Indigenous peoples of Connecticut were not considered “civilized”; they were outside of the Christian civilization that was colonizing the landscape. Because they existed outside of Christian civilization, they were perceived as beings who must be Christianized (Winthrop 1662). While this was the perspective guiding colonization of the region, it must be recognized that Indigenous peoples were not passive recipients of European culture.

It is often unacknowledged that Indigenous culture influenced that of European colonists. There is much evidence that transculturation occurred in early Connecticut (Lavin 2013, 311). Indigenous peoples introduced Europeans to American plants and animals, such as maize (Lavin 2013, 311). In fact, Native Americans taught English settler-colonists how to survive in the New England wilderness (Lavin 2013, 315). Discussing the settlement of Wethersfield, sources note that "The river Indians were friendly and taught the whites many things about the way to live in the wilderness. Had they been hostile, it is doubtful if our ancestors could have lived through the first two hard winters" (Curtis 1928, 9). It is clear that the survival of English settler-colonists in the Connecticut River Valley was dependent on cordial relationships with Indigenous peoples, and the adoption of Indigenous practices (Curtis 1928, 9, Lavin 2013, 311, 315).

The existence of Indigenous group boundaries are themselves a product of colonialism (Johnson 1999:155). Prior to colonization, indigenous polities were relatively egalitarian, and were characterized by fluid and dynamic identities and allegiances (Johnson 1999, 158, 160). The process of segmenting populations into distinct groups was accomplished "by crediting individual sachems with the authority to direct and speak for all 'their' people" whereby "English could enter into negotiations with whole 'nations,' and pit one nation against another as they sought prevent pan-tribal alliances from forming" (Goodby 1998, 163-164). Sachems were given the power to make important decisions regarding land, alliances, warfare, and trade (Johnson 1999, 158). Further, the pressure resulting from population decline, lack of land and resources, and competition in the fur and wampum trade reshaped former communities by rupturing some and forging others (Johnson 1999, 158). In these ways, traditional Indigenous community identities were disrupted. However, in practice the ways that individual agents lived may have rejected the colonial imposition of definitive tribal boundaries (Goodby 1998, 166).

One line of evidence supporting the contestation of colonial power and rejection of imposed social categories is through Indigenous ceramics (Goodby 1998). Late Woodland ceramics reflect the relative fluidity of polities and social boundaries of southeastern New England prior to colonization (Goodby 1998, 170). There is a lack of sharp boundaries for ceramic groupings, as with social grouping (Goodby 1998, 170). In general, because many Indigenous peoples adopted European brass kettles, there are fewer ceramic vessels from the seventeenth century than the periods preceding colonization (Goodby 1998, 171). Indigenous ceramics in Connecticut change drastically during the colonial period. Following the Pequot War (1636-1637), ceramics became exclusively shell-tempered, and the Shantok tradition, specifically, emerged and flourished (McBride, personal communication, 2017). The Shantok tradition survived until King Philip's War (1675) (Goodby 1998, 171, Kevin McBride, personal communication, 2017). After 1675, Indigenous ceramics disappear from the material record (Kevin McBride, personal communication, 2017). This is likely due to multiple factors, including the decimation of the Indigenous population of Connecticut during King Philip's War, which "wiped many defeated tribes off the map of New England forever" (Pequot Museum 2016). However, ceramics from this period do exist, and were being produced until at least King Philip's war, which lasted from 1675 to 1676 (Goodby

1998, 178, Grumet 1996, 86). It would be expected that with the emergence of discrete and competing tribal groups under European colonization, ceramic decoration would reflect these groupings in the seventeenth century (Goodby 1998, 166, 171, 180). Robert G. Goodby (1998) hypothesizes that "behavior resulting from the active role of the individual, consciously and deliberately manipulating style to either support or reject the centrality of social boundaries in social life" (180) should be apparent in ceramic decoration. However, there is no evidence that decoration was used to mark tribal affiliations, indicating that individual potters were actively resisting the effects of colonialism (Goodby 1998, 176).

Throughout the seventeenth-century different groups vied for land in the Connecticut River Valley. Contentious land purchases and appropriations caused the Indigenous peoples of the valley to negotiate relationships with incoming English settler-colonists and with the landscape (Vaughan 1979, 116). It has been suggested that in order to resist Pequot hegemony, Podunks, Wangunks, and Siciaoggs chose to ally with English settler-colonists (Vaughan 1979, 115-116). This strategy of alliance with the English may have driven Sequin (chief of Wangunks (Adams 1904, 32-33)) to sell the land of Wethersfield and Glastonbury to English settler-colonists (Vaughan 1979, 115-116), even though the concept of a land "sale" was foreign. The Indigenous conceptualization of the landscape as a whole was different from the European view of land as a commodity, which led to conflict and dissonance regarding land rights by 1636, when the permanence of land purchases was contested (Adams 1904, 39, 43-44, Grumet 1995, 154, Hinderaker and Mancall 2003, 28, Lavin 2013, 321-322). Indigenous peoples did not regard land as property that could be sold, but rather that it could be controlled in order to maintain ownership of the things the land produced, such as maize, fish, game, fruits, and nuts (Hinderaker and Mancall 2003, 28). In their perception of land, it was *access* to different land that could be traded (Hinderaker and Mancall 2003, 28). This conceptualization of the landscape is described by Lucianne Lavin (2013, 321) of the Institute for American Indian Studies: "Land was considered a gift from the Creator and an inheritance from the ancestors…The tribal community inhabited an intensely spiritual landscape filled with collective memories." In the contract outlining Sequin's sale of the land to settlers, it is stated that he may stay on the land and be protected by the settlers (Adams 1904, 43-44). This detail is important, because it shows Sequin's conceptualization of the land as unownable, while simultaneously exhibiting his attempts to negotiate relationships with the incoming settlers and the landscape, and to resist Pequot hegemony and European colonialism.

This strategy of attempting to maintain land rights was not unusual among Indigenous peoples coping with European colonists. While

> the documents…referred to as deeds were often carefully worded agreements to share the use of homelands and resources…native people consistently reserved for themselves the rights to collect firewood, hunt and fish, use their planting fields, and even build wigwams on the colonists' common pastures" (Handsman and Lamb Richmond 1995, 101),

it is rarely acknowledged that Native Americans consciously chose to, and evidently succeeded, to continue to live on their ancestral land (Handsman and Lamb Richmond 1995, 103). Despite this, native communities struggled to persist in traditional lifeways as English colonists settled along the Connecticut River Valley (Bragdon 2001, 50. Trade became necessary to survive, but often at a cost (Hinderaker and Mancall 2003, 9). Accompanying commercial relationships were the spread of disease, leading to tragic population decline, and conflict, which resulted in warfare (HInderaker and Mancall 2003, 9, 15-19).

While English settler-colonists were flowing into the region and Indigenous peoples were navigating the new colonial landscape, Pequots continued to be a formidable force. In 1634 Pequots were at war with Dutch traders and Narragansetts (Vaughan 1979, 124-215). In this conflict an English man was murdered, which caused English colonists to have a stake in the fighting (Vaughan 1979, 125). English settlers moved into Connecticut Valley, where Pequots tried to maintain control (Hinderaker and Mancall 2003, 29). In the fall of 1634, a treaty was signed which prohibited Pequots from attempting to stop the "River tribes" from selling land to colonists (Vaughan 1979, 125). Conflicts between different groups of Indigenous peoples and colonists culminated in the Pequot War which lasted from 1636 to 1637 (Silliman 2009, 218). The Pequots were destroyed in this engagement (Vaughan 1979, 149). In 1638 the Treaty of Hartford was signed and Pequots were forced to officially disband, and many were sold into slavery (Lavin 2013, 336, Vaughan 1979, 150).

Another conflict more pertinent to the study of the Hollister site is King Philip's War, which lasted from 1675 to 1676 (Grumet 1996, 86). King Philip, or Metacomet, was the Wampanoag leader, who sought for the tribes of New England to overthrow the English while their settlements were still relatively dispersed (Lavin 2013, 332). This was in response to the devastation, such as the loss of population, land, and lifeways, which had been caused by English colonization (Lavin 2013, 331). Metacomet's hopes were not satisfied, as tribal groups navigated the colonial landscape in complex ways, with some remaining neutral and others were allying with the English (Lavin 2013, 332). In the Connecticut River Valley, hostages were demanded from Indigenous communities (Lavin 2013, 332). Records from a meeting of the Council of War in Hartford on October 26th, 1675 document this demand for hostages:

> The Councill [sic] also came to agreement wth [sic] the Indians of these plantations in the county of Hartford, that they should be friendly to us and giue [sic] us hostages to assure of us of their friendship to us and that no damage be done to us by them, which should be continued wth [sic] us till the war is over" (Trumbull 1852, 378).

The war ended in 1676, when Philip was killed (Lavin 2013, 333).

It is evident through historical documents that John Hollister had a mutually beneficial relationship with the Wangunk of Glastonbury. It seems that Hollister was designated as a sort of intermediary between the Council of War and these Indigenous peoples during King Philip's War (Trumbull 1852, 375). A meeting on October 11th of 1675 shows that a Mr. Tallcott was ordered to help the "Wongun Indians" and their corn into town, presumably to protect them and their corn from potential raids (Trumbull 1852, 375). This order is to be delivered to the Indians directly, or to Mr. Hollister (Trumbull 1852, 375). This shows that Hollister seemingly had regular, and friendly, contact with the Wangunk of Glastonbury (then Wethersfield). On the same date, at Hollister's request, "the Court did permitt [sic] him to hire two or three men to fortify his house and secure his corn on the east side of the Great River" (Trumbull 1852, 375). Various historical sources postulate that these men who would have been hired by

Hollister were Wangunk (Adams 1904, 34, McNulty 1970, 15). Given his seemingly close relationship to the Wangunk, this seems likely. Hollister's relationship to the Wangunk in Glastonbury illustrates that Indigenous peoples were navigating the new colonial landscape in various ways, including allying or befriending English settler-colonists, and forging mutually beneficial relationships.

There is also an interesting document, in which a relationship between the Hollister family and a Wangunk girl, named Amix, is discussed. It is unclear where exactly this document originated, but it appears to derive from family history and lore that, while perhaps not completely truthful, may contain elements of a forgotten past. Amix is described as interacting with the Hollisters, learning from them, while also maintaining her own cultural practices, such as skinning and drying hides, and making clay pots. The document reads, "The Hollisters were good friends of the Indian girl and she helped them in getting along with the rest of the Red Hill Indians" (JSP 90). While this document should be referenced with caution, it is an important insight into how interactions between Indigenous peoples and the Hollister family may have transpired.

Hollister Occupation

Drawing upon historical documents, it can be determined who was occupying the site at certain points during the latter half of the seventeenth-century. Lieutenant John Hollister immigrated to America in approximately 1642, and was living in Wethersfield by 1644 (Adams 1904, 30, Case 1886, 19). Lieutenant Hollister's influence is described: "He was a large land-holder in Wethersfield, especially in that portion of the town lying on the east side of the Connecticut River, now known as Glastonbury" (Case 1886, 22).

Probate records and wills speak to the amount of wealth held by the Hollister family at Nayaug. Hollister obtained this land sometime from 1640-1645 (Glastonbury Records a, 2-3). The farm was occupied by tenants, Josiah Gilbert and family, from 1651 until 1663 (Glastonbury Records 1680, 126). There was presumably a house at this point, because Gilbert is recorded as having occupied Hollister's house in Nayaug (Glastonbury Records a, 2-3). Often, starter homes were built first, then settlers built more substantial structures (Harper 2012, 10). This land was passed to his son, John Hollister, upon his death in 1665, where it is referred to as "Nayog" (Case 1886, 25, Hollister 1665). This John Hollister died in Glastonbury in 1711, and it is soon after that the site was probably abandoned (Hollister 1711).

Post-occupation

Since the cellars were abandoned at the beginning of the eighteenth century, the site has served as an undeveloped agricultural field. A tobacco barn was constructed in the 1930s, but has since been removed. The activities that have occurred on the site in the three-hundred years since it was occupied have been minimal, leaving the site in excellent condition.

Stories of the farmstead survived, and in the summer of 2015, geophysical methods were employed to try to locate it. Doctor Brian Jones, the State Archaeologist of Connecticut, enlisted Peter Leach, a doctoral student at the University of Connecticut, to conduct ground-penetrating radar in the field where the Hollister farm was said to have been. This survey revealed a number of cellars and other features (Figures 1.2 and 1.3).

These intriguing results prompted Dr. Brian Jones to conduct a number of excavations during the summer of 2015 (Figure 1.4). Excavations were conducted by nonprofessionals, so there is not detailed information concerning stratigraphy, or the depth of artifacts. Even so, these excavations unearthed a number of artifacts, such as pipe stems, that could be dated to the seventeenth-century. This aligned with the Hollister occupation, confirming that the features located through ground-penetrating radar were related to the seventeenth-century farmstead.

Because there are so few, intact sites from this period in the region, the need for further investigation was realized immediately. Jasmine Saxon and I were recruited to conduct research at the site for our masters' theses beginning in the spring of 2016. The following chapters detail our work and individual research.

CHAPTER THREE: METHODS

By employing integrated methods, a comprehensive dataset of features, artifacts, and documents was obtained for the Hollister site. The geophysical methods magnetometry and ground-penetrating radar (GPR) were used to find features, recreate the colonial landscape, and to determine the extent of the site. Excavations were guided by the geophysical methods and were conducted in order to uncover artifacts and small-scale features not visible in the geophysical data. Archival research was conducted in order to supplement these data. Historical documents allow for a deeper understanding of the features, artifacts, and people who were occupying the site.

A local grid was established across the site by Dr. Brian Jones, the Connecticut State Archaeologist. A historical well was used as the N0E0 point, and a Topcon GTS201D total station was used to set up control points across the landscape (Figure 3.1). This grid was used to create grids for collecting magnetic and ground-penetrating radar data. Excavation units and test pits were also integrated into this grid.

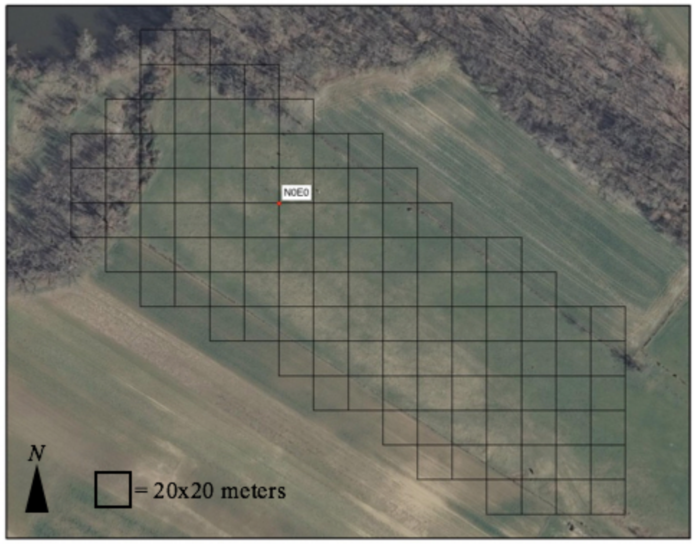


Figure 3.1: Image of the local grid that was established across the site. The red dot indicates the location of the N0E0 point, which is over a historical well. Each square in the grid is 20x20 meters. (Basemap from CTECO 2012).

Ground-penetrating radar was first conducted at the site during the summer of 2015 by Peter Leach, a doctoral student at the University of Connecticut. I processed these data in November and December of the same year. The GPR data were collected in three grids totaling an area of 100x30 meters. There was an abundance and range of features visible in in images produced from the data, demonstrating the necessity for further research.

In the summer of 2015, eight 1x1 meter excavation units were placed around a rectilinear feature that had been identified in GPR images. The excavations were conducted by non-professionals during a public day at the site and unfortunately there is little information concerning stratigraphy, depth, or provenience of artifacts discovered. This work yielded artifacts that were dated to the seventeenth-century. There are very few preserved remains from this time period in Connecticut, which makes work there especially significant.

Research at the site continued in March of 2016, when Jasmine and I conducted magnetometry. Magnetometry is a geophysical method of data collection in which variability in earth's magnetic field is measured (Kvamme 2006a, 206). This variability may be used to identify subsurface features altering earth's magnetism (Kvamme 2006a). Magnetic data are limited because the depth or detail of features may not be identified, however, a large amount of data may be collected in a relatively short amount of time (Kvamme 2003, 2006a). Thus, we were able to collect thirty, 20x20 meter grids in two days. Our goals were to determine the extent of the site, and to identify features to investigate further. Details concerning the collection, and processing of the magnetic data will be discussed in the section of this chapter focusing on magnetometry.

We returned to the site in July of 2016 to conduct GPR research. Ground-penetrating radar was conducted in areas of interest produced by the previous GPR data collected by Peter Leach, and the magnetic data. In total, ten grids of various dimensions were collected. The data were processed and analyzed each night. They were also used to determine where to collect further GPR data, and where to place excavations.

Excavations were also conducted in July of 2016. The locations of units and test pits were guided by the geophysical data. Three trenches, each measuring 3x1 meters, and two 1x1 meter units were excavated. In addition to the excavation units, thirty-six test pits were excavated across the site. These were placed over three of the cellars, in the area around the cellars, and over features of interest visible in the GPR data.

Finally, archival research was carried out in the summer of 2016. We visited the Wethersfield library, the Connecticut State Library, the Connecticut Historical Society, the Wethersfield Historical Society, and the Glastonbury Historical Society in order to collect archival resources and other historical documents that could supplement the archaeological data. Specifically, documents concerning the owners and occupants of the site during the period of occupation were collected so that a better understanding of the features and artifacts at the site may be formed.

Previous Work

A ground-penetrating radar survey and limited excavations, both conducted in the summer of 2015, preceded our work at the site. Peter Leach, a doctoral student at the University of Connecticut, collected GPR data at the site 2015. The data from Leach's 2015 survey showed four cellars and a number of other interesting features on the landscape, which prompted further study. Following Leach's GPR survey, excavations were conducted during a public dig day at the site. While these excavations were limited, they yielded 17th-century artifacts, further validating the need for archaeological research to be conducted, since there are few sites that date to this period of Connecticut's history.

Collaboration between Dr. Brian Jones, the Connecticut State Archaeologist and the landowner of the Hollister site, prompted the noninvasive GPR survey conducted by Peter Leach in the summer of 2015. Family histories had reached the landowner, a direct descendent of John Hollister, that indicated that there was a seventeenth-century farmstead buried in the pasture behind his home. It was unknown where exactly this site could be, so Peter Leach, a PhD student at the University of Connecticut, was asked to collect GPR data in the pasture. Three grids were collected by Leach, totaling 100x30 meters. These data revealed over a dozen features of various origins, which have been annotated (Figure 1.3). The number and variety of features in the data are intriguing and show the need for a broader analysis of the features on the landscape through integrated geophysical archaeological methods.

Peter Leach contacted Larry Conyers at the University of Denver concerning the GPR data, who suggested that graduate students conduct future research at the site. We were sent the data in the fall of 2015. In November and December of 2015 I processed the data and examined the profiles in order to better understand the vast number of features evident in the data. I created a number of amplitude slice-maps, on which I annotated features (Figure 3.2). I also located each feature in the profiles (Figure 3.3), and noted features that were visible in profiles and not the slice-maps. The images below exhibit the types of features that are throughout the data set, and how they appear in amplitude slice-maps and profiles (Figures 3.2 and 3.3).

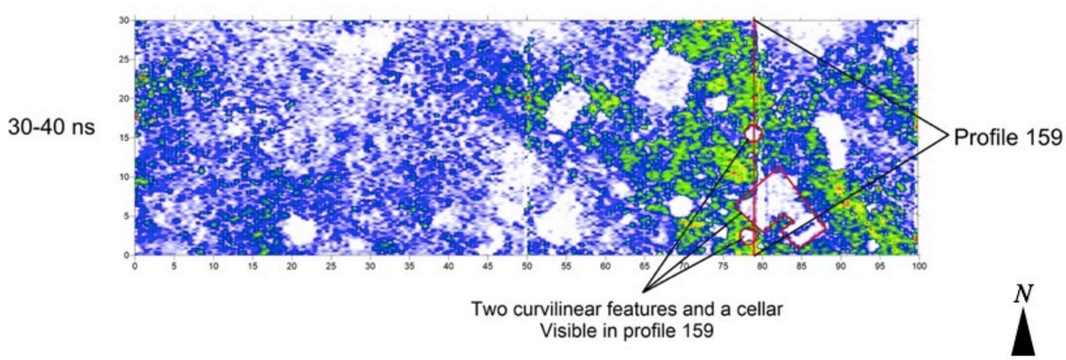


Figure 3.2: Slice-map of Peter Leach's GPR grid collected in the summer of 2015. Annotated is Profile 159 and the three features that are visible in both the slice-map and profile. Two curvilinear features of unknown origin and a cellar are clearly visible in this map. These features are distinctly defined in the profile, where their depths can also be determined (Figure 3.3).

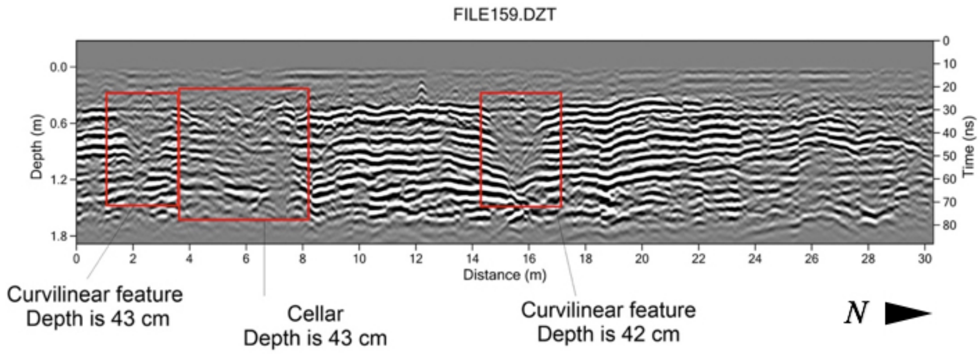


Figure 3.3: Three features are annotated in Profile 159. All three are visible as areas of low amplitude and truncate the natural stratigraphy beginning at a depth of approximately 43 centimeters. These features are also visible in the slice-map produced from the data (Figure 3.2).

By analyzing Leach's data, I was able to comprehend the copiousness and diversity of features at the site. The rectilinear features that are visible are likely European in origin and are possibly cellars beneath houses (Conyers 2012, 118-119). It is unclear if other curvilinear features are European, Indigenous, or both. I was especially interested in the circular features that were throughout the GPR data set, and thought they required further investigation. I hypothesized that they may be associated with an Indigenous occupation of the site, or perhaps a palisade that was reportedly constructed on the site in 1675 (Adams 1904, 205, 207, 212, Brian Jones, email to author, January 21, 2016, Pequot Museum 2016). These preliminary hypotheses formed by this initial GPR survey helped to guide future research at the site.

In August of 2015, limited excavations were conducted at the site. The red squares in Figure 1.4 mark the locations of eight, 1x1 meter units that were excavated during a public dig day (Figure 1.4). These units were placed around the perimeter of one of the cellars based on the GPR data collected by Leach. Since these excavations were completed by nonprofessionals, there is little data concerning stratigraphy and or provenience of artifacts. Nevertheless, the artifacts recovered through these excavations, specifically, a number of pipe stems, could accurately be dated to the seventeenth-century. This coincided with the dates prescribed to the farmstead that was reportedly associated with the cellars visible in the GPR data. Because few sites from so early in Connecticut's colonial history exist in Connecticut, it became clear that this site had great research potential.

The work done in the summer of 2015 showed that there was great need for further research at the site. The features visible in the GPR images, coupled with the seventeenth-century artifacts recovered through excavations, indicated that the site was an early colonial farmstead. Sites of this nature are rare in Connecticut, so the State Archaeologist of Connecticut, Dr. Brian Jones, was interested in pursuing further research. Since Jasmine and I had been incorporated into the research project, we proposed that we use the existing GPR data to plan and conduct additional geophysical survey and excavations through the spring and summer of 2016. This proposal was met with enthusiasm.

Magnetometry

The first survey method employed at the site was magnetometry, in March of 2016. Our goals in collecting magnetic data were to determine the extent of the site, create a comparative model, and to establish where to conduct a GPR survey in the summer of 2016. Over the course of two days, we collected thirty 20x20 meter magnetic grids, which were compiled to form a complete magnetic map across the landscape (Figure 3.4). The magnetic data overlapped the GPR grid collected by Leach in the summer of 2015 in order to compare the magnetic and GPR data (Figure 3.4). Once the data were collected, they were processed so that features in the data could be identified. The magnetic map was then annotated so that different types of magnetic anomalies could be interpreted. This allowed for comparisons to be made between the magnetic and GPR data, for conclusions to be drawn about subsurface features and the extent of the site, which could then be used in planning GPR surveys and excavations.

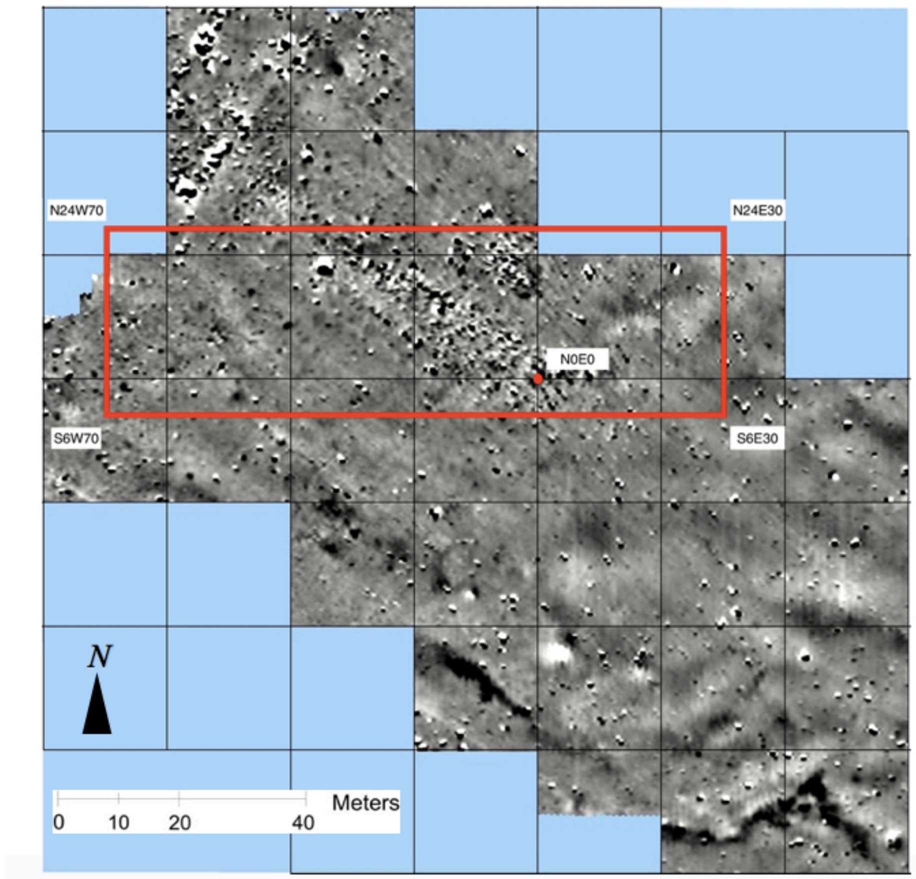


Figure 3.4: Outline of ground-penetrating radar data collected by Peter Leach in 2015 overlaid on the magnetic data collected in March of 2016.

Background: Magnetic Survey

Magnetometry is a geophysical archaeological method of data collection. A magnetometer measures the variability of earth's magnetic field produced by objects and features buried in the ground (Kvamme 2006a, 206). Both chemical and thermal processes cause certain features and objects to retain thermoremanent or retained magnetism (Kvamme 2006a). These magnetic materials then modify earth's magnetic field very slightly, and can be measured by sensors on the surface (Kvamme 2006a). During collection, earth's magnetic field is measured by the magnetometer in nanoteslas (nT) (Kvamme 2006a, 208). Ken Kvamme recommends that magnetometers that are accurate to .01 nT be used in order to detect smaller, subtler anomalies (Kvamme 2006a, 211). This can be achieved by setting the range on the magnetometer to record data that are within (+/-) 100 nT of the calibrated "zero" point of earth's magnetic field (Bartington Instruments Iss26, 22). Magnetometry is suitable for large-scale surveys of the landscape as it may be performed over large areas in relatively little time (Kvamme 2003, 2006a). While magnetic data are useful for locating the general areas of certain features, this method is limited because it cannot determine the depth of buried features, and it measures a relatively narrow range of features. Features that can be found with magnetic data include: the accumulation of fired artifacts, areas where the topsoil has been removed during the construction of features such as ditches and pits, features such as mounds, berms, and pits where topsoil has accumulated, rocks used for building, and metal artifacts (Kvamme 2006a, 441). We conducted magnetometry where Peter Leach had conducted GPR, and compared the data to the extant GPR data in order to determine what certain features look like in both data sets (Figure 3.4). This enabled us to better interpret magnetic data throughout the rest of the site, and to determine the limits of the site. Concentrations of features and artifacts could be associated with the site, while areas with fewer or no magnetic anomalies were determined to be beyond the limits of the site. These data were also helpful in choosing, based on where anthropogenic features are located, where to conduct additional GPR data collection in the summer of 2016. Data that are indicative of structures such as palisades or fortifications, or features that appear to be linear postholes were especially important in determining where to collect GPR data.

Data Collection

Magnetic data were collected on March 16th and 17th of 2016. Prior to collection, it was necessary to set the data collection parameters and calibrate the Bartington Grad 601-2 magnetometer. The parameters were the same for both days of data collection. The pace determines how quickly the magnetometer must be moving in order to collect a specific number of samples for each meter, and will vary based on the stride of the collectors. This pace was set for Jasmine Saxon and me, who were collecting the data. The pattern of collection was zig-zag, with the first traverse in the north direction. Two sensors were used, which means that there were two traverses for every meter in the x direction. Using two sensors reduces the data collection time, because two lines of data are collected in each traverse (OM 1800: 9). For each meter in the y direction, there were 8 samples, or readings. The nanotesla range was +/-100, meaning that anomalies that alter earth's magnetic field within a resolution of 0.01 nT will be recorded (Bartington

Instruments Iss26, 22). This means that smaller, subtler anomalies, as would be expected from a historical archaeological site, will be recorded (Kvamme 2006a, 211). It is important to calibrate the instrument so that a “zero” point correlated with earth’s magnetic field can be determined. This is the reference point around which positive and negative anomalies will be recorded in nanoteslas (Kvamee 2006a, 208). To calibrate the magnetometer, we followed the directions on the instrument, which were to face the cardinal directions and invert the magnetometer. Once the parameters were set and the magnetometer was calibrated, we began data collection. It was necessary that no metal was worn by anyone assisting with data collection, because metal can adversely interfere with the magnetic readings. Magnetometers are quite sensitive, and ferrous metal, and electric and magnetic fields on the operator or assistants can be recorded, compromising the data set (Kvamme 2006a, 226-227).

Over two days, thirty grids were collected, twenty-nine of which were 20x20 meters, and one that was 20x10 meters (Figure 3.5). Two of the 20x20 meter grids were truncated due to obstacles, such as brush. For each traverse, we walked at a constant pace, with the magnetometer beeping every meter as it recorded measurements. We used marked ropes to keep a steady pace and to ensure that we were collecting the correct traverse. There were 41 traverses in each grid.

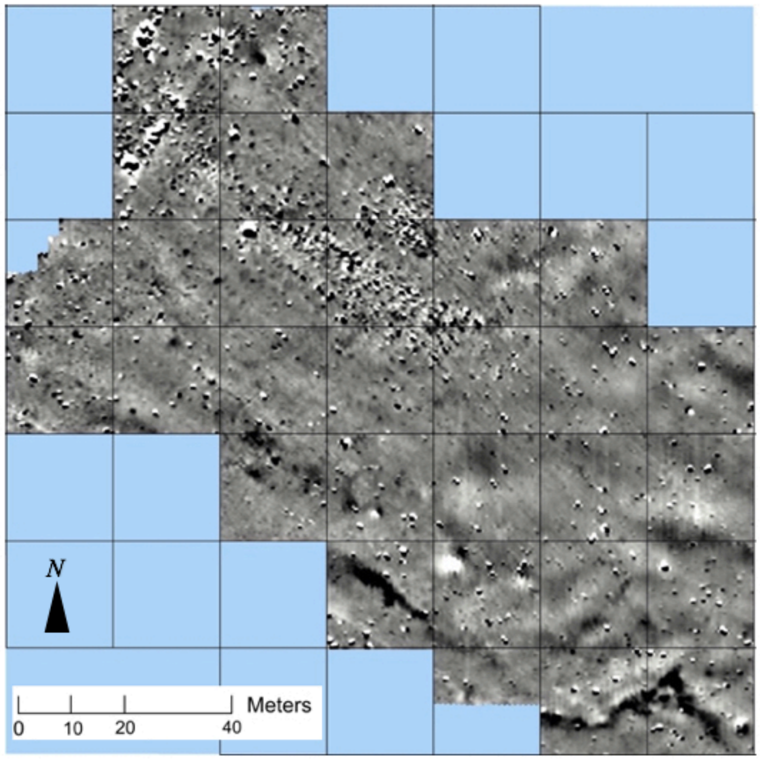


Figure 3.5: Compilation of 30 grids of magnetic data collected in March, 2016. The data were processed to produce this image. Each square is 20x20 meters, and is tied into the local grid. Image courtesy of Andy Creekmore.

Data Processing

The software used to download and process the magnetic data is Terrasurveyor (DW Consulting 2016). Each grid was imported into Terrasurveyor, and a composite (a map with all of the grids put together) was created by orienting each grid in space. There are a number of processing methods that were applied in order to best interpret the magnetic data (Andy Creekmore, personal communication February 18, 2016). Data spikes are extreme values that are caused by metal or magnetic artifacts (Kvamme 2006b, 237-238). The despike function removes these extreme nanotesla values and replaces them by averaging nearby values (Kvamme 2006b, 237-238). This is done so that extreme measurements do not visually obscure other, less extreme, values (Kvamme 2006b, 237-238). Striping in the data is caused by discrepancies in nanotesla values between traverses, often caused by the position of the magnetometer in relation to the ground (Andy Creekmore, personal communication February 18, 2016). This is because the sensitivity of the magnetometer is so great that height differences as small as a centimeter can affect the nanotesla values that are recorded (Kvamme 2006b, 241-242). The destripe function uses the mean nanotesla values from adjacent traverses to adjust the values and minimize striping (Andy Creekmore, personal communication February 18, 2016). Since the data are collected in traverses that are aligned and combined for each grid, there is typically a degree of misalignment and offset, visually apparent as a herringbone pattern, between adjacent traverses, called staggering (Kvamme 2006b, 241). The destagger function digitally slides alternate transects so that they are aligned properly (Kvamme 2006b, 241). The clipping function clips high and low nanotesla values, "permitting lower-contrast data to become more visible" (Andy Creekmore, personal communication February 18, 2016). Frequency in magnetic data "can be thought of as the spatial dimension of image components," or the size of image features (Kvamme 2006b, 242). Low pass frequency filters may be applied to the data to remove features small in size, which are often produced by instrument noise (Kvamme 2006b, 242-243). Alternatively, the filtering of high-frequencies (larger image components) can allow for smaller features to become more visible (Kvamme 2006b, 242-243). Pixelation in the image produced form the data can be caused by unequal sampling rates in the data set (Kvamme 2006b, 242). The interpolation function uses the extant data points to create new points, producing a more continuous data set and reducing pixelation in the image (Kvamme 2006b, 243, Andy Creekmore, personal communication February 18, 2016). This is important, because when the image is too pixelated, the eye is drawn to the edges of pixels, making it appear as though there are features where there are not (Kvamme 2006b, 243). Some experimentation was necessary when processing the data. It was important to apply each processing method with different parameters to visualize how it was affecting the data. Then, a satisfactory composite could be used to analyze and interpret the magnetic data.

Once a map was created, we examined and analyzed the anomalies visible across the site (Figure 3.6). Figure 3.8 shows an annotated map depicting anomalies that were especially interesting. These anomalies were used to plan future geophysical survey, compare magnetic and GPR data, and to interpret features on the site.

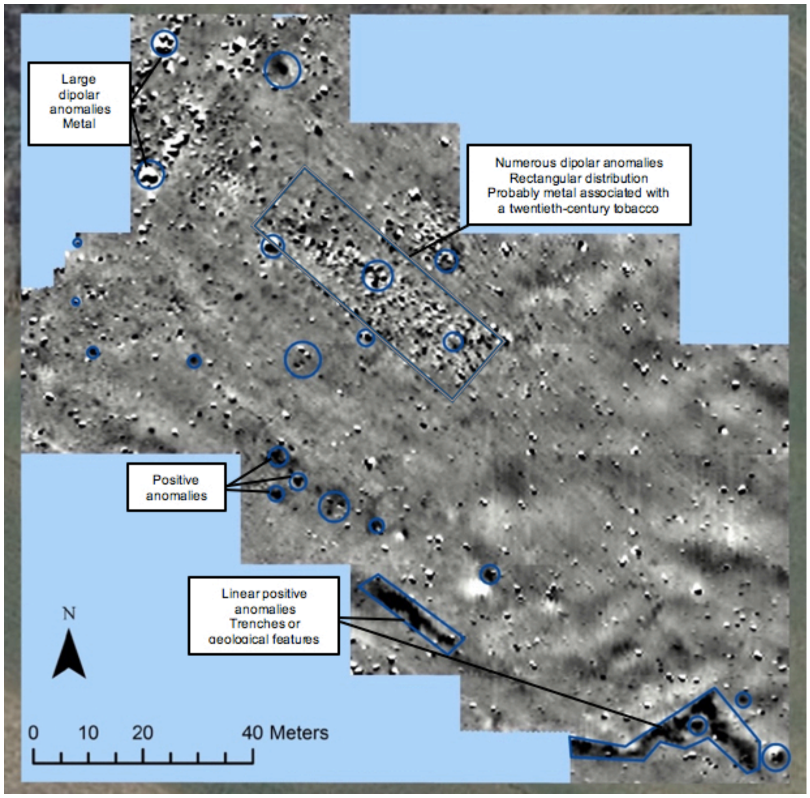


Figure 3.6: Annotated map of magnetic data. Different features and anomalies were chosen for future geophysical investigation. Original composite courtesy of Andy Creekmore. (Basemap from CTECO 2012).

Conclusion

The magnetic data revealed numerous features and anomalies across the landscape. These allowed for the extent of the site to be determined, and for areas to be selected for future GPR survey. Also, because we collected in the same area where Leach had conducted GPR, we were able to create a comparative model of what certain features and artifacts look like in magnetic and GPR data. The information derived from the magnetic survey were used to plan the GPR survey in the summer of 2016.

Ground-penetrating Radar

Building upon previous GPR data collected by Peter Leach in 2015, and magnetic data collected in the spring of 2016, we conducted a GPR survey in the summer of 2016. Previous data were used to determine where grids were to be located. These were chosen primarily to compare magnetic and GPR data, and to investigate features visible in the magnetic data in more detail. This is because, in comparison to magnetic data, GPR can reveal the depth and greater detail of subsurface features. In total, ten grids of various dimensions were collected across the site. These were tied into the local grid established across the landscape by Brian Jones. Once the data were collected, they were processed so that they could be more accurately and thoroughly analyzed and interpreted. In doing so, images from the data were produced that allow the data to be viewed two- and three-dimensionally. Interpretations of the data collected in this survey allowed for the extent of the site to be established, detailed information to be determined about a number of subsurface features, and for locations of excavations to be chosen with precision.

Background: Ground-penetrating Radar Collection and Processing

In contrast to magnetometry, GPR can determine the depth and greater detail of subsurface features that are both geological and anthropogenic. The collection of GPR data occurs when electromagnetic waves are transmitted into the ground, reflect off buried discontinuities and return to the surface to be measured (Conyers 2013, 27). Two-way travel time, the amplitude, and wavelength of the reflected wave are measured when it returns to the surface (Conyers 2016, 2, 2012, 28). The velocity of the wave changes depending on the properties of the buried feature that it encounters. This change is typically based on differential water saturation, which then produces reflections that may be viewed in images produced from the data (Conyers 2013, 27).

For our survey, we used a GSSI 400 MHz antenna and a GSSI SIR-3000 control unit, which were generously loaned to us by Peter Leach (Figure 3.7). Several variables must be considered when deciding what frequency antenna to use for data collection. The wavelength of propagating radar energy is directly related to energy frequency (Conyers 2012, 27). Wavelength is related to the degree of resolution that can be achieved through reflected energy (Conyers 2012, 27). Because the wavelengths of radar energy propagated from higher frequency antennas are shorter, they produce greater feature resolution than the longer wavelengths produced from lower frequency antennas (Conyers 2012, 27). However, frequency is also one variable that determines the depth to which radar energy is able to penetrate (Conyers 2012, 27) Lower frequency antennas, measured in megahertz (MHz) create longer wavelengths, which penetrate more deeply than shorter wavelengths produced by higher frequency antennas (Conyers 2013, 25). In this survey, a 400 MHz antenna was used, because it was necessary for the energy to penetrate more deeply than would have been possible with a 900 MHz antenna. With the 400 MHz antenna the radar was penetrating to a depth of about 2.5 meters. Radar waves from 900 MHz antennas typically do not penetrate more than one meter into the ground (Conyers 2012, 27).

Figure 3.7: The GSSI 400 MHz antenna is the orange box attached to the bottom of the cart. The blue cord connects the antenna to the GSSI 3000 control unit, where the data is stored.

Before the data may be collected, a number of parameters must be set on the control unit. The radar waves are transmitted from the antenna, reflect off of buried discontinuities, and return to the antenna, where they are recorded as a function of the time over which it takes for this to occur, or two-way travel time, and amplitude (Conyers 2012, 28, 2013, 27, 2016, 2). Reflection traces are composed of a number of samples, usually 512, over the two-way travel time window (Conyers 2013, 28). There are forty traces collected every meter, or one about every 2.5 centimeters. These traces are then compiled, or stacked, to create a reflection profile, which is the two-dimensional data produced from one transect (Conyers 2013, 29). The two-way travel time is measured in nanoseconds. The time window for the two-way travel time of the recorded wave should be determined based on the depth of features of interest (Conyers 2013, 92-94). It is also important to examine the wiggle trace, which depicts the wave being transmitted into the ground, while setting the time window, because it will indicate at what time the wave is being attenuated and recorded as noise. Once the maximum depth at which radar energy can be reflected back to the antenna has been reached, all that is recorded is noise (Conyers 2012, 96). Noise is visible in the wiggle trace as constantly changing amplitudes, deeper in the time window (Conyers 2012, 96). If the time window is too small, then important features in the ground can be missed, because the radar energy may not be penetrating as far into the ground as possible (Conyers 2013, 92). Alternatively, if the time window is open for too long, the resolution of the wave may be compromised, since more samples would be necessary to produce a well-defined waveform (Conyers 2013, 95). Typically, 512 samples are sufficient in order to create a composite trace (Conyers 2012, 32).

The frequency of the antenna being used must be selected, and the filters relating to that frequency must also be input. The frequency of an antenna is defined by the mean, and other frequencies are produced and recorded that are higher and lower than the mean frequency (Conyers 2012, 27). The filters determine which frequencies will be recorded. For a 400 MHz antenna, the filters would be set so that frequencies of 200 MHz and higher, and 800 MHz and lower would be recorded.

Since the radar waves spread conically and attenuate as they travel deeper into the ground, reflections received later in the time window will have, on average, lower amplitudes than those recorded earlier (Conyers 2013, 99). In order to adjust for this, and to make deeper reflections more visible, range gains may be set for collection (Conyers 2013, 99). Gains amplify amplitudes from later in the time window so they fit the average from earlier amplitudes (Conyers 2013, 99). To set the gains prior to acquisition, the antenna should be moved around the grid to ensure that the gains are both sufficient and not set so high that high-amplitude waves are clipped and therefore not recorded (Conyers 2013, 102).

The first direct wave should be set to 3.31 samples, or when time zero is -1 (Conyers 2013, 99). The direct-wave is the first reflection received by the antenna, and is of the ground surface (Conyers 2013, 99). Setting the direct-wave to -1, or one nanosecond into the time window, is done so that the ground surface can be located in profile, and only one nanosecond is used to locate it (Conyers 2013, 99).

Finally, the survey wheel must be calibrated through the control unit. The survey wheel turns as each transect is being recorded, and determines that forty traces are collected in each meter. It also ensures that the length of each transect is accurately recorded.

Once the parameters are set on the control unit, the data may then be collected. Data are collected by pulling an antenna back and forth in a zigzag pattern across the ground. This is done in parallel transects at predetermined intervals, usually either 25 or 50 cm (Figure 3.8). These transects are then aligned to form a grid.

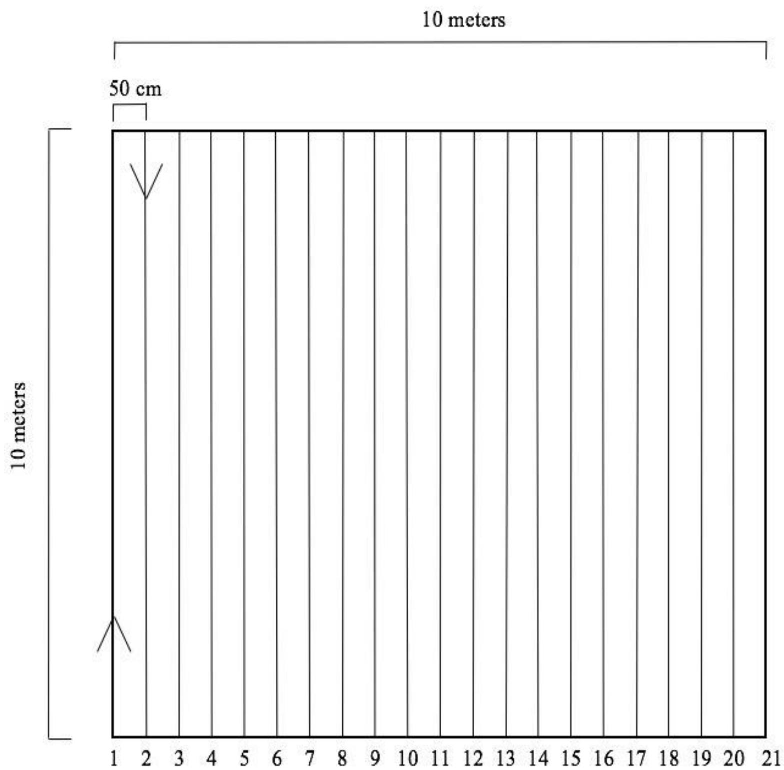


Figure 3.8: Diagram showing how to collect GPR transects in a grid using the zigzag collection method. A 10x10 meter grid with 50 centimeters between transects will have 21 profiles.

Images are produced from the data so that they may be viewed and interpreted. There are three primary software packages that were used to view, process, and analyze the data; GPR Viewer, GPR Process, and Surfer. Since transects are collected in alternating directions, GPR Process aligns the profiles so that they are oriented so that north is in the same direction for all. Profiles may be analyzed in GPR Viewer, where it is also possible to find RDPs for each grid in order to convert time to depth. GPR Process and Surfer are used to create plan-view amplitude slice-maps of the grids (Figure 3.9).

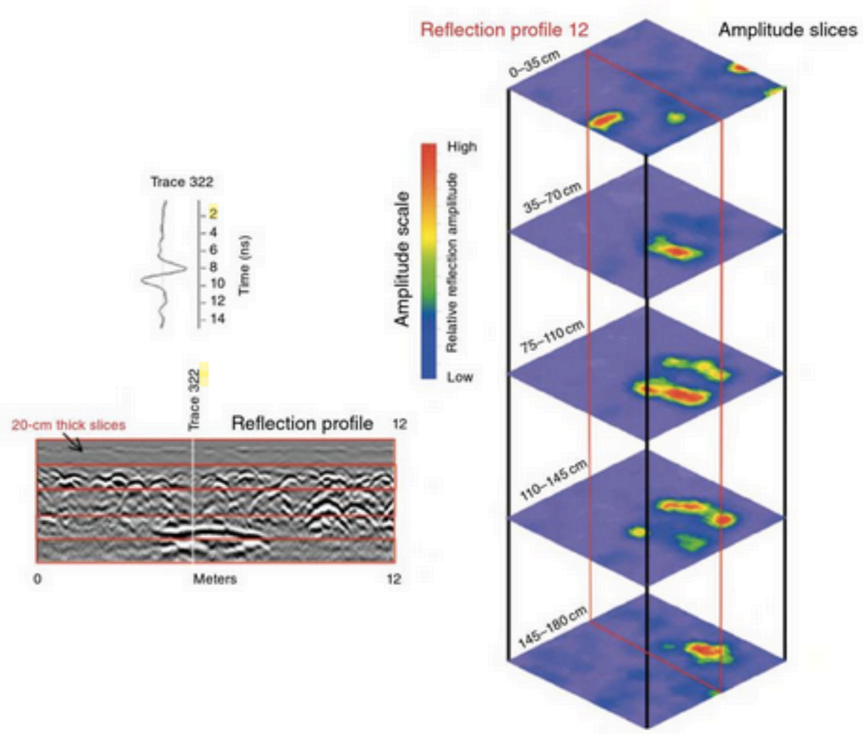


Figure 3.9: Image showing how profile images and amplitude slice-maps are related (Conyers 2016, 13). The colors in amplitude slice-maps are explicated by the scale bar labeled "Amplitude scale." Red colors are indicative of higher reflection amplitudes, while white and blue represent lower amplitudes (Conyers 2016, 13)

GPR Viewer is used to view the raw data in two-dimensional profiles (Figure 3.9). Background noise is produced when radio waves that were not transmitted by the antenna are recorded (Conyers 2012, 96). Background noise can be easily removed from profiles in GPR Viewer. The range gains can also be adjusted so that reflections become more visible (Conyers 2012, 96). The hyperbola fitting function can be used with point-source hyperbolas to find the relative dielectric permittivity (RDP) of the soil matrix. Hyperbolas of known geometry are fitted to hyperbolas in the data, and can then be used to determine the RDP of the soil in which the data were collected (Conyers 2013, 126).

Relative dielectric permittivity "measures velocity of propagating radar energy and also its strength" (Conyers 2013, 49). Once the RDP is found, it can be used as a proxy measurement for the velocity of waves traveling through the medium in profile (Conyers 2013, 48-49). The RDP can be entered into GPR Viewer, and the depth of the reflections in profiles will adjust accordingly. Since radar waves are recorded in two-way travel time, this allows for the locations of features in the vertical dimension to be converted from time to depth.

Slice-maps are plan-view maps of the data (Figure 3.9). They depict the entire GPR grid from above by using data from transect files. They are sliced horizontally in predetermined nanosecond ranges. Sequential slice-maps show data at increasing nanosecond ranges, with time being a proxy for depth (Figure 3.9). The velocity that was found in GPR Viewer can be applied to these slices to find accurate depths for features visible in the amplitude slice-maps. The color scale of slice-maps is such that warmer colors represent higher amplitudes, while cooler colors represent lower amplitudes (Figure 3.9).

In some cases, it is necessary to frequency filter the data after collection. This is often done when the antenna has received waves transmitted by outside antennas on the same electromagnetic spectrum, such as radios or cell phones (Conyers 2013, 26). Another instance where frequency filtering is beneficial is when it is necessary to isolate features that produce lower amplitude reflections (Conyers 2013, 143). In this scenario, lower frequencies are filtered, leaving higher frequencies, which can be used to produce images with higher resolution of features (Conyers 2013, 143).

Data Collection

Ten GPR grids were collected in many of the same areas where magnetometry had been collected in March of 2016 (Figure 3.10). The grid locations were chosen based on features that were visible in the magnetic data and in Peter Leach's GPR survey from 2015. Maps of the grid locations in relation to the magnetic data and each other are visible in Figures 3.10 and 3.11. The southwest corner locations of the grids are also annotated in Figure 3.11. We collected using control points in the local grid as the corners of the GPR grids. Information concerning the specific grid collection parameters are detailed in Table 1.

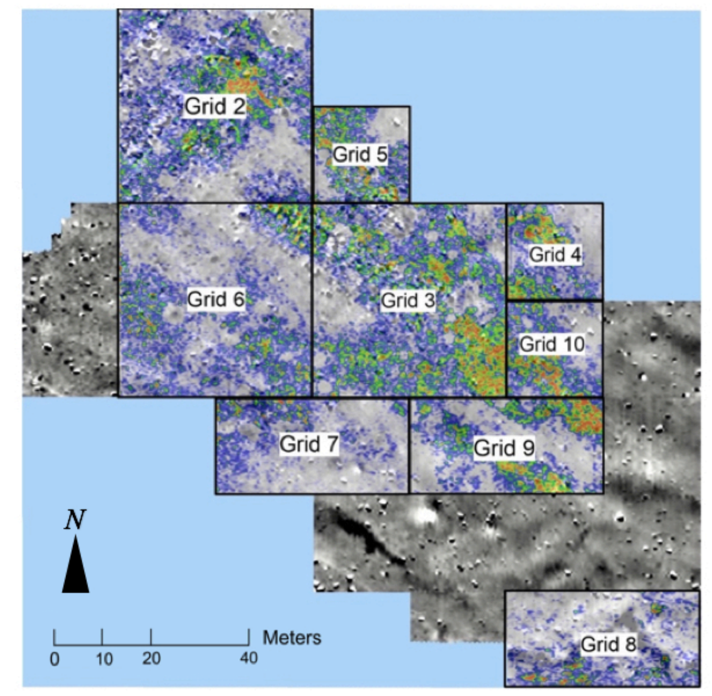


Figure 3.10: Compilation of the ten GPR grid locations in relation to the magnetic data.

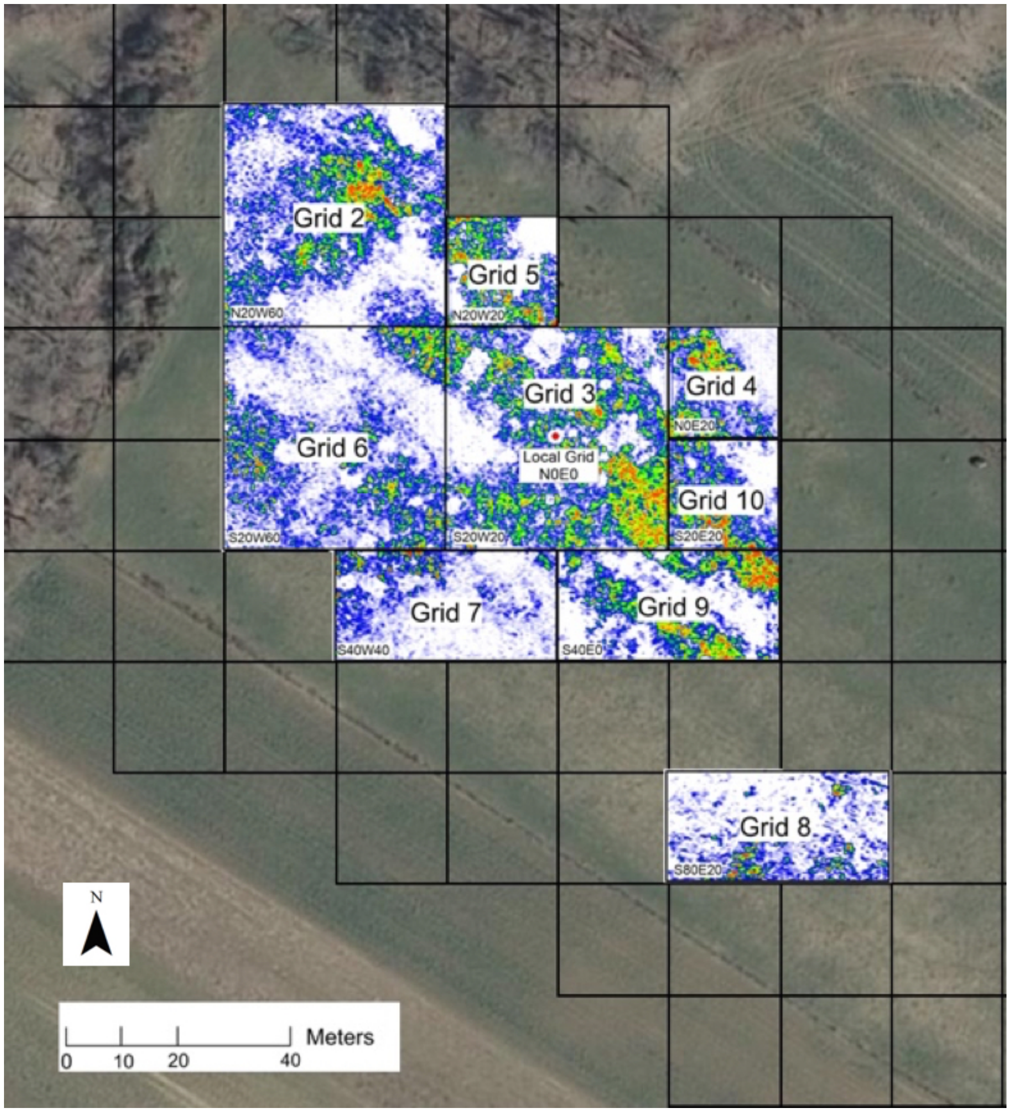


Figure 3.11: Compilation of the ten GPR grids in relation to each other. The southwest corner coordinates based on the local grid are annotated for each GPR grid. The N0E0 point for the local grid is in the center of GPR Grid 3. (Basemap from CTECO 2012).

Table 1: Collection parameters for each grid. The locations of the grids in relation to each other are visible in Figure 3.11.

	SW corner	Dimensions (meters)	Transect Intervals (centimeters)	MHz Antenna	Time window (nanoseconds)
Grid 1	N0W20	20x20	25	400	80

Grid 2	N20W60	40x40	50	400	80
Grid 3	S20W20	40x40	50	400	80
Grid 4	N20E20	20x20	50	400	80
Grid 5	N20W20	20x20	50	400	70
Grid 6	S20W60	40x40	50	400	75
Grid 7	S40W40	40x20	50	400	75
Grid 8	S80E20	40x20	50	400	75
Grid 9	S40E0	40x20	50	400	75
Grid 10	S20E20	20x20	50	400	75

Figure 3.12: Maeve Herrick collecting Grid 2. The 400 MHz antenna is the orange box being pushed along the ground. It is connected to the SIR 3000 control unit with a blue

cable. The survey wheel is attached to the wheel on the left. Transects were collected on and beside ropes to ensure that they were straight.

Data Processing

After collection, images were produced from the data. GPR Process was used to align the profiles, which were then viewed in GPR Viewer. In GPR Viewer, the background noise was removed and hyperbolas were fitted in order to determine the RDP for each grid. Once this was done, the profiles could be adjusted and the depth features within them could be more accurately determined. The range gains were also adjusted so that reflections could become more visible. We recorded the locations of features for each profile in each grid. GPR Process was also used to slice each grid to create amplitude slice-maps. When slice-maps were completed for all of the grids, I overlaid the grids in ArcMap. These maps are visible in Figures 3.10 and 3.11. Below, in Figures 3.13 and 3.14 are examples of how profiles and amplitude slice-maps were produced, analyzed, and interpreted.

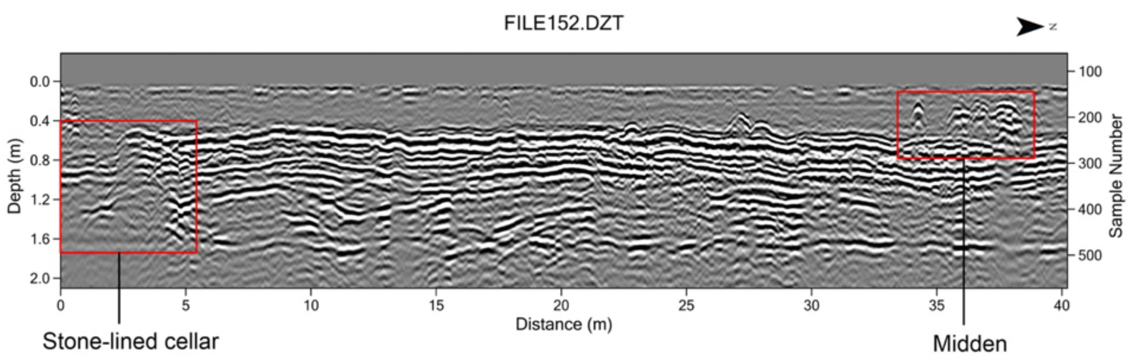


Figure 3.13: This profile from GPR Grid 6 shows a stone-lined cellar at a depth of approximately 40 centimeters, and a midden in the plow zone. The location of this profile is also visible in Figure 3.16.

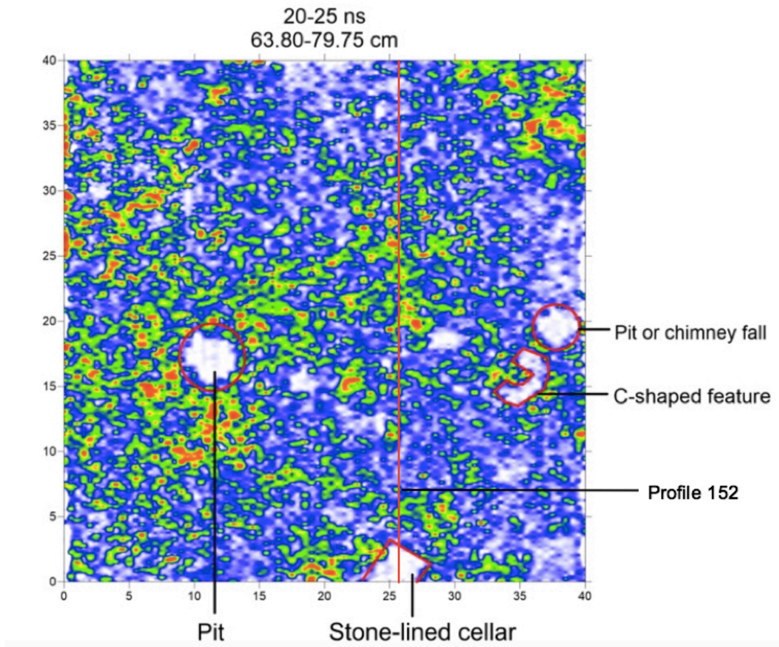


Figure 3.14: This slice-map of GPR Grid 6 depicts a number of features, visible as areas of low amplitude. They have been annotated. Annotated is the location of Profile 152, also seen in Figure 3.13.

Conclusion

This GPR survey allowed us to investigate features visible in the magnetic data further, to locate additional features that we will be able to analyze more fully with GPR images, and to locate areas for excavation. Because GPR allows for three-dimensional analysis, the location of excavation units could be accurately guided by interpretations of the GPR data. Features of interest were located in space and investigated more thoroughly through excavations.

Excavations

Once the GPR data were process and analyzed, they were used to determine where to place excavation units and test pits. The locations of three trenches were determined based on where three cellars were visible in the GPR data. Two units and two test pits were also excavated based on other features visible in the GPR images. Other test pits were placed in the areas surrounding and between the cellars. I added the locations of units and test pits to the GPR data (Figure 3.15). This helps to illustrate how the GPR data were used to choose where to place excavations, and will be referred to throughout this section.

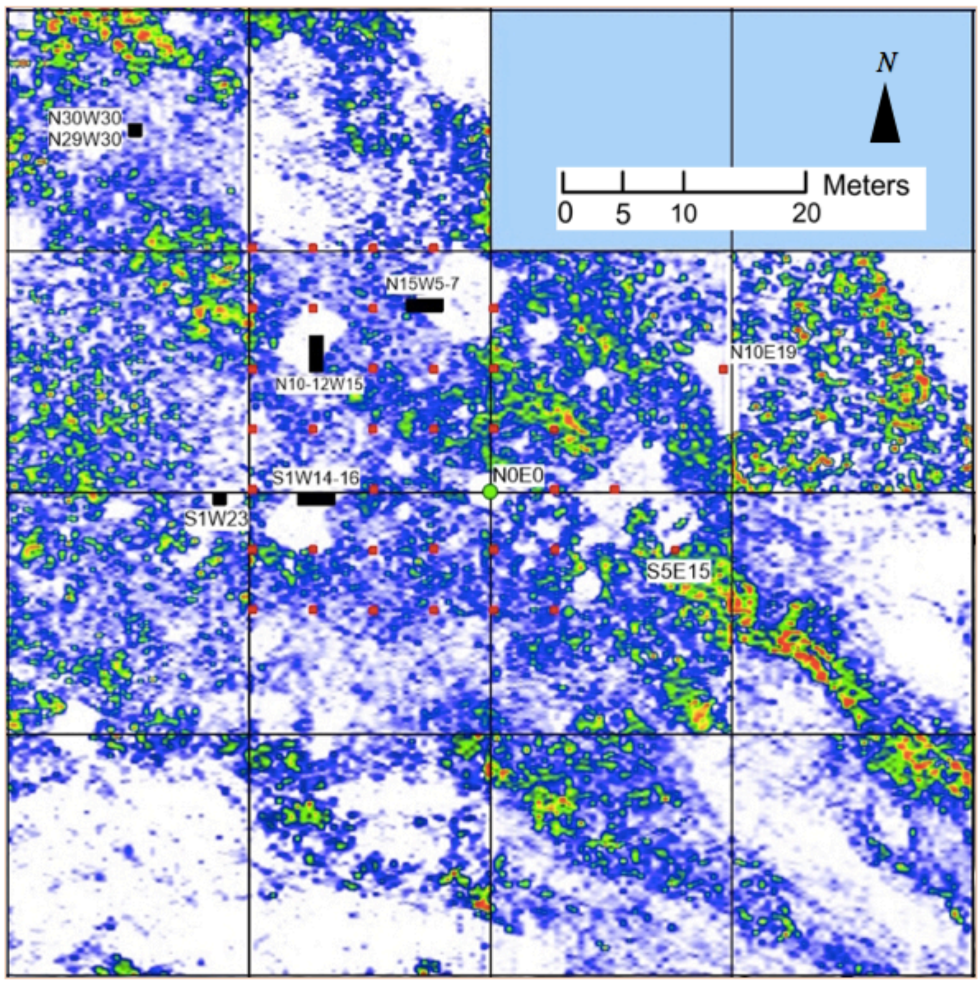


Figure 3.15: Excavation units are marked in black. The three 3x1 meter trenches were placed over three cellars visible in the GPR data. Two 1x1 meter units were dug over features to the northwest, and another to the west of the cellars. The unit to the northwest is the northern half of N29W30 and the southern half of N30W30. Thirty-six 50x50 centimeter test pits are marked in red.

All of the excavations were tied into the local grid that was established across the site. Each unit and test pit is denoted by the coordinates of its southwest corner within this grid. Units were excavated by quadrants, and artifact bags were labeled based on these quadrants. Usually, we began by shoveling, then troweled the edges of each quadrant and the bottom of each unit. The soil from every excavation unit and test pit was screened with 1/8-inch mesh.

Pit Feature Excavation

In the GPR Grid 2 (Figure 3.11) there were a number of pit features visible in the GPR images (Figures 3.16 and 3.17). It was hypothesized that these were associated with a palisade that may have been constructed on the site in 1675 (Adams 1904, 205, 207, 212, Brian Jones, email to author, January 21, 2016, Pequot Museum 2016). We chose to excavate a distinct pit feature that was visible in both the slice-map (Figure 3.16) and profiles (Figure 3.17). The slice-map shows the pit feature as a circular area of low-amplitude (Figure 3.16). In profile, the pit can be seen truncating the natural stratigraphy at a depth of about 50 centimeters (Figure 3.17). By using the GPR images, we were able to determine the precise location and depth of this feature in order to excavate it. The location of the 1x1 meter unit is visible in Figure 3.11 as unit N30W30/N29W30.

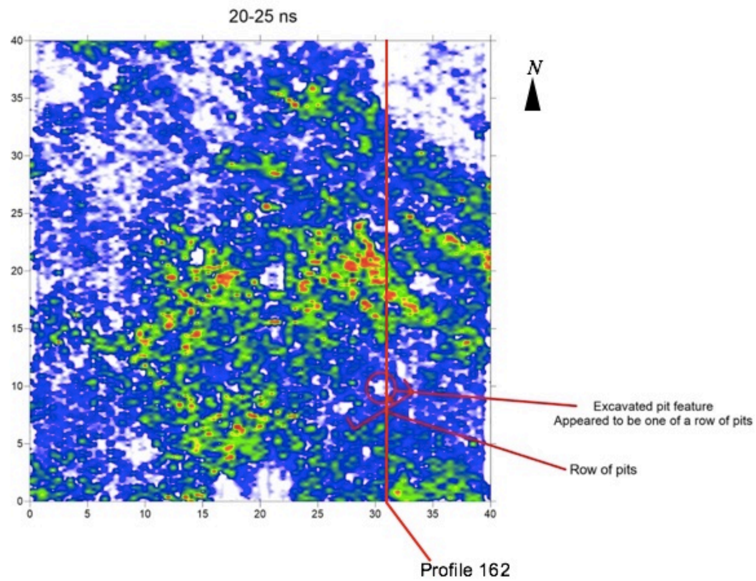


Figure 3.16: Slice-map of Grid 2. The pit feature excavated in unit N29W30/N30W30 is annotated and visible as a circular area of low-amplitude. Profile 162 has been drawn onto the map, and is visible in Figure 3.21.

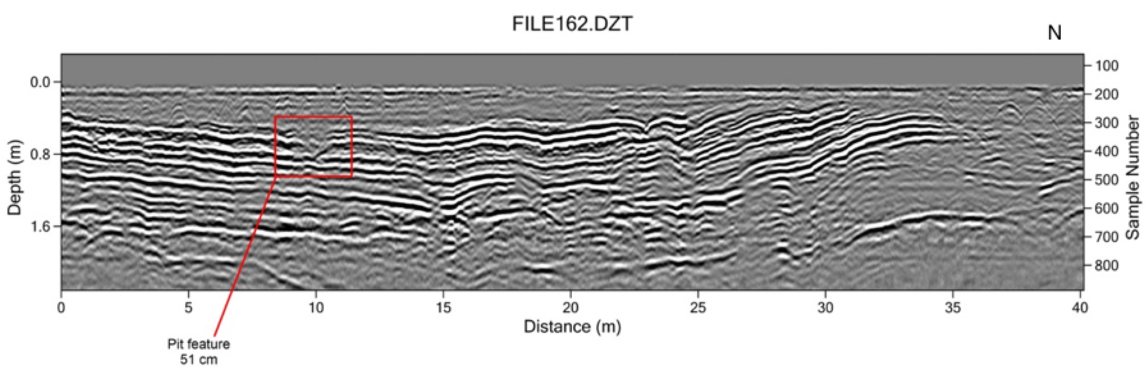


Figure 3.17: Profile showing a pit feature visible in the GPR data. This image indicates that a pit should disrupt the natural stratigraphy at a depth of 51 centimeters.

When excavating this feature, we thought we would see a difference in soil texture or color around 50 centimeters, which would correlate with the GPR data (Figures 3.16 and 3.17). We began by excavating the first 20 centimeters, which is the plow zone, where the soil is dark. Below the plow zone the soil becomes more yellow. The second level went to 28 centimeters, and the next to 35 centimeters. The following level went from 35-45 centimeters. We still were not seeing the feature, so we continued to 55 centimeters. At that level, there was much charcoal and a difference in texture between the north and south sections of the unit. The northern part of the unit was more clayey and soft, while the southern part was sandy and compact. We then continued to 65 centimeters, where the soil in three of the corners was gray in color. There was also more charcoal in that level. Finally, we excavated to 75 centimeters. At 73 centimeters, we saw a black, linear feature in the SW quadrant (N29W30 NW). We leveled out the unit at 73 centimeters. We then excavated to 85 centimeters in the entire unit. At 85 centimeters we were at the C-horizon, which was mottled. There was a thick black stain in the northern quadrants (N30W30 SW and SE). We never encountered a distinct soil change that would have been expected from a pit or posthole.

Oblong Feature Excavation

Another interesting feature of interest visible in the GPR data was an oblong depression in Grid 3 (Figure 3.18). This feature may be seen as an irregular area of low amplitude in the slice-map (Figure 3.19). Profile 179 depicts this feature as disrupting the natural stratigraphy beginning at a depth of approximately 40 centimeters (Figure 3.20). Because of its size, shape, and proximity to the cellars, we were suspicious that this feature could be a midden, so a test pit was dug in order to test this hypothesis. Jasmine Saxon and I excavated a 50x50 centimeter test pit with the southwest corner at N10E19 (Figure 3.15). We began by digging to 20 centimeters (the plow zone). We then dug from 20-110 centimeters in 10 centimeter levels. We reached glacial sediment at approximately 110 centimeters. The glacial sediment was distinctly granular and pinkish in color.

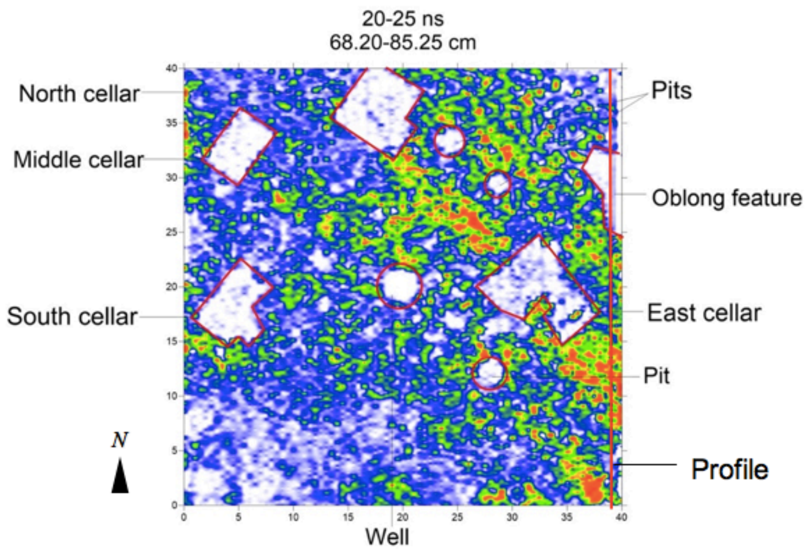


Figure 3.18: Annotated slice-map of GPR Grid 3. The oblong feature is visible as an area of low-amplitude. Profile 179 crosses this feature, which is visible in Figure 3.21.

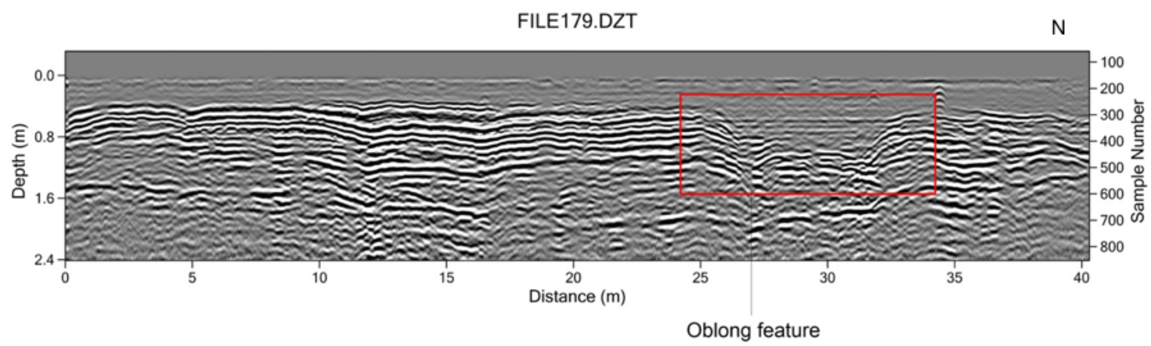


Figure 3.19: Feature visible in a GPR profile. A test pit was excavated at 30 meters in the x-axis of this profile. The test pit went to a depth of 110 centimeters, where it reached glacial sediment.

Cellar Excavations

Four cellars are displayed prominently in the slice-maps as rectangular areas of low-amplitude (Figure 3.20). Ground-penetrating radar profiles of the cellars depict them as well-defined areas of low-amplitude that truncate the natural stratigraphy (Figures 3.21 and 3.22). In these profiles, a number of point-source hyperbolas may be seen near the top of the historical cellar, and below the plow zone (Figures 3.21 and 3.22). These images indicate that the cellars were filled with sediment and artifacts that are different from the surrounding material (Conyers 2012, 110). The point-source hyperbolas suggest that there are a number of artifacts, in addition to sediments, that were used to fill the cellars when they were abandoned (Conyers 2012, 110). The GPR data were used to determine where to place three trenches that were excavated over three of the cellars (Figures 3.15 and 3.20). These units were excavated primarily by Friends of the Office of the State Archaeologist (FOSA) volunteers and other members of the community. They were dug to a depth of approximately 150 centimeters.

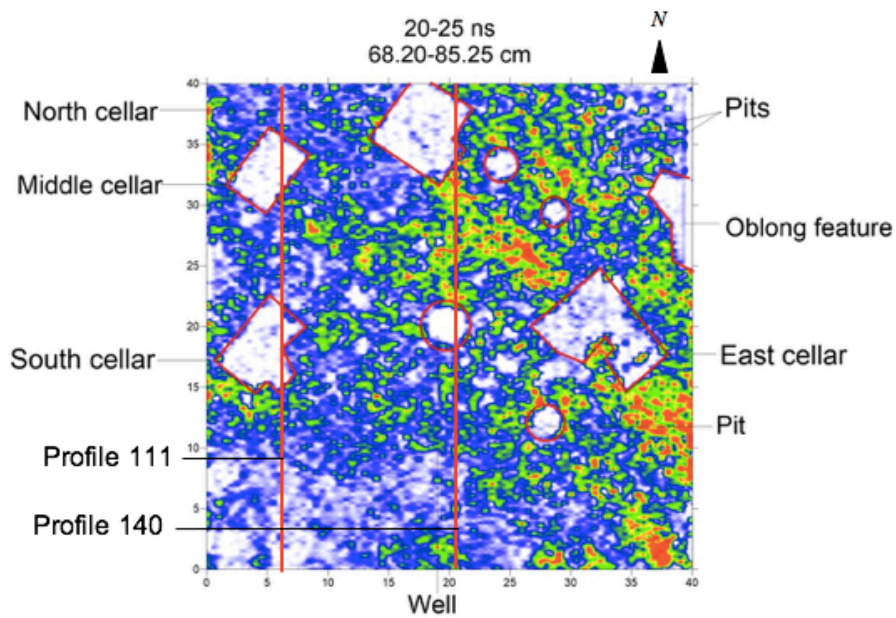


Figure 3.20: Annotated amplitude slice-map of GPR Grid 3. The cellars have been annotated. Profiles 111 crosses the south and Middle Cellars, and Profile 140 crosses the well that serves as the datum for the local grid and the North Cellar (also Figures 3.21 and 3.22).

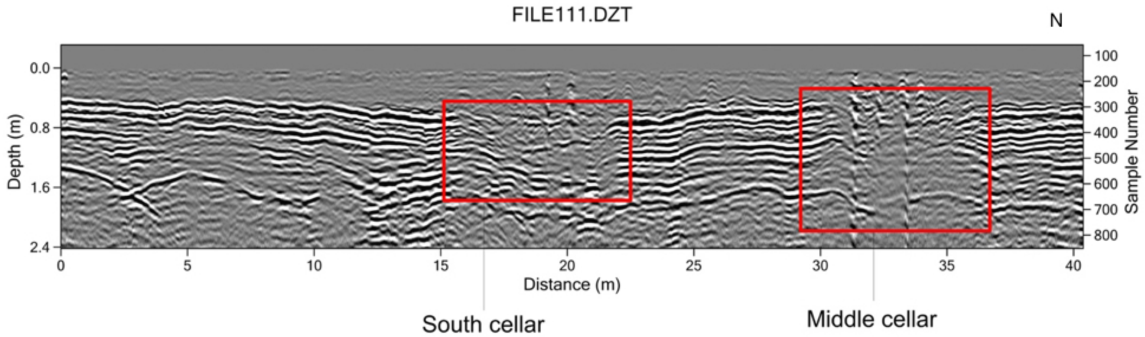


Figure 3.21: GPR profile showing the locations of the south and Middle Cellars. The areas of low-amplitude are sediments that filled the cellar holes when they were abandoned. A trench composed of units S1W14-16 was excavated over the South Cellar (also visible in Figure 3.22). Units N10-12W15 were opened over the Middle Cellar (also visible in Figure 3.22).

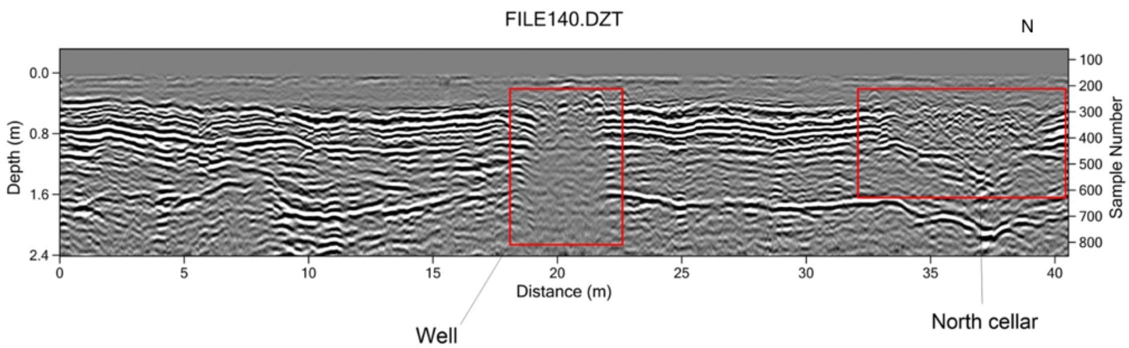


Figure 3.22: The well that served as the N0E0 datum for the entire local grid is visible in this GPR profile. The North Cellar is also visible. The units N15W5-7 comprised the 3x1 meter trench excavated in this feature (also visible in Figure 3.20). Well and cellar are both visible as areas of low-amplitude, indicating that they were filled with sediments distinct from the surrounding material (Conyers 2012, 110). The point-source hyperbolas visible in the North Cellar are indicative of artifacts that are included in the fill (Conyers 2012, 110).

Chimney-Fall Excavation

Images from ground-penetrating radar data were used to place an excavation unit over a feature hypothesized to be a chimney fall (Unit S1W23 in Figure 3.15). This feature may be seen in Figure 3.23 as an area of low amplitude. Further detail regarding this feature is evident in Profile 176 (Figure 3.24). In the profile, the feature is visible where the natural stratigraphy has been truncated (Figure 3.24). There are also a number of overlapping reflections indicative of fallen stone or another similar feature (Figure 3.24). This feature was also excavated by FOSA members.

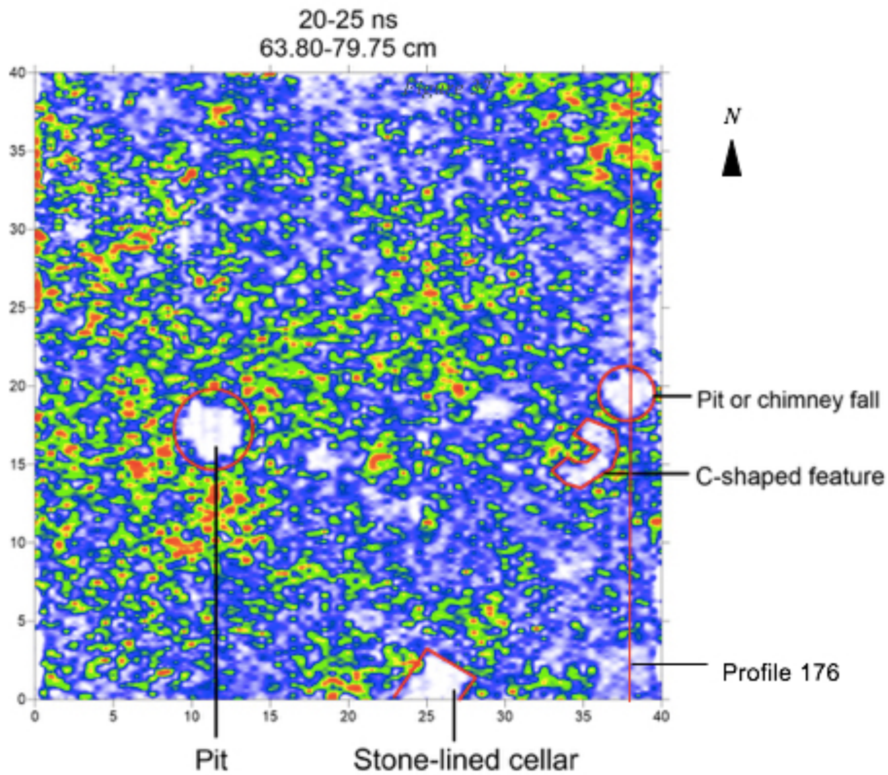


Figure 3.23: Annotated amplitude slice-map of GPR Grid 6 (Figure 3.11). Profile 176 has been added, showing where it crosses the hypothesized chimney fall. The chimney fall is visible as an area of low amplitude at about 20 meters north. Profile 176 may be seen in Figure 3.24.

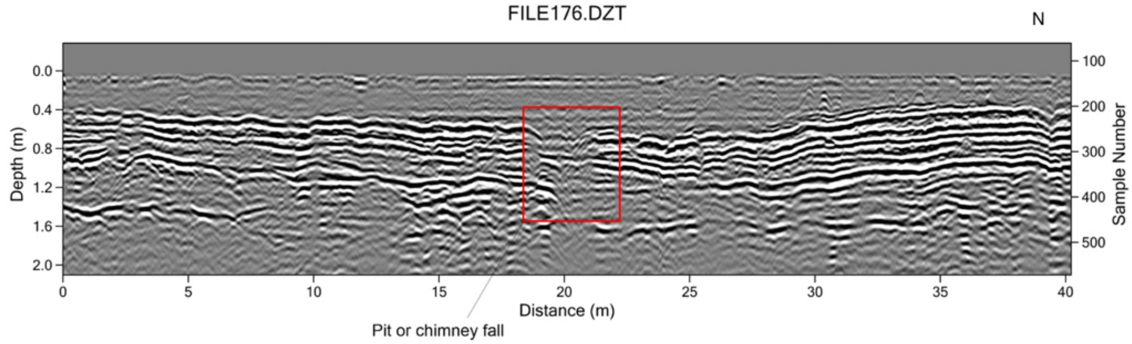


Figure 3.24: The hypothesized chimney fall has been annotated at approximately 20 meters north. This feature is an area of low amplitude that truncates the natural stratigraphy. There are also a number of overlapping point-source hyperbolas and undulating planar reflections indicative of a fallen stone structure or other similar feature. The location of this profile may be seen in Figure 3.23.

Shovel Test Pits

Dr. Brian Jones, Jasmine Saxon, and I led Natural Resources Conservation Service (NRCS) crews in digging a number of test pits (Figure 3.15). The locations of these test pits, and others excavated by NRCS, are annotated in Figure 3.11.

A number of test pits were excavated on a family dig day by members of the community, and on another day by members of a local Boy Scout troop. These test pits may be seen in Figure 3.15. They were excavated in 10 cm levels to at least 25 centimeters. Those that were not at 25 centimeters at the end of the day were completed by Brian Jones, Jasmine Saxon, other FOSA members, and me.

One test pit was strategically placed over the East Cellar based on GPR data (Figures 3.15 and 3.25). The East Cellar is a rectilinear area of low-amplitude annotated in Figure 3.23. It is also visible in Profile 164 as a low-amplitude area truncating the natural stratigraphy (Figure 3.24).

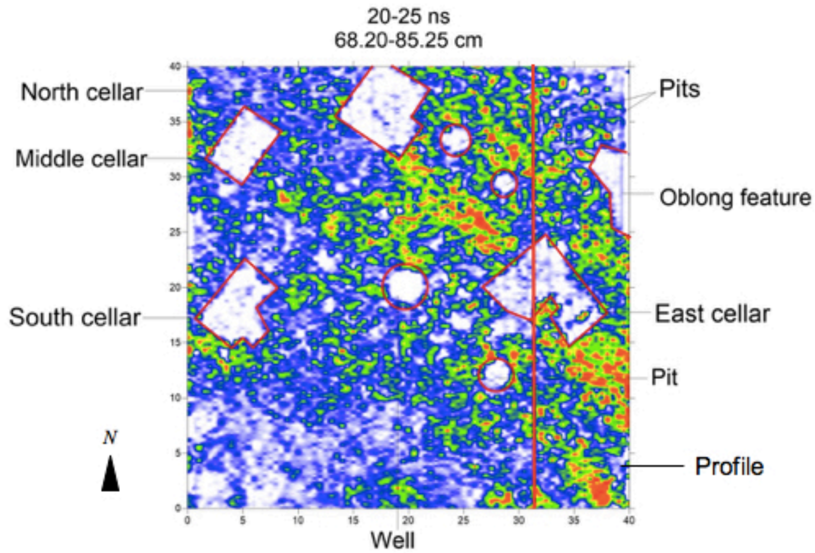


Figure 3.25: Amplitude slice-map of Grid 3. The East Cellar is visible as a rectilinear area of low-amplitude. Profiles 164 crosses this feature, and is also visible in Figure 3.26.

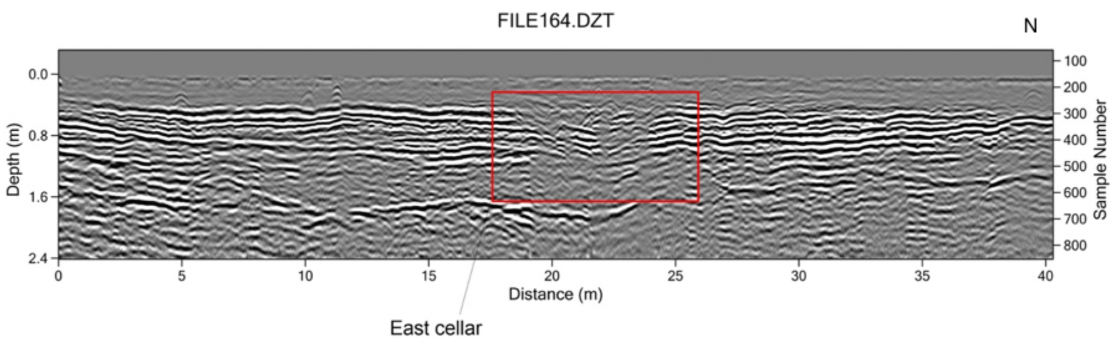


Figure 3.26: GPR profile in which the East Cellar is visible. A test unit was placed over a different area of this cellar (Figure 3.15).

Conclusion

These excavations yielded a wealth of data. They were strengthened by the ability of GPR to provide three-dimensional analysis, which can be used to guide excavations. More in-depth interpretations of the excavations themselves, and the artifacts uncovered from them, will be included in the Data Analysis chapter.

Archival research

We began archival research by going to the Wethersfield library. Relevant pages from numerous history books were photographed, such as *Glastonbury* by Florence Hollister Curtis, *The Public Records of the Colony of Connecticut* transcribed by J. Hammond Trumbull, *Glastonbury: From Settlement to Suburb* by Marjorie Grant McNulty, and *Contributions to the Family History of some of the First Settlers of Connecticut and Massachusetts,* by Nathaniel Goodwin.

Next, we went to the Connecticut State Library in Hartford. We examined maps and various microfilm and scanned pertinent documents. Among these are a number of Hollister probate records, including wills and inventories, and land deed indexes.

The Connecticut Historical Society had mostly secondary sources. There was a historic house inventory that had some information on the "1675" Hollister home. We photographed the pages discussing the home.

We then went to the Wethersfield Historical Society. There were a number of important sources for us to examine. The most significant was a book that was a transcription of the Public Records of the Colony of Connecticut 1665-1778 and the Journal of the Council of War 1675-1678. This volume also included the Charter of Connecticut. Other sources were; *Hale, House and Related Families: Mainly of the Connecticut River Valley* by Donald Lines Jacobus and Edgar Francis Waterman, *The History of Ancient Wethersfield* Volumes I and II by Henry R. Stiles, *Genealogical Dictionary of New England* by James Savage, *The Hollister Family of America: Lieut. John Hollister of Wethersfield, Conn., and his Descendants* compiled by Lafayette

Wallace Case, M.D., and *Records of the Particular Court of Connecticut 1639-1663* by the Connecticut Historical Society and the Society of Colonial Wars in the State of Connecticut. There was also a map of 17th Century Wethersfield Connecticut, created from data from Stiles' volume, *The History of Ancient Wethersfield.*

We also visited the Glastonbury Historical Society. There were a number of documents concerning the genealogy of the Hollister family, a land ownership lawsuit between John Hollister and G. Buckley beginning in 1680, and a document discussing a Native American girl named Amix who was associated with the Hollister family.

Conclusion

The research conducted at the Hollister site exemplifies the ways in which geophysical methods, excavations, and archival research may be integrated to produce a more holistic dataset. Previous research at the site consisting of a ground-penetrating radar survey and limited excavations revealed the importance of the site as an uncommon seventeenth-century colonial Connecticut farmstead, and the necessity of future research. These needs were met when, in March of 2016, Jasmine and I conducted a magnetic survey of the site. This survey determined the limits of the site, located features for future geophysical research, and contributed to a comparative model that could be used to compare GPR and magnetic data. In the summer of 2016, a GPR survey, guided by the previous magnetic survey, was conducted across the site. This allowed for features to be located and analyzed in greater detail than was possible with magnetometry. The three-dimensional analysis possible with images produced by GPR data also helped to guide excavations at the site. A number of units and test pits were excavated based on the locations of features visible in the images produced from the GPR data. Archival data were also collected in order to learn more about who was living at the site, when, and what they may have been doing. All of these sources of data have contributed to a vast, holistic data set.

CHAPTER FOUR: DATA ANALYSIS

The process of data collection and interpretation was recursive. The magnetic data collected in the spring of 2016 were used to plan further research, specifically ground-penetrating radar surveys. By examining the different types of anomalies present in the magnetic data, preliminary hypotheses were drawn and investigated by conducting GPR surveys, which allowed for more detailed readings to be processed. This allowed us to gain a better understanding of what different types of features look like in images produced from magnetic and ground-penetrating radar data. The GPR surveys also helped to guide excavations. Different features visible in images produced from these data were investigated through excavation units and shovel test pits. Features and artifacts uncovered in these excavations, specifically Indigenous ceramics uncovered from the Middle Cellar, will be discussed and interpreted (Figure 4.1).

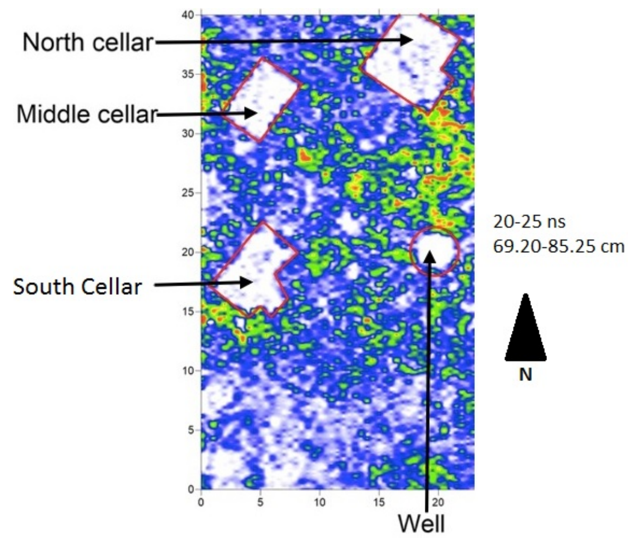


Figure 4.1: Map of cellars and well in GPR Grid 3. The Indigenous ceramics that will be discussed were excavated from the Middle Cellar.

Integrating the geophysical data also allowed for a comprehensive picture of the seventeenth-century landscape to be produced. By integrating magnetometry and ground-penetrating radar, the living surface was revealed, as well as a number of other features. From this information, a map depicting geological and cultural features was overlain on the landscape, showing what the landscape may have looked like when it was occupied during the seventeenth-century.

Interpretation of Cultural Landscape

Interpretation of the images produced from the geophysical data allowed for a map of the seventeenth-century landscape to be created. By integrating magnetometry and ground-penetrating radar, the living surface was revealed, as well as a number of other features, such as Indigenous dwellings and colonist cellars. From this information, it was possible to recreate what the landscape may have looked like when it was occupied during the seventeenth-century.

In order to fully comprehend the early colonial landscape, it is important to take into consideration the geological and environmental history of the area. Glaciers, glacial features, and post-glacial depositional stages have transformed the landscape throughout time, and the seventeenth-century landscape would have looked quite different than it does today. All of Connecticut was covered by the Laurentide ice sheet approximately 25-20 thousand years ago (Stone et al. 2005, 3). This huge glacial mass originated in Canada and ice moved south as far as Long Island (Stone et al. 2005, 3). As this ice sheet moved south from Canada, it carried with it rocks from the Canadian Shield, a geological region of exposed Archean crust, primarily composed of granitic gneiss (Monroe and Wicander 2008, 496). Granitic gneiss is a metamorophic rock type that has high concentrations of hornblende, biotite, and magnetitite, which are highly magnetic (Rosenblum and Brownfield 1999). This understanding of the composition of the glacial deposits laid down in this area of Connecticut is important because the magnetic mapping that was done at the site measures variations in magnetic susceptibility of the underlying sediments as well as surface materials and artifacts. In this way an understanding of the composition of various units, with respect to their magnetic constituents can be studied with the magnetic maps produced at the Hollister site to understand the geological and environmental history of the area. An understanding of the retained magnetism of the geologic units is important for this analysis.

While no one has conducted a magnetic susceptibility analysis of geological or soil units at the site, an analysis of the units' constituents with respect to magnetism can still be accomplished. This is what I do, because by doing so glacial till may be distinguished from fluvial sediments. With a magnetic scale that ranges from 0 (the most magnetic) to 1.7 (the least magnetic), magnetite falls at .01 on this scale, meaning that it is very highly magnetic (Rosenblum and Brownfield 1999, 15). Hornblende is between .30 and .60, and biotite is between .30 and .80, showing that these minerals are also relatively magnetic (Rosenblum and Brownfield 1999, 11, 14). These magnetic materials were deposited as glacial till when the ice sheet melted. This means that glacial till within approximately 1.5 meters of the surface will appear as positive magnetic values in the magnetic data.

The glacially-deposited units present at the Hollister site are composed of nonstratified cobbles that were generally unweathered when deposited, as they had been encased in ice since being transported from the far north in Canada (Stone et al. 2005, 45-46). One of the basic landform units deposited by these melting glaciers is an end moraine. An end moraine is a linear accumulation of till at the distal end of the ice sheet where relative southerly ice movement had ceased for some time, but sediments continued to be moved southward to the end of the glacier, to be stacked at the southern edge (Stone et al. 2005, 46). These deposits of glacially-derived sediment typically form long ridges that can be 10-60 feet (3-18 meters) thick (CTECO 2010, 3) after the ice has completely melted. They are often composed of unsorted or stratified sand, gravel, and boulders and when close to the present ground surface are and difficult to dig through and plow (CTECO 2010, 3). In Connecticut, moraines deposits are highly magnetic because they are both composed of magnetic minerals derived from the Canadian Shield, and are relatively unweathered. At the Hollister site two of these end-moraines are present, bounding the study area along the north and south. These will be discussed in more detail below, but are important because they would have been gravelly ridges visible on the landscape, influencing the settlement patterns of Indigenous peoples and English settler-colonists.

Other important units, which played a role in the interpretation of the historic landscape of the Hollister site are the braided streams that flowed from the glacial ice as its margin continued to retreat northward (Zeilinga de Boer 2009, 86). These river channels contained sediment derived from the glacial deposits, but also from other units along the Connecticut River Valley. The channels are composed of sand, but also silt and clay that was derived from various weathered areas to the north (Stone 2005, 4). They have much less magnetite and other ferromagnesian minerals in them than the glacial deposits, as their sediment loads are "pre-weathered" and these magnetic materials were transformed into non-magnetic clays (Reynolds et al. 2004). This is important because in combination with GPR analysis of buried units, the origin and age of certain units at the Hollister site can be identified by their magnetism.

Another important geological unit in the Connecticut River Valley is the glacial Lake Hitchcock, which formed 18.5 thousand years ago and persisted for approximately 4000 years (Zeilinga de Boer 2009, 86, Stone et al. 2005, 10, 12). It was formed as the glaciers melted and was dammed by end moraines to the south of the Hollister site (Stone 2005, 10). There is some indication of the Lake Hitchcock sediments at the Hollister site, which will be discussed in greater detail, and their origin and composition may be enhanced by studying their magnetism.

These geological units are all visible in the study area using the geophysical analysis. The thickness and extent of the till, fluvial units and the lake beds can be seen in GPR profiles. Their magnetism shows that the thick units that display positive magnetic anomalies are the glacial till and moraine units, high in the magnetic minerals brought down from Canada. The younger fluvial and lake deposits are negatively magnetic because these sediments were weathered prior to deposition, and therefore retain less ferromagnetic materials (Reynolds et al. 2004). These geological features will appear as negative magnetic values in the images produced from the magnetic data.

Based on this understanding of the geological and environmental history of the area and the magnetic susceptibilities of different geological units, the magnetic and GPR data collected over a 140x140 meter are at the Hollister site were integrated, allowing for the major landscape features to be identified. This is important, as many of the bedrock and sediment units that were prominent in the past are now covered by soil, which has been plowed and leveled in the last three-hundred years. However, during the crucial time when Indigenous people came in contact with the first European settlers in this area, important micro-environments still played an important role in settlement patterns and how some areas were used and manipulated by people. Ground-penetrating radar data provided good three-dimensional detail concerning the depth and dimensions of these geological features, especially fluvial channels that filled in the low areas between what were prominent raised areas of the glacial moraines (Grids 8 and 2 discussed in greater detail below). The GPR reflection profiles were first analyzed in two-dimensions, and then many profiles in individual grids were sliced to provide a three-dimensional analysis of the major landform features. Magnetic values were extracted from the magnetic gradiometry maps and directly compared to the GPR profiles in order to determine the origin and age of the visible units. The profiles used as illustration of this method are shown in Figure 4.2.

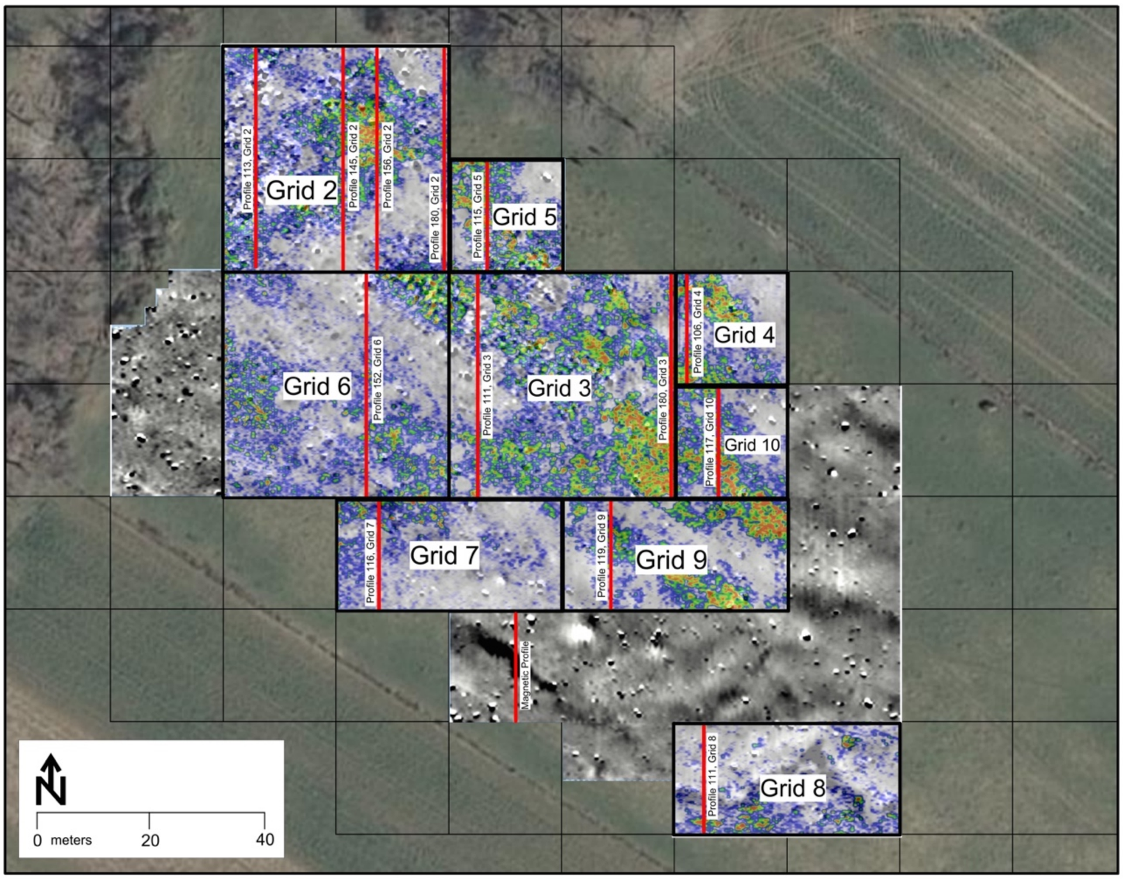


Figure 4.2: This map shows the images produced from the magnetic and GPR data overlaid on the present landscape. The profiles that are discussed in this section are shown in red. (Basemap from CTECO 2012).

On the southern edge of the study area, the magnetic map for Grid 8 (Figure 4.3) shows a positively magnetic feature running east-west, which extends west beyond Grid 8. To the north and south of this feature are less distinct linear negative anomalies. Given that the relatively unweathered materials composing glacial till is highly magnetic, the positively magnetic feature is interpreted as a glacial moraine. The weathered fluvial sediments deposited by braided streams are negatively magnetic, so it is likely that there are stream channels to the north and south of this moraine (Zeilinga de Boer 2009, 86). These stream channels are visible to the north and south of a high glacial feature in the GPR profiles, supporting this hypothesis (Figures 4.4 and 4.5).

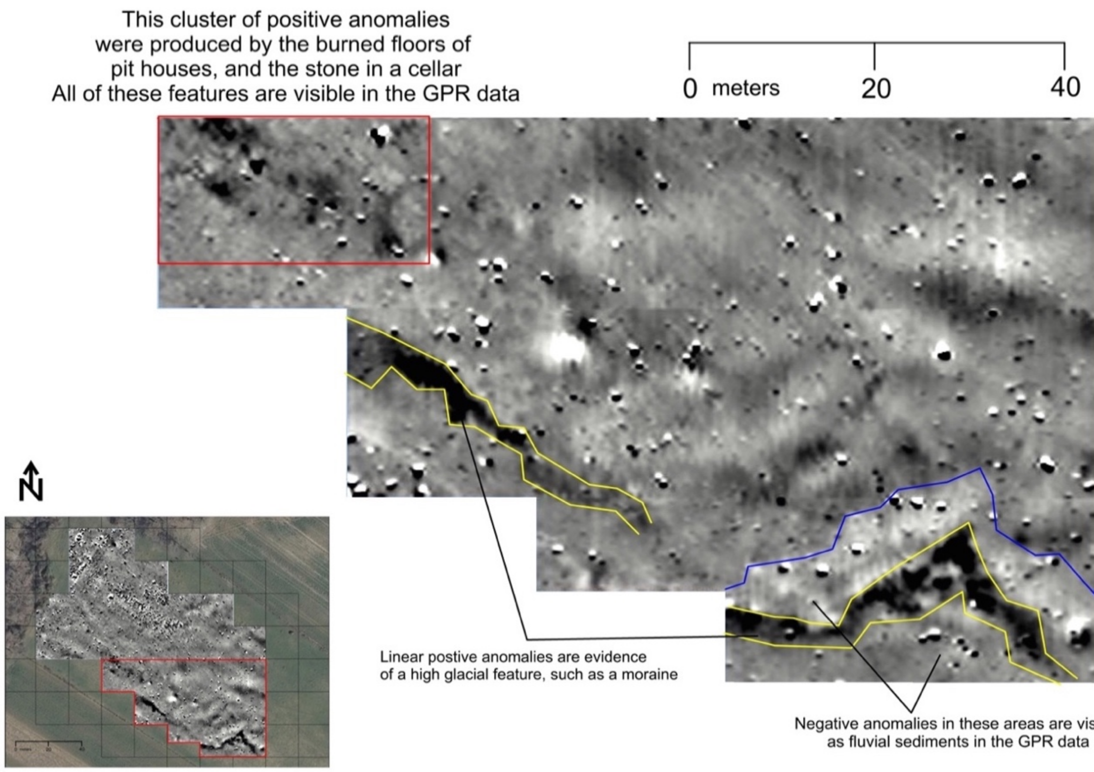
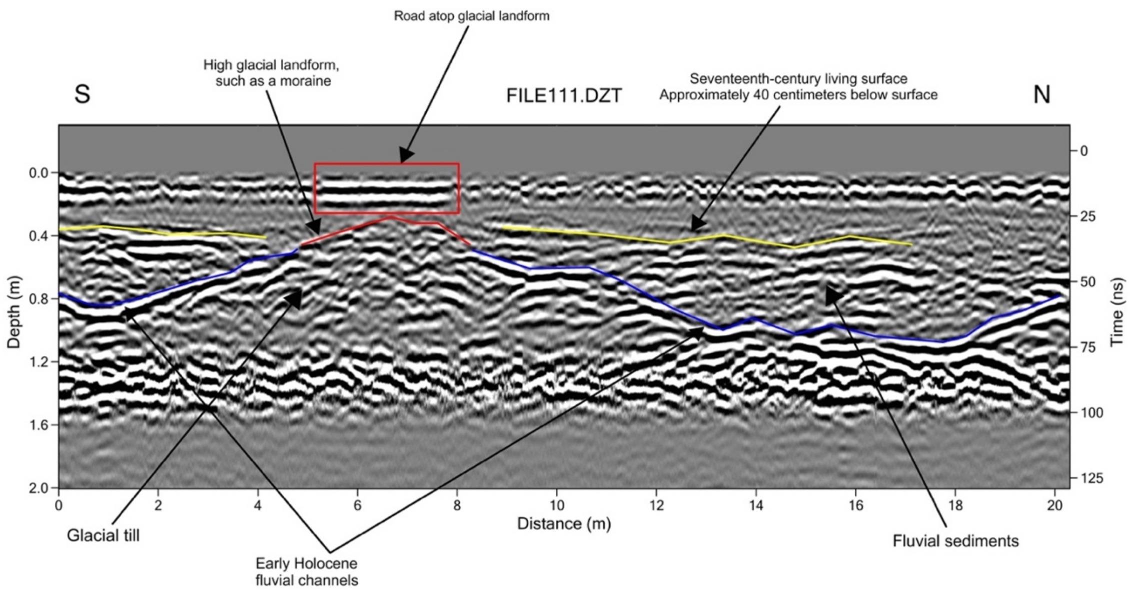


Figure 4.3: This portion of the magnetic data shows linear positive anomalies bounded by linear negative anomalies. The GPR data helped to discern what these features were (Figure 4.4). The positive (black) anomalies are recessional glacial moraines, with glacial till producing the anomalies visible in this image. The negative (white) anomalies are produced by fluvial sediments filling fluvial channels that bound the moraine. The northwest corner of this inset also shows positive anomalies that are produced by the burned floors of pit houses and a stone-lined cellar visible in the GPR data, which are discussed later, and are visible in Figures 4.19-4.21. (Basemap from CTECO 2012).

The GPR profile of the positive magnetic anomaly running east-west in Grid 8 (Figure 4.2) supports the conclusion that these features are stream channels and a moraine

(Figure 4.4). The magnetic values extracted from this profile (Figure 4.4) confirms that the very high positively magnetic feature is bounded to the north and south by areas of negative magnetism. This magnetism correlates with what would be expected from fluvial channels (negative magnetism) and glacial till composing a moraine (high positive magnetism). The GPR profile shows that the area of positive magnetism in the magnetic data coincides with a high glacial feature. The areas of negative magnetism correlate with fluvial sediments filling channels. High-amplitude planar reflections above the moraine indicate that at one point, there was a road atop the glacial feature. This moraine was probably visible as a ridge of gravelly soil. It is likely that over time, the channels filled with aeolian and fluvial sediments, and were low, marshy areas during the seventeenth century (Zeilinga de Boer 2009, 51, 88).



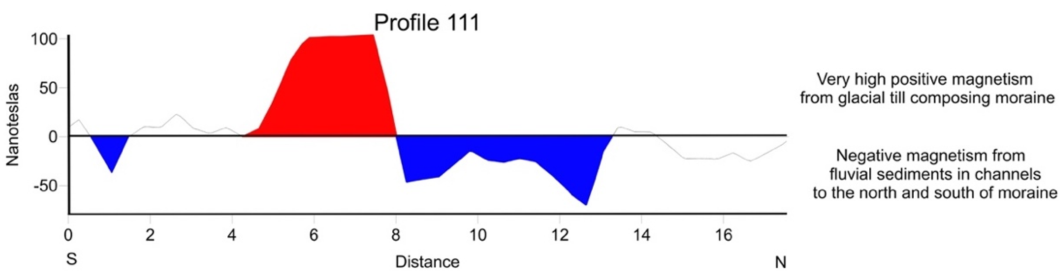


Figure 4.4: This complex profile from Grid 8 shows a number of features. Between meters 4.5 and 8 is a recessional glacial moraine composed of glacial till. This feature is higher than the living surface, which is at approximately 40 centimeters. This means that the glacial moraine would have been visible as a rocky ridge during the seventeenth-century. To the north and south of the glacial feature are Holocene fluvial channels that have been filled with sediment. These areas probably would have been low and marshy at the time of occupation. The magnetic profile that correlates with the GPR Profile 111 from Grid 8 shows two areas of negative magnetism, and one of very high positive magnetism. The glacial till composing the moraine visible in the magnetic map (Figure 4.2), and GPR slice-map and profile (Figures 4.6 and 4.4) is highly magnetic, while the fluvial fill exhibits negative magnetism.

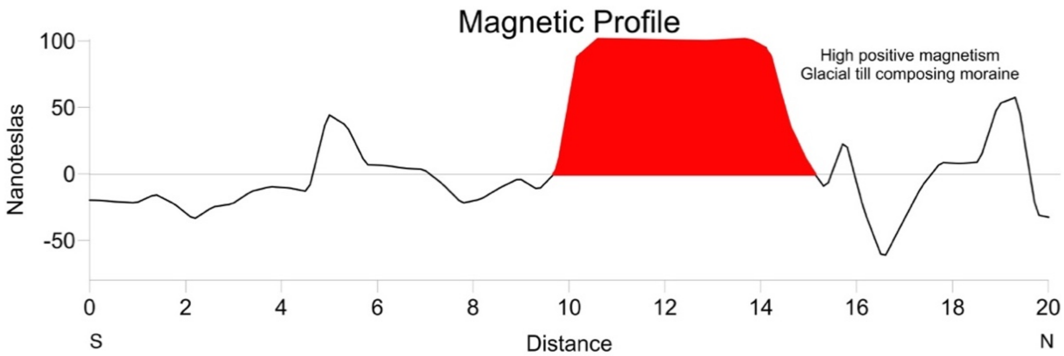


Figure 4.5: This profile from the magnetic data shows a very high magnetic area that coincides with the dark linear anomaly visible in the magnetic map (Figure 4.3). This shows that the glacial moraine in Grid 8 extends northwest.

By correlating the profiles with the GPR slice-map for Grid 8, the moraine and the fill in the fluvial channels may be identified (Figure 4.6). The less distinct negative anomalies are represented as areas of high-amplitude reflections in this map. This indicates that the stream beds to the north and south of the glacial moraine are more highly reflective than the till composing the moraine. The glacial till composing the moraine shows up as an area of low-amplitude.

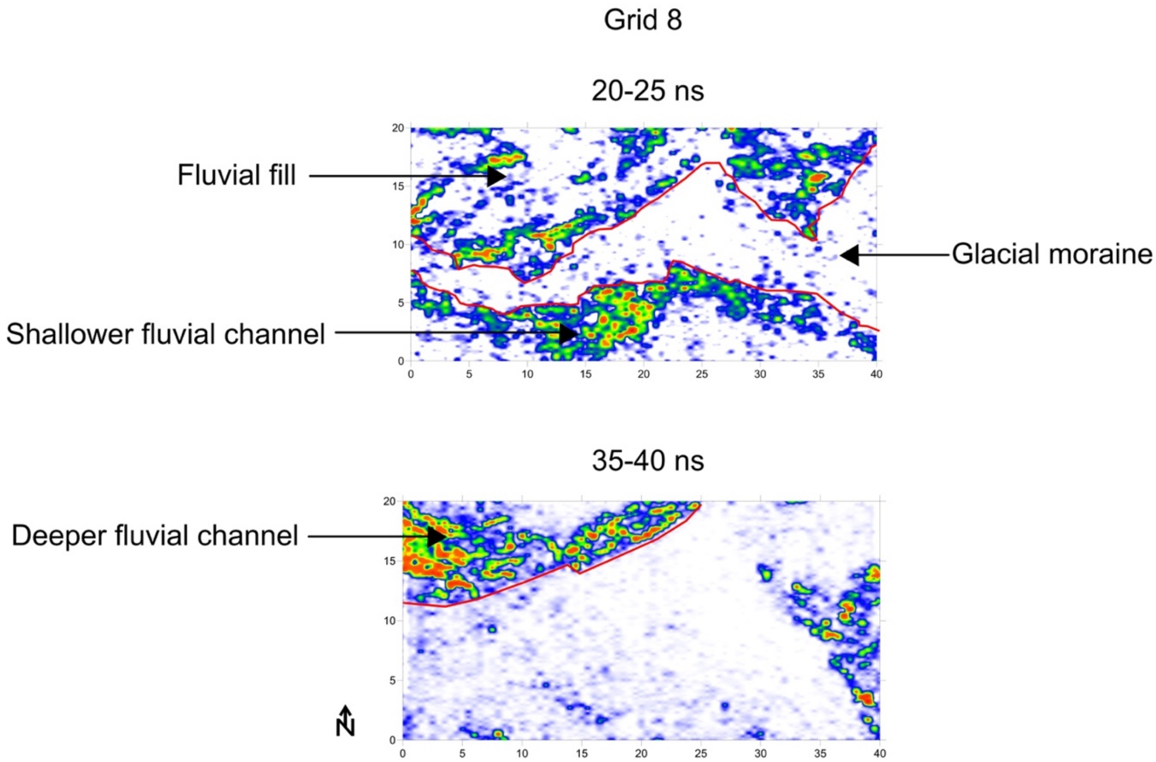


Figure 4.6: These slice-maps from Grid 8 show the glacial moraine bounded by fluvial channels and fill visible in GPR profiles and the magnetic data. The 20-25 ns slice shows an area of low-amplitude, which is the glacial moraine. To the north is fluvial fill, and a fluvial channel bottom is visible to the south. The northern fluvial channel is deeper, so is not visible until 35-40 ns. These differences in depth are apparent in the profile (Figure 4.4).

The data from Grid 8 provided a test for how merging GPR, magnetics, a knowledge of geological history, and the composition of sediments may be used to map the landscape. In this test, two main features were defined; a moraine, and post-glacial fluvial channels. The techniques used to map the landscape in Grid 8 were applied to other areas of the grid in order to place the rest of the site into an environmental framework. To the north, in Grid 2 (Figure 4.2), the sediment sequence appeared to thin and lap on to a feature that may have been a moraine (Figure 4.7). This area was tested to see if high glacial features may have bounded the site to the north, in addition to the south.

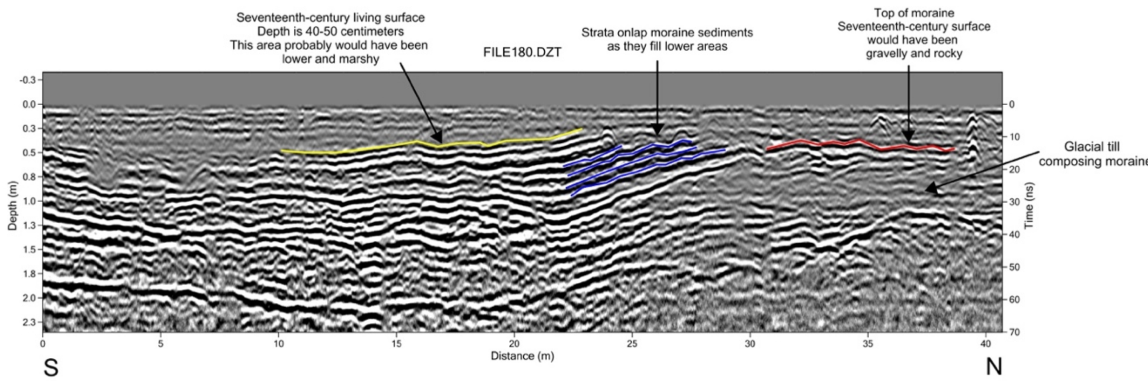


Figure 4.7: Another profile from Grid 2 shows the early colonial living surface at a depth of 40-50 centimeters. Here, the strata onlap the glacial moraine from 20-30 meters. The glacial till composing the moraine is visible from 30-38 meters. This moraine would have been a raised ridge of rocky soil during the early colonial period occupation. Fluvial sediments that filled the channel are on the margins of the moraine.

Profile 145 shows this thinning stratigraphy lapping on to the hypothesized high glacial feature (Figure 4.7). These features are visible in the GPR profiles (4.7 and 4.8). In order to discern the magnetic susceptibility of these features, magnetic values were extracted from Grid 2. As with the southern moraine, the glacial till composing this moraine appears as areas of high positive magnetism (Figures 4.7 and 4.8). The onlap to the south of the moraine and stratified fluvial sediments to the north are both negative magnetic features (Figures 4.8 and 4.9). This correlates with the data from Grid 8, confirming that a similar glacial feature bounds the site to the north. The filled fluvial channel to the north of the moraine was likely lower than the moraine, and would have been marshy during the seventeenth-century.

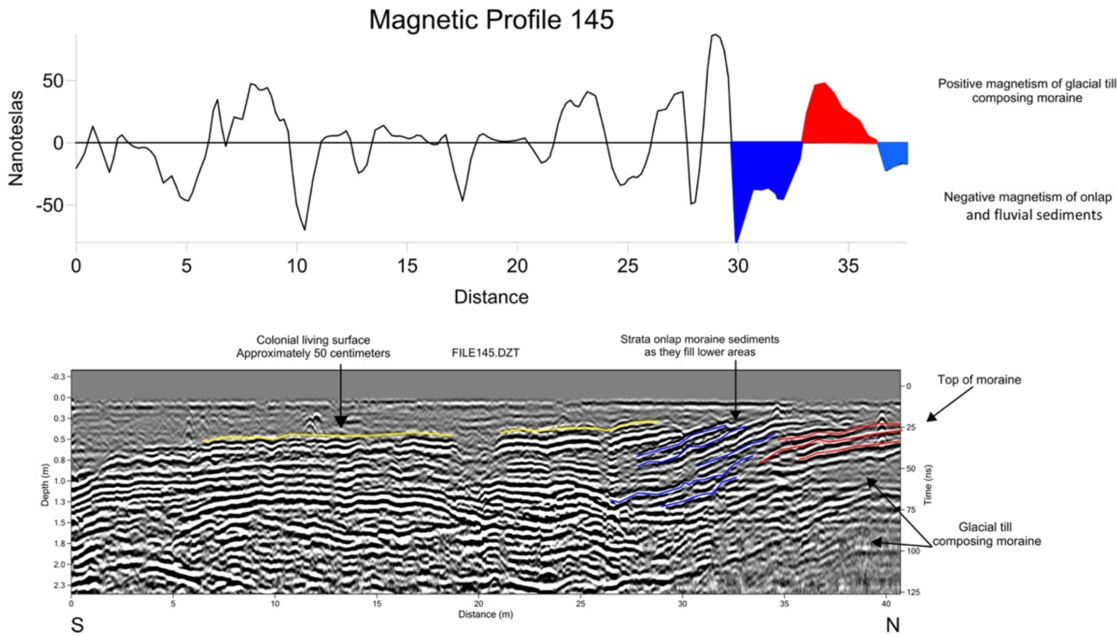


Figure 4.8: The magnetic profile that aligns with GPR profile 125 shows two areas of negative amplitude that coincide with the fluvial sediments to the north and south of the positive magnetism of the glacial till composing the moraine. The GPR profile from Grid 2 shows the colonial living surface at a depth of 40-50 centimeters. The strata onlap the moraine sediments between meters 26 and 34-35. The moraine would have been partially visible during the seventeenth-century occupation as a ridge of rocky soils. The areas of fluvial sedimentation to the north and south would probably have been lower and marshy during this period of occupation.

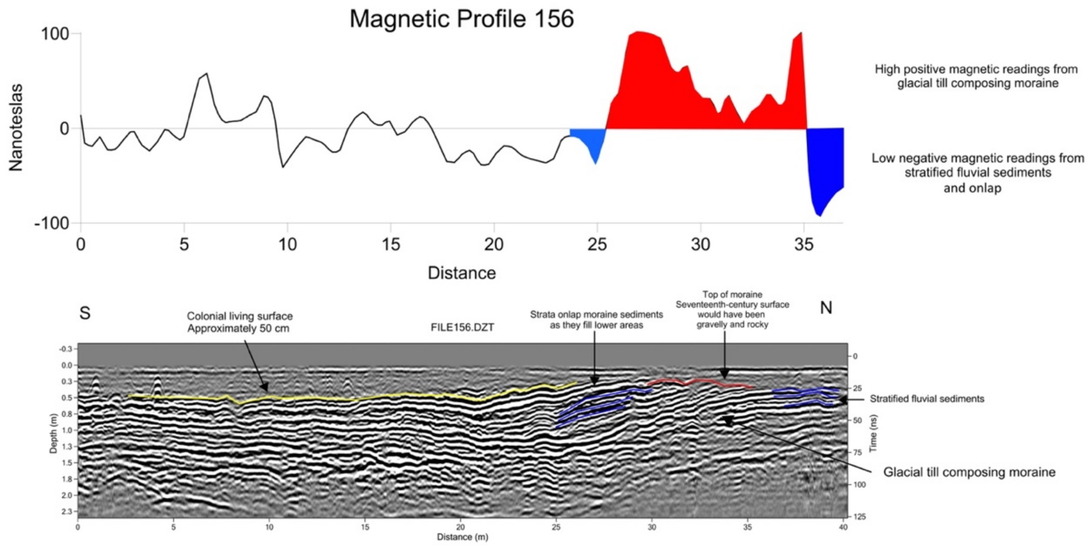


Figure 4.9: The magnetic profile 156 shows areas of negative magnetism that correlate with the onlap and the stratified fluvial sediments to the north and south of the moraine. The high positive magnetism correlates with the glacial till composing the moraine. The GPR profile also shows the colonial living surface at approximately 50 centimeters.

Using the GPR profiles and extracted magnetic values, the moraine, onlap, and fluvial sediments were mapped onto the magnetic map and GPR slice-map (Figure 4.10). This allows for these features to be viewed spatially on the landscape. Here, it becomes evident that, as with the southern moraine, the glacial moraine in Grid 2 trends northwest-southeast. During the seventeenth-century, this gravelly ridge would have been visible as a raised, rocky area on the landscape. The fluvial sediments to the north of the moraine would have been lower. This low area would have probably also been wet and marshy.

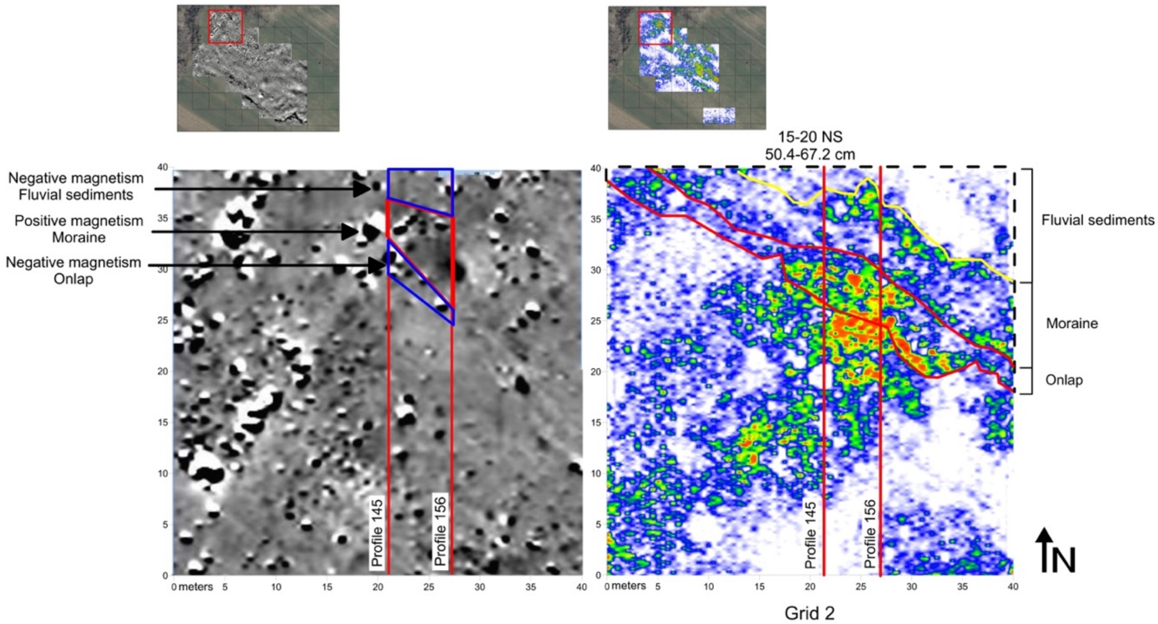


Figure 4.10: These maps of Grid 2 show where the profiles discussed above exist within the grid. The positive and negative magnetic areas, and other features annotated in the profiles have also been annotated in these maps. (Basemap from CTECO 2012).

In order to locate the seventeenth-century living surface, excavation profiles were used in conjunction with GPR profiles. The unit in Figure 10 was excavated in Grid 2 (Figure 4.2). In this profile, the well stratified lake deposits from glacial Lake Hitchcock are visible at the bottom. Above those deposits are fluvial sediments. At the very top of the profile is a darker layer of more recently deposited parent material, which is probably flood deposited. This layer has also been actively farmed and new soils have been generated. At approximately 50 centimeters below the surface, the seventeenth-century living surface is visible in the images produced from ground-penetrating radar data (Figure 4.11).

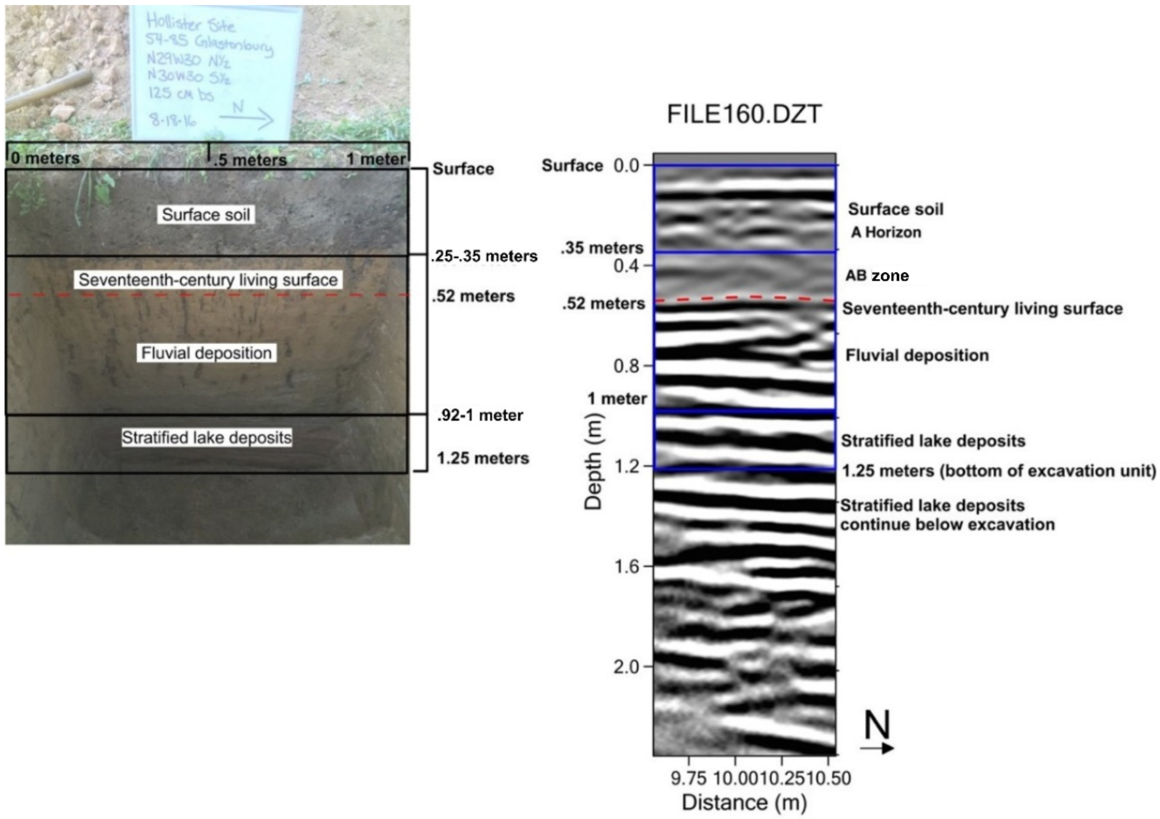


Figure 4.11: Soil horizons and the seventeenth-century living surface have been annotated.

The figure above depicts how a soil and GPR profile was correlated to confirm that accurate depths were recorded for different sedimentary and cultural layers. The surface soil horizon is visible as a layer of dark soil from the surface to approximately 35 centimeters. This layer is also seen in the GPR profile as high-amplitude reflections near the surface, extending to the same depth. Because the contact between the surface soil A horizon and the low-amplitude AB zone is at 35 centimeters in both the unit and GPR profiles, these profiles may be compared accurately. From 35 centimeters to 52 centimeters is an AB zone between the surface soil and the fluvial deposition, which visible as yellow soil in the unit profile. This horizon continues to 1 meter, where the stratified lake deposits are encountered. These continue beyond the unit profile, and are visible below 1.25 meters in the GPR profile, below the terminal depth of the excavation profile.

It is interesting that in the GPR profile, a distinct layer is visible at 52 centimeters. Analysis of a profile from Grid 3 (Figures 4.12, profile location in Figure 4.2) shows the continuation of this layer, which is correlated with artifacts and other materials that were compacted between two cellars. This indicates that the seventeenth-century living surface is visible in the GPR profiles as a distinct planar reflection at 40-50 centimeters.

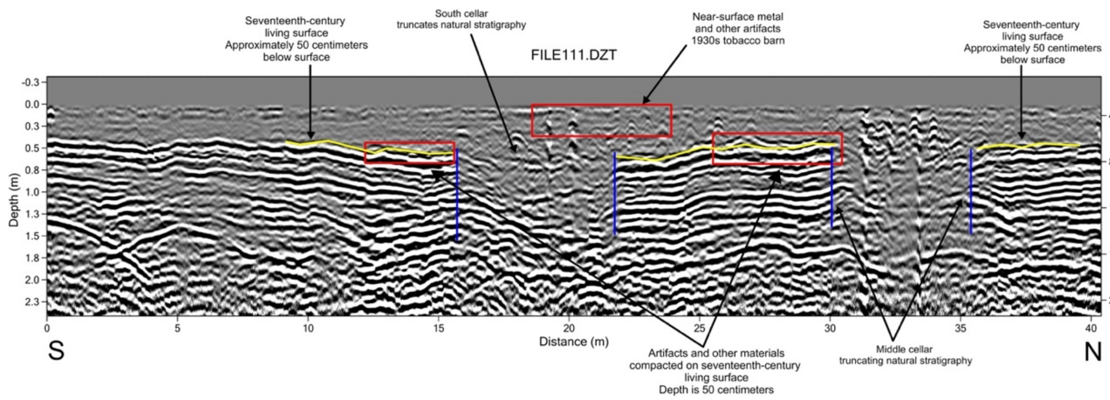


Figure 4.12: The seventeenth-century living surface is visible in Grid 3 as a planar reflection at a depth of approximately 50 centimeters. Artifacts and other materials that have been compacted on it are also apparent. Two European cellars truncate the natural stratigraphy. Later artifacts, probably from a twentieth-century tobacco barn, produce point-source hyperbolas near the present ground surface.

By examining the living surface as it was related to known cultural features, such as in Figure 4.12, the seventeenth-century occupational surface was established as a distinct horizon of compaction. This layer is typically at a depth of 40-50 centimeters. With this knowledge, the living surface was easily recognizable in grids where there were few cultural features (Figures 4.13-4.16, profile locations in Figure 4.2). The profiles in Figures 4.13-4.16 exhibit the continuity in depth of the living surface across the grid.

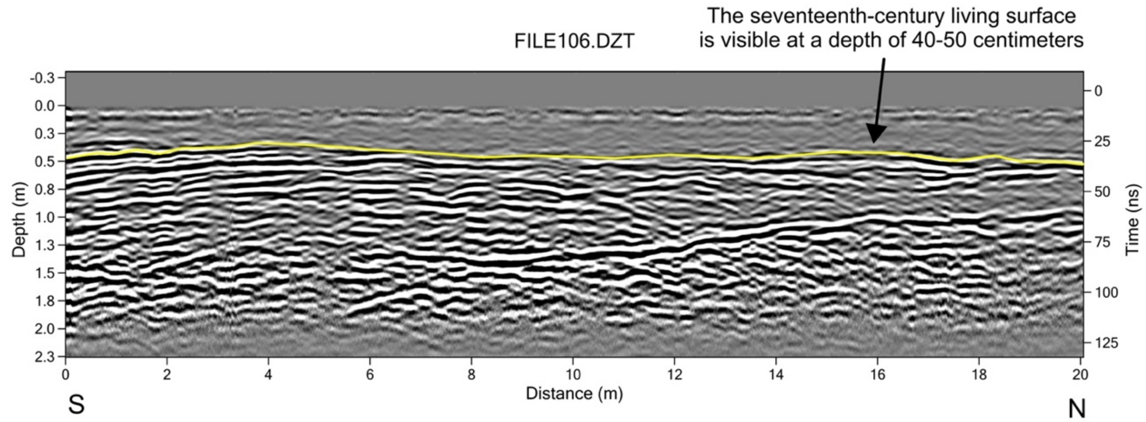


Figure 4.13: The seventeenth-century living surface is consistent throughout the site. This profile from Grid 4 shows the living surface at a depth close to 50 centimeters.

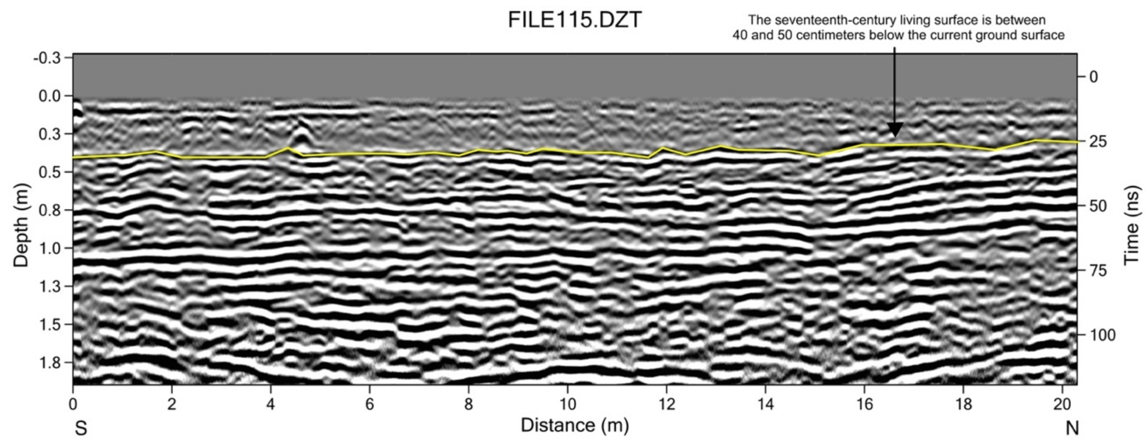


Figure 4.14: This profile from Grid 5 shows that the living surface is consistently at a depth of between 40 and 50 centimeters.

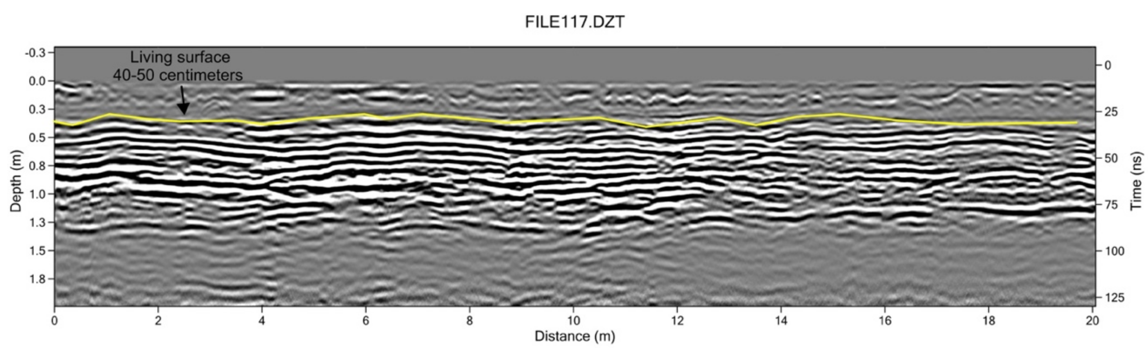


Figure 4.15: The seventeenth-century living surface continues at a depth of 40-50 centimeters in Grid 10.

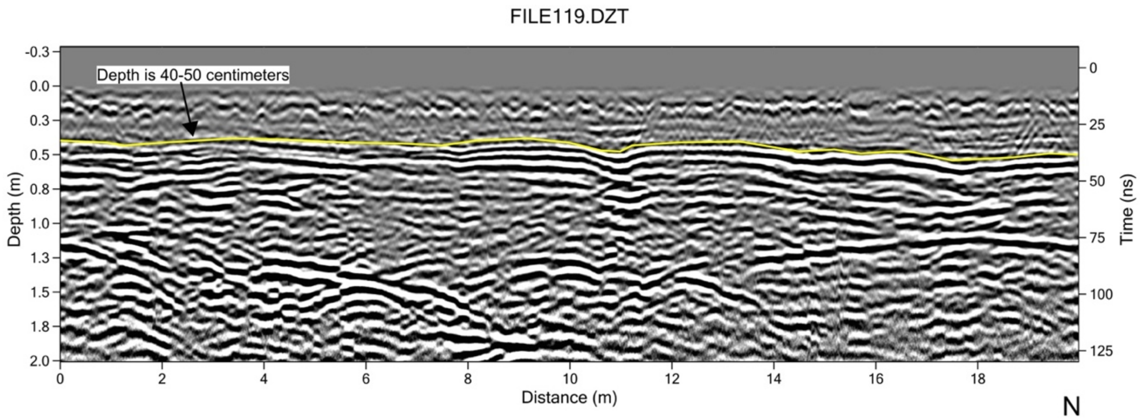


Figure 4.16: Profile 119 from Grid 9 shows the continuity of the living surface at a depth of 40-50 centimeters below the current ground surface.

This distinct living surface allows for the determination of relative ages of materials, sediments, and artifacts. For example, in Figure 4.16 (profile location in Figure 4.2), a later midden is visible above this horizon. This information allows for the seventeenth-century living surface and features to be more readily discerned from features produced by later, and earlier, occupations.

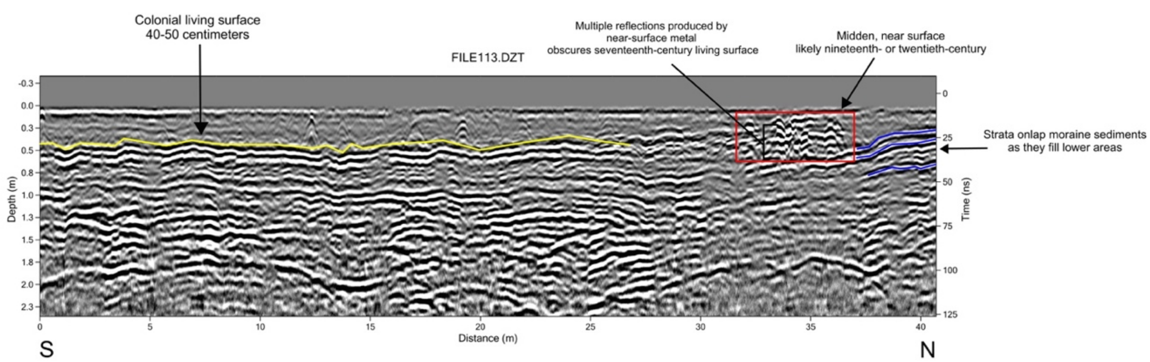


Figure 4.17: A nineteenth- or twentieth-century midden produces overlapping point-source hyperbolas on the northern end of this profile from Grid 2.

An oval structure in Grid 3 is visible in Profile 180 (Figures 4.17 and 4.2). It is known that Indigenous peoples in this region and period occupied oval houses (Lavin 2013, 274). The profile shows that this structure is also incised into the ground. The structure was cut approximately 50 centimeters into the living surface. Because this structure is cut more deeply into the ground (Figure 4.18), and is larger than the other oval structures in the southwestern area of the site (Figure 4.19), it may have been a winter dwelling, or is older. The half-meter or so of earthen walls would have provided more insulation during the winter than a structure built on top of the living surface. At just over a meter, this floor is too deep for magnetic analysis to be useful. While a magnetometer receives accurate readings to a depth of approximately 1.5 meters, a relatively small hearth at this depth will provide only a small deflection. However, a part of the floor produces a bowl-shaped reflection (Figure 4.18), indicative of a hearth (Conyers 2013, 153). Adjacent to this feature to the north and south, planar reflections produced by the compaction of the living surface are apparent. Here, the living surface is at a depth of 45-50 centimeters.

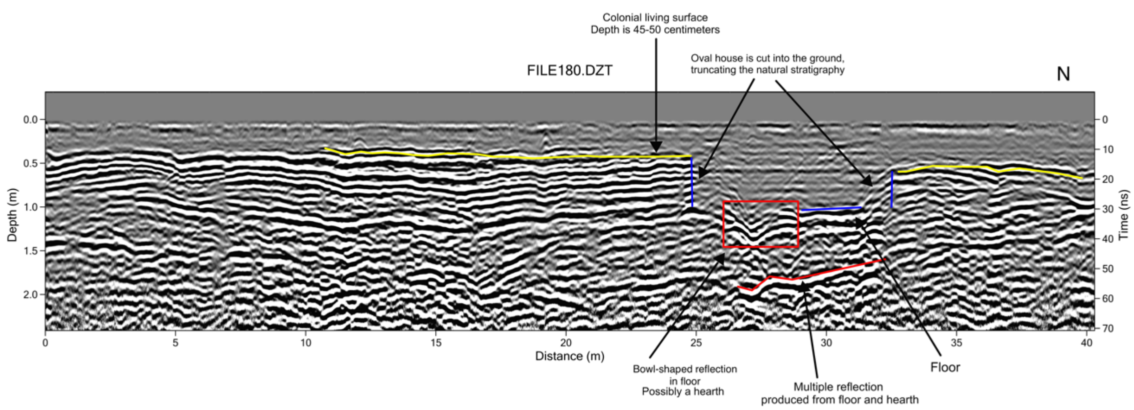


Figure 4.18: This profile from Grid 3 shows the colonial living surface at a consistent depth of 45-50 centimeters. An oval house is also present in this image. The walls truncate the natural stratigraphy, and a floor is visible as a planar reflection with a burned portion producing high-amplitude reflections. This burned area is potentially a hearth. The floor and hearth also produced a multiple reflection that has been annotated.

A smaller oval feature is in Grid 7 (Figure 4.2), and is bounded by planar reflections produced by the compacted living surface (Figure 4.19). Here, this important cultural horizon is slightly shallower, at approximately 40-45 centimeters. The floor of this structure is visible in the GPR profile as a planar reflection. The magnetic profile from this structure also shows the floor has an area of high positive magnetism (Figure 4.19). This is probably a hearth, which is also visible in the GPR profile as high-amplitude reflections.

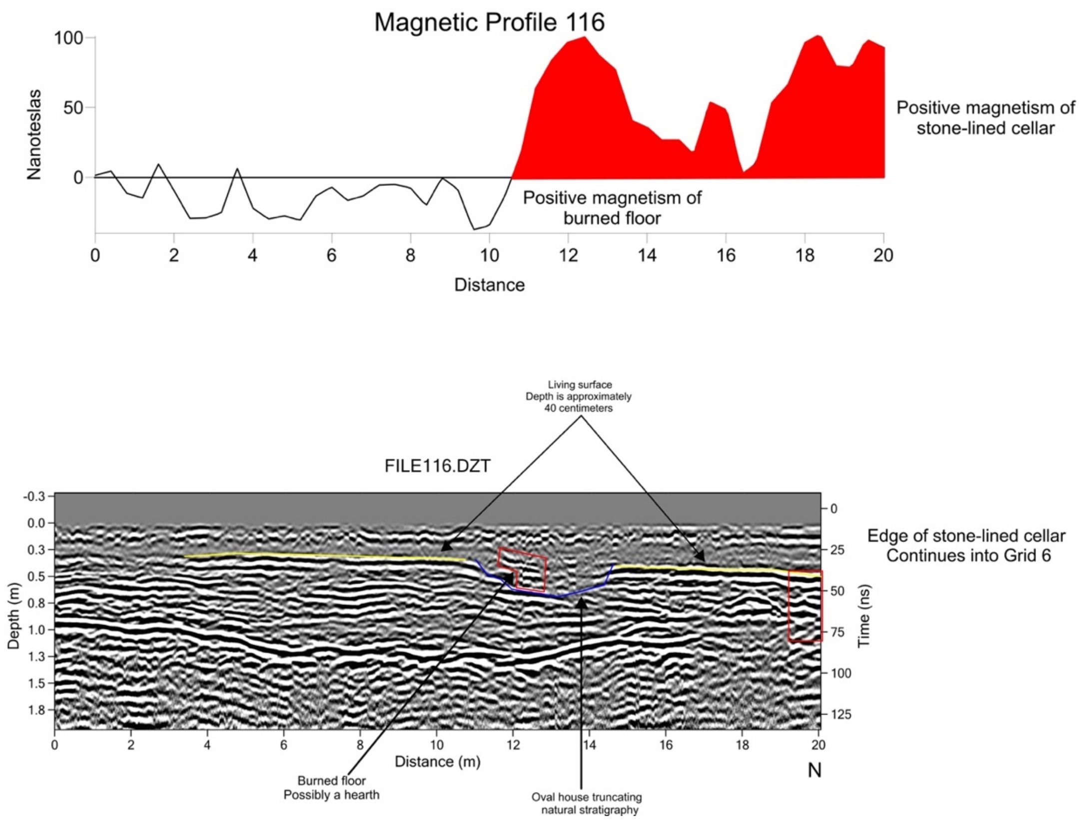


Figure 4.19: These profiles show one of the oval structures, and the burned floor within it. This burned portion of the floor is highly positively magnetic in the magnetic profile, and is visible as high-amplitude reflections in the GPR profile. The northernmost area of the profiles encounters the stone-lined cellar visible in Figure 4.22.

The feature in the profiles above is one of three oval features in the southwest area of the site (Grid 7 Figure 4.2). Figure 4.20 shows these features as anomalies with high positive magnetism. These measurements were probably produced from the burned floors of the oval features visible in the GPR slice-map. Figure 4.21 depicts these oval features as areas of low-amplitude in the GPR slice-map. Given that Indigenous peoples in this region occupied oval-shaped houses, it is likely that these oval features are evidence of three of these oval houses (Lavin 2013, 274). Since one cuts into another, they represent separate periods of occupation.

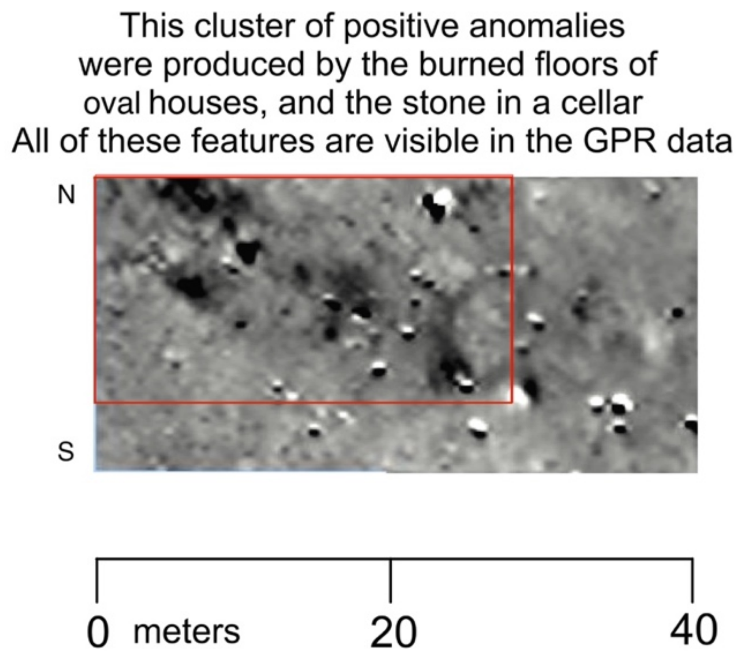


Figure 4.20: Magnetic map from Grid 7. The areas of high positive magnetism were probably produced from burned floors of the oval houses visible in Figure 14.

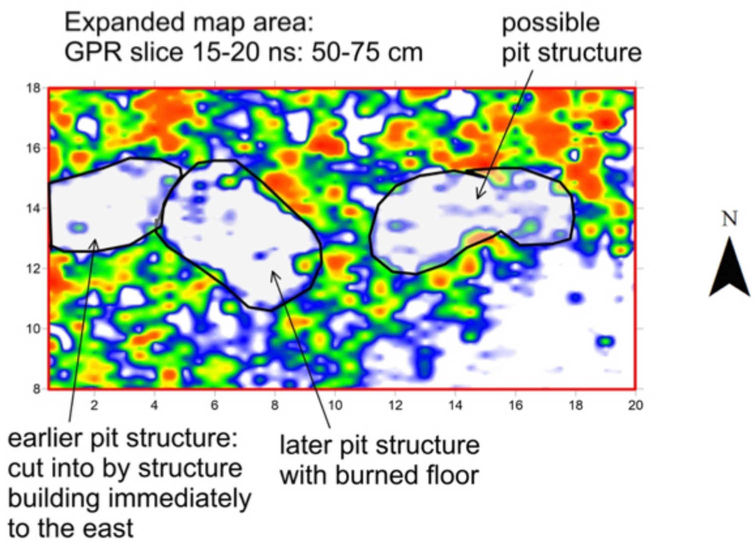


Figure 4.21: These oval areas of low-amplitude from Grid 7 align with the burned floor surfaces visible in the magnetic data and GPR profiles. These are likely Indigenous house structures.

In Grid 6 (Figure 4.2), a stone-lined cellar truncates the natural stratigraphy (Figure 4.22). The living surface is visible in Profile 152 as a compacted horizon, with artifacts producing point-source hyperbolas. These may be compared to later nineteenth- or twentieth-century artifacts, which also produce point-source hyperbolas, but are nearer the surface. In this profile, the living surface is also at a depth of approximately 50 centimeters.

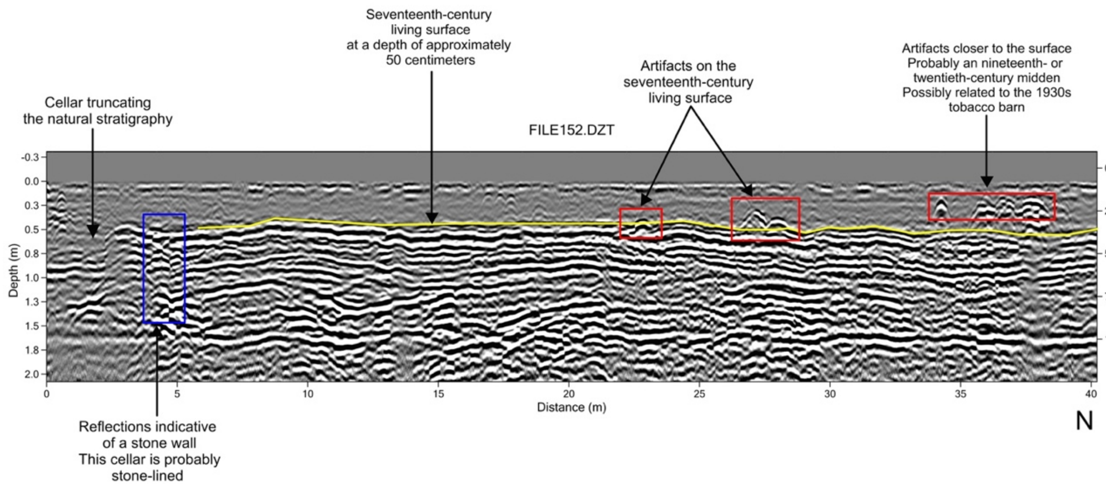


Figure 4.22: This profile from Grid 6 shows the living surface at a depth of 50 centimeters. Artifacts from this period produce point-source hyperbolas on this surface. Later artifacts, probably dating to the nineteenth- or twentieth-centuries are visible as point-source hyperbolas closer to the surface. On the southern edge of this image is a stone-lined cellar truncating the natural stratigraphy.

The living surface is consistently at a depth of 40-50 centimeters for the data when it is adjacent to both European cellars and Indigenous pit houses. This indicates that these different types of structures were occupied fairly closely in time, or even contemporaneously. Because one oval structure to the southwest cuts into another, it is likely that there were different occupational periods in the same area by Indigenous peoples of the Connecticut River Valley.

This analysis of the GPR and magnetic data allowed for a comprehensive map of the seventeenth-century landscape to be produced (Figure 4.23). It becomes clear through this map that the site is bounded to the north and south by recessional moraines, which would have been apparent on the surface as gravelly ridges. To the north of the northern moraine, and on either side of the moraine to the south would have been low, marshy areas where fluvial channels were filled with sediment. With this information about the seventeenth-century landscape, it is logical that the pit houses and cellars composing the cultural landscape of the site existed on the higher, more level ground between these moraines. The living surface from this period is consistently at a depth of 40-50 centimeters, so it is likely that Indigenous peoples inhabited the site soon before, or beside English settler-colonists.

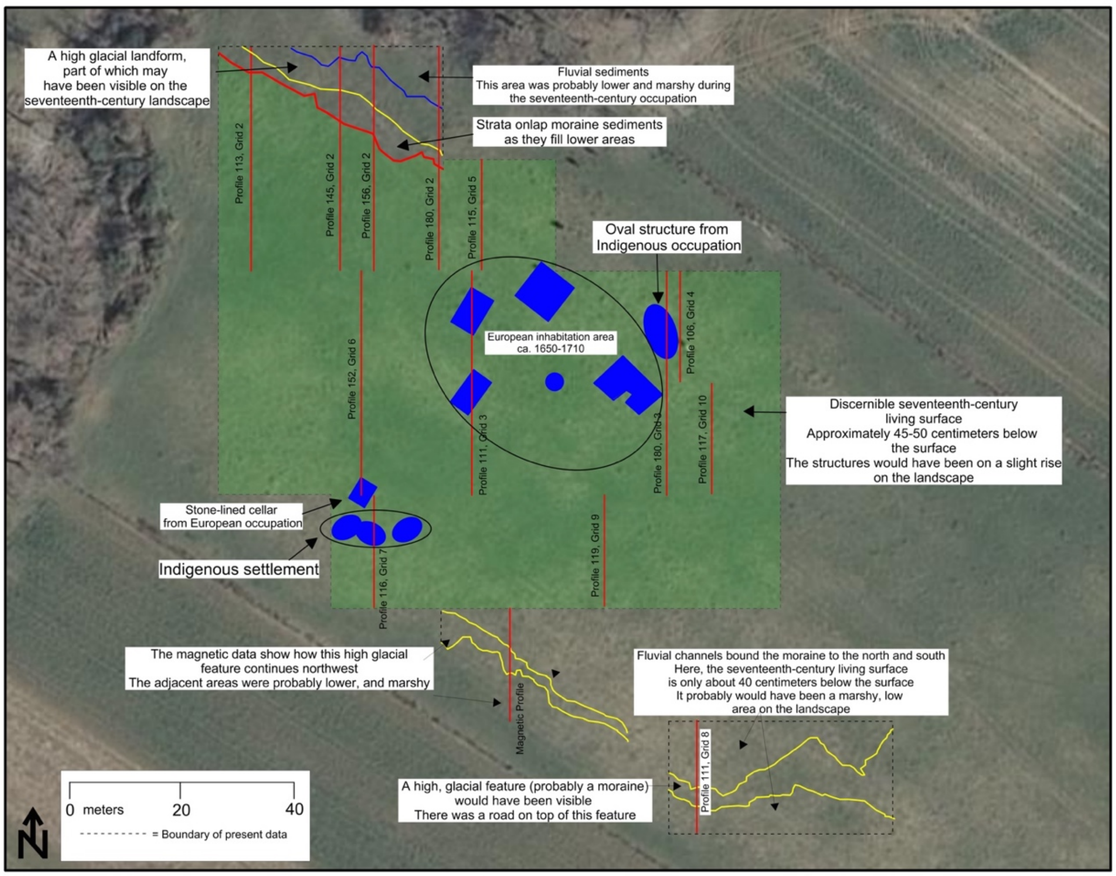


Figure 4.23: This map recreates the seventeenth-century landscape. In the northwest corner is a recessional glacial moraine. This would have been an elevated rocky area during the period of occupation. To the north of that moraine is a filled-in fluvial channel, which would have been low and marshy. The green area is the living surface, which is at a consistent depth of 40-50 centimeters throughout the images produced from the GPR data. It is relatively flat, dry, and homogeneous compared to the areas to the north and south. To the south and in the southeast corner is another recessional glacial moraine. Like the other, this would have been a raised ridge of rocky soil. This feature is bounded by fluvial channels that filled with sediment, which would have been boggy during the seventeenth-century. An indigenous settlement is in the southwest area of the site, while a European settlement is

centered between the moraines. All of the profiles that are annotated in this map are included in this section. (Basemap from CTECO 2012).

Magnetic data

Certain areas of the magnetic survey were chosen for further investigation based on the types of anomalies that were present in the images produced from the data (Figure 4.24). A discussion of the interpretation of the magnetic data, and how these impacted further study at the Hollister site follows.

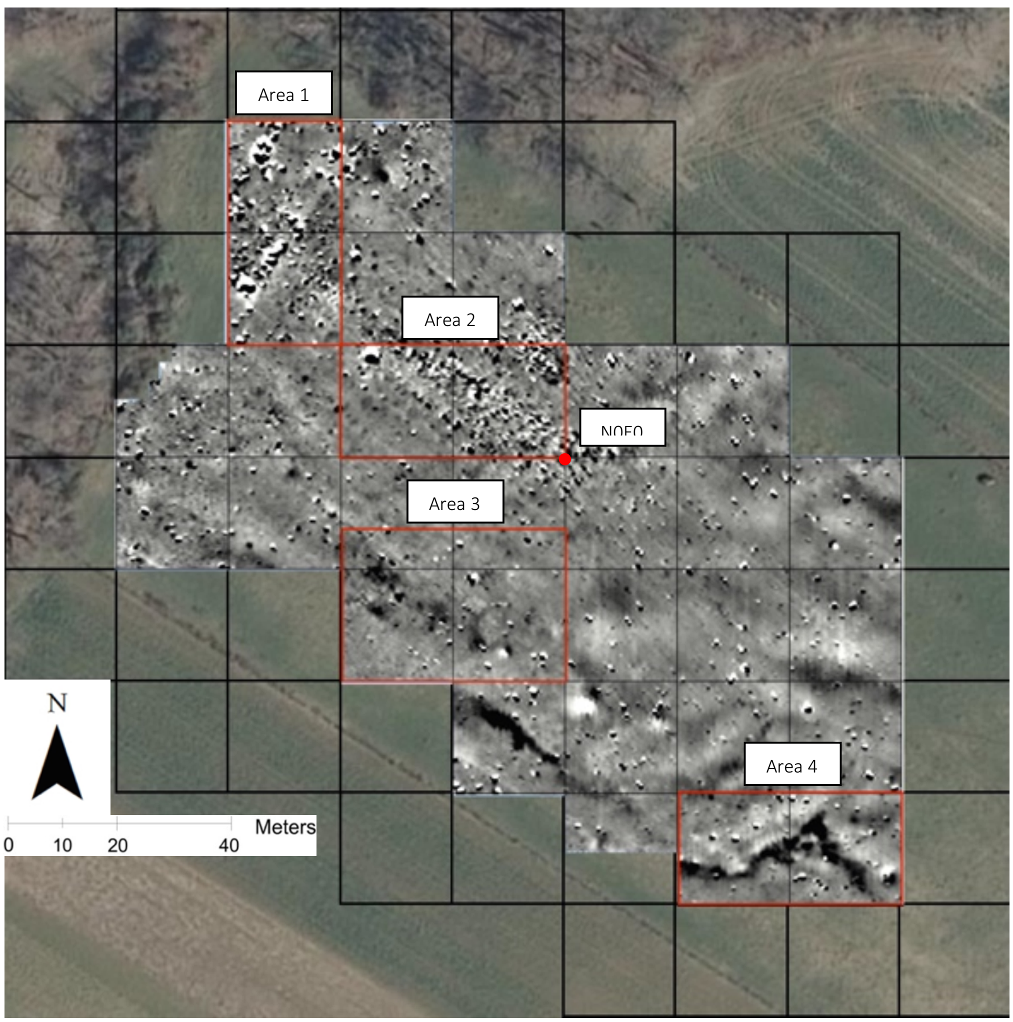


Figure 4.24: Map produced from the magnetic data. Four areas were chosen to focus further GPR survey. (Basemap from CTECO 2012).

Area 1 was chosen, because there were a number of large, dipolar anomalies present. Dipolar anomalies are indicative of iron artifacts (Kvamme 2006a, 221). Thus, it can be deduced that there are iron artifacts in this area. Further investigation with ground-penetrating radar reveal more detailed information about this area.

Area 2 is interesting, because it is an area that was known to contain cellars, as seen in Peter Leach's 2015 GPR data (Methods Chapter). However, these features were largely concealed in the magnetic data by a large, rectangular area of many dipolar anomalies (Figure 4.25). Iron artifacts remaining from wooden structures can conceal features below (Kvamme 2006a, 221). An aerial photograph from 1934 shows a tobacco barn in the same area as the rectangular area of dipolar anomalies (Figure 4.25). When the photograph and magnetic data are overlaid on the landscape, it becomes clear that the dipolar anomalies have been produced by metal, such as nails and hinges, which are associated with the tobacco barn. The 1934 photograph was taken at a slight angle, so while the overlay is not perfect, it is clear that the tobacco barn is the source of the metal detected in the ground. Coincidentally, the area where the tobacco barn was located is also where numerous cellars and pits are visible in the images produced from the ground-penetrating radar (GPR) data that were collected in 2015 by Peter Leach.

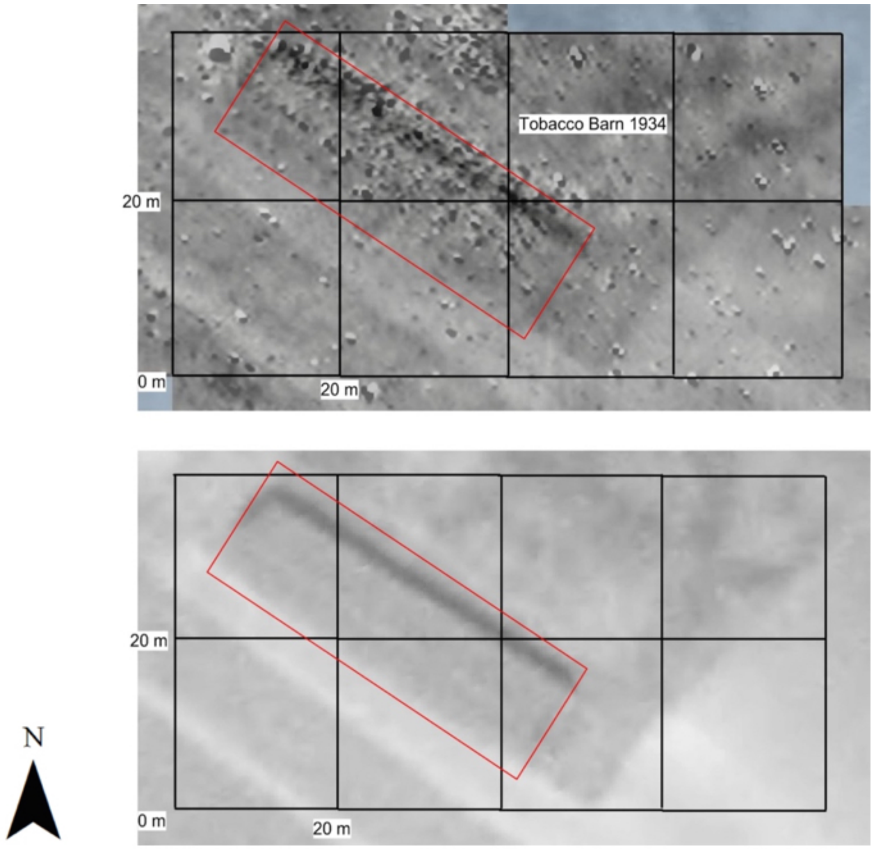


Figure 4.25: Many dipolar anomalies in the magnetic data align with a 1934 tobacco barn. Photograph public domain.

Area 3 was chosen as an area of interest, because there are a number of positive anomalies that appear to be aligned linearly parallel to the property line (Figure 4.24). Positive anomalies are black in the magnetic data, and are areas that have been enhanced magnetically (Fassbinder 2015, 85-86). Any pit, ditch, or posthole that has been refilled by topsoil will be magnetically enriched, and will be visible in the magnetic data as positive anomalies (Fassbinder 2015, 88, Kvamme 2006a, 217-219). The positive anomalies visible in the magnetic data were hypothesized to be postholes associated with the palisade that was reportedly constructed on the site in 1675 (Adams 1904, 205, 207, 212, Brian Jones, email to author, January 21, 2016, Pequot Museum 2016).

Finally, Area 4 was selected because of the long, linear, positive anomaly with a negative anomaly paralleling it to the north (Figure 4.24). Ditches may be filled with magnetically enriched soil, which would produce a positive linear anomaly such as the one seen in Area 4 (Kvamme 2006a, 217-219). Based on these interpretations of the magnetic data, this feature was also thought to be a ditch associated with the palisaded farm (Adams 1904, 205, 207, 212, Brian Jones, email to author, January 21, 2016, Pequot Museum 2016). These hypotheses were disproven once the magnetic and GPR data were integrated.

These interpretations of the magnetic data were used to guide ground-penetrating radar surveys in the summer of 2016. The magnetic data were also used in conjunction with the GPR data to better understand what different types of features look like in each data set. Interpretations of the ground-penetrating radar data address these observations.

Ground-penetrating Radar Data

The ground-penetrating radar survey conducted in July and August of 2016 was guided by the magnetic data. Areas of interest were chosen based on anomalies visible in the magnetic data. A total of ten grids were collected, all of which overlapped areas where magnetic data had been collected. Figure 4.26 depicts where the GPR grids were collected in relation to the magnetic data. Grid 1 was disregarded because it overlapped completely with Grid 3 and did not yield different or more significant results. The survey yielded a wealth of data, with many features visible throughout. From these many features, a few from each grid have been chosen to discuss further. Excavations that were guided by the GPR data will also be discussed.

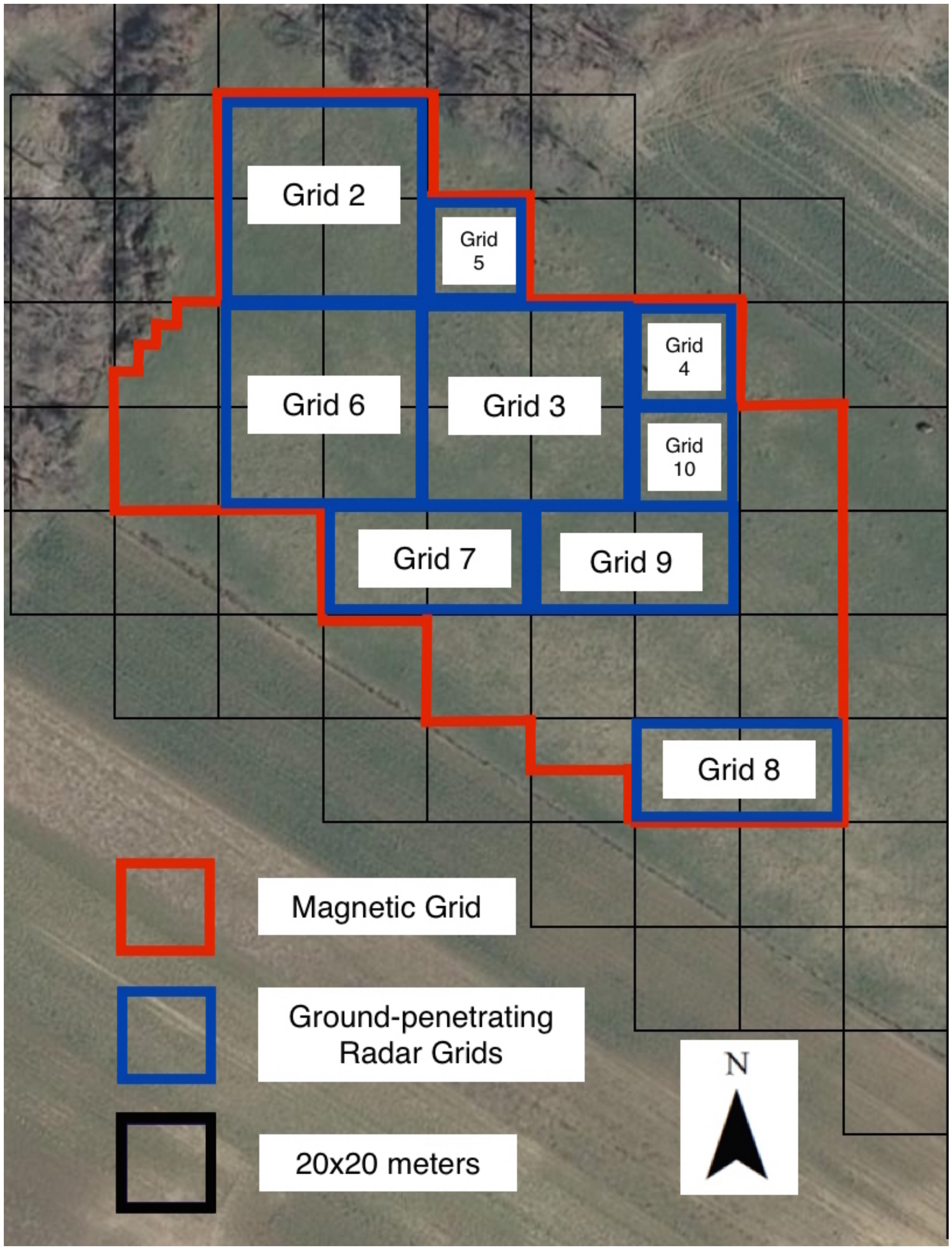


Figure 4.26: Map depicting the magnetic, GPR, and local grids in relation to one another. (Basemap from CTECO 2012).

Grid 2

The magnetic data from the area of the magnetic survey that overlapped with Grid 2 in the GPR survey depicted two areas with large, overlapping dipolar anomalies (Figure 4.27). These types of anomalies are characteristic of metal materials (Kvamme 2006a, 220). These features are also visible in the GPR data as numerous overlapping point-source hyperbolas (Figures 4.28 and 4.29). These types of reflections are typical of middens (Conyers 2012, 63). These reflections also exhibit multiples, which are when reflections bounce around within the object producing the reflection (Conyers 2012, 136). Multiple reflections are common in metal objects (Conyers 2012, 136). This example shows that middens containing metal may be readily identified by examining the magnetic data in conjunction with GPR data.

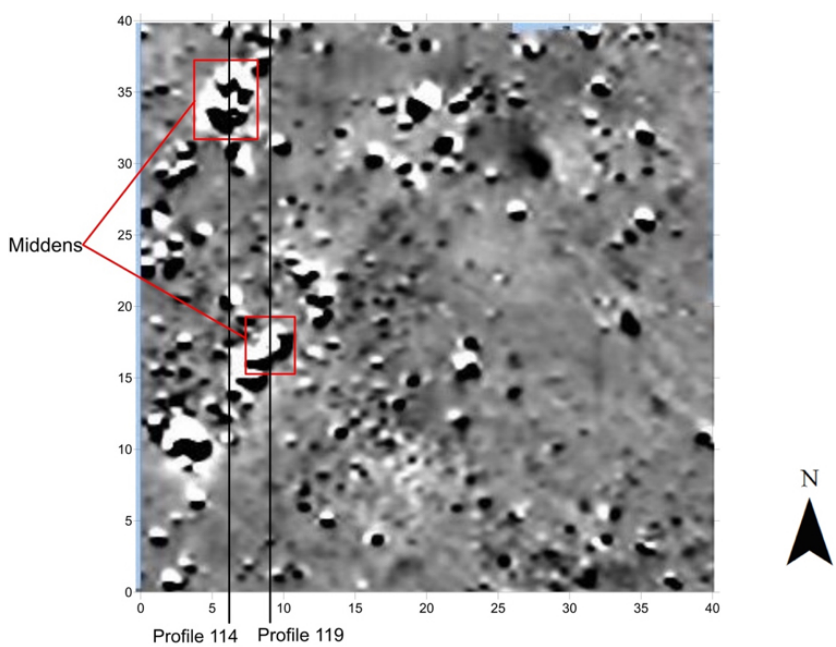


Figure 4.27: Magnetic data showing at least two, large overlapping dipolar anomalies. These are indicative of middens containing metal material. Profiles 114 and 119 were collected over these features.

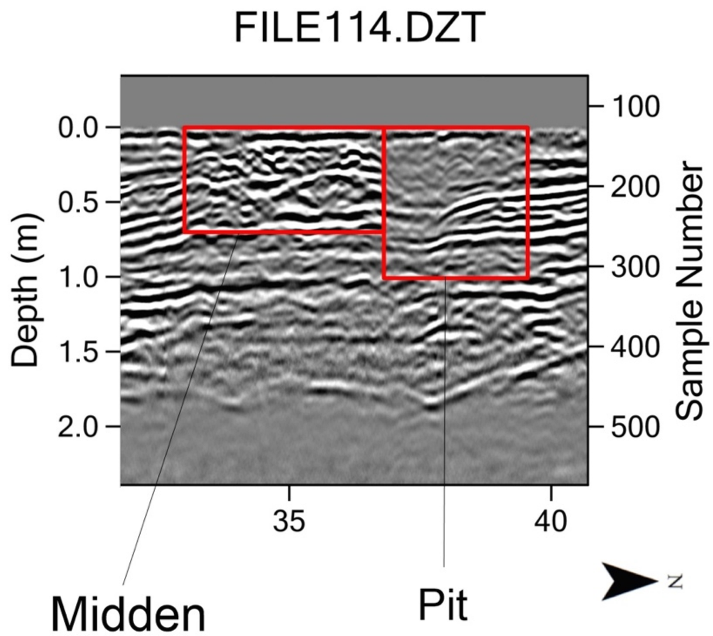


Figure 4.28: A midden identifiable by overlapping point-source hyperbolas is visible in this profile, which overlaps with dipolar anomalies seen in the magnetic data (Figure 4.24). This profile also shows a pit feature to the north of the midden. This pit is also visible in the amplitude slice-map from this grid (Figure 4.30).

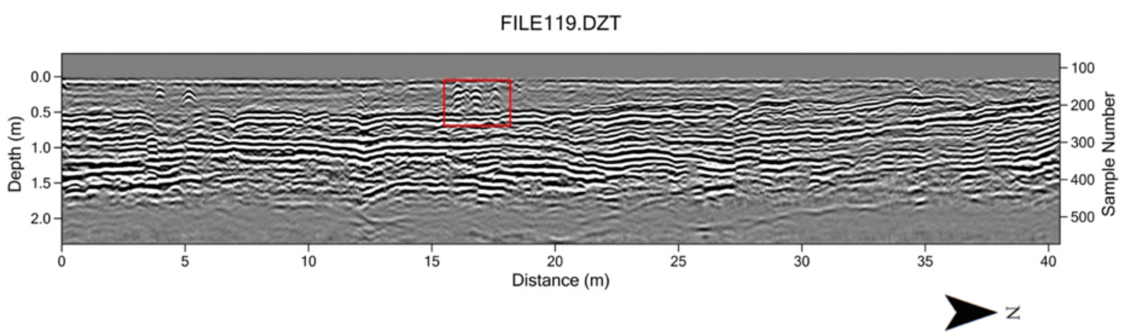


Figure 4.29: Overlapping point-source hyperbolas and multiple reflections are visible in this profile. These types of reflections are characteristic of middens containing metal objects, which coincides with the magnetic data, which shows dipolar anomalies where this profile was collected (Conyers 2012, 63, 136, Kvamme 2006, 220). This midden is also visible in the amplitude slice-map from this grid (Figure 4.30).

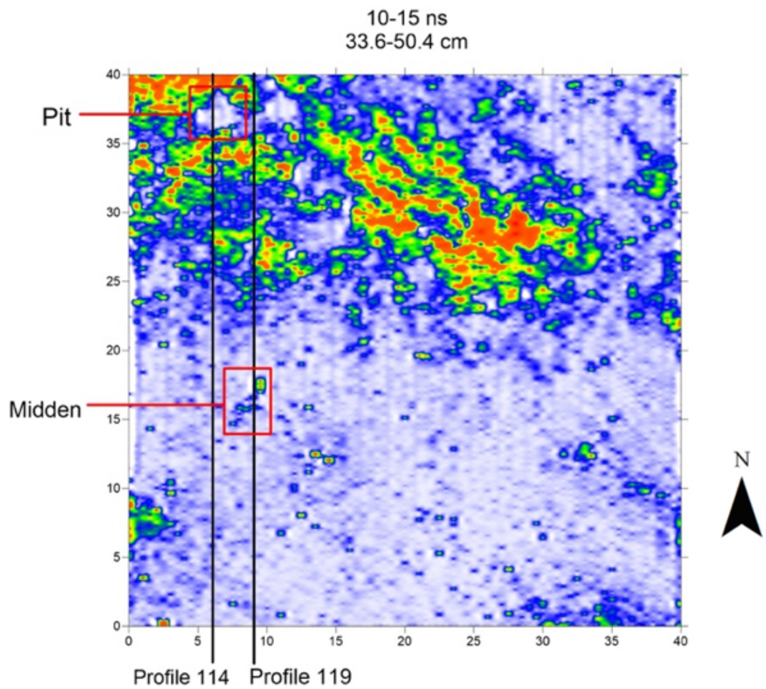


Figure 4.30: The amplitude slice-map from Grid 2 shows the pit visible in Profile 114, and the midden visible in the magnetic data and Profile 119.

Another feature of interest that is visible in the images produced from the data is a series of circular depressions of low amplitude. The amplitude slice-map from this grid depicts these features as a number of circles, aligned linearly (Figure 4.31). Profile 162 shows one of these features as a depression at a depth of 51 centimeters (Figure 4.31). These circular features are especially interesting because they could potentially have been associated with a palisade that was thought to have been constructed on the site (Adams 1904, 205, 207, 212, Brian Jones, email to author, January 21, 2016, Pequot Museum 2016). This feature was excavated, which will be discussed.

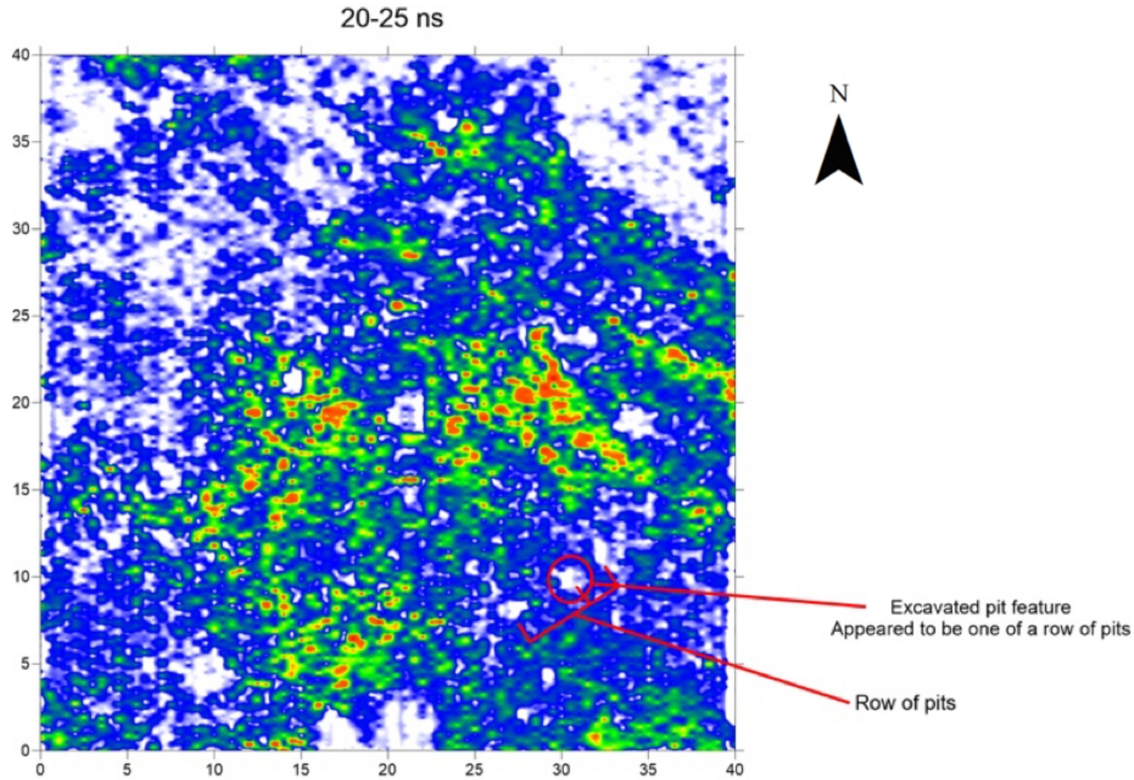


Figure 4.31: This amplitude slice-map from Grid 2 shows what appears to be a row of pits, one of which was excavated. This excavated pit is also visible in Profile 162 (Figure 4.32).

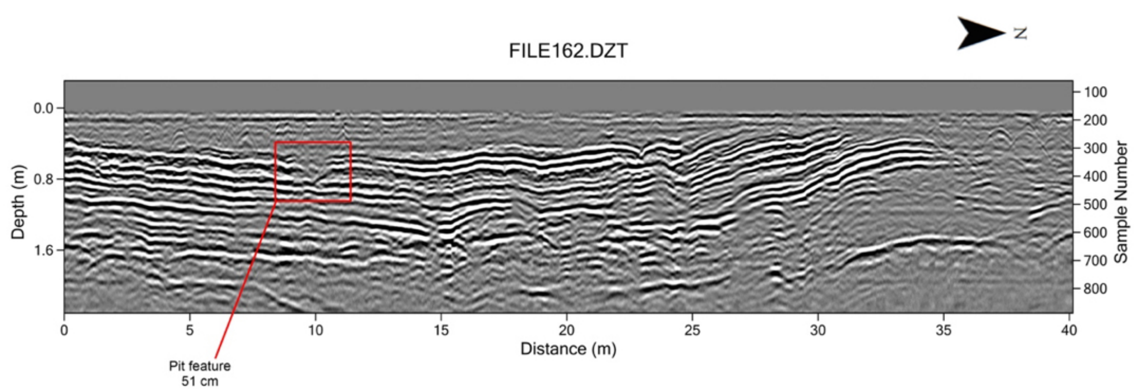


Figure 4.32: Profile 162 shows a depression at a depth of 51 centimeters that aligns with the circular area of low-amplitude in the slice-map (Figure 4.31). This feature was excavated because it was hypothesized to have been part of a palisade reportedly constructed on the site.

A unit was excavated over the depression visible in Profile 162 because it appeared to be part of a line of circular features, which were hypothesized to be postholes from a palisade (Adams 1904, 205, 207, 212, Brian Jones, email to author, January 21, 2016, Pequot Museum 2016). The location of this unit (N30W30/N29W30) in relation to Grid 6 is visible in Figure 4.33.

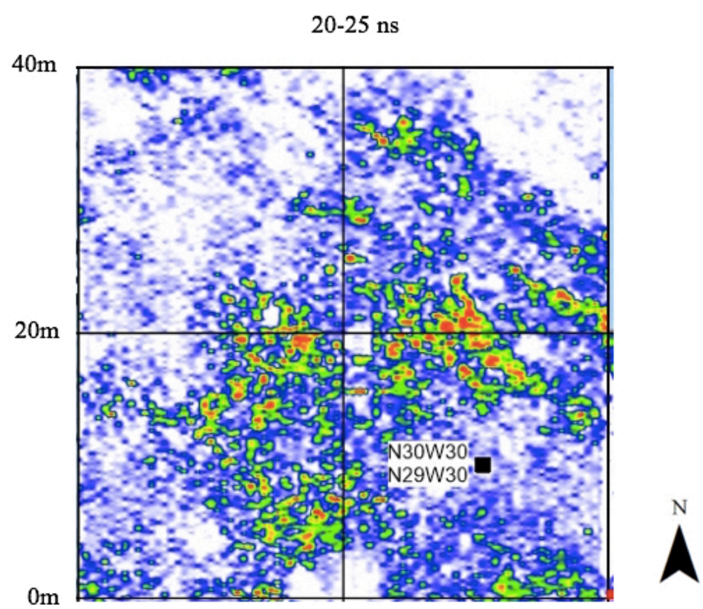


Figure 4.33: Location of unit N30W30/N29W30 in Grid 2.

Because it was hypothesized to be a posthole, it was anticipated that at some point a stain in the soil would be visible, indicating that a post had once stood where the area of low-amplitude was visible in the GPR images. Specifically, this stain should have appeared at a depth of 51 centimeters (Figure 4.32). However, as was discussed in the Methods chapter, this stain never appeared. Instead, we encountered linear black stains at approximately 85 centimeters, which were probably derived from rotted roots associated with a tree that had once stood there. As we excavated, we did not see features or changes in the soil that correlated with the GPR data. This is interesting, because it exemplifies how, sometimes, the images produced from GPR data display features that would otherwise be invisible. Perhaps the circular, low-amplitude feature that was excavated was simply a tree throw. Nevertheless, the amplitude slice-maps and profiles produced from the GPR data revealed a feature that was imperceptible during excavation.

Grid 3

Grid 3 is the most complex of the GPR grids that were collected during this survey. Four cellars, numerous pits, and an oblong feature are all visible in the slice-maps and profiles (Figures 4.34, 4.35, 4.36, 4.37, 4.38, and 4.39). This grid is also where the majority of excavations took place, which yielded a vast number of artifacts.

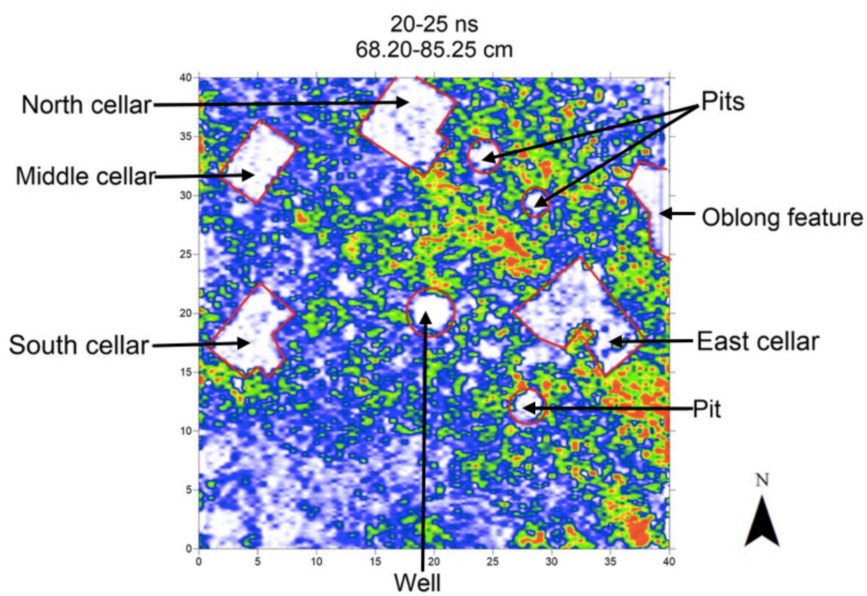


Figure 4.34: Numerous features are visible as areas of low-amplitude in the slice-map produced from Grid 3. High-amplitude reflections between the cellars have been produced by materials and artifacts on the buried 1600s living surface (Figure 4.39).

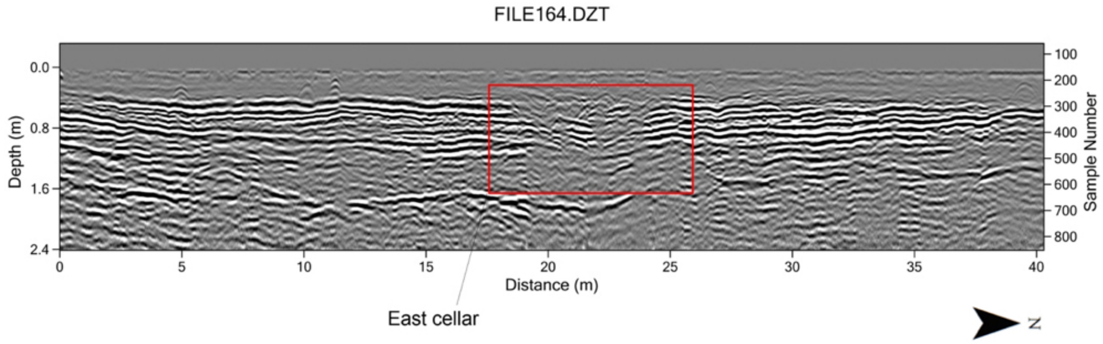


Figure 4.35: Profile 164 shows the easternmost cellar as an area of low-amplitude truncating the natural stratigraphy. Point-source hyperbolas within this area of low-amplitude are produced by object within the fill. This feature is also visible in the slice-map from this grid as a rectilinear area of low-amplitude (Figure 4.34).

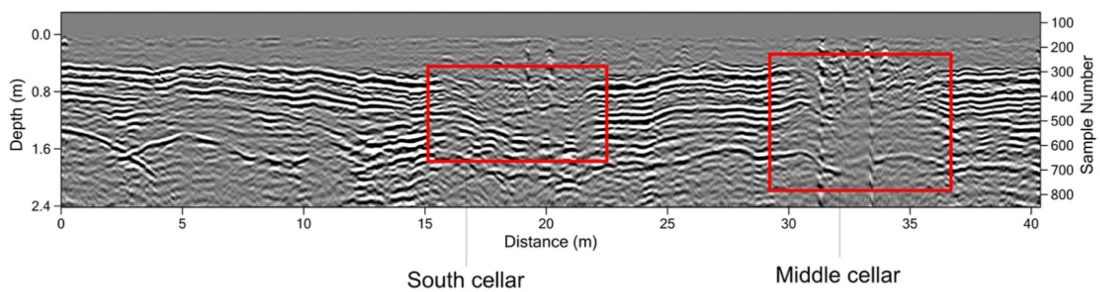


Figure 4.36: Profile 111 crosses both the South and Middle Cellars. These are visible as areas of low amplitude truncating the natural stratigraphy. These cellars have been labeled in the slice-map from this grid (Figure 4.34).

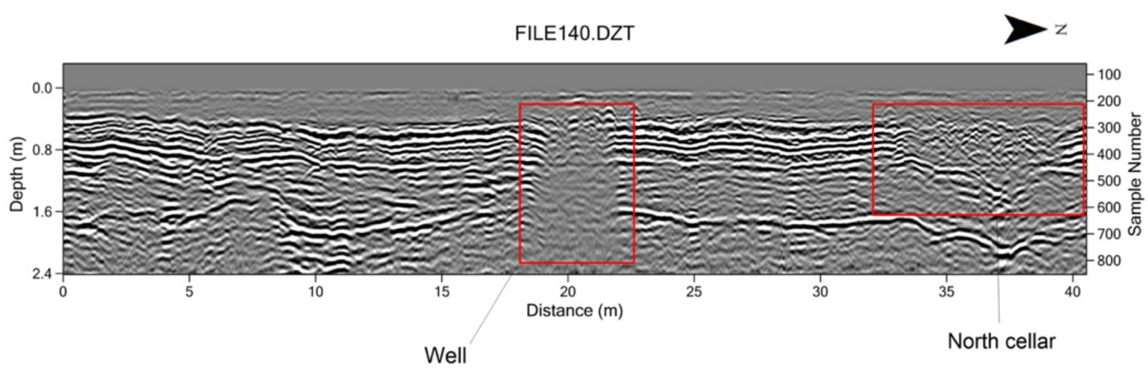


Figure 4.37: Profile 140 shows the well that was the N0E0 point for the local grid, and the North Cellar. These are visible as areas of low-amplitude, and have been labeled in the amplitude slice-map (Figure 4.34). Point-source hyperbolas may be seen in these features, and have been produced by objects in the fill.

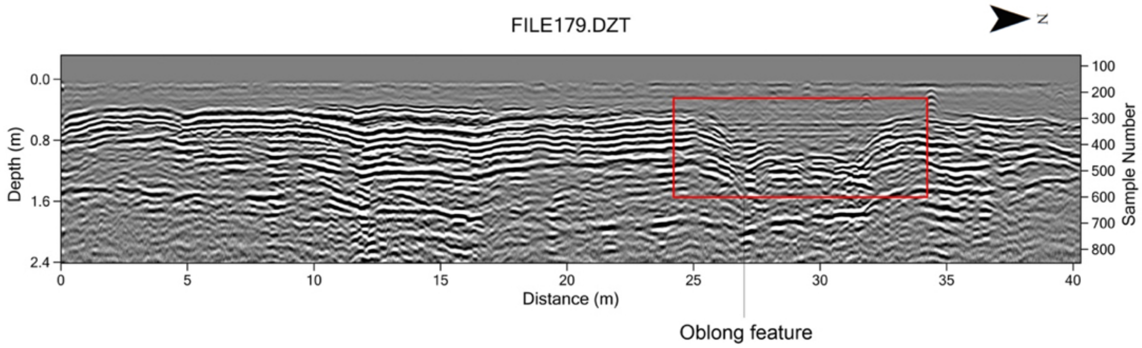


Figure 4.38: An interesting oblong feature visible in the slice-map is also apparent in Profile 179 as an area of low-amplitude that truncates the natural stratigraphy. Horizontal layers of sediment are visible within this feature, showing how it was filled over time.

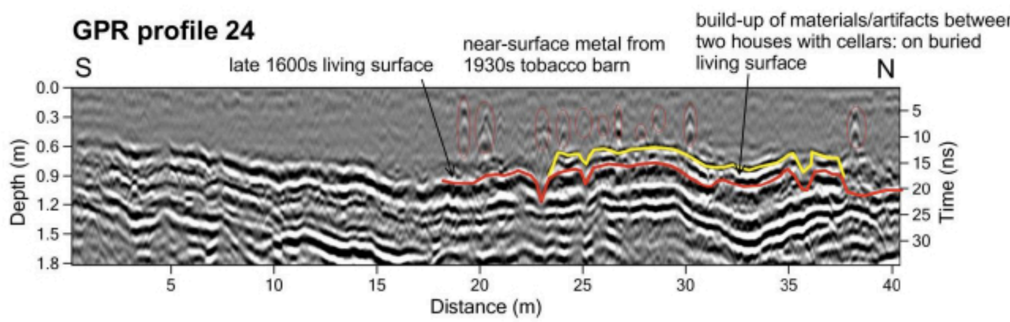


Figure 4.39: Profile showing artifacts on the seventeenth-century living surface, which produce the high-amplitude reflections between the cellars visible in the slice-map (Figure 4.34).

Four distinct cellars, a well, and numerous other features are visible in the amplitude slice-map produced for Grid 3 (Figure 4.34). These features can be seen as areas of low amplitude. This is because these features were cut into the natural stratigraphy, and were later filled with homogeneous fill. The natural soil matrix is visible around the features as high-amplitude reflections.

The cellars and well that serves as the N0E0 point for the local grid are visible in Profiles 164, 111, and 140 (Figures 4.35, 4.36, and 4.37). These features may be seen as areas of low-amplitude that truncate the natural stratigraphy. Within these areas of low-amplitude there are also point-source hyperbolas, which are created by objects within the fill.

An interesting, oblong feature was also visible in the data (Figures 4.34 and 4.38). In profile, it is visible as an area of low-amplitude with the natural stratigraphy appearing to slump into it (Figure 4.38). The stratigraphy is actually consistent, but appears this way because material above these stratigraphic layers is slowing the radar energy, making them appear deeper in the ground than they are. This happens more dramatically moving towards the middle of the feature, because there is more of this energy-attenuating material above the natural stratigraphy. The material filling this feature thus produces lower amplitude reflections that the surrounding soil matrix; this is supported by both the Profile and slice-maps, which show this feature as an area of low-amplitude (Figures 4.34 and 4.38). Profile 179 also shows how this feature was filled through natural sedimentation, over time. Depositional horizons are visible within the area of low-amplitude. Because of this feature's proximity to the cellars, and its amorphous shape, it was hypothesized that it was a midden related to the seventeenth-century occupation. However, further analysis revealed that it is probably an Indigenous oval house.

The high-amplitude reflections between the cellars evident in the slice-map (Figure 4.34) have been produced by artifacts on the seventeenth-century living surface. The GPR profile 24 shows this living surface, with high-amplitude reflections indicative of these materials (Figure 4.39). Numerous point-source hyperbolas produced by metal and other materials from the 1930s tobacco barn are also visible in this profile. These hyperbolas also contribute to the areas of high-amplitude between the cellars in the slice-map.

Three trenches and numerous shovel test pits were excavated in Grid 3. This discussion of excavations in Grid 3 will focus on the three trenches (N15W5-7, N10-12W15, and S1W14-16), and shovel test pit N10E19. Three trenches were excavated over portions of the three cellars visible in the images produced from the GPR data (Figure 4.40). The primary focus of this interpretation is on Indigenous ceramics that were found in the Middle Cellar, or trench N10-12W15. An interpretation of these ceramics begins on page 125. Another feature that was excavated was the oblong feature visible in Figures 4.34 and 4.38. A shovel test pit was excavated over this feature (N10E19).

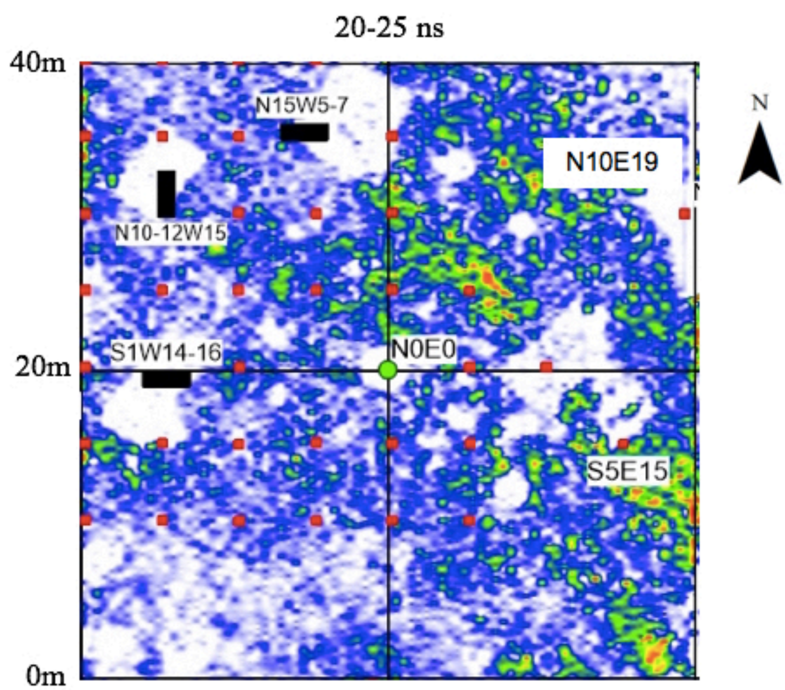


Figure 4.40: The black rectangles represent the three trenches that were excavated in Grid 3. The shovel test pit N10E19 is represented by a red rectangle. The other red rectangles are other shovel test pits that were also excavated.

The shovel test pit over the oblong feature did not yield many artifacts, and there were not any obvious features apparent. This allowed us to conclude that the feature visible in the images produced from the GPR data was not a midden. We dug until we reached glacial till, at approximately 110 centimeters, which is visible in Profile 179 (Figure 4.38). One artifact of note that was found in this test pit was a large quartz flake (Figure 4.41). This artifact, combined with the images of the feature from the GPR data, indicate that the feature may actually be an Indigenous oval house (Brian Jones, personal communication, 2016). More research will need to be conducted in order to explore this hypothesis further.

Figure 4.41: A large quartz flake that was found in the test pit excavated over the oblong feature visible in Grid 3 (Figures 4.38 and 4.40).

Grid 6

Grid 6 contains a number of interesting features that were discernible in the GPR data. The magnetic data depict two positive anomalies that were potentially pits or postholes (Figure 4.42). The GPR data provided greater information surrounding these features, as well as insight into others that were concealed by the dipolar anomalies associated with the tobacco barn in the magnetic data.

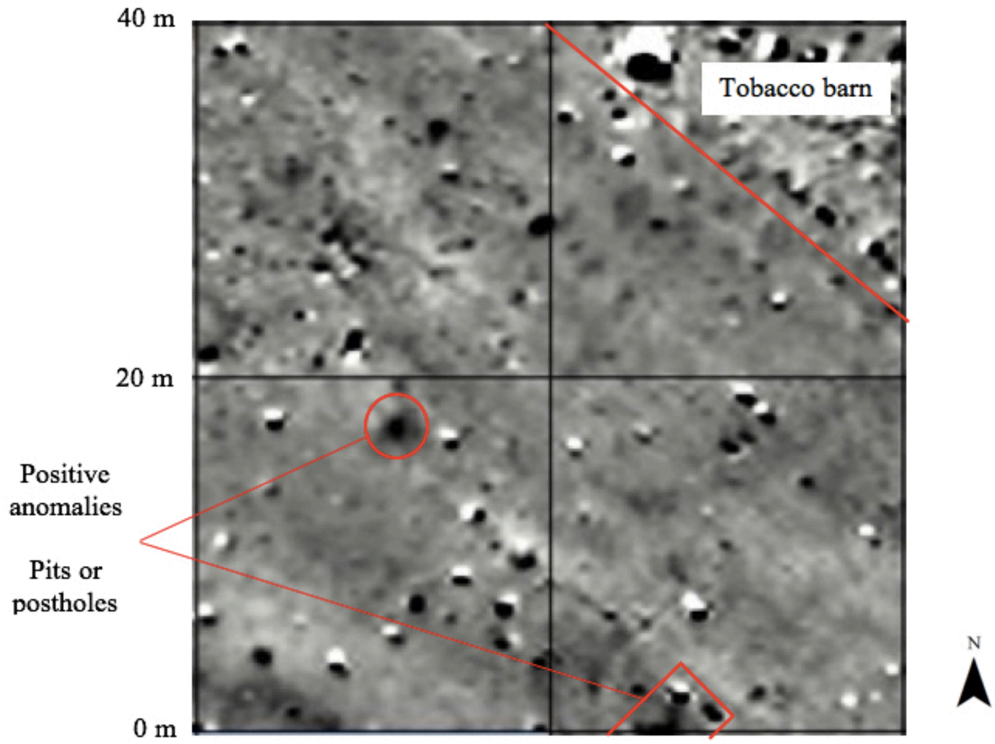


Figure 4.42: The magnetic data for the area covered by GPR Grid 6. Two positive anomalies, potentially pits or postholes. Part of the large footprint left by the tobacco barn is also visible in the upper right of the map.

The ground-penetrating radar data from Grid 6 reveal a number of features visible as areas of low amplitude (Figure 4.43). The two features that appeared as positive anomalies in the magnetic data were found to be a pit or well, and a stone lined cellar in profile analysis (Figures 4.44 and 4.45). While the preliminary hypotheses derived from the magnetic data were not exactly correct, the concept that positive anomalies reflect features consisting of topsoil that has filled features cut into the natural stratigraphy is supported by the GPR data.

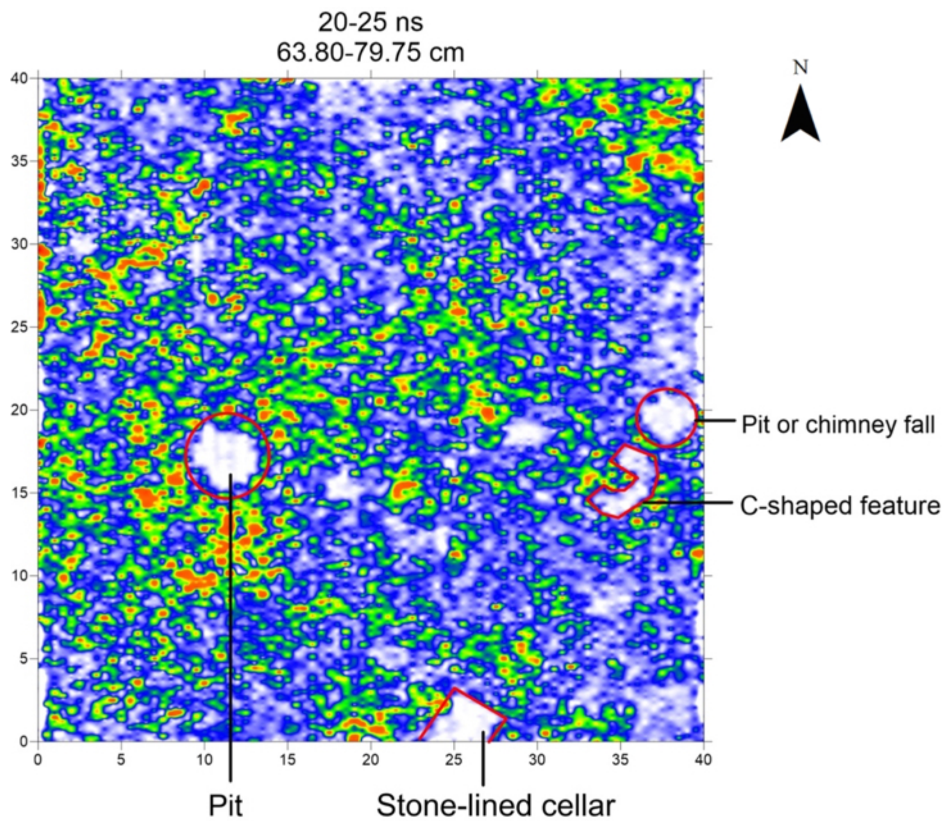


Figure 4.43: Slice-map produced for Grid 6. Features have been annotated.

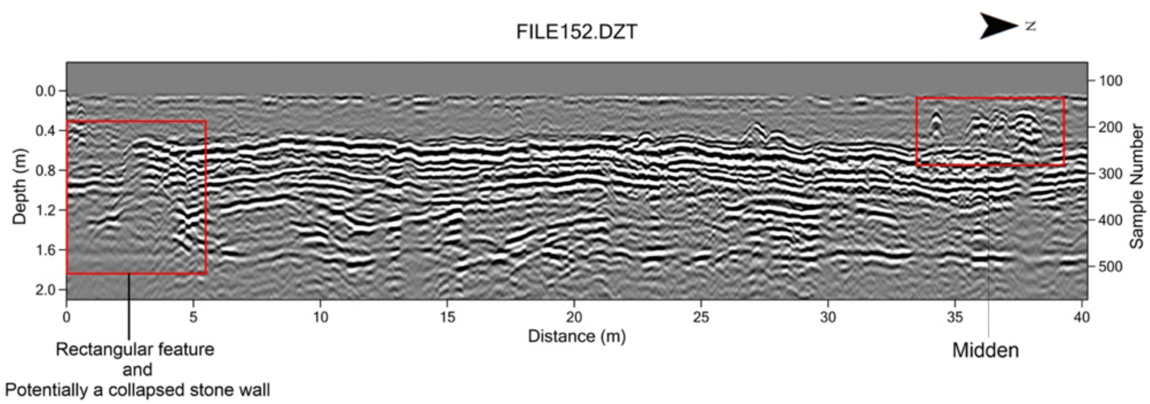


Figure 4.44: Profile showing a stone-lined cellar and a midden. The stone-lined portion of the cellar is visible as high-amplitude reflections at approximately 4-5 meters in the y-axis. The midden may be seen as overlapping point-source hyperbolas.

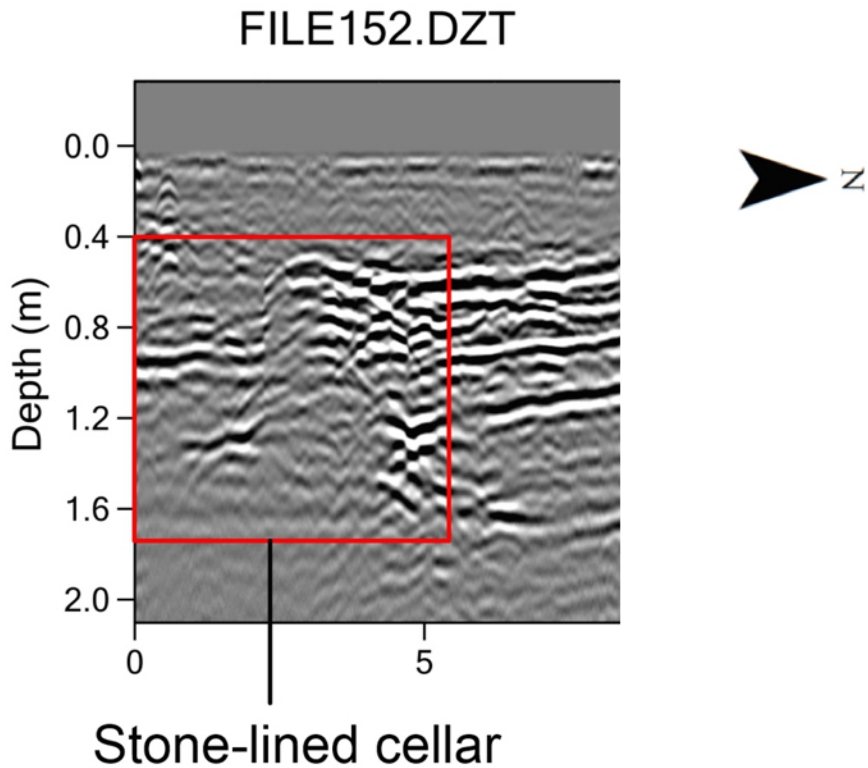


Figure 4.45: An area of Profile 152 showing high-amplitude reflections indicative of a stone-lined cellar.

Profile 152 is interesting, because it reveals that the feature to the south of the grid is a stone-lined cellar, and that there is a midden in this grid that is not visible in either the magnetic map or GPR amplitude slice-maps (Figures 4.42 and 4.43). The stone-lined cellar has been annotated in the amplitude slice-map, and is visible in Profile 152 as an area of low amplitude truncating the natural stratigraphy, with a number of high-amplitude reflections at the boundary between the cellar and stratigraphy (Figures 4.42, 4.43, and 4.44). These reflections have likely been produced from stone lining the cellar.

The hypothesis that one of the positive anomalies in the magnetic data is a pit is supported with the GPR data. It is visible as a circular area of low-amplitude in the slice-map for Grid 6 (Figure 4.42), and is can be seen as low-amplitude reflections truncating the natural stratigraphy in Profile 123 (Figure 4.46).

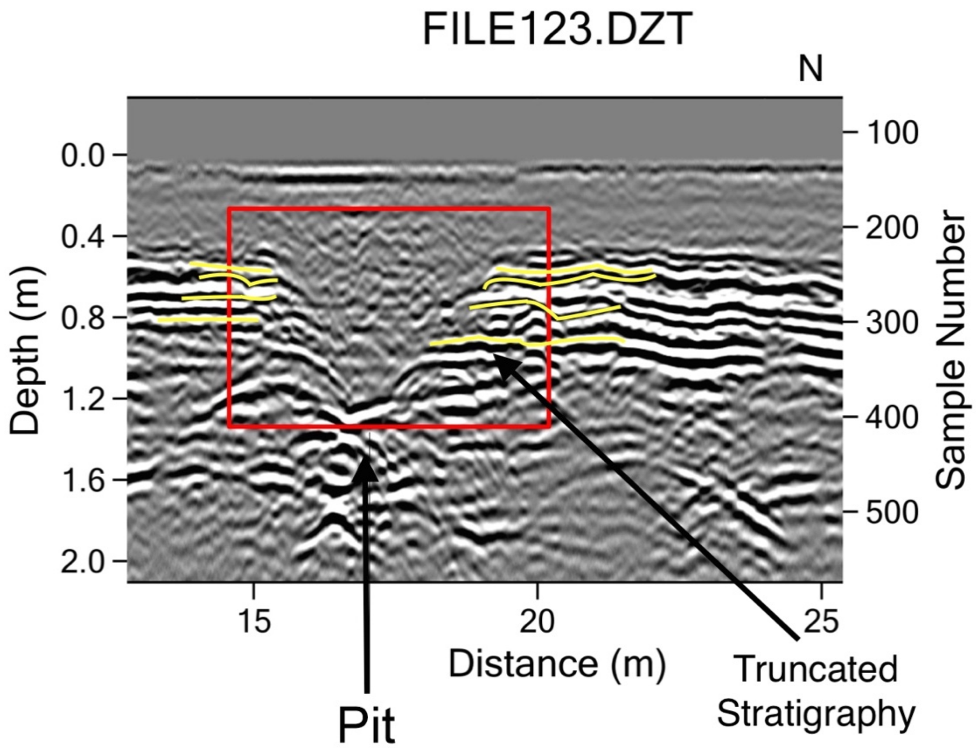


Figure 4.46: Profile 123 shows a pit feature truncating the natural stratigraphy. This feature is visible as a curvilinear area of low-amplitude in the slice-map for this grid, and as a positive anomaly in the magnetic map (Figures 4.42 and 4.43).

An interesting C-shaped feature in the amplitude slice-map is visible as an area of low-amplitude truncating the natural stratigraphy in Profile 172 (Figure 4.47). It is unclear what this feature is, but it is potentially the base of a chimney, and relates to the feature in Profile 176 (Figure 4.48).

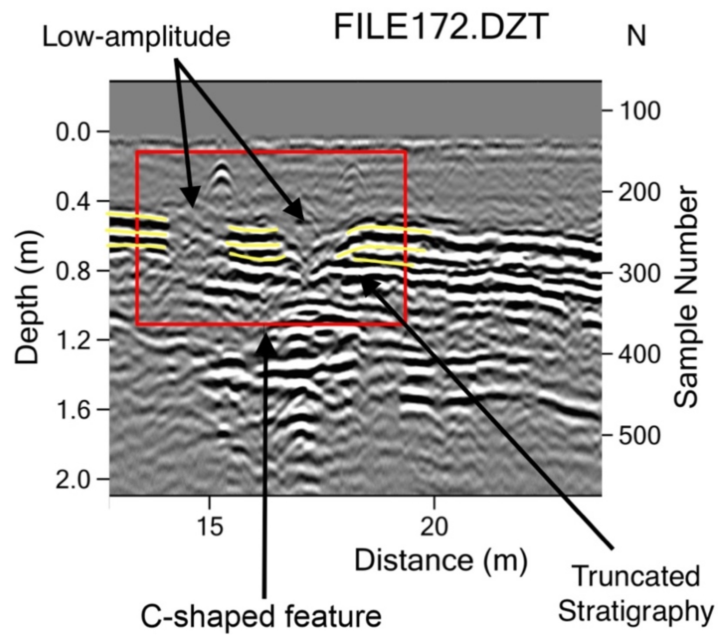


Figure 4.47: Profile depicting the C-shaped feature visible in the slice-map (Figure 4.43). The feature is apparent as areas of low-amplitude truncating the natural stratigraphy.

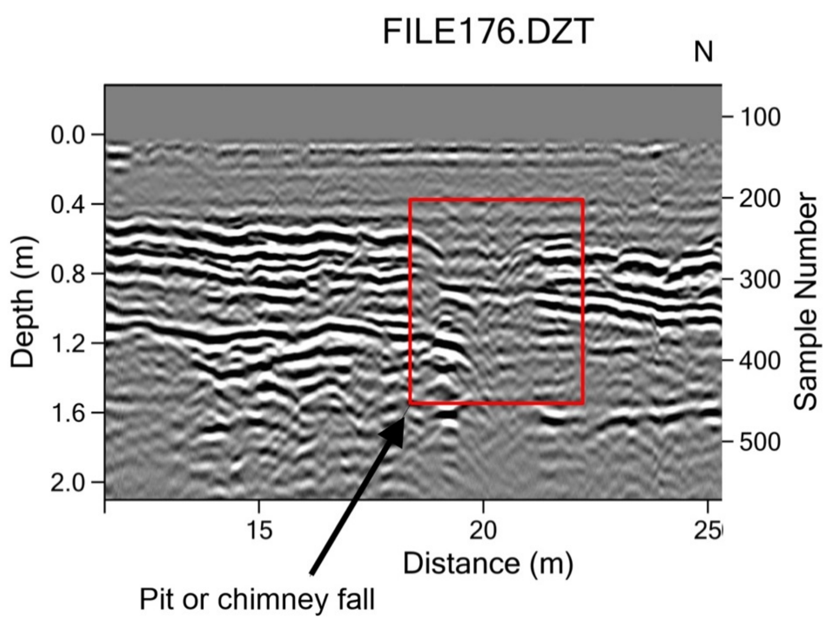


Figure 4.48: A potential chimney fall is apparent in Profile 176.

The feature to the northeast of the C-shaped feature is visible as an area of low amplitude truncating the natural stratigraphy in Profile 176 (Figure 4.48). There are also high amplitude reflections that are indicative of a fallen stone wall or chimney. This implies that this feature may be a chimney fall related to the base of the chimney, or C-shaped feature. The feature visible in Profile 176 was of such interest that an excavation unit was placed over it. This can be seen in Figure 4.49.

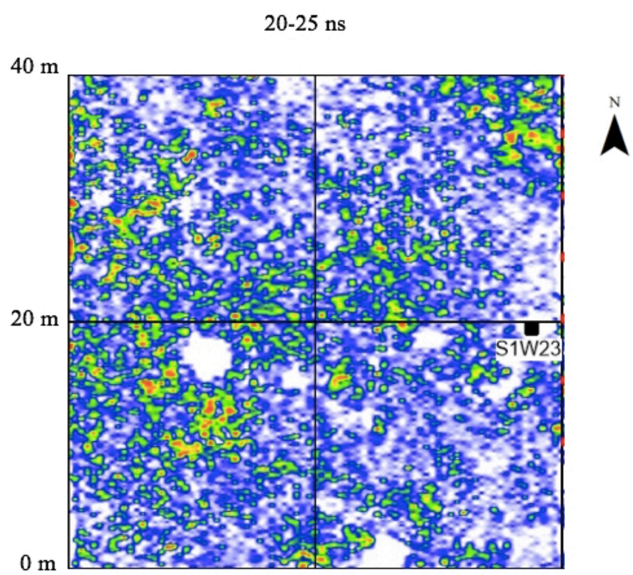


Figure 4.49: The location of the excavation unit that was placed over the hypothesized chimney fall.

Grid 7

Many of the positive anomalies in Area 3 (Figure 4.20) were surveyed in the GPR Grid 7. These anomalies were hypothesized to be postholes. However, the GPR data do not support this. The slice-map for Grid 7 shows a number of features characterized as areas of low-amplitude in the northwest area of the grid (Figure 4.21). These features appear to be Indigenous pit structures, the burned floors of which are visible in the images produced from the magnetic and GPR data (Figure 4.50). More in-depth analysis of these features was included in the reconstruction and analysis of the colonial landscape.

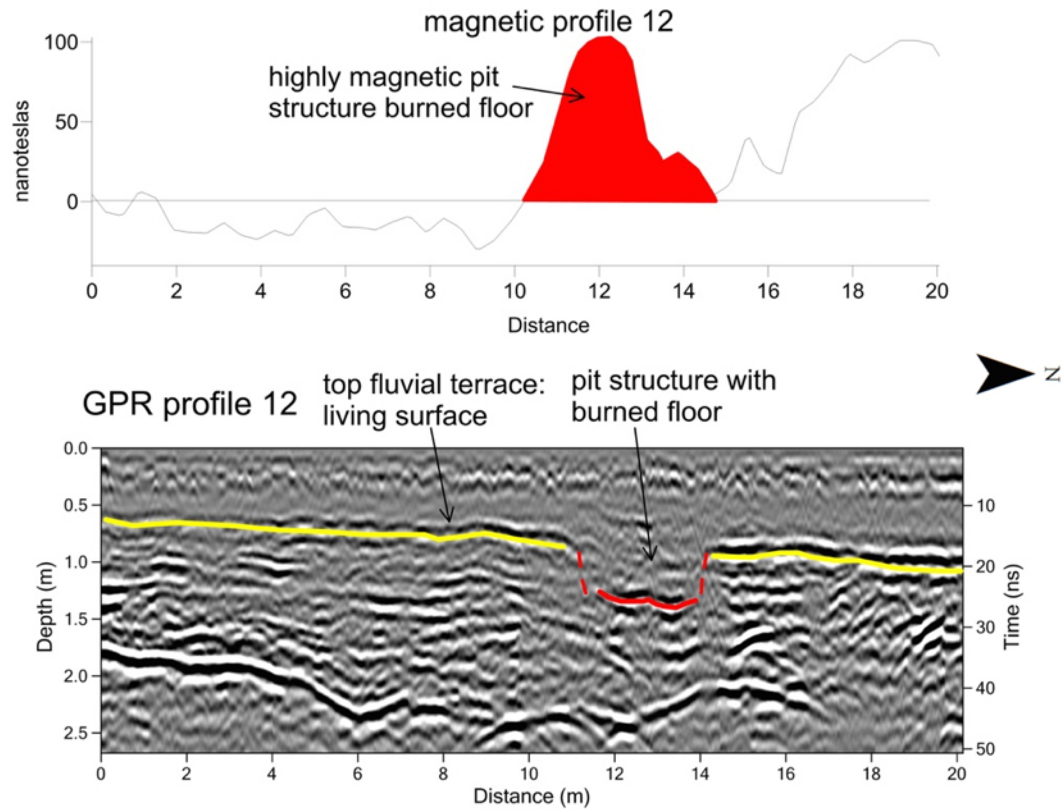


Figure 4.50: The magnetic values that coincide with the burned floor visible in Profile 12.

The preceding images (Figures 4.20, 4.21 and 4.50) show that these features in Grid 7 are oval areas of low amplitude, with burned floors. This indicates that they are likely prehistoric Indigenous pit structures like the one illustrated in Figure 4.51. They may also be similar to the one excavated in Grid 3.

Figure 4.51: Image of what the oval structures visible in Grid 7 may have originally looked like (ELCCT 2017).

Ceramics from the Middle Cellar

There were approximately 250 sherds of Indigenous ceramics found throughout the excavations. The focus of this analysis will be eight sherds from the Middle Cellar trench. These were chosen because they possess distinct traits, such as decorations or are portions of a rim, which may be used to identify the type of vessel that the sherds may have once been a part of. The eight sherds that are part of this interpretation are presumed to have been part of one vessel based on context, decoration, temper, and the thickness of the sherds. These eight sherds were found in adjacent units (N11W15 and N12W15) and similar depths. Most were found between 120 and 130 centimeters below the surface, and three were found between 100 and 110 centimeters. These units were in one of at least four cellars that were located through geophysical methods at the Hollister site. The photographs and captions associated with them illustrate the ways that decorations on the sherds indicate that they came from a single vessel (Figures 4.52-4.67). Many of the sherds are decorated with striations and medallions. There is also a castellation that is part of the assemblage (Figures 4.66 and 4.67). The shape of the sherds also suggest that these sherds were once part of a large ceramic vessel. Some appear to be part of the vessel's neck. The temper for all of the sherds are the same; they are all shell-tempered. Six of the sherds yielded measurements of thickness, with an average thickness of 7.33 millimeters, and a range of 1.5 millimeters.

Figure 4.52: Unit N12W15, SE quadrant, 120-130 centimeters. Two sherds refitted. Diagonal striations on neck.

Figure 4.53: Unit N12W15, SE quadrant, 120-130 centimeters. Two sherds refitted. Indented to attach medallion.

Figure 4.54: Unit N12W15, SE quadrant, 120-130 cntimeters. Two sherds refitted. Vertical striations on the rim, and diagonal striations on the neck. A medallion has been reattached. The rim diameter is 38 centimeters.

Figure 4.55: Unit N12W15, SE quadrant, 120-130 centimeters. Two sherds refitted. Indented to attach medallion. Vertical striations on interior of rim.

Figure 4.56: Unit N12W15, SE quadrant, 120-130 centimeters. Six sherds refitted. Diagonal striations on the neck and vertical, horizontal, and diagonal striations on the rim. The rim diameter is 25 centimeters.

Figure 4.57: Unit N12W15, SE quadrant, 120-130 centimeters. Six sherds refitted. Vertical striations on interior of rim. Indented for medallion.

Figure 4.58: Unit N12W15, NE quadrant, 120-130 centimeters. Two sherds refitted, one being a medallion that has been reattached. Diagonal striations on neck and medallion.

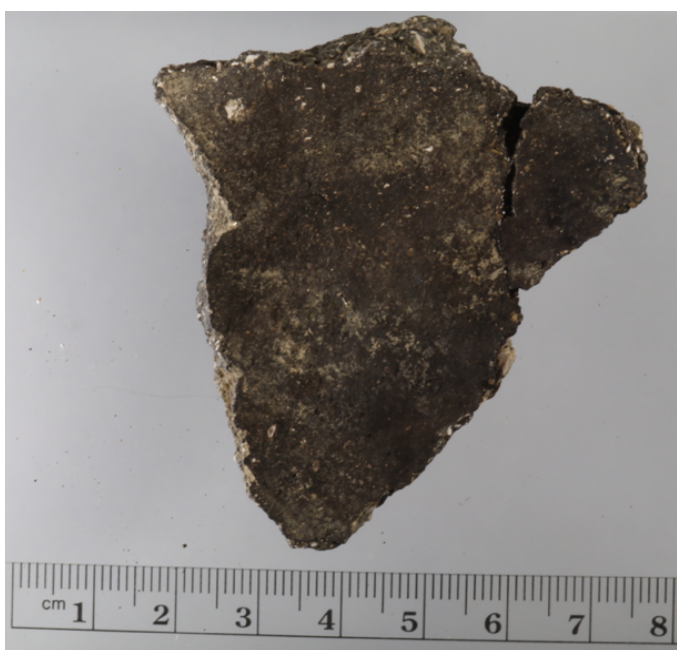


Figure 4.59: Unit N12W15, NE quadrant, 120-130 centimeters. Indented for medallion.

Figure 4.60: Unit N11W15, SW quadrant, 100-110 centimeters. Two sherds refitted. Diagonal striations on the neck and vertical striations on the rim. The rim diameter is 35 centimeters.

Figure 4.61: Unit N11W15, SW quadrant, 100-110 centimeters. Two sherds refitted. Vertical striations on interior of rim.

Figure 4.62: Unit N11W15, SW quadrant, 100-110 centimeters. Three sherds refitted. Diagonal striations on the neck and vertical striations on the rim. The rim diameter is 40 centimeters.

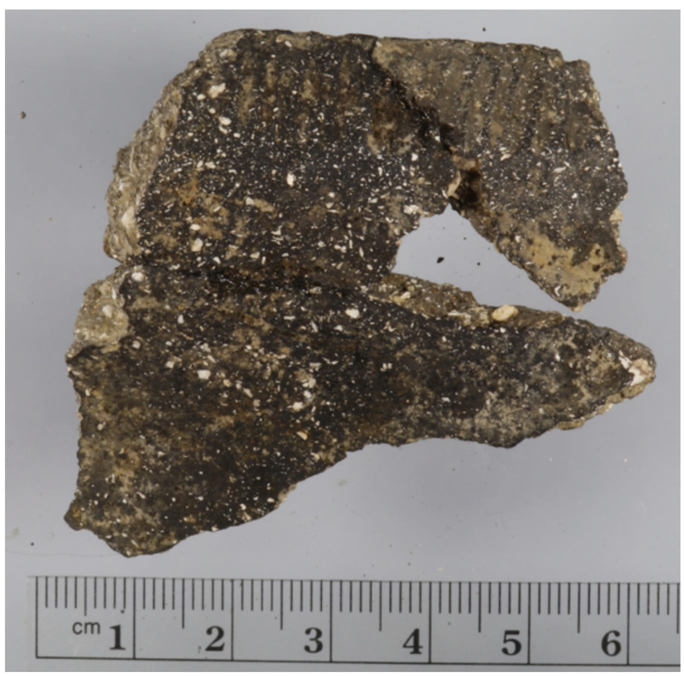


Figure 4.63: Unit N11W15, SW quadrant, 100-110 centimeters. Three sherds refitted. Vertical striations on interior of rim.

Figure 4.64: Unit N11W15, NE quadrant, 120-130 centimeters. This is a medallion. Diagonal striations and incision.

Figure 4.65: Unit N11W15, NE quadrant, 120-130 centimeters. Medallion.

Figure 4.66: Unit N11W15, SW quadrant, 100-110 centimeters. This is a castellation. Incision running vertically down the center.

Figure 4.67: Unit N11W15, SW quadrant, 100-110 centimeters. Castellation. Large incision in the center with smaller, vertical striations parallel on either side.

The Shantok tradition of ceramics dates to between the Pequot War (1636-1637) and King Philip's War (1675), which is during the time the Hollister site would have been occupied by English settler-colonists (Glastonbury Records L536 1680, 126, Hollister 1711, Kevin McBride, personal communication, 2017). During this period, the Shantok tradition was the only ceramic type being produced in the region (Kevin McBride, personal communication, 2017). The Shantok tradition is primarily from the east part of Connecticut, but varieties within this tradition have also been found in the lower Connecticut Valley, where the Hollister site is located (Lavin 1987, 24, 34). This tradition is characterized by shell-tempering, relative thinness (six millimeters, on average), round bases, shouldered vessels, most also exhibiting necks and collars (Rouse 1947, 14-16). Decorations are limited to designs and are typically located on the exterior of collars, lobes, ridges, and castellations (Rouse 1947, 16). One group of designs typical of this tradition are bands, which are often hatched horizontally, obliquely, or vertically (Rouse 1947, 16). Medallions are also often applied by pushing the vessel out from the inside, then pressing each individual medallion onto the outside (Kevin McBride, personal communication, 2017). These types of vessel shape and decoration are evident in the sherds associated with this object (Figures 4.52-4.67). The drawing below illustrates Shantok sherds with similar morphology to the eight sherds in the preceding photographs (Figure 4.68).

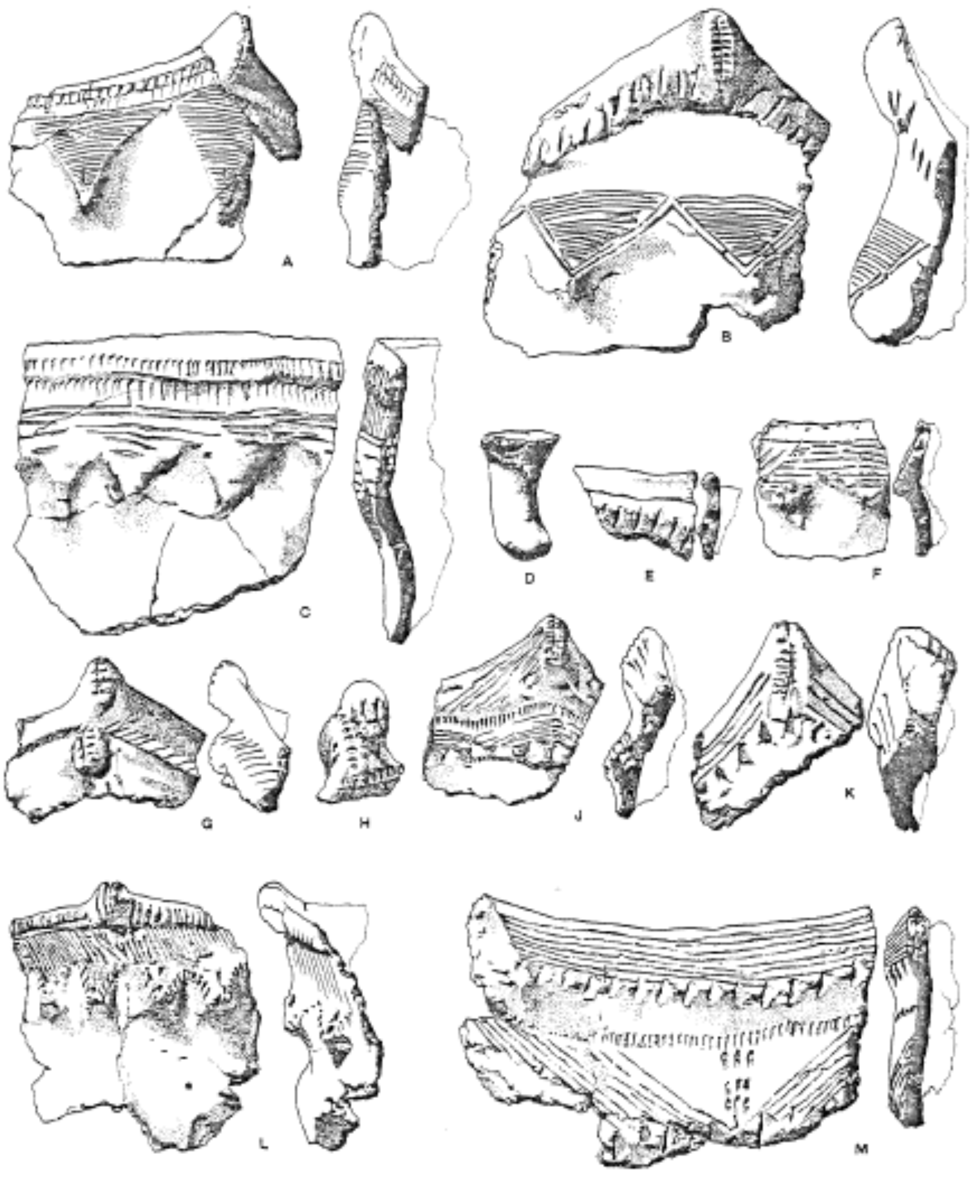


Fig. 5. Potsherds of the Shantok Tradition. All are from the Fort Shantok site, near Norwich, Connecticut, Scale 1/2. (Yale Peabody Museum catalogue numbers: A, 10248; B, 10245; C, 10246; D, 10257; E, F, 10261; G, 10254; H, 10255; J, 10250; K, 10253; L, 10252; M, 10249.)

Figure 4.68: Illustrations of Shantok tradition sherds (Rouse 1947, 15). Specifically, sherd L has similar striations as the sherds in Figures 4.52, 4.54, 4.56, 4.58, and 4.62 The castellations on sherds A, B, G, and J are similar to the castellation in Figures 4.66 and 4.67. The shapes of the sherds are also similar.

Another ceramic tradition present during the early colonial period in Connecticut was Hackney Pond (Lizee et al. 1995, 517). Hackney Pond and Shantok ceramic types are present in sites between the Connecticut and Thames rivers, where the Hollister site is located (Lizee et al. 1995, 521). The Hackney Pond tradition probably emerged before the Shantok tradition, as can be seen in Figure 4.69. There are many morphological differences between Shantok and Hackney Pond ceramics. Hackney Pond vessels are not castellated, have low-relief collars, do not have applied elements (such as medallions), and have no discernible temper (Lizee et al. 1995, 517-518). These are in contrast to the morphological characteristics of Shantok vessels. While Shantok ceramics are typically used as an ethnic marker of the early historic period Mohegan tribe, Hackney Pond is connected to the historic Pequot and pre-colonial sites (Lizee et al. 1995, 518).

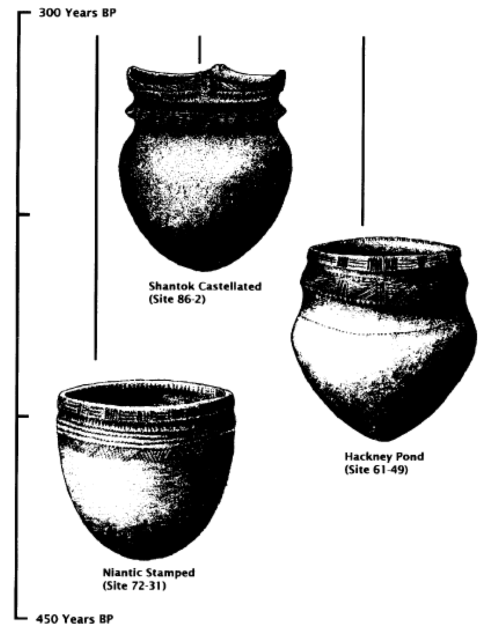


Figure 1. Illustrated chronology of Niantic, Hackney Pond, and Shantok ceramic types.

Figure 4.69: The figure above depicts the chronology of ceramic types in southeastern Connecticut (Lizee et al. 1995, 516). The Hackney Pond type predates Shantok, and is morphologically distinct.

It is clear that the sherds fall into the Shantok tradition. They are all shell-tempered. Several exhibit incisions that are hatched horizontally, obliquely, or vertically (Rouse 1947, 16). The medallions were also evidently attached to the vessel once the pottery was pushed out from the inside. The castellation in Figures 4.66 and 4.67 is also characteristic of this type (Rouse 1947, 16). Williams (1972) categorizes vessels with lip diameters between 6 and 9 inches (15.24-22.86 centimeters) as large (347). Given the rim diameters retained from these sherds, the vessel probably had a diameter of 25-40 centimeters, or 9.84-15.75 inches, making it a very large vessel. The variation in rim diameters may be explained by the castellation. If the vessel was castellated, then the rim would not have been perfectly round; it would have been more square (Williams 1972, 346-347). An illustration of what this vessel may have originally looked like may be seen in Figure 4.72. Similar rim and neck decorations are apparent, as well as castellations.

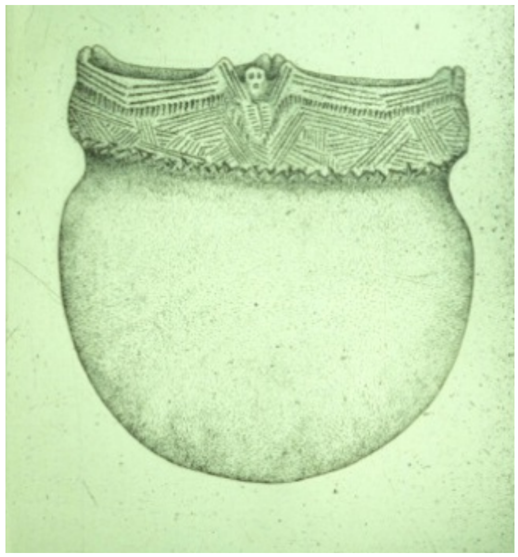


Figure 4.70: Image of a Shantok type vessel from site MP-CPI-17-002. The sherds from the Middle Cellar may have originally composed a pot similar to this. Image courtesy of Kevin McBride.

The rest of the sherds from the site were analyzed, but are not part of this interpretation, which is focused on one, distinct vessel. Data collected from the other sherds are contained in Appendix A. These data include, for each sherd: Photo Number (if applicable), Unit and accession number (where applicable); Quad excavated from; Depth excavated from (centimeters); Bag number; Count; Refit (number of fragments refitted where applicable); Dimensions (centimeters); Weight (grams); Rim diameter (centimeters); Thickness (millimeters) Notes (typically on decoration); and Temper. Counts and weights are used to determine the quantity of ceramics in each context, and the fragmentation of the assemblage (Hall et al. 2015, 31). This information may be used by others to conduct further research on the Indigenous ceramics excavated at the Hollister site.

Conclusion

This chapter addressed the different ways that features are visible in magnetic and ground-penetrating radar data; how, sometimes, features in ground-penetrating radar data are *more* visible in images; and how geophysical data may guide excavations. Excavations at the Hollister site yielded a wealth of artifacts, but the focus of this interpretation was on a number of Indigenous ceramic sherds unearthed from the Middle Cellar. These sherds are characteristic of the Shantok tradition, which aligns with the period of occupation at the Hollister site (Glastonbury Records L536 1680, 126, Hollister 1711, Kevin McBride, personal communication, 2017). While this interpretation of features and artifacts at the Hollister site considers what these things *are,* it does not address what that *means.* How these features and artifacts may illuminate the ways that negotiated interactions between Indigenous peoples and English settler-colonists were manifested in material culture, and how evidence of agency may be revealed by analyzing these features and artifacts will be addressed in the following Interpretation Chapter.

CHAPTER FIVE: INTERPRETATION

Artifacts and features revealed at the Hollister site were interpreted in order to test hypotheses regarding how interactions between Indigenous peoples and English settler-colonists at the Hollister site were manifested in artifacts and how the architectural features were placed on the historical landscape. Drawing on theories of agency, one way that these historic interactions can be interpreted is having led to resistance to the colonial structure. This interpretation draws on theories of agency because there is a dialectical relationship between agents and structures. Actors can act explicitly to challenge the cultural structure, but the structure also reinforces and defines the way that action is enacted (Ortner 2006a, 2, 2006b, Silliman 2001). I suggest that Indigenous actors navigated the colonial structure, reacting to colonialism by sustaining cultural practices, and by forging relationships with English settler-colonists (Ortner 2006b, 147). Artifacts, such as Indigenous ceramics found in a Hollister cellar, are evidence that certain cultural practices, such as pottery making, were retained and reshaped in specifically anti-colonial ways. An alternative hypothesis is that this vessel was obtained through trade, or another type of relationship between the Hollisters and Indigenous peoples. There is also evidence that Europeans were using these Indigenous ceramics, supporting the documentary evidence that various types of relationships were fostered between John Hollister and Wangunks in the region. Another analysis was done by placing people onto the historical landscape, where there is evidence that the site was occupied at various times by both Indigenous people and Europeans. This showed that each of these groups of people preferred certain areas, but still likely interacted with each other. While they mostly segregated spatially, there is some evidence that they also built their traditional houses within the area preferred by the other group. This suggests that there were regular interactions between these two groups at the site. Overall, the analysis indicates that there were complex interactions between these groups of people that may have played out on this historical landscape.

Landscape

The reconstruction of the seventeenth-century landscape allows for a compelling discussion of who was living at the site. This reconstruction revealed that different groups may have been living at the site at different times, but also likely lived together after contact. This can be documented by the images produced from the geophysical data, which show Indigenous and European dwellings that may have been occupied simultaneously. The historical documents also point to a close relationship between the Hollisters and Indigenous peoples of the region, where they discuss Hollister as a type of intermediary between a colonial institution, the Council of War, and Wangunk during wartime (Trumbull 1852). However, in general, these two very different people likely chose where to live on the landscape for sometimes similar and other more discrete and independent reasons.

The Indigenous structures on the landscape show evidence of a precolonial occupation, but also a contemporaneous, Indigenous presence at the Hollister site (Figure 5.1). In Grid 7 there are three oval structures, one of which cuts into another, indicative of

Indigenous occupations over time (Figures 5.1, 4.20, and 4.21). Another, larger oval structure is in Grid 3 (Figures 5.1 and 4.18) was cut into the earth and is probably from an early Indigenous occupation, or is perhaps evidence of a winter encampment. A dwelling with the floor dug to that depth would have been more insulated than one constructed directly on the surface. The presence of these dwellings show that Indigenous peoples were occupying the site throughout time, and likely contemporaneously with Europeans.

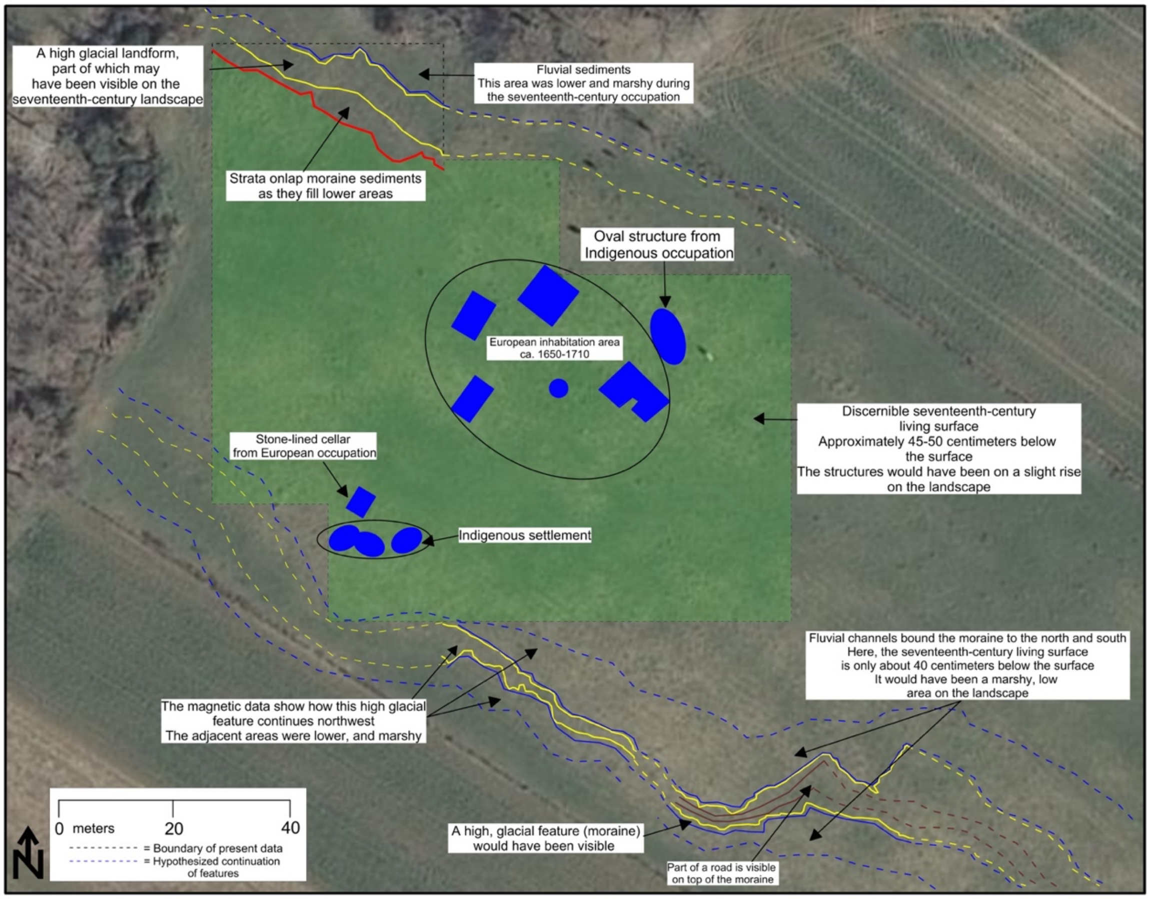


Figure 5.1: This map recreates the seventeenth-century landscape. In the northwest corner is a recessional glacial moraine. This would have been an elevated rocky area during the period of occupation. To the north of that moraine is a filled-in fluvial channel, which would have been low and marshy. The green area is the living surface, which is at a consistent depth of 40-50 centimeters throughout the images produced from the GPR data. It is relatively flat, dry, and homogenous compared to the areas to the north and south. To the south and in the southeast corner is another recessional glacial moraine. This would have been a raised ridge of rocky soil. This feature is bounded by fluvial channels that filled with sediment, which would have been boggy during the seventeenth-century. An Indigenous

settlement is in the southwest area of the site, while a European settlement is centered between the moraines. (Basemap from CTECO 2012).

On the wider landscape of the Connecticut River Valley, the Hollister site was an ideal location for both groups because it was close to the Connecticut River, which would have served as both a food resource for procuring fish and shellfish, and a navigable waterway (Hinderaker and Mancall 2003, 28). Research in the lower Connecticut River Valley has shown that the availability of water for these reasons contributed to site selection, with most Native American sites in the region being located on terraces overlooking rivers (Lavin and Banks 2011, 7). The first Europeans in the Connecticut River Valley were also attracted by these fertile fluvial terraces and resource-rich waterway (Taylor 1979, 4, 10). The Hollister site therefore provided resources that were preferred by both cultural groups, who likely used the nearby river in similar ways.

The interpretation of the historic environment at the Hollister site produced through analysis of a landscape reconstructions map (Figure 5.1) shows that both Indigenous peoples and English settler-colonists likely chose to inhabit the site at the same time (Figure 5.1). Both cultural groups lived in close proximity, but appear to have preferred different areas to build their houses (Figure 5.1). These differences may be attributed to the distinct building and subsistence patterns of each group, and how these were adapted to the landscape at the Hollister site.

The moraines and low, wet areas adjacent to them surely influenced where people chose to live on the landscape. The preserved glacial moraines, consisting of rocky sediment would have been visible on the landscape as ridges of rocky soil, unsuitable for either building homes or for plowing by the English. This research shows that in the midseventeenth-century, English settler-colonists occupied the ideal farmland on the rise between the moraines and low, boggy areas to the north and south (Figure 5.1). This area was ideal because it was a relatively level, dry area compared to the gravelly ridges and associated wet lowlands to the north and south. As can be seen with the GPR maps and profiles (Figures 4.34-4.37) these farmers built houses with deeps cellars primarily used for storing food for months at a time (Harper et al. 2013, 22). For this reason, they chose locations away from the marshy areas with high water tables, and clustered them in the area most suitable for farming. The agriculture practiced by Indigenous peoples would have led them to choose ground for farming that was similar to that of the English. Both groups liked to grow maize on the floodplains of the Connecticut River Valley, and therefore would have chosen similar areas to exploit, such as the flat, well-drained central area of the Hollister site (Hasenstab 1999, 148, Taylor 1979, 4, 10, 92).

It appears that the southwestern area of the site was preferred for some reason by its Indigenous inhabitants as three oval houses are visible in this area, one of which was burned (Figure 5.1). All three structures appear to be clustered in one location, with evidence of some remodeling and possibly abandonment of two of the buildings. These structures and their remodeling over time indicates that there must have been some time length when Indigenous peoples occupied this area of the site. There must have been some time between the pit structures, one of which is within the remains of older ones. While it is not known what this time was, with each structure possibly being inhabited for at least one or two generations, the time could have been 60-80 years. If this time period was during the time that Europeans also lived close by then this would have aligned closely with the period of time when colonists were living at the Hollister site (1651-1711 approx.) (Glastonbury Records 1680, 126, Hollister 1711).

The grouping of these Indigenous houses in the southwestern part of the site, and the inference that they were occupied for 60 or 80 years could also be tied to another well-known Indigenous archaeological site (the Horton site), which is located directly to the south of the Hollister site. While there is nothing published on work done there, it is thought that this area has a long history of Indigenous occupation. The Horton site contains features and artifacts dating back more than 4,000 years (Marteka 2015), so it is apparent that people preferred this general area for a very long time. Fire pits, stem points, and adzes have been found in what may have been Native American camps along the flood plain at the Horton site (Marteka 2015). These Indigenous peoples, who gathered food and resources prior to adopting agriculture in about 1000 CE (Bernstein 2006, 279), would no doubt have preferred the southern part of the Hollister site because the wetland resources bounding the southern moraine would have been easily accessible (Chilton 2008, 54). The three house cluster (Figure 5.1) may just be a continuation of that larger site to the south. If those houses are late in age, then this occupational preference then likely continued into colonial times. Only further research can determine if the people who occupied those houses were contemporaries with the Europeans.

Other environmental zones also played a part in how people exploited this land, with the marshy areas adjacent to the moraines in late glacial time being still low and wet during the seventeenth-century occupation. Elsewhere in New England these boggier or wet areas were places where food resources could be collected, such as blueberries, cranberries, and serviceberries (Malloy 2007, 1-2, 4, 6-7). These berries are native to Connecticut, are edible, and thrive in wet soils (Malloy 2007, 1-2, 4, 6-7). This shows that though the two groups may have lived in close proximity, and shared preferences for where to live, there were also differences in the ways they exploited the land. Indigenous peoples chose to settle in the southwestern area of the site, closer to these wetland resources. This may have been done in order to exploit food, such as berries.

Another interesting use of this historic landscape is evidence of a road or pathway of some sort that was constructed on the southern moraine (Figure 5.1). This feature was presumably constructed by the English colonists, who, unlike the Indigenous inhabitants, would have used wagons for transportation, making roads a necessity. It may have been built on the same high and dry area that had been used for centuries by the inhabitants of this area. The pathway or road would have allowed colonists to travel to and from the farmstead on high ground while avoiding marshy areas when heading to the farmstead or river to the west.

While the Indigenous and European settlements appear to be partially segregated, there is still evidence of close proximity between these two groups. There is one oval structure directly within the English farmstead (Figure 5.1). This could have been an earlier dwelling, and no age dates are available for this interesting house. But interestingly, there is also one English cellar near the Indigenous oval structures in the southwestern part of the site (Figure 5.1). Their close proximity, assuming contemporaneity, indicates that there may have been close, interesting, and perhaps congenial interactions between Indigenous peoples and English settler-colonists here.

Closer analysis of these very different architectural features reveals that there is little difference in the depth of these structures. They were all incised into the ground between approximately 40 and 52 centimeters below the ground surface. This indicates that the oval houses are not deeper, and therefore older, than the European cellars. The seventeenth-century living surface is also at a consistent depth of 40-50 centimeters depth throughout the site (Figures 4.12-4.16). This living surface allows for the relative dating of features and artifacts above and below it. The Indigenous structures and European cellars are at consistent depths in relation to this living surface, suggesting that the two types of domiciles coexisted on the seventeenth-century landscape.

While there is no documentary evidence to support a concurrent living arrangement at the site, there is a historic record of a Wangunk girl named Amix, who worked for the Hollisters (JSP 90). This is good evidence that even as late as 1673 or so (Adams 1904, 34) Indigenous peoples of Glastonbury may have been living beside or within the Hollister family (JSP 90). Also, land deeds often included the rights of native people to maintain access to their land, and sometimes live in the colonizers' pastures (Handsman and Lamb Richmond 1995, 101). In these documents there are specific stipulations that say that native people reserved the "rights to collect firewood, hunt and fish, use their planting fields, and even build wigwams on the colonists' common pastures" (Handsman and Lamb Richmond 1995, 101). Further, a history of the area says that the Wangunk leader, Sequin, arranged to stay on the land and be protected by the settlers (Adams 1904, 43-44). This documentation supports an arranged cohabitation of the two groups beginning with the colonization of the Connecticut River Valley, and continuing until 1673, when most Wangunks lived on a reservation in Chatham (Adams 1904, 34). Timothy H. Ives' research on the Wangunk during the reservation period (1673-1784) explores how Wangunk and Europeans in this region continued to foster ways of living peacefully in close proximity (Ives 2011, 68). Presumably, Indigenous peoples of this area consciously chose to continue to live on their ancestral land soon after colonization, despite the modifications and transformation of the landscape that came with European colonial impositions (Handsman and Lamb Richmond 1995, 103).

This cohabitation and conscious choice of where to live relates to Silliman's concept of acts of residence, which is when active agents "stake out a claim in their social worlds, even under contexts of oppression and domination, that may have little to do with outright or even impromptu resistance" (2001, 195). In a very different part of the world, but still in an area where native people were interacting with colonizers, Silliman provides the example of native workers at Rancho Petaluma, north of San Francisco, California (2001, 197, 199-203). Rancho Petaluma was a land grant given by the Mexican government to Mariano G. Vallejo in 1834 (Silliman 2001, 197, 199-203). Here, native workers lived and worked, and "staked out a residence in the colonial world" by continuing traditional practices of flint knapping and using stone tools, despite having access to colonial metal tools (Silliman 2001, 199-204). If Indigenous and English occupations of the Hollister site were also contemporaneous, it is possible that their co-inhabitance in this one small area shows a similar act of staking out their residence in a colonial world in similar ways.

Ceramics and Agency

Material culture at the site can be used as evidence to address active negotiations that occurred on the colonial landscape, such as fostering relationships with colonizers and contesting power and ownership. For instance, the Indigenous peoples of the region continued to produce ceramics in specifically anti-colonial ways between the Pequot War (1635-1636) and King Philip's War (1675) (Goodby 1998, Mrozowski et al. 2007, 151). They also fostered economic relationships, alliances, and friendships with English settler-colonists. These are all ways that Indigenous peoples both actively resisted colonialism, but were also integrated into the colonial structure, through trade, alliances, and other nuanced and negotiated relationships with colonizers. This type of interaction can be seen at the Hollister site by the discovery of one ceramic vessel uncovered in a European cellar (Middle Cellar, Figure 4.1, image of what the vessel may have looked like in Figure 4.70). This vessel was uncovered in the Middle Cellar, mostly between 120 and 130 centimeters below the surface. This vessel is not anomalous, as it was found alongside many other Indigenous ceramic sherds (Appendix A).

The vessel's presence indicates that Indigenous agents were interacting with and possibly influencing in some way the material culture of the colonists. As it was found within an English settler-colonist cellar it shows that a colonist family at the site may have incorporated this vessel into their household. While its context seems to be counter to the morally and culturally superior narratives constructed by the colonists (Grafton 1992, 40, Winthrop 1662) it indicates that these colonists at the Hollister site may have instead been adopting aspects of Indigenous material culture. However, there are other possible hypotheses on how it came to be found there. It could have been purchased or traded for by a colonist. It is also possible that it was acquired not as an object but instead for what it may have originally contained. Considering that there was a close relationship between John Hollister and the Wangunks, and the story of Amix, another idea about its presence there was that it was a gift (JSP 90). A fourth hypothesis is that this vessel had been owned by Indigenous laborers at the site, and it was incorporated into the European household in some interesting but unknowable way.

The Indigenous ceramic vessel's style falls into the Shantok tradition (Rouse 1947, 14-16), which flourished throughout eastern Connecticut and the lower Connecticut River Valley from the Pequot War, in 1636-1637 through King Philip's War in 1675, when the Indigenous population of Connecticut was largely annihilated (Lavin 1987, 24, 34, Goodby 1998, 171, Kevin McBride, personal communication, 2017). The Shantok tradition coincides with the period of European occupation of the Hollister farmstead. In addition, there was a vast amount of Indigenous ceramics found in other excavation units at the site (Appendix A). The State Archaeologist for Connecticut, Brian Jones, said "There is more Indian pottery in that site than I've ever seen at any site ever," and "if we just had ceramics we could argue that it is a contact period Native American site" (Brian Jones, personal communication January 14th, 2017). This, combined with the fact that one whole pot and many sherds of this pottery was found within one of the European cellars, suggests that the production and use history of the singular vessel is complex. While there is no doubt it was produced by an Indigenous potter, since it was found in a European cellar, and dates to the period of English occupation of the site where it was found, it was probably used by the English settler-colonist inhabitants. It was likely incorporated in some way into the European household and would have been readily available for use. There must have also been relationships between the colonist family occupying the site and Indigenous peoples of the region in order for the English inhabitants to have obtained the vessel.

It is noteworthy that dating of the Shantok tradition is bounded by two wars, the Pequot War (1636-1637) and King Philip's War (1675). These wars were tremendously disruptive and traumatic for Indigenous peoples of southern New England and both were essentially the result of Puritans attempting to acquire land in the Connecticut River Valley (Schramer and Sweet 1992, 1) and the Indigenous peoples resisting violently (Lavin 2013:331-332, Vaughan 1979, 133). So many Pequots were killed during the Pequot war that afterwards those people no longer existed culturally (Silliman and Witt 2010, 52). Just a few decades later, thousands of Indigenous people were killed during King Philip's War (Pequot Museum 2016), which was the result of a sachem (Metacomet) to unite the New England tribes and overthrow the English (Lavin 2013:332). It is after this conflict that the Shantok ceramics completely disappear from the archaeological record (Goodby 1998, 178, McBride personal communication 2017). The Shantok style emerged after the Pequot War, and, because of the destructive nature of King Philip's war on Indigenous peoples of the region, was no longer produced after about 1675 (Goodby 1998, 178, McBride personal communication 2017). This allows for a relatively narrow dating of the Shantok style (1635-1676).

The Shantok style is both demarcated by two wars, and may have been a product of it. The Shantok tradition “can be read as an expression of Mohegan [one Pequot subgroup making these types of ceramics] identity at a time when political instability was pervasive in Southern New England” (Mrozowski et al. 2007, 151). The interwar decades when it was manufactured “may have inspired Mohegan potters… to use their ceramic art to project their identity” (Mrozowski et al. 2007, 151). This suggests that there was some political reason inherent in the production of Shantok pottery. This is supported elsewhere by Goodby (1998), who argues that Indigenous peoples expressed and defended traditional native identity and culture by continuing the traditional practice of producing ceramics despite having access to European brass kettles (171, 177). While this may be oversimplifying the adoption of European goods by Indigenous peoples, there *is* a general decline in ceramic vessels during the seventeenth-century, which may be related to the influx of brass kettles during this period (Goodby 1998, 171). Goodby also argues that Indigenous peoples of Connecticut resisted colonialism by not using decorations on ceramics to mark tribal affiliations that were imposed by English settler-colonists in the seventeenth-century (1998, 176). In these ways the production of ceramics during the interwar period could be perceived as ways for Indigenous peoples to counter colonialism by maintaining cultural practices despite other technological options, and by ignoring imposed social categories.

These perspectives illustrate that the very existence of this vessel at the Hollister site is evidence of Indigenous peoples as active agents who navigated the colonial landscape, and who may have partially resisted colonialism by continuing to produce ceramics in specifically anti-colonial ways (Goodby 1998, Mrozowski et al. 2007, 151). The production of Shantok could have been one way to subvert colonialism, and a way for Indigenous peoples to continue to stake out some kind of claim in the new colonial world they were faced with. This is in relation to the existence of the vessel, generally. However, the location of the vessel in a European cellar indicates that fostering relationships and navigating the colonial world were complex endeavors for English colonists and Indigenous people alike.

The abundance of ceramics in the cellars at the Hollister site is evidence that Indigenous material was adopted in some interesting and little-documented way by colonists (Appendix A). This is speculative, but the abundance of ceramics here of Indigenous origin shows that there could have been some intense and long-term interaction that still needs to be studied. Perhaps the singular vessel in the cellar and the abundance of ceramics elsewhere shows that Indigenous peoples of Connecticut were successful at fostering alliances, and perhaps even farming in a co-dependent and possibly peaceful way over time. Another possibility is that there may have been Indigenous laborers at the farmstead, in which case the vessel may have been used by an Indigenous person in an English household. Indigenous peoples may have also forged economically based relationships, such as trade, with colonists in order to stake out a claim in the new colonial environment.

The numerous narratives that point to John Hollister's friendly relationship with Indigenous people in Glastonbury tends to support the hypothesis that the vessel may have been a gift, which explains why it was found nearly whole in this cellar (Adams

1904, 34, JSP 90, McNulty 1970, 15). Documentary evidence, such as *The Public Records of the Colony of Connecticut from 1665 to 1678; With the Journal of the Council of War, 1675 to 1678,* also points to Hollister as being an intermediary between colonial powers and the Wangunk of the town (Trumbull 1852). During King Philip's War (1675-1676) Connecticut River communities were distrustful of the Wangunk, despite them being allies (Lavin 2013, 332-333). English colonists even demanded Wangunk hostages in order to ensure their loyalty (Lavin 2013, 332, Trumbull 1852, 378). For this reason, the Wangunk would have benefited from an English friend and representative. Hollister is also postulated to have hired Wangunk men to help construct a palisade on his farm during King Philip's war in order to protect it from raids (Adams 1904, 34, McNulty 1970, 15, Trumbull 1852, 375). Other documents indicate that in 1675, "The Councill [sic] sent an advice to the Wonggum [sic] Indians to accept of Mr. John Holister's [sic] tender, and to com and builda [sic] fort at Nayage, which should not prejudice their interest" (Trumbull 1852, 411). Here, the council appears to have been instructing the Wangunk of Glastonbury to build a fort to protect themselves, as the English colonists were about to go to war with nearby Wampanoag tribe of Connecticut (Lavin 2013, 332). That nearby tribe was an adversary of the Wangunk, and this is written evidence that was a mutually beneficial relationship between them and John Hollister, which may have been for mutual protection during times of trouble. In this case, it appears that the Wangunk were negotiating colonial relationships by befriending Hollister and vice-versa. Both probably benefitted from this relationship whereby Hollister was permitted to hire Wangunk men to fortify his farm while receiving protection. If this were the case, it could be expected that the vessel may have been a gift, or a similar result of this close relationship, but as it is not dated, this is very speculative. Whatever its history, the singular vessel is material evidence that Indigenous peoples in Glastonbury were actively navigating the new colonial landscape in multifarious ways, including through economic relationships, allying or befriending English settler-colonists, and fostering mutually beneficial relationships.

This circumstance of English colonists using Indigenous ceramics is not unique for period and region, but contributes to the growing literature concerning the adoption of Native American material culture by European colonists. There is evidence that it was normal for settler-colonists to have native pots in the first colonial homes because there were close trade and other types of relationships between colonists and Indigenous peoples (Ross Harper, personal communication 2017). Elsewhere Native American and European material culture, including Indigenous ceramics, were found together at a plantation on Long Island, Sylvester Manor (Mrozowski et al. 2007, 144-145, 151). Those ceramics are very similar to the Shantok tradition, and dated to the between 1650 and 1735 (Mrozowski et al. 2007, 152, 2010, 28-29), which aligns closely with the occupation of the Hollister site (Glastonbury Records 1680, 126, Hollister 1711). Mrozowski et al. (2007, 152) argue that there was a documented political and cultural relationship between Indigenous groups in Connecticut and on Long Island, so this kind of relationship was not at all unique. All are evidence of the changing political and economic landscape under colonialism (Mrozowski et al. 2007, 152). On nearby Long Island, a colonial Indigenous presence was unanticipated at the plantation, but inevitably provided evidence of Indigenous laborers at the plantation (Mrozowski et al. 2007, 145). The Shantok ceramics from the Hollister site are also evidence of a similar forgotten history, in which cultural influence was multidirectional, and where Indigenous peoples were active agents forming relationships to counter colonialism and stake out a claim in the colonial world in ways we are just beginning to appreciate.

It is important to recognize that the colonists, not just Indigenous peoples, were also active agents, perhaps actively choosing to use Indigenous ceramics. This adoption of elements of Indigenous culture is counter to the general perspective of the colonizers of New England which, instead, has usually considered the ways in which Indigenous peoples "assimilated" to European culture (Lavin 2013, 315). Despite evidence that Indigenous peoples helped early English colonists to survive, the typical narrative from this time is that Indigenous peoples adopted European culture (Lavin 2013, 311-315). The ceramic vessel found in the European cellar is evidence that, as the English settlers were colonizing, "civilizing," and Christianizing the New England landscape, there was still evidently a preference for Indigenous pottery (Grafton 1992, 40, Winthrop 1662). This highlights an apparent irony of the traditional historical narratives surrounding colonialism. As the colonists had access to brass kettles, which began to replace Indigenous pottery during the early colonial period (Goodby 1998, 171) they may still have preferred Indigenous ceramics. While it is best not to over-interpret one ceramic vessel, its presence points toward the necessity of generating new hypotheses on other types of relationships, such as friendship, or employment that occurred during this early colonial time. There were undoubtedly many now forgotten interactions between Indigenous peoples and English settler-colonists.

Conclusion

Images produced from the geophysical data, artifacts from excavations, and historical documents were used collectively to identify and interpret interactions on the complex colonial landscape. Features, such as pit structures, on the landscape indicate that Indigenous peoples may have staked out a claim in the colonial landscape by continuing to live on their land, which they had occupied for centuries prior to encountering the European settler-colonists (Silliman 2001, 195). They lived in different areas mostly, but there are two indicators that it was not total segregation. An oval structure near the English settlement, and a cellar near the Indigenous settlement show that there were close interactions between these two groups (Figure 5.1). The abundance of Indigenous ceramics also shows that the singular vessel found in the Middle Cellar, and the interactions that had to have occurred for it to get there, are not anomalous. The ceramic vessel found in the Middle Cellar speaks to the ways Native Americans were navigating complex relationships with the colonizers through trade, or another type of social or economic interaction, such as an employer-employee relationship. Through these relationships, Indigenous peoples could have sought to contest power and ownership inherent in the colonial structure, by staking out a claim in many different ways in the colonial world.

These claims may also have been bi-directional, and this research indicates that the lived experience of English settler-colonists may have run counter to the typical colonial narrative found in history books for the last few hundred years. By fostering alliances, friendships, and economic relationships with settler-colonists, Indigenous peoples may have been better equipped to counter colonization. This may be seen in Hollister's work as an intermediary between Wangunks and the Council of War (Trumbull 1852). Further, the continued production of ceramics during this period was in itself a political or economic act, whereby Indigenous peoples continued traditional lifeways despite the possible oppression or at least domination of the new colonial powers and influx of European goods (Goodby 1998).

CHAPTER SIX: CONCLUSION

The Hollister site likely looked quite different during the seventeenth-century than it does today. On the southern edge of the site, a glacial moraine bounded by fluvial channels was identified geophysically. This area was likely defined by a ridge of gravelly soil, with low, marshy areas to the north and south. Near these features are four Indigenous oval houses visible in the images produced from the GPR data (Figure 5.1). To the north of the site another moraine was found, also bounded by a fluvial channel, and directly to the south by lacustrine sediments (Figure 5.1). The moraine would have been visible on the seventeenth-century landscape as ridges of gravelly soil, and the filled fluvial and lacustrine features would have been low, marshy areas. English settler-colonists primarily inhabited the relatively flat, dry area between the two moraines and marshy areas. The seventeenth-century living surface was also identified in the GPR profiles, and was visible throughout the nine GPR grids collected across the site (Figure 5.1, 4.12-4.16). This analysis of the landscape, when incorporated by understanding where people lived shows that Indigenous peoples and English settler-colonists chose to occupy the site in both similar and distinct ways. It also shows that these two groups were occupying the site at the same time.

It is clear from the reconstruction of the seventeenth-century colonial landscape that English colonists and Indigenous peoples were choosing to occupy the site in both similar and different ways. The Indigenous oval structures in the southwestern area of the site (Figure 5.1, 4.20, and 4.21) were closer to the marshy resources adjacent to the glacial moraine in that area. These structures are not dug deeply into the ground, unlike the European cellars in the central part of the site (Figures 5.1, 4.34-4.37). In this region Indigenous oval houses, like those at the Hollister site, were built directly on the ground, on which low wooden platforms would have been constructed (Lavin 2013, 274). Indigenous peoples probably occupied this area because the low, wet environments were exploited for food resources, such as berries (Malloy 2007, 1-2, 4, 6-7). Europeans would not have wanted cellars to be too near to wetland resources with a high water table, as they would have flooded. Therefore, they built on the flat, dry area between the two moraines. It is also evident that both groups chose to avoid living directly on the gravelly moraines, which would have been difficult to build or farm on. Instead, a road was constructed on the relatively high, dry southern moraine, so that the site could be reached without crossing the wet ground that would have been adjacent to the moraine.

The finding that Indigenous peoples and English settler-colonists were likely cohabitating at the site, which is apparent by the seventeenth-century living surface and depths of features in the images produced from the geophysical data, is interesting. This discovery provides evidence that Indigenous peoples of the Connecticut River Valley may have been challenging the colonial structure by practicing “acts of residence” (Silliman 2001, 195). By continuing to occupy land owned by John Hollister, Indigenous peoples could have been staking claim to a landscape that was steadily becoming dominated by colonists. This speaks to the agency of Indigenous peoples of the region, who resisted colonialism by acting in ways that allowed them to ‘go on’ in the world (Silliman 2001, 192).

Documentary evidence also indicates that friendships were fostered between Indigenous peoples of the area and John Hollister (Trumbull 1852). This shows that the early colonial environment may have been a period in which some Europeans and Indigenous peoples were dependent on each other. Hollister is portrayed in various narratives as a friend to the Wangunk in Wethersfield (Adams 1904, 2015, Trumbull 1852). He is also depicted as a sort of representative for the Wangunk, as he is documented as having conveyed messages to them from the Council of War (Trumbull 1852, 375). The documents showing that Hollister may have hired Wangunk men to help fortify his farm in a time of war (Adams 1904, 34, McNulty 1970, 15, Trumbull 1852, 375) is also evidence that there may have been mutually beneficial relationships between Wangunk people and the Hollisters. These relationships are not necessarily indicative of active resistance to colonialism, but rather the navigation of the new, complex colonial environment in creative ways. Early colonial Connecticut was a place where Indigenous peoples and English settler-colonists alike were seeking friendships that would better their chances for survival. In those early days of European settlement where population density was low and there was little in the way of a military force, facing the influx of strange people into their land, Indigenous peoples likely fostered friendships with the Hollisters in return for a representative in colonial institutions. Later, when there was a threat of war by other Indigenous peoples elsewhere who were violently resisting colonialism (1675-1676), John Hollister sought help in fortifying his farm from

Wangunks he had befriended (Adams 1904, 34, McNulty 1970, 15, Trumbull 1852, 375). This confusing situation is difficult to discern based on the limited amount of information I have. However, I can conclude from the documents that relationships were fostered between John Hollister and the Wangunks of the area. Further evidence of close relationships may be seen in the Indigenous settlement at the Hollister site, and Indigenous ceramics that were recovered from one of the English cellars.

Analysis of Indigenous ceramics recovered from the Middle Cellar also revealed the multifarious ways that Indigenous peoples of Connecticut were forming relationships with English colonizers. Sherds belonging to a large Shantok vessel indicate that different types of relationships, such as economic, alliances, and friendships, were being fostered between Indigenous peoples and English settler-colonists. The context of the vessel along with the abundance of Indigenous ceramic sherds in two of the European cellars indicates that it was being used by the colonists. This research supports other recent work in the area that shows that in the seventeenth-century, Indigenous pottery was integrated into the first European households (Mrozowski et al. 2007, 144-145, 151, Ross Harper, personal communication). The traditional historical narrative of colonialism supports the "ethnic double standard" that Indigenous peoples adopted European culture and became assimilated, while ignoring the evidence that early colonists also depended on Indigenous people and culture to survive (Lavin 2013, 311-315). Evidence that English settler-colonists were adopting at least these well-preserved artifacts of Indigenous culture challenges the traditional historical narrative of interactions between these two groups of people in the region (Lavin 2013, 315).

Geophysics allowed for the examination of a larger area (140x140 meters, approx.) than would have been possible with traditional archaeological methods. I was also able to use geological knowledge to decipher the images produced from the geophysical data, and reconstruct the seventeenth-century landscape. Data produced through excavations, and documentary evidence, showed how Europeans and Indigenous peoples were interacting with each other at the Hollister site. I would urge other archaeologists to be more diligent in employing integrated methods, geophysical, specifically. This research exemplifies how doing so produces a more robust analysis of an archaeological site.

Future Research

There are many questions and directions for future research that should be explored. It would be interesting to explore the origins of the ceramic vessel. Specifically, to discover where the clay came from would help to discern who, more precisely, created the vessel. This would also lead to a better understanding of where the vessel came from, which, in turn, could answer questions about how it was obtained by English settler-colonists. If these questions cannot be answered, that is interesting, too. It would show that delineations between groups were not as distinct as originally thought. What the vessel was used for, would also be an interesting topic to explore. Archaeobotany could reveal what types of materials were stored in the vessel. This could also help address the question of how or why it was obtained by English settler-colonists. This may also reveal that it was used in similar or different ways by Indigenous peoples and colonists.

The geophysical surveys produced a wealth of data that could be used to explore questions concerning the landscape at the site. While the seventeenth-century landscape was recreated, this recreation also raised questions concerning the chronology of occupation of the site by different peoples. Both Indigenous peoples and Europeans occupied the site. Was there a coexistent occupation? If Indigenous people were occupying the site prior to European colonization, when, precisely, were they living there? And when did they stop living there? If Indigenous peoples and colonists co-occupied the site, when and why did they do so? What does this say about the colonization of Connecticut? There are many questions to be asked and answered concerning the colonial landscape, but they will need to be addressed in the many years of research left to be done.

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APPENDICES

Appendix A

Ceramics Data

Photo Number	Unit or accession number	Quad	Depth (cm)	Bag #	Count	Refit (# of fragments)	Dimensions (cm)	Weight (grams)	Rim diameter (cm)	Thickness (mm)	Notes	Temper
	N12W15	SE	110-120	37	1		less than 2 cm	1.06		N/A		Shell
	N12W15	SE	110-120	37	1		3.8 x 2.7	5.83		7	None	Shell
415	N12W15	SW	120-130	42	1		3 x 2.8	6.44		6.5	Painted, 3 stripes	Shell
0406, 0407, and 0408	N11W15	SW	100-110	42	1		4.8 x 3.2	17.89		N/A	Striations, castellation?	Shell
	N12W15	SW	110-120	36	1		4.3 x 2.3	4.72		4	vertical striations, part of rim	Shell
	N12W15	SW	110-120	36	1		5.1 x 2.4	8.03		6	vertical striations, part of rim	Shell
0409 and 0410	N12W15	SE	120-130	43	1	2	9.9 x 8.5	70.47		8	diagonal striations, nearing rim, indented for a medallion	Shell
0411 and 0412	N12W15	SE	120-130	43	1	2	10.5 x 7.3	87.42	38	6.5	Rim, vertical and diagonal striations, medallion, indented for medallion	Shell

0413 and 0414	N12W15	SE	120-130	43	1	6	12.8 x 8.2	76.53	25	8	Rim, vertical, diagonal, and horizontal striations, indented for a medallion	Shell
	N12W15	SE	120-130	43	1		7.5 x 3.8	24.49		6.5	None	Shell
	N12W15	SE	120-130	43	1		4 x 2.3	5.6		6	Painted?	Shell
	N12W15	SE	120-130	43	1	2	4.6 x 5.5	18.68		7	None	Shell
	N12W15	SE	120-130	43	1	2	7.1 x 3.3	17.08		7.5	None	Shell
	N12W15	SE	120-130	43	1		7.2 x 3.2	19.37		6	Triangular impressions	Shell
0416, 0417, and 0418	N12W15	SE	120-130	43	1	2	3.8 x 2.4	8.23	35 (may be too small)	7	Rim, vertical striations	Shell
	N12W15	SE	120-130	43	1		6.8 x 2.3	11.54		7	None	Shell
	N12W15	SE	120-130	43	1		3.4 x 2.6	6.55	too small	6	Rim, diagonal striations	Shell
	N12W15	SE	120-130	43	1		3.9 x 2.4	5.03		6	None	Shell
	N12W15	SE	120-130	43	1		2.6 x 1.5	1.91		6	striations	Shell
	N12W15	SE	120-130	43	1		3 x 1.5	2.87		6.5	None	Shell
	N12W15	SE	120-130	43	1		2.8 x 1.4	2.04		N/A	None	Shell
	N12W15	SE	120-130	43	1		2.5 x 1.9	2.7		6	None	Shell
	N12W15	SE	120-130	43	1		2.7 x 1.4	3.27		7	None	Shell
	N12W15	SE	120-130	43	1		less than 2 cm	0.26		N/A	None	Shell
	N12W15	SE	120-130	43	1		less than 2 cm	0.06		N/A	None	Shell
	N12W15	SE	120-130	43	1		less than 2 cm	0.3		N/A	None	Shell
	N12W15	SE	120-130	43	1		less than 2 cm	0.5		N/A	None	Shell

N12W15	SE	120-130	43	1		less than 2 cm	1.09		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.37		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	1.06		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.96		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.29		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	1.07		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.58		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.19		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.52		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.13		N/A	striations	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.22		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.94		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.78		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.42		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.31		N/A	None	Shell
N12W15	SE	120-130	43	1		less than 2 cm	0.41		N/A	None	Shell
N12W15	SE	120-130	43	1		2.1 x 2	2.41		5.5	None	Shell
N11W15	NE	120-130	55	1		6.9 x 5.8	33.16		8	None	Shell
N11W15	NE	120-130	55	1		8.2 x 5.8	39.53		7	None	Shell
N11W15	NE	120-130	55	1		5.7 x 6.2	25.63		7	None	Shell
N11W15	NE	120-130	55	1		less than 2 cm	0.68	too small	N/A	vertical striations, part of rim	Shell

419	N11W15	NE	120-130	55	1		5.5 x 2.8	11.29	could not get measurement	7	vertical striations, part of rim	Shell
0420, 0421, 0422, 0423	N11W15	NE	120-130	55	1		2.7 x 2.4	4.77		N/A	medallion	Shell
	N11W15	NE	120-130	55	1		5.1 x 5.1	20.2		7	None	Shell
	N11W15	NE	120-130	55	1		6.4 x 3.1	14.69		7.5	Striations	Shell
	N11W15	NE	120-130	55	1		8.6 x 4.4	30.32		6.25	None	Shell
	N11W15	NE	120-130	55	1		5 x 5.8	27.48		7	None	Shell
	N11W15	NE	120-130	55	1		4.6 x 2.6	9.65		7	None	Shell
	N11W15	NE	120-130	55	1		5.1 x 3.2	12.58		7	None	Shell
	N11W15	NE	120-130	55	1		8 x 2.4	17.08		7	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	0.51		N/A	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	0.64		N/A	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	0.45		N/A	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	0.82		N/A	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	0.33		N/A	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	0.3		N/A	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	0.3		N/A	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	0.17		N/A	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	0.2		N/A	None	Shell
	N11W15	NE	120-130	55	1		4 x 2.9	5.68		5.5	None	Shell
	N11W15	NE	120-130	55	1		4 x 2.1	7.13		6	None	Shell
	N11W15	NE	120-130	55	1		3.4 x 1.1	5.15		8	None	Shell
	N11W15	NE	120-130	55	1		2.9 x 1.6	3.48		6.5	None	Shell

	N11W15	NE	120-130	55	1		2.3 x 1.5	0.81		N/A	None	Shell
	N11W15	NE	120-130	55	1		2.1 x .9	1.16		6	None	Shell
	N11W15	NE	120-130	55	1		2.3 x 1.9	2.49		5.75	None	Shell
	N11W15	NE	120-130	55	1		2.8 x 2	2.76		N/A	None	Shell
	N11W15	NE	120-130	55	1		1.95 x 2.1	1.63		N/A	None	Shell
	N11W15	NE	120-130	55	1		2.3 x 2.1	1.35		N/A	None	Shell
	N11W15	NE	120-130	55	1		2.8 x 1.8	3.37		N/A	None	Shell
	N11W15	NE	120-130	55	1		less than 2 cm	2.07		N/A	None	Shell
	N11W15	NW	120-130	54	1		2.9 x 1.6	2.58		6	None	Shell
	N11W15	NW	120-130	54	1		6.2 x 4.4	26.21		6.5	None	Shell
	N11W15	NW	120-130	54	1		8.1 x 5	46.6		7	None	Shell
0424, 0425	N11W15	NW	120-130	54	1	3	7.9 x 8.1	69.7		6.5	None	Shell
	N11W15	NW	120-130	54	1		7.4 x 4.4	22.45		6..75	None	Shell
	N11W15	NW	120-130	54	1		8.5 x 3.5	34.85		7.5	None	Shell
	N11W15	NW	120-130	54	1		4.3 x 3	11.15		7	None	Shell
	N11W15	NW	120-130	54	1		4.5 x 2.9	8.2		6	Impressions	Shell
	N11W15	NW	120-130	54	1		6 x 5.3	30.5		7.25	None	Shell
	N11W15	NW	120-130	54	1		5.3 x 5.4	20.42		6.5	Impressions	Shell
	N11W15	NW	120-130	54	1		3.2 x 3	5.53		N/A	None	Shell
0427, 0428	N11W15	NW	120-130	54	1		2.4 x 1.8	2.91		N/A	Medallion	Shell
429	N11W15	NW	120-130	54	1		2.25 x 1.7	2.65		N/A	Medallion	Shell
426	N11W15	NW	120-130	54	1		4.5 x 2.5	12.72	42	7	Rim, vertical striations	Shell
	N11W15	NW	120-130	54	1		5 x 1.8	7.35		6.5	None	Shell
	N11W15	NW	120-130	54	1		3.9 x 2.6	9.28		6	None	Shell
	N11W15	NW	120-130	54	1		3.2 x 1.9	2.84		6.5	Impressions	Shell
	N11W15	NW	120-130	54	1		less than 2 cm	0.54		N/A	None	Shell
	N11W15	NW	120-130	54	1		less than 2 cm	0.67		N/A	None	Shell
	N11W15	NW	120-130	54	1		less than 2 cm	0.9		N/A	None	Shell

N11W15	NW	120-130	54	1	less than 2 cm	0.47	N/A	None	Shell
N11W15	NW	120-130	54	1	less than 2 cm	0.28	N/A	None	Shell
N11W15	NW	120-130	54	1	less than 2 cm	0.28	N/A	None	Shell
N11W15	NW	120-130	54	1	less than 2 cm	0.58	N/A	None	Shell
N11W15	NW	120-130	54	1	less than 2 cm	0.41	N/A	None	Shell
N11W15	NW	120-130	54	1	less than 2 cm	0.64	N/A	None	Shell
N11W15	NW	120-130	54	1	less than 2 cm	0.37	N/A	None	Shell
N11W15	NW	120-130	54	1	less than 2 cm	0.07	N/A	None	Shell
N11W15	NW	120-130	54	1	2.25 x .9	0.91	N/A	None	Shell
N11W15	NW	120-130	54	1	1.9 x 1.3	1.4	5.5	None	Shell
N11W15	NW	120-130	54	1	2.2 x 2.1	5.82	6	None	Shell
N11W15	NW	120-130	54	1	2.4 x 2.2	3.93	N/A	None	Shell
N11W15	NW	120-130	54	1	2.9 x 1.5	4.88	7	None	Shell
N11W15	NW	120-130	54	1	2.9 x 1.4	3.9	7	None	Shell
N11W15	NW	120-130	54	1	3.1 x 1.9	4.35	6.5	None	Shell
N11W15	NW	120-130	54	1	3.5 x 2	1.87	N/A	None	Shell
N11W15	NW	120-130	54	1	2.65 x 2	2.26	N/A	None	Shell
N11W15	NW	120-130	54	1	2.4 x 1.1	0.47	N/A	None	Shell
N11W15	NW	120-130	54	1	2.5 x 1.2	1.73	N/A	None	Shell
N11W15	NW	120-130	54	1	2.2 x 1	1.85	7	None	Shell
N11W15	NW	120-130	54	1	3 x 1.3	1.78	5	None	Shell
N11W15	NW	120-130	54	1	2.6 x 1.1	1.86	6	None	Shell
N12W15	SE	130	43 A	1	2.1 x 1.2	0.81	N/A	None, cleanup under stones	Shell
N12W15	SE	130	43 A	1	less than 2 cm	0.19	N/A	None, cleanup under stones	Shell
N12W15	SE	130	43 A	1	less than 2 cm	0.11	N/A	None, cleanup	Shell

											under stones	
	N12W15	SE	130	43 A	1		less than 2 cm	0.23		N/A	None, cleanup under stones	Shell
	N12W15	SE	130	43 A	1		less than 2 cm	0.21		N/A	None, cleanup under stones	Shell
	N12W15	SE	130	43 A	1		less than 2 cm	0.24		N/A	None, cleanup under stones	Shell
	N12W15	SE	130	43 A	1		less than 2 cm	0.11		N/A	None, cleanup under stones	Shell
	N12W15	SE	130	43 A	1	3	9.5 x 5	38.29		6	Impressions, cleanup under stones	Shell
	S1W16	SW	70-80	26	1		2.1 x 1.6	2.82		5.5	None	Shell
0430, 0431	S1W16	SW	70-80	26	1		3.8 x 4	19.2	24	N/A	Rim	Shell
0432, 0433	N12W15	NE	120-130	41	1	2	5.3 x 6	29.69		7	Medallion and upper portion, diagonal striations	Shell
0434,	N12W15	NE	120-130	41	1		2.5 x 2.4	4.73		N/A	Rim? Diagonal striations	Shell
	N12W15	NE	120-130	41	1		5 x 4.6	20.55		6.75	None	Shell
	N12W15	NE	120-130	41	1		5 x 2.5	8.49		7	None	Shell
0435, 0436, 0437	N12W15	NE	120-130	41	1		2 x 2.5	3.34		N/A	Medallion, diagonal striations	Shell
	N12W15	NE	120-130	41	1		2.3 x 2.1	3.61		7	None	Shell
	N12W15	NE	120-130	41	1		3.1 x 2.2	4.71		6	None	Shell
	N12W15	NE	120-130	41	1		3.1 x 1.1	2.32		6.5	None	Shell
	N12W15	NE	120-130	41	1		2.1 x 1.3	2.77		6.5	None	Shell
	N11W15	NW	110-120	51	1		3 x 2.6	7.31		8	None	Shell
	N11W15	NW	110-120	51	1		4 x 2.6	10.9		7.5	None	Shell

438	S1W16	SE	70-80	27	1	4.3 x 3.95	22.01	36 (may be too small	N/A	Rim, impressions	Shell
	S1W16	SE	70-80	27	1	3.8 x 3.8	9.72		6.5	None	Shell
	S1W16	SE	70-80	27	1	2.6 x 2.7	4.84		5	None	Shell
	S1W16	SE	70-80	27	1	4 x 1.5	3.27		5	None	Shell
	S1W16	SE	70-80	27	1	3.1 x 2.5	3.65		5	None	Shell
	S1W16	SE	70-80	27	1	3.2 x 2.1	3.24		5	None	Shell
	S1W16	SE	70-80	27	1	2.3 x 1.2	1.31		4.5	None	Shell
	S1W16	SW	80-90	34	1	4.9 x 2.9	9.83		6.25	None	Shell
439	S1W23/1211	NW	30-40	15	1	4.5 x 4.7	15.35		6	Near rim, diagonal striations, still Shantok time period, but not tradition, could be Hackney Pond	Not discernable
0440, 0441	S1W14/1686	SW	130-140	56	1	3.5 x 2.8	4.9		5.5	Impressions, Hackney Pond	Not discernable
	S1W15/1918	SE	60-70	27	1	2 x 1.6	0.97		4	None, Hackney Pond	Not discernable
	S1W15/2035	NW	80-90	40	1	4.35 x 2.2	7.35		5.25	None	Shell
	S1W15/2035	NW	80-90	40	1	2.2 x 1.5	1.75		5.25	None	Shell
	N11W15	NW	40-50	20	1	3 x 1.6	1.83		N/A	None	Shell
0444, 0445	N11W15	SW	100-110	42	1	12 x 5.4	69.65		7	None	Shell
	N11W15	SW	100-110	42	1	6.7 x 2.6	15.94		6	Painted?	Shell
	N11W15	SW	100-110	42	1	5.1 x 2.2	11.7		7.5	None	Shell
	N11W15	SW	100-110	42	1	5.9 x 2.6	19.26		6.25	None	Shell
	N11W15	SW	100-110	42	1	6.2 x 3.6	26.66		6.25	None	Shell
	N11W15	SW	100-110	42	1	7.4 x 5	33.8		6.25	None	Shell

446	N11W15	SW	100-110	42	1		1.5 x 2.2	2.52		5.5	Painted, refits to painted sherd in N12W15 SW Bag 42	Shell
0447, 0448	N11W15	SW	100-110	42	1	2	5.2 x 4	17.61	35 (may be too small)	7.25	Rim, vertical and diagonal striations, refits on right side of sherd in N12W15 SE 130cm	Shell
0449, 0450	N11W15	SW	100-110	42	1	3	5.9 x 5.7	24.61	40 (may be too small)	7.25	Rim, vertical and diagonal striations	Shell
	N11W15	SW	100-110	42	1		8.5 x 4	25.78		7	None	Shell
	N11W15	SW	100-110	42	1		4.2 x 4	12.56		6.25	None	Shell
	N11W15	SW	100-110	42	1		2.2 x 1.3	0.63		N/A	Sheared part of rim? vertical and horizontal striations	Shell
	N11W15	SW	100-110	42	1		2 x 1.7	2.16		7	vertical striations, part of rim?	Shell
	N11W15	SW	100-110	42	1		2.15 x 3.5	6.36		7.25	Striations, part of rim?	Shell
0451, 0452	N11W15	SW	100-110	42	1	2	5.9 x 2.9	17.2	40	7	Rim, vertical striations	Shell
	N11W15	SW	100-110	42	1		6.4 x 3.3	20.41		7.5	None	Shell
	N11W15	SW	100-110	42	1		2.3 x 1.7	2.97		N/A	None	Shell
	N11W15	SW	100-110	42	1		3.9 x 2.9	7.88		6.25	None	Shell
	N11W15	SW	100-110	42	1		4.9 x 2.5	10.16		7.25	None	Shell
	N11W15	SW	100-110	42	1		3.9 x 1.9	6.82		7	None	Shell

0453, 0454, 0455, 0456	N11W15	SW	100-110	42	1	2.6 x 2	3.11	N/A	Medallion	Shell
0457, 0458	N11W15	SW	100-110	42	1	1.7 x 1.5	1.88	N/A	Medallion	Shell
0459, 0460	N11W15	SW	100-110	42	1	2.9 x 1.45	2.43	N/A	Part of castellation?	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.94	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	1.24	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.62	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.5	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.61	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.39	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.36	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.46	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.38	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.51	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.43	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.39	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.41	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.47	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.39	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.14	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	0.15	N/A	None	Shell
	N11W15	SW	100-110	42	1	Less than 2 cm	1.16	N/A	None	Shell

N11W15	SW	100-110	42	1	Less than 2 cm	1.29	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.8	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.64	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.48	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.98	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	1.52	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.68	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	1.39	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.65	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.79	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.81	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.19	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.38	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.18	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.18	N/A	None	Shell
N11W15	SW	100-110	42	1	Less than 2 cm	0.2	N/A	None	Shell
N11W15	SW	100-110	42	1	3.55 x 2.2	6.86	6.75	None	Shell
N11W15	SW	100-110	42	1	3.6 x 2.7	5.27	N/A	None	Shell
N11W15	SW	100-110	42	1	3.7 x 2	5.29	7	None	Shell
N11W15	SW	100-110	42	1	3.8 x 2.4	6.37	7	None	Shell
N11W15	SW	100-110	42	1	3.4 x 2.5	5.8	6	None	Shell
N11W15	SW	100-110	42	1	3.6 x 2.8	8.24	7	None	Shell
N11W15	SW	100-110	42	1	2.1 x 2.6	6.58	6.75	None	Shell

	N11W15	SW	100-110	42	1	3.2 x 1.35	2.77	N/A	None	Shell
	N11W15	SW	100-110	42	1	3.5 x 1.3	4.75	7.5	None	Shell
	N11W15	SW	100-110	42	1	2 x 1.8	2.09	N/A	None	Shell
	N11W15	SW	100-110	42	1	2.6 x 1.5	2.68	6.5	None	Shell
	N11W15	SW	100-110	42	1	2.3 x 1.6	2.49	5.5	None	Shell
	N11W15	SW	100-110	42	1	2.1 x 2.1	2.49	6.75	None	Shell
	N11W15	SW	100-110	42	1	2.9 x 1.1	3.03	5	Impressions	Shell
	N11W15	SW	100-110	42	1	2.3 x 1.5	2.36	6	None	Shell
	N11W15	SW	100-110	42	1	2.5 x 1.7	1.74	6.5	None	Shell
	N11W15	SW	100-110	42	1	2.4 x 1.5	2.71	6	None	Shell
	N11W15	SW	100-110	42	1	2.5 x 1.5	2.53	6.75	None	Shell
	N11W15	SW	100-110	42	1	2 x 1.7	2.45	7	None	Shell
	N11W15	SW	100-110	42	1	2.4 x 1.7	1.78	5.5	None	Shell
	N11W15	SW	100-110	42	1	2.2 x 1.9	2.16	6.25	None	Shell
	N11W15	SW	100-110	42	1	2.3 x 1.1	1.83	7	None	Shell
	N11W15	SW	100-110	42	1	2.4 x 1.5	1.11	6.5	None	Shell
	N11W15	SW	100-110	42	1	2.2 x 1.7	1.48	7.5	None	Shell
	N11W15	SW	100-110	42	1	2.7 x 1.5	1.23	N/A	None	Shell
	N11W15	SW	100-110	42	1	2.1 x 1.3	0.93	N/A	None	Shell
	N11W15	SW	100-110	42	1	2.25 x 1.4	0.58	N/A	None	Shell
	N11W15	SW	100-110	42	1	2.1 x 1.2	1.15	5.5	None	Shell
	N11W15	SW	100-110	42	1	2.2 x .9	1.01	6	None	Shell
	N11W15	SW	100-110	42	1	2.1 x .85	0.74	N/A	None	Shell
	N11W15	SW	100-110	42	1	2 x 1.2	0.62	N/A	None	Shell
0442, 0443	S1W16	NE	60-70	24	1	7.8 x 4.7	21.1	7	None	Shell