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“Penniless and Unknown”: Temporality of the Milwaukee County Poor Farm Cemetery - A GIS Analysis

Eric Eugene Burant
University of Wisconsin-Milwaukee

"PENNILESS AND UNKNOWN": TEMPORALITY OF THE MILWAUKEE COUNTY POOR FARM CEMETERY - A GIS ANALYSIS

by

Eric E. Burant

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ABSTRACT

"PENNILESS AND UNKNOWN": TEMPORALITY OF THE MILWAUKEE COUNTY POOR FARM CEMETERY - A GIS ANALYSIS

by

Eric E. Burant

The University of Wisconsin-Milwaukee, 2020
Under the Supervision of Dr. Patricia Richards

This thesis uses GIS modeling techniques of spatial data, archaeological data, and historical documentation to determine patterning of material culture associated with interments at the Milwaukee County Poor Farm Cemetery (MCPFC), an unmarked cemetery located in Wauwatosa, Wisconsin. Archaeological excavations at the MCPFC in 1991-1992 and again in 2013 recovered over 2,400 individuals associated with Milwaukee County's practice of providing burial for institutional residents, unidentified or unclaimed individuals sent from the Coroner's Office, the remains of cadaverized individuals, and community poor from 1862 through 1925 (Richards 2016).

Previous research identified two distinct material culture classes; grave goods and grave inclusions. These two broad categories support the interpretation of four potential burial classes (Richards 2016:100). While these artifact associations adequately examine the relationship between material culture and respective burial class, it does not necessarily represent a broad temporal patterning of material culture within a spatial context.

This thesis utilizes spatial analyses to identify and examine the distribution of temporality in order to provide a more accurate and complete spatial understanding of the history and land use at the MCPFC. Spatial patterns in the distribution of temporally diagnostic material culture such as coins, footwear, jars or containers, and positively identified individuals are used to refine temporally significant burial clusters across the cemetery. The results of this study refine the current assumptions of land use patterns based on coffin handle distributions and confirm the larger spatial patterning of temporality across the cemetery. This thesis also provides a GIS model and external database designed to facilitate future research of the MCPFC.

For my father, Brian J. Burant

Forever catching the wind

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LIST OF ABBREVIATIONS

GIS: Geographic Information System

GLARC: Great Lakes Archaeological Research Center

IDW: Inverse Distance Weight Interpolation

MCBS: Milwaukee County Board of Supervisors

MCMC: Milwaukee County Medical Complex

MCPFC: Milwaukee County Poor Farm Cemetery

TDS: Total Data Station

TPQ: Terminus Post Quem

UWM-ARL: University of Wisconsin- Milwaukee Archaeological Research Laboratory

UWM-CRM: University of Wisconsin- Milwaukee Cultural Resource Management

UWM-HRMS: University of Wisconsin- Milwaukee Historic Resource Management Services

ACKNOWLEDGMENTS

First and foremost, I would like to thank my advisor Dr. Patricia Richards for her tireless support throughout this process. She has shown an unyielding commitment to protect and preserve the history of the Milwaukee County Poor Farm Cemetery and the individual narratives of those who were laid to rest there. I am honored to have been a part of a project that I am sure will continue through generations. The academic guidance and professional assistance you have provided me over the last ten years has been truly inspiring, for that, I am most indebted. I also need to thank the other members of my committee, Dr. John Richards and Brian Nicholls, for their insight and advice in the completion of this thesis. The educational, professional, and personal encouragement and support these two have provided me over the last decade have been invaluable. All of you have done so much for me and have made me a better archaeologist. This simple thank you to my mentors will never be enough.

Additionally, I would like to thank everyone from the laboratory and field crews who have participated in the Milwaukee County Poor Farm Cemetery Project. The contributions you all have made to this collection of archaeological data has been immense, without your efforts this research would have not been possible. Unfortunately, there are too many to be named, but this group of scholars require special acknowledgment; Alexander Anthony, B Charles, Brooke Drew, Emily Epstein, Shannon Freire, Catherine Jones, Nicholas Richards, and Jessica Skinner. Thank you for your commitment to the research of the Milwaukee County Poor Farm Cemetery, I look forward to many future collaborations together.

During my years as a student I have benefited greatly from the friendships that were created. I would like to extend thanks to my graduate school cohort; Andrew Saleh, Megan

Thornton, and Robert Vander Heiden Jr. We have shared many laughs as we learned, mostly through trial and error, and my skillsets are much better for it. I appreciate all of the knowledge they have bestowed upon me and I hope to return the favor in the future.

Finally, I need to thank my family who has provided an insurmountable amount of support throughout my professional pursuits and academic ambitions. Without their support I would have never been able to complete this work. Your unwavering love has been the force that has always kept me grounded. Thank you.

CHAPTER ONE: INTRODUCTION

Introduction

This thesis uses GIS modeling techniques of spatial data, archaeological data, and historical documentation to determine patterning of material culture associated with interments at the Milwaukee County Poor Farm Cemetery (MCPFC) located in Wauwatosa, Wisconsin. The Milwaukee County Poor Farm Cemetery is an umbrella term used to describe the four cemeteries that were used by Milwaukee County to provide a "decent" burial for the county's indigent population (Richards 1997). This practice began in 1872 and continued until 1974. It is estimated that over 10,000 individuals found a final resting place across these four cemeteries (Richards 2016:17).

The primary focus of this research is Cemetery II, an unmarked cemetery referred to here as the Milwaukee County Poor Farm Cemetery (MCPFC). This cemetery was utilized by Milwaukee County between 1882 and 1925. The forty three active years within a spatially bounded area are corroborated by an array of historical documentation including the *Register of Burials at the Milwaukee County Poor Farm Cemetery,* Milwaukee County death certificates, and Milwaukee County coroner's inquests, Milwaukee County General Hospital patient ledger, and the *City of Milwaukee Annual Commissioner of Health Reports* (Drew 2018). Formal archaeological excavations at the MCPFC occurred during 1991-1992 and again in 2013. These combined excavations recovered over 2,400 individuals from 2,169 coffin locations associated with the burial of institutional residents, unidentified or unclaimed individuals sent from the county Coroner's Office, the remains of cadaverized individuals, and community poor (Richards 2016:161). The number of coffin locations used in this study is reflected by mapped coffins only, this number does not include multiple burials within a single grave shaft placed one over the other. The number of individuals differs from the total coffin locations because some coffins contained multiple burials.

It is estimated that 7,222 individuals were buried at the MCPFC, of these burials 5,363 are listed on the *Register of Burials at the Milwaukee County Poor Farm.* The number of recovered individuals only represents roughly 32 percent of the population of the cemetery (Richards 2016:88). Although, the burial ledger contains the names of interred individuals, in most cases, there is no way to correlate those names with an individual burial. Despite the extensive contemporary documentation of the cemetery, the MCPFC quickly became forgotten after it was closed. Although the cemetery was fenced, the interments of the cemetery were never formally marked with identifying headstones, at best a simple white wooden cross grave marker signified the location of the burial. The MCPFC appeared on few historic maps, Figure 1.1 illustrates the estimated cemetery boundaries from the historical record and current interpretations.

Figure 1.1: Historical mapped boundaries of the MCPFC (adapted from Richards 2016)

The MCPFC has historically been subjected to multiple episodes of disturbance. These disturbances have included various utility replacement projects and road reconstruction improvements. The largest historical disturbance to the cemetery occurred during 1932 with the construction of a Nurse's School and Residence Hall (Richards 2016; Richards and Kastell 1993). This construction disturbed a large number of graves in the eastern and central portions of the cemetery (Figure 1.2). The total disturbed area is calculated at roughly 65,470 square feet, disinterring a possible 2,618 burials (Richards 1997:106). The extent of this disturbance greatly affected the ability to correlate the specific excavated interment to the individuals listed in the *Register of Burials* (Richards 1997:104).

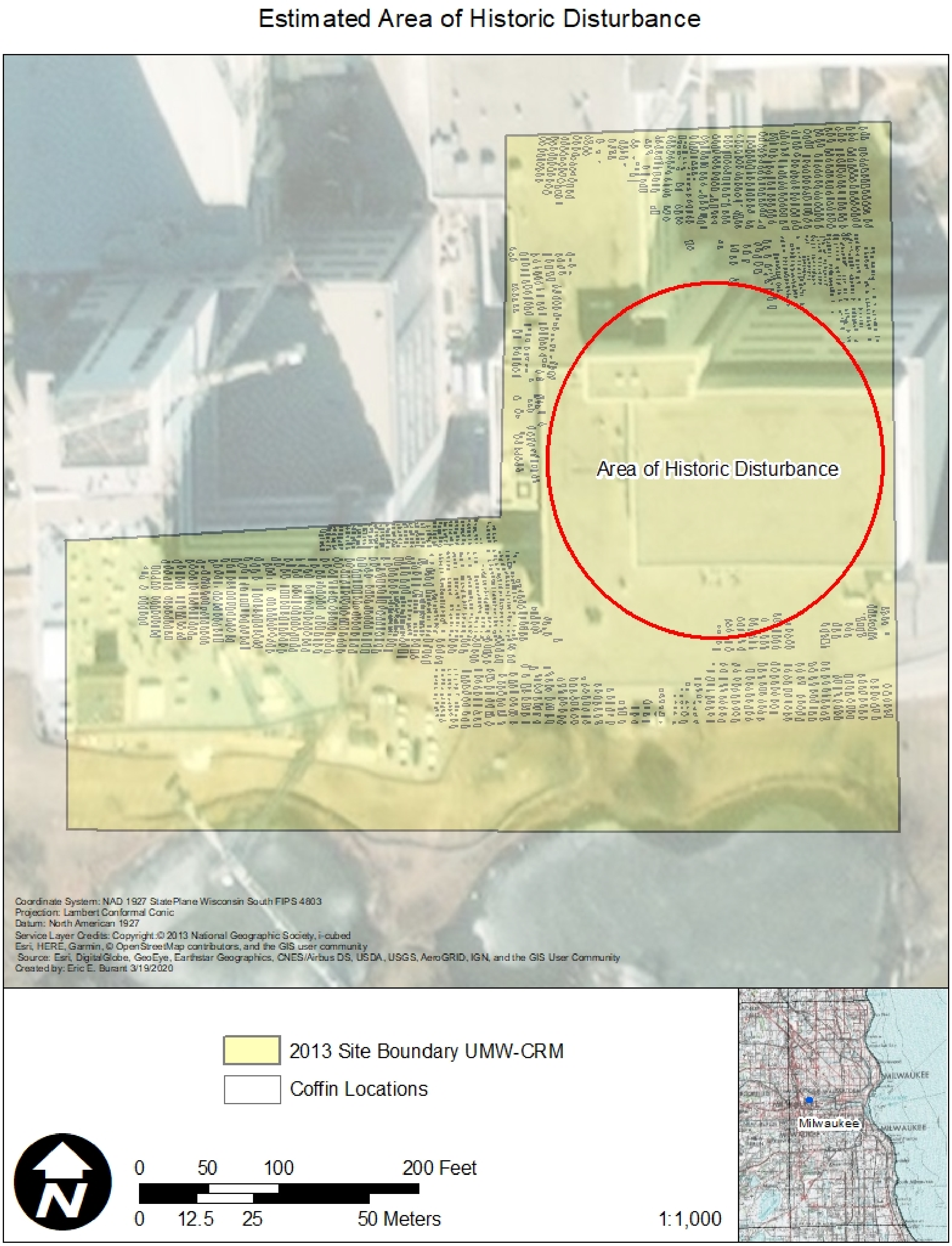

Figure 1.2: Estimated area of disturbance by Nurse's Hall and Residence (adapted from Richards 2016)

The cemetery organization and land use interpretations devised by Richards (1997) defined seven separate areas of use (Figure 1.3). These use areas were reconstructed using archaeological evidence in the forms of post molds, regular grave arrangements, material culture, and historical documentation (Richards and Kastell 1993:202). Area I is the largest and earliest used portion of the cemetery (Richards 1997:106). Area I was most affected by the construction of the Nurse's residence and later underground utility disturbances, an estimated 80.83% of area was impacted (Richards 1997:106). Areas II, III, and VII were also observed to be disturbed, but to a lesser extent. Area II, located to the north of Area I, was delineated by a series of post molds representing a fence line separating Areas I and II (Richards 1997:116). Area II is the only portion of the cemetery that could be directly dated. These dates are a result of recovered burial number tags that relate to listed burial ledger entries (Richards 1997:113). Area III, located south of Area I, was also defined by a sequence of post molds to the south and a road feature to the north (Richards 1997:114). Based on spatial patterning and associated burial number tags the temporal placement of Areas II and III suggest they were used more recently than Area I and possibly used at the same time. Area IV, located west of Area III, consists of only juvenile burials. Area IV was utilized later than Area I and earlier than Area VI, but the temporal relationship to Area V is undefined (Richards 1997:114). The western extant of Area IV is unknown, a portion of Area IV remains intact and unexcavated. Area V is located southwest of Area I and is defined by a series of post molds to the north (Richards 1997:114). Area V was determined to have been utilized more recently than Area I and earlier than Area VI, although, the temporal relationship to Area IV and V is unknown (Richards 1997:114). Area VI, located north of Area V, is separated by a series of post molds to the south and consist of only juvenile burials. Based on a burial number tag and associated historical documentation Area VI was the most recently utilized portion of the cemetery and was possibly in use in 1925 (Richards 1997:115). Area VII is separated from Area III by a five-foot-wide buffer, possibly representing an abandoned road (Richards 1997:115). It is assumed that Area VII was utilized after the abandonment of the road south of Area I, but the incomplete excavation to the west and lack of associated temporally diagnostic material culture does not provide a more detailed sequence (Richards 1997:115).

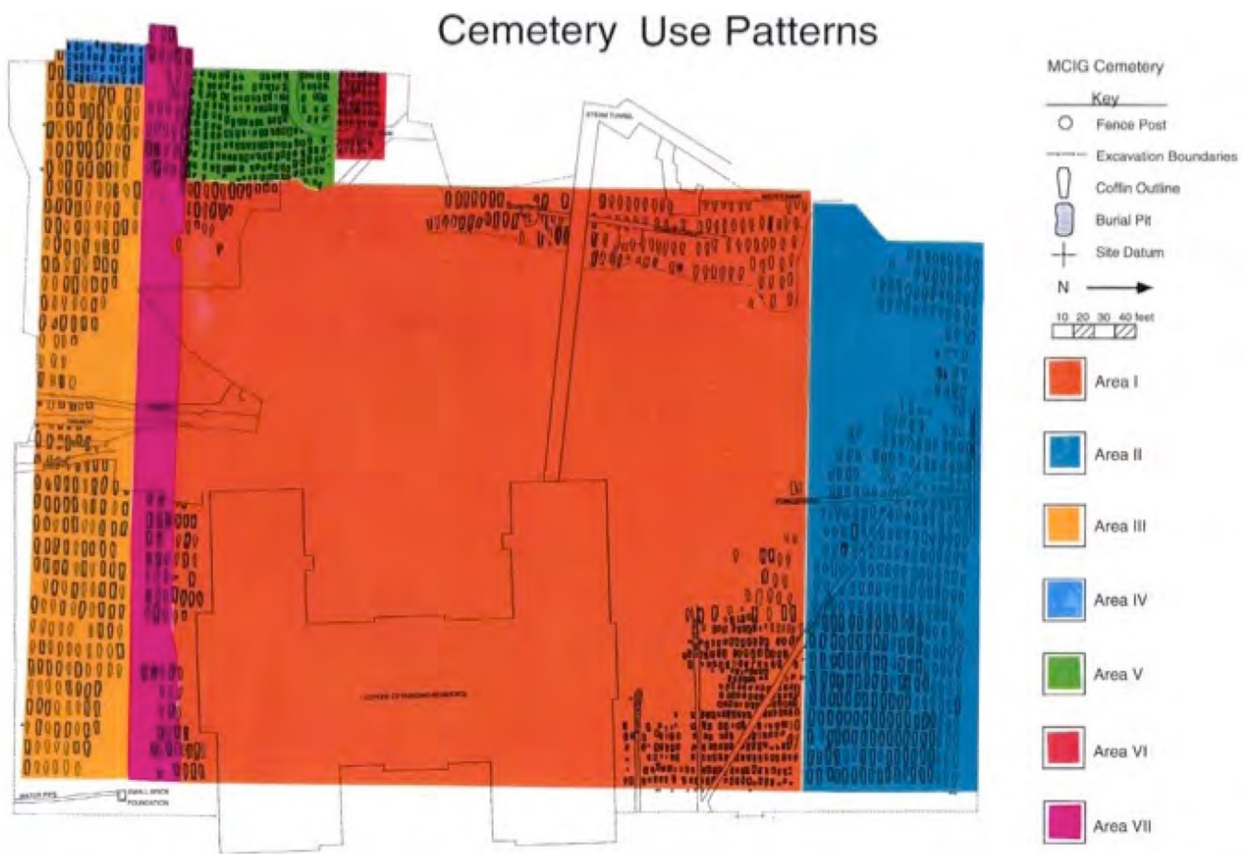

Figure 1.3: MCPFC use pattern interpretations as of 1997. Reproduced with permission from Richards (1997:108)

The 2013 archaeological excavation data resulted in a slightly updated reconstruction of use areas (Figure 1.4). This updated interpretation relied on the spatial relationships between adult and juvenile sized coffins and localized material culture associations. Area I remains the oldest portion of the cemetery (Richards 2016:89). Area II is believed to be the most recently used portion of the cemetery, based on identified burials dating to 1918 through 1924 (Richards 1997). The 2013 excavations uncovered the remaining western portions of Areas V, VI, and VII. Area V consists of only juvenile burials and curiously mimics the L-shape of the larger cemetery configuration (Richards 2016:89). Area VII consists of only adult burials that extend to the west and north, surrounding the juvenile interments of Area V. Area V and VII represent what is possibly the first western expansion of Area I and are considered to have been utilized after Area I was completely occupied (Richards 2016:89). Areas I, V, VII, and all burials recovered during the 2013 excavations may have represented the original fenced cemetery illustrated by the WPA era map in Figure 1.1. Areas III and VI are spatially distinct from other areas of the cemetery, separated by a five-foot buffer. Coffin handle types recovered in these areas suggest they were utilized later in time, although, the temporal relationship to Area II is unknown (Richards 2016:89). The periods of use remain unclear for Area VI, due to the fact that the western limits of this area are unknown and remain unexcavated.

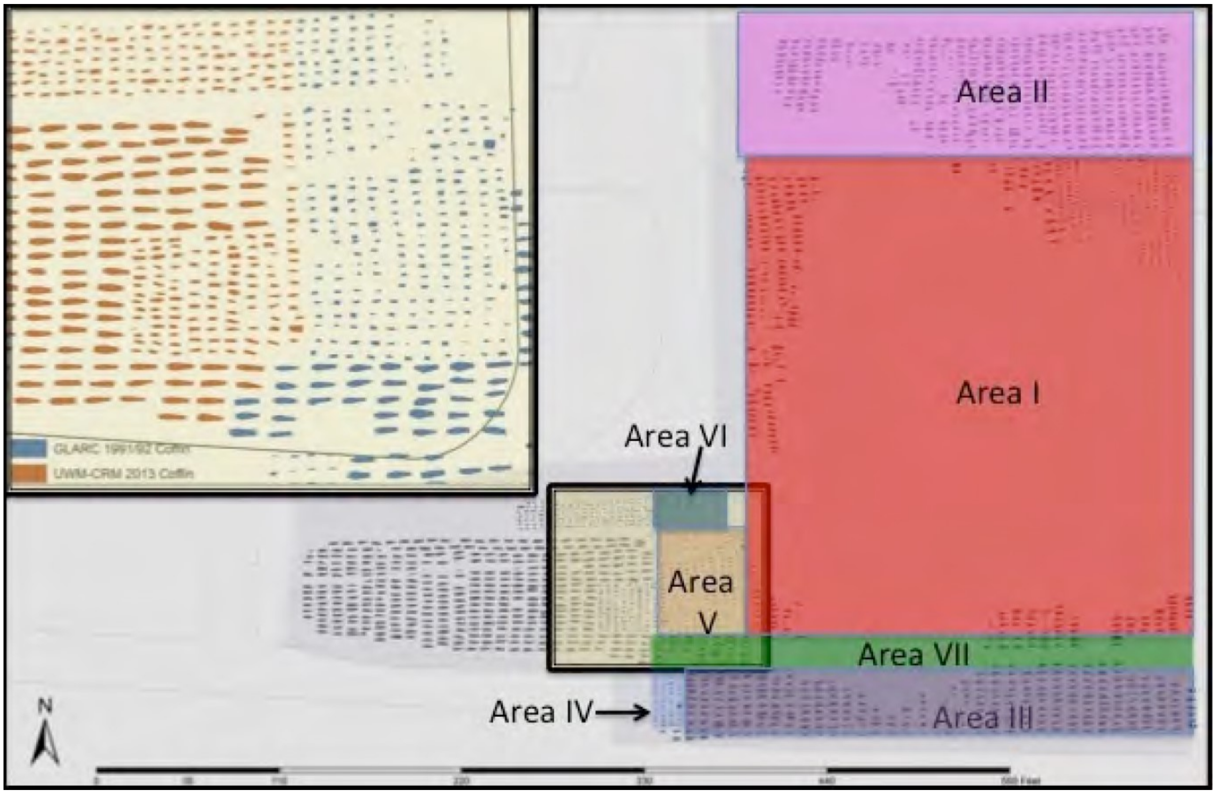

Figure 1.4: MCPFC Cemetery Use Pattern Interpretations as of 2016. Reproduced with permission from Richards (2016:89)

In 2017 Kubicek and Richards produced a GIS based spatial analysis of the coffin handles (observed in situ) recovered from the MCPFC. This analysis addressed two questions; the first, if the distribution of coffin handle types can be used as a temporal signifier, and second, if the distribution of coffin handle types was a reliable burial category indicator (Kubicek and Richards 2017). A total of 10 distinct coffin handle types were recovered from the MCPFC. These coffin handle types were identified using various historic hardware company catalogs. The manufacturing dates associated with each identified coffin handle typology are shown in Table 1.1.

The results of this analysis confirmed the L-shaped configuration of the cemetery, with Area II consisting of a spatially distinct area to the north. Area II is represented by coffin handle types III, VII, and VIII and these dates are secured by the date of burial for the individuals within this area (Kubicek and Richards 2017). Coffin handle Types IV, V, and VI were found to be associated with Area III. These types, in association with types I and II, likely suggest that burials in Area III date earlier than those in Area II and may result in temporal overlap with Area I (Kubicek and Richards 2017). In addition to testing the temporal significance of coffin handle types, this analysis produced evidence of a relationship between coffin handle type and burial category. This distinguished mixed burials (cadavers) by Type I or Type II handles only, with no combination of handle types present in these burials (Kubicek and Richards 2017). Ultimately, the distributions of coffin handle types are indicative of multiple factors, such as date of interment and burial category (Kubicek and Richards 2017).

Table 1.1: Identified coffin handles and associated date ranges (after Kubicek and Richards 2017)

Coffin Handle Type	Coffin Handle Date Range
Type I	Unknown
Type II	1897-1920s
Type III	1907-1956
Type IV	1920-1956
Type V	Unknown
Type VI	1948-1956
Type VII	1912-1920
Type VIII	1922-?
Type XII	1922-?

This thesis examines the current spatial and temporal organization of the MFPFC, as defined by Richards (1997; 2016) and Kubicek and Richards (2017). These interpretations provide the basis for a comparative study. The results are discussed in Chapter Five.

The material culture assemblage recovered from the MCPFC is characterized by two broad types, grave goods and grave inclusions. Grave goods are defined as artifacts that are directly associated with the individual or purposefully placed with the interred individual (Richards 2016:101). Alternatively, grave inclusions are indirectly associated with the individual and may reflect disposal practices or accidental artifact additions (Richards 2016:101). The material culture selected for analysis in this research was based on an artifact's temporally diagnostic information. Artifacts from both grave goods and grave inclusions were included in this analysis. The three primary artifact types considered in this study were coins, footwear, and jars or containers. A subset of the data used in the analysis includes 190 individuals who were identified by means of spatial and historical data (Richards 1997:276). These identifications include an associated date of burial. The temporal relationships that manifest in the distribution of this data set are discussed in Chapter Four.

Previous research of the MCPFC has highlighted historical, archaeological, and osteological analyses that contextualize historical documents and material culture assemblages (Drew 2018), spatial patterning (Klingman-Cole 2015), the relationship between Milwaukee County and local medical schools through evidence for autopsy or medical school use of individual corpses (Anthony 2015; 2019), a refined method of juvenile age assessment (Epstein, et al. 2015), relationship between material culture and age (Charles 2019), strontium analysis for the establishment of identity (Freire 2017), and the application of portable X-ray fluorescence technology to the excavation and analysis of human remains (Jones 2010). Few previous studies have focused on spatial use or temporal organization of the MCPFC. This study investigates these topics to further the understanding of a once forgotten cemetery.

Project Description

This thesis utilizes spatial analyses to investigate the temporal sequence of land use at the MCPFC. The implementation of an integrative GIS database consisting of material culture and positive burial identifications can be used to explore the ways in which temporally sensitive material objects generalize broad site use patterns within a spatial context. The GIS method of kriging was adopted to model predictive temporal areas across the cemetery. This interpolative technique was then compared to the results of Kubicek and Richards (2017). The entire excavated cemetery is considered for this study, although, specific areas of the MCPFC with relatively little temporal identification will be subjected to reevaluation. These areas include the southern limits of the cemetery (Area III, IV) and areas north and west of the disturbance for the Nurse's School and Residence (Areas I, III, V, VI, VII). The focus of this thesis will emphasize the identification of temporally diagnostic material culture items that represent datable burial clusters or single interments. This study is intended facilitate interdisciplinary research involving all aspects of the MCPFC.

Statement of Purpose

In order to refine the current understanding of broad spatial patterns of the material culture associated with the interments at the MCPFC, I propose to evaluate the degree to which the material culture categories of grave good artifacts or inclusions temporally relate within a spatial context using a GIS data model. The proposed hypothesis is as stated; if temporal burial associations can be identified by respective forms of materiality and positively identified individuals, then a statistically significant interpolative model can be patterned across the cemetery.

Some of the key questions I consider include:

1) Are artifact types indicative of temporal or chronological site use patterns?

2) Is the spatial distribution of artifacts temporally significant?

3) Can spatial patterns of material culture predict burials without temporal reference?

Organization of the Thesis

The thesis is organized into five chapters. The proposed scope of this thesis is presented in the introduction in Chapter One.

Chapter Two provides relevant information concerning previous research relating to aspects of the material culture assemblage found at the MCPFC. This chapter is subdivided by a brief overview of the study area and followed by a literature review of the MCPFC project history.

Chapter Three presents the relevant information regarding the data and the method used to analyze this data. This chapter is divided into two sections. The first details the material culture artifacts types selected for analysis, the collection and digitization of artifact data, and the study's limitations. The second outlines the design and employment of a GIS database, data model, and analytical spatial techniques. Included in the second section is an overview of the data as a whole.

Chapter Four examines the spatial distribution of the artifact attribute data. This chapter is divided into two sections. The first details the analysis of artifact temporality and the distribution of artifacts by type. The second outlines the experimental study of burial date interpolation using the kriging method.

Chapter Five provides the conclusions of this thesis and consists of three sections. The first section explores a comparative analysis using temporal data collected from coffin handles. The second section summarizes the findings from the MCPFC temporal and spatial analysis as it compares to site organization and land use. The third section considers the study's implications and offers suggestions for future research.

The order of appendices are as follows. Appendix A presents the coffin shapefile attribute table. Appendix B lists all analyzed coffin lot numbers by burial lot and displays the associated artifact analysis data. The terms used for archaeological and historical components and those applied to the applications of GIS techniques can be found in the Appendix C. Appendix D provides a table of the kriging prediction analysis error for all kriging tests.

CHAPTER TWO: LITERATURE REVIEW

History and Archaeology at the Milwaukee County Poor Farm Cemetery

Milwaukee County has an extensive history of care for the poor. In 1852 the Milwaukee County Board of Supervisors (MCBS) purchased 160 acres of farmland in Wauwatosa from Hendrick Gregg, a current board member (Proceedings of the MCBS 1852:103). This location was originally designated as the Milwaukee County Poor Farm and became the site for Milwaukee County's indoor relief program. Indoor relief established an institutional setting where recipients could receive housing, food, and basic healthcare (Avella 1987:199). The formation of an almshouse provided assistance to the county's poor and indigent. This ultimately marginalized the desperate poor and sick to the edges of the growing urban environment. The Poor Farm property quickly expanded between 1852 through the 1970s (Figure 2.1) to include additional facilities such as a general hospital, an almshouse, an orphanage, mental institutions, and other public and municipal infrastructure (Richards et al. 2017:237). This complex became known as Milwaukee County Institution Grounds (MCIG). Currently, the property is occupied by the Milwaukee Regional Medical Center.

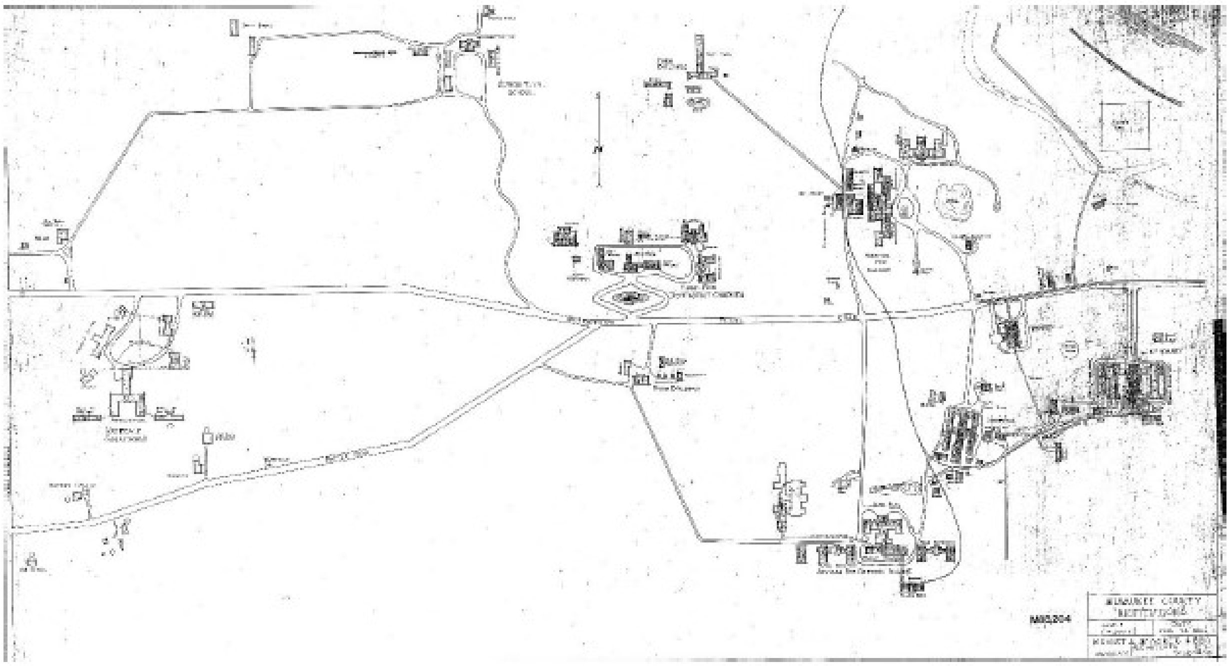

Figure 2.1: 1924 map of county grounds institutions. Original on file at the UWM-ARL archives, reprinted with permission

The designation “Milwaukee County Poor Farm Cemetery” is an umbrella term that encompasses four separate burial locations (Figure 2.2). These cemeteries were designated for the burial of institutional residents, unidentified or unclaimed individuals sent from the county Coroner’s Office, the remains of cadaverized individuals, and community poor (Richards 2016:161). It is estimated that over 10,000 individuals found a final resting place in one of these four cemeteries (Richards 2016:17). The earliest cemetery located on the county grounds is Cemetery I, Milwaukee County Grounds – Windsor Tract (47MI0528/47BMI0173). This cemetery, roughly 2.5 acres in size, was in use by 1878 before closing in 1882, though historical records may indicate an earlier use (Richards 2016:218). Located in the southeast corner of the Milwaukee County Poor Farm, a high-water table and unevenness of ground rendered this burial plot unusable (*Proceedings of the Milwaukee County Board of Supervisors* 1878). By 1882 Cemetery II was developed to replace Cemetery I. Mechanical stripping and remote sensing investigations by Overstreet and Sverdrup confirmed the location of the cemetery (1992). Cemetery III, Milwaukee County Grounds – Potters Field (47MI0530/47BMI0175), was established in order to accommodate the county's continual need for burial services (Richards 2016:3). This cemetery was first used in 1925, after the closure of Cemetery II, and continued operations until 1974 (Richards 2016:218). Located north of Watertown Plank Road, this cemetery is marked by a fenced area and commemorative signage. Most of the grave locations are currently unmarked with the exception of three intact stones (Wisconsin Historical Preservation Database 2020). Cemetery IV, Milwaukee County Grounds – Cemetery Two (47MI0529/47BMI0174), also referred to as the Asylum Cemetery, is located northwest of Cemetery III. The dates and function of this cemetery are unknown, but the cemetery may have been in use between 1884 and 1914 (Richards 2016:4). In 2001, archaeological survey discovered several iron grave markers. A total of eleven intact burial locations were identified and documented during subsurface testing. The results of these investigations suggest that at least 150 to 300 burials may be present within the cemetery limits (Richards and Richards 2001). Currently, this cemetery location is unfenced but is marked with commemorative signage.

Locations of Milwaukee County Poor Farm Cemeteries

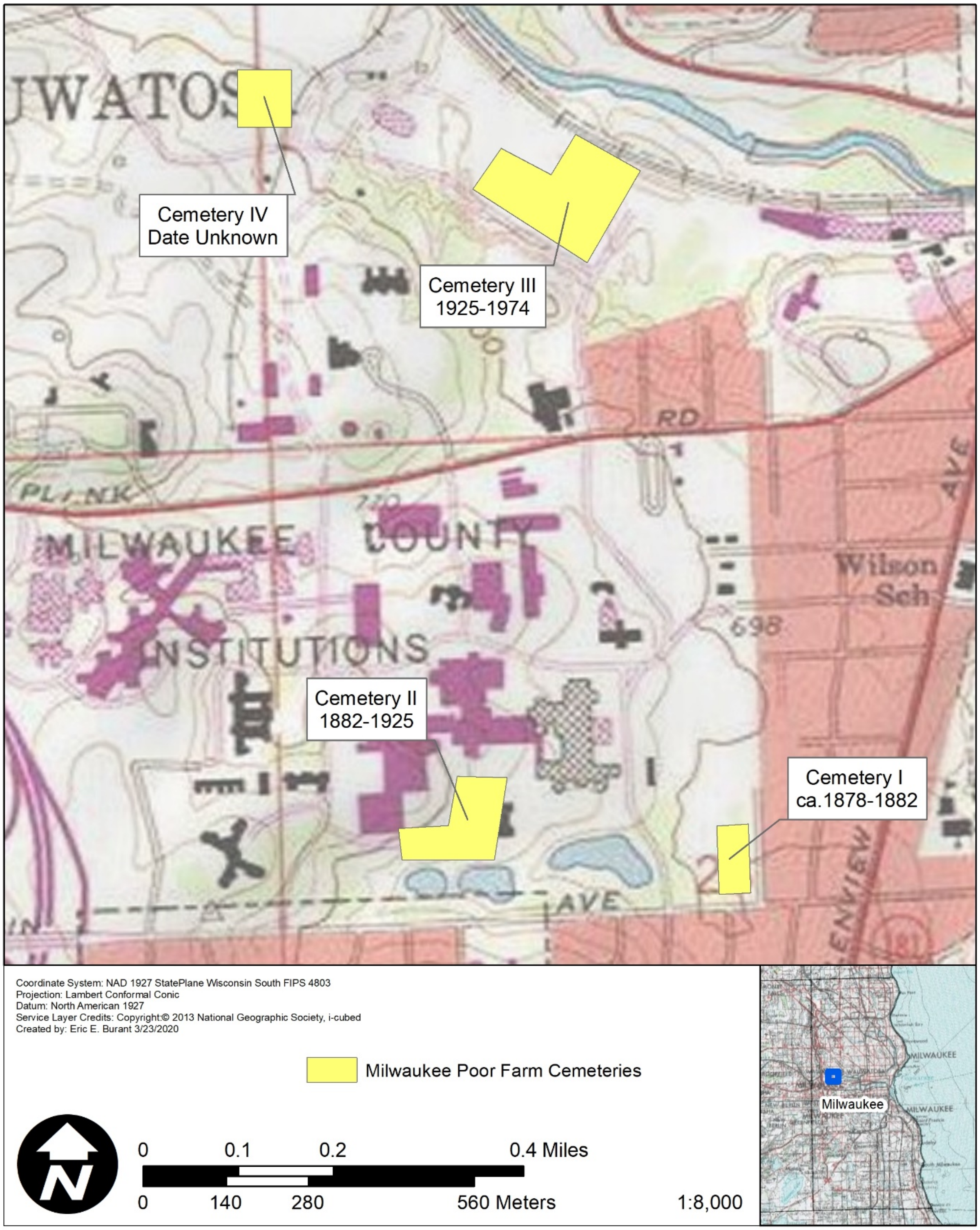

Figure 2.2: Locations of Milwaukee County Poor Farm Cemeteries (adapted from Richards 2016)

The focus of this research is Cemetery II. Cemetery II, also recognized by the Wisconsin Historical Preservation Database as Milwaukee County Grounds – Froedtert Tract (47MI0527/47BMI0076), is a cataloged burial site protected under Wisconsin Burial Site Preservation Statue § 157.70 (Figure 2.3). The original estimated size of the cemetery based on 1930s historic maps measured 3.48 acres (Richards 2016:88). The current cemetery site boundaries as defined by the Wisconsin Historical Preservation Database (2020) total 1.610 acres. It is estimated that approximately 0.292 to 0.382 acres of the cemetery remains intact under present day Doyne Avenue (Richards 2016:86). Cemetery II was active between 1882 and 1925 (Richards 2016). All further references to the Cemetery II will use the abbreviation MCPFC.

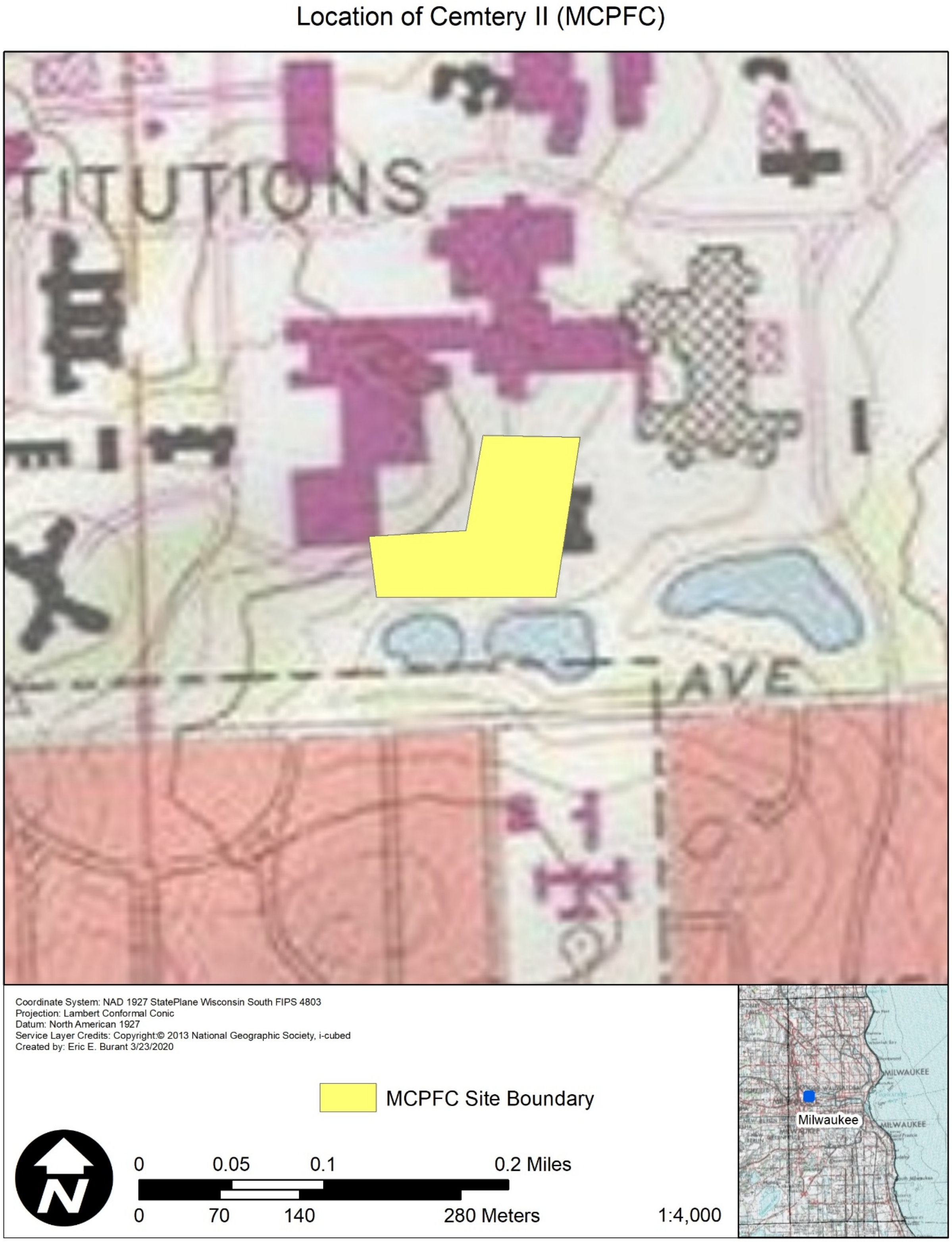

Figure 2.3: Location of Cemetery II (47MI0527/47BMI0076) (adapted from Richards 2016)

Prior to systematic archaeological investigations, ground disturbing activities coincident with the limits of the cemetery have repeatedly disturbed burials. These activities have included various utility replacement projects and road reconstruction improvements (Richards 2016; Richards and Kastell 1993). The largest historical disturbance to affect the MCPFC occurred during 1932 with the construction of a Nurse's School and Residence Hall. Predating the erection of the school and dormitory, presumably between 1928 and 1932, Milwaukee County reportedly disinterred graves from the MCPFC for reburial in Cemetery III. Although, the simple white cross grave markers were removed, it is likely that the majority of burials were never exhumed (Richards 2016:4).

Archaeological Excavations

The first systematic archaeological excavations to take place at the MCPFC occurred in 1991 and were conducted by Great Lakes Archaeological Research Center, Inc. (GLARC) under the direction of Patricia Richards. These excavations occurred in anticipation of the demolition of the Nurse's School and Residence Hall and subsequent construction for a new ambulatory care center and associated parking structure at the city of Wauwatosa's Milwaukee Regional Medical Center. The proposed construction project impacted approximately 1.88 acres of the original cemetery (Figure 2.4). Over the course of two field seasons, between summer of 1991 and fall of 1992, a total of 1,649 burials were recovered (Richards 2016; Richards and Kastell 1993). Upon the completion of the archaeological investigations in 1992, remote sensing was used to demarcate the cemetery boundaries in an effort to delineate the extent of all possible intact burial locations. The results of this additional testing concluded that an estimated 0.8 acres of intact cemetery remained (Richards and Kastell 1993:61).

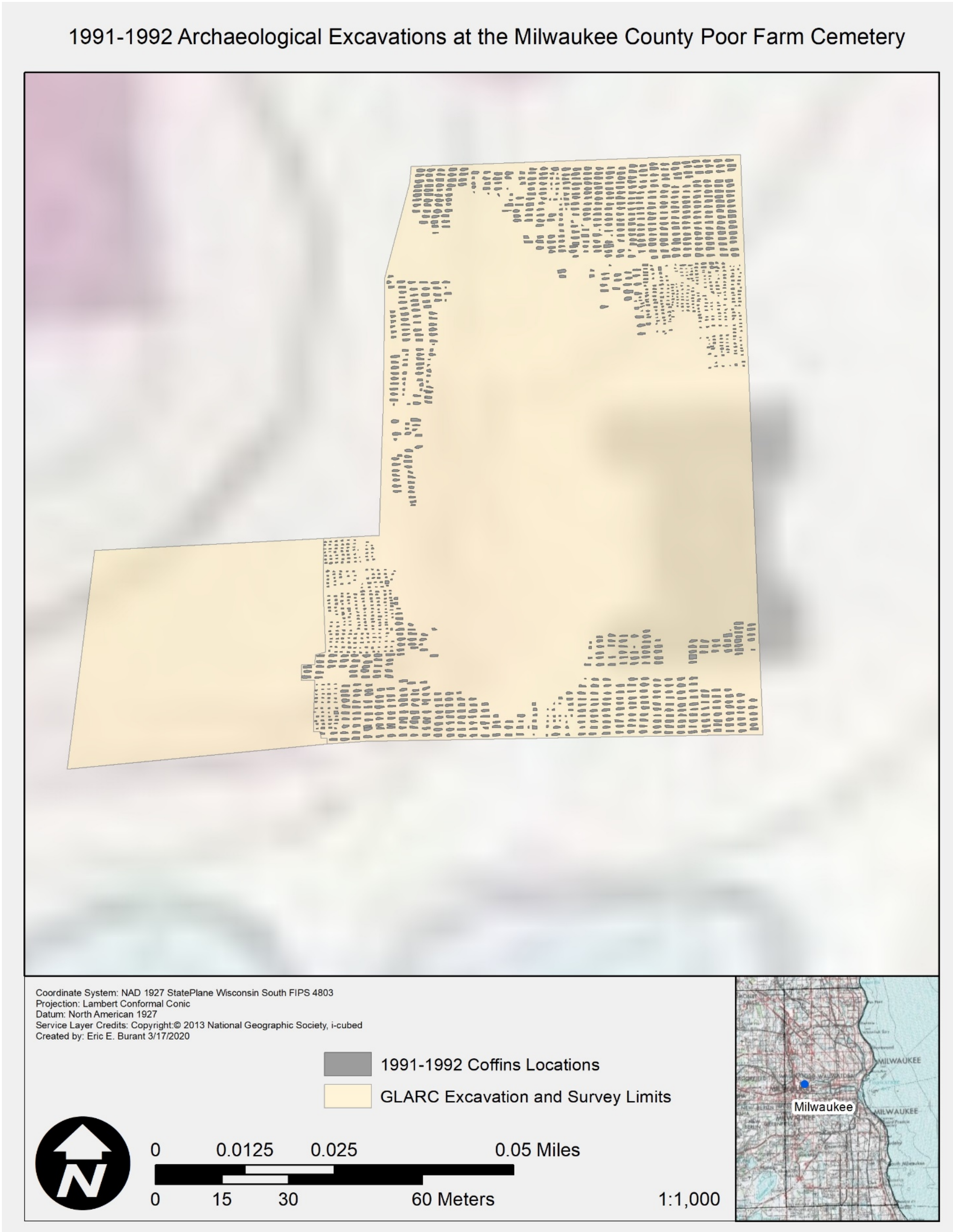

Figure 2.4: 1991-1992 archaeological excavations at the Milwaukee County Poor Farm Cemetery (47MI0527/47BMI0076) (adapted from Richards 1997)

In 2013 the construction for a Center for Advanced Care at the Froedtert Hospital Medical Center again threatened burials within the MCPFC. University of Wisconsin-Milwaukee Historic Resource Management Services (now UWM-CRM) was contracted to perform the archaeological investigations in compliance with the Wisconsin Burial Site Preservation statute (*Wis. Stat. § 157.70*). The proposed project was directed by Dr. Patricia Richards and resulted in the excavation of 0.48 acres (Figure 2.5). A total of 632 distinct coffin locations were excavated resulting in the recovery of approximately 831 human burials and a single dog burial (Richards 2016:7).

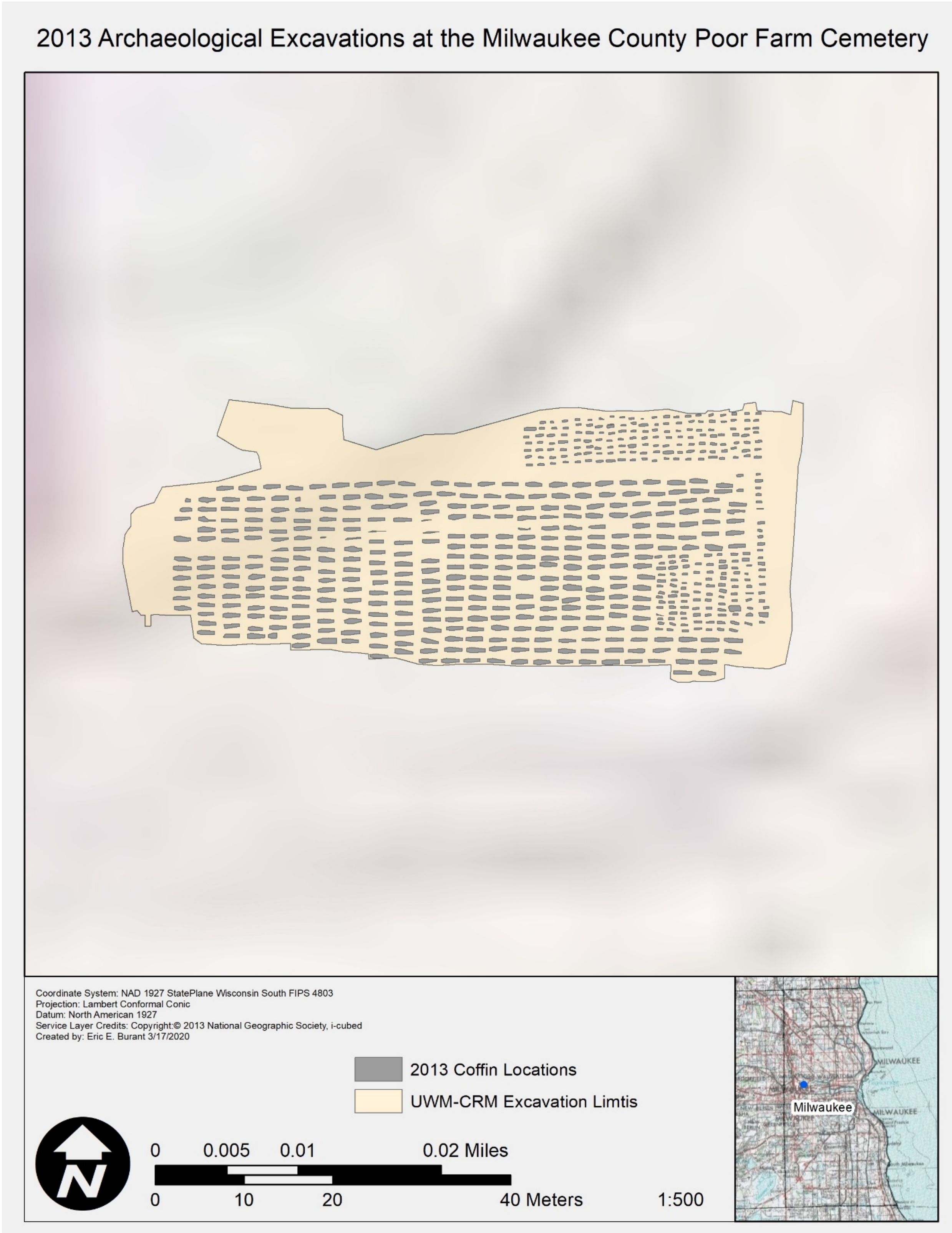

Figure 2.5: 2013 archaeological excavations at the Milwaukee County Poor Farm Cemetery (47MI0527/47BMI0076) (adapted from Richards 2016)

The human remains, material culture assemblage, and excavation documentation produced from the 1991 and 1992 archaeological excavations were temporarily stored at Marquette University (Drew 2018:38). Since the acquisition of the collection in 2008, UWM has accessioned and curated all materials in the University of Wisconsin-Milwaukee Archaeological Research Laboratory (UWM-ARL). The UWM-ARL provides museum quality archival facilities that are compliant with federal laws that specify standards for repositories curating archaeological heritage materials. Currently, the collections from the 2013 excavations are housed in the UWM-ARL curation facility awaiting a ruling on final disposition (Richards 2010). In total the entire MCPFC collection from the 1991, 1992, and 2013 excavation seasons consists of material culture and osteological remains of over 2,400 individuals from 2,169 coffin locations (Figure 2.6).

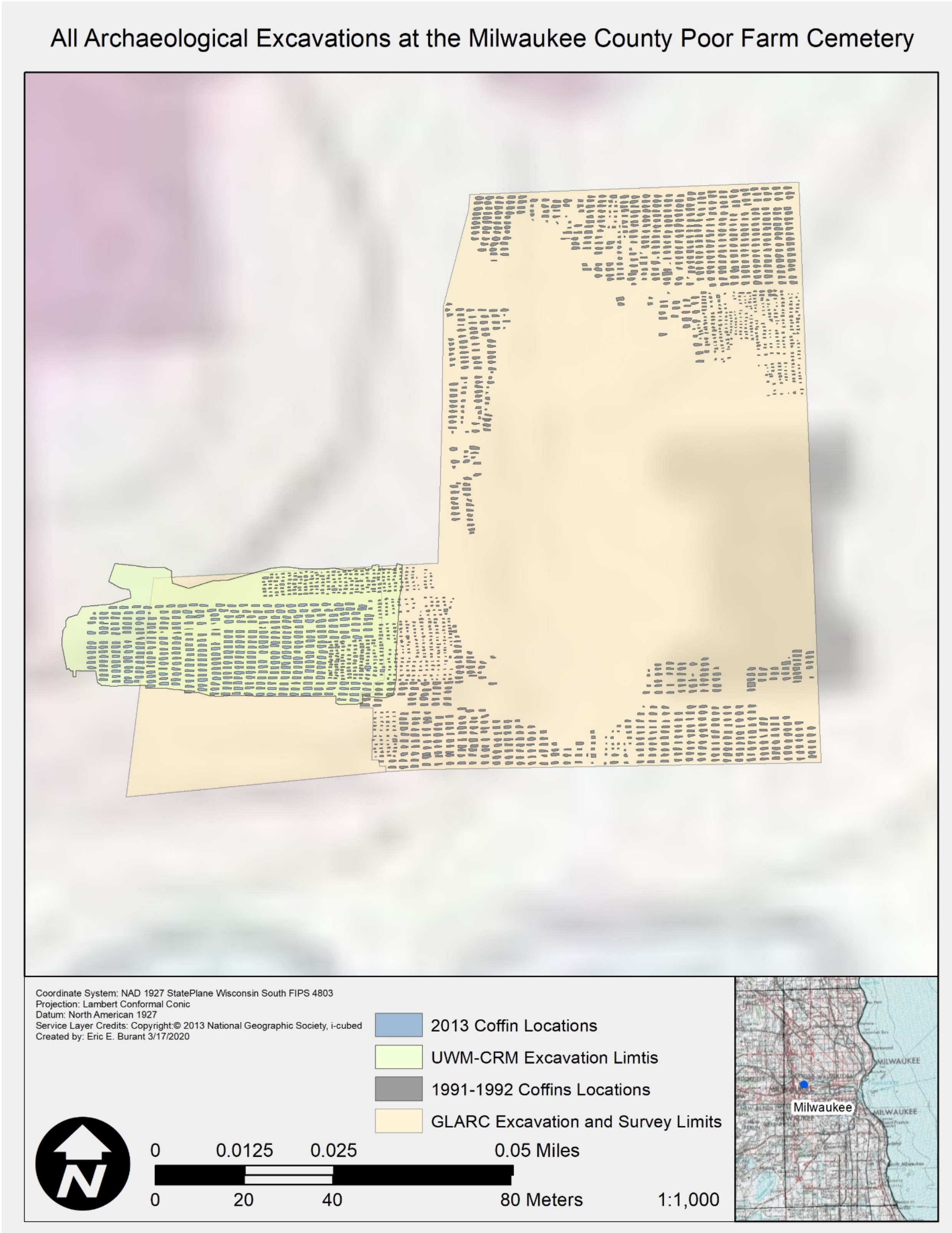

Figure 2.6: All archaeological excavations at the Milwaukee County Poor Farm Cemetery (47MI0527/47BMI0076) (adapted from Richards 2016)

Previous Research

This literature review synthesizes previous research at the MCPFC that focuses on aspects of the material culture assemblage. While this summary is targeted at material culture studies associated with Master's theses and PhD dissertations, additional studies have been conducted relating to other facets of the material culture assemblage (Burant 2015, 2017; Charles et al. 2017; Kubicek and Richards 2017; Skinner 2017; Richards 2014; Richards et al. 2017).

Drew (2018) undertook an intensive study that focused on the archaeology of the individual. Drew reviewed approximately 250,000 burial records in order to develop a database of 7,226 individuals buried at the MCPFC, including 1,844 individuals who were not listed in the *Register of Burials*. This study provided contextual evidence for the larger social networks and structures that ultimately led to an individual being buried in the poor farm cemetery. This research produced a comprehensive demography of the burial population, utilized statistical modelling to provide contextual explanations in the identification of under and overrepresented groups, contributed to the procedures in burial identification efforts, and constructed a sample of life history narratives that, according to Drew, attempts to reverse the anonymity of these marginalized people buried at the MCPFC (2018:185). The analysis of material culture was employed during the individual burial identification process. This supplemental data was used to secure identification in support of osteological and historical data.

Freire (2017) conducted a study that utilized strontium isotope analysis to address outstanding questions regarding the intersection of body and law within the cemetery context. The research questions focused on specific immigrant populations as targets for post-mortem medical investigations and the additional insights that could be provided regarding the known burial population. Two general burial categories were identified. Freire's Category A represents a standard, institutionalized, pauper burial. No evidence of post-mortem investigative practices was observed (excluding autopsies). Freire's Category B represents a greater complexity in burial practice. These burials exhibit post-mortem practices including autopsy, multiple interred individuals, missing skeletal elements, and/or the presence of material grave inclusions. Sixty-two individuals and the remains of one dog were sampled for strontium isotopic signatures of natal region. The dataset produced by these signatures includes three groups; Category A burials, Category B burials, and locally born individuals. Freire concluded that no specific immigrant population was targeted for post-mortem medical or institutional investigations. The motivation behind Category B burials may have included the relative utility and ease in the acquisition of corpse selection. Along with a spatial and temporal refinement of cemetery organization in the southwestern portion, strontium isotopic analyses contributed to the identification of 10 individuals.

A study conducted by Charles (2019) compared dental and osteometric age assessments to the material culture assemblage recovered with individuals. This research considered the apparent patterns in the construction of personhood as it relates to age. Four hundred and fifty subadult burials with age estimations at death of one year and under were analyzed in this study. Charles determined that as the age of an individual progresses the development of personhood becomes increasingly recognized. Material culture associations also inform interpretations of personhood. Older decedents, those individuals who survived beyond two postnatal weeks, likely had greater familial ties which resulted in the accompaniment of grave goods. This is observed in the presence of clothing and personal adornment items. The presence of grave inclusions was commonly associated with younger individuals, those who died during the fetal stage. This indicated that the interred were subjected to informal burial practices that are associated with a lack of personhood. The presence of grave inclusions suggest interaction with a county, medical, or public institution.

Anthony (2019) completed an analysis of medical waste items recovered from the MCPFC. This study attempts to identify the medical institution(s) from which the interred body and associated artifacts originated. A total of seventy-four coffin locations were subjected to analysis. The artifact analysis also incorporated bioarchaeological data. Supporting bioarchaeological evidence included post-mortem medical intervention in the form of autopsy, dissection, amputation, and use as medical specimens. Anthony hypothesized that different types post-mortem medical intervention may correlate to institutional origin. For example, autopsy was a practice of the Coroner’s Office. Dissection was usually performed at local medical colleges. The use of medical specimens was a feature of the County Pathology Department. Each of these medical institutions performed distinct, although sometimes overlapping, post-mortem medical procedures. Anthony concluded that a definitive correlation between artifact type and institutional origin was inconclusive, although, burial location proximity and artifact type similarities strongly suggest a shared temporality and institutional origin. In order to identify unique patterns in material culture and bioarchaeological data, further information is needed on the post-mortem procedures and medical practices of various medical institutions. Although the results of the study were inconclusive, it was suggested that the addition of medical waste during the burial dehumanized the individual.

Klingman-Cole (2015) produced a study that focuses on GIS and spatial interpretations at the County Grounds utilizing historical map data. This research was developed to determine changes in structural land use at the MCIG, specifically examining the historical documentation in county operations between 1850 and 1980. Klingman-Cole determined that a chronological and spatial land use analysis can be used to establish changes at the county grounds over time. These structural changes reflect cultural and societal changes within the selected timeframe. As Milwaukee's urban area expanded, becoming more industrialized, an influx in immigrant populations resulted in a densely occupied community. The time period of the study coincides with Milwaukee County's efforts to decrease the high rates of disease and death that plagued the developing city. Thus, the spatial changes in the structure at the MCIG notably reflect the county's efforts to facilitate health and wellness concerns in a growing urban landscape.

Applications of Geographic Information Systems

Geographic Information Systems (GIS) is an interdisciplinary research tool with fluid definitions. GIS as a technological tool is pragmatic to informing perspectives on data with a spatial component. With such a wide range of applications the opportunities for examining the relationships of space may seem infinite. The most general definition of GIS covers three main components (Heywood et al. 2011). The first recognizes GIS as a computer system. This system implies more than just technology, but includes all forms of hardware, software, and appropriate technical procedures. The second informs GIS as a set of spatially referenced or geographical data. The third functions as the GIS's ability to carry out various data management and analytical tasks. In all, GIS adds value to spatial data by allowing data to be organized efficiently, integrated with other data, and analyzed (Heywood et al. 2011:18). GIS effectively creates new data that can be manipulated and visualized. This newly generated data must be critically interpreted to create new knowledge about the dataset.

In the social sciences and archaeology, GIS has been widely adapted as a technology that can be used to visualize, interpret, and understand complex spatial datasets by quantitatively analyzing trends, relationships, and patterns (Ballas et al. 2018; Conolly and Lake 2006; Cruz Berrocal et al. 2014; González-Tennant 2016). The early use of GIS in archaeology focused on its ability to undertake specific forms of analysis. Most commonly, GIS was used in the creation of artifact distribution maps, predictive modelling, viewshed analysis, and cost surface analysis (Aldenderfer 1992; Kvamme 1999). Although, mapmaking and data visualization are recognized as an important feature of GIS (Fisher 1999; Kvamme 1999). These analytical techniques can then be used to examine the intersection of cultural and physical environments, simulate social and cognitive aspects of human behavior, and exemplify the relationships between human behavioral responses to environmental changes (Aldenderfer 1996; Kvamme 1999).

Historical archaeologists typically divide GIS into three broad categories that include inventory, spatial analysis, and mapmaking (González-Tennant 2016:25). GIS is an effective tool for the management of archaeological data and the interpretation of remotely sensed data (Kvamme 1999). These datasets are maintained within a geospatial database. With properly formatted datasets and well-maintained data management procedures, robust data collections can be long lasting and continually incorporated into a useful archaeological GIS. The versatility in the geospatial analyses maximize an archaeologist's ability to model historical events. The geospatial analysis of archaeological data can be grouped into three subcategories that include locational modeling, cost surface analysis, and visibility analysis (González-Tennant 2016:28). Locational modeling incorporates cultural and environment variables capable of site catchment, territoriality, and predictive studies (Delle et al. 2003). Cost surface modeling calculates weighted landscape variables as a cost and can simulate travel scenarios between locales (Ballas et al. 2018). Visibility analysis, or viewsheds, use elevation data to determine the visible space between defined observation locations and mathematically model cognitive and experimental features of the landscape (Kvamme 1999:177). A product of GIS is map creation and data visualization. These representations of geospatial data can occupancy statistical data to convey practical archaeological information. The contributions of GIS to historical archaeology is more than just a simple tool, it is a process, a vital process that considers advancing technological approaches in the creation of archaeological knowledge.

Space and Place: GIS in Mortuary Analysis

The incorporation of GIS into historical research incorporated the dimension of space and place into the past (Boonstra 2009; DeBalts and Gregory 2011). This serves as a basis for the reconstruction of historical events, landscapes, and data, as well as, the spatial modelling and analysis of local variations and developments in the past (DeBalts and Gregory 2011:456). Space and place provide important perspectives on cemeteries. The nature of space is dominated by two theoretical viewpoints, the absolute concept and the relative concept (Conolly and Lake 2006:3). Absolute space is viewed as a container of all material objects, existing independently of all other objects it comprises and impossible to envision in the absence of objects (Conolly and Lake 2006:3). The relative concept holds a positional view that space is a relation between material objects of events (Harvey 1969:195). The space of cemeteries is given, it is the reality of the physical location. Place is an individually subjective concept and interpreted by the meaning projected onto space (Alderman and Dwyer 2004). The place of cemeteries holds emotional attachment and personal significance. Space and place are codependent. Space requires movement between places, while place inherently requires space (Tuan 1977).

GIS and mortuary analysis, concerning intra-site mortuary studies, have the ability to combine and analyze the spatial relations between burial characteristics and location. Goldstein (1981) states that mortuary practices are reflections of interpersonal, inter-group, and intra-group relationships, as well as, the relationships of social and cultural systems. She argues that mortuary analyses are almost exclusively conducted using non-spatial substance language, although, a space-time language should be considered as well (Goldstein 1981:58). Space-time language is described as a framework that describes an object or event by a spatial location or coordinate and by the fourth dimension (Harvey 1969:215). Non-spatial, or substance, language describes an object or event by a set of properties or attributes (Harvey 1969:216). If two things share the same aspects of space-time or substance languages, then it is implied that both share the same physical location or attributes (Goldstein 1981:58).

The spatial examination of burials can be used to deduce information on social relationships on two levels. The first reflects the degree of structure, spatial separation, and ordering of the burial site which reproduces the organizational principles of the society. The second reflects the spatial relationship between burials with the site boundaries as a representation of status, familial groups, decent groups, or spatial classes. Goldstein (1981:67) concludes five dimensions of spatial analysis in mortuary studies: (1) that mortuary systems are multidimensional and include a spatial component, (2) the spatial component is also multidimensional and reflects varying relationships and interactions, (3) simple techniques are the most productive forms of spatial analysis, (4) when the spatial component is used as a framework for examining the results substance language approaches it can produce an understanding of the meaning and interrelationships of the group, and (5) the combination of non-spatial substance language and space-time language provides the most information about the cultural elements of a mortuary site. Cemeteries are a spatial produced product of society. Cemeteries undergo the same organizational, demographical, and spatial developments as society, or culture, as a whole and thus provide insight into cultural practices and perceptions.

CHAPTER THREE: METHODS

Methods

The research methods utilized for this thesis employed traditional models from interrelated disciplines including archaeological examination of material culture remains and geographical information systems data management and analysis. The GIS designed and created for this thesis research facilitates storage, retrieval, editing, and analysis of material culture data related to the MCPFC. Integration of various data types at this scale is an immense task. The types of data collected for this thesis include digital spatial data obtained from archaeological project mapping and remote sensing, and digitized data obtained from artifact inventories.

Material Culture

The material culture assemblage recovered from the MCPFC excavations is currently curated in the UWM-ARL facility. During the initial inventory and analysis of the 2013 material culture assemblage, artifacts recovered from burial contexts were separated into two broad, yet distinct, categories consisting of grave goods and grave inclusions. These categories were designed to assist in the interpretation of four classes of burial; those who died as institutional residents, unidentified or unclaimed individuals sent from the county Coroner's Office, or community poor (Richards 1997) and the remains of cadaverized individuals (Richards 2016).

Grave goods are described as material culture artifacts that are directly associated with an individual and purposefully interred within the individual's coffin. Grave goods include the artifact categories of personal items and clothing (Richards 2016:101).

Alternatively, grave inclusions are defined as artifacts that are indirectly associated with the individual and represent intentional disposal practices or accidental inclusions. Grave inclusions are associated with the artifacts pertaining to one of the county institutions identified as medical or hospital research items or medical waste (Richards 2016:101).

The inventory and analysis of the material culture assemblage recovered from the 1991-1992 differed in terms of the definitions and parameters used to classify and quantify the material culture from that of 2013 excavation. The 1991-1992 material culture inventory and analysis categorized artifacts designed to create burial categories. Three distinct groups of individuals were observed (Richards and Kastell 1993:92). The 2013 inventory and analysis interpreted the material culture remains through the lenses of identity as they were constructed by the individual, as well as, the identity that was ascribed by the community from which they came (Richards 2016:100). The 2013 inventory divided the artifact assemblage into larger classes based on function that recognized four distinct groups of individuals (Richards 2016:100).

The artifact analysis schema implemented in this study was intended to standardize material culture classifications. Artifacts that were selected for this study were based on the artifact's ability to provide temporally significant or diagnostic information. Larger artifact classes were disregarded for a simplified artifact type approach. Artifact types were considered by item only. This is exemplified by the jar/container category. The 2013 inventory separated vessel type by use (e.g. indulgences, supply bottle, medicine bottle, specimens jar, etc.), while this study collapsed these more exclusive types and focused only on individual artifacts.

The artifacts chosen for this analysis included coins, footwear, and jars or containers. The metrics that were recorded for each artifact included: count, material, length, width, and depth (thickness), weight (in grams), condition, terminus post quem (earliest artifact date), artifact date range, and occasionally a brief description (Appendix B). Only material culture recovered from burial lots containing coffin lot information was analyzed. No general collection or surface finds were included. As noted in previous chapters, the recovery of burial tags aided in the identification of a select number of burials. These temporally diagnostic artifacts were not subjected to a separate analysis but were subsumed into the identified burial category.

Positive burial identification dates were also included in the spatial analysis. These were collected using individual death certificates and strontium isotopic data outlined by Richards (1997) and Freire (2017). The data collected was converted into a digital format for the integration into the GIS.

GIS and Database Design

Database Design

The design of this GIS allows for the customization of ESRI's object-oriented relational model into a single, cohesive, digital format that contains diverse types of datasets. The purpose of this thesis is to conceptualize and format data models into a GIS to meet the requirements that sufficiently document, preserve, and provide accessibility to attribute data relating to historic cemetery information associated with multiple archaeological excavations.

In order to adequately facilitate the stated goals of this research and create an efficient GIS the following questions must be answered:

1) What spatial and non-spatial data is required in a cemetery GIS?

2) What are the criteria of a well-designed database?

3) How can the database's effectiveness be tested?

4) What types of analyses and visualizations are aided by spatial data?

The four steps (Figure 3.1) that must be considered during the initial database design include the physical reality, the conceptual model, the logical model, and the physical model (Shekhar and Chawla 2003). The physical design model is the intended product of the database design architecture and it is dependent on the software and hardware employed. It is created internally by the ESRI ArcGIS software. Thus, this portion of the design model will not be explained in this chapter.

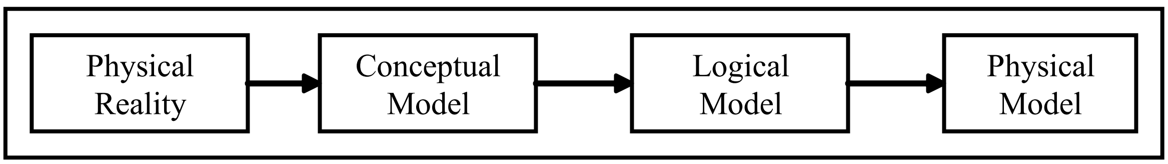

Figure 3.1: Database design (adapted from Shekhar and Chawla 2003)

Physical Reality

A GIS is strictly the manipulation of the digital representations of real-world entities (Conolly and Lake 2006:24). However, a GIS is limited in the resources with which it can replicate an infinitely complex world. These digital representations are ultimately generalized symbolic illustrations. The reality is that the cemetery exists, or existed, but it can only be represented by a spatial data model. The representation of the entities within the cemetery are represented by a vector data structure, characterized as a unique geometrical element (point, line, or polygon). These component entities must be identified in order to develop the database.

Conceptual Model

The conceptual model identifies discrete geographical entities and the associated attribute values and relationships with other entities that is integrated by the data. This can then be modelled using an entity-relationship (E-R) diagram. The term ‘entity’ refers to any phenomena that can be defined and distinguished from any other phenomena (Jones 1997:167). Real-world entities are variables that are used as the basis of study for the researcher. Establishing these variables and the predicted relationships between them is the foundation of the conceptual framework. Figure 3.2 displays the E-R diagram developed for the conceptual model. Once the entities are designated in the conceptual model these entities become features in the logical model.

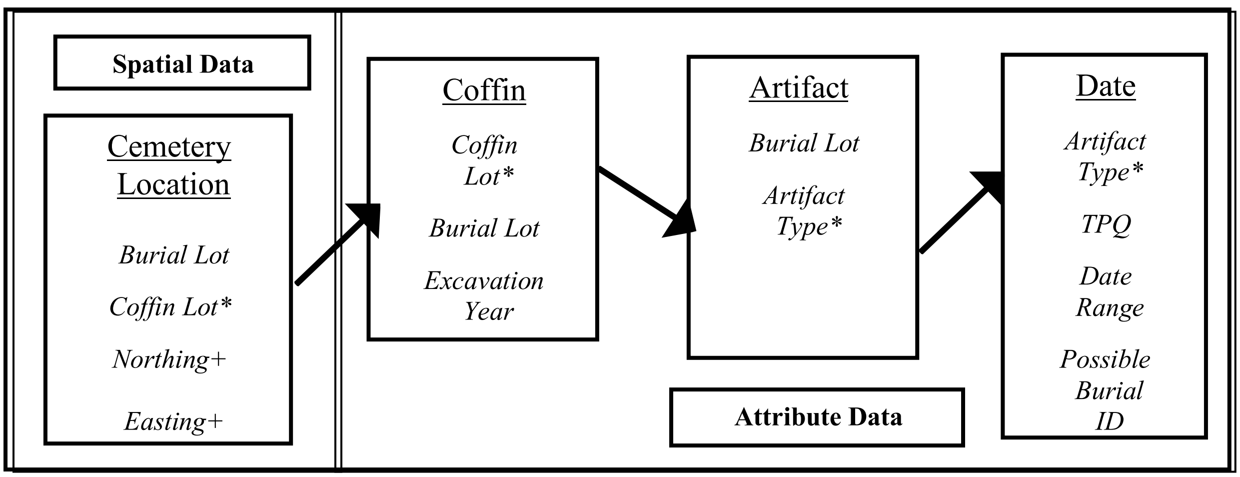

Figure 3.2: Entity-Relationship diagram for the database design (adapted from Conolly and Lake 2006:56) [boxes = entities and attributes, arrows = relationships, * = unique values, and + = spatial attribute]

Logical Model

This stage of the GIS model entails the implementation of the structure of the database. Initial attribute field data population ensures that the relationships function as intended. The logical model also tests the extraction of information in the combinations that are required for subsequent spatial analyses.

Since the basic unit of analysis for this study is the coffin, the most important feature of the database is the location of the coffin polygon. The coffin feature dataset was collected by

UWM-CRM staff during the 2013 excavation of Cemetery II. Locational data was obtained using a Sokkia 5 F Total Data Station (TDS) and a TopCon FC-2500 data collector. A site grid was established to record the horizontal and vertical locations of all burial locations, excavation limits, utility corridors, and all other cultural features encountered during the 2013 excavations (Richards 2016:38). The coffin polygons are representative of the coffin edges identified during excavation. Depending on the coffin construction (six or four-sided) reference nails were placed and the coordinates for each nail were recorded using the TDS. All coordinate locations for the 2013 burials are referenced to the site grid. The coffin locations for the 1991-1992 field excavations were recorded in a similar manner, using a local grid. Datums were set using a transit and stadia. Spatial locational data was recorded using an alidade and plane table. Alignment of the two series of excavation data was completed using overlapping features from the separate excavations. These included the identification of previously excavated burial pits and grave shafts along the eastern limits of the 2013 field season and the location of buried utility corridors and disturbances (Richards 2016:82).

The GIS database organizes the previously collected datasets and the data collected for the study into a series of relational datasets. Individual features (shapefile) that are included in this study were organized into a feature class that shared the same geometry type and attribute fields. The data layers are described in Table 3.1. All other data layers produced by the spatial analysis were stored in the file geodatabase in a separate feature class. Information about the artifacts recovered within each burial location was entered into the attribute table. This included artifact type, counts, relative terminus post quem date, artifact estimated date ranges, and possible burial ID date. The complete attribute table can be found in Appendix A. Features, attributes, and their relationships are based on the needs of the preliminary study for identifying temporal patterns in cemetery organization. All features were projected in the GIS using the Wisconsin State Plane South coordinate system (FIPS 4803, linear US feet) referencing the NAD 1927 datum.

Table 3.1: Feature data layers

Feature Name	Data Model Type	Creator/Credit
Coffin (1991-1992 and 2013)	Polygon	UWM-CRM
Coffin Handles	Polygon	UWM-CRM
Site Boundaries	Polygon	UWM-CRM, WHPD
Excavation Block and Excavation Boundary Limits	Polygon	UWM-CRM
Estimated Remaining Extent	Polygon	UWM-CRM
Artifact Dates	Point	Eric E. Burant
All Dates	Point	Eric E. Burant

Spatial Analysis Methods and Techniques: Kriging

Interpolation is an analysis method that uses spatially distributed data to produce a continuous field of values between all known spatial entities (Steinburg and Steinburg 2006:182; Conolly and Lake 2006:90). The continuous field is represented as a raster data model. Individual data values are stored in each pixel (cell) of the raster file. Methods of interpolation can be generally categorized into two separate approaches; deterministic and geospatial.

The deterministic method uses a non-statistical formula to create a raster surface. This process accounts for the value of nearby cells and applies weighted values based on the distance from the cell being computed (Conolly and Lake 2006:97). One example of a deterministic interpolation method is the inverse distance weight (IDW) interpolation method, in which a single data value influence on surrounding interpolated values diminishes with distance. The deterministic method performs well on most datasets but may not be suitable for situations where the spatial autocorrelation is weak or the density of distribution of data is irregular. When a spatial autocorrelation test was performed on all temporally diagnostic artifacts in the MCPFC GIS, the results showed that the spatial distribution of all artifacts was random, suggesting that a deterministic approach was inappropriate.

Geostatistical methods of interpolation are based on statistical models that measure the degree of spatial variation and autocorrelation in a dataset to predict an interpolated surface, as well as, produce information on error rates and accuracy of the estimated prediction (Conolly and Lake 2006:98). One form of geostatistical interpolation is kriging. Kriging first calculates the weights of values by the construction of an experiment variogram, an estimated curve that best fits the spatial structure of the data. This mathematical model predicts the influence that distance has on the relationship between known values then fits the model into a predicted surface. The model also produces predicted surface estimations of model accuracy.

Although there are several different methods of kriging techniques, the surface model interpolation method used in this study to interpolate dates of interment across the cemetery is known as ordinary kriging. Ordinary kriging assumes an unknown mean value interpreted as a random variable and is estimated by the spatial location and the values of sampled neighbors. For a complete explanation of the ordinary kriging process see Wackernagel (1995). The tools for kriging process are provided by ESRI ArcGIS and use a multistep geostatistical wizard to assist in the production of valid results.

Schema

Multiple material culture classes were used as the primary source of database construction. Initial data normalization retrieved small subsets of attribute data included in the grave good and grave inclusion artifact classes to create a series of connected tables of relational information in a data model. These tables were divided by artifact type that included coins, jars/containers, and footwear and included artifact counts and temporally diagnostic dates. The data was cleaned to reflect only these artifact categories and eliminate duplicate data entries. These individual tables are related by a primary key connected to the coffin lot. Data query within the access database can produce a series of burial lots with individual artifact type counts, dates, and descriptions. This data was joined to the burial spatial data vector shapefile within the geodatabase to provide artifact distribution visualization and support spatial interpolation. Using SQL queries, spatial analyses and individual maps were created representing both artifact type and temporal designation. The unit of analysis thus consists of the coffin and was used for all spatial analyses.

CHAPTER FOUR: ANALYSIS AND RESULTS

Material Culture Analysis

In total, 2,169 coffin locations were excavated across the MCPFC. Of the total number of excavated coffin locations 842 (38%) contained some form of material culture, excluding coffin hardware. Temporally diagnostic artifacts were identified in a total of 84 coffin lot locations accounting for 3.8% of the total assemblage (Figure 4.1). The data sample collected for this study includes only 3.8% (n=84) of all excavated coffin lots and 9.9% (n=84) of all coffin locations that produced grave goods or grave inclusion materials.

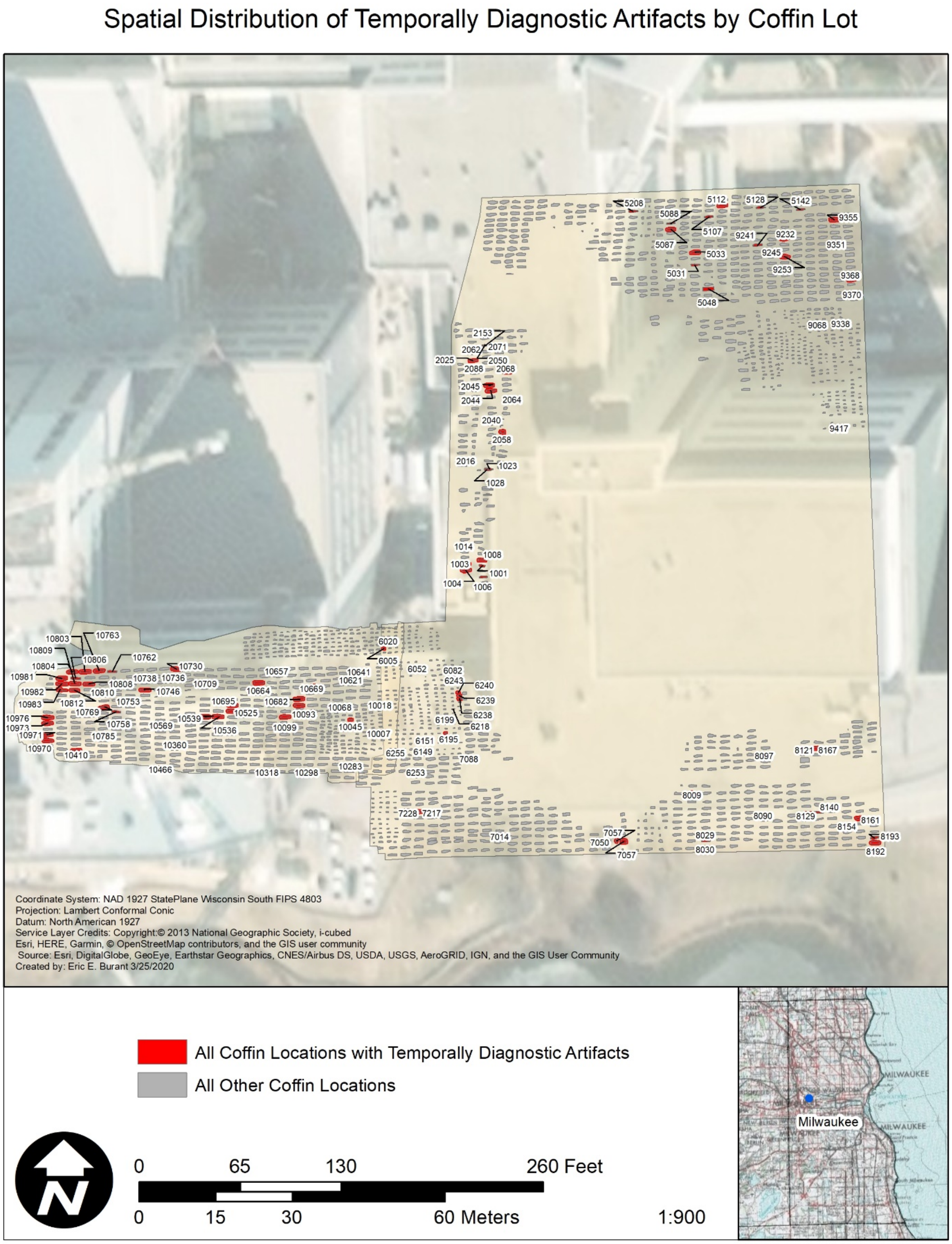

Figure 4.1: Spatial distribution of temporally diagnostic artifacts by coffin lot

As discussed in the previous chapters, three artifact types were determined to provide the most sensitive temporal data for spatial analysis. The focus of the artifact analysis is to identify a terminus post quem for all diagnostic materials. Terminus post quem (TPQ) is the earliest time an event (burial) may have occurred. When two or more temporally diagnostic artifact types were observed within the same coffin lot the earliest TPQ date was selected. The results that follow highlight each of the analytical approaches by artifact type and visualize the distribution of each artifact type.

Coins

Coins were recovered from 14 (16.6%) coffin locations containing temporally diagnostic material culture. Terminus post quem dates were assigned to the coffin lot based on the minted date on the coin. When a minted date could not be determined for the coin, the earliest date of mint for that particular coin was assigned. In the event that a coin's denomination could not be identified the diameter of the coin was used to compare to metrics listed in Hudgeons et al. (2009) coin guide. The estimated date ranges for coins reflect all years of coin minting. Figure 4.2 illustrates selected coins. Figure 4.3 illustrates the spatial distribution of coins. Table 4.1 lists the identified coins at the MCPFC.

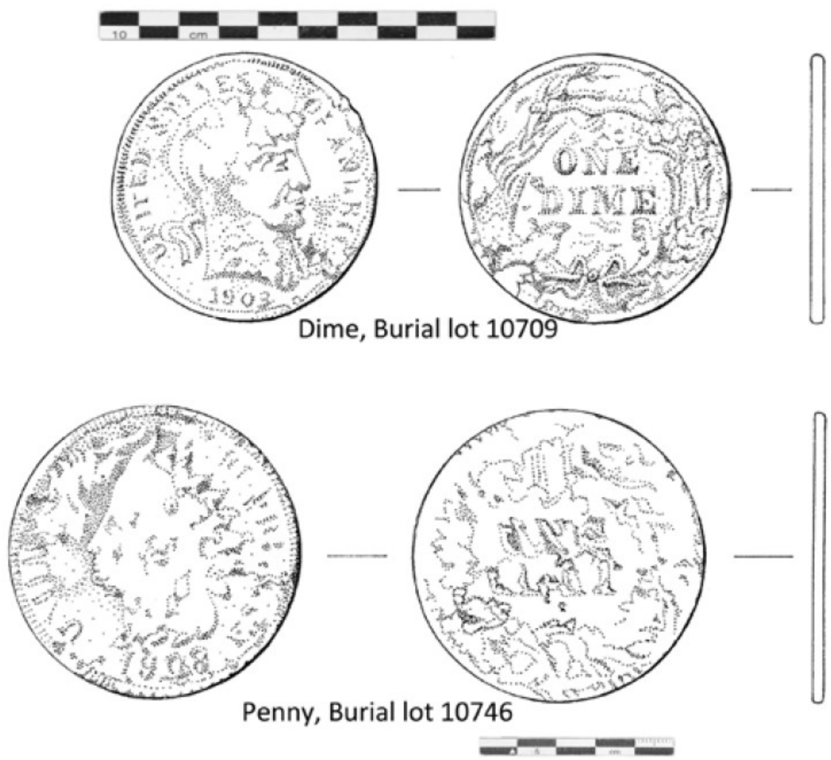

Figure 4.2: Illustration of selected coins, copy on file at the UWM-ARL. Reproduced with permission from Richards (2016:131)

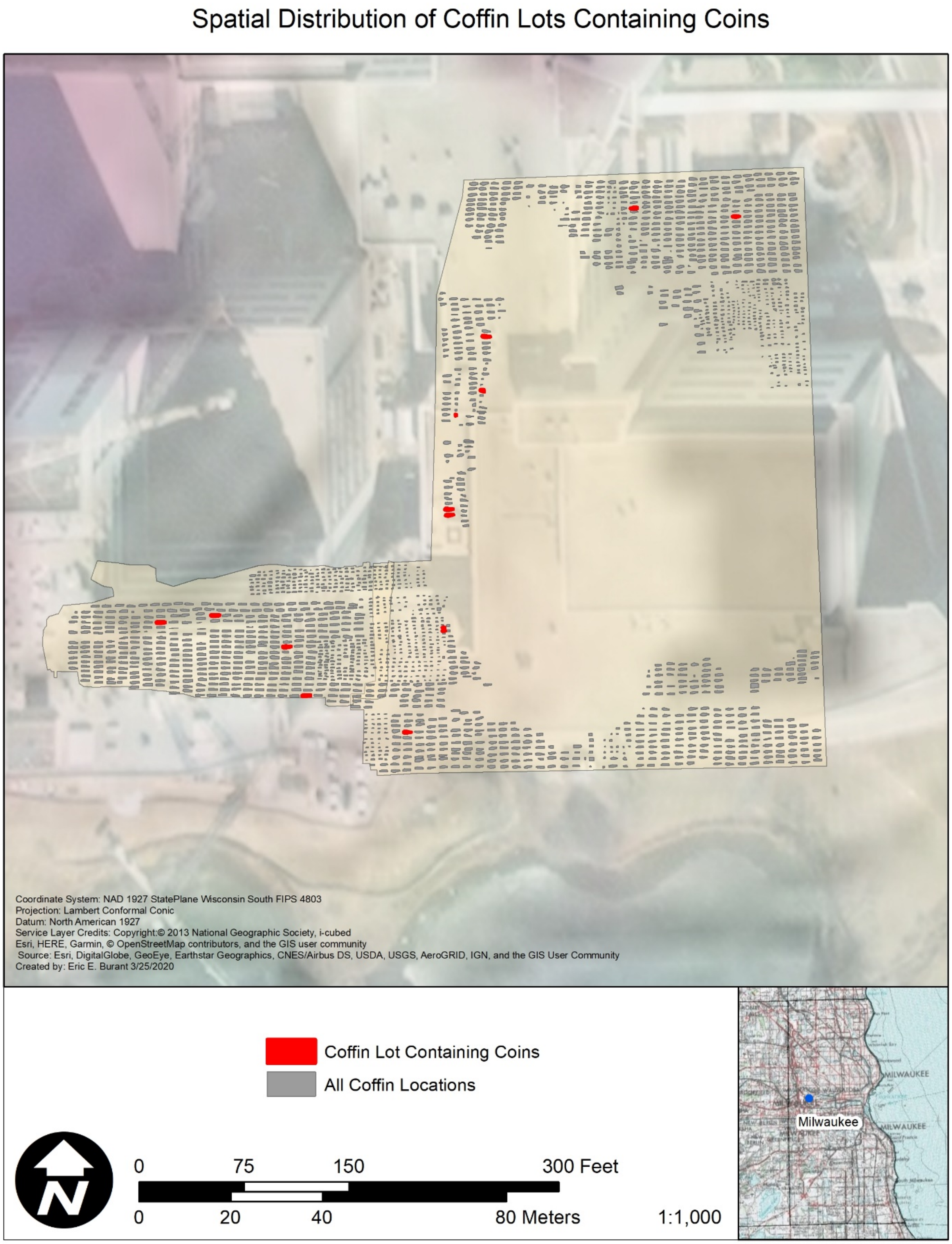

Figure 4.3: Spatial distribution of coins

Table 4.1: Recovered coins by coffin lot number

Coffin Lot	Count	Coin Type	Terminus Post Quem	Artifact Estimated Date Range
1003	2	'Indian Head' One Cent	1888	1883-1915
1004	10	'Indian Head' One Cent (4) Two Cent (5) UnID (1)	1882	1859-1909
2016	1	'Liberty Head' Dime	1905	1892-1916
2058	2	'Liberty Head' Nickel	1883	1883-1913
2068	2	'Liberty Head' Nickel	1911	1883-1912
5087	8	'Liberty Head' or 'Barber' Quarter (3) 'Liberty Head' or 'Barber' Half Dollar (1) 'Shield' Nickel (1) 'Mercury' Dime (3)	1917	1866-1945
6238	1	'Indian Head' One Cent	1905	1859-1909
6239	4	'Indian Head' One Cent (2) UnID (2)	1897	1859-1909
7228	1	'Indian Head' One Cent	1880	1859-1909
9232	1	'Lincoln Head' One Cent	1913	1909-1959
10298	1	'Liberty Head' Nickel	1906	1883-1912
10099	1	'Indian Head' One Cent	1905	1883-1915
10709	1	'Barber' Dime	1903	1892-1916
10746	2	'Indian Head' One Cent (1) 'Liberty Head' Nickel (1)	1908	1883-1915

Jars/Containers

Jars and containers were recovered from 37 (44.0%) coffin locations containing temporally diagnostic material culture. The 1991-1992 artifact inventory included all glass vessels under the category of jars and containers. The 2013 artifact inventory separated glass vessels into multiple categories by presumed vessel use based on burial context and osteological associations. These artifact categories included personal tonic bottles, indulgences, medical waste, research items, and supply bottles. All vessels, independent of form or function, are likely representative of disposal practices. The various subcategorizations of the 2013 inventory were not applied to this analysis of glass vessels. A single artifact classification was implemented for all glass vessels, artifact usage was not considered necessary for determining vessel date. The most useful morphological elements in determining vessel date were finishes and closures, body and seams, manufacturing technique, and raised embossing. Raised embossing on the vessel body or base provided marker's mark details that focused TPQ dates and estimated artifact date range. Vessel dates were commonly placed into date ranges of 10-15 years. When only an estimated date range could be identified, the initial date of use was assigned as the TPQ. All vessels were subjected to the schema established by the SHA/BLM historic glass bottle identification and information website (Lindsey 2020). Figures 4.4-4.6 illustrate selected jars and containers. Figure 4.7 illustrates the spatial distribution of jars and containers. Table 4.2 lists the identified jars and containers at the MCPFC.

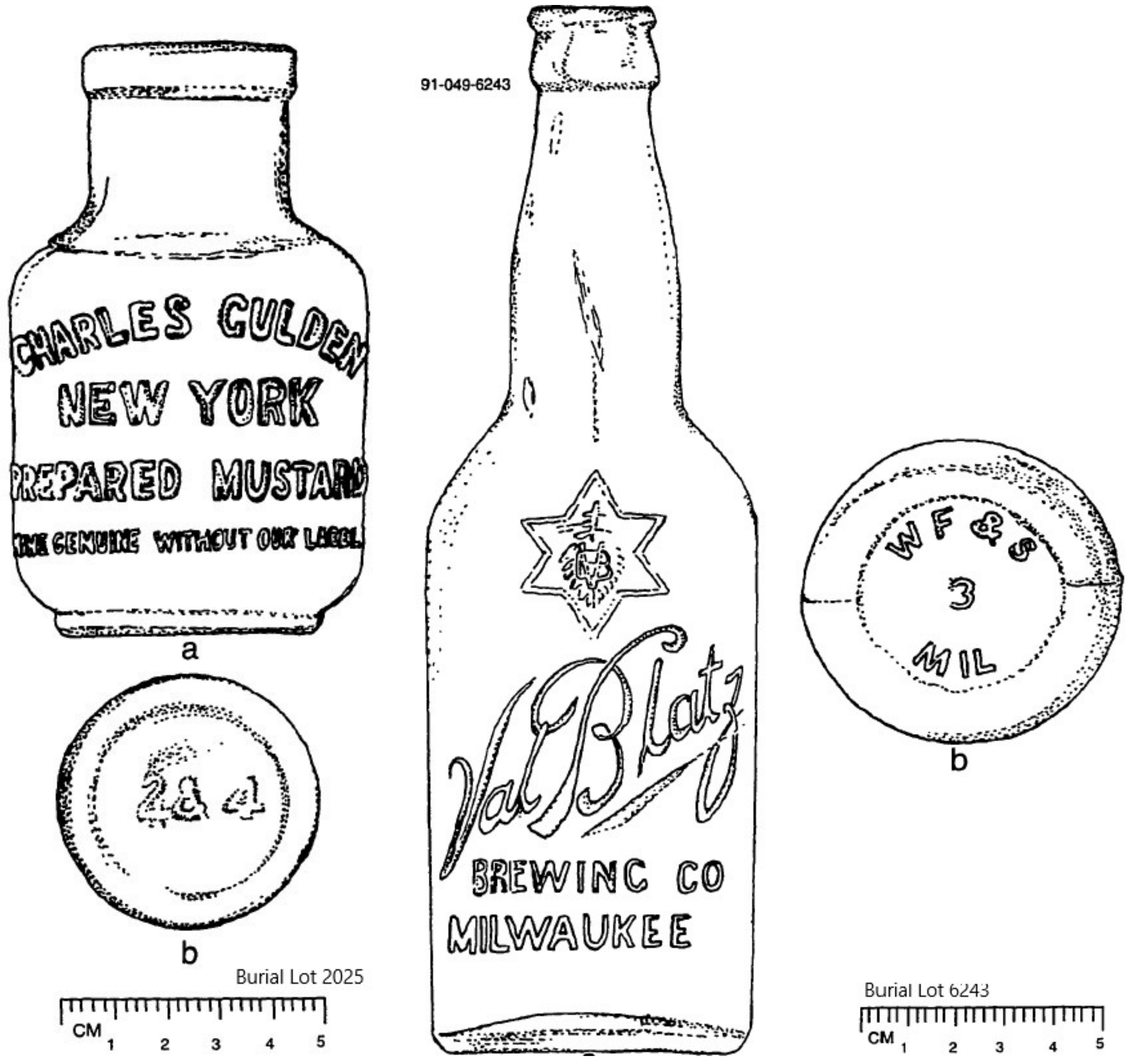

Figure 4.4: Illustration of selected food and beverage jars/containers, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:244-247)

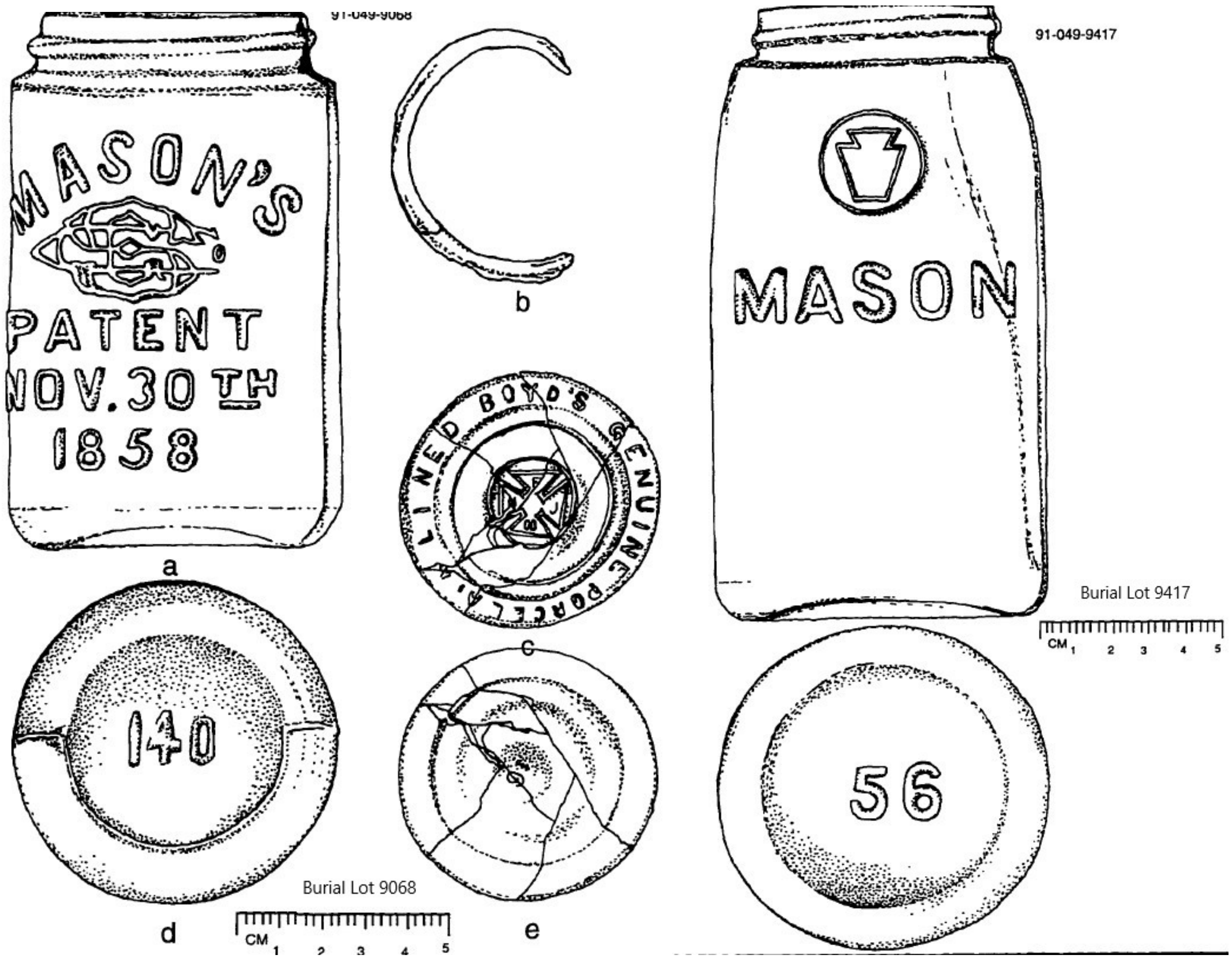

Figure 4.5: Illustration of selected mason jars/containers, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:244-247)

Figure 4.6: Illustration of selected jars/containers. Left prescription bottle, Right: perfume bottle, copy on file at the UWM-ARL. Reproduced with permission from Richards (2016:128-129)

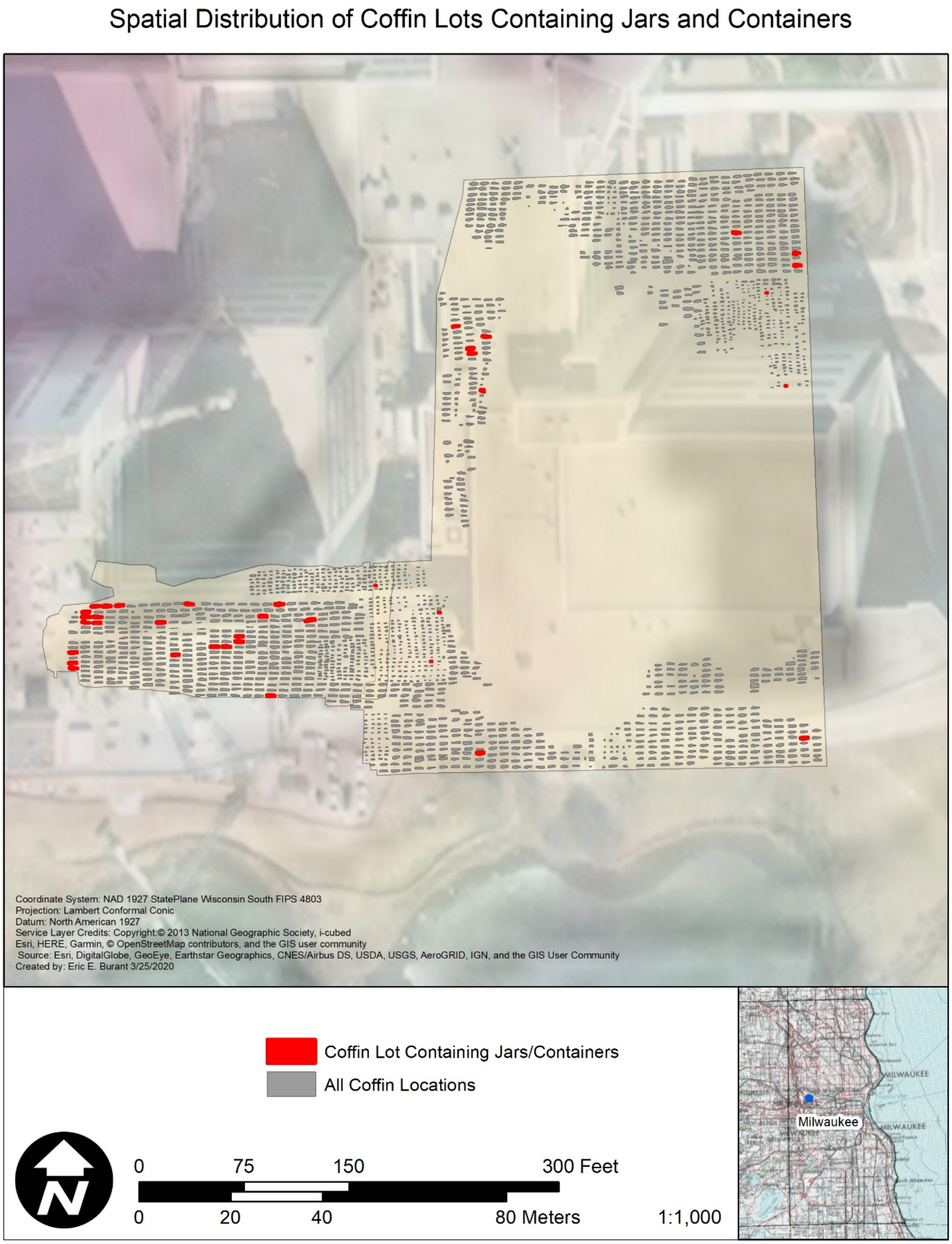

Figure 4.7: Spatial distribution of jars/containers

Table 4.2: Recovered jar/containers by coffin lot number

Coffin Lot	Count	Jar/Container Type	Terminus Post Quem	Artifact Estimated Date Range
2025	1	Mustard Jar	1890	1890-1925
2044	2	Wide Mouth Threaded Closure Jar	1850	1850-1930
2045	1	Prescription Bottle	1870	1850-1930
2058	1	Vaseline Jar	1883	1883-1918
2091	1	Crown Top Beverage Bottle	1911	1910-1930
6005	1	Condiment Jar	1884	1880-1900
6195	1	Mason Jar	1867	1867-1871
6243	1	Beverage Bottle	1896	1896-1900
7014	1	Prescription Bottle	1870	1870-1910
8161	1	Prescription Bottle	1870	1870-1910
9068	1	Mason Jar	1899	1899-1906
9253	1	Fragment Only	NA	NA
9368	1	Prescription Bottle	NA	NA
9370	1	Prescription Bottle	1890	1890-1930
9417	1	Mason Jar	1895	1895-1915
10318	2	Prescription Bottle	1880	1880-1900
10525	1	Fragment Only	NA	NA
10536	1	Fragment Only	NA	NA
10539	1	Prescription Bottle	1870	1870-1910
10569	1	Supply Bottle	1890	1890-1910
10657	1	Fragment Only	NA	NA
10664	3	Milk Bottle	1875	1875-1915
10669	5	Vaseline Jar	1910	1910-1930
10695	1	Prescription Bottle	1890	1890-1911
10730	1	Fragment Only	NA	NA

Coffin Lot	Count	Jar/Container Type	Terminus Post Quem	Artifact Estimated Date Range
10746	1	Fragment Only	1908	1853-1913
10763	5	Food Jar	1882	1882-1915
10803	3	Prescription Bottle	1910	1910-1930
10804	1	Fragment Only	NA	NA
10809	2	Prescription Bottle	1870	1870-1910
10812	4	Perfume Bottle	1880	1880-1904
10970	2	Fragment Only	NA	NA
10971	5	Mineral Water Bottle	1895	1895-1904
10973	1	Condiment Jar	1884	1884-1890
10981	5	Ink Bottle	1880	1870-1930
10982	5	Condiment Jar	1901	1870-1920
10983	4	Prescription Bottle	1904	1904-1930

Footwear

Footwear was the most abundant temporally diagnostic artifact type recovered from the MCPFC and includes all shoes, boots, and related hardware. Footwear was recovered from 40 (47.6%) of all coffin locations containing temporally diagnostic material culture. The footwear type identification and dating schema followed the standardized analytical procedure outlined by Anderson (1968), Dappert-Coonrod and Mihich (2018), and Quirk and Beaudoin (2012). This procedure analyzed footwear morphology based on manufacturing technique (turned or welted), construction (nailed, sewn, or cemented), and make (handmade or machine made). In most instances, the TPQ was assigned to the earliest date of the estimated range based on shoe manufacture. The fragmentary condition of the footwear did not aid in the identification of footwear models in historic catalogues. Due to the nature of the cemetery's demography footwear may have commonly been repurposed, passed down, or repaired. This long-term exhaustive use of footwear widens the potential artifact estimated date range. In some cases, the TPQ dates to a year earlier then the historical records provide for cemetery use.

A total of seven burial lots containing footwear from the 1991-1992 excavations could not be located within the UWM-ARL MCPFC material culture collections. These missing lots were transferred to Marquette University from GLARC but were not included in the materials transferred to the UWM ARL as part of the July 2008 memorandum of understanding (MOU) executed between the Wisconsin Historical Society and the Board of Regents of the University of Wisconsin System. Figures 4.8-4.9 illustrate selected footwear. Figure 4.10 illustrates footwear construction morphology. Figure 4.11 illustrates the spatial distribution of footwear. Table 4.3 lists the identified footwear at the MCPFC.

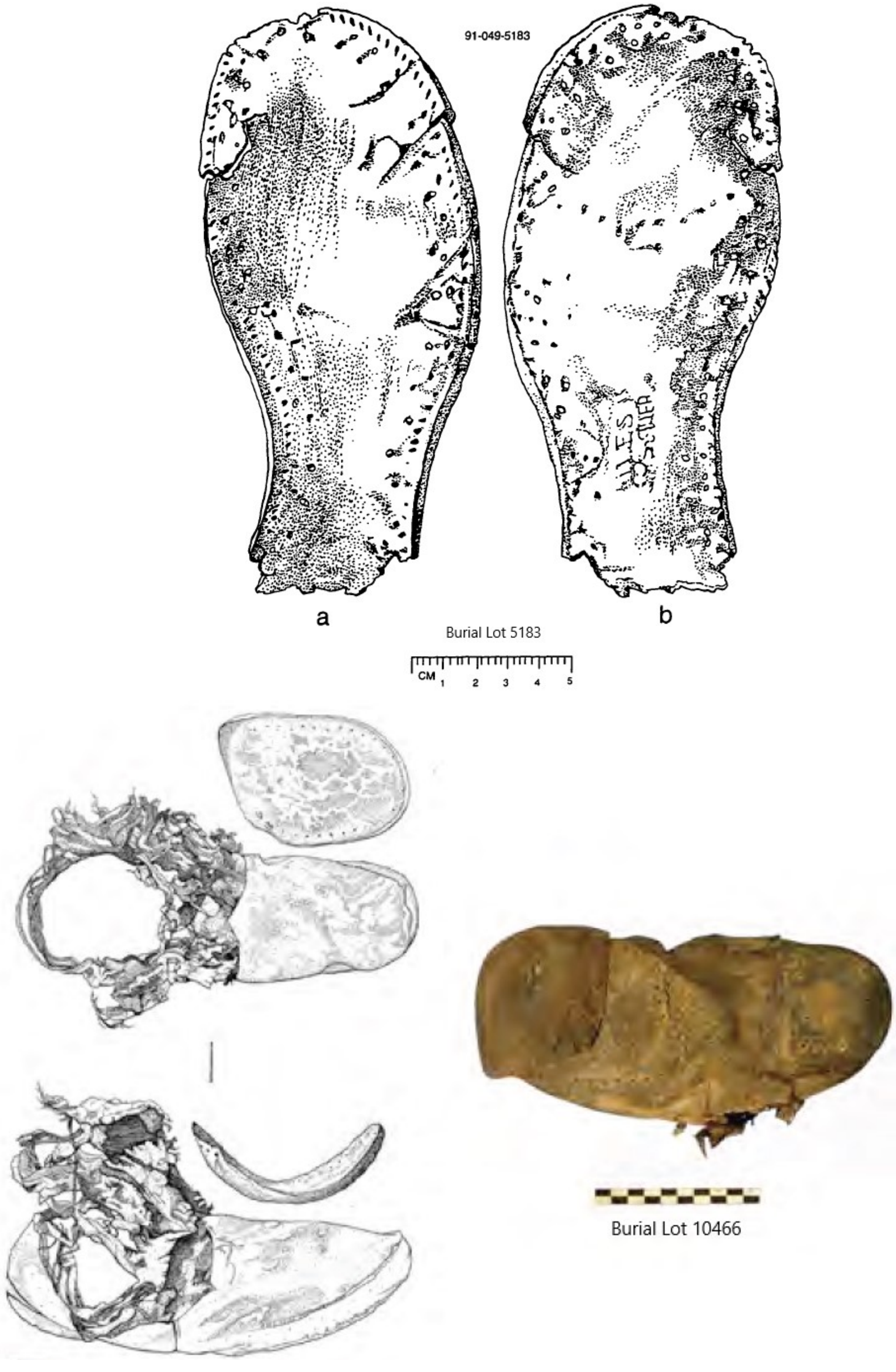

Figure 4.8: Illustration of selected footwear. Upper: standard screw, Lower: cemented, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:227; 2016:120)

Figure 4.9: Illustration of selected footwear. Upper: Goodyear Welt, Lower: McKay, copy on file at the UWM-ARL. Reproduced with permission from Richards (2016:120)

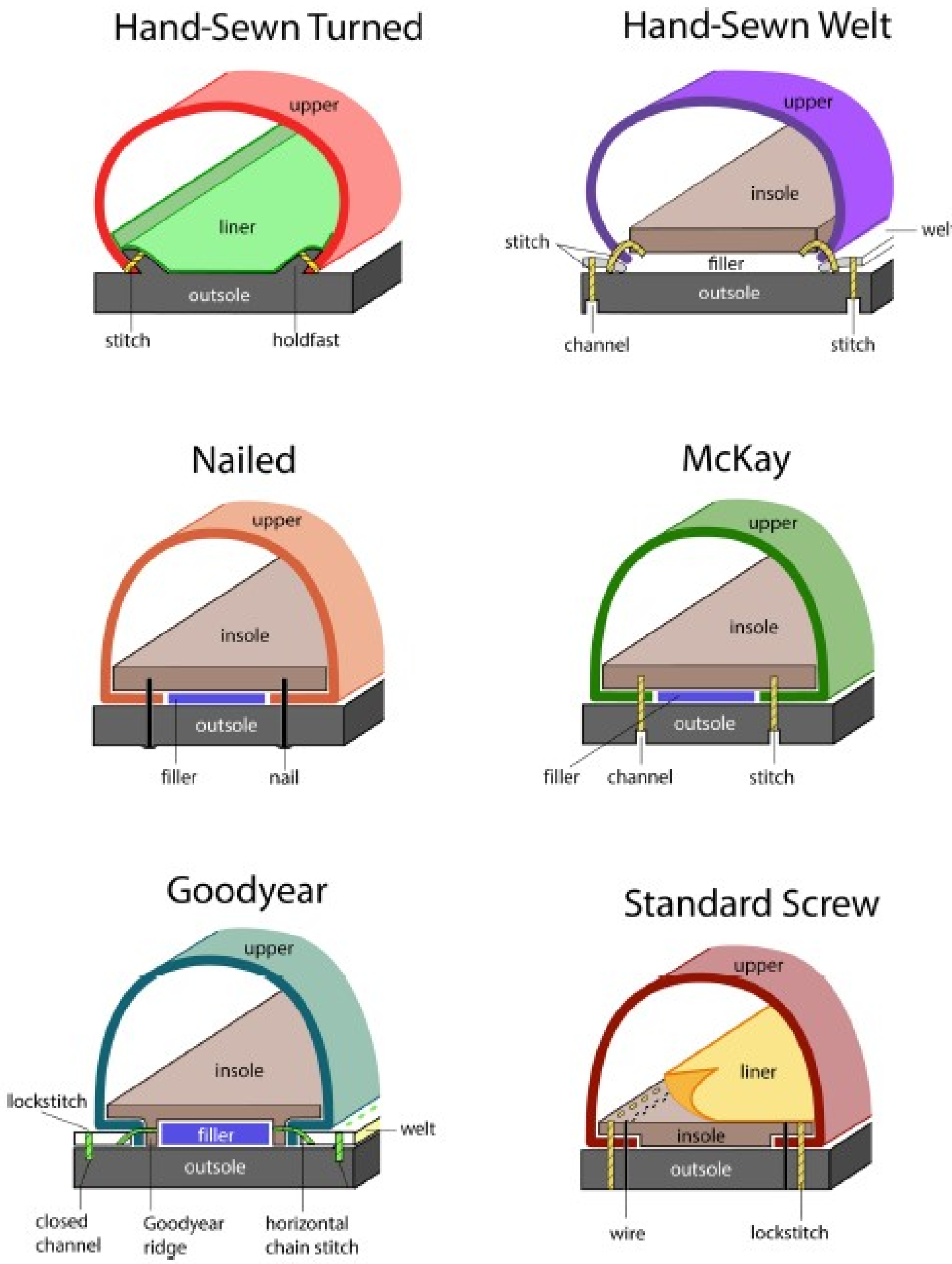

Figure 4.10: Illustration of footwear construction Morphology. After Dappert-Coonrod and Mihich (2018:650)

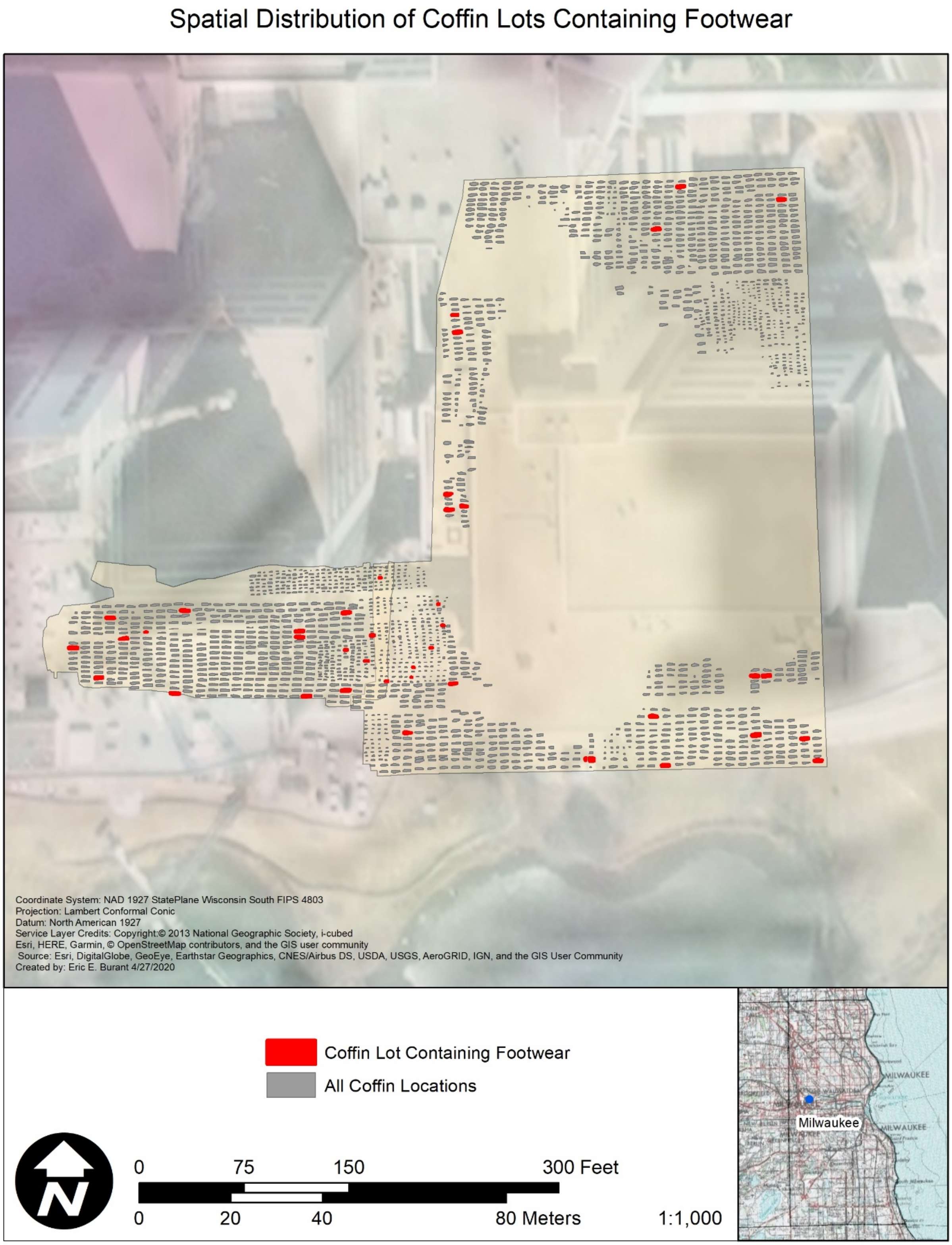

Figure 4.11: Spatial distribution of footwear

Table 4.3: Recovered footwear by coffin lot number

Coffin Lot	Count	Footwear Type	Terminus Post Quem	Artifact Estimated Date Range
1003	2	Nailed	1888	1883-1915
1008	2	Footwear Not Present	NA	NA
1014	2	Footwear Not Present	NA	NA
2062	2	Nailed	1875	1875-1925
2088	2	Footwear Not Present	NA	NA
5033	2	Standard Screw	1880	1880-1925
5112	2	McKay	1862	1862-1925
6020	1	Footwear Not Present	NA	NA
6082	2	Fabric Construction	NA	NA
6149	2	McKay	1875	1875-1925
6151	1	Hand Sewn Turned	1830	1830-1925
6199	1	Footwear Not Present	NA	NA
6240	1	Footwear Not Present	NA	NA
6255	2	Footwear Not Present	NA	NA
7057	2	Nailed	1830	1830-1925
7088	2	Goodyear Welt	1880	1880-1925
7228	2	Goodyear Welt	1880	1859-1909
8009	2	Nailed	1875	1875-1925
8030	2	McKay	1875	1875-1925
8121	2	Standard Screw	1880	1880-1912
8129	1	Standard Screw	1880	1880-1925
8161	1	Goodyear Welt	1870	1870-1910
8167	1	Nailed	1830	1830-1925
8192	1	Goodyear Welt	1880	1880-1925
9355	2	Goodyear Welt	1880	1880-1925
10007	1	Fragment Only	NA	NA
10018	1	Nailed	1875	1875-1925

Coffin Lot	Count	Footwear Type	Terminus Post Quem	Artifact Estimated Date Range
10045	1	Nailed	1875	1875-1925
10093	1	Goodyear Welt	1875	1875-1925
10283	2	Goodyear Welt	1880	1880-1925
10298	2	Goodyear Welt	1906	1875-1925
10410	1	Cemented	1912	1912-1925
10466	2	Cemented	1912	1912-1925
10621	2	Goodyear Welt	1880	1880-1912
10682	2	Nailed	1875	1875-1925
10736	2	Nailed	1875	1875-1925
10753	1	Fragment Only	NA	NA
10769	2	McKay	1875	1875-1925
10808	1	Fragment Only	NA	NA
10976	2	Goodyear Welt	1880	1880-1925

Spatial Analysis

Comparative Analysis: Coffin Handles

Kubicek and Richards (2017) produced a study that used coffin handles to test temporal hypotheses across the MCPFC. A total of 10 distinct coffin handle types (Figures 4.12-4.20) recovered from the MCPFC. Figure 4.21 illustrates the coffin handle type distribution by date ranges established by Kubicek and Richards (2017). Hardware company catalogs provided manufacturing dates for identified coffin handle types. Two coffin handle types, Type I and V could not be identified in historic catalogs, thus could not be assigned to a date range. However, Type I coffin handles overlap spatially with Type II and VI handles and Type V overlaps with Type IV and VI. Type II handles were assigned a date range between 1897 and the 1930s. Type

III handles were dated to between 1907 and 1956. Type IV were suggested to range between 1920 and 1956. Hardware catalogs provided a Type VI handle date range between 1948-1956. The date range based on hardware catalogs for Type VI falls outside the identified closing date of the MCPFC. These handles are problematic and not reliably identified. Type VII handles were suggested to between 1912-1920. Types VIII and XII handles were assigned a beginning date of 1922, but no ending date was discovered. A discussion of the distribution of coffin handles by Kubicek and Richards (2017) compared to the results of burial date interpolations in this study is presented in Chapter Five.

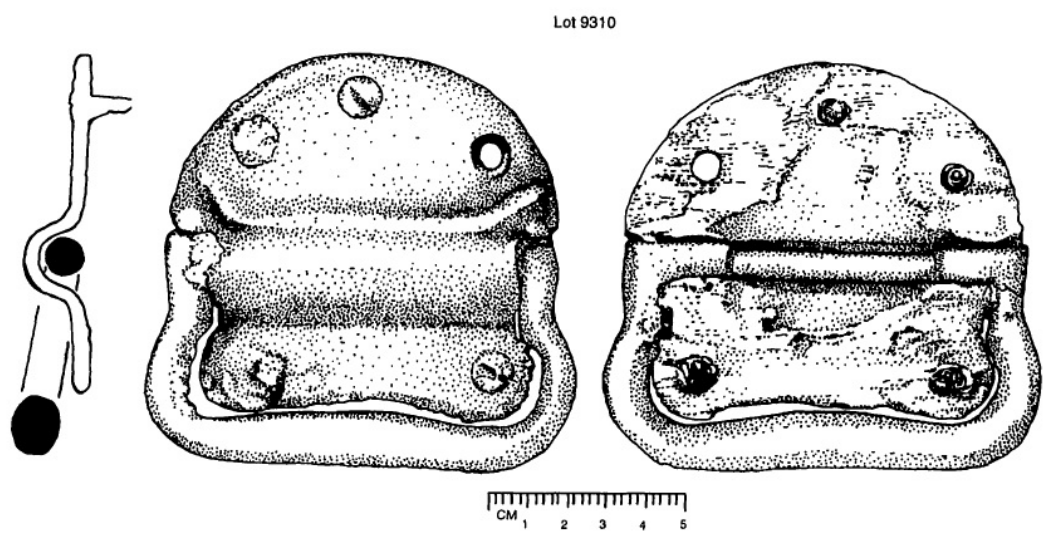

Figure 4.12: Illustration of Type I coffin handle, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:164)

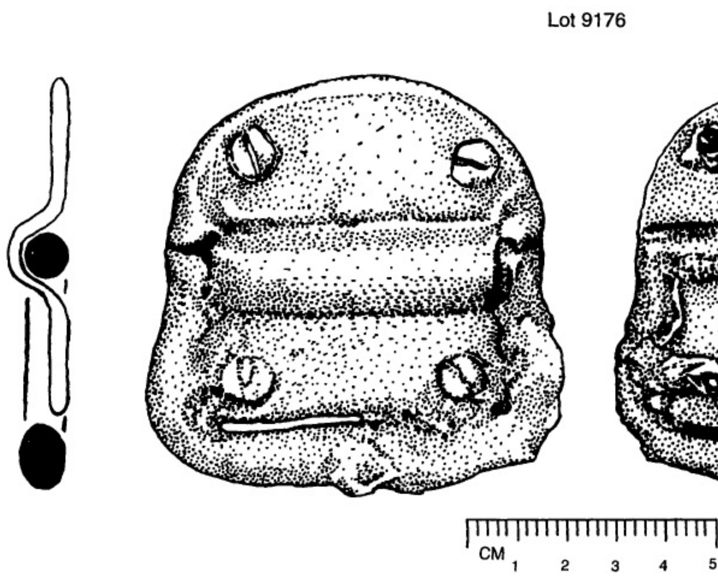

Figure 4.13: Illustration of Type II coffin handle, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:166)

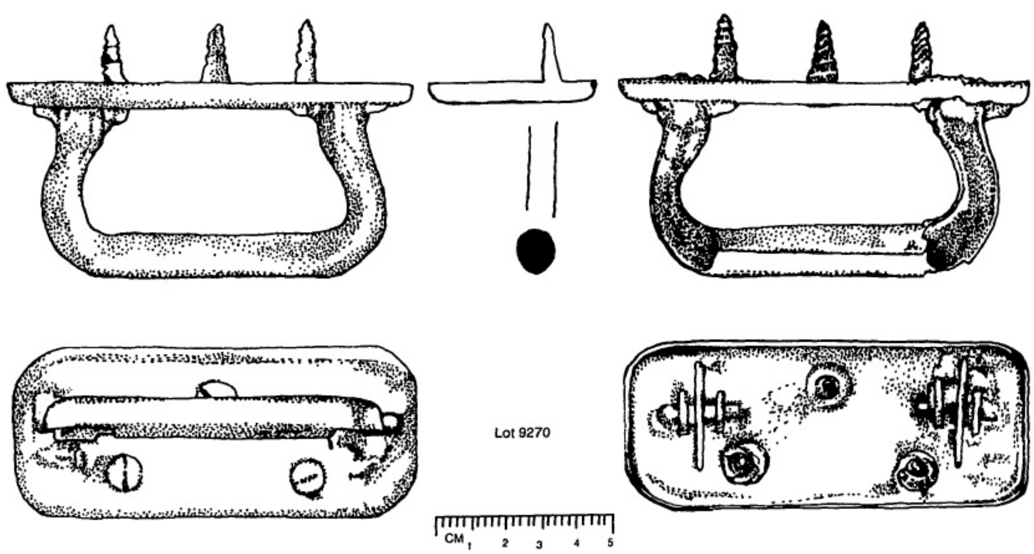

Figure 4.14: Illustration of Type III coffin handle, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:168)

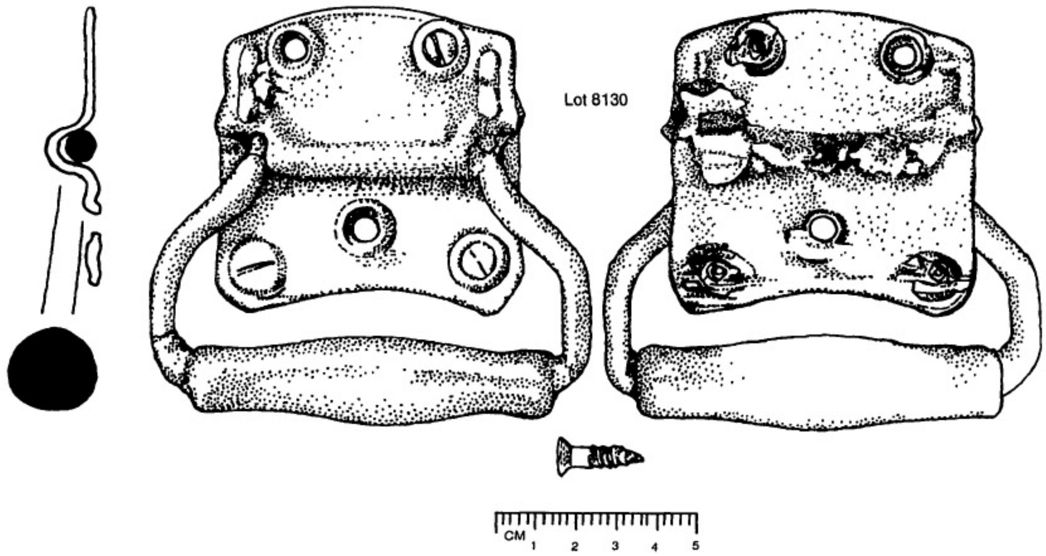

Figure 4.15: Illustration of Type IV coffin handle, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:169)

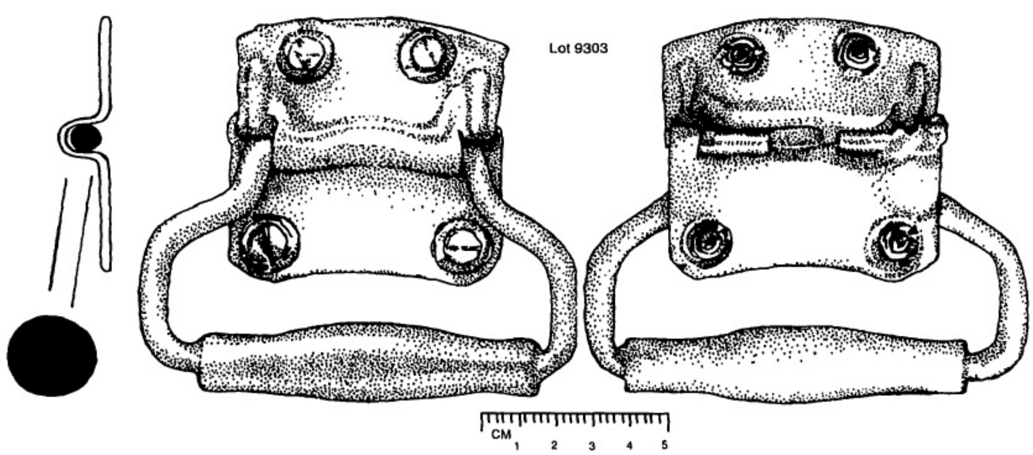

Figure 4.16: Illustration of Type V coffin handle, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:171)

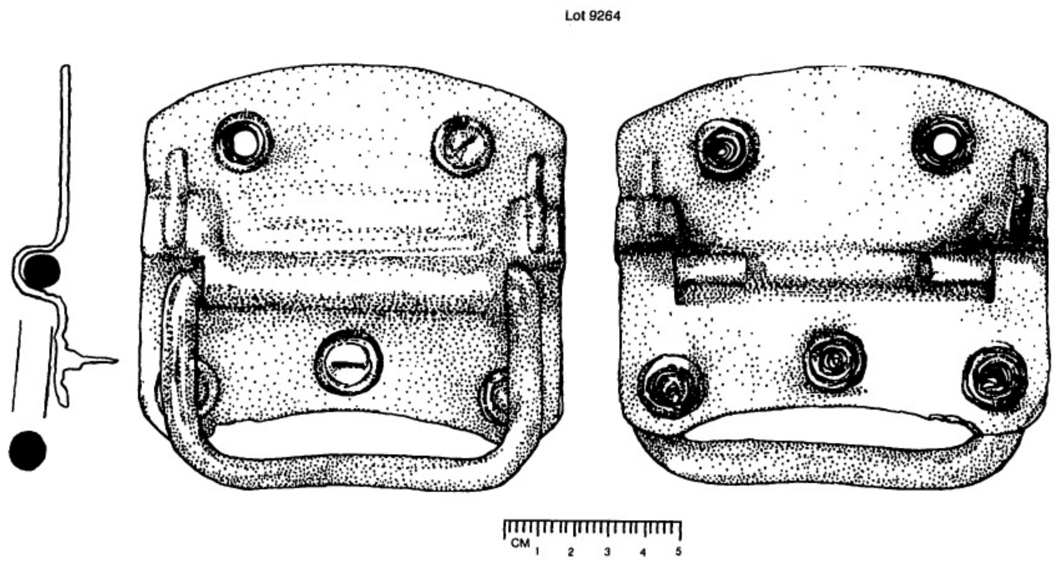

Figure 4.17: Illustration of Type VI coffin handle, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:171)

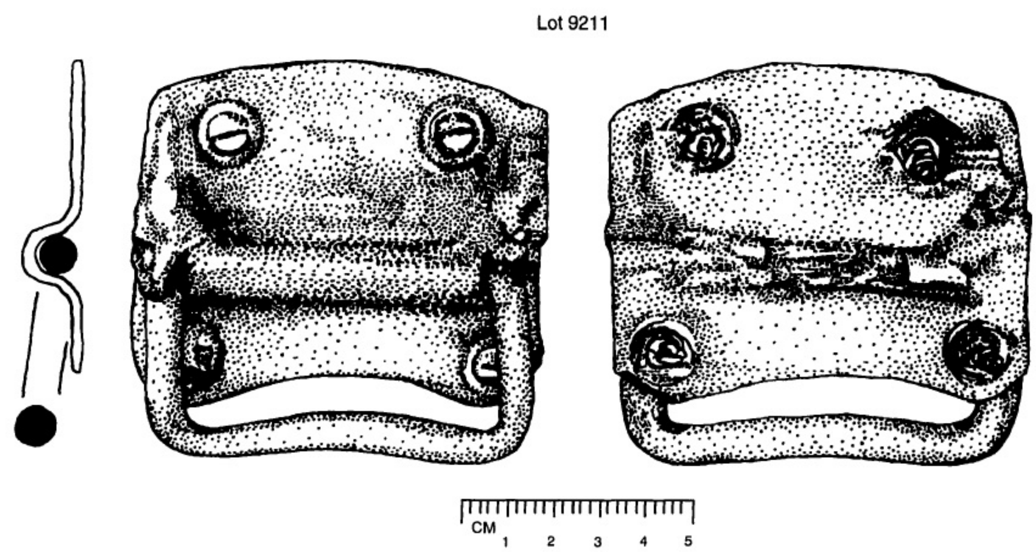

Figure 4.18: Illustration of Type VII coffin handle, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:174)

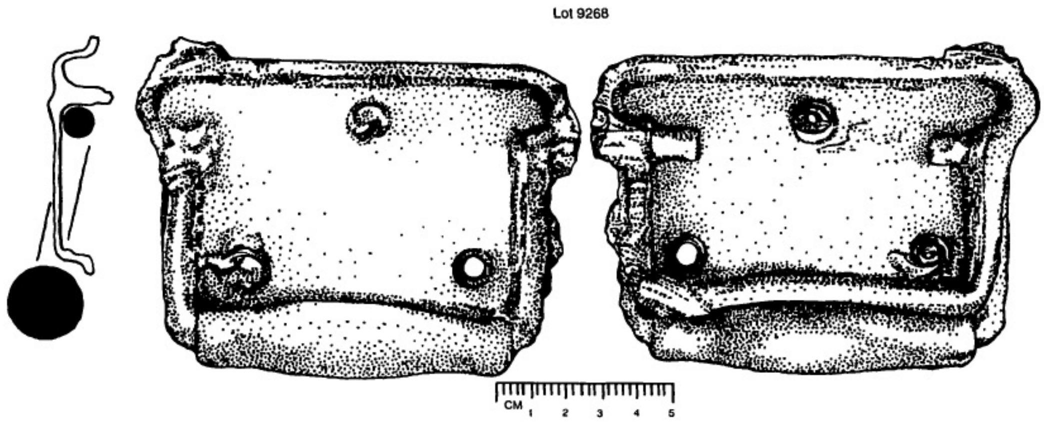

Figure 4.19: Illustration of Type VIII coffin handle, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:176)

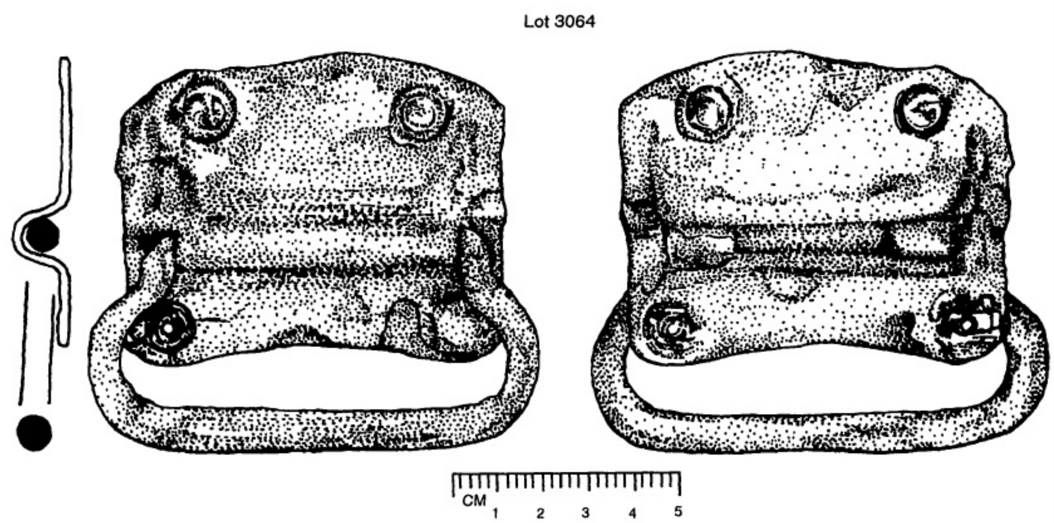

Figure 4.20: Illustration of Type XII coffin handle, copy on file at the UWM-ARL. Reproduced with permission from Richards (1997:183)

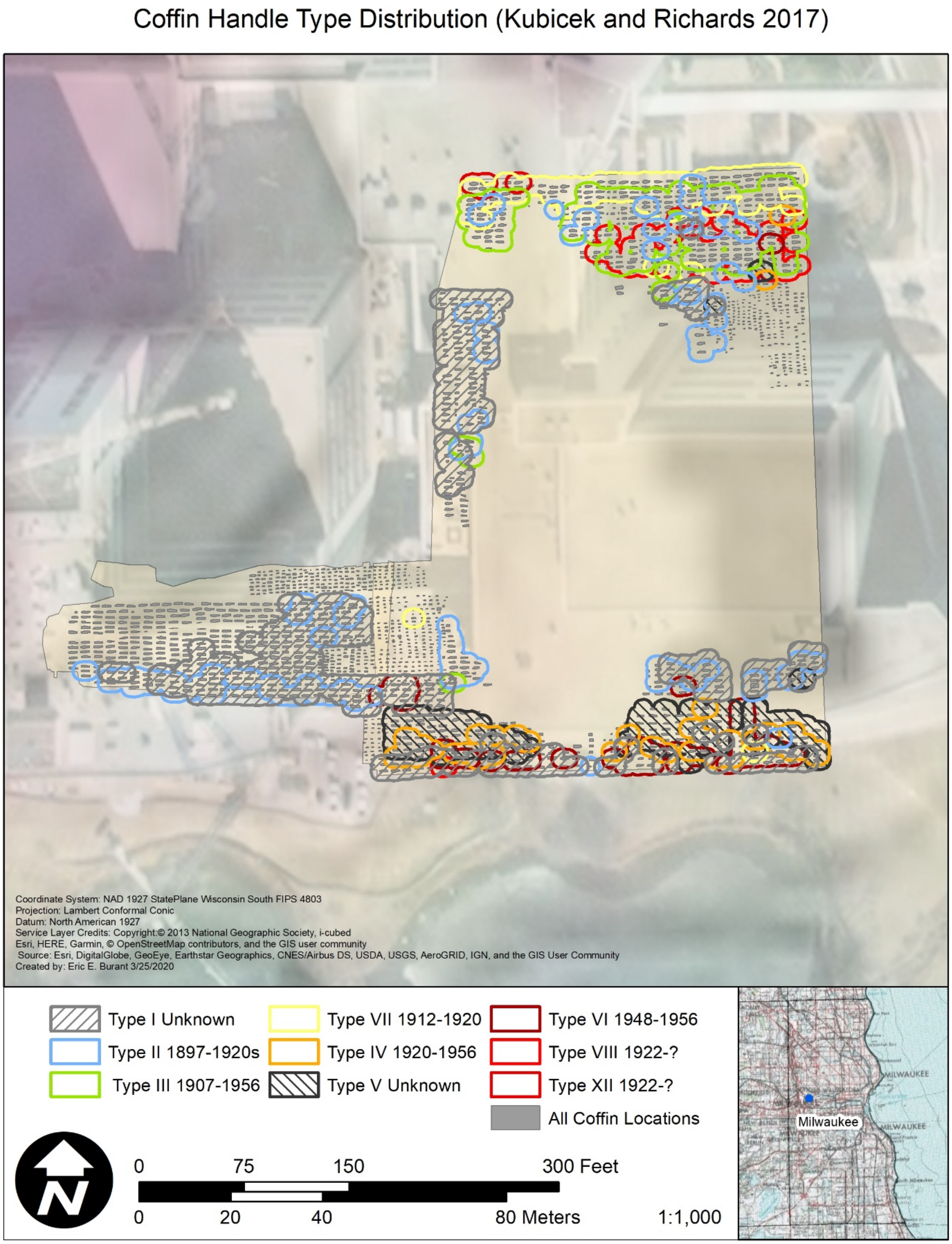

Figure 4.21: Coffin handle type distribution by date ranges reported by Kubicek and Richards (2017)

Potential Positive Burial Identification

Putative burial dates established by Richards (1997) were based on a combination of location, consistent grave patterning, and the recovery of burial number tags. These grave patterns were reinforced by the death certificates of those individuals listed in the *Register of Burials* ledger. Possible burial identification was assigned to 190 individuals. These identified burial locations are focused in the northernmost portion of the MCPFC (Figure 4.22). In addition to the burial locations identified by Richards (1997) 10 burial locations were confirmed by Freire (2017). Of these 190 locations with associated dates of burial a total of 164 coffin locations were suitable for interpolation and were added to the GIS.

Figure 4.22: Spatial distribution of possible burial IDs

Temporal Artifact Distribution

Based on the three temporally diagnostic artifact types analyzed in this study 66 (3.0%) coffin locations produced temporally sensitive data that estimated the date of interment, represented by the TPQ date (Figure 4.23). Table 4.4 summarizes all dates by artifact type.

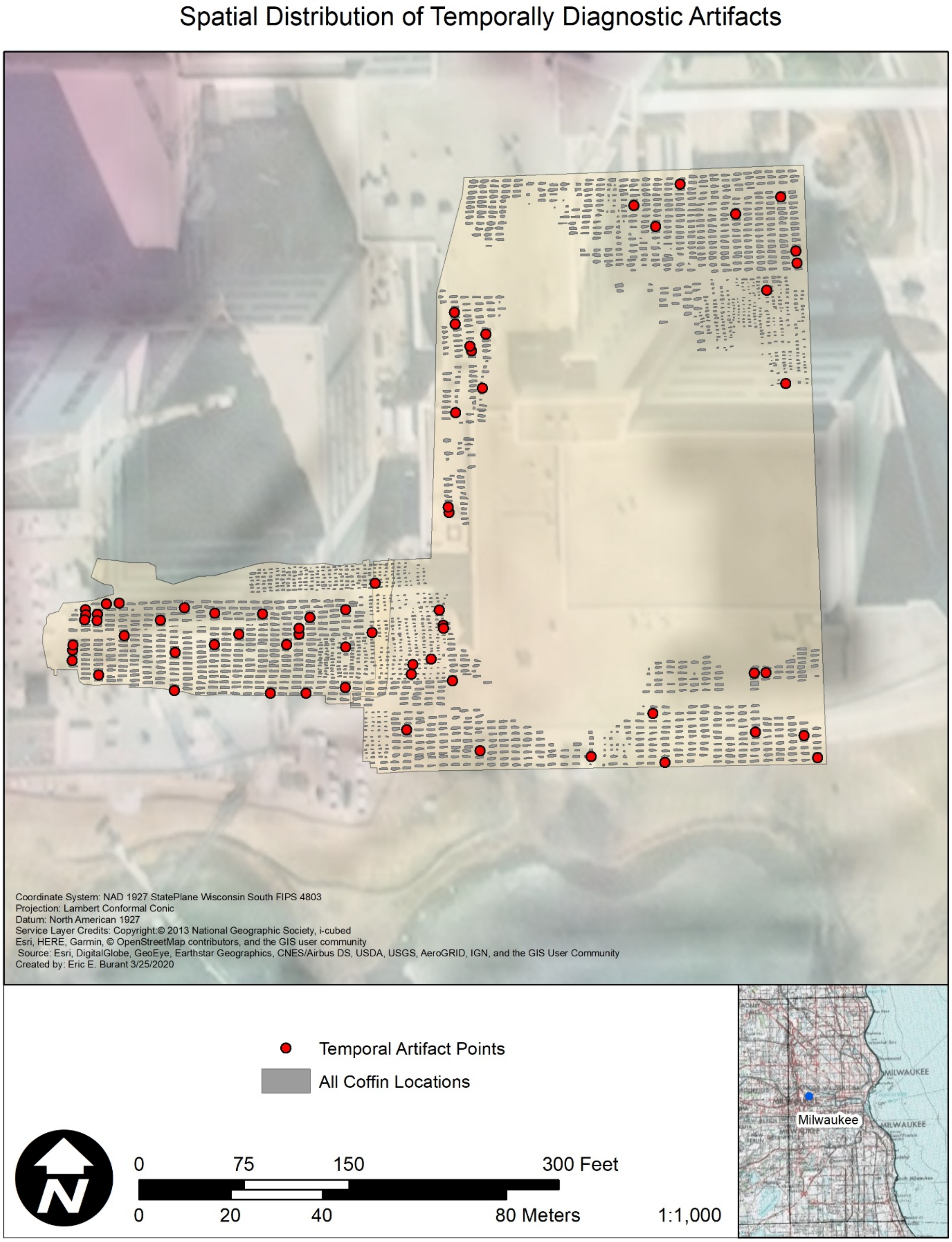

Figure 4.23: Spatial distribution of temporally diagnostic artifacts

Table 4.4: Date by artifact type

Date	Artifact Type
1830	Footwear
1850	Jars/Containers
1860	Jars/Containers
1867	Jars/Containers
1870	Jars/Containers
1875	Footwear, Jars/Containers
1880	Coins, Footwear, Jars/Containers
1882	Coins, Jars/Containers
1883	Coins, Jars/Containers
1884	Jars/Containers
1888	Coins, Footwear
1890	Jars/Containers
1895	Jars/Containers
1896	Jars/Containers
1899	Jars/Containers
1901	Jars/Containers
1903	Coins
1904	Jars/Containers
1905	Coins
1906	Coins, Jars/Containers
1908	Coins, Footwear
1910	Jars/Containers
1911	Coins, Jars/Containers
1912	Footwear
1913	Coins
1917	Coins
1918	Footwear
1923	Footwear
1924	Footwear

Burial Date Interpolation

The interpolation method applied in this study was ordinary kriging. Ordinary kriging is used if the mean is assumed constant but unknown. The variable considered for the technique was earliest possible date of interment or TPQ. The results of the interpolated surface model represent the earliest date of burial. These surface models are bounded to the extent of the sampled data points. Interpolated surface models were created for each artifact type analyzed and for all temporally sensitive coffin lots, including combining all diagnostic material culture and positively identified burials with and associated date of interment. The interpolated surface for coin artifact TPQ is illustrated in Figure 4.25. The ordinary kriging statistical results are listed in Table 4.5. The interpolated surface for jar/container artifact TPQ is illustrated in Figure 4.26. The ordinary kriging statistical results are listed in Table 4.6. The interpolated surface for coin artifact TPQ is illustrated in Figure 4.27. The ordinary kriging statistical results are listed in Table 4.7. The geostatistical wizard, a function of the ArcGIS software, was used to provide a series of prediction errors for all artifact type kriging models. The optimized ordinary kriging model has the lowest standard error for all interpolated surface models. Each interpolated surface model held statistically significant results. A discussion of the artifact interpolated date models compared to the results of all temporally diagnostic data, as it relates to temporal patterning and land use, is provided in Chapter Five.

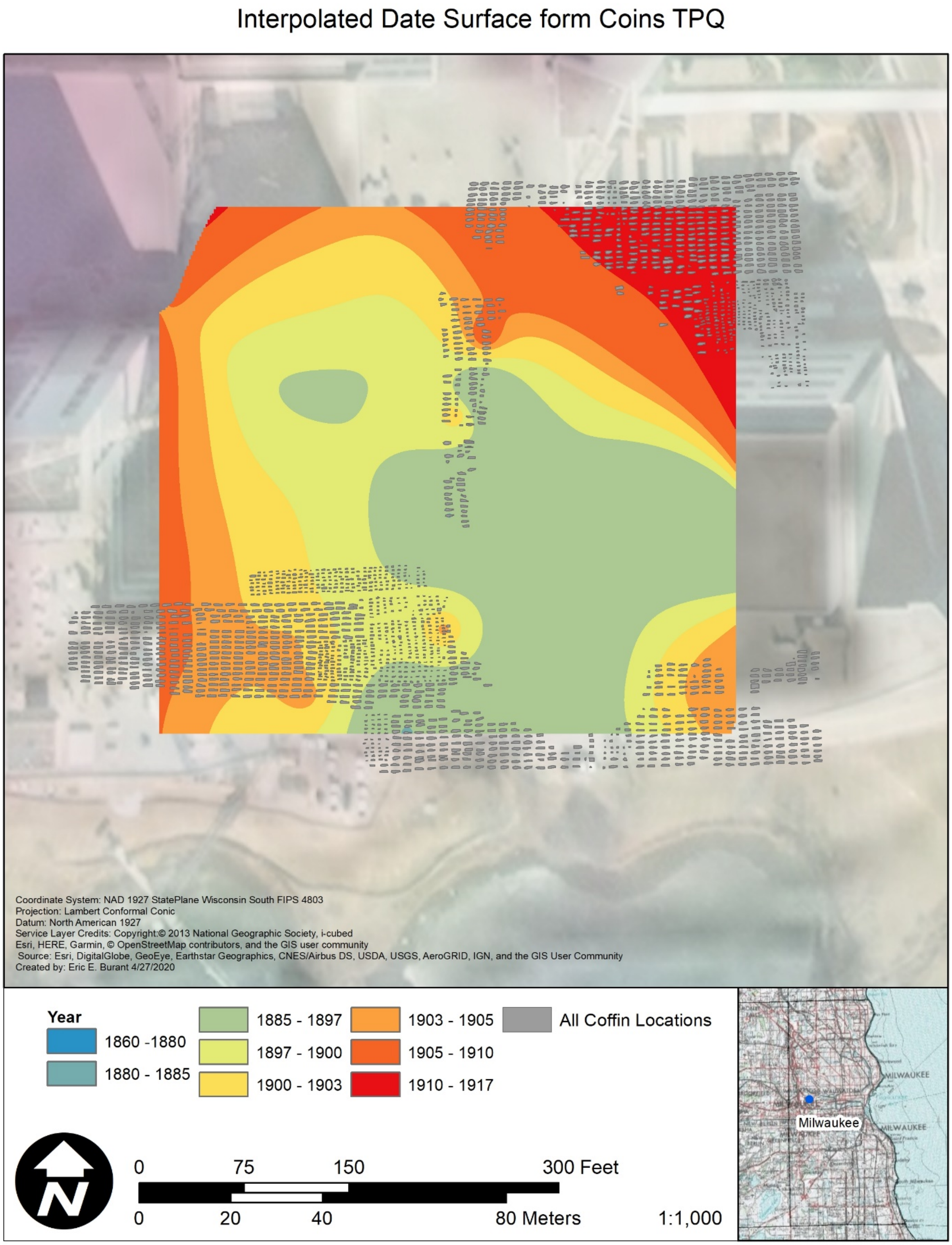

Figure 4.25: Interpolated date surface for coin TPQ

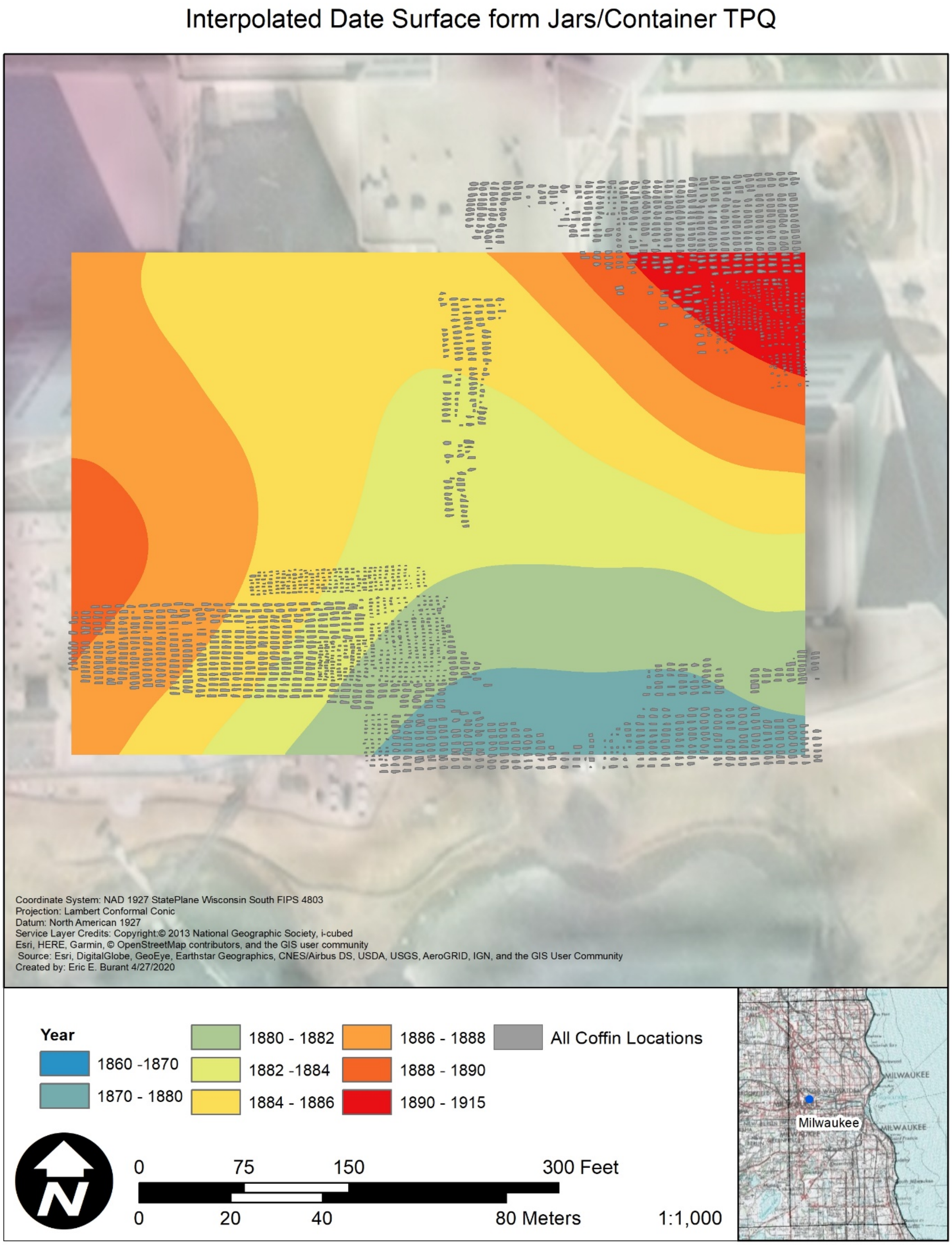

Figure 4.26: Interpolated date surface for jar/container TPQ

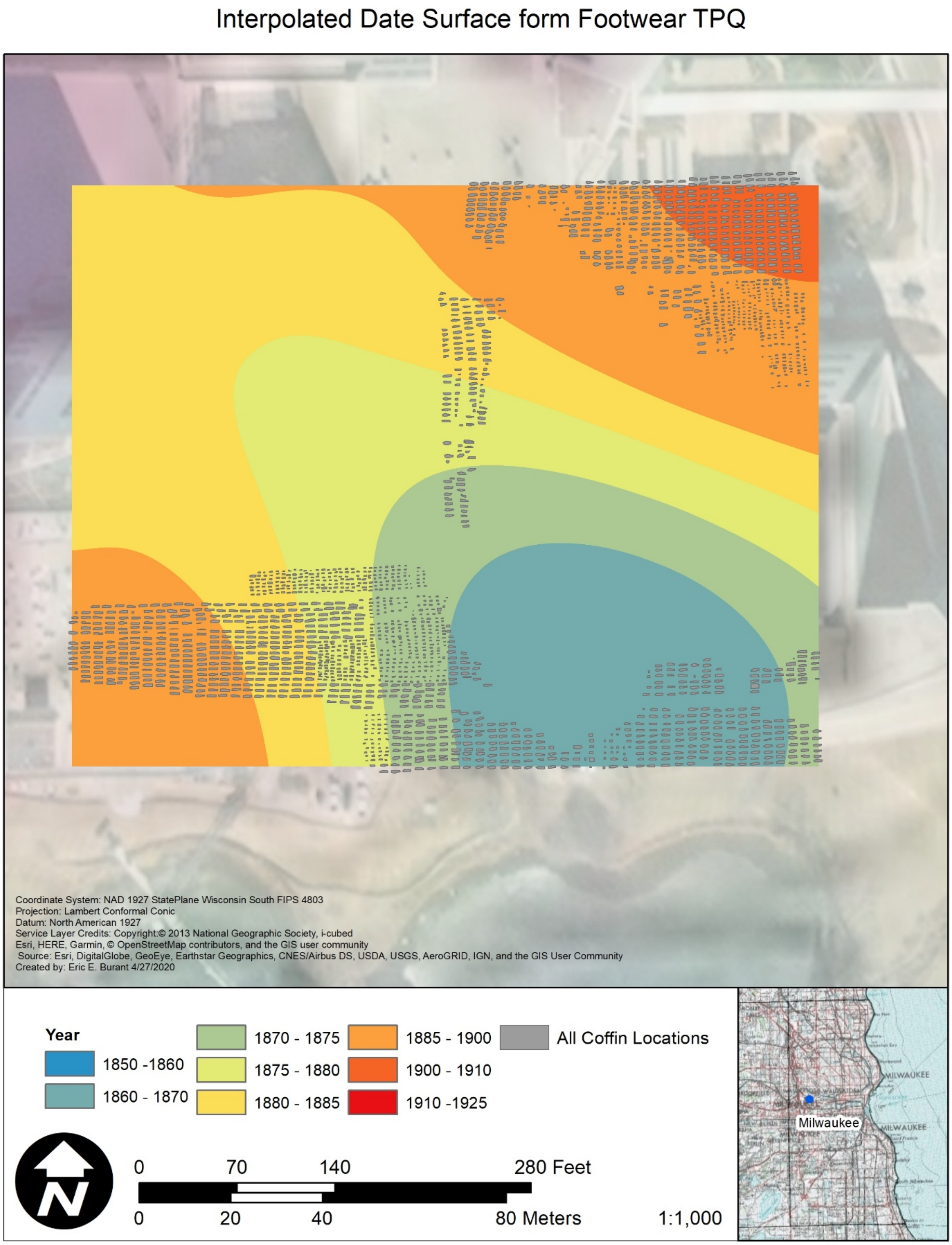

Figure 4.27: Interpolated date surface for footwear TPQ

Table 4.5: Ordinary kriging test statistical results for coins

Measure	**Prediction**	
	Normal	**Optimized**
Mean	-0.02	-0.01
Root Mean Square	11.20	11.04
Mean Standardized	0.00	0.00
Root Mean Square Standardized	0.94	0.93
Average Standard Error	11.64	11.57

Table 4.6: Ordinary kriging test statistical results for jars/containers

Measure	**Prediction**	
	Normal	**Optimized**
Mean	-0.07	-1.27
Root Mean Square	17.13	16.49
Mean Standardized	-0.007	-0.04
Root Mean Square Standardized	1.03	0.86
Average Standard Error	16.62	19.60

Table 4.7: Ordinary kriging test statistical results for footwear

Measure	Prediction	
	Normal	Optimized
Mean	-0.619	-0.615
Root Mean Square	20.97	21.07
Mean Standardized	-0.02	-0.25
Root Mean Square Standardized	1.03	1.06
Average Standard Error	20.28	19.648

Two hundred seventy-seven (10.4%) distinct coffin locations that contained temporally sensitive data were utilized during this analysis (Figure 4.28). Figure 4.29 illustrates the interpolated surface results of ordinary kriging. Again, the geostatistical wizard was used to provide a series of prediction errors for the kriging model. These prediction errors are used to judge how valid the interpolation model is. The square root mean indicates how closely the model predicts the interpolated values based on the model variance, this is dependent on the density and configuration of the data. The level of error varies on which particular kriging type was used. The optimized ordinary kriging model has the lowest standard error. This model produced a mean value of -0.505, a root mean squared value of 10.779, a mean standardize score of -0.071, a root mean square standardize score of 0.498, and an average standard error of 3.13. The root mean squared value is optimized at a value closest to one. The root mean square standardized value is a bit low in this model, ideally the score would be zero. This score means the model is overestimating the variability in the predictions, but it was the lowest of all tested kriging models (Appendix D). The root mean squared value level of error essentially means there is a 20-year period in which each coffin location could fall. The prediction errors for this model suggest an overestimated prediction with a wide range of error, however there is still value in using the predicted model to extrapolate larger temporal and spatial patterns. All statistical results for ordinary kriging test are listed in Table 4.8.

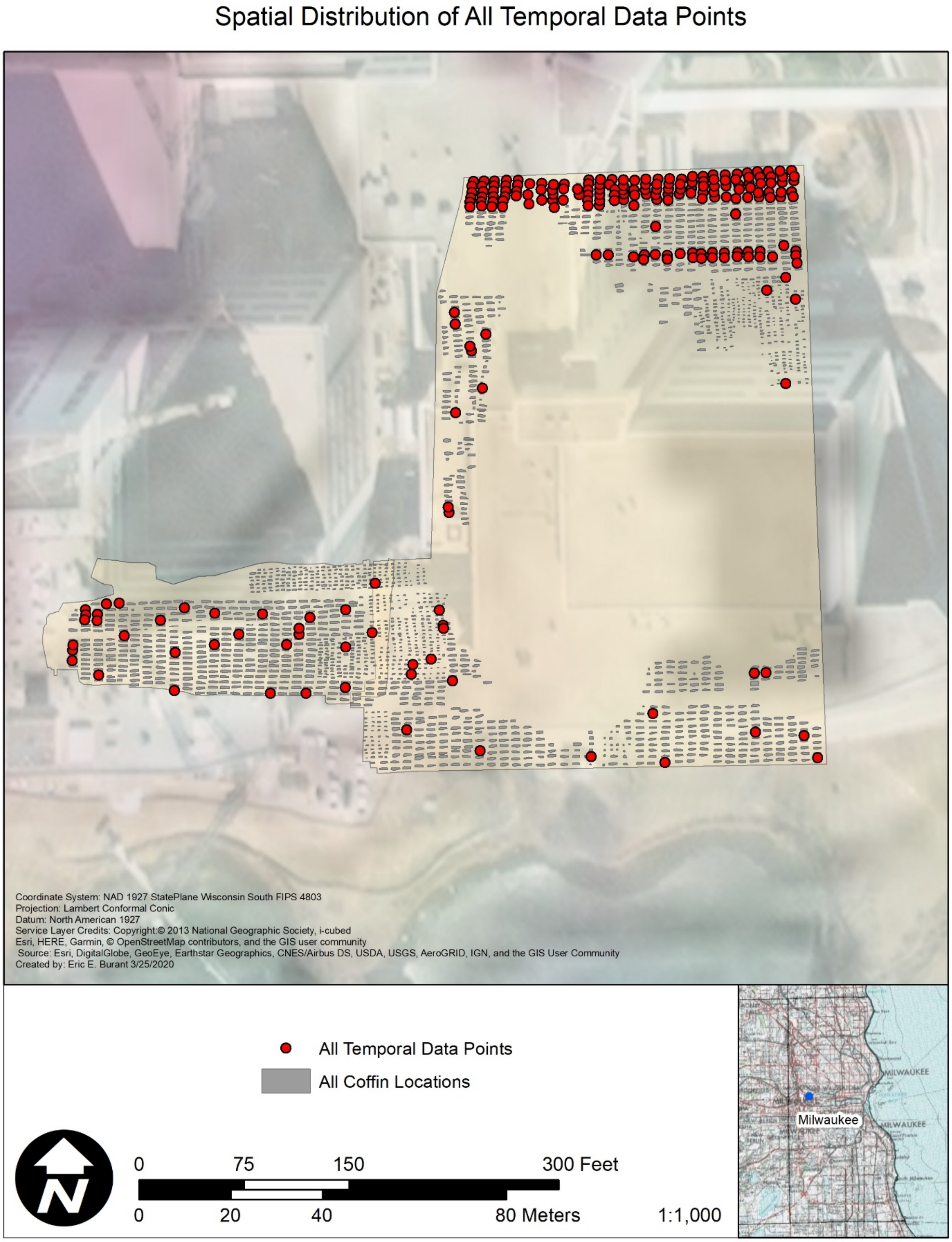

Figure 4.28: Spatial distribution of all temporal data points

Interpolated Date Surface from Coffin Lot TPQ

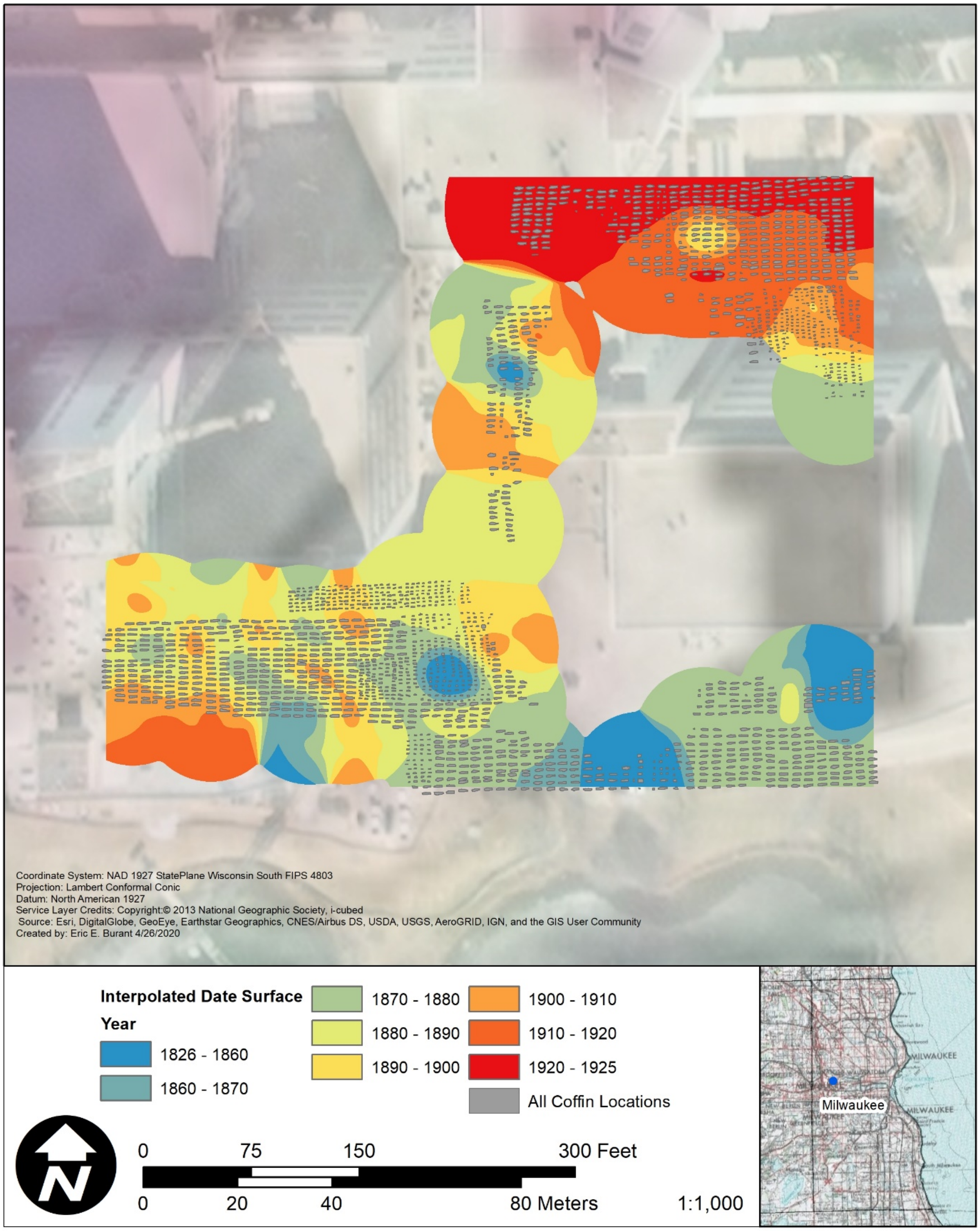

Figure 4.29: Interpolated date surface from coffin lot TPQ

Table 4.8: Ordinary kriging test statistical results for all temporally significant data

Measure	Prediction	
	Normal	Optimized
Mean	-0.619	-0.505
Root Mean Square	10.015	10.779
Mean Standardized	-0.106	-0.071
Root Mean Square Standardized	2.044	0.498
Average Standard Error	3.096	3.13

Figure 4.30 illustrates the prediction error surface. Given the distribution of dated locations, the error surface model shows a distinctive pattern of low error values around each sampled point. This reflects the limited reliability of the analysis, where prediction errors are minimal closest to the sampled locations and highest at a further distance away from the sampled locations. However, these error values suggest an acceptable model.

Predicted Standard Error Surface for Interpolated Date Surface

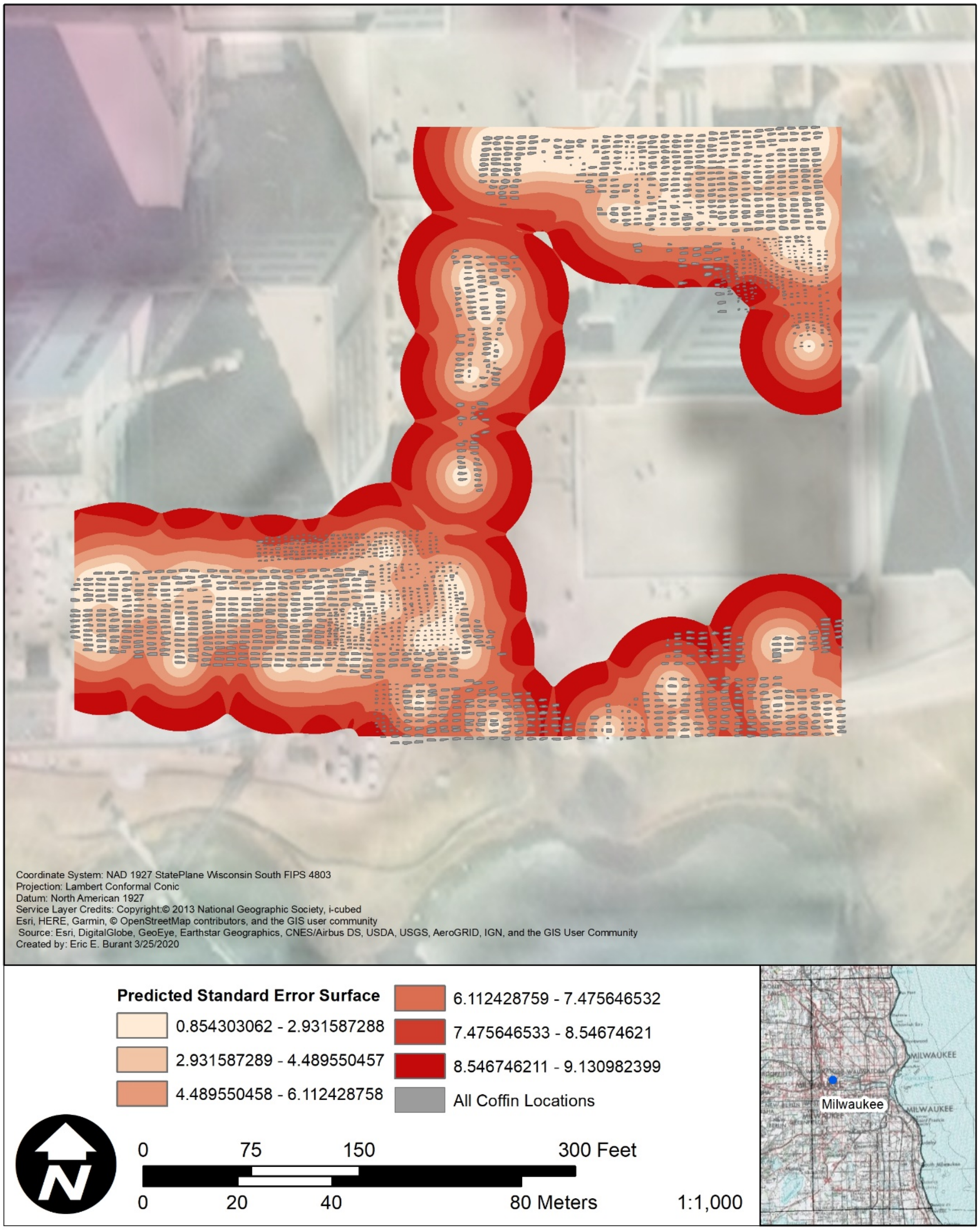

Figure 4.30: Predicted standard error surface for interpolated date surface

In order to assign a date to all coffin locations using the interpolated surface, the surface model was converted to a raster file with a default output cell size of 0.1 meters. Then the raster value to point feature tool was used to extract the interpolated dates from the point shapefile created for all coffin center points. The total number of points were separated by date range. A total of 2,136 (98.4%) coffin locations were suitable for interpolation. These coffin locations are sorted by date range in Table 4.9.

Table 4.9: Coffin count by interpolated date range

Date Range	Total Number of Coffins (%)
>1860	60 (2.8%)
1860-1870	77 (3.6%)
1870-1880	497 (23.2%)
1880-1890	480 (22.4%)
1890-1900	278 (13.1%)
1900-1910	236 (11.1%)
1910-1920	250 (11.7%)
>1920	208 (9.7%)

CHAPTER FIVE: DISCUSSION AND CONCLUSIONS

Summary

The purpose of this thesis is to produce a spatial analysis that uses temporally significant material culture types and positively identified burials to deduce temporality and land use patterns across the MCPFC. A comparative analysis was conducted using the temporal data developed by Kubicek and Richards (2017). In turn, this study provides a GIS model and external database designed to facilitate future research of the MCPFC. Previous research identified two distinct material culture classes; grave goods and grave inclusions. These two broad categories support the interpretation of four potential burial classes (Richards 2016:100). While these artifact associations adequately examine the relationship between material culture and respective burial class, it does not necessarily represent a broad temporal patterning of material culture within a spatial context.

Accordingly, this present research utilized spatial analysis techniques to identify and examine temporal organization to provide a more accurate and complete spatial understanding of the construction and site use at the MCPFC. Spatial patterns in the distribution of temporally diagnostic material culture such as coins, jars or containers, footwear, and positively identified individuals are used to refine temporally significant patterns across the cemetery.

This study demonstrates that with a methodologically tested spatial analysis, a researcher should be able to explore the temporal organization interpretations of the MCPFC. The analyses performed in this study were selected to achieve the project goals. A reevaluation of select artifact types provided a reference timeframe for the earliest date of burial. The experimental burial date interpolation allowed for a refined examination of the MCPFC burials through time.

The kriging technique was undertaken in attempt to assign unknown date values that were missing from the remaining burials. While not exact, the interpolation is suggestive of spatial trends that support the current understandings of temporal organization at the MCPFC. A discussion of the results of this analysis compared to the current interpretations of site use and temporal organization follows below.

Discussion and Conclusions

Coffin Handle Distribution Comparison

The results of the burial date interpolation suggest the possibility of refining the coffin handle dates. When the interpolated surface and identified coffin handle date ranges are displayed together, similar spatial patterns emerge (Figure 5.1). Many of the coffin handle date distributions are contemporaneous, or within an appropriate margin of error, of the interpolated date average for all coffin lots that occur within these established coffin handle date ranges (Table 5.1). The averaged interpolated date for each coffin handle type was calculated by isolating each coffin handle type polygon then selecting all the coffin center points, extracted from the interpolated date results in chapter four, within the coffin handle type polygon. An average for all points with associated interpolated dates for each handle type was calculated. This mean average was compared to the coffin handle date ranges established by Kubicek and Richards (2017). Five of the known handle date ranges are concurrent, or are within six years, of the interpolative date averages. This is shown in coffin handle types II, III, VII, VIII, and XII. These results reinforce the reliability of the coffin handle dates for these types.

Some the coffin handle distribution results remain tentative. Unknown temporal references to handle types limit the understanding of the cemetery organization and use patterns.

This is particularly evident in Type I handles which are the most common. The burial date interpolation for these coffin handle types suggest that Type I have a date range beginning in 1882 at the beginning of cemetery use. This early use date is supported by the fact that these handles types are only observed within the original section of the cemetery, identified as Area I (Richards 1997:106). The Type V interpolated date average is 1876, prior to cemetery use. The distribution of Type V handles is concentrated in the southern portion of the cemetery. The early interpolated average may be a result of an overestimation in interpolated dates. Type V handles overlap with Types IV and VI. Types IV and VI handles have associated dates that begin after the cemetery was closed. These types are not particularly useful in identifying temporally distinct areas, due to the resulting overlap of unknown handle types and further the ambiguity of Type V.

Coffin handle types IV and VI share a significant gap in date ranges compared to the interpolated date averages. This inconsistency is problematic. Type IV has a suspected date range between 1920-1956 and an interpolated date of 1877. Type VI handles have assumed range between 1948-1956 and an interpolated date estimate of 1874. These handle types are spatially restricted to the southern cemetery limits, identified as Areas III and VII (Richards 1997:115). Although these handle types have the latest dates and include ranges that postdate the official closing of the cemetery, it is assumed that the southern portion of the cemetery dates slightly earlier than the northern portion, based on the association with Type I and II handles (Kubicek and Richards 2017). It is unlikely that burial occurred within the MCPFC after 1925.

Type IV and VI handle dates must be refined if they are to be included in the spatial identification of cemetery organization. In this instance, the method of coffin handle identification using historic catalogs was not useful. It is likely that these handle types reflect a much earlier date then previously understood. These handles resemble the later types identified in the manufacturer catalogs. Type IV handles (Figure 4.15) are similar to Type V handles (Figure 4.16) and Type VI handles (Figure 4.17) are similar to Type VII handles (Figure 4.18) in style of construction. Both Types vary from their similar counterparts in respect to number of nails that attach the plate and the size of the plate. This discrepancy may account for a difference in manufacturing source, such that Type IV and VI handles were non-locally produced. Although, the similarities between the handle types may suggest that these coffin handle styles were produced during coincident time periods. It is also of note that Type IV and VI coffin handle are spatially associated with Type V handles. This may also reinforce their contemporary use within the cemetery.

The coffin handle analysis performed by Kubicek and Richards (2017) also analyzed the relationship between coffin handle type and burial category. It was concluded that a homogeneous burial program was reflected in the use of Type I and Type II handles. This study did not attempt to answer questions regarding the classification of burial class within the population.

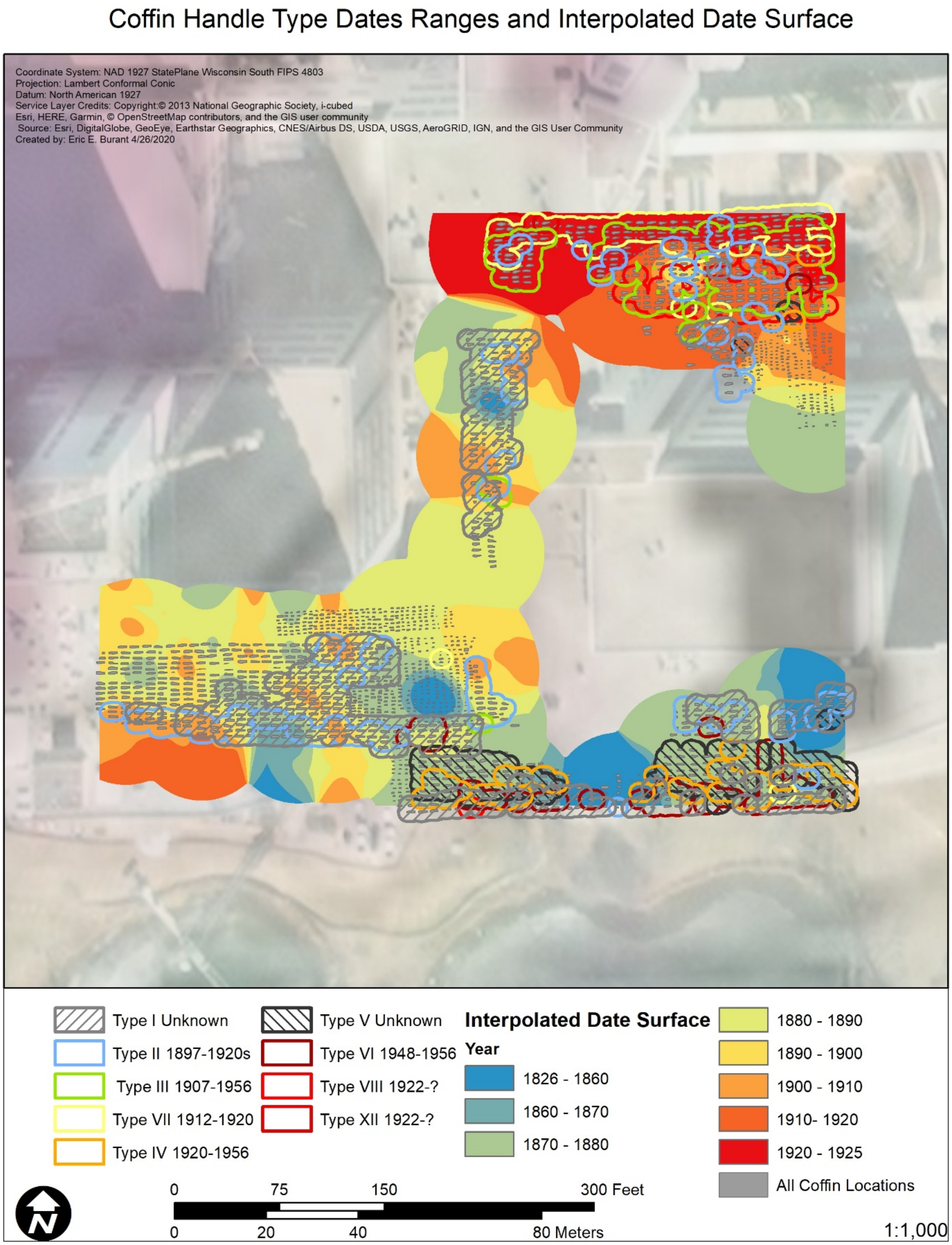

Figure 5.1: Coffin handle type dates and interpolated dates

Table 5.1: Coffin handle type vs. interpolated date average

Coffin Handle Type	Coffin Handle Date Range	Interpolated Date Average
Type I	Unknown	1882
Type II	1897-1920s	1894
Type III	1907-1956	1916
Type IV	1920-1956	1877
Type V	Unknown	1876
Type VI	1948-1956	1874
Type VII	1912-1920	1919
Type VIII	1922-?	1914
Type XII	1922-?	1924

Burial Date Interpolation and Spatial Organization

The proposed spatial organization of the MCPFC was outlined by Richards (1997) with reference to material culture, burial demographics, and individual death and burial records. Her interpretation designated Area I as the earliest portion of the cemetery with a use-life extending from 1882 to 1900. Areas II and III were suggested to be used contemporaneously sometime after 1915. Both areas IV and V were thought to be utilized between 1890 and 1920. Lastly, Areas VI and VII were estimated as in use around 1925. These land use and temporal interpretations are illustrated in Figure 5.2 and Figure 5.3.

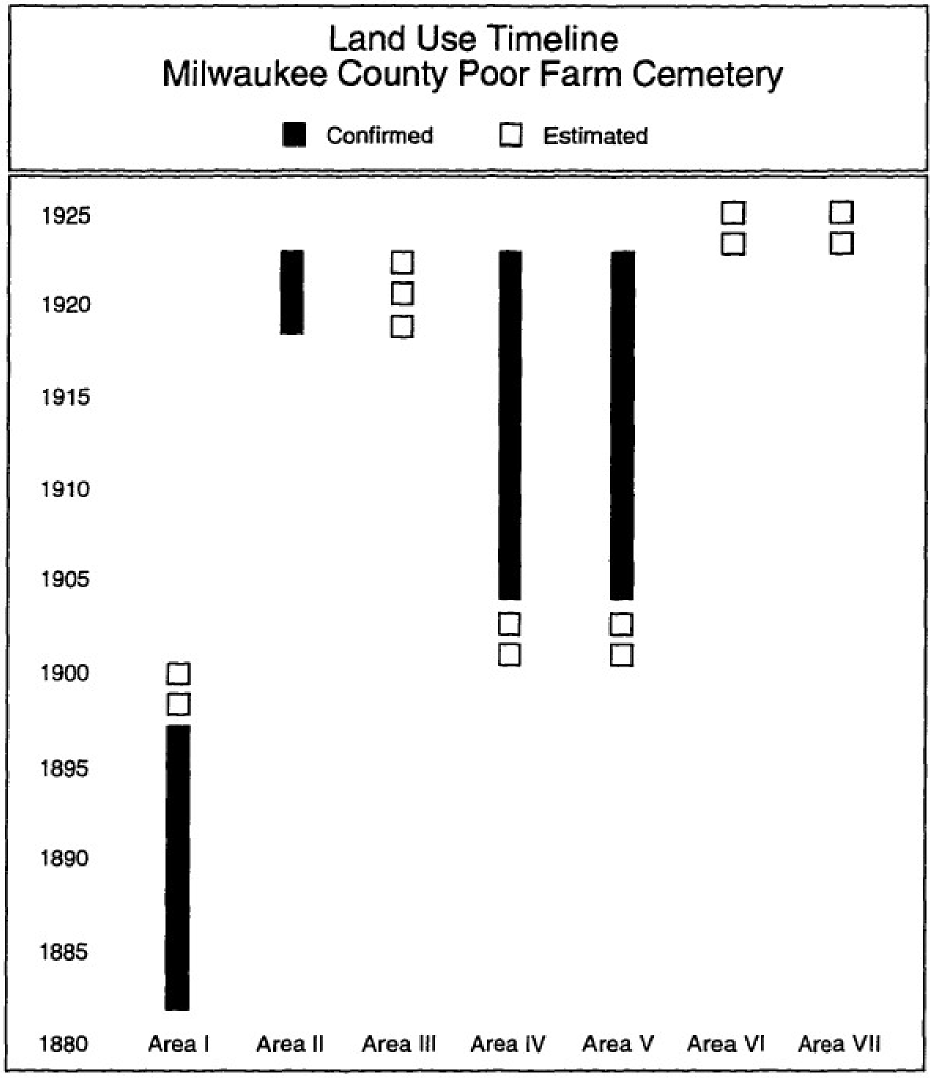

Figure 5.2: Illustration of cemetery land use timeline. Reproduced with permission from Richards (1997:108)

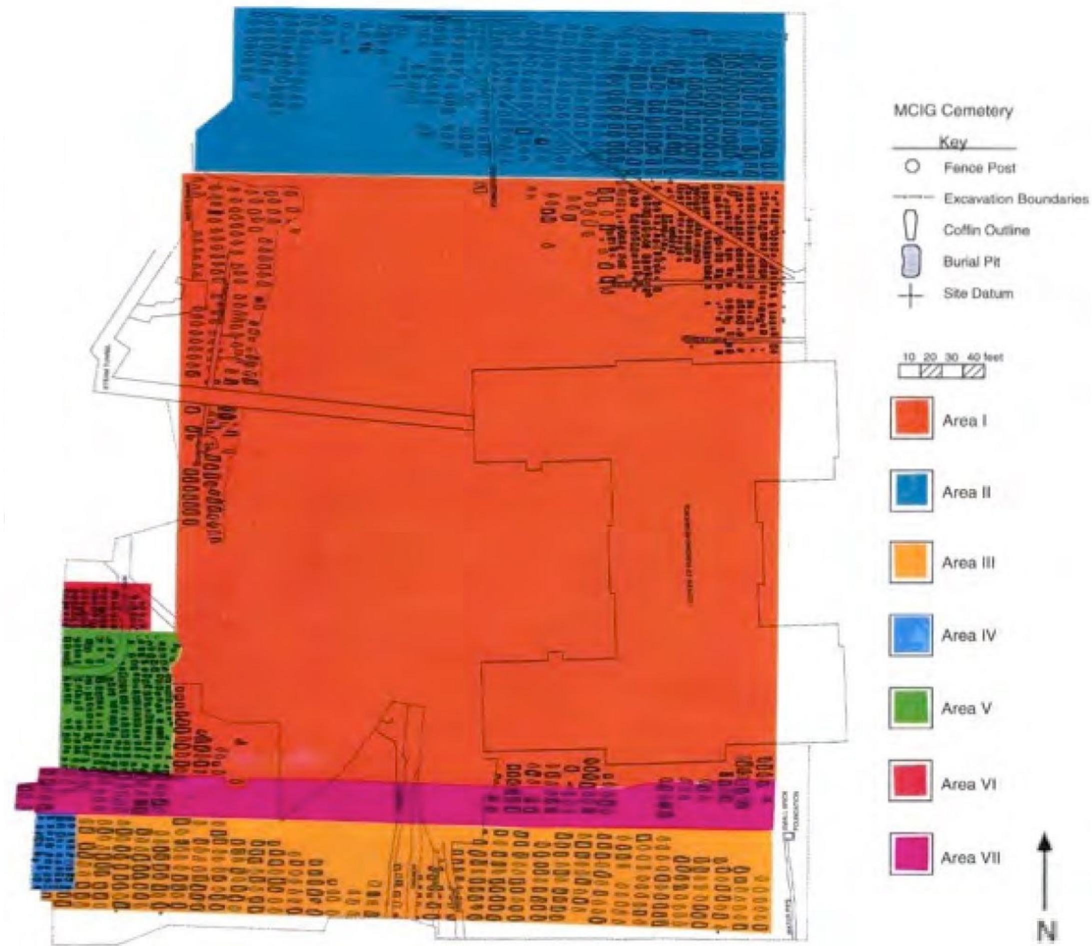

Figure 5.3: Illustration of cemetery land use pattern. Reproduced with permission from Richards (2016:88)

Research following the 2013 excavations reassessed the interpretation of the temporal organization of the MCPFC. In this reassessment the initial backwards "L" configuration is viewed as a spatially discrete section, used in succession from east to west, prior to the development of Area II. The L-shaped configuration includes Areas I, V, VII, and all burials recovered during the 2013 excavations. Areas III and VI are separated by a five-foot buffer from other areas of the cemetery and are thus considered spatially distinct. Coffin handle types recovered in these areas suggest they were utilized later in time, although, the temporal relationship to Area II is unknown (Richards 2016:89).

The results of the kriging interpolative surface models utilizing three separate artifact types, and all joined temporal data with the archaeological coffin handle spatial data recognize four distinct areas of use (Figure 5.4). Area A coincide with the L-shaped configuration, which was most likely the original cemetery and used the earliest. This area is associated with the distribution of Type I handles. The interpolated surface appears to display the earliest grave locations to the east. Interpolated dates increase progressively towards the western limits of the cemetery between 1882 and 1915. The model suggests that burials were interred from the south-southwest to the north and then east to west in the original portion of the cemetery. This pattern mimics the presumed east-west interment practice of the original demarcated cemetery but does not follow the presumed initial north to south placement of burials.

Area B is identical to Area II designated by Richards (1997; 2016) where the latest dates appear at the north end of the cemetery utilized after 1915. Area B is dominated by coffin handle types III, VII, and VIII. Area B was most likely utilized after all other portions of the cemetery were filled. The temporal patterns of the interpolative model confirm the long-established historical documentation of this area.

Area C includes both Area III and IV identified by Richards (1997; 2016). The organization of Area C (Figure 5.5) remains problematic. This portion of the cemetery is associated with some of the earliest dates based on the interpolated surface, but associated coffin handle types suggest a period of use between 1882-1920. Seven different coffin handle types were observed within Area C. These include handle types I, II, IV, V, VI, VII, and VIII. The date ranges assigned to these types span the entire active period (and beyond) of burial in the cemetery. Area C is dominated by Type V handles, which have an interpolated date of 1876. Only coffin lots with handle types I, IV, and V were observed to contain temporally diagnostic material culture. These associated artifact TPQ dates cover a 10-year duration between 1870 and 1880. The discrepancy between the interpolated dates and the coffin handle date ranges may be a result of an over representation of early types footwear that were observed in this area. A conservative interpretation based on wide ranging coffin handle dates and overlapping coffin handle types associated with early interpolated dates for this area may represent a period of occupation contemporary to, or shortly after, use in Area A and before beginning use in Areas B or D. Although, it would not be unlikely to encounter instances of grave shaft or coffin reuse where later coffin handle types are observed in what is presumed an earlier land use area. The challenge to secure a finite chronological reference in Area C may be explained by other variables that is not that is not bound to artifact typology or variation within artifact classes within this study. These variables may include a combination of date of interment, burial classification, or institutional origin. Additional artifact analyses and bioarchaeological identifications are needed to assist in refining these distinctions.

Area D which includes Area VI and the juvenile burials recovered during the 2013 excavations is a spatially distinct area recognized by juvenile interments. This area also displayed discrepancies between the interpolated model and presumed use dates. Based on a burial number tag and associated historical documentation Area D is suggested as the most recently utilized portion of the cemetery and was possibly in use as late as 1925 (Richards 1997:115). However, the interpolated dates for this area suggest a range of 1880 to 1910. The deviation between the dates is most likely a result of the underrepresentation of temporally diagnostic artifacts. No temporally diagnostic artifact types or coffin handles were recovered from this area.

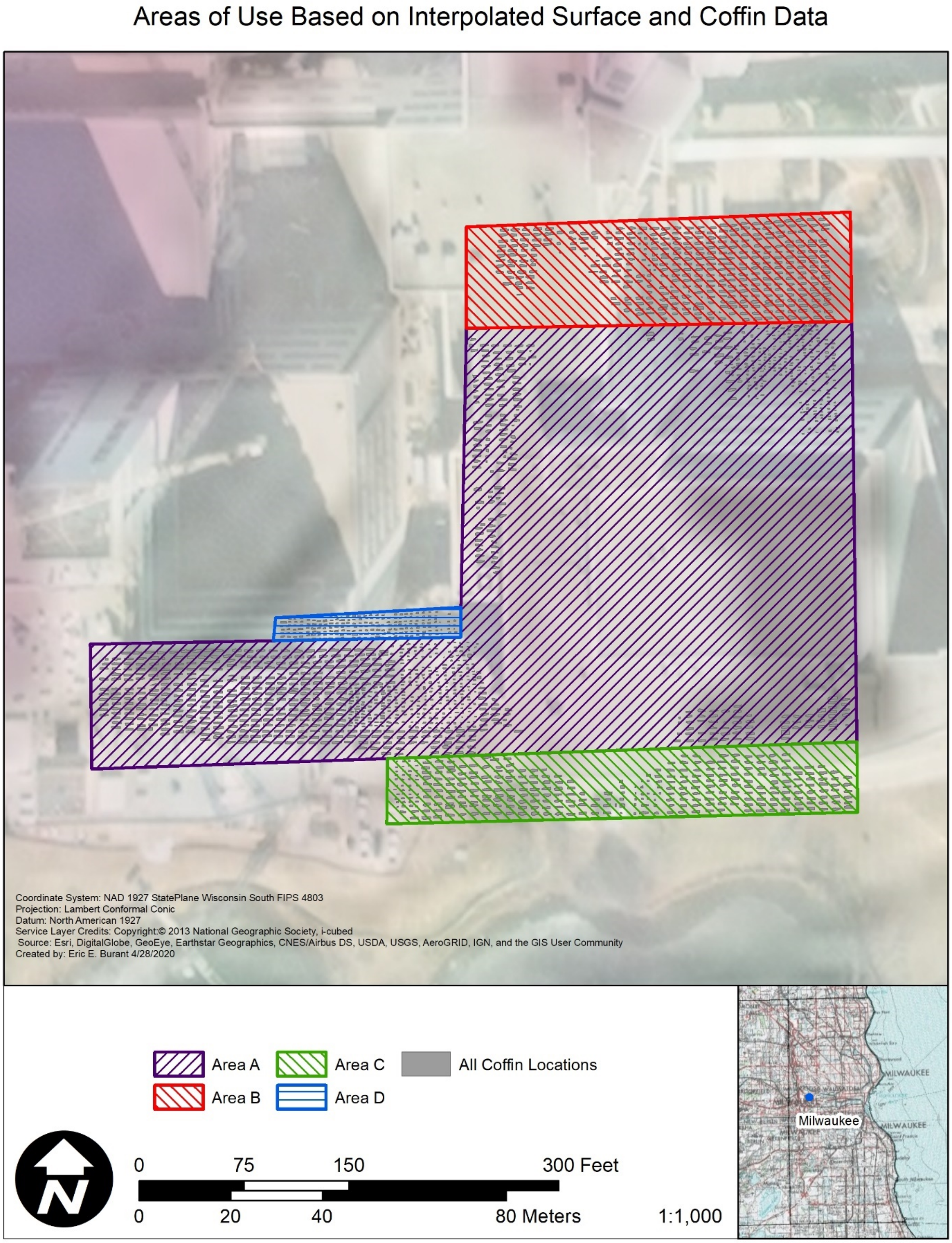

Figure 5.4: Areas of use based on interpolated surface and coffin data

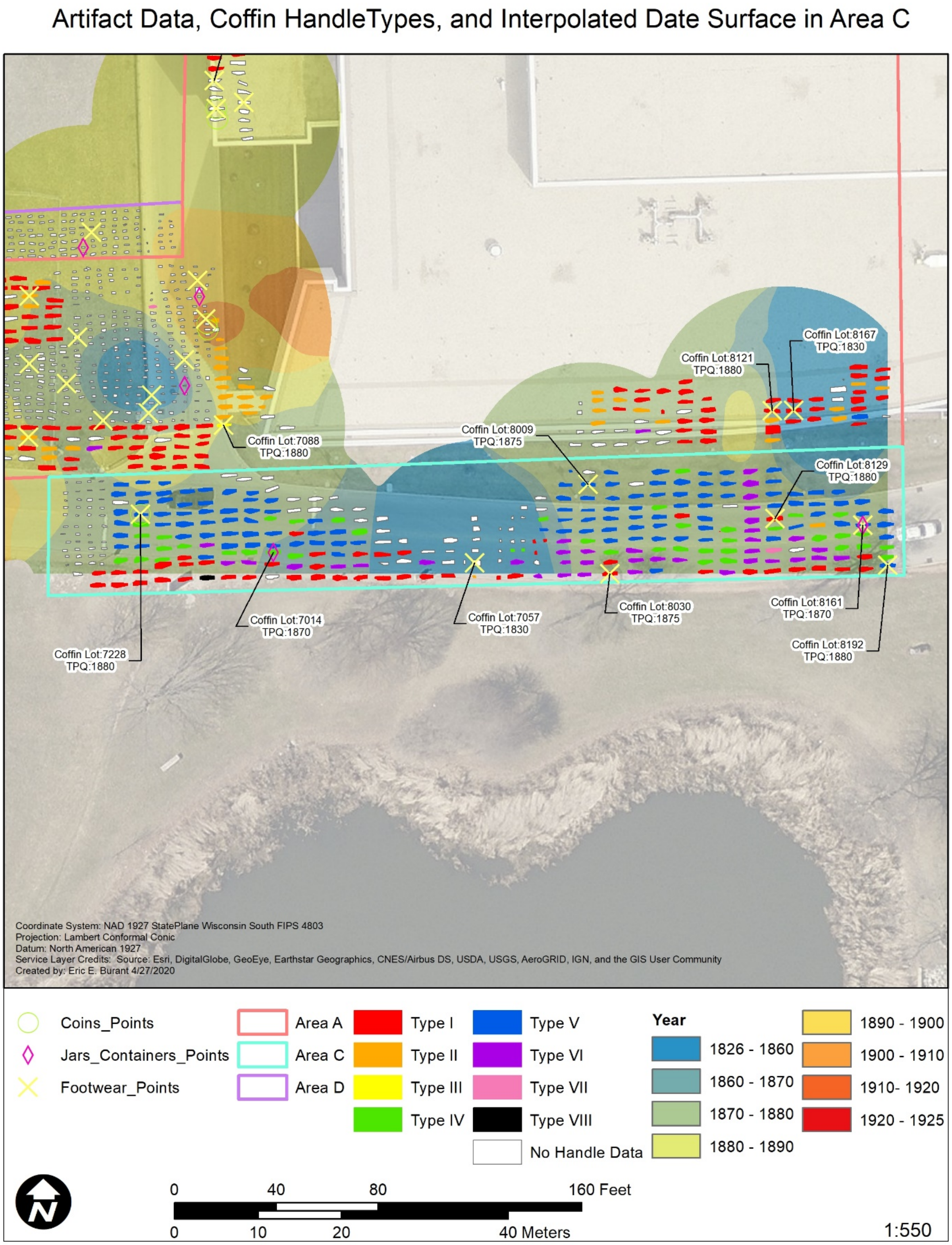

Figure 5.5: Interpolated surface, coffin handle data, and artifact data in Area C

The interpolative model also provides insight into the estimated remaining extant portion of the MCPFC, located under Doyne Avenue (Figure 5.6). The remnant cemetery is estimated at 0.292 acres in size and conservative calculations based on recognized burial spacing and density estimate the possibility of 382 to 1,165 intact burials (Richards 2016:86). The burial date interpolation for this portion of the cemetery is inconclusive, but it can be assumed, based on the average date of interpolation, the area may have been in use circa 1896 and after.

Burial Interpolation Dates for the Remnant Portion of the MCPFC

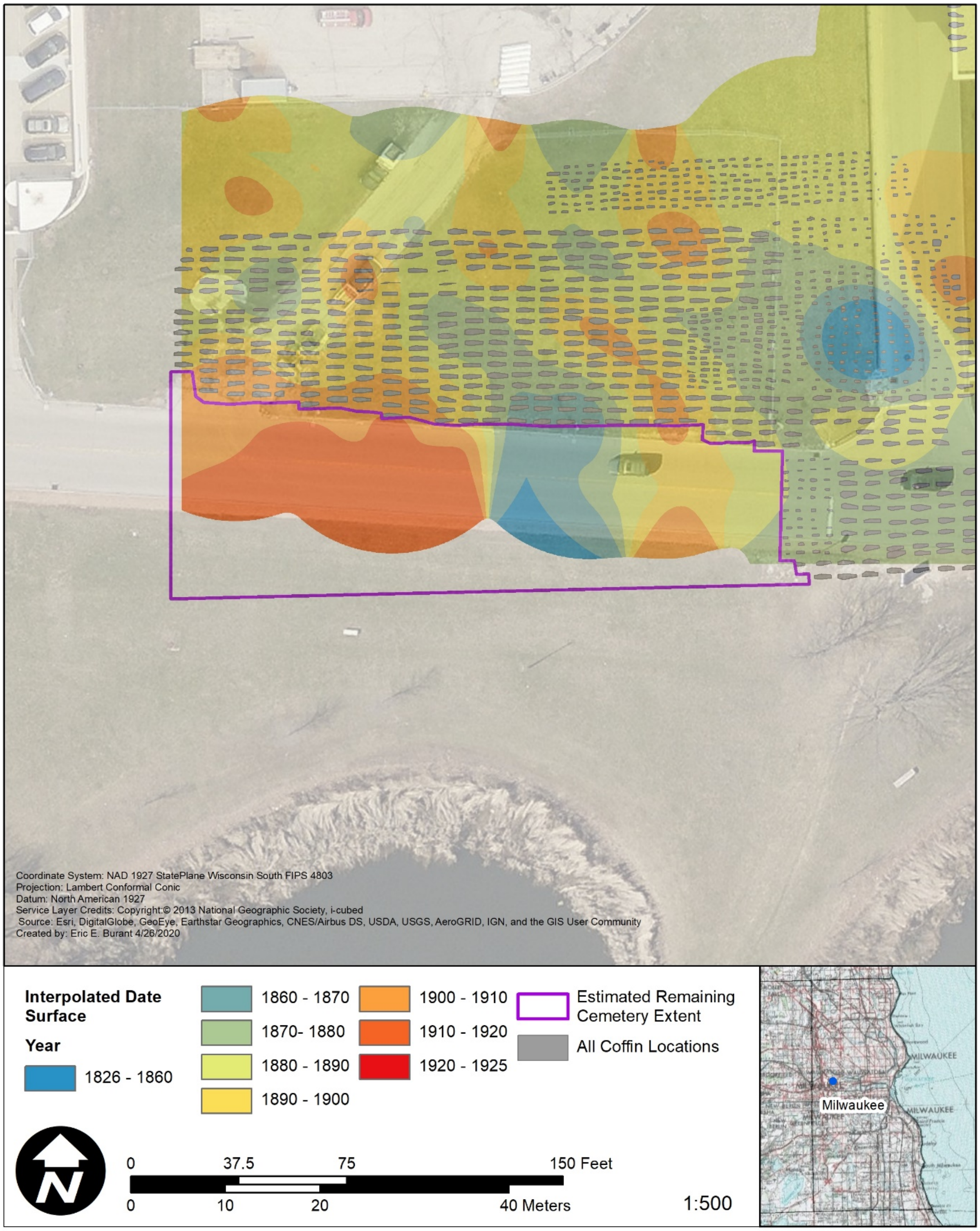

Figure 5.6: Burial interpolation dates for the remnant portion of the MCPFC

This study attempted to refine the current understanding of the broad spatial patterns in selected material culture types associated with the interments at the MCPFC. This research asked three questions. The results allowed the following conclusion to be drawn:

1) Are artifact types indicative of temporal or chronological site use patterns?

The artifacts selected for this study were based on their ability to contain temporally significant information. While these types were able to produce an estimation of the earliest possible burial date, each artifact type category is shown to have a presumably random distribution. Individual types such as coins, jars, and footwear do not adhere to a positive spatial autocorrelation and are not necessarily indicative of the larger temporal or chronological site use patterns. Further spatial analyses are needed to effectively demonstrate burial clustering for individual chronological interment.

2) Is the spatial distribution of artifacts temporally significant?

The individual artifact interpolative surface models do represent the broad spatial patterning of temporality. These three models conform largely to a pattern of interment that closely resembles the presumed land use patterns. The temporal chronology of burials within the MCPFC follows an east to west direction from earliest to latest as seen in Area A. The latest internments occurred in Area B. The historical documentation in this area is supported by temporal reference of artifact types recovered from Area B.

3) Can spatial patterns of material culture predict burials without temporal reference?

The interpolative models are not necessarily useful for predicting burials that do not have temporal reference. Although, broad temporal pattering may be gleaned from the models, more localized coffin clusters will need to be subjected to close examination of artifact and osteological data to determine temporal significance of individual burials and neighboring burial clusters. This is particularly evident in Area C. Area C contained artifact types with early date references and a variety of coffin handle types with unknown or wide-ranging date associations. The temporal discrepancies recognized here limit the level of confidence that the interpolative model has for individual burial prediction.

Limitations of Study and Future Research

While the burial date interpolation method proved successful in providing more temporally significant spatial data some limitations occurred. Material culture studies, like much of archaeology, rely on secondary sources for historic artifact seriation. Some of which contain factual errors which are perpetuated within the literature. TPQ dates and date ranges given to artifact types were estimations based solely on artifact morphology. The reuse and repurposing of temporally diagnostic artifacts by the individuals interred within the cemetery and those at the county institutions is probable. This may inadvertently assign a date of burial earlier than intended, so the designated burial dates may not be as accurate as expected. Occasional reuse or repurposing of artifacts may include footwear used by the population interred within the cemetery and glass vessels (Jars/Containers) used by those who work or study within an institutional setting on the county grounds.

The interpolative models produced in this study are only estimations of the most temporality significant data. These models, like the coffin handle ranges, convey estimated date ranges that do not fall within the active years of the cemetery. The cemetery was only active for a relatively narrow window of time spanning forty-three years. The years that date prior to cemetery use in the interpolated model are reflected by earlier dated artifact types that may be overrepresented in the interpolation, such as footwear. The average TPQ date for all artifacts within the footwear category was 1875. Stylistic changes in footwear manufacture was minimal during the active years of interment at the cemetery. The wide date ranges applied to footwear morphological styles effects these date discrepancies. Thus, as researchers we must be critical of the interpretations applied to artifact temporality.

Potential applications of this GIS at the MCPFC includes the incorporation of multimedia data into the GIS digital format. The use of hyperlink can be applied to all coffin polygons. This would allow a researcher to access photographs, burial descriptions, individual biographies, historical and ancillary data within the GIS software. Additional research focused on the analysis of spatial autocorrelation of larger material culture categories, such as medical waste or clothing and personal items, may provide more in-depth interpretations of burial categories and individual identification. Interment date alone does not distinguish burial class or category.

This study introduced some of the technical and methodological issues that must be considered in the creation of a historical cemetery GIS database. GIS represents a powerful tool for analytic study of spatial relationships and phenomena. When GIS is used most simply as a visualization tool it allows for the visual analysis of the spatial distributions of burial attributes. Creating a GIS database template is necessary for consistency in the documentation of historic cemeteries in the fields of cultural resource management or academic research. With geospatial technologies rapidly changing and the increasing accessibility to archival data the need for a robust database design is needed. The development of a well-designed GIS for the MCPFC will aid in the preservation of spatial, material culture, osteological, and historical information and its subsequent research and analysis. A GIS has the potential for standardizing entry, query, and analysis of related cemetery data. This GIS is designed to include temporally diagnostic details that related to the interred individuals at the MCPFC. The flexibility of the GIS is of utmost value. The construction of this GIS considered flexibility and extensibility with the capability to incorporate and integrate additional bioarchaeological and osteological data. With advances in the knowledge of the interred individuals at the MCPFC new forms of data and new historical information is collected, therefore this GIS is intended to become an active archive of data concerning the MCPFC.

REFERENCES CITED

Aldenderfer, Mark

1996 Introduction. In *Anthropology, Space, and Geographic Information Systems*, edited by Mark Aldenderfer and D. G. Herbert, pp. 3-18. Oxford University Press, New York, New York.

1992 The State of GIS and Anthropological Research. *Anthropological Newsletter* 3:14.

Alderman, Derek and Owen J. Dwyer

2004 Putting Memory in Its Place: The Politics of Commemoration in the American South. In *World Minds: Geographical Perspectives on 100 Problems*, edited by D. Janelle, B. Warf and K. Hansen. Springer, London.

Anderson, Adrienne

1968 The Archaeology of Mass-Produced Footwear. *Historical Archaeology* 2:56-65.

Anthony, Alexander W.

2019 *Less Than Human: A Study of the Institutional Origins of the Medical Waste Recovered at the Milwaukee Poor Farm Cemetery*. Master's Thesis, Department of Anthropology, The University of Wisconsin-Milwaukee, Wisconsin.

2015 *The 1912 Grave Desecration of the Milwaukee County Intuition Grounds Poor Farm's Cemetery*. Paper presented at the 80th Annual Meeting of the Society for American Archaeology, San Francisco, CA.

Avella, Steven M.

1987 Health, Hospitals, and Welfare: Human Services in Milwaukee County. In T*rading Post to Metropolis: Milwaukee County's First 150 Years*, edited by Ralph M. Aderman, pp. 196- 254. Milwaukee County Historical Society, Milwaukee, Wisconsin.

Ballas, Dimitris, Graham Clarke, Rachel S. Franklin, and Andy Newing

2018 *GIS and the Social Sciences: Theory and Applications*. Routledge, New York.

Boonstra, Onno

2009 Barriers between Historical GIS and Historical Scholarship. *Journal of Humanities and Arts Computing* 3(1-2):3-7.

Burant, Eric E.

2017 *Paper Tiger: Historic Newspaper Text from the Milwaukee County Poor Farm Cemetery Material Culture Collection*. Paper presented at the 50th Annual Meeting of the Society for Historic Archaeology, Fort Worth, TX

2015 *What's in a Grave?: A Preliminary Analysis of Material Culture from the Milwaukee County Institution Grounds Cemetery.* Paper presented at the 80th Annual Meeting of the Society for American Archaeology, San Francisco, CA.

Chang, Kang-tsung

2014 *Introduction to Geographic Information Systems*. 7th ed. McGraw-Hill, New York.

Charles. Brennan E., Eric E. Burant, and Patricia B. Richards

2017 *Limbus Infantum: Shrouds, Safety Pins, and the Materiality of Personhood in Juvenile Burials at the Milwaukee County Poor Farm Cemetery*. Paper presented at the 51st Annual Meeting of the Society for Historic Archaeology, New Orleans, LA.

Charles, B

2019 *"Buried…Like a Human Being" at the Milwaukee County Poor Farm Cemetery: A Bioarchaeological Approach to Defining Fetal and Infant Personhood Through Biological Development, Historical Discourse, and Diapering*. Doctoral dissertation, Department of Anthropology, The University of Wisconsin-Milwaukee, Wisconsin.

Conolly, James and Mark Lake

2006 *Geographical Information Systems in Archaeology*. Cambridge University Press, Cambridge.

Creswick, Alice M.

1987 *The Fruit Jar Works Vol. 1*. Privately Published, Grand Rapids, MI.

Cruz Berrocal, Maria, Maria Sebastian Lopez, Antonio Uriante Gonzales, and Jose Antonio Lopez-Saez

2014 Landscape Construction and Long-Term Economic Practices: An Example from the Spanish Mediterranean Uplands Trough Rock Art Archaeology. *Journal of Archaeological Method and Theory* 21(3):589-615.

Dappert-Coonrod, Claire P. and Martha Mihich

2018 Walking in Their Shoes: A Late Victorian Shoe Assemblage from the New Mississippi River Bridge Project in East St. Louis. *Historical Archaeology* 52:643-665.

DeBats, Donald A. and Ian N. Gregory

2011 Introduction to Historical GIS and the Study of Urban History. *Social Science History* 35(4):455-463.

Delle, James A., James Boyle. And Thomas W. Cuddy

2003 Introduction to the Finger Lakes National Forest Archaeology Project. *Northeast Historical Archaeology* 32:1-18.

Drew, Brooke L.

2018 *Death in Anonymity: Population Dynamics and the Individual Within the Milwaukee County Poor Farm Cemetery, 1882-1925*. Doctoral dissertation, Department of Anthropology, The University of Wisconsin-Milwaukee, Wisconsin.

Epstein, Emily M., Brianne E. Charles, Brooke L. Drew

2015 *Neonatal Line Assessment among Milwaukee County Institution Grounds (MCIG) Perinates to Determine Viability*. Paper presented at the 80th Annual Meeting of the Society for American Archaeology, San Francisco, CA.

Freire, Shannon K.

2017 *A Public Humanity: the Application of Isotopic Analysis to the Intersection Between Body and Law at the Milwaukee County Poor Farm Cemetery*. Doctoral dissertation, Department of Anthropology, The University of Wisconsin-Milwaukee, Wisconsin.

González-Tennant, Edward

2016 Recent Directions and Future Developments in Geographic Information Systems for Historical Archaeology. *Historical Archaeology* 50(3):24-49.

Goldstein, Lynne

1981 One-dimensional Archaeology and Multi-dimensional People: Spatial Organization and Mortuary Analysis. In *The Archaeology of Death*, edited by R. Chapman, I. Kinnes, and K. Randsburg, pp. 53-69. Cambridge University Press, New York.

Harvey, David

1969 *Explanation in Geography*. London, Edward Arnold.

Heywood, Ian D., Sarah Cornelius, and Steve Carver

2011 *An Introduction to Geographical Information Systems*. Pearson Education Limited, United Kingdom.

Hudgeons, Marc, Tom Hudgeons Sr. and Tom Hudgeons Jr.

2009 The Official 2009 Blackbook Price Guide to United States Coins. 47th ed. Random House, New York.

Jones, Catherine R.

2010 *Hope Dies Last: Applying Energy Dispersive X-Ray Fluorescence Spectroscopy to the Elemental Analysis of Human Bone*. Master's Thesis, Department of Anthropology, The University of Wisconsin-Milwaukee, Wisconsin.

Jones, Christopher

1997 *Geographical Information Systems and Computer Cartography*. Harlow, Longman.

Klingman-Cole, Sarah.

2015 *Land Use Analysis of the Milwaukee County Institutional Grounds: a Chronological and Spatial Depiction of Cultural Change*. Master's Thesis, Department of Anthropology, The University of Wisconsin-Milwaukee, Wisconsin.

Kniffen, Fred.

1967 Necrogeography in the United States. *Geographical Review* 57:426-427.

Kubicek, Richard H. and Patricia B. Richards

2017 *$1.87 Each, Four Feet Long and Over; $0.87 Each, Less than Four Feet: A Spatial Analysis of Coffin Type and Coffin Hardware from the Milwaukee County Poor Farm Cemetery*. Poster presented at the 82nd Annual Meeting of the Society for American Archaeology, Vancouver, British Columbia, Canada.

Kvamme, Kenneth

1999 Recent Direction and Development in Geographical Information Systems. *Journal of Archaeological Research* 7(2):153-202.

Quirk, Laura and Matthew

2012 If the Shoe Fits: Analysis of Ninetieth-Century Shoes. *KEWA* 11(4-6):27-32. London Chapter of the Ontario Society.

Lindsey, Bill

2020 Historic Glass Bottle Identification and Information Website. Electronic document, https://sha.org/bottle/index.htm, accessed February 5, 2020. United States Department of the Interior Bureau of Land Management.

Lockhart, Bill

2015 A Tour Through Time in Vaseline Jars. Electronic document, https://sha.org/bottle/pdffiles/Vaseline2015.pdf, a accessed February 5, 2020. Society for Historical Archaeology.

2007 The Origins and Life of the Export Beer Bottle. Bottles and Extras 18(3):49-58.

Lockhart, Bill, Beau Shriever, Bill Lindsey, and Carol Serr

2017 Keystone Mason Jars, Part I: John Landis Mason and His Companies. Electronic document, http://bottleinfo.historicbottles.com/pdffiles/MasonKeystone1.pdf, accessed February 5, 2020. Society for Historical Archaeology.

2017 Keystone Mason Jars, Part II: Mason Fruit Jar Co. and Keystone Users. Electronic document, http://bottleinfo.historicbottles.com/pdffiles/MasonKeystone2.pdf, accessed February 5, 2020. Society for Historical Archaeology.

2015 The DGCO Logos and the Glass Houses that Used Them. Electronic document, https://sha.org/bottle/pdffiles/DGCo.pdf, accessed February 5, 2020. Society for Historical Archaeology.

2014 Consolidated Fruit Jar Co. Electronic document, https://sha.org/bottle/pdffiles/ConsolidatedFruitJar.pdf, accessed February 5, 2020. Society for Historical Archaeology.

Lockhart, Bill, Pete Schulz, Beau Schriever, Carol Serr, and Bill Lindsey

2014 Chicago Glass Mfg. Co. Electronic document, https://sha.org/bottle/pdffiles/ChicagoGlassMfg.pdf, accessed February 5, 2020. Society for Historical Archaeology.

Milwaukee County Institute Administration

N.D. *Milwaukee County Asylum.* Original in Possession of Milwaukee County Historical Society.

Overstreet, David F., and Keith Sverdrup

1992 Archaeological and Remote Sensing Investigations at the Froedtert Hospital Tract, Milwaukee County Medical Complex. Great Lakes Archaeological Research Center, Inc. Report of Investigations No. 310. Milwaukee, Wisconsin.

Proceedings of the Board of Supervisors of the County of Milwaukee

1852 Manuscript on file, Milwaukee County Historical Society, Milwaukee, Wisconsin.

1878 Manuscript on file, Milwaukee County Historical Society, Milwaukee, Wisconsin.

Richards, Patricia B., Catherine R. Jones, Emily Mueller Epstein, Nicholas W. Richards, Brooke L. Drew, and Thomas J. Zych

2017 "You Couldn't Identify Your Grandmother if She Were in that Party": The Bioarchaeology of Postmortem Investigation at the Milwaukee County Poor Farm

Cemetery. In *The Bioarchaeology of Dissection and Autopsy in the United States*, edited by Kenneth C. Nystrom, pp. 237-257. Springer, New York.

Richards, Patricia B., Catherine R. Jones, Eric E. Burant, and Richard H. Kubicek

2017 *Clothing, if not called for within 30 days will be disposed of: The Material Culture of Death Forgotten at the Milwaukee County Poor Farm Cemetery*. Paper presented at the 51st Annual Meeting of the Society for Historic Archaeology, New Orleans, LA.

Richards, Patricia B. and John D. Richards

2001 Archaeological Investigations of Milwaukee Metropolitan Sewerage District Development Areas, Milwaukee County Grounds, Wauwatosa, Wisconsin. University of Wisconsin-Milwaukee, Report of Investigation No. 146. Milwaukee, Wisconsin.

Richards, Patricia B. and Matthias W. Kastell

1993 *Archaeological Excavations at the Almshouse Burial Ground, Milwaukee County Poorhouse Wauwatosa, Wisconsin*. GLARC Report of Investigation No. 333. Milwaukee, WI.

Richards, Patricia B.

2016 *Nine for Mortal Men Doomed to Die: The Archaeology and Osteology of the 2013 Milwaukee County Poor Farm Cemetery Project (Froedtert Tract – 47 MI 0527)*. University of Wisconsin- Milwaukee Cultural Resource Management Services, Report of Investigation No. 381. Milwaukee, Wisconsin.

2015 *MCIG according to MCIG: historic document research*. Paper presented at the 80th Annual Meeting of the Society for American Archaeology, San Francisco, CA.

2014 *Impotent, Able Bodied, or Idle: Untangling the Poor Buried in the Milwaukee County Poor Farm Cemetery*. Paper Presented at the 20th Annual Meeting of the European Association of Archaeologists, Istanbul, Turkey.

2010 The Milwaukee County Institution Grounds Collection at the University of Wisconsin-Milwaukee. Paper presented at the Society for American Archaeology, St. Louis, MO.

1997 *Unknown Man No. 198: The Archaeology of the Milwaukee County Poor Farm Cemetery*. Doctoral dissertation, Department of Anthropology, The University of Wisconsin-Milwaukee, Wisconsin.

Shekhar, Shashi and Sunjay Chawla

2003 *Spatial Databases: A Tour*. Prentice Hall, Upper Saddle River, New Jersey.

Skinner, Jessica L.

2017 *Like Pulling Teeth: Relationships Between Material Culture And Osteology At The Milwaukee County Poor Farm Cemetery*. Paper presented at the 51st Annual Meeting of the Society for Historic Archaeology, New Orleans, LA.

Steinburg, Steven J. and Sheila L. Steinburg

2006 *Geographical Information Systems for the Social Sciences Investigating Space and Place*. Sage Publications, Inc. Thousand Oaks, California.

Toulouse, Julian H.

1971 *Bottle Makers and their Marks*. Thomas Nelson & Sons, New York.

Tuan, Yi-Fu

1977 *Space and Place: The Perspective of Experience*. Englewood Cliffs, New Jersey. University of Minnesota Press.

Wackernagel, Hans

1995 Ordinary Kriging. In: *Multivariate Geostatistics*. Springer, Berlin, Heidelberg

Whitall, Tatum& Co.

1880 Druggists', Chemists' and Perfumers' Glassware, Philadelphia.

1894 Druggists', Chemists' and Perfumers' Glassware, Philadelphia.

1904 Price List of Laboratory Glassware and Apparatus, Philadelphia.

Wisconsin Historical Preservation Database

2020 Wisconsin Archaeological Site Inventory. Available at https://www.wisahrd.org/ASI/Sites/Primary.aspx?id=15750. Accessed February 25, 2020.

Zumwalt, Betty

1980 Ketchup, Pickles, Sauces - 19th Century Food in Glass. Mark West Publishers, Fulton, CA.

APPENDIX A: COFFIN SHAPEFILE ATTRIBUTE TABLE

OBJECTID*	Coffin Lot#	Burial Lot#	Associated Lot#	Coins	Jar/Container	Footwear	Terminus post quem	Artifact Estimated Date Range	Possible Burial ID Date
685	1003	1003		2		2	1888	1883-1915	
682	1004	1004		10			1882	1859-1909	
684	1008	1008				2			
690	1014	1014				2			
724	2016	2016		1			1905	1892-1916	
770	2025	2025			1		1890	1890-1925	
753	2044	2044			2		1850	1850-1930	
754	2045	2045			1		1870	1850-1930	
736	2058	2058		2	1		1883	1883-1918	
778	2062	2062				2	1875	1875-1925	
758	2068	2068	2091	2	1		1911	1910-1930	
771	2088	2088				2			
205	3033	3033							1923
215	3036	3036							1922
208	3037	3037							1923
207	3038	3038							1923
206	3039	3039							1922
209	3040	3040							1922
214	3041	3041							1922
210	3047	3047							1922
213	3048	3048							1922
204	3054	3054							1923
211	3055	3055							1922
212	3056	3056							1922
198	3060	3060							1923
193	3061	3061							1925
188	3062	3062							1925
189	3063	3063							1925
194	3064	3064							1925
199	3065	3065							1923
200	3066	3066							1924
195	3067	3067							1925

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OBJECTID*	Coffin Lot#	Burial Lot#	Associated Lot#	Coins	Jar/Container	Footwear	Terminus post quem	Artifact Estimated Date Range	Possible Burial ID Date
190	3068	3068							1925
191	3069	3069							1925
196	3070	3070							1925
201	3071	3071							1924
203	3072	3072							1923
202	3073	3073							1924
197	3074	3074							1925
192	3075	3075							1925
253	5001	5001							1918
251	5011	5011							1918
186	5028	5028							1918
88	5033	5033	5183			2	1880	1880-1925	
178	5047	5047							1918
874	5048	5048							1918
176	5055	5055							1918
175	5074	5074							1918
177	5075	5075							1918
252	5079	5079							1918
113	5087	5087		8			1917	1866-1945	
111	5089	5089							1923
110	5090	5090							1924
108	5092	5092							1925
104	5094	5094							1923
118	5095	5095							1924
119	5096	5096							1925
120	5097	5097							1924
105	5098	5098							1924
106	5099	5099							1924
107	5100	5100							1925
99	5101	5101							1925
100	5102	5102							1924
95	5103	5103							1924
94	5104	5104							1923

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OBJECTID*	Coffin Lot#	Burial Lot#	Associated Lot#	Coins	Jar/Container	Footwear	Terminus post quem	Artifact Estimated Date Range	Possible Burial ID Date
93	5105	5105							1923
84	5106	5106							1923
83	5107	5107							1923
96	5108	5108							1924
97	5109	5109							1924
98	5110	5110							1925
800	5111	5111							1925
801	5112	5112				2	1862	1862-1925	1924
82	5113	5113							1924
81	5114	5114							1923
802	5116	5116							1924
66	5118	5118							1923
65	5119	5119							1924
1499	5120	5120							1925
803	5121	5121							1925
804	5122	5122							1924
869	5123	5123							1924
57	5124	5124							1923
58	5125	5125							1923
54	5126	5126							1923
55	5127	5127							1923
56	5128	5128							1924
806	5129	5129							1924
805	5130	5130							1925
807	5131	5131							1925
808	5132	5132							1924
39	5133	5133							1924
41	5135	5135							1923
870	5136	5136							1923
38	5137	5137							1924
810	5138	5138							1924
809	5139	5139							1925
811	5140	5140							1925

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OBJECTID*	Coffin Lot#	Burial Lot#	Associated Lot#	Coins	Jar/Container	Footwear	Terminus post quem	Artifact Estimated Date Range	Possible Burial ID Date
812	5141	5141							1924
871	5142	5142							1924
872	5143	5143							1924
814	5144	5144							1924
813	5145	5145							1925
815	5146	5146							1925
816	5147	5147							1924
873	5148	5148							1924
817	5149	5149							1924
819	5150	5150							1924
820	5151	5151							1925
818	5152	5152							1924
822	5153	5153							1924
821	5154	5154							1925
37	5155	5155							1924
240	5174	5174							1918
237	5178	5178							1918
129	5185	5185							1922
116	5190	5190							1923
117	5191	5191							1923
121	5192	5192							1925
122	5193	5193							1925
123	5194	5194							1924
124	5195	5195							1923
125	5196	5196							1923
130	5206	5206							1923
131	5207	5207							1923
132	5208	5208							1924
133	5209	5209							1925
134	5210	5210							1925
135	5211	5211							1925
902	5212	5212							1925
903	5213	5213							1924

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OBJECTID*	Coffin Lot#	Burial Lot#	Associated Lot#	Coins	Jar/Container	Footwear	Terminus post quem	Artifact Estimated Date Range	Possible Burial ID Date
904	5214	5214							1923
905	5215	5215							1923
906	5216	5216							1922
915	5226	5226							1923
916	5227	5227							1924
918	5229	5229							1925
919	5230	5230							1924
1498	5232	5232							1923
920	5233	5233							1923
921	5234	5234							1923
922	5235	5235							1924
923	5236	5236							1925
924	5237	5237							1925
925	5238	5238							1924
927	5240	5240							1923
928	5243	5243							1925
929	5248	5248							1923
1515	5250	5250							1922
1514	5258	5258							1922
1020	6005	6005			1		1884	1880-1900	
950	6020	6020				1			
1011	6082	6082				2			
1228	6149	6149				2	1875	1875-1925	
568	6151	6151				1	1830	1830-1925	
572	6195	6195			1		1867	1867-1871	
583	6199	6199				1			
1135	6238	6238		1			1905	1859-1909	
1134	6239	6239		4			1905	1859-1909	
1133	6240	6240				1			
1220	6243	6243			1		1896	1896-1900	
1215	6255	6255				2			
1169	7014	7014			1		1870	1870-1910	
1239	7057	7057				2	1830	1830-1925	

APPENDIX A: COFFIN SHAPEFILE ATTRIBUTE TABLE

OBJECTID*	Coffin Lot#	Burial Lot#	Associated Lot#	Coins	Jar/Container	Footwear	Terminus post quem	Artifact Estimated Date Range	Possible Burial ID Date
543	7088	7088				2	1880	1880-1925	
1400	7228	7228		1		2	1880	1859-1909	
1440	8009	8009				2	1875	1875-1925	
1461	8030	8030				2	1875	1875-1925	
1288	8121	8121				2	1880	1880-1912	
1295	8129	8129				1	1880	1880-1925	
1326	8161	8161			1	1	1870	1870-1910	
1332	8167	8167				1	1830	1830-1925	
1346	8192	8192				1	1880	1880-1925	
322	9068	9068			1		1899	1899-1906	
22	9209	9209							1923
7	9210	9210							1923
8	9211	9211							1923
21	9212	9212							1923
23	9213	9213							1923
36	9214	9214							1923
33	9232	9232		1			1913	1909-1959	
30	9253	9253			1				
1038	9279	9279							1918
1039	9280	9280							1918
1040	9281	9281							1918
1041	9282	9282							1918
1042	9283	9283							1918
1043	9284	9284							1918
1044	9285	9285							1918
1045	9286	9286							1918
1046	9287	9287							1918
1047	9288	9288							1918
1048	9289	9289							1918
1049	9290	9290							1918
1050	9291	9291							1918
1119	9341	9341							1918
1114	9346	9346							1918

APPENDIX A: COFFIN SHAPEFILE ATTRIBUTE TABLE

OBJECTID*	Coffin Lot#	Burial Lot#	Associated Lot#	Coins	Jar/Container	Footwear	Terminus post quem	Artifact Estimated Date Range	Possible Burial ID Date
1079	9355	9355				2	1880	1880-1925	1923
1080	9356	9356							1923
1081	9357	9357							1923
1082	9358	9358							1923
1092	9368	9368			1		1890	1890-1930	1918
1093	9369	9369							1918
1094	9370	9370			1		1895	1895-1915	
1099	9378	9378							1918
455	9417	9417			1		1880	1880-1900	
2155	10007	10007				1			
1536	10018	10018				1	1875	1875-1925	
1556	10045	10045				1	1875	1875-1925	
1594	10093	10093				1	1875	1875-1925	
1598	10099	10480		1			1905	1859-1909	
1751	10283	10283				2	1880	1880-1925	
1764	10298	10298		1		2	1906	1875-1925	
1783	10318	10318			2		1860	1860-1880	
1848	10410	10410				1	1912	1912-1925	
1858	10466	10466				2	1912	1912-1925	
1895	10525	10525			1				
1904	10536	10536			1				
1907	10539	10539			1		1870	1870-1910	
1928	10569	10569			1		1890	1890-1910	
2142	10621	10621				2	1880	1880-1912	
1975	10657	10657			1				
1982	10664	10664			3		1875	1875-1915	
1987	10669	10669			5		1910	1910-1930	
1997	10682	10682				2	1875	1875-1925	
2008	10695	10695			1		1890	1890-1911	
2021	10709	10709		1			1903	1892-1916	
2033	10730	10730			1				
2040	10736	10736				2	1875	1875-1925	
2050	10746	10746		2	1		1908	1853-1913	

APPENDIX A: COFFIN SHAPEFILE ATTRIBUTE TABLE

OBJECTID*	Coffin Lot#	Burial Lot#	Associated Lot#	Coins	Jar/Container	Footwear	Terminus post quem	Artifact Estimated Date Range	Possible Burial ID Date
2057	10753	10753				1			
2066	10763	10763			5		1882	1882-1915	
2072	10769	10769				2	1875	1875-1925	
2096	10803	10803			3		1910	1910-1930	
2097	10804	10804			1				
2101	10808	10808				1			
2102	10809	10809			2		1870	1870-1910	
2105	10812	10812			4		1880	1880-1904	
2120	10970	10970			2				
2121	10971	10971			5		1895	1895-1904	
2123	10973	10973			1		1884	1884-1890	
2126	10976	10976				2	1880	1880-1925	
2130	10981	10981			5		1880	1870-1930	
2131	10982	10982			5		1901	1870-1920	
2132	10983	10983			4		1904	1904-1930	

APPENDIX B: LOT INFORMATION AND ARTIFACT DATA

Coffin Lot	Burial Lot	Coin Count	Coin Type	Jar/Container Count	Jar/Container Type	Jar/Container Description	Footwear Count	Footwear Type	Footwear Description	Artifact Estimated Date Range
1003	1003	2	‘Indian Head’ One Cent				2	Nailed	Turned manufacture, nailed construction, probably male's shoe	1883-1915 (Anderson 1968)
1004	1004	10	‘Indian Head’ One Cent (4), Two Cent (5), UnID (1)							1859-1909
1008	1008						2	Footwear Not Present		NA
1014	1014						2	Footwear Not Present		NA
2016	2016	1	‘Liberty Head’ Dime							1892-1916
2025	2025			1	Mustard Jar	Clear glass, mouth blown, 3-piece mold, tooled finish, cup-bottom mold				1890-1925 (Lindsey 2020)
2044	2044			2	Wide Mouth Threaded Closure Jar	Front Emossed "Charles Gulden/New York/ Prepared Mustard/ None Genuine Without Our Label", Basel Emboss "2&4"				1850-1930
2045	2045			1	Prescription Bottle	Clear glass, 2-piece mold, tooled finish, prescription lip				1850-1930
2058	2058	2	‘Liberty Head’ Nickel	1	Vaseline Jar	Continous thread finish, bead seal, machine made, Front emboss "Vaseline/…sebrou…/…Yo.."				1883-1918 (Lockhart 2015)
2062	2062						2	Nailed	Turned manufacture, nailed construction, probably male's shoe	1875-1925 (Anderson 1968)
2068	2068	2	‘Liberty Head’ Nickel							1883-1912
2088	2088						2	Footwear Not Present		NA
2091	2091			1	Crown Top Beverage Bottle	Amber glass, machine made, crown top closure				1910-1930
5033	5183						2	Standard Screw	Wire and stitch construction, Standard Screw, Right and Left present, probable male's shoes	1880-1925 (Anderson 1968)

APPENDIX B: LOT INFORMATION AND ARTIFACT DATA

Coffin Lot	Burial Lot	Coin Count	Coin Type	Jar/Container Count	Jar/Container Type	Jar/Container Description	Footwear Count	Footwear Type	Footwear Description	Artifact Estimated Date Range
5087	5087	8	‘Liberty Head’ or ‘Barber’ Quarter (3), ‘Liberty Head’ or ‘Barber’ Half Dollar (1), ‘Shield’ Nickel (1),‘Mercury’ Dime (3)							1866-1945
5112	5112						2	McKay	Stitched construction, Right and Left present	1862-1925 (Anderson 1968)
6005	6005			1	Condiment Jar	Clear glass, 2-piece mold, Cylinderical shape, Basal emboss "T.A. Snider Preserve Co/Cincinnati O."				1880-1900 (Lockhart et al. 2014)
6020	6020						1	Footwear Not Present		NA
6082	6082						2	Fabric Construction		NA
6149	6149						2	McKay	Turned manufacture, Stitched construction, Right and Left present, probable male's shoes	1875-1925 (Anderson 1968)
6151	6151						1	Hand Sewn Turned	Turned manufacture, Stitched construction, probably child's shoe	1830-1925 (Anderson 1968)
6195	6195			1	Mason Jar	Clear glass, 2-piece mold, post-bottom mold, Front emboss "[MA]SON'S/[PA]TENT/[NO]V 30th/[1]858", Basal emboss "826"				1867-1871 (Lindsey et al 2014)
6199	6199						1	Footwear Not Present		NA
6238	6238	1	‘Indian Head’ One Cent							1859-1909
6239	6239	4	‘Indian Head’ One Cent (2), UnID (2)							1859-1909
6240	6240						1	Footwear Not Present		NA
6243	6243			1	Beverage Bottle	Aqua glass, 2-piece mold, tooled finish, Export style, post-bottom mold, Front emboss "Val Blatz/ Brewing Co/Milwaukee", Basal emboss "WF&S/3/MIL"				1896-1900 (Lindsey 2020)
6255	6255						2	Footwear Not Present		NA

APPENDIX B: LOT INFORMATION AND ARTIFACT DATA

Coffin Lot	Burial Lot	Coin Count	Coin Type	Jar/Container Count	Jar/Container Type	Jar/Container Description	Footwear Count	Footwear Type	Footwear Description	Artifact Estimated Date Range
7014	7014			1	Prescription Bottle	Clear glass, 2-piece mold, tooled finsih, prescription lip, Front emboss "3i", Basal emboss "PAT [illegible]"				1870-1910 (Lindsey 2020)
7057	7057						2	Nailed	Turned manufacture, nailed construction, highly fragmented	1830-1925
7088	7088						2	Goodyear Welt	Welted manufacture, stitched construction, right and left shoes present, probable male's shoes	1880-1925
7228	7228	1	'Indian Head' One Cent				2	Goodyear Welt	Welted manufacture, stitched construction, right and left shoes present, probable male's shoes	1859-1909
8009	8009						2	Nailed	Turned manufacture, nailed construction, brass/copper nails, probable male's shoes	1875-1925
8030	8030						2	McKay	Turned manufacture, Stitched construction, Right and Left present, probable male's shoes	1875-1925
8121	8121						2	Standard Screw	Wire and stitch construction, Standard Screw, highly fragmented	1880-1912
8129	8129						1	Standard Screw	Wire and stitch construction, Standard Screw, highly fragmented	1880-1925
8161	8161			1	Prescription Bottle	Clear glass, 2-piece mold, tooled finsih, prescription lip, Front emboss "3iv", Basal emboss "-"	1	Goodyear Welt	Welted manufacture, stitched construction, highly fragmented	1870-1910 (Lindsey 2020)
8167	8167						1	Nailed	Turned manufacture, nailed construction, probably male's shoe	1830-1925
8192	8192						1	Goodyear Welt	Welted manufacture, stitched construction, highly fragmented, left shoe only	1880-1925

APPENDIX B: LOT INFORMATION AND ARTIFACT DATA

Coffin Lot	Burial Lot	Coin Count	Coin Type	Jar/Container Count	Jar/Container Type	Jar/Container Description	Footwear Count	Footwear Type	Footwear Description	Artifact Estimated Date Range
9068	9068			1	Mason Jar	Clear glass, 2-piece mold, post-bottom mold, Front emboss "MASON'S/CFJ Co Symbol/PATENT/NOV 30th/1858", Basal emboss "40", Mason patent fruit jar closure, with porcelain cap liner				1899-1906 (Lindsey et al 2014)
9232	9232	1	'Lincoln Head' One Cent							1909-1959
9253	9253			1	Fragment Only					NA
9355	9355						2	Goodyear Welt	Welted manufacture, stitched construction, right and left shoes present	1880-1925
9368	9368			1	Prescription Bottle	Clear glass, oval base, prescription lip				NA
9370	9370			1	Prescription Bottle	Aqua glass, prescription lip				1890-1930
9417	9417			1	Mason Jar	Aqua glass, 2-piece mold, post-bottom mold, Front emboss "Keyston Mason Symbol/MASON", Basal emboss "56"				1895-1915 (Lindsey et al 2014)
10007	10007						1	Fragment Only		NA
10018	10018						1	Nailed	Turned manufacture, nailed construction, machine-made, sole only, with brass/copper nails, probable child's shoe	1875-1925
10045	10045						1	Nailed	Turned manufacture, nailed construction, hand-made. Highly fragmented	1875-1925
10093	10093						1	Goodyear Welt	Welted manufacture, stitched construction Left shoe only, sole fragmented	1875-1925
10099	10099	1	'Indian Head' One Cent							1883-1915

APPENDIX B: LOT INFORMATION AND ARTIFACT DATA

Coffin Lot	Burial Lot	Coin Count	Coin Type	Jar/Container Count	Jar/Container Type	Jar/Container Description	Footwear Count	Footwear Type	Footwear Description	Artifact Estimated Date Range
10283	10283						2	Goodyear Welt	Welted manufacture, stitched consturction "goodyear welt", machine-made. Right and left shoes present.	1880-1925
10298	10298	1	‘Liberty Head’ Nickel				2	Nailed	Turned manufacture, nailed construction, machine-made. Possible evidence for shoe repair on left shoe. Right and left shoes	1883-1912
10318	10318			2	Prescription Bottle	Bottle 1 - Clear glass, 3-piece mold, Applied finish. Bottle 2 - Clear glass, "6 oz" embossed on front top above label area, 2-piece cup mold, prescription finish,				1880-1900 (Lindsey 2020)
10410	10410						1	Cemented	Welted manufacture, cemented construction, machine-made. Rubber/Composite construction material. Sole only, fragmented	1912-1925
10466	10466						2	Cemented	Welted manufacture, stitched and cemented construction, machine-made. Modern construction. Right and Left shoes. Boot-like, rubber galoshes with fabric at ankles	1912-1925
10525	10525			1	Fragment Only					NA
10536	10536			1	Fragment Only					NA
10539	10539			1	Prescription Bottle					1870-1910
10569	10569			1	Supply Bottle	Aqua-tinted, 2-piece cup mold, tooled prescription finish, Basal embossed "8"				1890-1910 (Lindsey 2020)
10621	10621						2	Goodyear Welt	Welted manufacture, stitched construction, machine-made. Leather, stitched (two rows). Reddish-Brown. Fragmentary. Soles, interior sole-lining, and the back of the shoe that wraps around the heel are present. Upper portion of shoes absent.	1880-1912
10657	10657			1	Fragment Only					NA
10664	10664			3	Milk Bottle	Milk glass				1875-1915

APPENDIX B: LOT INFORMATION AND ARTIFACT DATA

Coffin Lot	Burial Lot	Coin Count	Coin Type	Jar/Container Count	Jar/Container Type	Jar/Container Description	Footwear Count	Footwear Type	Footwear Description	Artifact Estimated Date Range
10669	10669			5	Vaseline Jars and Suplly Bottles	Bottle 1 - Clear glass, 2-piece cup mold., Tooled prescription finish. Basal embossed "USA PAT DEC 11 1894". Bottle 2 - Clear glass. 2-piece cup molded bottle. Front embossed "CHESEBROUGH MFG CO. Vaseline". Bottle 3 - Refit. Clear glass. 2-piece cup molded bottle. Front embossed "CHESEBROUGH MFG CO. Vaseline". Bottle 4 - 2-piece cup mold. Threaded finish with Zine cap. Basal embossed "D, F 7 Co.". Dean, Foster and Co. Bottle 5 - Clear glass. Incomplete. Partial side embossed "NE…". Possible Chesebrough New York.				1910-1930 (Lockhart 2015)
10682	10682						2	Nailed	Turned maunfacture, nailed construction, machine-made. Possible evidence for repair on heels. Two main pieces: inner and outer soles of each shoe. Soles are nailed together. Some iron oxide present. Highly degraded, smaller fragments are also present.	1875-1925
10695	10695			1	Prescription Bottle	Clear glass, 2 Piece cup mold (1880s-1910) tooled prescription finish, Frontal Emboss "…se DRUGGIST" Basal embossed "SHELDON"				1890-1911 (Lockhart et. al 2015)
10709	10709	1	'Barber' Dime							1892-1916
10730	10730			1	Fragment Only					NA

APPENDIX B: LOT INFORMATION AND ARTIFACT DATA

Coffin Lot	Burial Lot	Coin Count	Coin Type	Jar/Container Count	Jar/Container Type	Jar/Container Description	Footwear Count	Footwear Type	Footwear Description	Artifact Estimated Date Range
10736	10736						2	Nailed	Turned manufacture, nailed consturction, hand-made. Right and Left shoes. Soles and heel present. Associated fragments bagged with individual shoe.	1875-1925
10746	10746	2	'Indian Head' One Cent (1), 'Liberty Head' Nickel (1)	1	Fragment Only					1883-1915
10753	10753						1	Fragment Only		NA
10763	10763			5	Prescription Bottles	Bottle 1 and 2- 2-piece cup mold, tooled prescription finish Body Embossed: "Louis Schmitt Parmacist Milwaukee, Wis.", Basal embossed: "USA WT&Co PAT DEC 11 94"				1882-1915 (Lindsey 2020)
10769	10769						2	McKay	Stitched construction, machine-made. Fragmented; Right (13fargments), Left (12+ fragments, copper shoe eyelet)	1875-1925
10803	10803			3	Prescription Bottle	Clear glass, 2-piece mold, tooled finsih, prescription lip				1910-1930 (Lindsey 2020)
10804	10804			1	Fragment Only					NA
10808	10808						1	Fragment Only		NA
10809				2	Prescription Bottle and Vaseline Jar	Bottle 1 - 2-piece cup bottom mold w/tooled prescription finish, clear glass, front embossed "Herman L. Emmerich Ph.G. Milwaukee, Wis". Bottle 2 - 2-piece cup bottom mold w/tooled patent finish, Amber Vaseline bottle				1870-1910 (Lindsey 2020)
10812	10812			4	Perfume Bottle and Supply Bottles	Bottle 1 - Two piece cup mold applied prescription finish, Front Embossed "D.R.G.M. 120728" Amber glass. Bottle 2 - Two piece cup mold w/tooled patent finish, clear glass Medicine Dropper Bottle				1880-1904 (Whitall & Tatum 1904)

APPENDIX B: LOT INFORMATION AND ARTIFACT DATA

Coffin Lot	Burial Lot	Coin Count	Coin Type	Jar/Container Count	Jar/Container Type	Jar/Container Description	Footwear Count	Footwear Type	Footwear Description	Artifact Estimated Date Range
10970	10970			2	Fragment Only					NA
10971	10971			5	Prescription Bottles and Specimens Jar	Bottle 1 - Prescription finish w/stopper frag. Jar 2 - Museum specimen jar lid 18in Diam Lid for a 16in Diam Jar Embossed "Whitall Tatum & Co. Philadelphia New York" around edge of rim, Embossed "Pat. June 11th 1895" on top of lid.				1895-1904 (Whitall & Tatum 1904)
10973	10973			1	Condiment Jar	clear glass, slight teal tint. Base fragment. "S" embossed on bottom of base. Machine made, seam visible. Found in "Fill"				1884-1890 (Lockhart et al. 2014)
10976							2	Goodyear Welt	Welted manufaccture, stitched construction "goodyear" stitch, machine-made. Evidence for repair on soles. Fragmented; Right(15 frags) Left(40 frags). Tacked sole. Shoe eyelets present. Found underneath individual, probably placed in coffin first.	1880-1925
10981				5	Prescription Bottle, Vaseline Jar, Specimens Jar, and Ink Bottle	Bottle 1 - Clear glass, 2-piece mold, tooled finish, prescription lip. Bottle 2 - Vaseline bottle with cork, Machine blown, 2-piece mold, Patent finish. Bottle 3 - Ink Bottle, Base embossed "Higgins Inks Brooklyn, N.Y.", Machine blown, 2-piece mold. Jar 4- Museum Jar lid 3in diameter; embossed "WHITALL TATUM & CO PHILADELPHIA NEW YORK" around rim and "PAT JUNE 11th 1895".				1870-1930 (www.higginsinks.com) (Whitall & Tatum 1904)

APPENDIX B: LOT INFORMATION AND ARTIFACT DATA

Coffin Lot	Burial Lot	Coin Count	Coin Type	Jar/Container Count	Jar/Container Type	Jar/Container Description	Footwear Count	Footwear Type	Footwear Description	Artifact Estimated Date Range
10982				5	Prescription Bottle and Vaseline Jar	Bottle 1 - Vaseline bottle , Machine blown, 2-piece mold, 2 verticle seam lines. Bottle 2 - Amber glass, post-bottom mold, Applied patent finish, Base embossed "W.T. & Co.". Bottle 3- Tall or Boston style round prescription bottle. Bottle 4 - Post-molded, Prescription Lip, Embossed side: "HUGO E. BAUCH NORTH AVE & 3RD ST. MILWAUKEE", Embossed Base: "W.T. Co & O A". Bottle 5 - 2-piece cup mold, Prescription tooled finish, Base embossed "(N)"				1870-1920 (Lindsey 2020) (Whitall Tatum 1880: 14)
10983	10983			4	Prescription Bottle	Fragment of Museum Jar Lid, Homeopathic bottle				1904-1930 (Whitnall Tatum 1904:61)

APPENDIX C: GIS TERMS AND CONCEPTS TABLE

GIS Adapted Terminology (ESRI 2020; Chang 2014)	**GIS Adapted Descriptions** (ESRI 2020; Chang 2014)
Feature Class	A dataset that stores features of similar geometry type in a geodatabase.
Feature Dataset	A collection of feature classes in a geodatabase that share the same coordinate system.
File Geodatabase	An assortment of files in a folder or disk that can store, query, and manage both spatial and nonspatial data. A file geodata is created in ArcGIS.
GIS	A system for capturing, storing, querying, managing, analyzing, and displaying geospatial data.
Kriging	Kriging (Simple) is a stochastic interpolation method that assumes that the spatial variation of an attribute includes a factor of spatial correlation.
Ordinary Kriging	A kriging method that assumes the absence of a phenomena and focuses on spatial correlation.
Raster Data	The raster data model uses a series of cells or pixels to represent a continuous field.
Semi-variogram	A diagram that displays the measure of spatial dependence among points to the distance between sampled points.
Shapefile	A simple, nontopological, format for storing geometric location and attribute information of spatial data.
Spatial Interpolation	The process of using points of known value to estimate unknown values.
Universal Kriging	A kriging method that assumes the spatial variation of an attribute has a structural component in addition to a shared spatial correlation.
Validation	A technique for comparing interpolation models while testing the accuracy of the model.
Vector Data	The vector data model uses *x,y* coordinates to represent point, line, and polygon features.

APPENDIX D: KRIGING PREDICTION ANALYSIS ERROR TABLE

Krining Type	Measure	Prediction		Quantile		Probability		Prediction Standard Error	
		Normal	Optimized	Normal	Optimized	Normal	Optimized	Normal	Optimized
Ordinary	Mean	-0.619	-0.505	-0.399	-0.265	0.0236	0.033	-0.085	-0.218
	Root Mean Square	10.015	10.779	9.58	11.732	0.296	0.295	11.807	10.15
	Mean Standardized	-0.106	-0.071	-0.067	-0.03	Not Provided		0.0008	-0.082
	Root Mean Square Standardized	2.044	1.498	1.977	2.633			2.642	2.468
	Average Standard Error	3.096	3.13	3.068	3.725			3.68	3.133
Simple	Mean	-0.505	-1.5	1.717	1.059	0.0955	0.094	1.068	1.059
	Root Mean Square	10.789	10.707	19.61	19.002	0.485	0.485	18.953	19.002
	Mean Standardized	-0.068	-0.156	0.087	0.0578	Not Provided		0.057	0.0578
	Root Mean Square Standardized	0.419	0.395	0.92	0.91			0.905	0.9106
	Average Standard Error	18.87	25.02	21.31	21.069			21.12	21.069
Universal	Mean	-0.265	-0.093	-0.265	-0.6315	0.032	0.0307	-0.36	-0.631
	Root Mean Square	11.732	9.094	11.732	10.065	0.341	0.293	11.457	10.065
	Mean Standardized	-0.03	-0.015	-0.0306	-0.108	Not Provided		-0.041	-0.108
	Root Mean Square Standardized	2.633	1.908	2.633	2.061			2.445	2.061
	Average Standard Error	3.725	3.026	3.725	3.107			3.695	3.107