PHASE I and II GEOARCHAEOLOGICAL INVESTIGATION OF THE RIVERSIDE PROJECT AREA

VOLUME 1: BACKGROUND, RESEARCH DESIGN, RESULTS, and CONCLUSIONS

Prepared for:
The Dermot Company, Inc.
729 7th Avenue, 15th Floor
New York, NY 10019

Prepared by:
Geoarcheology Research Associates
92 Main Street, Suite 207
Yonkers, NY 10701

Joseph Schuldenrein, Ph.D., R.P.A.
Principal Investigator

John A. Turck, Ph.D.

Eva Hulse, Ph.D., R.P.A.

Kevin Wiley, Ph.D., R.P.A.

Rebecca Yamin, Ph.D., R.P.A.

Joe Mazzariello, B.A.

Acacia Berry, B.A.

and

Zenobie S. Garrett, Ph.D, R.P.A., editor

With contributions by

Diana Choi, Randa Harris, Julie Richko Labate, Molly Miranker, Jessica Vayo, and Rona Winter-Livneh

GRA

February 2016

ACKNOWLEDGEMENTS

Numerous city, state, and federal organizations contributed to the successful performance of the Riverside 2 project. The authors wish to thank, in particular, Mr. Drew Spitler of Dermott, Inc. for supporting and overseeing the cultural resources effort at Riverside 2 project over the course of GRA's efforts (2012-2015). Without his singular support the project would not have proceeded as smoothly as it did. Mr. Parker Terrill and Mr. Mark Sangiorgi, both formerly of Dermot, served as liaisons between GRA and the client during the critical field phases of the work. Mr. Sangiorgi's interest in and appreciation of the work as well as his understanding of the compliance process allowed us to proceed with the transition from excavation to analysis and report writing phases with minimum difficulty. Ms. Amanda Sutphin, chief archaeologist for the New York City Landmarks Commission, was pivotal in the early negotiation phases of the Scope of Work, in facilitating contacts between the client and contractor, and in explaining the protocols and regulatory aspects of the work. Her efforts resulted in an expeditious and efficient performance of the key tasks attendant to project completion. Ms. Bethany Klein of AECOM was responsible for co-ordinating the general schedules for the archaeological team and construction personnel. The heavy equipment excavators were uniquely helpful in keying construction activities to the unique needs of the archaeological team. They allowed GRA to synchronize archaeological tasks to specific construction deadlines.

TABLE OF CONTENTS

VOLUME 1

Page

VOLUME 2

APPENDICES

LIST OF TABLES

LIST OF FIGURES

MANAGEMENT SUMMARY

Cultural resources investigations were undertaken at Parcel 2 of the Riverside Center Development in order to assess archaeological sensitivity, and to fulfill compliance requirements of Section 106 of the National Historic Preservation Act. Parcel 2 is located between 60th and 61st Streets, just west of West End (11th) Avenue, on the Upper West Side of Manhattan. This was a multi-stage assessment in which Geoarcheology Research Associates, Inc. (GRA) followed up an initial study by Mueser Rutledge (2011). Baseline investigations were undertaken between July and August of 2012. At that time, GRA proposed that a more comprehensive series of deeper investigations, including area wide excavations, be undertaken. The follow-up excavations were performed from October, 2012 through September, 2013. Investigations extended through 3-9 m (10-30 ft) depths across two potentially high-yield parcels of the project footprint and penetrated deposits that dated from the 21st through the 19th centuries and well into landscapes of prehistoric age (6000 B.P.). During the field work, an extensive historic archaeological inventory (nearly 10,000 artifacts) was collected, processed, and curated. The dominant archaeological assemblages dated from the 1870s to the turn of the 20th century. Specialist analyses also included census documentation, assemblage classification and taxonomy, and faunal studies linked to ethnographically based subsistence and dietary practices for the mid late-nineteenth century. For prehistoric time frames efforts focused on post-glacial landscape reconstructions (estuarine and terrestrial) whose timelines and changing configurations were indexed by radiocarbon dating, dendrochronology, pollen, and molluscan analyses.

Methods and strategies for this work stressed applications of high technology survey and digital mapping procedures, followed up by multi-dimensional Geographic Information Systems (GIS) and data base integration. 3-dimensional modeling of the linked depositional and archaeological contexts produced time-transgressive reconstructions of the changing man-land dynamic, the remnants of which lay stacked beneath the project footprint.

An urban-oriented geoarchaeological Research Design was followed over the course of this work. Its impetus was derived from baseline Phase 1 investigations that were structured around a deep-testing strategy. Systematically spaced geoprobes were driven through the thick "landfill" deposits and produced well-sorted organic matrices of obvious estuarine origin. The depth of these sediment complexes conformed to surfaces associated with the most recent Late Holocene sea level curves for the New York City area. Two organic samples extracted from geoprobe cores produced stratigraphically ordered dates of ca. 6000 and 3000 B.P., the time frame of the Late Archaic culture complex at the (then) nearshore margins of the Hudson River east bank. Additionally shallow water gastropods preserved within the dated sediment matrix (*M. lateralis* and *Ilyanassa obsolete*) confirmed the presence of an intra-tidal environment. That landscape could have sustained biomes and subsistence resource zones associated with nearshore Late Archaic sites. On this basis, the recommended Phase 2 strategy was to test the potential for prehistoric surface and site complexes at a location where evidence for such preservation had never been conclusively documented before. Two loci which produced the most extensive mantles of estuarine deposition were selected for testing at the Riverside 2 parcel.

The Phase 2 work was designed for exploring prehistoric archaeological potential. It involved systematically placed 1x2 test excavation units, shovel testing, and coring along with supplementary paleoenvironmental analysis. However, the 3-9 m (10-30 ft) depth to the Late Holocene estuarine surface proved to be a complex challenge for both logistical and archaeological reasons. Archaeologically, there was evidence of unique fill stratification, dense concentrations of both isolated early 20th and 19th century finds and features, and preservation of historic soil formation signifying buried stable surfaces. Logistically, there were OSHA and safety based measures attendant to opening up a test area where extensive surface and sub-surface operations were to be undertaken. An archaeological monitoring protocol was initiated to oversee heavy machine stripping of the (presumed) landfill. An agreement was reached with the developers that only key features would impede or limit the stripping operations. With time and increased depth the richness of the historic (and especially 19th century) archaeological record within the presumed fill became ubiquitous. The fill was stratigraphically separable in many portions of the site, visibly offsetting episodes of landscaping and terrain sculpting. These signified changing land use down the sequence, although in general the fill was laid down for surface stabilization. Historic archaeological features were often palimpsests or relicts of archaeological integrity superposed on historic fill surfaces. Such features included abandoned railroad structures, 19th century cribbing structures, a well, an extended early 20th century Belgian block road surface, remnants of stockyard pens, and widespread discard features with clustered artifact assemblages. An array of posts dated to the early 19th century conformed to the configuration of a late early-nineteenth century dock at the interface of the basal landfill and the Late Holocene estuarine landform.

Taken together, dense historic finds, features, segmented but intact surfaces coupled with indications of archaeological integrity forced a strategic reassessment of the monitoring protocol. Isolated feature "types" were documented utilizing controlled excavation and/or survey methods in cases where the boundaries of material culture clusters were identified. Uniquely prominent was a site-wide, up to 1.8 m (6 ft) thick 1870s stratigraphic unit dominated by commercial and residential waste; segments were interdigitated with discrete trash pockets and feature clusters. That unit preserved the densest and most unique archaeological contexts preserved on site; fully 80% of the artifact inventory came from that master stratum. Finally, a buried landform—glacial moraine hill flanked by a buried stream channel—was also recognized beneath the cumulative landfill complex on the north part of the site.

As fieldwork drew to a close, the complex depositional sequence of Riverside 2 emerged as a unique challenge for establishing a site-wide archaeological context. Since the site's dominant cultural components turned out to be historic, priorities in analyses shifted over the course of the field effort. Key analytic issues included the following: How is it possible to sort out material culture inventories in a compromised setting where traditionally defined "disturbed contexts" (episodic landfill sedimentation) nevertheless preserved intact feature complexes? How is it possible to establish protocols for grouping material culture inventories? In a broader sense the Riverside 2 site posed more fundamental quandaries concerning site formation process, scale, and assessments of integrity. For compliance purposes the question of integrity posed a challenge to determining criteria of formal significance in addition to addressing more heuristic paradoxes. Ultimately, there was a basic challenge to the initial Research Design and objectives of the Scope of Work. This involved a reversal of priorities from the targeted prehistoric to the demonstrably dominant historic component.

Against this backdrop, researchers faced a clear challenge. Can a comprehensive approach be applied to a site whose base was sealed in a prehistorically sterile but intact landscape and whose upper portion preserved a disturbed landfill with historic features? Towards this end, a flexible stratigraphic framework was applied that was structured by *allostrata*, a geologically based stratification system that accommodates synchronic transition in the Holocene record for the natural and cultural data sets preserved in the landscape. It allowed us to continually adjust the master sequences as the project developed and chronologies were matched up with particular depositional layers across the site. The system was especially useful for ordering the variable landfill strata, as well as major structural features that were recognized. In all, nine (9) master strata were identified that spanned the vertical transition from bedrock (Unit 0) to the uppermost sub-parking lot landfill (Unit 8). Sub-strata within specific fill and natural geological units were also distinguished.

Viewed in broader perspective, the Riverside 2 archaeological site preserved a series of prehistoric and historic landscape segments and archaeological features. The prehistoric landscape of the site consisted of steep relief characterized by a low-lying estuarine setting whose nearshore margins were dated to the Archaic cultural interval (6000-1000 B.P.). To the north and east elevated late glacial kettle hills and moraine landforms created a steep landscape ideally suited for prehistoric settlement, even though no clear evidence of cultural occupation was found. The results of pollen, sedimentology, and molluscan analyses indexed by radiocarbon dates provided evidence of changing vegetation zones, climates, and subsistence environments that would have been exploited by the relatively sparse prehistoric populations that occupied the area. After an extensive gap in the stratigraphic sequence, the earliest evidence for settlement post-dates Euroamerican contact and is registered in the form of a dock that may have fronted the estuary and landward facing agricultural lands (a post is dated to ca. 1807). Intensive settlement and the emergence of urban neighborhoods began after the mid-nineteenth century where the archaeological record is signaled by dense trash disposal areas. These could be tied to historic neighborhoods where there were possible material indications of ethnic occupation and dietary proclivities. Timelines for subsequent occupations are registered by structural features and confirmed by documentary evidence. Above the fill-based evidence for dominant residential activity in the 1870s there are structural features of cribbing, roadway preparation, paving, wells, and railroad support facilities that confirm the massive landscaping and land use histories of an area that indexed major changes in New York City's economic and commercial history.

Finally, this study is an example of how new directions in the archaeology of the Built Environment will be implemented in the 21st century and beyond. In the age of sustainability, progressive applications of high technology methods supplemented by increasingly streamlined, less labor intensive, and high yield field methods will provide the road map for addressing archaeological questions in more efficient and focused ways.

CHAPTER 1: INTRODUCTION

The main goal of this project was to assess Parcel 2, the "project area," of the Riverside Center Development for archaeological sensitivity, determining the potential for the property to house deposits of prehistoric and historic significance. The project area is located between 60th and 61st Streets, just west of West End (11^{th}) Avenue, on the Upper West Side of Manhattan (Figure 1.1). Parcel 2 is part of the northeast section of Parcel N (one of 15 parcels that made up the West Side Site [see Landes and Frizzi 2005]), on block 1171, lot 165 (Figure 1.2). Although the project area was occupied by a parking lot at the initiation of this investigation (Figure 1.3), it underwent many changes throughout its history.

The Environmental Impact Statement presented by AKRF in conjunction with the 1992 approvals for the Riverside Center Development concluded that there was potential for prehistoric archaeological resources on Parcel N of the Riverside Center Development (which includes Parcel 2), that could be disturbed by the proposed development. Specifically, AKRF's report flagged two areas located by a stream running through the eastern portion of Parcel N as potentially sensitive for either seasonal fishing camps or shell middens.

Typically, prehistoric remains near waterways are found on elevated areas by the mouths of estuaries or along the shoreline in coves where fish and shellfish would have been more easily obtainable. Traces of seasonal fishing camps, represented by scattered tools and hearths, may be discovered in such locations, or shell middens, sometimes many feet high, which mark the sites where shell fish were collected and harvested. Plotting the location of such features helps reconstruct ancient topography, land use patterns, and the movements of prehistoric populations, while chemical analysis of shells and other organic materials places the reconstruction in its proper chronological context.

There are two portions of Parcel 2 that contained evidence of potential prehistoric timing (see Figure 1.3). Sensitive Area 1 is from 40 ft south to 60 ft north of West 61st Street and 200 ft east-west, from the west side of West End Avenue (approximately 800 sq. ft., excluding the area of the street). Sensitive Area 2 is from south of the line of the north side of West 60th Street to the south border of parcel 2 and approximately 200 ft west of the west side of West End Avenue (approximately 12,000 sq. ft.).

These two areas lie adjacent to the former shoreline as depicted on historic maps. The depth of fill on the project site over the pre-Colonial land surface, often up to 15 feet but highly variable between locations on the parcels, was determined by borings conducted by Langan Engineering & Environmental Services in 2005 and Mueser Rutledge Consulting Engineers in 2011.

Geoarcheology Research Associates, Inc. (GRA) conducted Phase I and II archaeological investigations of the project area, including extraction and analysis of borings (Figure 1.4), monitoring (including collecting samples at randomized locations, locations of well sites, and locations within an area excavated for a pool, Figure 1.5 and Figure 1.6), archaeological excavations of shovel test pits (Figure 1.7, Figure 1.8, and Figure 1.9), archaeological units and trenches (Figure 1.10 and Figure 1.11), and analysis of the sediment and stratigraphy of machine trenches, machine-cut profiles, and augers (Figure 1.12 and Figure 1.13). Fieldwork was initiated to determine the nature of shell deposits in correlation with the original shoreline of Manhattan and the Hudson River, and to determine if deposits of prehistoric age occurred within the project footprint. Previous investigations suggested that artificial fill, deposited during historic time periods, was between 3 and 9 meters (10 and 30 feet) thick. Thus prehistoric and early historic deposits, if present, could only be accessed through deep testing. The GRA approach took the form of an explicitly geoarchaeological testing strategy in an urban landscape: deep testing with concomitant analysis and dating of soils and sediments related to the original landscape and the artificial filling activities. A key element in this study was obtaining absolute ages on subsurface deposits that are contemporaneous with known periods of prehistoric or historic activities. This included identifying and dating the interface between natural landforms and artificial landfill, as well as surfaces within these deposits.

As with all urban archaeology, this study contributes to our understanding of the complexity of cities and how they grow and change. Urban archaeology has the uncanny ability to uncover completely forgotten parts of the past. This includes both the changing landscape over time, as well as information about people. Often the people we find out about are not the ones in the history books, but those who have left broken possessions behind in abandoned privies, wells, or cisterns in their backyards. The artifacts recovered tell us something about the people, e.g., what they could afford to own, who they aspired to be, and how their lives connected to the larger world. The archaeology conducted for this project uncovered a different record of the forgotten past, and has brought to light more than layers of sediment. It has connected us to a forgotten part of our own past, and to the energy and ingenuity that went into, and continues to go into, the development of New York City, and reveals what a complicated process it has been.

The fieldwork and laboratory analysis were performed under contract to the Dermot Company. This final report satisfies the requirements set forth by the New York City Landmarks Preservation Commission (LPC) per formal Guidelines for Archaeological Work in New York City. These guidelines specify protocols for protection and documentation of properties under their jurisdiction. LPC requires that the work be conducted, and final report be submitted, prior to issuance of a Final Notice of Satisfaction, as stated in the Restrictive Declaration for this parcel (CRFN 2011000434594), initially filed on December 1, 2011. Additional curation and public education efforts will be addressed separately.

Organization of the Report

This report is organized in a series of chapters that follows a standard progression in scientific reporting. It begins with an examination of relevant background information and a comprehensive literature review (Chapter 2). The knowledge developed in Chapter 2 helped shape the research design, which in turn called for a set of methods to carry out that design (Chapter 3). The results of the research design and prescribed methods are reported in Chapter 4. A discussion of the meaning and importance of these results follows in Chapter 5. Finally, comprehensive conclusions and recommendations are offered in Chapter 6. When possible, information pertinent to a particular chapter is intended to be contained within that chapter alone. However, through phases of field research and analysis, an understanding of the site emerged as a place that had undergone a series of depositional processes. Further, it is emphasized that the understanding of the depositional processes took shape over the course of the field work and analysis. As a result, a formal site-wide sequence stratigraphy was developed that accommodated flexibility based on both field relations and analysis results. It was decided to follow an allostratigraphic scheme with foundations in geology and applications that could link both culturally and naturally (i.e., geological) separable but time equivalent deposits across the entire site. Thus, the material recovered on site could best be interpreted in the framework of depositional units and subunits. As these depositional units form the organizational structure of the results and are referred to throughout the report, they are presented here at the onset (Table 1.1). These depositional units/strata chronicle changes from most recent (Depositional Unit 8-Parking lot fill) to earliest (Depositional Unit 0-Schist boulders and bedrock). More detailed descriptions and explanations of the depositional units are presented with the results in Chapter 4.

Table 1.1. Description of Depositional Units

Unit	Characteristics	Cultural materials	Age
8 Parking lot fill	Heterogeneous strata of friable, granular sandy loam and black, loose coal slag, capped by concrete and asphalt.	Mixed 19th and 20th century materials. The brick foundation and wooden cribbing were surrounded and filled by this stratum.	AD 1988 *terminus post quem* (TPQ)
7 Rail embankment improvements	Friable, granular, sandy loam with coal, brick, angular cobbles and pebbles, primarily of schist.	Mixed 19th and 20th century artifacts.	ca. 1931-1933 (archival sources)
6 Railbeds	Loose, angular schist cobbles and sand.	None.	ca. 1892 (archival sources)
5 Redeposited sandy material	Friable, granular sandy loam, oxidized.	Artifacts include building materials, food waste, and dishware.	AD 1890 (TPQ)
4: Stockyard pavement			
4c Surface of Belgian block pavement	Compact, firm plant material and sand in the crevices of the paving blocks.	Sparse residential, commercial, and industrial debris.	AD 1890 (TPQ)
4b Belgian block pavement	Rough, hand-cut stone blocks with the tops measuring 15 X 15 cm (6 X 6 in).	Layer is entirely cultural in origin.	AD 1874 (TPQ)
4a Sandy substrate	Well-sorted, granular medium-grained sand.	Sparse residential, commercial, and industrial debris.	AD 1874 (TPQ)
3: Landfill			
3d Final trash landfill	Friable, granular sandy silt loam with ash, burned material, and artifacts.	Numerous residential, commercial, and industrial items. This stratum and 3b contain the vast majority of artifacts recovered during the excavation.	AD 1874 (TPQ)
3c Runoff deposit	Alternating bands of coarse and fine sand.	Small fragments of brick and other historic debris.	ca. September 29, 1874
3b Initial trash landfill	Like 3d.	Like 3d.	AD 1870 (TPQ)
3a Stony landfill	Firm to friable, granular sandy loam with 50% cobbles and boulders, mostly schist. Primarily around the exterior of the well in the bed of the former stream.		AD 1870 (TPQ)
2: Estuarine cove			
2c Historic clay silt	Firm, subangular blocky clay silt with lighter and	Accumulated around the wooden harbor posts.	ca. AD 1807-1874 (age of post to date of

	darker laminations. 5% mica flecks and shell fragments.	Contained occasional brick, cattle bone, and shell. The upper surface contained numerous materials which migrated downwards from the landfill above.	stockyard construction)
2b Sand	Loose, single grain, well sorted f sand, coarsens downward to poorly sorted, fmc sand with 10% mica flecks.	The wooden harbor posts were set into this layer.	ca. AD 1807 (dendrochronological results for post)
2a Early silts and clays	Alternating bands of firm, subangular blocky silty clay and friable, granular fine sand. Increasing gravel component with depth. Many bivalve shells.	None.	Cal BP 1365 to 645/ Cal AD 585 to 1305 (Beta-374387)

1: Sandy post-glacial landform

1b Historic surface of landform (A and B horizons)	Mature horizonation. Gradual transition to C horizon below.	Charcoal, brick, and glass fragments present in A horizon, decreasing with depth. The stone foundation was built into this surface, as was the base of the well.	AD 1870 (TPQ)
1a Parent material of landform (C horizon)	Friable, granular to weakly subangular blocky fine silty sand.	None.	Cal BP 10245 to 10160/ Cal BC 8295 to 8210 (Beta-374382)

0 Schist boulders and bedrock	Large boulders of schist. Visible in places through the surface of the harbor sediment, and exposed by machine cuts into the sediment.	None.	Paleozoic with Pleistocene disturbance

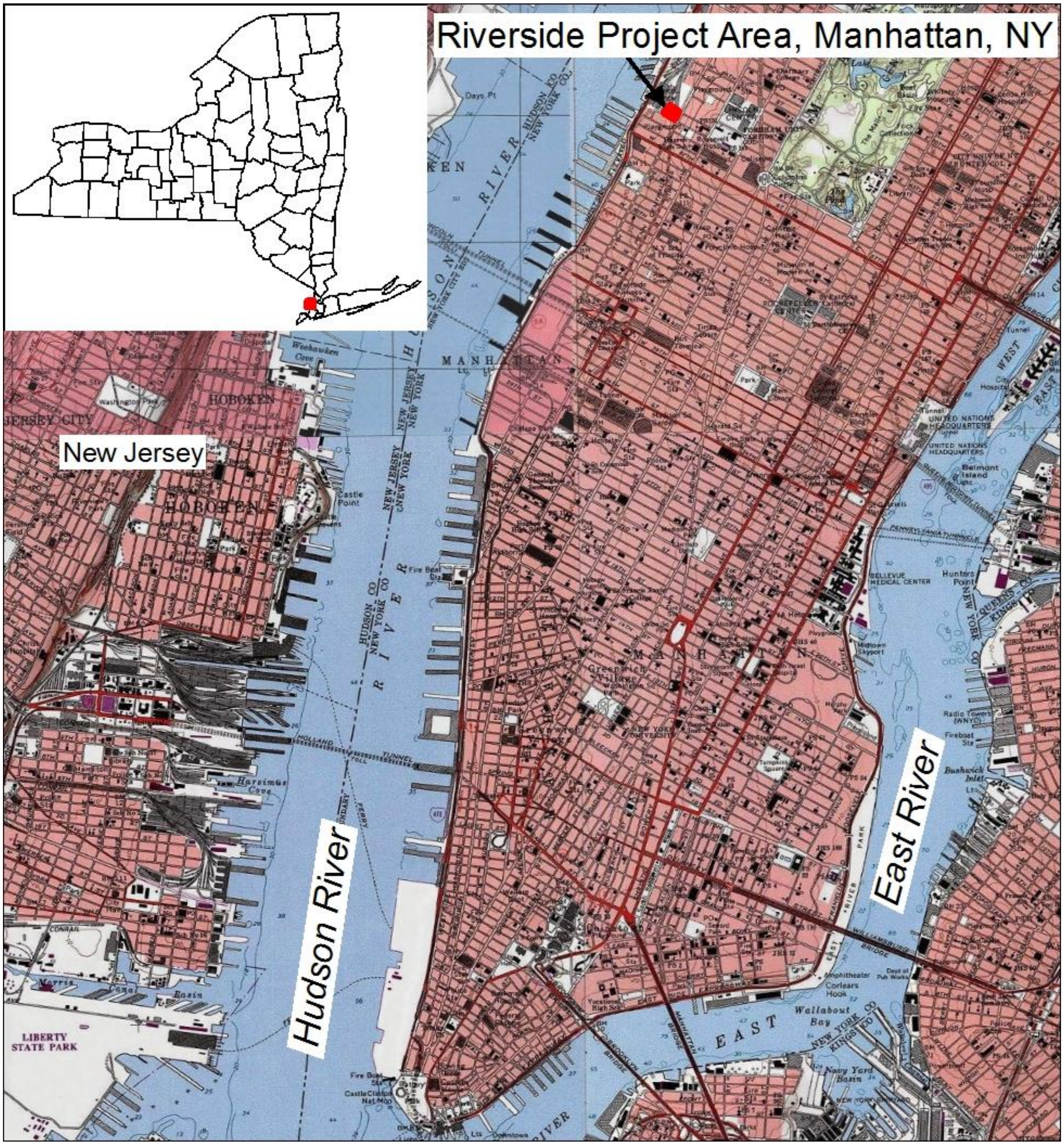
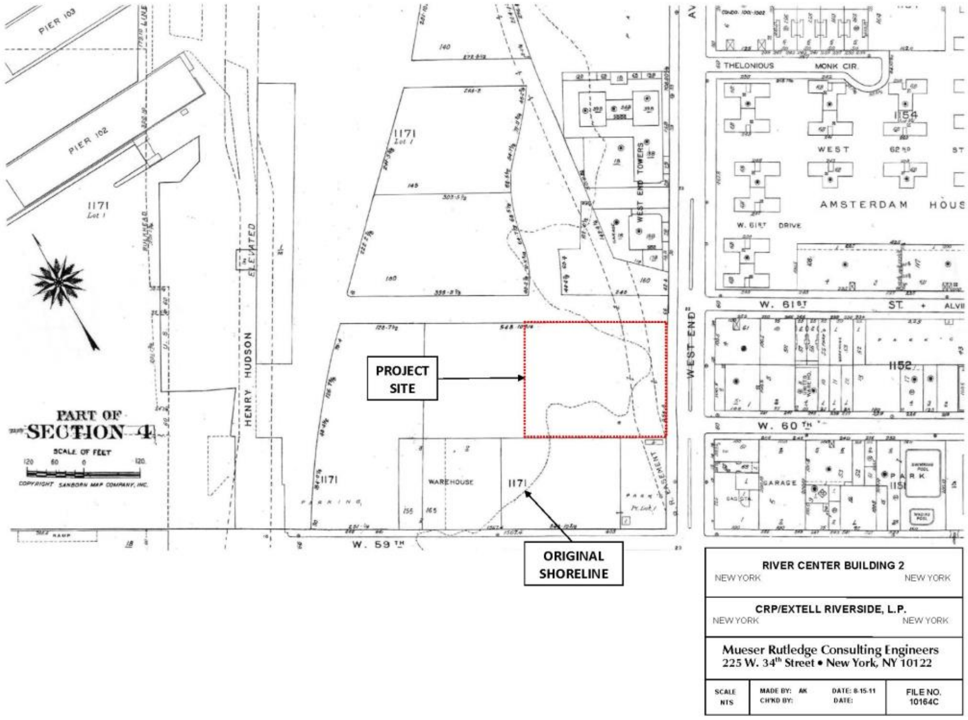
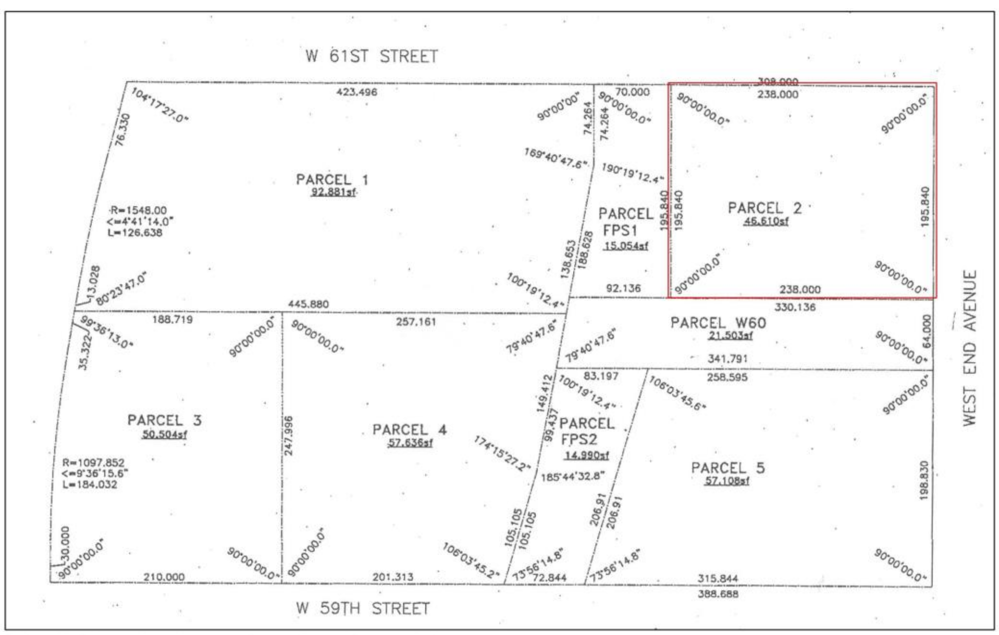


Figure 1.1. Location of the Riverside project area in Manhattan, New York.



a.



b.

Figure 1.2. The Riverside project area. Located between 60th and 61st Streets, and west of West End Avenue (a) from Mueser Rutledge Consulting Engineers (2011). Location of Parcel 2 (b).

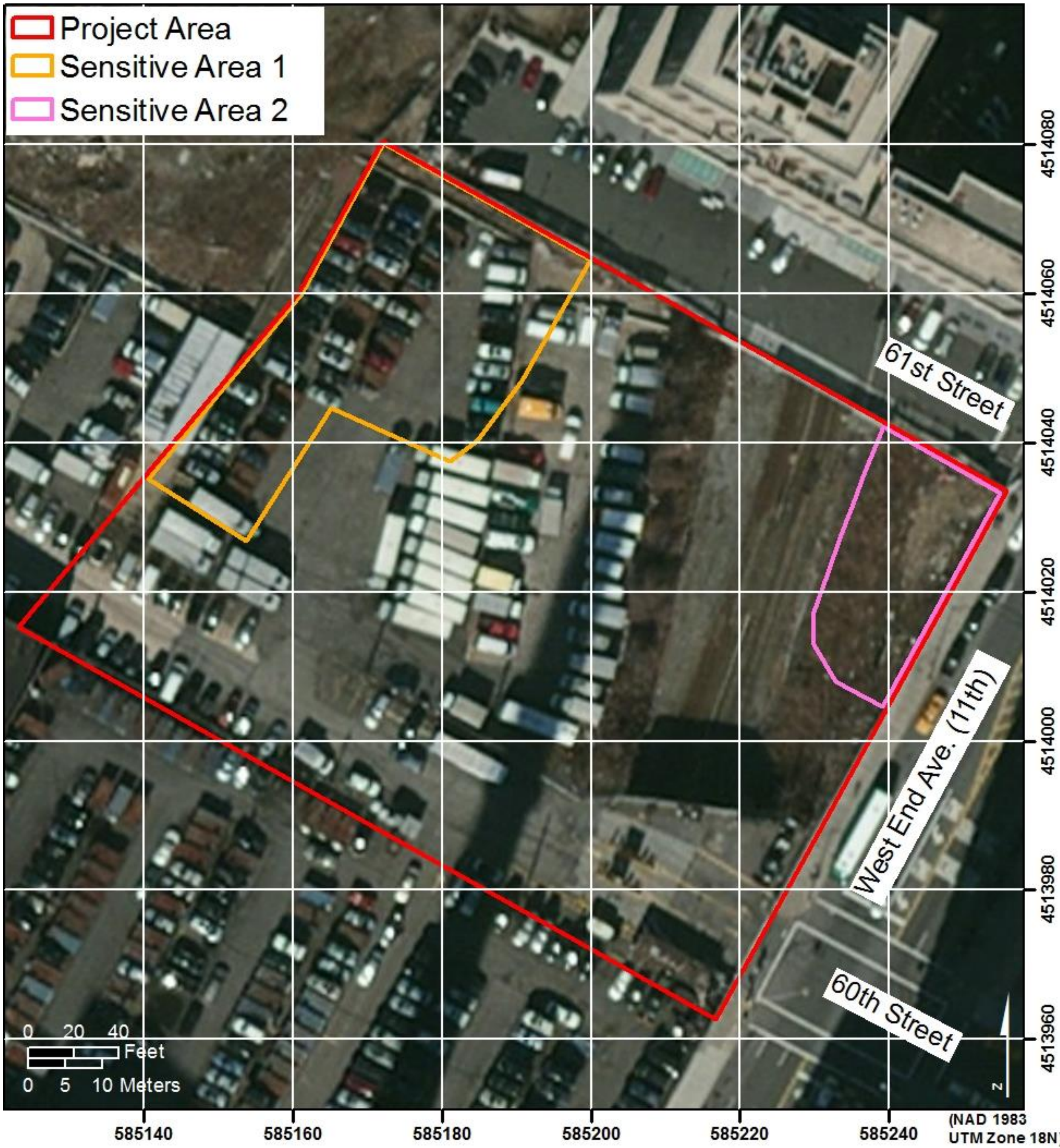


Figure 1.3. Project area with background imagery from 2010. Note Sensitive Areas 1 and 2, the locations with potential archaeological sensitivity.

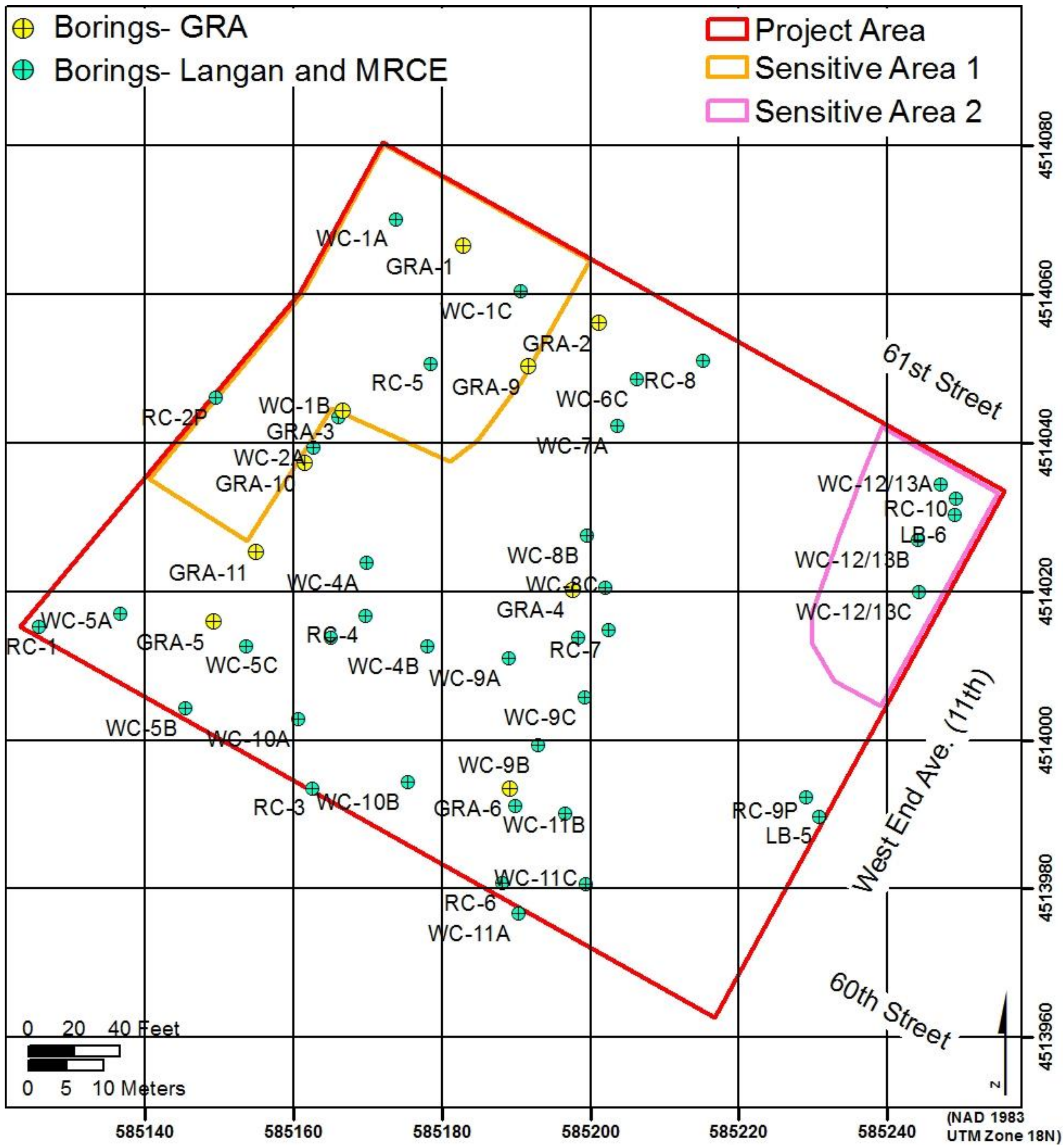


Figure 1.4. Locations of borings analyzed.

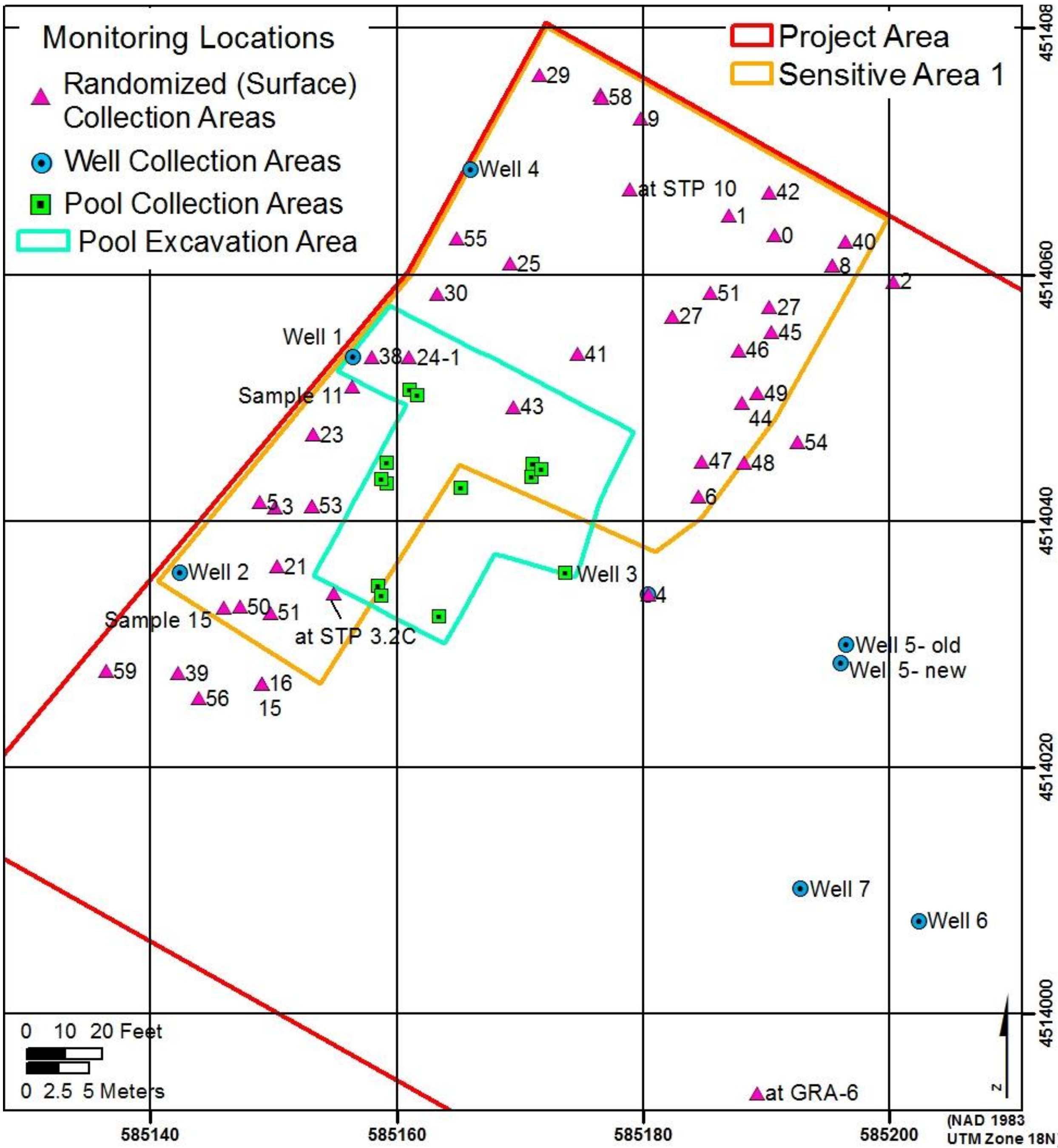


Figure 1.5. Collections made at monitoring locations in Sensitive Area 1.

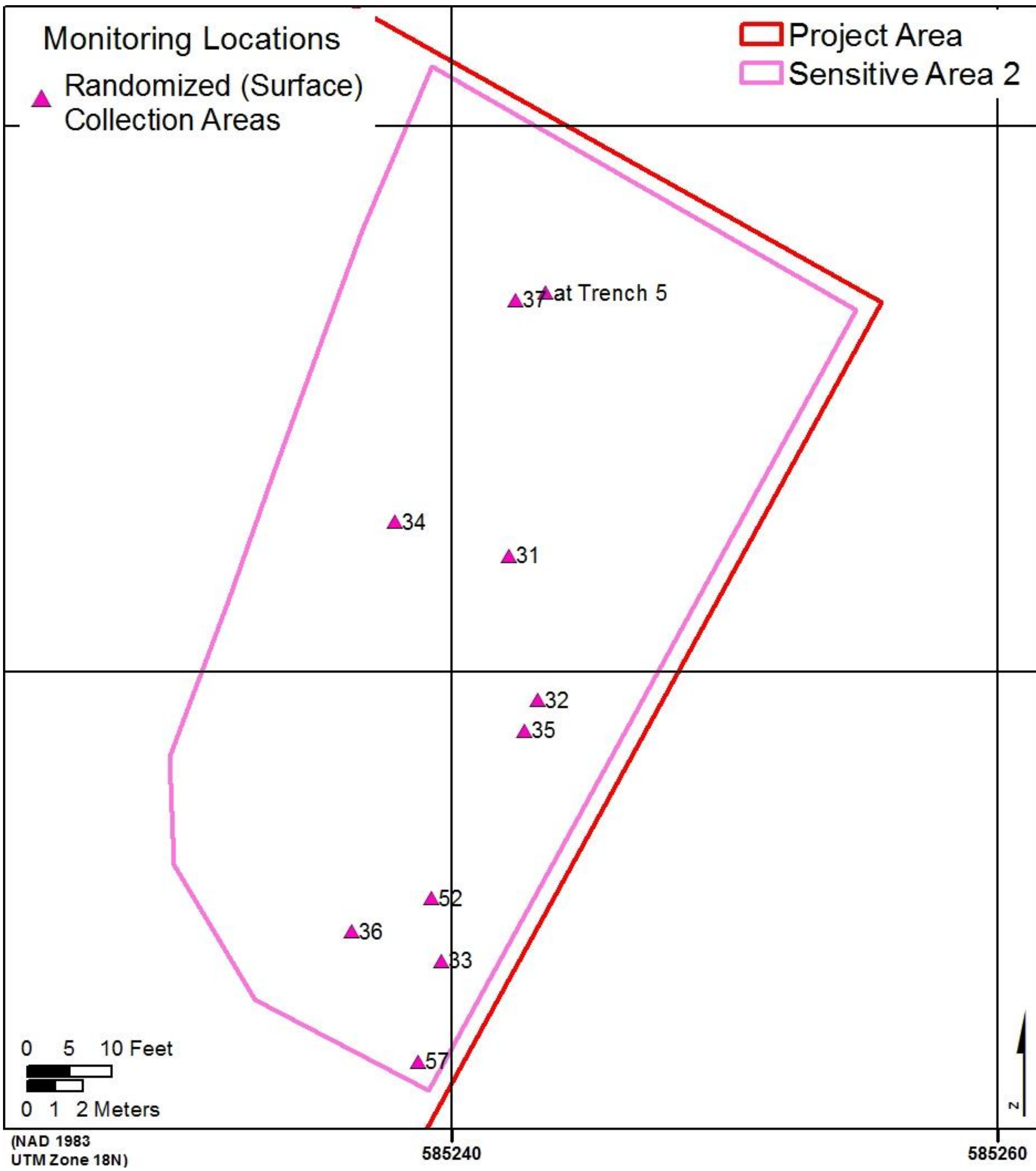


Figure 1.6. Collections made at monitoring locations in Sensitive Area 2.

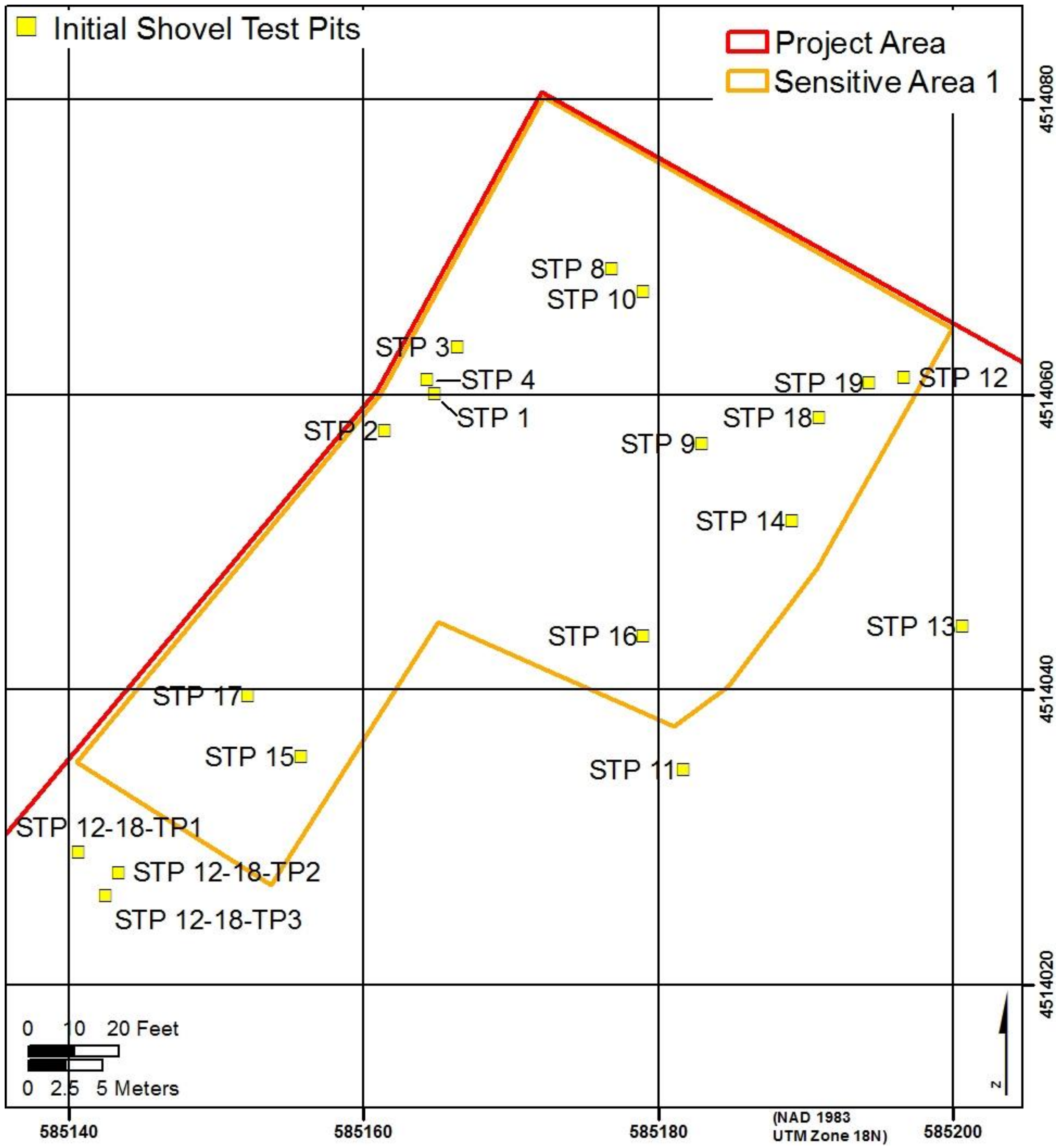


Figure 1.7. Locations of initial shovel test pits.

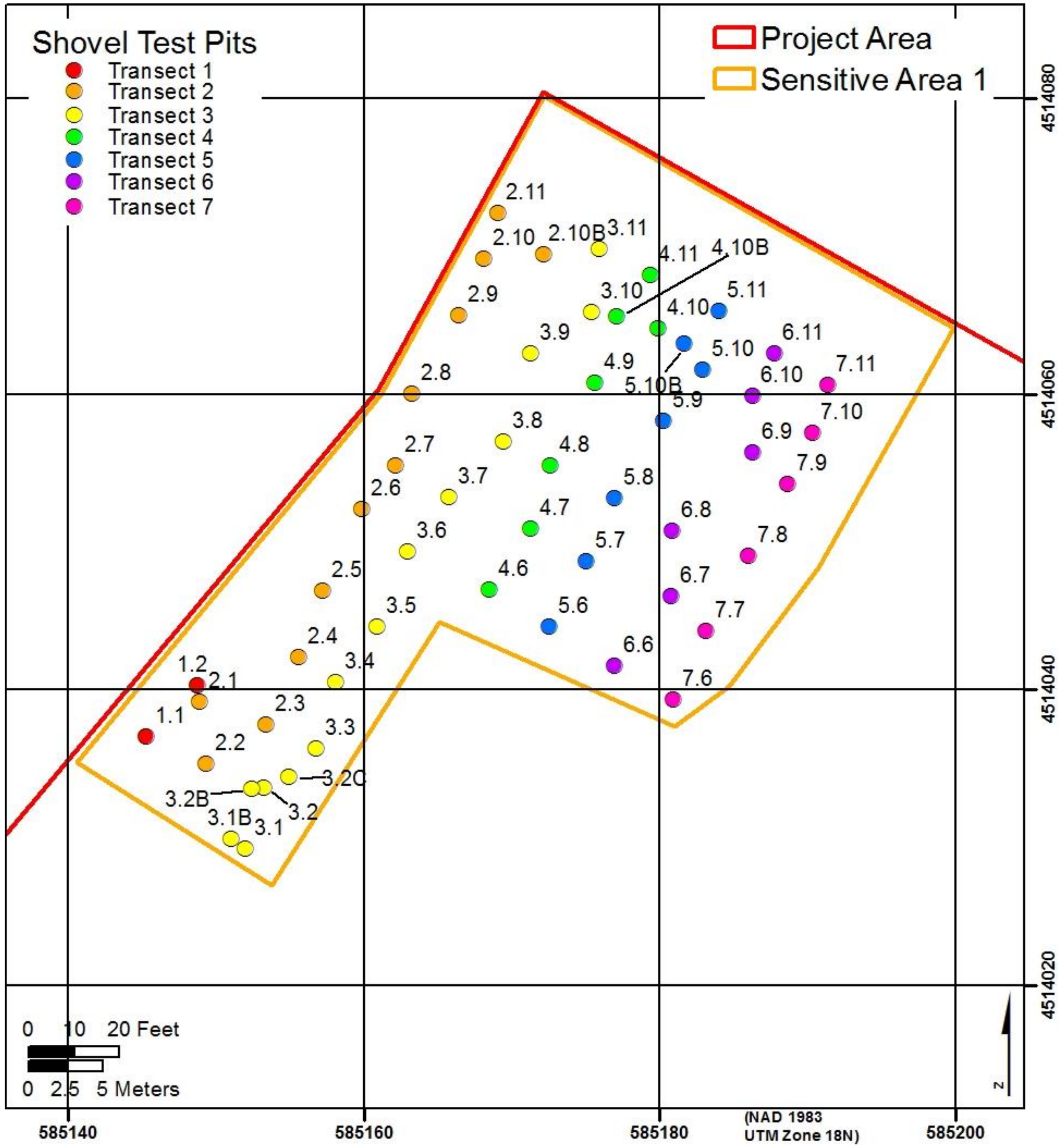


Figure 1.8. Locations of standardized shovel test pits in Sensitive Area 1.

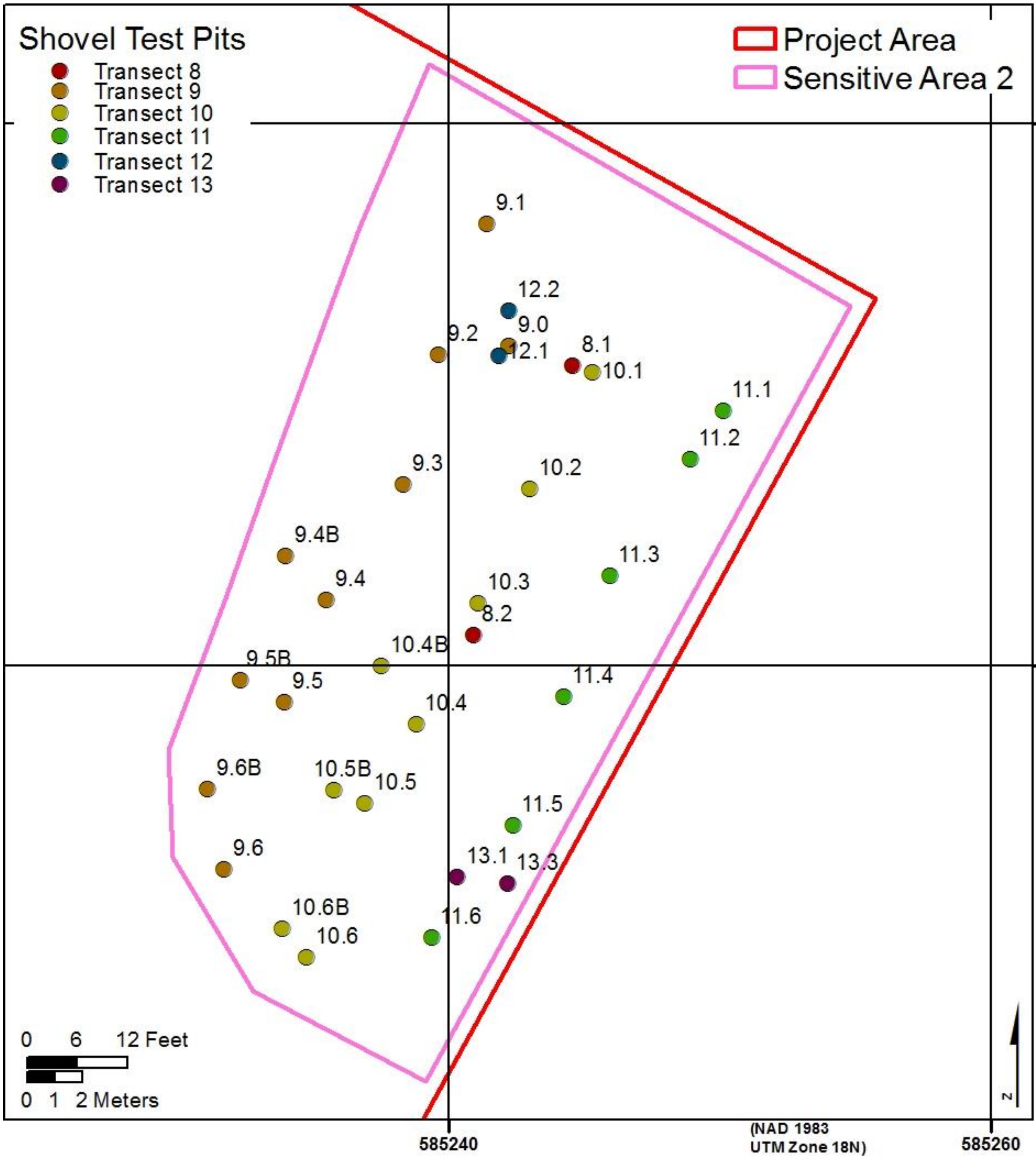


Figure 1.9. Locations of standardized shovel test pits in Sensitive Area 2.

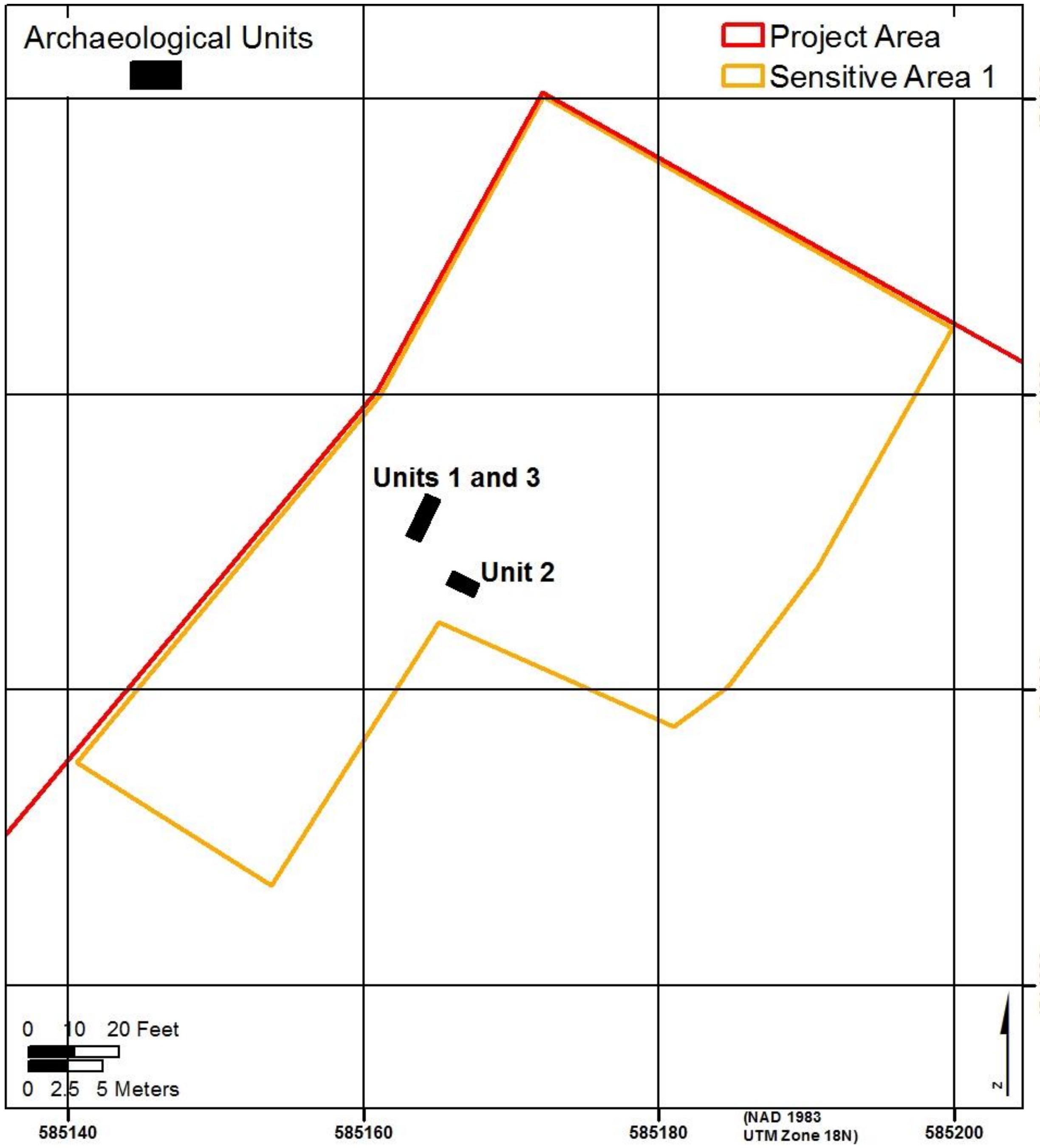


Figure 1.10. Archaeological units and trenches in Sensitive Area 1.

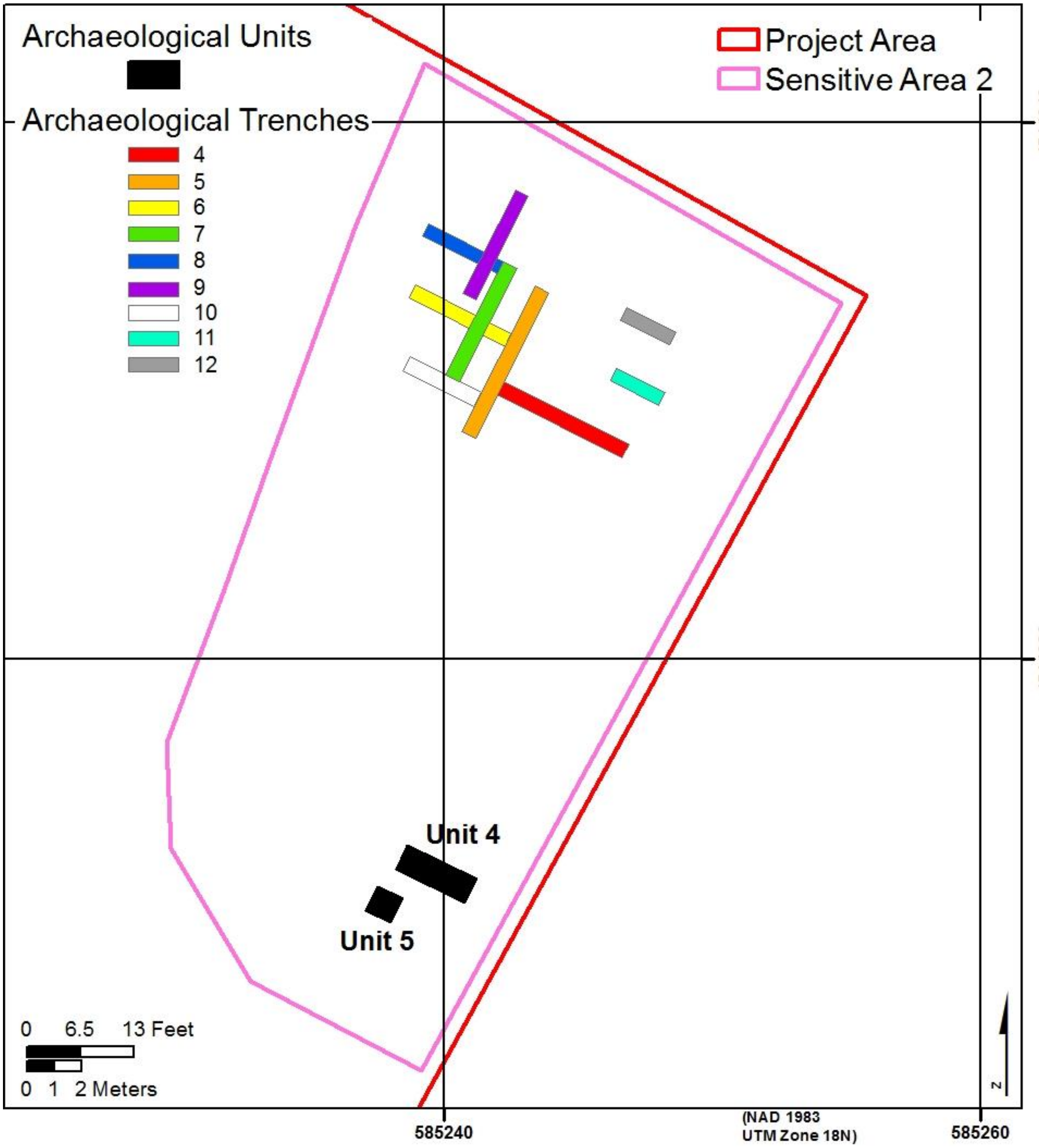


Figure 1.11. Archaeological units and trenches in Sensitive Area 2.

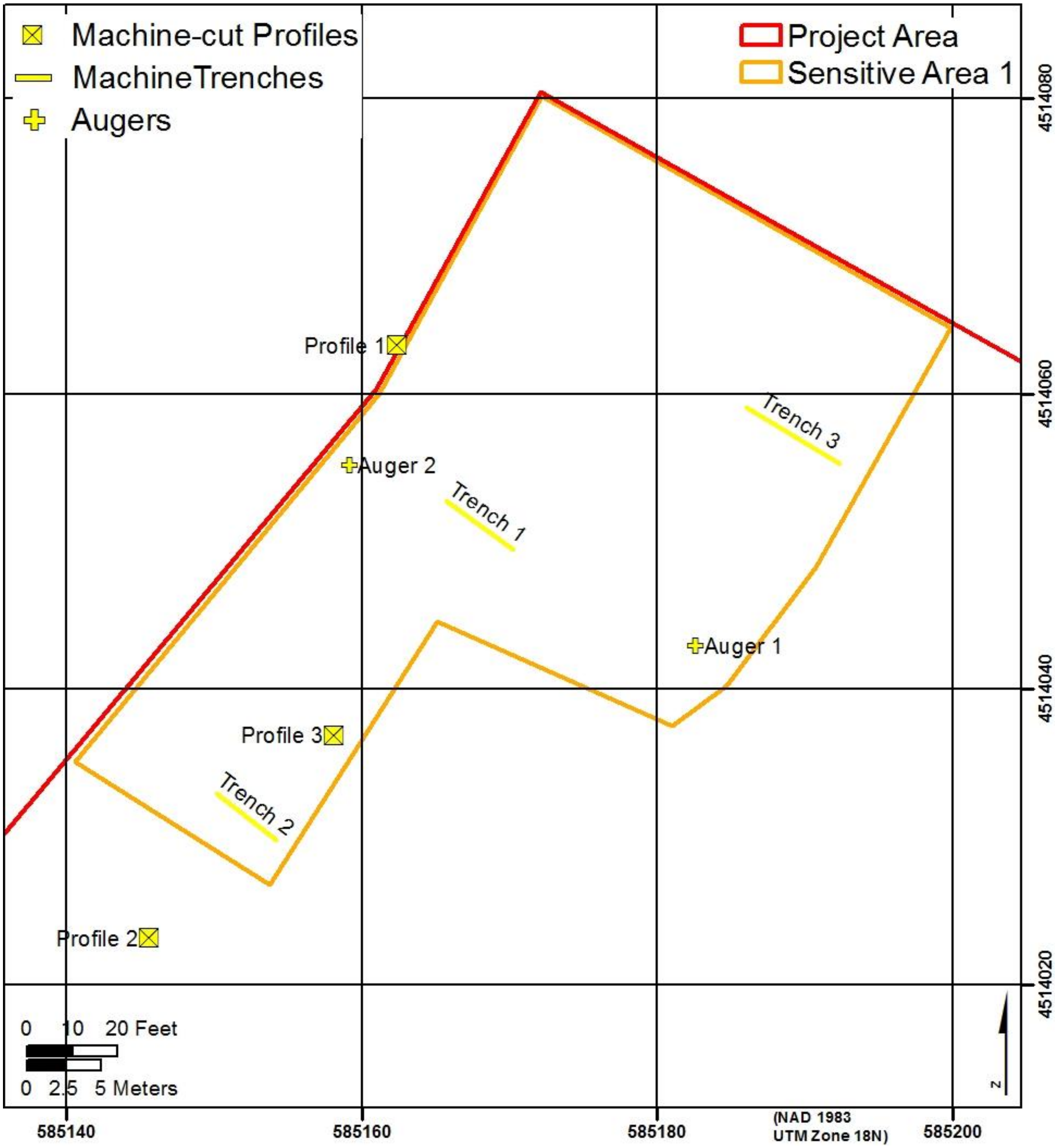


Figure 1.12. Sensitive Area 1 machine trenches, machine-cut profiles, and bucket augers, where sedimentological analyses were performed.

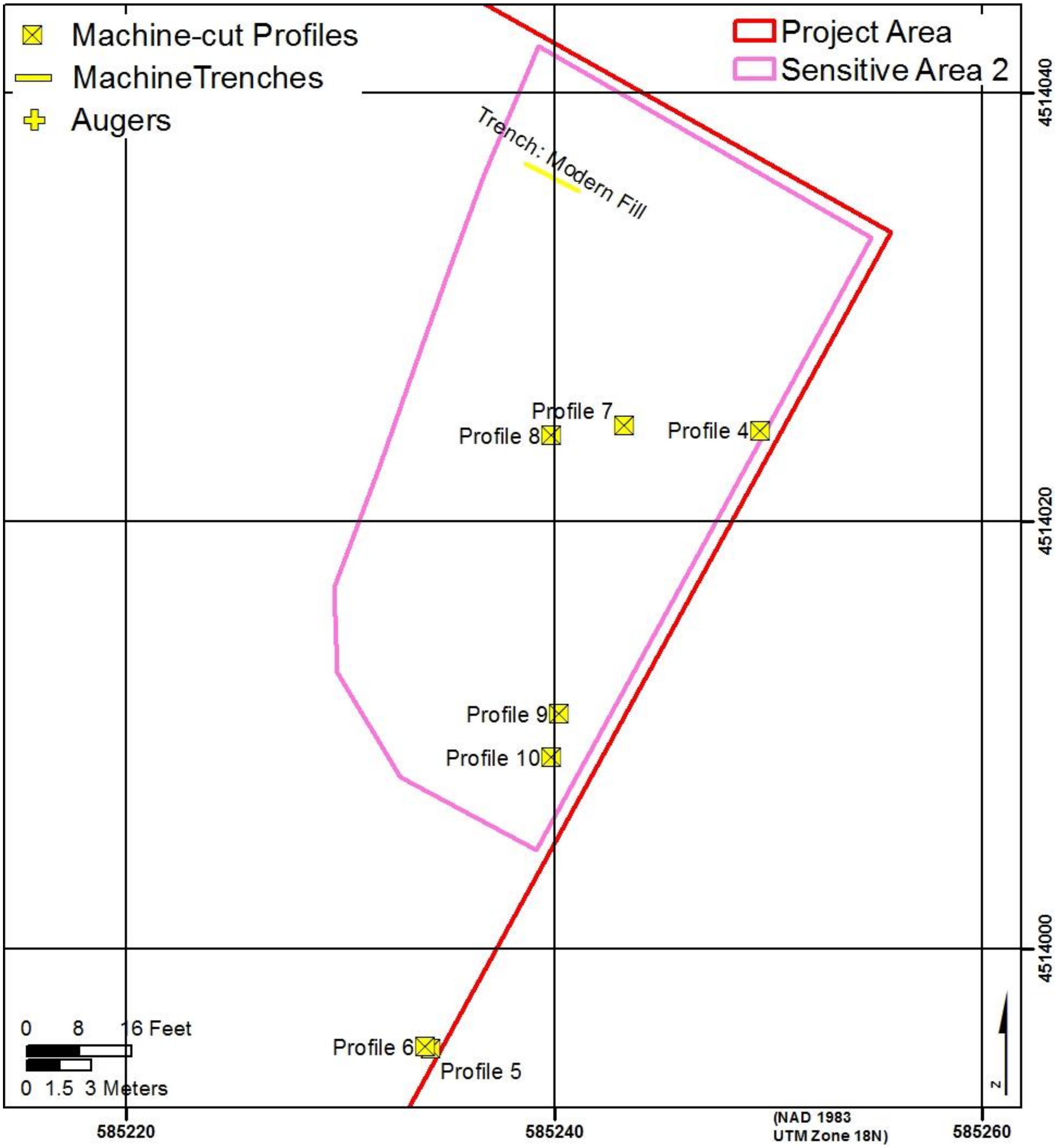


Figure 1.13. Sensitive Area 2 machine trenches, machine-cut profiles, and bucket augers, where sedimentological analyses were performed.

CHAPTER 2: BACKGROUND and LITERATURE REVIEW

Introduction

This chapter presents the environmental and geological background of the region along with a comprehensive examination of archaeological work in the New York City area including information on known Paleoindian, Archaic, Woodland, and Contact Period sites. From the Contact Period onward to the twentieth century, historic information about the project area and vicinity is considered. Included in this history is a tracing of land parcel and water lot ownership and also important developments, such as the onset of the Hudson River Railroad and the Union Stockyards. Finally, a detailed look at the 1870 and 1880 Federal Censuses for the neighborhood surrounding the project area provides a valuable context for assessing the impact of the land reclamation event at this location, which likely took place in the late fall and/or early winter of 1874-1875.

Environment

Pleistocene Glaciation, Chronology, and Landform Development

The Late Quaternary landform history of the New York Bay is a function of bedrock geology and events associated with regional glacial history. The surface and subsurface deposits date almost exclusively to the end of the Pleistocene (after 18,000 B.P.) as well as the Holocene. The sediments record the region's history of glaciation and deglaciation and corresponding marine-based submergence and emergence. Regional geological and paleoenvironmental studies are extensive. Relevant research has focused on bedrock geology (Isachsen et al. 1991; Schuberth 1968), late Pleistocene and Holocene surficial deposits (Antevs 1925; Averill et al. 1980; Lovegreen 1974; Merguerian and Sanders 1994; Rampino and Sanders 1981; Reeds 1925, 1926; Salisbury 1902; Salisbury and Kummel 1893; Sirkin 1986; Stanford 1997, 2010), as well as postglacial vegetation change (Stanford and Harper 1991) and sea level rise (Newman et al. 1969; Weiss 1974). More recently, there have been detailed studies of archaeological preservation potential for Holocene surficial deposits (Thieme and Schuldenrein 1996, 1998; Larsen et al. 2010) and estuarine sediments (LaPorta et al. 1999, Wagner and Siegel 1997).

The predominant landscape characteristics of the coastal regions of New York and New Jersey are level to rolling plains, with steep hills formed from glacial moraines. The entire area contains deep, unconsolidated glacial outwash deposits of sand and gravel. The surface above bedrock, in most places, is covered by a thin mantle of glacial till. The coasts are characterized by tidal marshes and sand dunes.

The Upper New York Bay is an estuary formed within a valley deepened and widened by the advance and retreat of the Laurentide continental ice sheet of the last Ice Age. Mesozoic-age Newark Group rocks underlie most of the New York Harbor region in New Jersey and extend up the west side of the Hudson River. The Palisades Sill of Triassic-age marks the western shore of the Hudson River in the New York City area. The sill is an igneous intrusion into the Newark Group sedimentary rocks. These sedimentary rocks contrast with the Cambrian to Ordovician metamorphic rocks of the New York Group east of the Hudson River. Quaternary-age glacial deposits rest unconformably on the Newark Group sedimentary rocks as well as those of the New York Group.

Prior to the terminal Wisconsinan, glaciers advanced across the region at least twice during the Pleistocene (Stanford 1997; Sirkin 1986). Both Illinoisan (ca. 128,000-300,000 B.P.) and pre-Illinoisan (> 300,000 B.P.) terminal moraines are mapped in northern New Jersey, and these ice advances may be represented by still earlier tills on Long Island (Rampino and Sanders 1981; Merguerian and Sanders 1994). Older tills have a "dirty" appearance and can be distinguished from late Wisconsinan deposits by the presence of unweathered mudstone, sandstone, and igneous rock-clasts in the late Wisconsinan deposits (Stanford 1997).

The Hudson-Mohawk Lobe of the latest, or Wisconsinan, ice sheet advanced to its Harbor Hill terminal moraine by 20,000 B.P. (Sirkin 1986; Sirkin and Stuckenrath 1980). The extensive and arcuate-shaped Harbor Hills landform marks the final position of the ice advance, links Long Island with Staten Island, and is dated by post-glacial radiocarbon dates from northwestern New Jersey of 19,340±695 B.P. in a bog on Jenny Jump Mountain (Stanford 1997) and 18,570±250 B.P. in Francis Lake (Cotter et al. 1986).

During the later phases of the Pleistocene, the hydrography at the glacial margin was dynamic and resulted in a glaciolacustrine landscape that involved cyclic retreats and transgressions of linear lakes that approximated the morphologies of the valleys. Lakes Passaic, Hackensack, Hudson, and Flushing variously occupied the terrain between Long Island and east-central New Jersey as well as the Hudson valley. In Newark Bay and the lower reaches of the Hackensack and Passaic River valleys, subsurface stratigraphy revealed uniform lake bed sequences beginning with deep, classically-varved, pro-glacial sediments (Antevs 1925; Lovegreen 1974; Reeds 1925, 1926; Salisbury 1902; Salisbury and Kummel 1893; Stanford 1997; Stanford and Harper 1991). Reddish-brown muds derived from Mesozoic-age Newark Group rocks form thicker winter layers, while more sandy sediment layers were deposited as the ice melted during the summer. The top of the glaciolacustrine sediment sequence is typically an unconformable contact from 4-9 m (12-30 ft) below the present land surface in the Hackensack Meadowlands (Lovegreen 1974). These same varved silts and clays fill the deeper parts of the incised Hudson valley and are overlain by riverine sands and gravel, which are, in turn, capped by thick marine estuarine muds.

Deglaciation of the Mohawk River lowland between 13,000 and 12,000 B.P. was a key event in the geologic history of the New York Harbor area. Proglacial Lake Iroquois, which occupied the Lake Ontario basin, subsequently drained directly to the Hudson River valley via the Mohawk lowland and added to the volume of pro-glacial Lake Hudson. Researchers disagree on the mechanism, but an outlet through the Harbor Hill moraine at the Narrows was opened at about this same time, emptying Lake Hudson and forming the present Hudson River drainage pattern. Newman and his coauthors (Newman et al. 1969) noted that marine and brackish water filled the 27 m (89 ft)-deep channel of the Hudson River at 12,500±600 B.P. (14,830 cal B.P.) as evidenced by marine and brackish marine microfossils preserved at the base of organic silts beneath peat bogs at Iona Island. It is unclear as to whether the erosion of the outlet through the Harbor Hill moraine was gradual or catastrophic as proposed by Uchupi et al. (2001) and Thieler et al. (2007). Nevertheless, evidence suggests that flow from the Hudson River eroded a channel and valley across the exposed continental shelf to drain and deposit a delta on the outer shelf at a lowered sea level stand. Most challenging to our understanding of the Hudson River history is the lack of a clear explanation for a direct marine connection between contemporaneous sea level at the edge of the continental shelf and the upper Hudson River valley. More generally, we consider the shelf to have been subaerially exposed at this time. Differential isostatic adjustment of the earth’s crust following deglaciation is the most reasonable explanation accounting for down-warping and depression of the crust beneath glacier ice in the north and commensurate uplift of the continental shelf, thereby raising sea level in line with the upper Hudson River channel. Evidence for differential uplift of the crust along the upper Hudson Valley (relative to the New York Harbor area) is based on historic tide gauge data by Fairbridge and Newman (1968), although the complete relationship remains unclear.

The early Holocene landscape of the New York region has been profoundly influenced by late Pleistocene glaciation. As recently as 15,000 B.P., most of what is now New York City was covered by the Wisconsin Ice Sheet. Sea levels were 50 meters lower than today, so that much of what is now the bottom of New York Harbor and the Continental Shelf was dry land (Schuldenrein et al. 2014). The net effect is that any evidence of human occupation from the late Pleistocene was either inundated, or scoured away by glaciers. Around 13,000 years ago, the waters of the Hudson River, which had been trapped behind a moraine dam to form Glacial Lake Bayonne or Albany (as per Stanford 2010), breached the moraine which separated it from the Atlantic. The lake drained out, leaving a broad post-glacial basin bisected by the Hudson River. Newly exposed surfaces began to erode as streams carved gullies through moraine deposits and the redeposited till of the post-glacial lacustrine margins. These early glacial tills and redeposited tills are commonly found within six meters (20 ft) of the modern surface of the New York region, and date to 20,000-16,000 B.P. These late Pleistocene sediments are typically capped by much younger sediments. This gap in the chronology is partly due to the fact that the wetlands which provide the best-preserved organic material for radiocarbon dating formed within low-lying areas such as basins and gulleys, which themselves formed during post-glacial erosion. Geoarchaeological analysis by GRA on Staten Island confirms this gap (Schuldenrein et al. 2013). The deepest sediments are poorly-sorted sands with gravel and clay rip-ups, indicating a high-energy fluvial environment. These date to around 18,000 cal B.P., perhaps indicating redeposition of old organic material as the lake drained. This layer interfaces unconformably with a well-sorted, fine-grained, shelly sand above, which began to accumulate at a steady rate beginning 2,600 cal B.P.

The present study relies on an accurate record of relative sea level rise developed for the New York Harbor area by Schuldenrein et al. (2013) for determining the submerged locations of probable prehistoric human habitation areas in the Hudson River channel. That study proposed a model for archaeological sensitivity that would help guide plans to minimize impacts on cultural resources by future marine construction. The sea level curve (Figure 2.1) was derived from existing and newly reported radiocarbon analyses from nearby submerged settings (Schuldenrein et al. 2013), and presents a relative sea level history consistent with "far field" eustatic sea level studies (Fleming et al. 1998). The curve shows a rise in relative sea level at a rapid rate of approximately nine mm/yr (0.5 in/yr) from at least 9,000 until 8,000 cal B.P., with a diminished rate of 1.5-1.6 mm/yr (0.06 in/yr) from 7,000 cal B.P. until the present. This sea level model is consistent with studies for the Connecticut shore (Bloom and Stuiver 1963), Massachusetts (Redfield and Rubin 1962), as well as the re-examination of the Delaware Bay data (Belknap and Kraft 1977; Nikitina et al. 2000) by Larsen and Clark (2006).

At the present project area, the basal geology is the Manhattan Formation, which is composed of Paleozoic schist and amphibolite. Pleistocene glaciation tore up fragments of this bedrock and deposited rounded boulders of the same throughout the Hudson River valley. The surficial geology for the project area is glacial till, with bedrock lying one to three meters (3 to 10 ft) deep, but occasionally cropping out at the surface. This zone of shallow bedrock has a variable mantle of till and rock fragments.

Background Research

Paleoindian Period (12,000-9,500 B.P.)

Retreating glaciers exposed the lower Hudson River Valley by 13,000 B.P., allowing for the establishment of flora and fauna, as well as the initial settlement of Native American populations in the northeast (Hartgen Archaeological Associates 1990). In general, these northeastern Paleoindians were hunter-gatherers, most likely hunting large mammals, such as mammoths and mastodons, as well as smaller animals, and supplementing their diet with fish and wild plants (Cantwell and Wall 2001). The most recognizable lithic technology of Paleoindians is fluted points, with lithic assemblages also including diagnostic knives, scrapers, drills, and gravers. Paleoindians were most likely fairly mobile, living in small groups of fewer than 50 individuals (Dincauze 2000). Archaeological evidence of Paleoindians in New York City is scarce. Occupations that may have been close to the coastline have obvious preservation and recovery issues: as sea levels rose, much of the shoreline became submerged (see Schuldenrein and Aiuvalasit 2011 for a discussion of sea level changes in New York City). The only Paleoindian site discovered in New York City is Port Mobil, on Staten Island (locations of sites mentioned throughout this background section are shown in Figure 2.2). This site consists of fluted points and other stone tools (Kraft 1977; Ritchie 1980).

Archaic Period (9,500-3,000 B.P.)

Spanning almost 7,000 years, the Archaic period has been sub-divided into three main sub-periods based on both ecological and cultural changes identified in the archaeological record. These sub-periods are the Early Archaic (9,500–7,000 B.P.), the Middle Archaic (7,000– 5,500 B.P.), and the Late Archaic (5,500–4,000 B.P.) (see Richie 1980, as well as Hartgen Archaeological Associates 1990; Historical Perspectives 1997). There is also sometimes a period between the Archaic and Woodland periods, referred to as either the Terminal Archaic or Transitional Period (4,000-3,000 BP). Although there is still some debate regarding timing (Funk 1997; Kraft 1986; Pfeiffer 1990; Ritchie 1980), these dates have garnered the broadest consensus and are employed here.

In general, post-glacial warming continued during the Early Archaic period, with hardwood forests becoming more extensive. Emerging habitats, such as the formation of lakes and other small water bodies, drew in smaller animals (e.g., rabbit, turkey, waterfowl, and white-tailed deer), as well as human populations (AKRF 2008). Eventually, peoples of the Archaic became less mobile, likely migrating seasonally, but repeatedly occupying specific territories (Dincauze and Mulholland 1977). In the Northeast in general, the exploitation of coastal resources started during the Middle Archaic period, with evidence in the form of both fishing technology (e.g., hooks and stone net sinkers) and faunal remains (shell middens, estuarine and marine fishes, etc.). Changes in lithic technology include the initial evidence of stone mortars and pestles, stone axes, a greater range of hide scrapers, and eventual manufacture and use of steatite bowls. Non-local lithic materials were also used suggesting groups were connected by (a) trade network(s) throughout the Archaic period (AKRF 2008).

In the coastal New York area, Archaic sites have been located on tidal inlets, coves, bays, and fresh water ponds (Elquist 2015; Ritchie 1980). Only a few Early Archaic sites have been identified in New York City and none on Manhattan. Most of these sites are located on Staten Island and include Ward's Point (Funk 1976), Richmond Hill (Anderson 1976), the H. F. Hollowell site, and the Old Place site (Ritchie and Funk 1971). As water levels were considerably lower during the Early Archaic, these sites were originally further inland. Any Early Archaic sites that were originally along the coast are now likely submerged (see Salwen 1962, 1965). At the Old Place Site, specific domestic tasks could not be discerned, and only stone tool assemblages were recovered from a relatively shallow depth (Ritchie 1980). The other three sites were stratified habitation sites, with evidence related to various domestic tasks (e.g., cooking, woodworking, and hide processing). This palimpsest of occupation makes it difficult to discern whether people returned to these sites seasonally, or visited them more sporadically while passing through (Cantwell and Wall 2001).

Few Middle Archaic period sites have been found in the area, with most being large shell middens (predominantly of oyster), often found near major water courses such as the Hudson River (Brennan 1974; Claassen 1995). Seasonal population movements, based on the exploitation of specialized resources may have become well established in this period and in turn may have led to the creation of territories (Dincauze and Mulholland 1977). Middle Archaic shell middens have been documented north of New York City, along the Hudson River. For example, Dogan Point, dating between 6,900 and 4,400 B.P., is the oldest known such site on the East Coast, consisting of Middle and Late Archaic shell middens (Brennan 1974; Cantwell and Wall 2001; Claassen 1995; Funk 1991, 1996). Non-shell midden Middle Archaic sites have been found on Staten Island based on projectile points. These include Ward's Point, Chemical Lane, and Harik's Sandy Ground (Jacobson 1980; Lavin 1980; Rubertone 1974).

At the onset of the Late Archaic, sea levels had risen to approximately 18 meters below their current level. Over this period, the climate continued to warm, affording ample resources for peoples occupying the Northeast (Historical Perspectives 1997). An increased population has been noted not only in the Northeast but specifically in the New York City area as well (Cantwell and Wall 2001). Though the increased number of sites could have resulted from an increased population "brought on by the more stable environment", it may also simply be from "a bias in site visibility" (Historical Perspectives 1997:V-4).

Several sites have been found in the New York City area from this time. For example, Harik's Sandy Ground Site, Wort's Farm Site, Goodrich Site, Smoking Point Site, Pugsley Avenue Site, and Bay Terrace Creek Site have all yielded Late Archaic projectile points (Cohn and Armelagos 1988; Eisenberg 1982; Lavin 1980; Lenik 1989; Silver 1984; Skinner 1919, 1920; Smith 1950; Weil 1971; Williams 1968; Wisniewski 1986). However, on the island of Manhattan, Tubby Hook and Inwood, located on the northern tip of the island, are the best known sites (Bolton 1922; Skinner 1915; Smith 1950). Both sites contain large shell middens, while the Inwood site also features rock shelters that were inhabited by Archaic populations. Both sites were continuously occupied for several thousand years. The Late Archaic components of these sites contained stone axes likely used for various woodworking tasks and bannerstones likely used as counterweights in conjunction with atlatls. These bannerstones represent the earliest evidence of the use of spearthrowers in the New York City area.

It has been speculated that Late Archaic people within the New York City area had a "warm-weather main base camp or village" (Cantwell and Wall 2001:59). From here, they would have traveled to fishing stations and to other locations to gather wild plants in the spring and fall. In the fall, they also would have likely gathered seeds and nuts in preparation for the winter. Winter months may have been spent away from these base camps or villages, more toward the interior, at hunting camps. However, this picture is based more on a general pattern emerging throughout the Northeast than on direct evidence recovered within New York City (for general coverage of this topic see: Bettinger 1987; Fagan 2000).

In the Terminal Archaic or Transitional period (4,000-3,000 BP), the first evidence of ceremonial behavior emerges (within New York City) and new technological developments arise as well (Cantwell and Wall 2001). Funk identifies three distinct cultural traditions over this period based on projectile point typology observable through the Northeast: the Launentian tradition (with the Vergennes phase and the Vosberg complex), the Small Stemmed tradition (with the Sylvan Lake complex), and the Susquehanna tradition (with the Snook Kill and Orient phases) (Bolton 1976:250). All three of these traditions are evident in the Hudson River Valley. However, the relation of these material culture traditions to one another remains a subject of debate (see: Snow 1980).

Many Terminal Archaic sites have been found throughout New York City, especially from the Orient phase of the Susquehanna tradition. Material from this phase is primarily identified by long fishtail projectile points. For example, Orient fishtails have been recovered from Tubby Hook site in Manhattan, Bay Terrace Creek in Queens, Smoking Point and other sites on Staten Island, and at the Throgs Neck site in the Bronx (Silver 1984; Skinner 1919, 1920; Wisniewski 1986). The other typical piece of Terminal Archaic material culture is a soapstone (steatite) bowl. This new type of bowl implies an accompanying shift in cooking practices. These pots are relatively heavy and also efficient at retaining heat, characteristics that point toward the possibility of a more settled lifestyle (Cantwell and Wall 2001).

Evidence of ceremonial behavior in the Terminal Archaic comes in the form of four complex hilltop cemeteries attributed to the Orient phase and found on eastern Long Island (Orient I, Orient II, Jamesport, and Sugar Loaf Hill) (Booth 1982; Latham 1953, 1978). Unfortunately, these sites were first excavated by avocational archaeologists; thus, the primary records regarding these sites are incomplete by today's standards. Ritchie reanalyzed much of their work and conducted additional fieldwork of his own (Ritchie 1944, 1959, 1980). These sites reveal an elaborate and varied treatment of the dead and their remains, ranging from single burials to communal burials, cremations, deposition at different points of decomposition, bundling of bones, and the deposition of burial goods as well (Cantwell and Wall 2001). Although these sites indicate ceremonial behavior of the Terminal Archaic people in the general region, no such site has been found within New York City or in the directly surrounding area (AKRF 2008).

Woodland Period (3,000-500 B.P.)

The Woodland period spans roughly two and a half millennia. As with the Archaic, the Woodland Period is divided into sub-periods: Early Woodland (3,000-1,700 BP), Middle Woodland (1,700-1,000 BP), and Late Woodland (1,200-500 BP) (Hartgen Archaeological Associates 1990; Historical Perspectives 1997). In general, during the Woodland Period of the Northeast, people underwent dramatic social, economic, and technological changes, shifting further away from a nomadic lifestyle of hunting and gathering to a more settled lifestyle incorporating horticulture (Cantwell and Wall 2001). Social rituals become more evident, with elaborate human and canine burials, and artifacts such as stone pipes representing the first evidence of ritual smoking. Pottery production began in this period as well, and sub-period attribution is often based upon seriation of pottery characteristics. Early Woodland pottery took the form of coil pots with pointed bases, manufactured with grit temper. In the Middle Woodland, people produced shell-tempered vessels that were embellished with stamped and imprinted ornamentation. Near the end of the Middle Woodland, finely decorative rims were also added to these vessels. By the end of the Late Woodland, people were producing high-quality and intricately decorated pottery (AKRF 2008; Louis Berger Group 2004). Other technological developments took place in addition to pottery production. Composite tools became more common during this time, and the development of the bow and arrow also occurred. Woodland people persisted in making tools from imported materials, showing that earlier trade networks remained in use (AKRF 2008; Cantwell and Wall 2001).

Populations around New York City continued to hunt and forage for at least part of the time. The patchwork of assorted environmental resources throughout the region may have made a complete shift to agriculture less attractive (Cantwell and Wall 2001; Grumet 2009). However, these Woodland societies seemed to be more sedentary than peoples from the previous periods, and these settlements were often paired with the farming of various crops, as well as with intensified linkages between groups of people and territories (AKRF 2008; Cantwell and Wall 2001). In eastern New York, the Early Woodland Period manifests as the Middlesex Phase, consisting of undecorated ceramics known as Vinette 1 pottery, which was tempered with steatite. Pottery indicative of this period has been observed at sites along major waterways and tributaries. Such sites are also often found at sand and gravel mining operations in close proximity to fresh water (Hartgen Archaeological Associates 1990; Historical Perspectives 1997; Ritchie 1980). Over the course of the Early Woodland Period, temperatures gradually grew cooler, and thus the availability of resources was possibly constricted. Settlement patterns seem to indicate a shift toward the reliance on alternative resources. Coastal resources, providing year round availability, were sought while upland hunting and gathering continued as a supplemental strategy (Hartgen Archaeological Associates 1990; Historical Perspectives 1997). Among these coastal resources were anadromous fish, which provided a predictably consistent and reliable food source. The possibility that fish weirs were used in the Hudson and smaller tributary rivers has been suggested, although it has not been linked specifically to the Early Woodland. Such a practice is thought to have provided a significant caloric source for a growing population (Brumbach 1986).

Evidence for the Early Woodland in New York City is limited. It comes primarily from the North Beach site, where La Guardia Airport is presently located. Excavation of a refuse pit prior to the construction of the airport resulted in an assemblage of over 400 pottery sherds, wood and hide working tools, bone awls and needles, and various hunting equipment (Smith 1950:186-187). It has been suggested that at the time of occupation, this site may have been a base camp for a small family group (Cantwell and Wall 2001:76).

There is more evidence for the subsequent Middle Woodland period in New York City. In general, site types ranged from small seasonal and temporary camps, workshops, cemeteries, burial mounds, to large camps that were semi-permanent and recurrently occupied (Funk and Ritchie 1973:349). Semi-permanent camps or "village" sites such as Tottenville on Staten Island and Port Washington on Long Island were occupied during this time (Ceci 1990) and were situated in general proximity to locations where resources could be easily targeted. Along the coast, and on the shores of the Hudson River, shell middens indicate an increased reliance on aquatic resources (Hartgen Archaeological Associates 1990; Historical Perspectives 1997). In the Lower Hudson drainage, the Middle Woodland is made up of the Windsor tradition Northbeach Phase and Clearview Phase (Snow 1978). These phases are demarcated by changes in projectile point and ceramic styles (Funk and Ritchie 1973; Smith 1950; Suggs 1966) (for detailed information on projectile point types see: Ritchie 1971). At this time, more exotic raw materials were employed in the manufacture of lithics, which indicates the possibility of an increased level of traffic along trade networks. This is typified in both the lithics and ceramics recovered at the Morris-Schurz site in the Bronx (Kaeser 1963). In terms of ceramics, vessel walls became thinner, and vessel shape became more rounded. These changes may indicate a shift in cooking practices, which in turn may indicate the adoption of maize horticulture (Braun 1980; Ceci 1979). It has also been suggested that ornamentation of ceramics may have been used to signify cultural affiliation, and thus may be indicative of a heightened sense of territoriality (Hartgen Archaeological Associates 1990; Historical Perspectives 1997).

Over the course of the Late Woodland period, the East River tradition replaced the Windsor tradition. Specifically in the New York City area, the East River tradition was composed of the Bowmans Brook phase, and then the Clasons Point phase (Snow 1978). Settlement patterns indicate the utilization of a wide range of ecological settings. Late Woodland peoples occupied coastal and island locations, including tidal streams and coves, as well as inland locations on major drainages, with campsites found along streams, near swamps, and at inland rockshelter sites (Hartgen Archaeological Associates 1990; Historical Perspectives 1997; Ritchie 1980). Examples of shellfishing stations include the Dyckman Street site (Skinner 1920) and the Kaeser site (Rothschild and Lavin 1977). Overall for this period there was both an increase in the number of sites and the size of those sites as well as number of artifacts recovered (Hartgen Archaeological Associates 1990; Historical Perspectives 1997). The people of this area inhabited a set of small village communities at sites such as Archery Range, Washington Heights-Inwood, Clasons Point, Aqueduct, Bowmans Brook, and Ward's Point (Cantwell and Wall 2001). An annual subsistence round likely persisted with movements following a seasonal pattern (Hartgen Archaeological Associates 1990; Historical Perspectives 1997). It has been suggested (e.g., Mulholland 1988) that semi-permanent settlements may have resulted in increased competition and the need to defend productive tracts of land, which in turn may have heightened a growing sense of territory. However, when living in New York during the early-to-mid 1600s, van der Donck (2008) noted that Native Americans would let anyone use resources, as long as those people were not from a group currently at war with them (suggesting that conflict arose for other reasons).

Contact Period to Present (AD 1500 to Present)

The arrival of the first Europeans in the early 1500s marked the end of the Woodland period and the onset of the Contact Period. The Lenape (The People) occupied an area known as Lenapehoking (The Land of the People). The local group of Lenape spoke a dialect now known as Munsee and occupied an area that included the lower Hudson Valley from western Long Island to northern New Jersey and into northeastern Pennsylvania (AKRF 2008; Cantwell and Wall 2001). The name Munsee, used to refer to these people, should not imply a single, unified socio-political entity. The Munsee were comprised of numerous "autonomous groups," (Cantwell and Wall 2001:120) some of whose names still persist as place names, such as Canarsee, Hackensack, and Massapequa (Grumet 2013). The Munsee lived in villages made up of multiple longhouses and practiced some farming, but still subsisted largely through hunting, gathering, and fishing (AKRF 2008; Grumet 2013).

Although this period is known as the Contact Period, the precise nature of the contacts between the Lenape and the first European colonists is not fully understood; however, both groups most certainly affected each other. Interactions slowly but steadily increased after the voyage of Henry Hudson's Half Moon in 1609 with the creation of a trading post and the formation of the New Amsterdam colony (Burrows and Wallace 1999). In 1624, Fort Amsterdam was begun at the behest of the Dutch West India Company (at the location now occupied by the National Museum of the American Indian—New York). The introduction of European culture into indigenous society significantly changed the ways of life once maintained by the Native Americans, and ultimately had deleterious effects. New commodities such as guns, glass beads, copper kettles, and alcohol greatly impacted many traditional Lenape practices and their overall socio-economic structure. Furthermore, European diseases such as smallpox, typhus, measles, and diphtheria decimated large segments of the population (AKRF 2008; Burrows and Wallace 1999).

Initially, Lenape groups continued to occupy semi-permanent village sites, which they had established near water sources; such sites include Sapokanikan near the Hudson River in present-day Greenwich Village (Burrows and Wallace 1999), Schorrakin along the Harlem River (Grumet 1981), and Saperewack at Spuyten Duyvil Creek (Sanderson 2013). They managed to coexist with the Dutch colonists and as trade become more intensive, the Lenape grew increasingly sedentary. However, as the European population increased and desired more land, the relationship between the Europeans and Lenape was strained and ultimately severed. Fighting erupted between the Dutch and the Lenape and Weckquaesgeek to the north, most notably in Kieft's War (1643-1645), which resulted in the death of approximately 1600 Native Americans. Ultimately, the Dutch forced the Lenape out of the region (AKRF 2008; Burrows and Wallace 1999).

Manhattan's Upper West Side, where the Riverside site is located, was originally part of the region north of the city proper, stretching from 14th to 125th Street. The Dutch called this area Bloomingdale (vale of flowers), a region of farmland providing produce to the city's residents downtown (Historical Perspectives 2000). The region's main thoroughfare was Bloomingdale Road, which cut across Manhattan diagonally from 23rd to 114th Street. However, this large, central section of Manhattan north of the Great Kill (present-day 42nd Street) along the Hudson River remained unsettled during the Dutch period and no land grants were issued in this area (Stokes 1922).

After the English victory over Dutch New Amsterdam in 1664, the new provincial governor Nicolls granted a 1,300-acre tract of land, from approximately modern-day 42nd Street to 90th Street west of present-day Central Park, to four Dutchmen and one Englishman: Johannes Van Brugh, Jan Vigne, Egbert Wouters, Jacob Leendersen, and Thomas Hall on October 3, 1667 (Liber Patents II:97, 111) (Stokes 1922, 1928). The southernmost 150 acres went to van Brugh and the next 150 to Vigne. The remaining property was divided into ten lots of approximately 100 acres each, which were distributed to the five men listed above. The two lots stretching from 59th to 66th Street became the property of Thomas Hall, one of the island's first English inhabitants (Stokes 1922:81).

The land from 59th to 70th Street, including the property of Thomas Hall, was transferred in 1696 to Theunis C. Stille (Liber Deeds, XXXI: 271), who transferred it to John Harpendinck in 1720 (Liber Deeds, XXXI: 271). Harpendinck likely sold it to Stephen (Etienne) Delancey ca. 1729 (Geismar 1987; Stokes 1922). At this time, this land was known as "Little Bloomingdale." It remained in the Delancey family through the remainder of the Colonial period (see Liber Wills, XIV:91, Liber Wills, XVI:15, Liber Deeds, XIV:258). The Delancey family is prominent in New York history. Stephen Delancey (1663-1741) was a leading New York City merchant and property holder, and member of the Provincial Assembly from 1705 to 1737. After Delancey died in 1741, the property was consolidated in the hands of one son, James Delancey (1703- 1760), who also had an illustrious public career, as a member of the governor's council, as Chief Justice of the New York Supreme Court, and as acting provincial governor from 1753 until his death (Geismar 1987).

James Delancey (1732-1800), the son of the elder James, inherited the estate from his father in 1760. Delancey was a member of the Provincial Assembly from 1768 to 1776 and an ardent supporter of the Sons of Liberty during the earlier part of his career. During the years before the Revolution, however, his loyalties shifted to the crown. After the war, his estates, like those of other Loyalists, were confiscated under the Laws of Forfeiture (Laws of N.Y., 1779, chap. 25), and the property was sold to John Somerindyck in 1785 (Book of Sales of Forfeited Estates, 78). John Somerindyck died in 1790, and the property passed to his wife Ann and from her to their children in 1809. By 1815, the Somerindyck property was divided into six parcels (Conveyance Index Prior to 1917: Book 128). William Cock and his wife Abigail, daughter of John Somerindyck held the property between 59th and 6lst Streets (Geismar 1987; Rothschild and Dublin 1985). However, by 1819, the property had been acquired by John Low and passed on to his children after his death in 1852 (Geismar 1987; Mott 1908). By 1869, John Paine and William Blodgett had acquired land from the Lows including the present project area (Liber Deeds 1312: 235ff) and had purchased water lot grants from the City (Grants of Land Under Water Liber I:414, 496).

The landscape of the present-day project area has undergone significant modifications by humans in the last 200 years, mostly related to railroad and stockyard activities. Four developments in the mid-19th century triggered the Upper West Side's rapid transition from rural to urban environment: the completion of the Hudson River Railroad ca. 1850 (Burrows and Wallace 1999), acquisition of land for the construction of Central Park in 1856 (Rosenzweig and Blackmar 1992), the extension of the Ninth Avenue "El" into the area in 1879, and the opening of Western Boulevard in 1869 (following the route of the Bloomingdale Road north of 59th Street, and renamed Broadway for its entire length in 1899) (Federal Writers' Project 1939). As further described below, the large railroad yard, evident on the project site, caused the West Side to develop two distinct types of neighborhoods: an industrial neighborhood with poor residents, and the more affluent residential Upper West Side (Burrows and Wallace 1999). In 1851, the Hudson River Railroad Company completed its rail line, which ran from the tip of Manhattan north to Albany along the West Side. Most of the site west of the railroad right-of-way had not yet been filled, and remained under water.

The land between the railroad yard at 60th Street and another large yard at 30th Street quickly attracted industries such as lumberyards, slaughterhouses, lime kilns, stables, distilleries, and warehouses. The industries in turn brought unskilled laborers who lived in wooden shanties nearby. During the 1860s and 1870s, as industry pushed northward to 59th Street, tenements for the workers were constructed. The Ninth Avenue El encouraged further speculative development of tenements when it was extended northward to 64th Street (Federal Writers' Project 1939:274). Shortly after the Civil War, the emerging neighborhood in the southern part of the study area (and extending farther south) acquired the reputation as one of the toughest areas in the city and the name "Hell's Kitchen" (AKRF 2008).

In 1869, when John Paine and William Blodgett had purchased the water lots between 60th and 63rd Streets from the City, they paid $8,033.33 for the lot between 60th and 61st Streets. In 1873, they sold it through an intermediary to William H. Vanderbilt for $475,500. Adjusting for inflation, in 2014, that is a profit of over $9.1 million. The land reclamation process likely took place in the late fall and/or early winter of 1874-1875.

The Union Stockyard was built in 1875, adjacent to the Hudson River Railroad tracks. The stockyard's history and impact were deeply influenced by the presence of the railroad and, as Geismar (1987, 1995) has noted, an understanding of the Hudson River Railroad is instrumental to understanding the development of this part of the Upper West Side. Fill was deposited for the construction of the railroad and its massive stone embankments in the mid-nineteenth century. This expanded the land available for development substantially over a lagoon on the Hudson River (Geismar 1987:31-41; 1995:10-12). Coupled with the economic opportunities granted by the railroad itself, this human modification of the landscape stimulated commercial and industrial development, including bakeries, cattle pens, stables, and even the New York Times printing plant (see Geismar 1987:22-31). While the location of the stockyard was based on its proximity to the railroad, in another sense, it was the landscape change that initiated the economic growth of the area. Thus, the Union Stockyard, the history of the railroad, and the land-filling activities are interrelated information pertinent to understanding the evolution of the project area.

The Hudson River Railroad

The history of the railroad in New York City originates not in the city itself, but in the development of rail lines to the north and west. Rivalries between cities in Central and Western New York State created a rail system that would eventually incorporate New York City and allow it to engage with markets further afield (Dobbin 1994; Meyer et al. 1917; Stiles 2009). The economic aspirations of rival markets in Boston and Philadelphia led New York City to invest heavily in rail lines. In conjunction with these competing rail hubs, the opposition of the predominant, yet ultimately inefficient, steamboat industry also proved to be an important factor in shaping New York City's involvement in the rail industry.

Even before rail lines were set, the cities of Albany, Schenectady, and Troy controlled the flow of trade on and across the Hudson River during the early nineteenth century, drawing most freight traffic away from New York City (Meyer et al. 1917:353). Rail dominance of trade lines in this area began with the 1826 charter of the Mohawk and Hudson Railroad, which connected Albany and Schenectady (Meyer et al. 1917:356). By 1831, railroads had spread further north, connecting the commercial centers of Buffalo, Cayuga Lake, and Utica with each other and with other cities in Central New York State (Meyer et al. 1917:357). In that same year, New York City began tapping into this burgeoning network by extending the New York and Harlem line which, at the time, was only a horse-drawn street railway (Meyer et al. 1917:363-364). It took 15 more years, however, for another railroad to connect directly to the island of Manhattan.

New York City was slow to join railroad development during the early nineteenth century, primarily because of the city's concentration on steamboat freighting on the Hudson River, especially after the Erie Canal opened in 1825 (Johnson et al. 1922:125). New York's location at the mouth of the Hudson made it ideal for maritime trade, and by the middle of the nineteenth century, the city controlled both domestic and international trade along the eastern seaboard. Domestically, this included coal from Philadelphia and Baltimore, sugar and molasses from New Orleans, rice from South Carolina and Georgia, tobacco from Virginia, and manufactured goods from New England and the Middle Atlantic. Internationally, two-thirds of all American imports entered through New York City between 1830 and 1850. At the end of that period, New York was the third largest American importer of cotton as well as its fourth largest exporter (Johnson et al. 1922:342).

The second major reason for the success of the steamboat industry in New York was its minimal, and consequently highly profitable, infrastructure needs. Steamboats could travel wherever the markets were best to make the highest profit. Rails, on the other hand, were immovable pieces of infrastructure that cost a lot to build and had numerous fixed costs to operate. In addition, through the mid-nineteenth century there were hundreds of competing companies controlling thousands of miles of rail, all operating on seven different track widths, causing a logistical (and financial) headache for transferring freight across multiple lines (Stiles 2009:381-382).

Finally, the public and government were biased against rail companies, fearing them as a "means of illegal profits by stock-jobbing speculators" (quoted in Meyer et al. 1917:354). This sentiment continued well into the 1870s, as evidenced by an article in the New York Tribune titled "The Railway Kings' Purposes" (1874), and it was not unfounded. As a result, legislation was drafted hindering aid to railroads and supporting construction of canals instead (Dobbin 1994:47; Meyer et al. 1917:353-355). Canals were renowned for drawing large revenues from ever-increasing tolls. After seven years of operation, the Erie Canal (Figure 2.3) earned almost $1,230,000, a 20% gross on its construction cost. By 1841 it was earning $2,000,000 in tolls (Meyer et al. 1917:354). Adjusted to 2013 dollars, that is around $28.7 and $45.3 million, respectively.

Eventually the public began to realize the need for rails, noting that steamboats were significantly slower than trains. A trip by steamboat between Albany and New York City took about 10 hours, while the same 144 mile trip by rail would have taken half as long (Morgan 1842:10). The ability to travel between New York and major trade centers within the same day was an advantage for businessmen and other travelers when compared to the overnight journeys required by maritime routes. Steamboats were also highly susceptible to seasonal traffic. From May to November, traffic along the Hudson was so dense that the canals could not support the demand for goods from markets east of the river (Meyer et al. 1917:356). In addition, the Hudson River tended to freeze during the winter months, closing the canals and essentially shutting New York off from its usual trade partners, including the agricultural centers of western New York State. Hudson River Railroad surveyor John Jervis made the case in 1846 that the opening of railroads between Buffalo and the Hudson River had already considerably changed the flow of trade in pork. With the river routes closed in the winter and the rails opening up trade eastward, Boston became the only convenient city to handle trade with western New York State. Fearing that other agricultural goods would follow suit, Jervis argued that New York City would need a line like the Hudson River Railroad to maintain year-round business with Boston, lest other cities to the north become more convenient markets (Jervis 1846:15-16). In fact, his fears were warranted: Boston did help fund the development of the Attica and Buffalo railroads during the 1840s (Cleveland 1909).

Competition between cities for commerce was cutthroat during this era. Goods for international trade could also be diverted to Philadelphia and Baltimore (Stiles 2009:407). Both by sea (before the Erie Canal) and by rail, Philadelphia in particular had a long history of influencing legislation designed to circumnavigate New York City via Albany in an attempt to isolate the city from domestic and international markets (Cleveland 1909). Clearly, without a substantial investment in the growing system of rails in New York State, New York City would be at a severe disadvantage economically. Railroads such as the Hudson River Railroad were needed.

Richard Price Morgan made the first survey for a potential railroad along the Hudson River in 1842. He outlined a 144 mile route from New York City to Greenbush (a town across the river from Albany), espousing the economic benefits of a railroad connecting New York City to Albany. In addition, Morgan (1842) also pointed out that the relatively flat gradations would make the line reasonably cheap to construct and to run freight across. Three years later, James Boorman started the process of creating the Hudson River Railroad, but his proposal was rejected in favor of supporting the expansion of the New York and Harlem line to Albany instead ("Hudson River Railroad" 1851). The corridor was surveyed a second time in 1846, this time leading to the commissioning and organization of the Hudson River Railroad by 1847 (Meyer et al. 1917:366; Myers 1900:107). Trains were running within two years (Meyer et al. 1917:366) and construction was completed to Greenbush by 1850 (Adams 1996:204). The entire line was definitely opened and in use by 1851 ("Hudson River Railroad" 1851, Meyer et al. 1917:366; Walling 1867:9) (Figure 2.4). On the island of Manhattan the line crossed Spuyten Duyvil Creek and went down 12th Avenue to a point near 68th Street where it ran southeast to the intersection of 60th Street and 11th Avenue. From there it traveled down the center of 11th Avenue and West Street into the southern tip of the city (Myers 1900, Walling 1867). It initially terminated at Chambers Street, but later moved to West 30th Street and 10th Avenue ("Improvements of Modern Travel" 1853, Walling 1867).

There is some confusion as to the exact operation of the railroad within the city limits. According to Myers (1900:107), there were no applications for steam franchises on the Hudson River Railroad or on the New York and Harlem lines from 1847 to 1867. Both Myers (1900) and Meyer (1917) describe the use of horse-drawn carts on rail tracks in downtown Manhattan. This seems to suggest that no steam engines were used by railroads in the city proper, although several sources suggest otherwise. As early as 1854, citizens and lawmakers had attempted to pass legislation against the use of steam engines on the Hudson River Railroad, even attempting to remove the stretch of track below 60th Street ("Proposal to Tear up the Rails" 1854). Complaints of smoke, the spooking of horses, the potential property damage from sparks, and the depreciation of property values along the rail line are clearly stated in an attempt to ban the use of the rail below 59th Street ("Stopping Steam on the Hudson River Railroad" 1855). These complaints seem to have accomplished little. In 1856, "dummy engines", or steam engines disguised as more-familiar passenger carts, were planned to replace horse-drawn cars on the Hudson River Railroad from the Chambers-street station to 31st Street. These carriages were an attempt to placate horses encountered on the streets and a means to save the company money ("Dummy Engines on the Hudson River" 1856). Another attempt at banning the use of steam engines, this time below 53rd street, was made well over a decade later ("Steam on the Eleventh-Avenue" 1867). The 1868 Beers map of New York shows a change in the graphic representation for the Hudson River Railroad from 53rd Street southward suggesting that the public had gotten its way.

New York's other rail line, the New York and Harlem on 4th Avenue, also seems to have encountered objections to the use of steam inside the city. The Common Council formally ordered this railroad to not use steam engines below 42nd Street in 1854, but the company ignored the mandate and the effort was formally dropped after several years of legal battles and continued use ("Steam Below Forty-second Street" 1856, "The Harlem Railroad Company vs. The City and Police Commissioners" 1858). It appears to have been the norm for big railroad corporations to not heed any objections from the public or city legislatures. It seems that money and the need for efficiency were significant contributing factors.

The Hudson River Railroad helped increase access to goods and keep their prices low for Manhattan's West Side, but never proved to be good business probably because the New York and Harlem line was already slightly more established for connecting New York to the outside world. The two lines were constantly pitted against each other by the New York Central Railroad, which completely controlled all freight from Buffalo to Albany. When freight reached Albany it could go either to the Hudson River or New York and Harlem lines, or to The People's Line steamboats. Before 1866, there was no bridge allowing the New York Central to connect to either of the two railroads, meaning that freight needed to be unloaded and packed into steamboats regardless of where it would ultimately end up. To save on costs and time, the New York Central often sent its freight to the People's Line, leaving little freight to be transported on either railroad (Stiles 2009:407-408).

The Hudson River Railroad allowed a faster commute into New York City for businessmen based in Central New York. In fact, by the middle of the century, rail passage along both the Hudson River Railroad and the New York and Harlem lines doubled due to the increase of long-distance travelers and suburban commuters (Burrows and Wallace 1999:931). It should be noted that the Hudson River Railroad catered more towards long distance transport of goods and people than local needs. Between 1855 and 1867, there were only four passenger stops between Chambers and 31st streets, then nothing until 80th Street ("Improvements of Modern Travel" 1853, "The Hudson Railroad" 1851, "Railroads" 1855, Walling 1867). Carrying freight was far more profitable than carrying people as constant stops by steam engines ran up costs (Hadley 1897, Jervis 1846, Morgan 1842). In addition, transportation at the time was not easily affordable for most of the working class, eliminating a huge section of the potential clientele (Burrows and Wallace 1999:991). Since it was not very lucrative, the Hudson River Railroad had fallen into disrepair and near bankruptcy by the early 1860s. It took the entry of Cornelius Vanderbilt into the railroad industry to turn its fortunes around.

The Vanderbilt Era. Cornelius "Commodore" Vanderbilt entered the railroad industry determined to rebuild the suffering lines within Manhattan (Stiles 2009:371). He was voted to the board of electors of the New York and Harlem line in 1857. He saw the competition with the Hudson River Railroad, as orchestrated by the New York

Central, as a drain on the business and for years tried to buy-out (or ally himself with) members of the Hudson River Railroad to weaken what little authority it had on the West Side. After receiving a tip about the Hudson River Railroad's plan to control the New York Central in 1864, Vanderbilt consolidated his holdings in Harlem through a stock corner, leaving him with a controlling stake. This act was quickly followed by a disputed election which allowed Vanderbilt's business associates to take control of the Hudson River Railroad's board and then elect a Vanderbilt-ally and old Hudson River board member, John Tobin, as President (Directors' Minutes May 17, 18 1864; Stiles 2009:380-397). On July 6, 1864, the Vanderbilt-controlled executive committee of the Hudson River Railroad voted to end competition with the Harlem (Executive Minutes, July 6 1864; Stiles 2009:380-397). Vanderbilt was voted president of the Hudson River Railroad in 1865 with his son, William, as Vice President (Directors' Minutes, June 6, 1865; Stiles 2009:411).

Competition raged on with the New York Central, though. Even after the completion of a bridge at Albany that finally allowed a continuous rail run to Manhattan, the New York Central continued to ship freight by the steamboats of Daniel Drew's People's Line (Stiles 2009:418). In what was obviously a deal struck between Drew and Vanderbilt in 1866, the People's Line ceased lowering its prices and discontinued freight connections with the New York Central. Drew had been trying to obtain control of the Erie Railroad (which Vanderbilt had stock in) and apparently agreed to leave Erie stock alone in exchange for helping the Hudson River Railroad. Through a series of further alliances and machinations, Vanderbilt gained control of the New York Central in 1871, consolidating it with the Hudson River Railroad to create the New York Central and Hudson River Railroad Company (Stiles 2009:505). Although it is never specifically spelled out in the documentary record, it is likely that Vanderbilt's control of the New York Central and Hudson River Railroad was closely tied to the construction of the Union Stockyards (Figure 2.5 and Figure 2.6).

The Union Stockyards

The Union Stockyards were not the first big stockyards to be built in New York City, but they were the first to be built on the Upper West Side. In 1869, G.W. Seymour and Co. opened the Hudson River Sheep Yards, which also imported large numbers of calves, at West 48th St. There was a Hog Yard at West 40th Street, and there were stockyards on Manhattan's east side at 100th Street and 4th Ave. There were also two cattle yards on the west side of the Hudson River. One was in Weehawken and the other, first called the Communipaw Yards and then the Harsimus Cove Yards, was located in Jersey City ("New York Cattle Market" 1871, New York State Agricultural Society 1868:1028, "The Proposed Abattoir" 1874, "The Stock Yards" 1875). Animals were sold live and then transported to slaughterhouses, such as the one on West 34th Street. One contemporary source reported that consumers complained about the "diminished" taste of dressed beef hauled from far away. They apparently wanted freshly slaughtered meat and could tell the difference. The animals had to be well cared for and sold quickly to ensure the quality of the product both for the consumer and the dealer as well as for "humanitarian reasons" ("The Stock Yards" 1875). The proximity of the yards to the slaughterhouses was considered paramount to meeting this goal ("The Stock Yards" 1875).

Railroads were essential to getting fresh meat to consumers. In the 1870s, it was estimated that about 2.2 million cows, steers, and oxen came into the greater area of New York, Brooklyn, Jersey City, and Hoboken per year. Many came from the relatively nearby city of Buffalo, New York, but to meet the demand, animals also had to be brought from more distant places including Kansas, Missouri, Ohio, and Illinois ("Live Stock Market 1860, "Live Stock Market" 1874, "New York Cattle Market" 1871, "The Stock Yards" 1875). Railroads made it possible to condense an 800 mile trip from Chicago to New York into six days ("Railroad Monopoly" 1873, "The Stock Yards" 1875). It is no surprise, then, that stockyards in the greater New York area were located near, and connected to, the railroads under Vanderbilt's control, including the Hudson River Railroad. The yards in Jersey City and Weehawken, however, were connected to rival railroad companies, namely the New Jersey Central and Erie Railroad, which joined the market in freighting cattle from Buffalo. These rail companies gradually bought out ferry companies operating on the Hudson River and constructed their own facilities in lower Manhattan, allowing them to import and ferry thousands of cattle across the river every week. By 1873, a third line, the Pennsylvania and Erie, joined the market ("The Erie Railway" 1870, "New Jersey Ferries" 1870, "Railroad Monopoly" 1873).

The rail companies serving the New Jersey yards siphoned away business from the Vanderbilt-owned properties, and for a while they appeared to be in control. An article published in 1870 stated that the Weehawken Ferry had dominated the cattle trade to New York since 1758 ("The New Jersey Ferries" 1870). Around the same time, the New York and Harlem Railroad lost a significant amount of control in the cattle trade when they were tricked into a price manipulation by Jay Gould and James Fisk, president and financier of the New Jersey Central ("The New Jersey Ferries" 1870; Stiles 2009:458-470). Attempts to build up the eastern shore of the Hudson in response initially failed. Planning to build a new stockyard and/or slaughterhouse by 1873, a company called Allerton, Dutcher & Moore bought property on the Upper West Side near 61st and 11th Ave, but they failed to carry out their contract ("The Proposed Abattoir" 1874). An account published in 1874 described plans for a giant slaughterhouse extending from West 57th to 63rd Streets and from 11th to 13th Avenues, but there is no record of it having been built. Cornelius Vanderbilt is then said to have bought the property in an effort to counter his competitors in New Jersey and monopolize the cattle trade in New York City ("The Proposed Abattoir" 1874). Although the actual ownership of the stockyards was unclear in its early days of operation, it is implied that at least some of the ownership from the One-Hundredth Street Yards on the east side was transferred to the new yards on the west side ("The New Cattle Yards" 1875).

Why this property was specifically chosen is another interesting development tied to the aforementioned slaughterhouse. Since the 1600s, there were many attempts to move slaughtering activities to the northern edges of the city, or out of the city entirely, due to their smell, "unsightliness", and perceived risk of disease ("Abattoirs" 1866, "The Butchers and the Board of Health" 1866). By the early 1870s, the number of slaughterhouses throughout Manhattan had grown to 53 (often small) operations that, in total, handled over 2.5 million animals a year. Inspecting and monitoring this many establishments dispersed throughout the city increasingly became a logistical concern of the city's Board of Health ("The Board of Health" 1874, "City Questions" 1875). In response to complaints from the public and from the Board of Health, legislation was introduced in 1868 that moved all slaughtering north of 40th Street ("City Questions" 1875, "The Proposed Abattoir" 1874). By the mid-1870s, residents of Manhattan's Upper West Side were fighting to push the line northward to 110th Street, and temporarily succeeded in 1874, although the line was moved back to 40th Street in January of 1875 ("City Questions" 1875). Ultimately, the city aldermen were not convinced that slaughterhouses were as much of a health menace as the public and media portrayed them to be. In fact, the then president of the city's Board of Health argued that shipping already-cut meat from New Jersey, as was proposed at the time ("Another Abattoir to Be Erected" 1874), was more dangerous due to the need to inspect a live animal for quality and disease. To many, it seemed more sanitary and economical to concentrate slaughtering into giant abattoirs like the one proposed between 57th and 63rd Streets ("Railroad Monopoly" 1873). It is for those reasons that slaughterhouses along waterfronts, such as the one at Manhattan Market, were still allowed when the boundary was pushed to 110th Street ("City Questions" 1875). The proposed huge abattoir would require nearby cattle pens for which there was plenty of room on the underdeveloped Upper West Side, especially when compared to the Upper East Side at the time (Burrows and Wallace 1999:929). The Riverside site, where a portion of the Union Stockyards were built in 1874-75, was a perfect location that kept slaughtering legally close to the city yet far enough away from the masses, some of whom still opposed slaughtering within the city limits ("City Questions" 1875, "The Health of the City" 1875) (Figure 2.7).

It is also possible that the construction of the Union Stockyards was part of a public works project. Post-Civil War politicians had already started making great efforts to improve New York's infrastructure, including undeveloped portions of the Upper West Side. Even before the war, Republican-backed initiatives and commissions such as the West Side Association craved to beautify Manhattan in the visage of great European cities such as Paris (Burrows and Wallace 1999:917, 923). To a degree their efforts worked, but due to massive riots and political corruption during the Civil War, the majority of expenditures had to be approved by state-based legislatures. These government bodies were often staffed by professionals who were well meaning, but the added bureaucracy stifled the effectiveness of desired improvements and caused resentment over lack of self-governance (Burrows and Wallace 1999:917-928).

In 1869, Boss Tweed and the Democratic Party took control of city government, promising to re-establish self-governance and create jobs. While the new government scuttled some of the old Republican efforts such as the Metropolitan Board of Health initiative, it continued public works projects in an even more grandiose and centralized manner than the previous administration. For a number of reasons, however, the new Democratic government concentrated more on the Upper East Side than the Upper West Side. One reason was that the area on the east side was less hilly and thus easier to grade than the west side. It was also true that many more people lived on the Upper East Side. Part of the Democratic motive to continue the public works projects was to maximize the number of jobs they could hand out although there was also a desire to make as much money as possible on the projects. Tammany Hall had longstanding ties with the Upper East Side through previous investments, which made it advantageous to stay in the area they already knew. This resulted in over three times more Tammany Hall investment in the Upper East Side than the Upper West Side, mostly consisting of housing developments (Burrows and Wallace 1999:929-931).

In addition, the Union Stockyards were constructed just two years after the Panic of 1873. New York was struck hard and fast, with over 30,000 unemployed people reported to be wandering the city streets between 1874 and 1875. While welfare was much disdained and avoided by politicians of the time, there were anti-depression efforts which included providing public employment on park, street, and transit improvements (Burrows and Wallace 1999:1022-1023, 1028-1031). Although it is not specifically documented as such, it seems fairly reasonable to suppose that the construction of the Union Stockyard may have been an anti-depression employment project.

Construction. According to articles in *The New York Times*, the stockyard was completed during the end of January of 1875 to prepare for opening on February 8 ("The New Cattle Yards" 1875, "The New Stock Yards Opened" 1875). At this point the stockyards occupied ten acres from West 60th to West 63rd Streets between 11th Avenue and the Hudson River, with the intention of expanding north to 65th Street in the spring ("The New Cattle Yards" 1875, "The New Stock Yards Opened" 1875). Unfortunately, additional documentary evidence for the construction of the Union Stockyards is sorely lacking, and even contradictory. For instance, a front page article from the February 12 edition of the New York Daily Tribune suggests the stockyards were still "proposed," but several pages later the "Live Stock Market" section clearly states that there are stockyards in existence on 60th Street ("A Railroad and Gas Company at Issue" 1875:1, 9). Everything before January 1875 is circumstantial. As mentioned above, the *New York Times* article "The Proposed Abattoir" suggests that there had not been any construction on the Union Stockyard site as of March 1874. In an October 12 article for the *New York Daily Tribune* ("The Railway Kings' Purposes" 1874), the lawyer John McKeon is quoted as stating:

> Do the people of this city know that on the west side of the city a new depot, with grain elevators, is to be made for the New-York Central, and that streets and avenues are to be closed up for their benefit?

McKeon is clearly speaking about general construction in the stockyard area, but it is not clear from his wording how much of the construction was still in the planning stage. A livestock market report in the *Tribune* from October 29 does not mention the Union Stockyards ("Live Stock Markets" 1874), so it was certainly not in use at that time. Historic maps do not clarify the construction timeline. An 1871 insurance map by Perris and Browne suggests the land was already filled in, yet the 1874 Viele Atlas suggests that the site was still a cove. According to the New York Public Library and New York Historical Society (personal communications), there are no other surviving maps showing the area between 1871 and 1879.

Layout and Operation. When the Union Stockyards opened, they extended from West 60th to West 63rd Streets and 11th Avenue to the Hudson River. There were 93 yards in total, divided into three major groups by north-south running lanes between West 60 and 61st Street, 61st and West 62nd Street, and 62nd and 63rd Streets. All yards were partitioned by double plank fences and each area was paved with Belgian block and covered with sand ("The New Cattle Yards" 1875, "The New Stock Yards Opened" 1875). Individual yards also contained at least one double water-trough, at least one patented folding feeding rack (to prevent waste of hay), and numerous sewers and drains ("The New Cattle Yards" 1875, "The New Stock Yards Opened" 1875, "The Stock Yards" 1875). As already mentioned, another six acres of yards were planned to be constructed up to 65th Street, although maps from 1879 (Bromley) and 1885 (Perris and Browne) only show stockyards up to 64th Street. When the stockyard opened, there were plans to construct a building to hold hogs south of 60th Street ("The New Stock Yards Opened" 1875).

As described above, the stockyards were connected to the Hudson River Railroad, but not to the main line. Reports from the first operating day mention that the utilized rails were on the west side of the stockyard property adjacent to the Hudson River, not on the east where the main line ran along 11th Avenue. The offshoot lines into the stockyard are clearly shown on the 1879 Bromley map, but interestingly not on any subsequent map in the following decades (Figure 2.8, Figure 2.9, Figure 2.10, and Figure 2.11). An eight-foot-wide stone wall aimed to separate the facility from the railroad and to serve as an unloading platform was also said to have been under construction at the time of the opening, but no maps confirm its existence ("The New Cattle Yards" 1875, "The New Stock Yards Opened" 1875).

A hotel was also part of the stockyard construction project and is shown on the Bromley 1879 map (see Figure 2.8). It was to have been located 200 feet from 11th Avenue and 200 feet from West 60th Street. As described in the *New York Times* article that announced the opening of the stockyards ("The New Cattle Yards" 1875), the hotel was "a handsome three-story brick building with a mansard roof." It faced south and was 75 feet wide and 25 feet deep with a 12-wide "piazza" running around the entire structure. The first floor contained a kitchen, dining room, and bar room; the second, the director's room, general office, and telegraph room. There were also 12 lodging rooms for visitors and outbuildings for horses and carriages. To the west of the main building was a huge platform scale (42 feet long and 12 feet wide) that could accommodate 50 animals at once. The scale was covered with a gable-roofed wooden building.

The yards are said to have differed in size and function. At least 25 yards, about 35 feet wide by 50 feet long, were located next to the tracks and used for the unloading of cattle. Each of these yards was designed to hold about 25 heads of cattle. The animals were then quickly moved to the 40 main yards, each measuring about 40 by 70 feet and capable of holding up to 2000 head. The cattle were kept in these primary pens until they were selected for purchase, upon which they would be moved via gates to adjacent, smaller, 30 by 40 feet pens. Finally, the purchased cattle would be moved through a series of at least 25 gates of various sizes located along 11th Avenue where they awaited slaughter ("The New Cattle Yards" 1875, "The New Stock Yards Opened" 1875).

For the first year or so of operation, slaughtering was not performed on the property of the Union Stockyards. The *New York Times* reported that the application for the slaughterhouse on 59th Street was withdrawn on April 7, 1875, due to public health concerns ("The Health of the City" 1875). The abattoir application was brought back to the proposal stage a few days later ("The Fifty Ninth Street Abattoir" 1875), but Mayor Wickham shut it down upon inspection at the end of the month ("City and Suburban News" 1875). Another article in the *New York Times*, written the following August, states that the cattle sold from the Union Stockyards were sent to multiple slaughterhouses ("The Stock Yards" 1875), probably including the brand new slaughterhouse on 34th Street adjacent to the Manhattan Market ("The New Abattoir" 1875). The plan to consolidate all slaughtering in the city on 60th street apparently never came to fruition, evidently out of fear of a monopoly ("Slaughter-Houses Inspected" 1876). By the time the 1879 Bromley and Robinson map was published, however, an abattoir is shown south of 60th Street (Figure 2.8).

During the late 1870s and 1880s, the areas around the Union Stockyards began to expand in form and function. An illustration of a huge grain elevator for the (now) New York Central and Hudson River Railroad on 60th Street and the Hudson River appeared in *Harper's Weekly* in 1877 (Grafton 1977:229) (Figure 2.12). It also appears on the 1879 Bromley and Robinson map (Figure 2.8). This grain elevator was said to have held over a million bushels of grain to be transferred to ships for domestic and foreign markets (Grafton 1977:229). By 1883 the yards had expanded down to 58th Street and added another grain elevator adjacent to the river between 62nd and 63rd Streets (Figure 2.10). By 1885, most of the slaughterhouse between 59th and 60th Streets had been converted to a three-story covered cattlehouse/slaughterhouse and a new slaughterhouse and refrigerating house had been constructed between 58th and 59th Streets (Figure 2.11). By the end of the 1880s there was a lard refinery between 59th and 60th Streets and also a storehouse ("Millions Swept Away" 1889). Although these structures were constructed in 1881, they do not appear on maps until 1885 (see Figure 2.10 and Figure 2.11).

A massive fire in 1889 destroyed the two grain elevators, the lard refinery, some pier structures, and some storehouses along the riverfront ("Millions Swept Away" 1899). Only one grain elevator was rebuilt (Bromley 1891). Miraculously, the stockyards were spared, but reconstruction and repurposing of the stockyards is evidenced on later maps. The 1892 Sanborn map shows several new rail lines built over the eastern end of the block between 60th and 61st Streets as well as a plethora of new lines leading to the three piers along the waterfront, significantly reducing the size and span of the cattle pens. The facility between 59th and 60th Streets was now completely converted to house live cattle, likely to accommodate this change.

Additional atlases indicate that the stockyards were still in use well into the twentieth century. The 1907 Sanborn map, 1922 Sanborn map, and 1924 Bromley map clearly show cattle pens still in use on the northern end of the Riverside site (Figure 2.13). The 1924 Bromley map labels the entire area from West 60th to West 63rd Street, "Freight yard of the New York Central Railroad," indicating an official shift in use of the property away from the stockyards and toward the railroad. This shift toward the railroad is also noted by Geismar (1987).

A 1930 map by Bromley depicts no structures at the project area, although the rails are still present (Figure 2.14). This provides a *terminus ante quem* for the use of the stockyards. The 1955 Bromley map (Figure 2.15) shows that at that time, the area was completely converted to service the railroad. Ramps, "auto platforms," and chicken/ milk platforms servicing the New York Central Railroad dominated the site. New rails for platforms were constructed, but did not last long, as seen in the 1967 and 1974 Bromley maps. According to a personal communication noted by Geismar (1987:33), the railroad in this area was no longer in operation by 1968.

Census Data Analysis

According to insurance maps, there were no structures in the project area prior to the construction of the Union Stockyard in 1875. In fact, there were very few structures in the greater surrounding area, even after the stockyard opened (as seen on various nineteenth-century insurance maps, including: Perris and Browne 1862, 1871, and 1885; Bromley and Robinson 1879; Bromley 1880; and Robinson 1883). However, census records indicate that people did live in the vicinity of the project area. This census data was analyzed to understand the ethnic and socio-economic profile of the residents in the neighborhood surrounding and including the project area.

Data Sources

While the 1875 State Census for New York County would have been ideal for this study, it has not survived in the New York City Archives. In its place, the Federal censuses of New York for 1870 and 1880 were used, and a comparison was made between these two datasets in order to construct a residential and commercial profile of the neighborhood in the period immediately before and after the Union Stockyard opened. The point of studying both census datasets is to examine cultural and economic changes occurring in the years leading up to and postdating the construction of the stockyard. This will illuminate any effects the arrival of the stockyard had on the community, and also reveal what might be found in the historic artifact assemblage recovered at the site. Because the stockyard was built after the Panic of 1873, there is also the possibility of seeing how this economic downturn affected the neighborhood.

The 1870 census was taken twice, resulting in two different enumerations. Physical copies of the first enumeration are available at the New York City Archives. The second enumeration, at least the part covering the project area, was lost in a fire (according to the archives staff). Digital copies of both enumerations are available via online databases on ancestry.com (organized by the Church of Latter Day Saints). These databases were especially useful as some of the information had already been compiled in an easy-to-use index. The information in the index was copied and pasted directly into Microsoft Excel spreadsheets, which expedited the data collection process. However, the index was not comprehensive, and much of the data had to be compiled manually. Specifically, the index entries did not contain all the information present in the scanned documents, making line-by-line attention for data entry necessary. In addition, the information in the index seems to have been run through text recognition software, resulting in highly suspect spellings. This needed to be checked against the scanned documents. There were also some obvious differences in the online database and the physical documents. The information itself was the same, but the handwriting seemed different, place names were abbreviated, spellings were slightly different, or some terms were slightly different.

More issues arose from the fact that the 1870 census was taken twice. The reason for the two enumerations was steeped in politics. A little over a month after the initial census was completed, New York City's mayor, Oakley Hall, contested the enumeration results in an open letter to the City Common Council, accusing the federal Republican government of purposely undercounting the city's population for political reasons ("Politics and the Census" September 13, 1870). U.S. Marshal George Sharpe, who was responsible for the census, defended the men he hired and their work, especially due to the sometimes difficult populace ("The City Census" September 15, 1870). Mayor Hall never gave the names of his supposed sources to authorities, and, formal investigations into census complaints found that the vast majority of them were groundless ("More Census Complaints Disproved" September 17, 1870; "The Complaints Against the Census—More False Statements Exposed" September 27, 1870; "The Second Census" February 15, 1871). Mayor Hall's well known connections to the Tweed Ring may have motivated him to demand a recount to pad voter numbers although his true intentions are difficult to discern considering that other large cities such as Baltimore and Philadelphia would ultimately have a second census as well ("Current Notes" November 28, 1870; "The Second Census" February 15, 1871). Mayor Hall reorganized the election districts of the city (around which censuses of the time were organized), and began his own new census to prove that the city had grown larger than officially recorded ("The New Census of the City" December 19, 1870). He was quickly stopped following an order from President Grant for an entirely new federal census ("Mayor Hall and the Census" December 20, 1870). The official second census was again undertaken by Marshal Sharpe and was to only be a physical count of residents who lived in the city as of June 1, 1870 ("The New Census of the City" December 19, 1870; "The Retaking of the Census" December 2, 1870). The final results showed a mere 2 percent increase from the previous enumeration, more or less confirming the veracity of the first enumeration ("The New Census Complete" February 2, 1871; "The Second Census" February 15, 1871).

Data between both enumerations differed in quality and quantity (see Table 2.1). Some discrepancies in addresses were also noted between the two 1870 enumerations. The first enumeration has more in-depth demographic data than the second enumeration, but without address information (house and street numbers), it was impossible to know who actually fit within our designated study area (see Methods below). For this reason, the second enumeration was given more emphasis in the analysis. The first enumeration was used to cross-reference missing data, but this effort yielded limited results. Part of the reason for this was due to differences in spellings (or interpretations of spellings) of people's names between the two documents. The other part stems from the fact that families marked as neighbors in one enumeration were often nowhere near each other in the other. For instance, the Stone family (Figure 2.16), who lived adjacent to the project area, is shown with one set of neighbors in the first enumeration and a different set in the second (see hand-written excerpts from both census documents below). One possible explanation for this problem is that the first enumeration census-taker recorded information (or made rounds) in an unorthodox manner. Padding of one of the enumerations does not seem likely because, as discussed below, the first enumeration was accused of being under-representative, and the second enumeration ultimately supported the count of the first.

Attempts to rectify these differences were confined to specific questions that arose in the analysis. Trow's New York City Directories were helpful in addressing the more questionable data present in the two census documents, and insurance maps were also consulted throughout the study. These other resources helped us address inconsistencies in the census data.

Methods

The 1880 census was obtained in a fully digitized Microsoft Access database upon request from the North Atlantic Population Project (NAPP) and the Integrated Public Use Microdata series (IPUMS), organized by the Church of Latter Day Saints and made available by the Minnesota Population Center (Ruggles et al. 2010a, b). While this census contained more information at a substantially greater degree of consistency than the 1870s documents, it postdated the construction of the stockyard, and therefore was used mainly for comparative purposes with the 1870 information. The different census documents each contained varying levels of detail (see Table 2.1). The lack of consistency in recording house numbers and family numbers is especially important to note, because this forced all data to refer to individuals, not households or families. At the time the census was taken, the definition of "family" for census purposes "may mean one person living alone, as well as parents and their children, and the same designation covers all the inmates of one boarding-house or hotel" (the *New York Times* "The Ninth Census" June 1, 1870). Due to these reasons, our analyses focused on the individual, following other recent studies that use individuals as the main unit of study (Logan et al. 2011).

All three documents contained entries on thousands of individuals living on Manhattan's Upper West Side. In order to efficiently sample these data, a target area was designated that was relevant to the population in the vicinity of the stockyard. The key criterion was proximity to the project area. The target area for the census study is bounded on the south by West 55th Street, on the east by 8th Avenue/ Central Park, on the north by West 65th Street, and on the west by the Hudson River, except for one block (Figure 2.17). The target area's dimensions make up a roughly 1 km^2 (~0.5 square mi) buffer around the site, encompassing the cluster of housing towards Central Park. This target area, based on street blocks (or "block groups"), makes it easier to understand the micro-geography of urban environments, and easier to perform comparisons over time (Glaeser and Vigdor 2001:2).

The target area studied is based on the second 1870 enumeration, since this enumeration has the best address information for the residents in the area. The census record for this year organized residents by election wards, which were subsequently divided into various districts. The target area encompasses the 3rd, 4th, and 5th districts of the 22nd Election Ward (Map of Political Divisions and Subdivisions 1870).

In contrast to the 1870 Census, the target area in 1880 covered 10 smaller enumeration districts (ED 512-521). This is no doubt due to the population boom that occurred over the 10-year span. There were now 15,113 individuals living in the neighborhood, an increase of just under 11,000 people.

Ethnic Background. A major focus of this analysis was to characterize the ethnic backgrounds of the population in the target area. The two main pieces of information from the census documents used to determine ethnicity were place of birth, and color/race. The place of birth field was most relevant, but color/race was sometimes used to mark people of foreign birth, or non-"white" ethnicity, albeit inconsistently (census takers usually only put a check mark in this column next to people who were foreign born, or had foreign born parents). The level of detail with "places of birth" varies within and between the documents, likely dependent on the answer supplied to the census taker. Sometimes states or countries are given, while at other times specific cities or provinces are named, especially for many of the German immigrants. Germany would not be a completely unified entity for another year, and it is interesting to see the dichotomy between those who claimed nationality from "Germany" and those who cited a specific area, such as Bayern or Hessen. For the purposes of this study, though, the state/country level sufficed.

Socioeconomic Status. The other major focus of this analysis was to understand the socioeconomic status of the population in the target area, as wealth, real estate, and occupation can sometimes be associated with material culture. A socioeconomic profile of the target area was developed using occupation as an indicator of status. The occupations associated with people, and the frequencies with which they appear, were treated as indicators of the socioeconomic status of the population. As pointed out in a well-known study (Sobek 1996:172), "the one piece of information about an individual's social position that is regularly available in the historical record is his or her occupation." To use this method, occupations are assigned a socioeconomic index score (SEI). The SEI is based upon a statistical study by Duncan which combined elements from a 1947 survey of American occupations compared to the median income and education levels for men in 1950 (see Reiss 1961). According to this index, the higher the score assigned, the more prestigious an occupation was regarded. We apply these scores to the late nineteenth century, as Sobek (1996) argues is valid (see Appendix A).

It should be noted that this approach to the study of class is fairly subjective. While income level does factor into the score, the concept of "prestige" is highly dependent on peoples' views in both a modern and historic sense. Furthermore, the census data which this method depends on is fairly subjective in itself, as explained previously. Nevertheless, utilization of the socioeconomic index is still valuable in helping to reconstruct a socioeconomic profile of the neighborhood responsible for the artifact assemblage of the project area.

The North Atlantic Population Project (NAPP) had already assigned SEI scores, based on Duncan's analyses, to occupations in the 1880 Federal Census for New York (see Ruggles et al. 2010a, b). Although other works have utilized different statistical approaches to expand upon Duncan's work that account for geographic and historic differences (see: Stevens and Featherman 1981; Ganzeboom, Graaf, and Treiman 1992; Hauser and Warren 1996), Sobek (1996) justified the extension of Duncan's SEI scores into the late nineteenth century by comparing the income value of 140 occupations in 1890 with those in 1950. He found a significant statistical correlation between the two years, concluding that the scale was valid when extrapolated into the past. This study, therefore, assumes that the methodology utilized and the scores assigned by the NAPP are accurate.

SEI scores for the 1870s populations were assigned based on the scores in the 1880 NAPP database. However, interpretation was required due to differing nomenclature between the census years. In some instances, what was written in the 1870 census was not detailed enough, or too confusing, to assign an SEI score. GIS mapping included only residents with available SEI scores, as well as locational information. Likely shanty town residents, for whom such data were not available, were therefore omitted. Potential problems also occurred due to the wide range of scores assigned to groups in what seemed like related professions. For example, those labeled as "stone cutters" score 25 while "stone breakers" score 8. While the 1880 census often had a level of specificity that clarified the differences between the two, the 1870 census did not. A simple designation as "stone worker" was not uncommon. Occupations such as these were conflated into broad categories during the data collection phase to account for this problem. In addition, average SEI scores needed to be calculated and assigned to these broad categories. Another problem is that some of the SEI scores may be highly variable in comparison to the 1950 occupations they were based on. For example, street vendors (i.e., "hucksters" or "peddlers") have an SEI score of 8 according to the NAPP, which generally correlates with Sobek's incomes for 1890 (Sobek 1996:196). However, other scholars have pointed out (e.g., Smith 2009:38) that simple pushcart vendors were capable of earning small fortunes, sometimes even enough to own property (although such instances were probably rare).

SEI values were mapped in a number of ways. First, the total number of people was plotted per street segment. This is the total population living on each street segment. All people who had good locational information were plotted, regardless of being assigned an SEI score. Next, the total number of people who had assignable SEI scores were plotted (again, per street segment). This is the raw number of individuals from which we would perform the rest of the SEI analyses. The average SEI was then calculated. These maps represent the average SEI value of all of the people on each street segment. This shows the general socioeconomic status on each street.

To understand how residential patterns differed among people with the low and high socioeconomic status, the lowest and highest SEI values for each street segment were analyzed. The resulting maps show the raw number of individuals on each street segment. The "Low SEI" group consisted of SEI values of 4-12. SEI values of 0 and 7 were omitted from the analysis. Students (0) and those who "kept house" (0) represent dependents and non-wage earning "occupations." With domestic servants (7), it is not clear whether these people belonged to the household they were listed under, or alternatively, worked somewhere else. Also, the terminology used by the census recorders is inconsistent. Those who "kept house" were presumably different than "housekeepers" and "domestic servants," but it is also possible that census takers misinterpreted an answer, received an ambiguous answer, or did not realize the difference between the two. This problem has been recognized elsewhere, especially in the use of the "keeps house" term (https://usa.ipums.org/usa/1860_1870_release_notes.shtml). While IPUMS (and by proxy NAPP) does classify each individual case differently based on familial relations and the wording of the record, such an effort was beyond the scope of this study.

For the 1870 data, the low SEI group consisted of 256 individuals, most of who (233) were designated as "laborers." The remaining occupations included in the low group were gardeners (12), porters (4), textile workers (4), lumber yard workers (2), and one dock worker. The socioeconomic profile for 1880 was calculated in the same way as the 1870 data, with the same score range being applied (low SEI values of 4-12, not including 0 and 7). However, due to the greater specificity of the 1880 census and NAPP/IPUM's different methodology, some occupations that were omitted in the 1870 study due to lack of detail were included in 1880. These included hucksters/ vendors (51), metal workers (36), and stone breakers (6). In addition, the residents with SEI scores of 0 included retirees and those labeled without an occupation by NAPP. The low SEI group from 1880 also comprises a much wider variety of occupations, including ash mongers (8), collectors (1), factory boys (1), ice wagon workers (1), hostlers and stablemen (23), cattle drivers and caretakers (3), plumbers (1), stockyard workers (23), railroad workers (24), janitors (31), cab drivers (34), elevator operators (1), cleaners (3), paper hangers (1), oystermen (2), hotel and hospital service employees (5), restaurant workers (2), dyers (3), and laundresses/washers (66).

The "High SEI" group had values of 72-93. For the 1870 census data, the high SEI group consisted of 18 individuals including publishers (7), teachers (6), lawyers/ attorneys (3), one designer, and one doctor. The high SEI grouping for 1880 additionally includes buyers (1), veterinarians (3), pharmacists (14), engineers (4), and architects (4).

The final calculations analyze the percent of the population with low SEI values, and the percent with high SEI values. This looks at the number of people in the low SEI group (or high SEI group) per the total number of people that had been assigned SEI values. This was a way to include the majority of the SEI values (SEI scores of 13-71) in the analysis, since looking at just the raw count of low and high SEI data omitted these counts.

GIS Analysis. ESRI's ArcGIS software (v. 9.2 and 10.0) was used in the analysis of the census data, focusing on how ethnic origins and occupations link to the built urban environment, making it possible to analyze the spatial distribution of the population and its relationship to the development of the Upper West Side of Manhattan. As Gregory and Healy (2007) have noted: although rare, using GIS in historical studies provides novel insights concerning the geographic organization of society and its evolution.

A GIS dataset of the target area needed to be created that represented the late nineteenth century landscape. To accomplish this, contemporary address, street, and rail information was obtained in the form of a Topologically Integrated Geographic Encoding and Referencing (TIGER) shapefile (from the U.S. Census Bureau, http://www.census.gov/geo/maps-data/data/tiger.htm). Some alterations were made to the TIGER shapefile, using the 1871 and 1885 Perris and Browne Insurance maps (the nearest maps to the census years) to adjust for historic changes to the streets. This resulted in a total of 61 “street segments” which correspond mostly to street blocks. Residents were then assigned to a street segment according to the information available in the census records. As noted in Table 2.1, the census information was only precise to the street-block level in the 1870 census, making a more detailed spatial analysis impossible. Although building-level information was available with the 1880 census data, we applied the same street-block level information as with the 1870 census, to keep analysis consistent.

To visualize the census data in its proper residential and industrial contexts, data from the 1871 and 1885 Perris and Browne Insurance maps were digitized in ArcGIS. This included the type of dwellings (i.e., residential, industrial, or public), building description (e.g., school, church, hospital, etc.) when available, building material (i.e., wood frame or brick), building height (i.e., number of stories), street address, and Hudson River shoreline. These maps were photographed with a digital camera, and the files were uploaded and georeferenced in ArcGIS. The data for each year were heads-up digitized as polygon shapefiles, and the pertinent information was added to the respective attribute tables.

One caveat to the following spatial analysis is that only census data with firm locational information (i.e., address, street, or block) were used in the analysis. In some cases, locational information was absent, illegible, or too confusing to confidently assign to a street segment (in both the 1870 and 1880 datasets). One example of this can be seen in the 1870 census data, where some residents were grouped within large areas encompassing multiple blocks. These residents had to be omitted from the analysis. This type of data omission makes it especially difficult to interpret street segments with apparent population gaps (i.e., the pattern could be due to either a lack of population or omitted data).

1870 Federal Census Analysis

Total Population

According to the second 1870 census, there were a total of 4,129 people living in the target area. Of this number, we were only able to map 2,851 people (Figure 2.18), with digitized 1871 Perris and Brown insurance map as background. The classification method chosen to visually represent the data was “Natural Breaks” with three classes. This method designates the breaks between classes based on naturally-occurring large gaps in data values, keeping similar values together, and separating dissimilar values (McGrew and Monroe 2000:25). On this map, lighter colors represent lower population numbers, with darker colors representing higher population numbers.

There are two main explanations for apparent gaps in the population map. As noted previously, a large part of the population could not be located in space, and thus were omitted from the analysis. With the 1870 data, people in District 3 were often lumped into large areas, such as between 62nd Street, 69th Street, 8th Avenue, and Broadway. The 1871 map of the area indicates that these areas were mostly free of buildings, with only a few small, unorganized structures (see Figure 2.7, above 62nd Street). The large amount of people attributed to the area, with the apparent lack of buildings, leads us to conclude that there was probably a shanty town in this area, made up of temporary buildings that the insurance maps did not bother to record. Shanty towns were common on both the upper east and west sides of Manhattan in this period. Many sources report the increase in shanties during the 1870s depression, as New Yorkers were unable to afford the cheapest places, even renting shacks. The 1870 census disclosed that 10,000 Irish, German, and African-American settlers were living in the upper wards of Manhattan. An eyewitness found Manhattan compactly built for more than five miles northward from the Battery, but “between blocks of imposing houses were groups of rough wooden huts occupied by Irish squatters with their poultry and pigs” (Still 1956:205). Near the project area in the 4th District, census documents record some people living in a location called the “Black Rocks”, which seems to be a shanty district between 55th Street, 56th Street, Broadway, and 7th Ave (“New York” June 26, 1871; “Wife Murder in one of the Shanties on the Black Rocks” Feb 1, 1873). The 1880 census also records shanties on West 63rd Street (ED 520). The other explanation for population gaps may very well be due to the absence of people. For example, the area south of 57th Street and west of 10th Avenue contained mostly industries, such as breweries and stone yards (according to the 1871 Perris and Browne map), where people would not have lived.

Birthplaces and Ethnicities

Overall, the neighborhood in 1870 was fairly balanced between domestic and foreign births (Table 2.2 and Table 2.3). Those born in the United States comprised 2,194 individuals (53.2% of the total population in the target area), while 1,934 were foreign immigrants (46.9% of the total). Almost all of the residents fell into one of three basic groups: those born in New York (49.0% of the total population), those born in the United Kingdom (23.3%), and those born in Germany (22.6%). There was more variability amongst those from the American States (16) than those from foreign countries (8). Of the 2,024 domestic births, the overwhelming majority (92.24%) were born in New York. This is not surprising, as most of these were children. That being said, there are a number of different states represented from outside of New York. The relatively large number from nearby New Jersey and even Massachusetts is not surprising, but people from states further away were also represented, perhaps brought to the city by trading ties or the availability of jobs.

Of the foreign born population, those hailing from the United Kingdom and Germany predominated (comprising 23.3% and 22.6%, respectively) (Table 2.3). Of the 961 individuals from the United Kingdom, 865 (90.0%) were from Ireland. The other 10% came from England (78) and Scotland (18). More people came from Germany (932) in this period than from Ireland (865), although both ethnic groups were prominent, and probably visible, in the neighborhood. Outside of a small group from Canada, the remainder of the foreign born population almost exclusively derives from other northern and central European countries.

Since the resident Irish-born and German-born populations vastly outnumbered all other ethnicities, these are the only two ethnic groups which allow for any meaningful spatial analysis. Both ethnic groups were fairly spread throughout the project area (Figure 2.19). Although there was a stronger, but small, German-born presence between 9th and 10th Avenues south of 56th Street, as well as a somewhat-stronger Irish-born presence in the east between 57th and 62nd Streets, the populations of both groups tended to overlap substantially. While German-born residents did live in more high-population pockets than Irish-born residents, their spatial distribution does not suggest that they lived in German-dominated areas. Both Germans and Irish tended to correspond to the same patterning of the larger population in general. In other words, high-population counts of both Irish-born and German-born residents almost always occurred in street segments with high total population counts, including both foreign-born and domestic-born residents. Low-population and medium-population counts generally follow the same patterning as well. Therefore, evidence indicates that the ethnicities were mixed throughout the neighborhood.

Socioeconomic Profile of the 1870 Neighborhood

Exactly 825 residents with SEI scores were assigned to street segments for the 1870 census data. This raw number of people who were assigned SEI values shows minimal clustering, with no more than 88 people per segment Figure 2.20). The streets with the higher average socioeconomic status seem to be concentrated in the southeastern portion of the target area (Figure 2.21). There is also one street segment with a high average socioeconomic status, along 60th street (at the southern boundary of the current project area). When only people with the lowest socioeconomic status are looked at, it was revealed that there are not many of them (at most 18 on any given street segment), and that they are dispersed throughout the entire target area (Figure 2.22). The percent of the population with low SEI values confirms this, showing that on all but three street segments, people of low socioeconomic status make up less than half of the residents (Figure 2.23).

The number of people with the highest SEI scores (72-93) make up only 1.9% of the population. Plotting the raw number of individuals confirms this, indicating a low number of high status people, not concentrated in any one area (Figure 2.24). The percent of the population with high SEI scores further shows this pattern, with at most 12.5% of the people on one street segment being of higher socioeconomic status (Figure 2.25).

In general, wherever there is a higher concentration of people with high SEI scores, there is also a higher concentration of people with low SEI scores. Although there are more people of lower socioeconomic status in the target area, the spatial analyses does not reveal any significant patterning. The conclusion is that in 1870, the various socioeconomic classes were evenly spread throughout the study area, with no noticeable clustering of socioeconomic groups. When all the occupations are taken together, people fall into a variety of occupations, many of which may be considered working class (e.g., in the building trades), but also skilled artisans and shopkeepers.

1880 Federal Census Analysis

Total Population

The most noticeable population trend for the 1880s is an increase in the number of people (Figure 2.26). Although this could be interpreted as an increase in the number of people with good locational information and/or better census-taking methods, evidence suggests that a real population increase also occurred in the target area. The background map from 1885 (by Perris and Browne) shows a dramatic increase in buildings in the target area, suggesting population increase. The majority the people seem to be concentrated in the southern half of the project area, especially between 9th and 11th Avenues below 59th Street. This corresponds to the greater amount of large residential buildings. Also of note is the fairly large number of people living directly east of the project area.

Changing Ethnicities
The overwhelming majority of residents in the neighborhood remained "white," but with a change in the ethnic make-up of the people. There seems to be a shift towards a more predominantly domestic-born populace (Table 2.4 and Table 2.5). In 1880, those born within the United States comprised 64.49% of the total population in the target area, and even more residents than in 1870 were born in New York City itself (now 55.77% of the total population). The next most populous states represented continued to be neighboring New Jersey and Pennsylvania plus Massachusetts, but the number of states represented more than doubled (from 16 to 37, including the District of Colombia) and covered a wider swath of the country than before.

There were noticeable demographic shifts in the foreign-born population as well. As already noted, the number of foreign-born individuals compared to the total population noticeably diminished (down to 35.6%). The composition within this group also changed. While the United Kingdom remained at the top, the specifically Irish-born population increased to 53.5 percent of the foreign-born populace, although they still comprised about the same percent of the total population at 19.1 percent. Irish-born immigrants clearly became the dominant foreign-ethnic group in the neighborhood whereas people from Germany diminished in number, now representing only 26.9% of the foreign-born population and 9.7% of the total population. The number of Canadians, Italians, and Austrians in the population increased, but thirteen new nationalities were also represented. While the neighborhood gradually became more naturalized, it also became more diverse (Table 2.4 and Table 2.5).

Irish-born and German-born communities again essentially followed the same patterning of the total population (Figure 2.27**)**. In fact, both groups now have a more similar patterning to each other, further suggesting that the community was mixed rather than segregated. The German-born residents again tended to live in higher-population pockets, but this observation seems even less pertinent for the 1880 census considering that the Irish-born residents now vastly outnumber even the German-born residents, so much so that the low-population groupings of the Irish-born outnumber both the low- and medium-population German-born groupings. Even with a more ethnically diverse pool, the foreign-born community became dominated by Irish immigrants.

Socioeconomic Profile of the 1880 Neighborhood
Reflecting the growth in population, 12,774 residents with SEI scores were assigned to street segments for the 1880 census data (Figure 2.28). Correlating with the increase in buildings, the majority of people with mappable SEI scores seem to be in the southern portion of the target area. Similar to 1870, the streets with the higher average socioeconomic status seem to skew towards the southeast portion of the target area (Figure 2.29).

There are 1,223 individuals (9.2%) with the lowest SEI scores. This number has increased from 1870, but in general the people with low socioeconomic status are still fairly evenly distributed (Figure 2.30). The percent of the population with low SEI scores corroborates this, indicating that only two street segments have a population made up of 50.0% lower socioeconomic status (Figure 2.31). The vast majority of the streets have less than 25% low status people.

Roughly 1.0% of the population (138 individuals) achieved the highest socioeconomic status. For the most part, these people cluster in the southeast portion of the target area, away from the Union Stockyards and industrial buildings located near the Hudson River (Figure 2.32). They are all but absent from the northern section of the target area. These higher-status people also make up very small percentages of the neighborhood, with the majority of them making up 8.7% or less of any given street segment (Figure 2.33). This indicates that higher status people were living among lower status people.

In general, analysis of 1880 data is similar to that of 1870: it indicates a fairly even distribution of residents with low and high SEI values across the project area. However, there are some differences. Individuals with low and high socioeconomic statuses represent much less of the population than in 1870. This indicates that the majority of the increase in population by the 1880s was with people that fell in the middle of the status spectrum.

1870 vs. 1880 Neighborhoods

Over the ten year period between census studies, the community around the Riverside site underwent some noticeable changes. While the pure numbers highlight the growing change toward a predominant Irish-born community, mapping of these figures suggests that the community was fairly mixed. Some degree of clustering might be suggested in 1870, but over time everyone was more or less living together. In one way, this may correspond with scholars who argue that ethnic groups tend to consolidate in neighborhoods over time and to express their ethnic identity more as time goes on (McCarthy 1997). However, it should be noted that domestic-born populations have not been mapped in this study, which would be important in verifying the above statement. Domestic-born populations were not mapped because of their ambiguity in the census records. Especially with children, it is impossible to know for sure how American-born residents actually defined themselves, or were identified by others, simply based off of the census. For example, even if someone was born in Tennessee, they may have been raised in a way which identified them better as "German" or some other ethnic identity than "American". The only irrefutable line of "otherness" that can be discerned from the census is place of birth outside of the United States. Therefore, ethnic identity cannot be based on the census alone. Comparisons to diagnostic artifacts found within the Riverside site are examined below (see Chapter 5) to further discern the identity of the community.

In both 1870 and 1880, the neighborhood surrounding the project area was predominantly "working class," although there were also many residents with occupations that had SEI scores placing them somewhere in the middle. These occupations included many skilled artisans, and a huge variety of shopkeepers (e.g., barbers, butter and candy dealers, cotton brokers, furniture dealers, importers, pharmacies, etc.). There were also many white collar workers: auctioneers, bankers, book agents, clerks of many different kinds, insurance adjusters, etc. Along with the population expansion, there was a large increase in the specific occupations within both lower and middle class status categories. Whereas there were 19 different specific manual labor types in 1870, there were 61 in 1880. In 1870 there were 15 skilled artisan types, as compared to 51 in 1880, and there were 12 different kinds of storekeepers compared to 55. Clearly, by the penultimate decade of the nineteenth century, a range of people from many different walks of life lived together in this growing section of the Upper West Side.

Summary

This chapter presented the environmental and geological background of the region along with a comprehensive examination of archaeological work in the New York City area including information on known Paleoindian, Archaic, Woodland, and Contact Period sites. From the Contact Period onward to the twentieth century, historic information about the project area and vicinity was considered. Included in this history was a tracing of land parcel and water lot ownership and also important historical developments, such as the onset of the Hudson River Railroad and the Union Stockyards. Finally, a detailed look at the 1870 and 1880 Federal Censuses for the neighborhood surrounding the project area provided a valuable context for assessing the impact of the land reclamation event at this location, which likely took place in the late fall and/or early winter of 1874-1875.

Table 2.1. Comparison of Demographic Data between Census Documents.

Data Available within Census Documents	1870 1st Enumeration		1870 2nd Enumeration			1880
	District 15	District 16	District 5	District 4	District 3	Districts 511-521
House Number	V	V	/	/	*	/
Name of Street			X	X	X	X
Family Number	X	X				X
Name	X	X	X	X	X	X
Age	X	X	X	X	X	X
Sex	X	X	X	X	X	X
Color	X	X	I	I	I	X
Occupation	X	X	X	X	X	X
Value of Real Estate	X	X				
Value of Personal Estate	X	X				
Birthplace	X	X	X	X	X	X
Marital Status	X	X				X
Familial Relationship						X
Mother/Father of Foreign Birth	X	X				
Attended School within the Census Year	X	X				
Personal Health	X	X				X
Literacy	X	X				X
Citizenship Status and Voting Eligibility	X	X				
Months Unemployed During Census Year	X	X				

X = Completely Available
/ = Mostly available, but contains gaps of information for reasons unknown
V = Numbered by visit, not actual address
I = Information often put in wrong category and/or not filled to document's specifications
*Only one entry throughout the entire document

Table 2.2. Domestic-Born Residents According to the Second 1870 Census Enumeration.

US State	Count	%Domestic	%Total
New York	2,024	92.25%	49.03%
United States, n.s.	99	4.51%	2.40%
New Jersey	29	1.32%	0.70%
Massachusetts	12	0.55%	0.29%
Maryland	5	0.23%	0.12%
Connecticut	4	0.18%	0.10%
Pennsylvania	4	0.18%	0.10%
South Carolina	4	0.18%	0.10%
Maine	3	0.14%	0.07%
Kentucky	2	0.09%	0.05%
Vermont	2	0.09%	0.05%
Alaska	1	0.05%	0.02%
Louisiana	1	0.05%	0.02%
Missouri	1	0.05%	0.02%
Ohio	1	0.05%	0.02%
Virginia	1	0.05%	0.02%
Wisconsin	1	0.05%	0.02%
Total	2,194	100.00%	53.15%

Table 2.3. Foreign-Born Residents According to the Second 1870 Census Enumeration.

Country	Count	%Foreign	%Total
United Kingdom	961	49.69%	23.28%
Germany	932	48.19%	22.58%
France	18	0.93%	0.44%
Canada	9	0.47%	0.22%
Unclear	5	0.26%	0.12%
Italy	4	0.21%	0.10%
Austria	3	0.16%	0.07%
Belgium	1	0.05%	0.02%
Netherlands*	1	0.05%	0.02%
Total	1934	100.00%	46.85%

UK Country	Count	%UK	%Foreign	%Total
Ireland	865	90.01%	44.73%	20.95%
England	78	8.12%	4.03%	1.89%
Scotland	18	1.87%	0.93%	0.44%
Total	961	100.00%	49.69%	23.28%

Table 2.4. Domestic-Born Population According to the 1880 Census Enumeration.

US State	Count	%Domestic	%Total
New York	8,429	86.48%	55.77%
New Jersey	335	3.44%	2.22%
Pennsylvania	217	2.23%	1.44%
Massachusetts	172	1.76%	1.14%
Connecticut	113	1.16%	0.75%
Ohio	51	0.52%	0.34%
Vermont	45	0.46%	0.30%
Virginia	42	0.43%	0.28%
Maryland	33	0.34%	0.22%
South Carolina	32	0.33%	0.21%
Illinois	30	0.31%	0.20%
New Hampshire	30	0.31%	0.20%
Maine	28	0.29%	0.19%
United States ,n.s.	22	0.23%	0.15%
California	20	0.21%	0.13%

Michigan	18	0.18%	0.12%
Missouri	17	0.17%	0.11%
Georgia	15	0.15%	0.10%
Louisiana	15	0.15%	0.10%
Wisconsin	14	0.14%	0.09%
Rhode Island	13	0.13%	0.09%
Unknown	13	0.13%	0.09%
Iowa	6	0.06%	0.04%
Florida	5	0.05%	0.03%
Texas	5	0.05%	0.03%
Washington	4	0.04%	0.03%
Alabama	3	0.03%	0.02%
Kentucky	3	0.03%	0.02%
West Virginia	3	0.03%	0.02%
Delaware	2	0.02%	0.01%
Indiana	2	0.02%	0.01%
Minnesota	2	0.02%	0.01%
North Carolina	2	0.02%	0.01%
Tennessee	2	0.02%	0.01%
District of Columbia	1	0.01%	0.01%
Kansas	1	0.01%	0.01%
Mississippi	1	0.01%	0.01%
Nebraska	1	0.01%	0.01%
Total	9,747	100.00%	64.49%

Table 2.5. Foreign-Born Population According to the 1880 Census Enumeration.

Country	**Count**	**%Foreign**	**%Total**
United Kingdom*	3,451	64.16%	22.83%
Germany	1,445	26.86%	9.56%
Canada	111	2.06%	0.73%
Italy	84	1.56%	0.56%
Austro-Hungarian Empire	79	1.47%	0.52%
France	69	1.28%	0.46%
Switzerland	48	0.89%	0.32%
Cuba (Spain)	16	0.30%	0.11%
Unknown/"at sea"	14	0.26%	0.09%
Denmark	13	0.24%	0.09%
Poland	8	0.15%	0.05%
Sweden	11	0.20%	0.07%
Netherlands**	8	0.15%	0.05%
Belgium	5	0.09%	0.03%

West Indies	4		0.07%	0.03%
Russia	4		0.07%	0.03%
South America, n.s.	2		0.04%	0.01%
Iran***	2		0.04%	0.01%
Japan	2		0.04%	0.01%
Norway	2		0.04%	0.01%
Brazil	1		0.02%	0.01%
Total	5,379		100.00%	35.59%

UK Country	Count	%UK	%Foreign	%Total
Ireland	2,882	83.05%	53.58%	19.07%
Unspecified*	588	16.95%	10.93%	3.89%
Total	3,470	100.00%	64.51%	22.96%

Austro-Hungarian Empire	Count	%AH	%Foreign	%Total
Austria	72	91.14%	1.34%	0.48%
Czech Republic	5	6.33%	0.09%	0.03%
Hungary	2	2.53%	0.04%	0.01%
Total	79	100.00%	1.47%	0.52%

*Including Bermuda (1)
**Including Curacao (1)
***Possibly British Afghanistan?

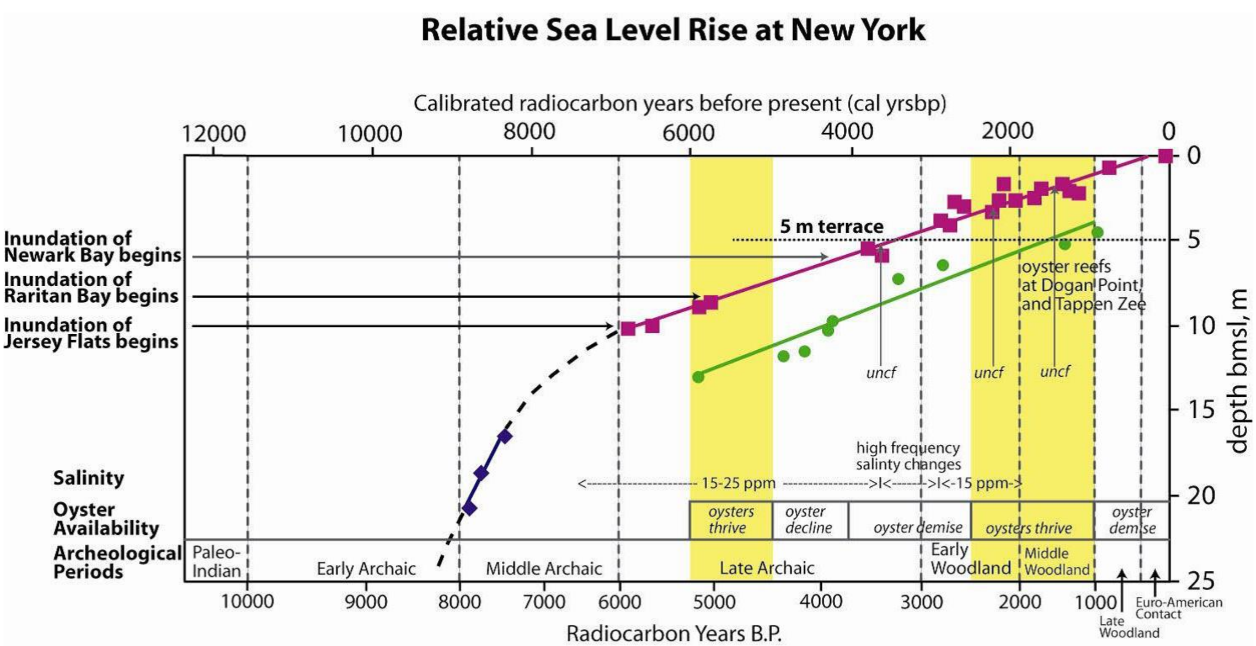


Figure 2.1 Sea level curve for New York Harbor (from Schuldenrein et al. 2013).

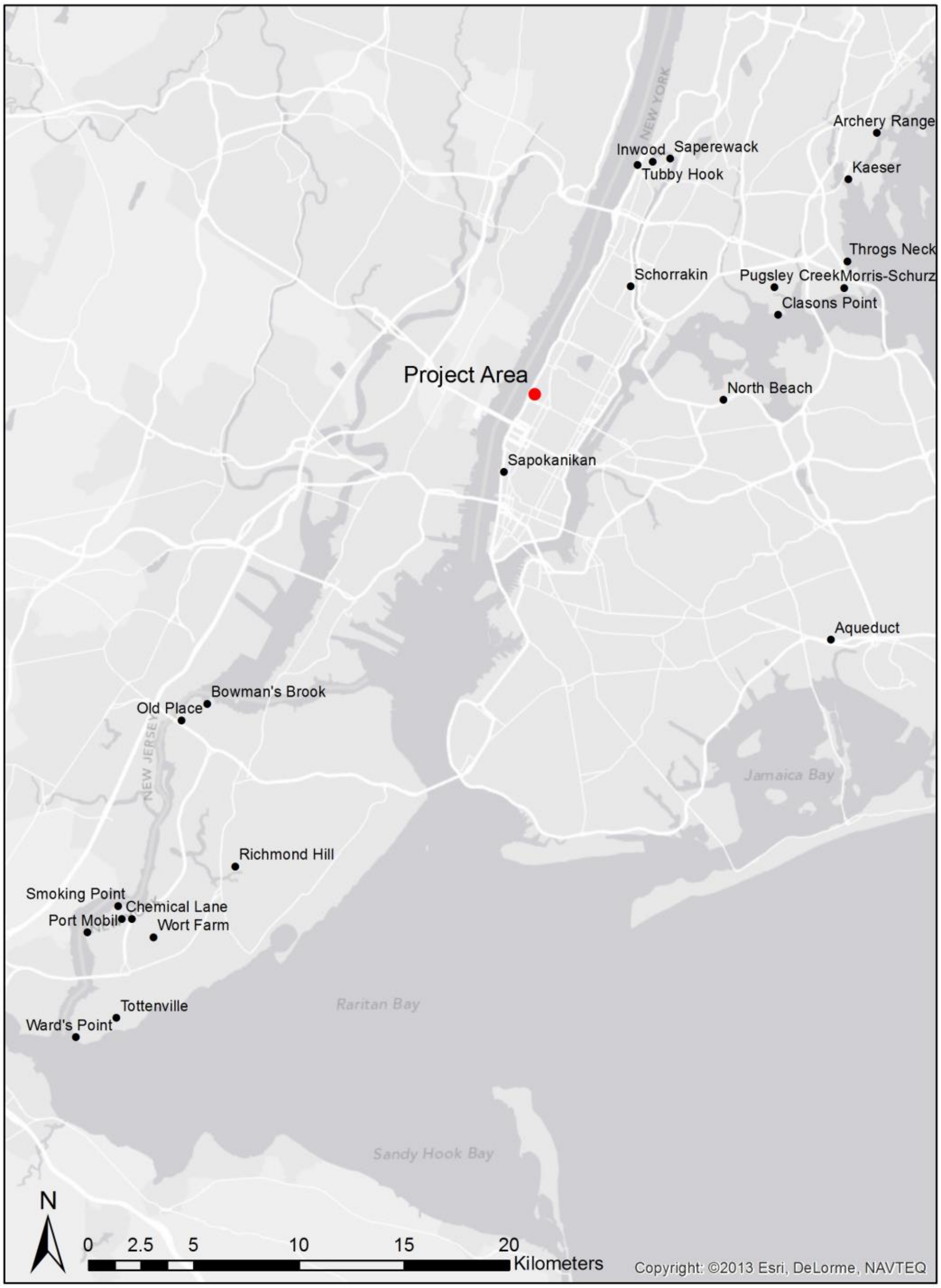


Figure 2.2 Map of Prehistoric Archaeological Sites in New York City Referenced in the Text.

Figure 2.3. View of the Erie Canal (Hill 1829). From the New York Public Library Digital Collections. Image ID 54577.

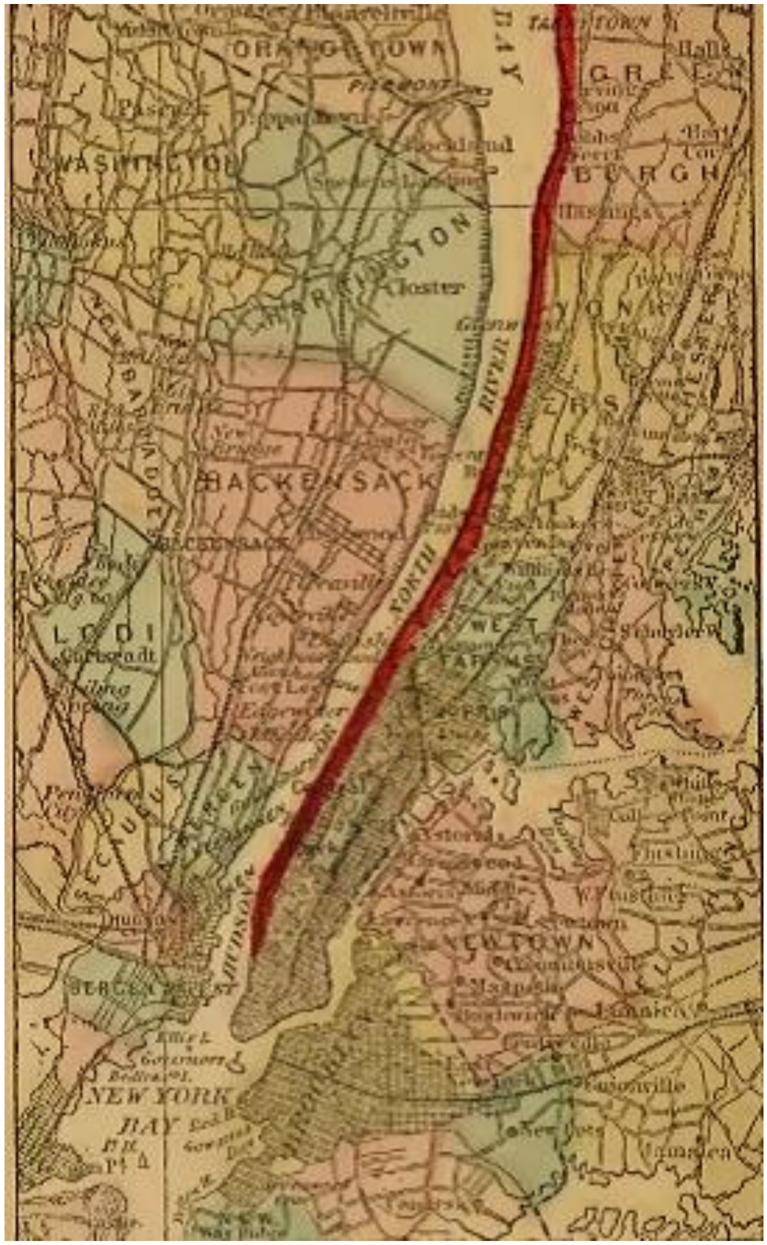


Figure 2.4. Route of the Hudson River Railroad (red) according to Walling's Route Guides (1867).

Figure 2.5. 1862 Perris and Browne map of the Hudson River Railroad in the neighborhood of the project area.

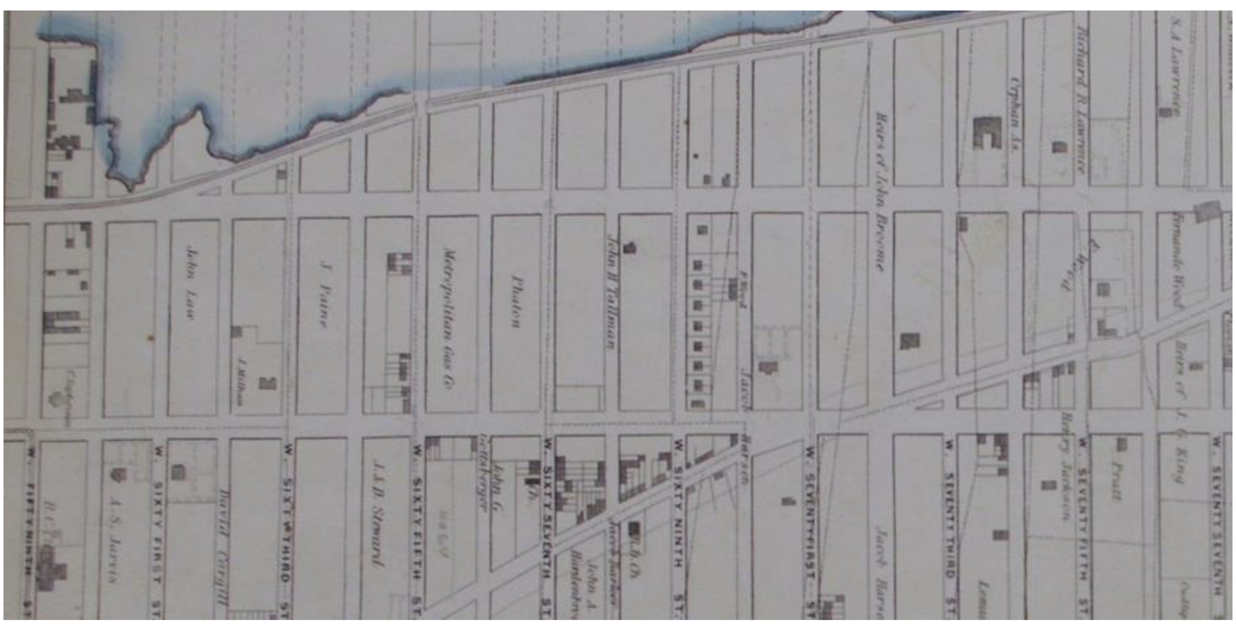


Figure 2.6. 1867 Dripps map showing the Hudson River Railroad and the project area.

Figure 2.7. 1871 Perris and Browne map showing the project area (red dashes) and surrounding neighborhood. Note the potential shanty town (green outline) to the north.

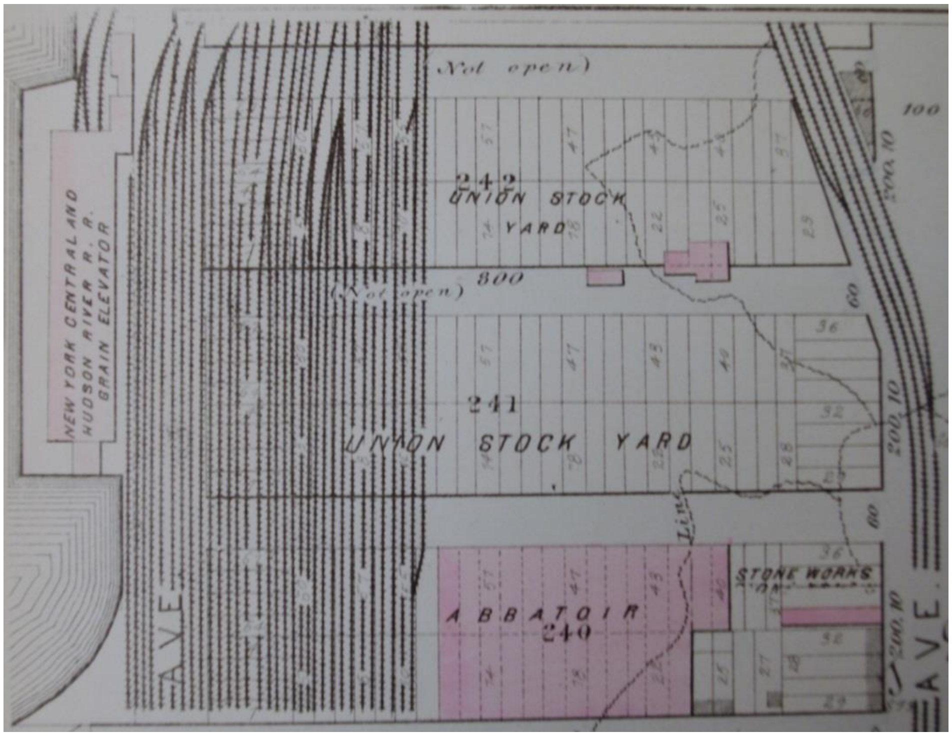


Figure 2.8. 1879 Bromley and Robinson map showing the Union Stockyards and Slaughterhouse, from W. 59th Street to W. 62nd Street.

Figure 2.9. 1880 Bromley map of the Union Stockyards and Slaughterhouse.

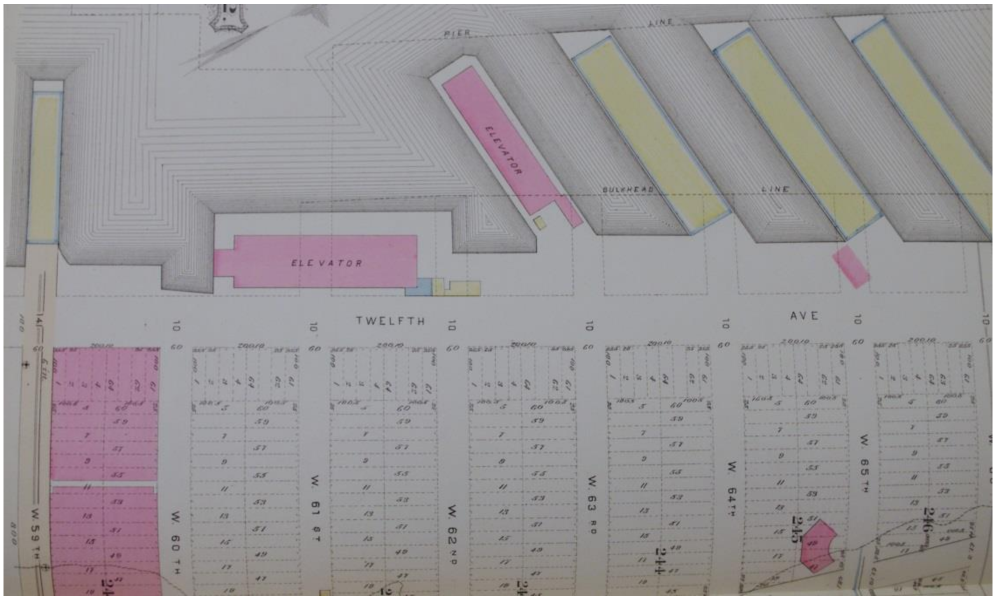


Figure 2.10. 1883 Robinson map of the Union Stockyards and Slaughterhouse.

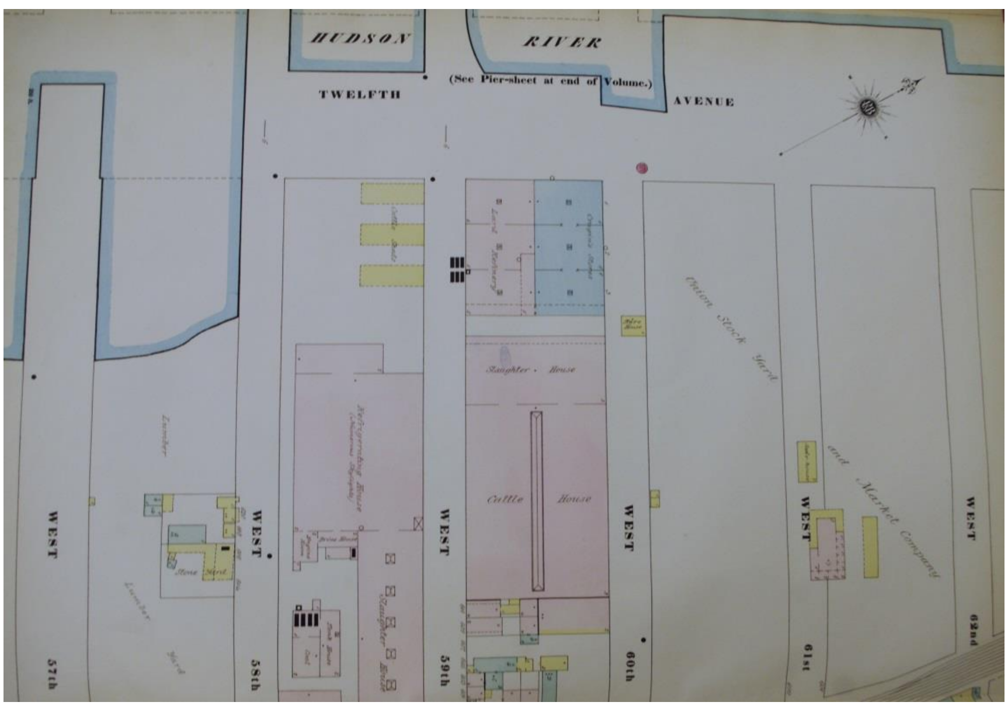


Figure 2.11. 1885 Perris and Browne map of the Union Stockyards and Slaughterhouse.

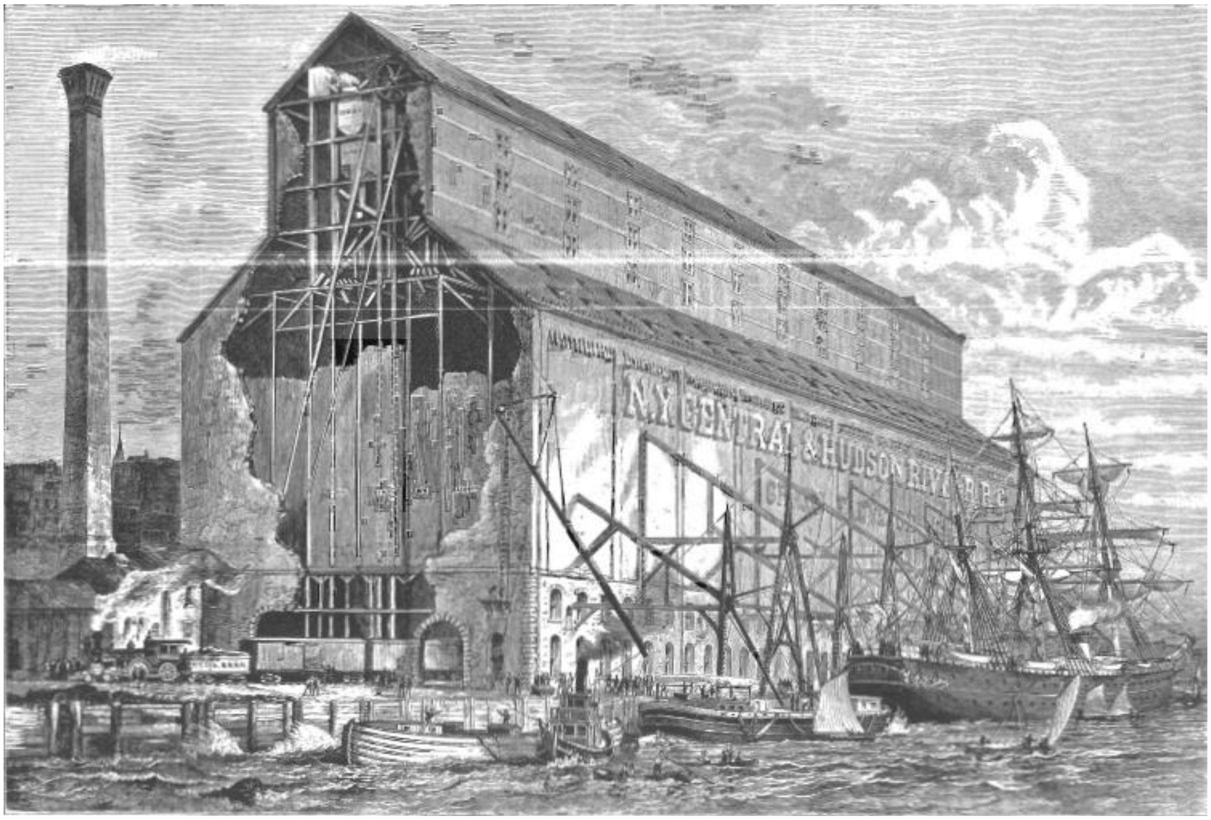


Figure 2.12. The first grain elevator erected near the project area in 1877 (Grafton 1977:229).

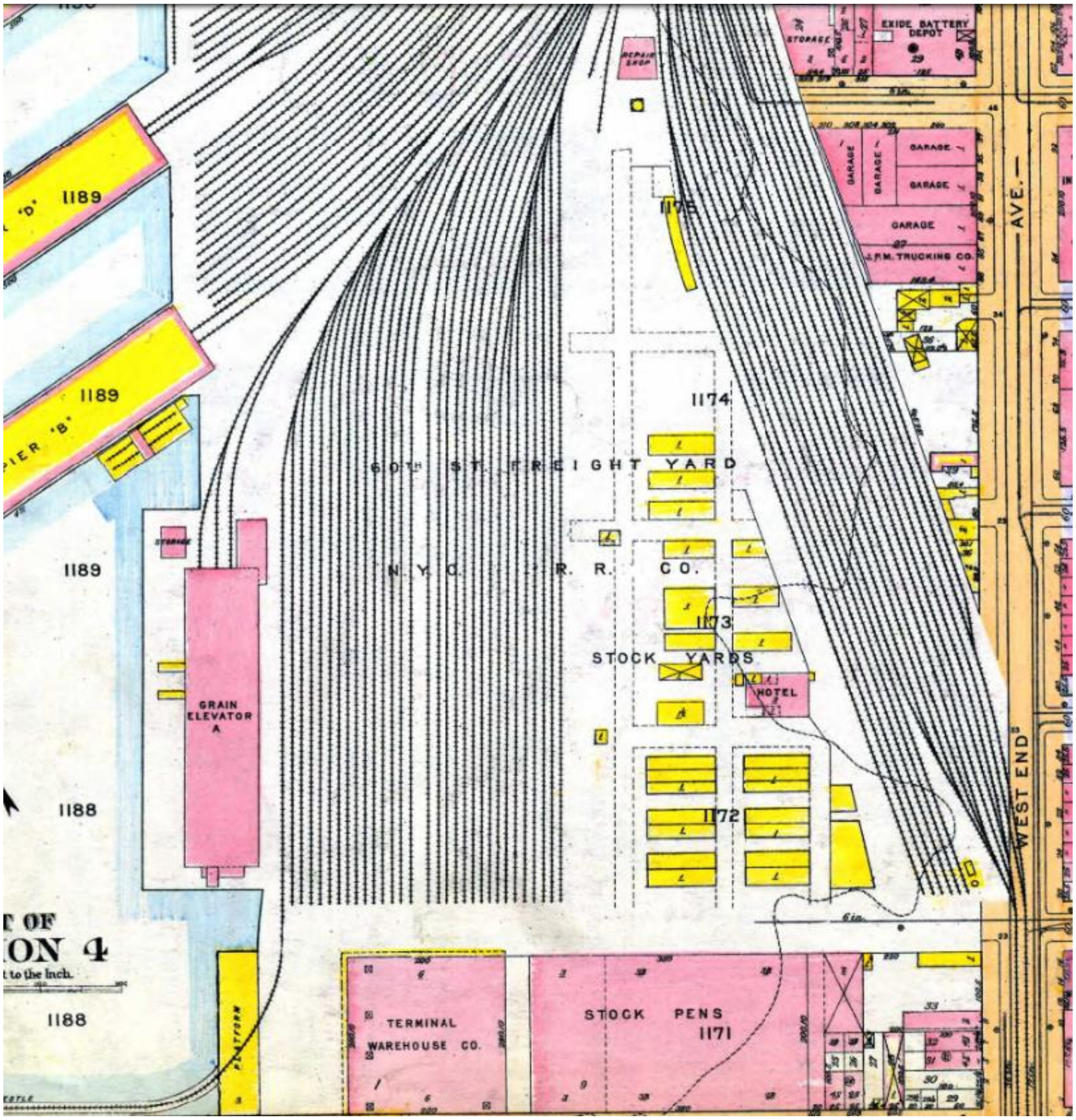


Figure 2.13. 1924 Bromley map of the project area with surviving cattle yards in the early Twentieth Century.

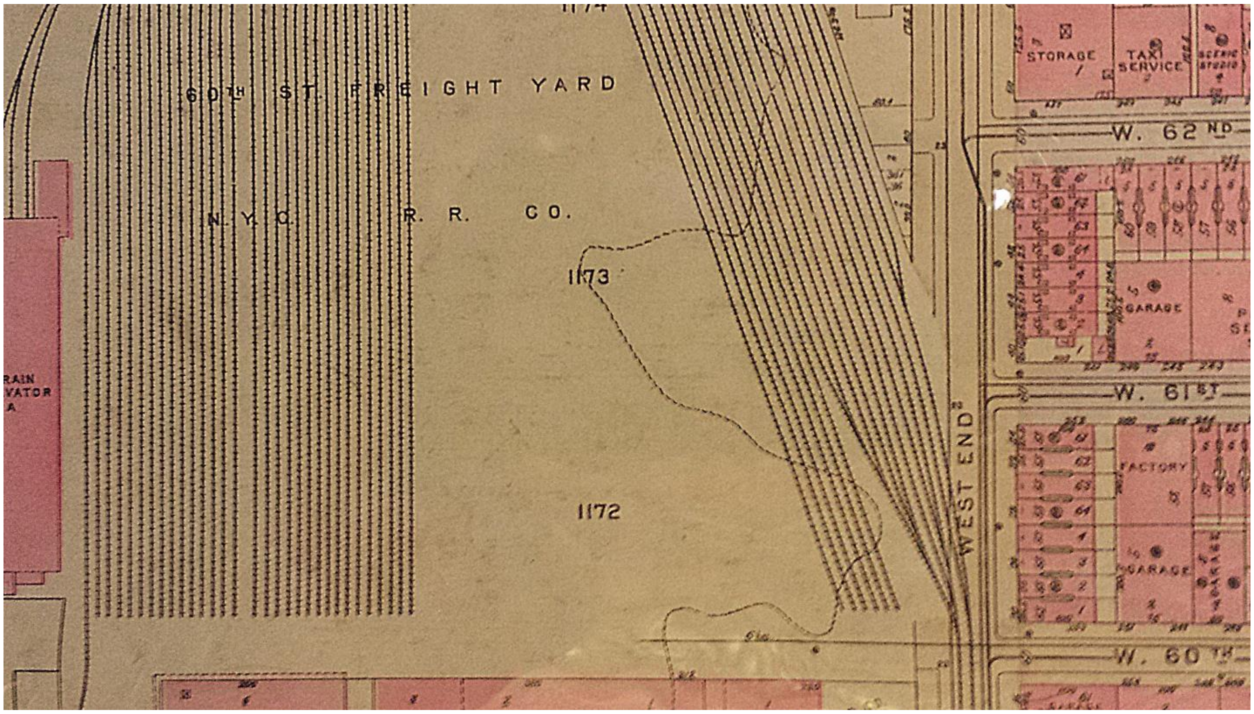


Figure 2.14. 1930 Bromley map showing no structures within the project area.

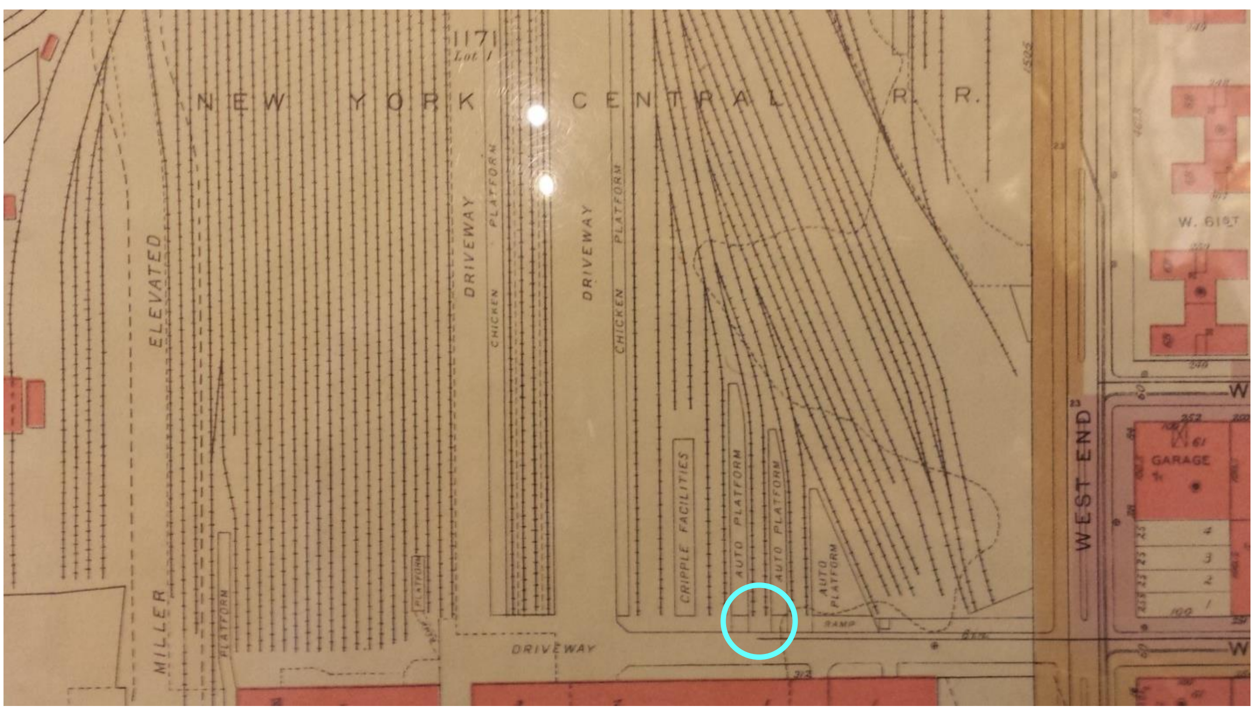


Figure 2.15. 1955 Bromley map showing structures related to the railroad. Note the structures (circled) that possibly correlate to the brick structure found through GRA's field efforts.

Figure 2.16. Entries for the Stone family in the first enumeration (left) and second enumeration (right) of the 1870 census. Note the different neighbors recorded in each enumeration.

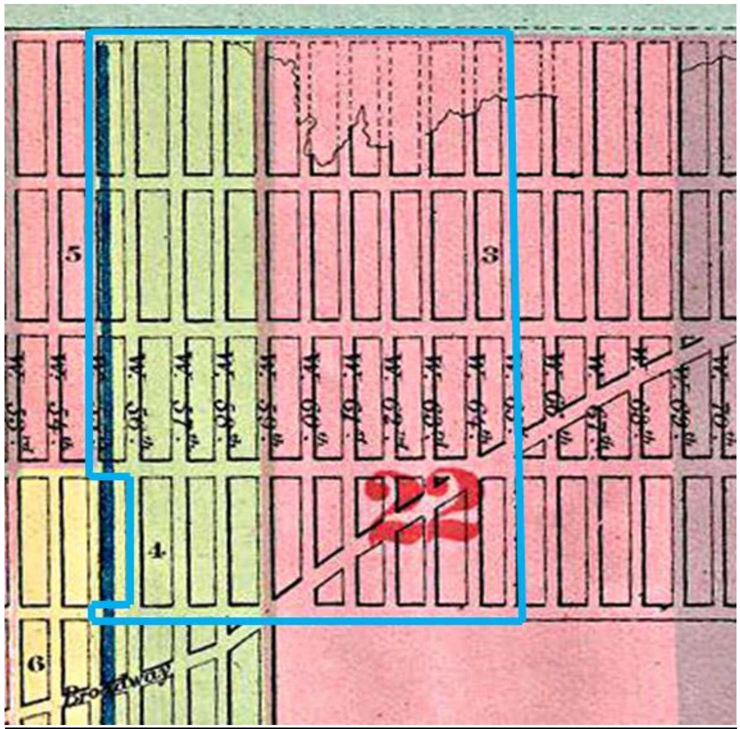


Figure 2.17. Target area for the census study (highlighted in blue).

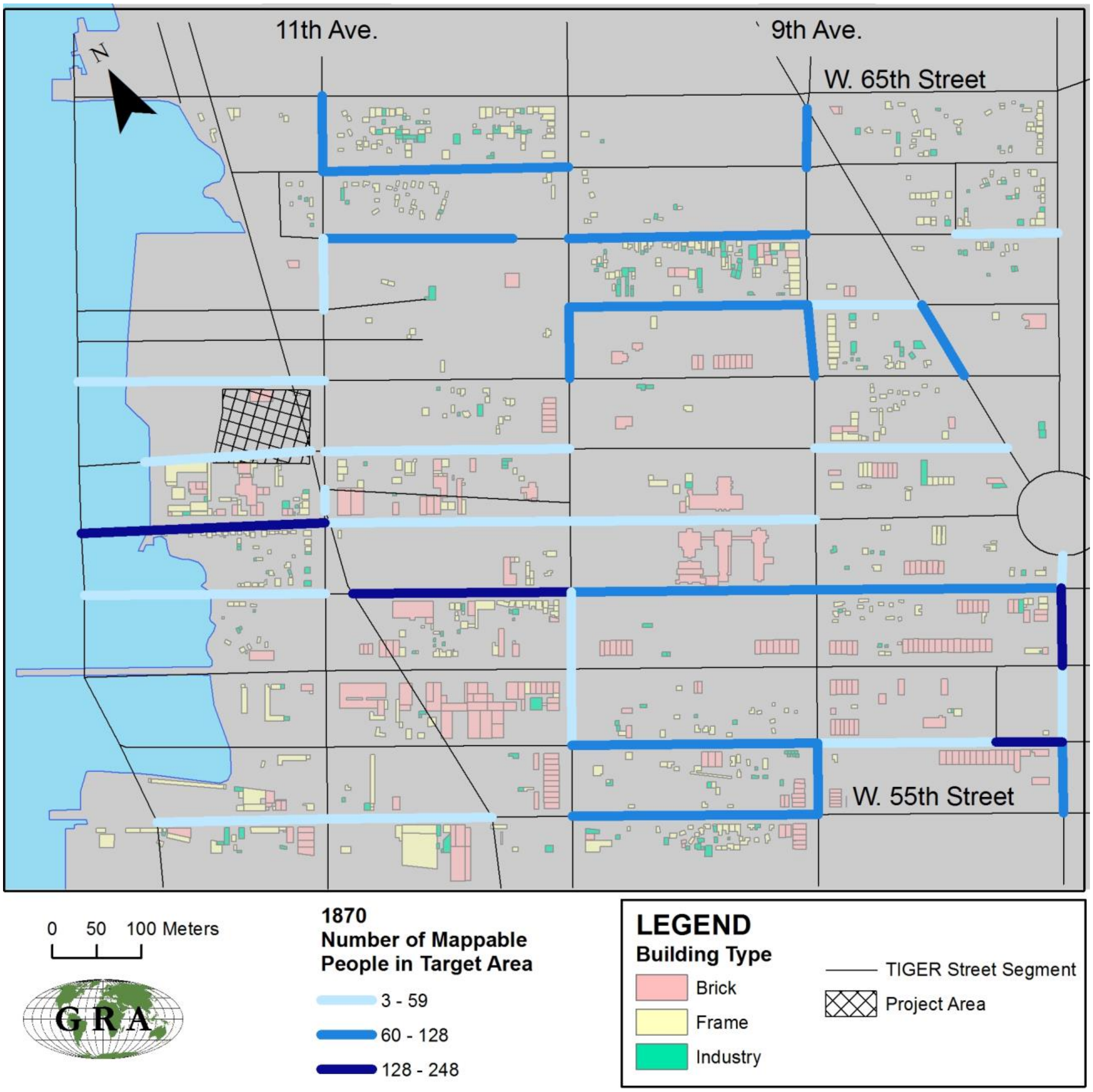


Figure 2.18. Total population counts per street segment according to the 1870 Federal Census.

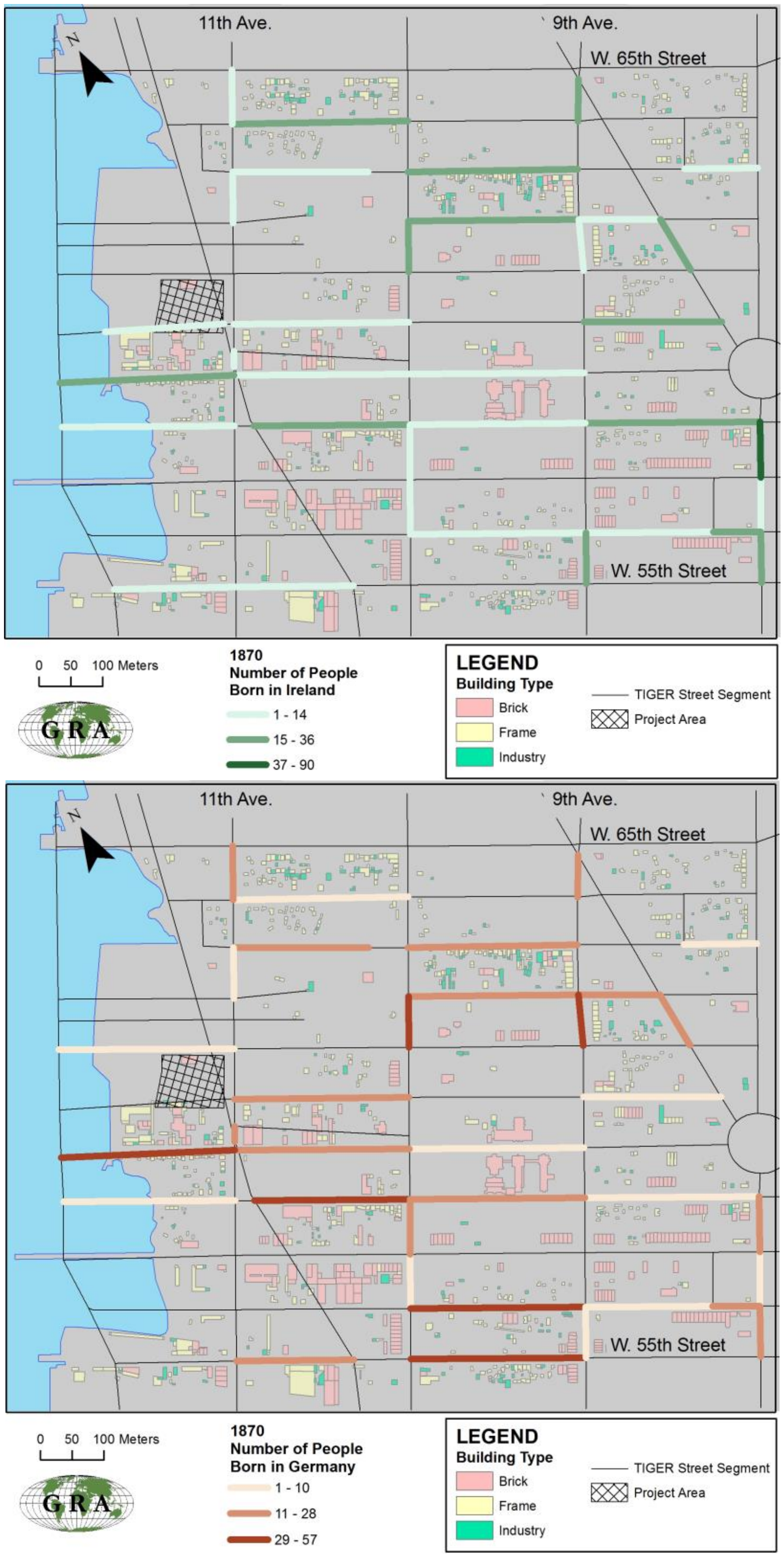


Figure 2.19. Number of Irish-born (top) and German-born (bottom) residents per street segment, according to the 1870 Federal Census.

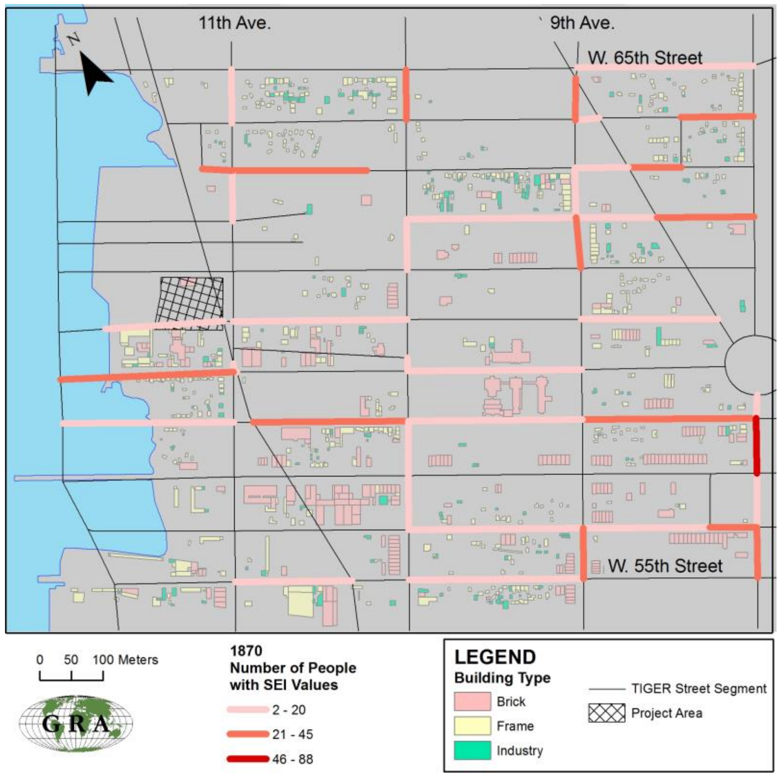


Figure 2.20. Number of residents per street segment with assignable SEI scores for 1870.

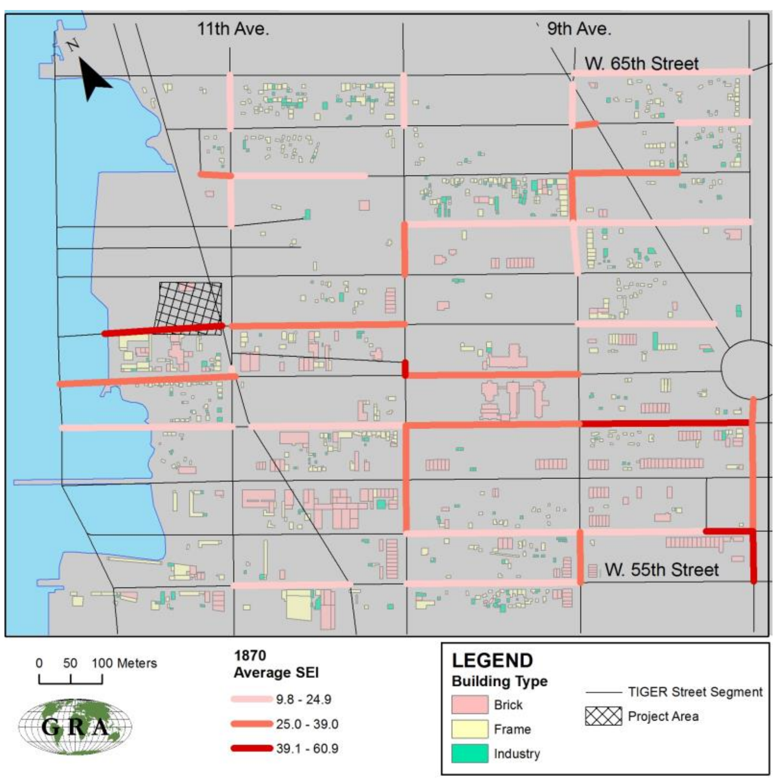


Figure 2.21. Average SEI score per street segment in 1870.

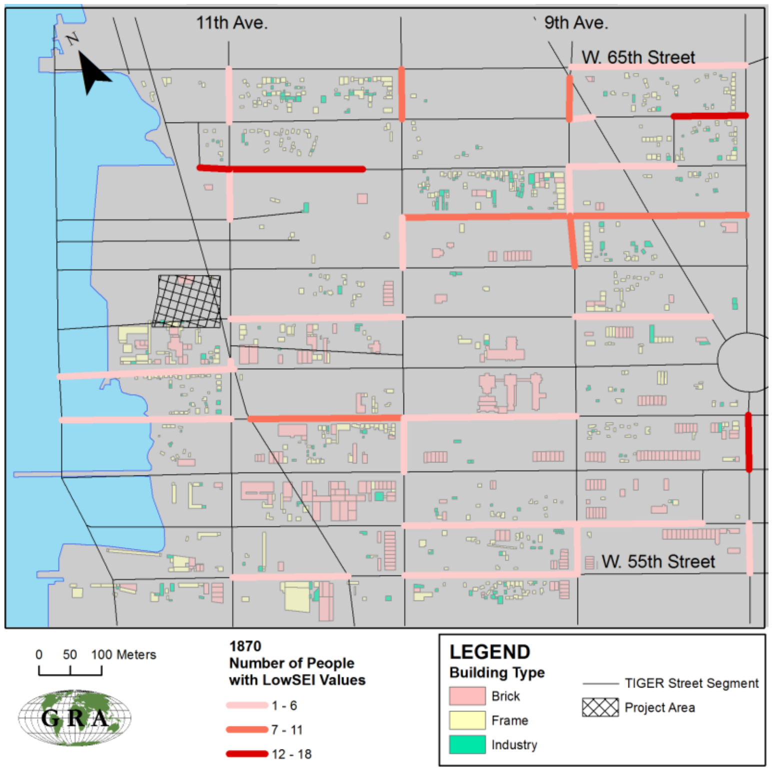


Figure 2.22. Number of residents per street segment with low SEI scores for 1870.

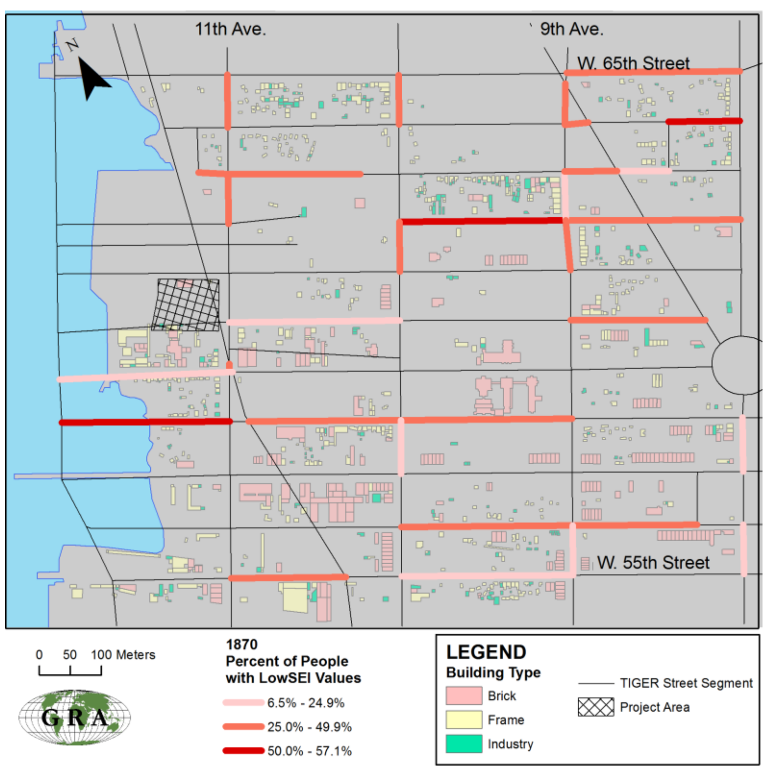


Figure 2.23. Percent of the population with low SEI values for 1870.

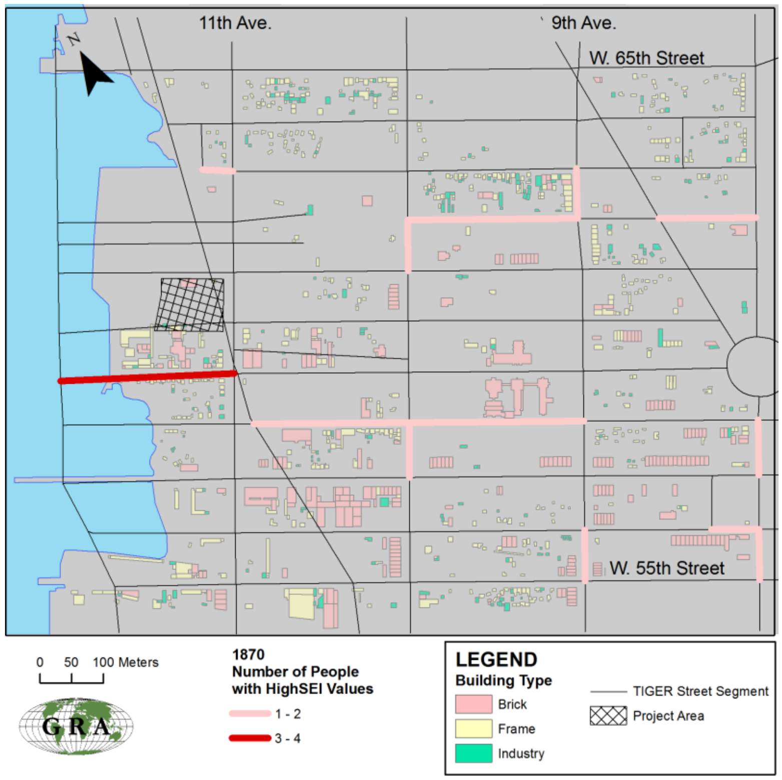


Figure 2.24. Number of residents per street segment with high SEI scores for 1870.

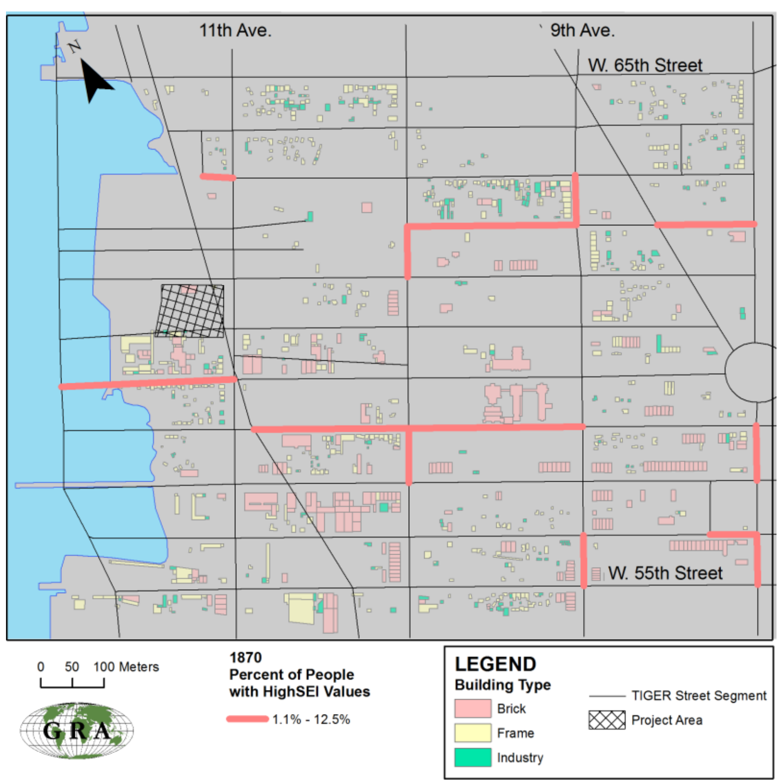


Figure 2.25. Percent of the population with high SEI values for 1870.

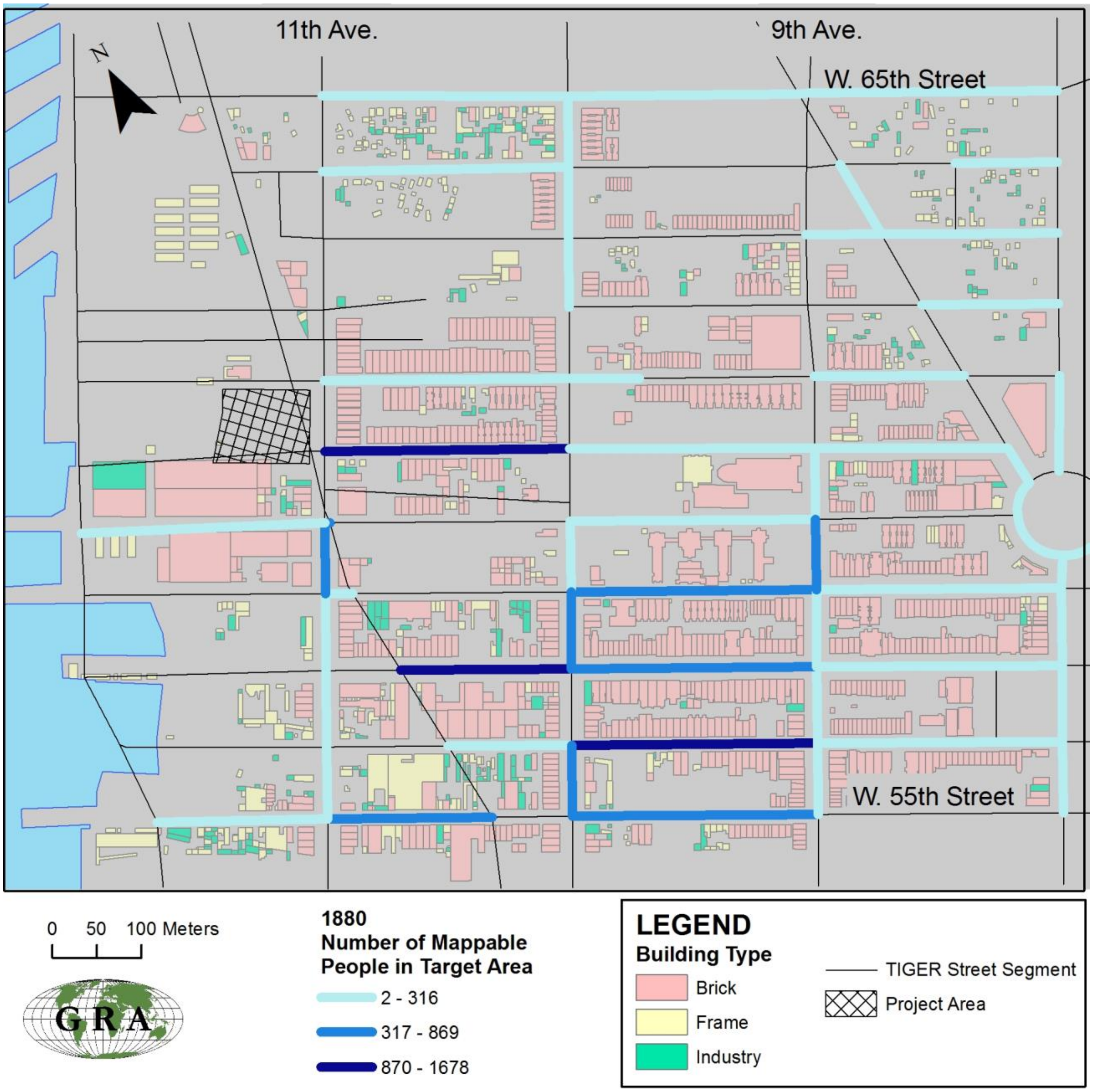


Figure 2.26. Total population counts per street segment according to the 1880 Federal Census.

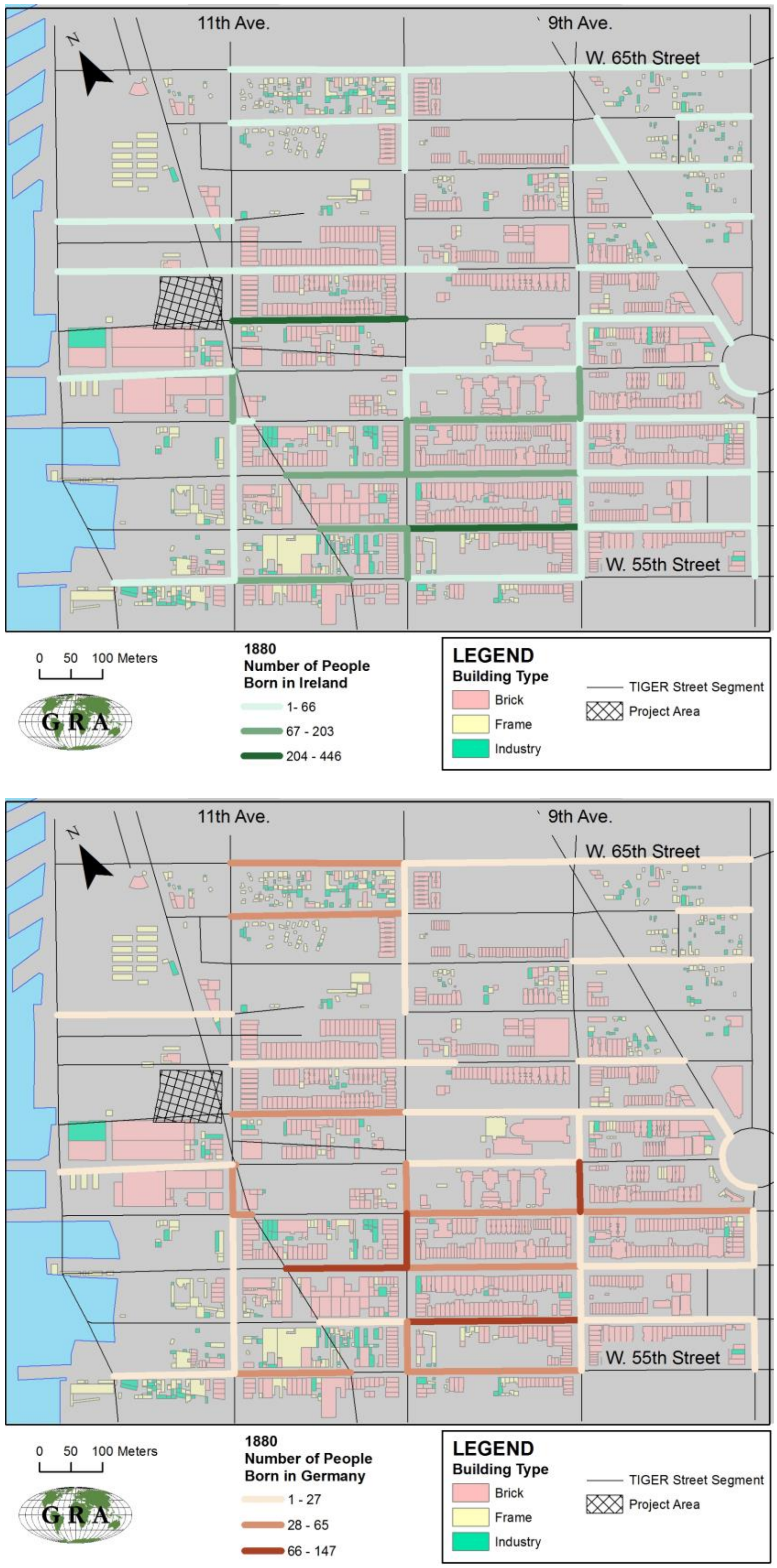


Figure 2.27. Number of Irish-born (top) and German-born (bottom) residents per street segment in 1880.

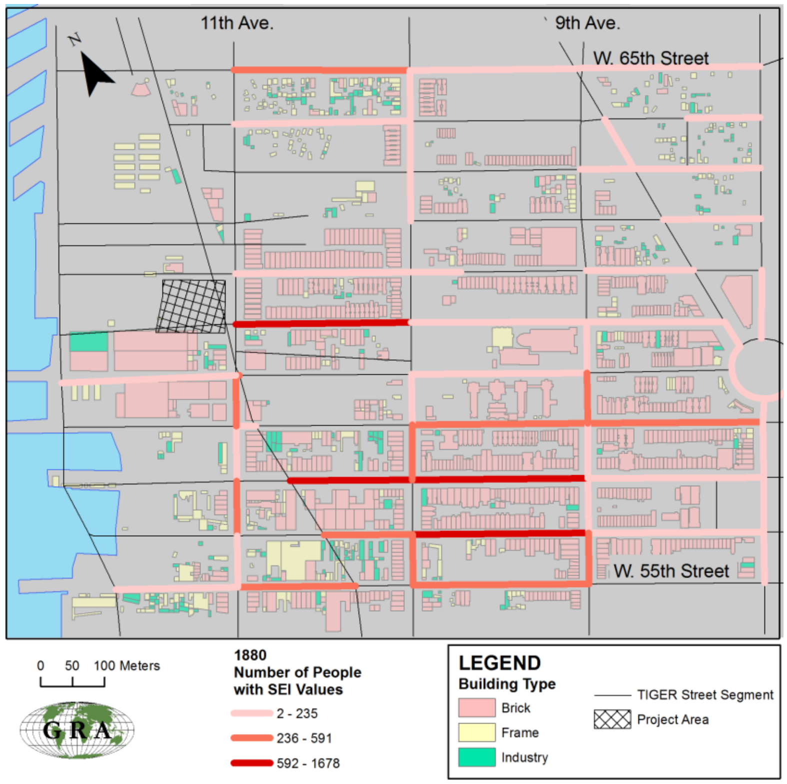


Figure 2.28. Number of residents per street segment with assignable SEI scores for 1880.

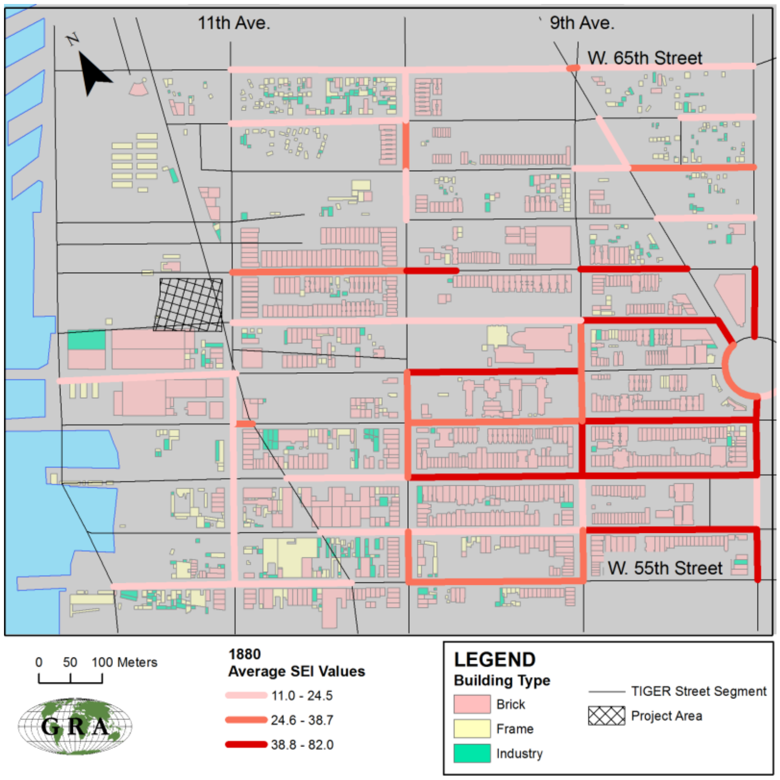


Figure 2.29. Average SEI score per street segment in 1880.

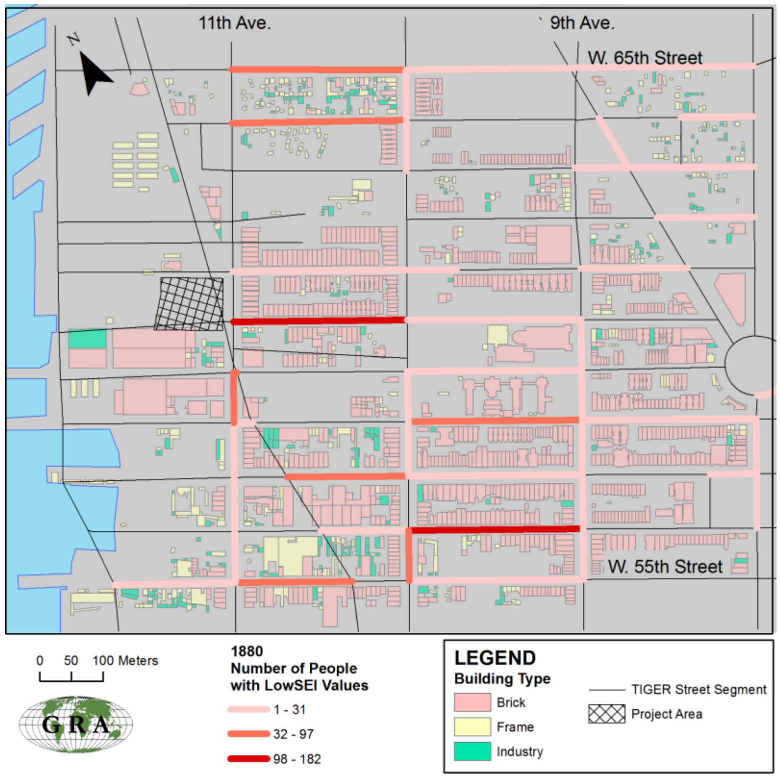


Figure 2.30. Number of residents per street segment with low SEI scores for 1880.

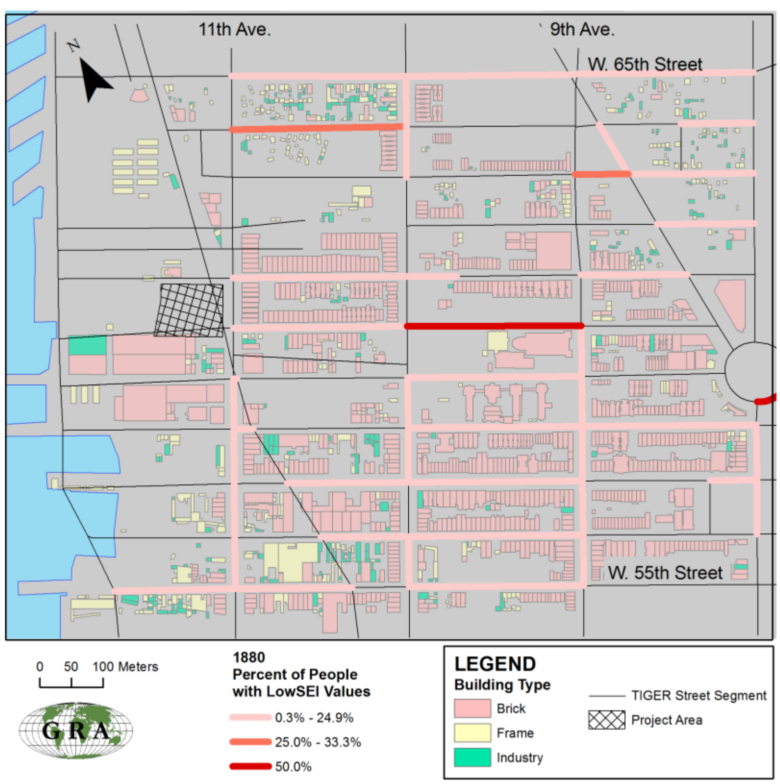


Figure 2.31. Percent of the population with low SEI values for 1880.

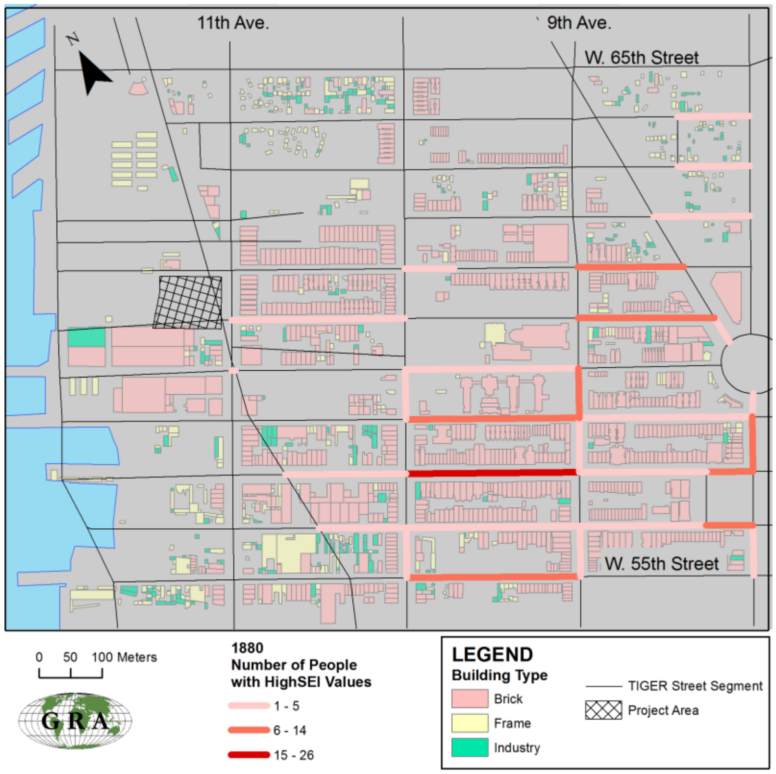


Figure 2.32. Number of residents per street segment with high SEI scores for 1880.

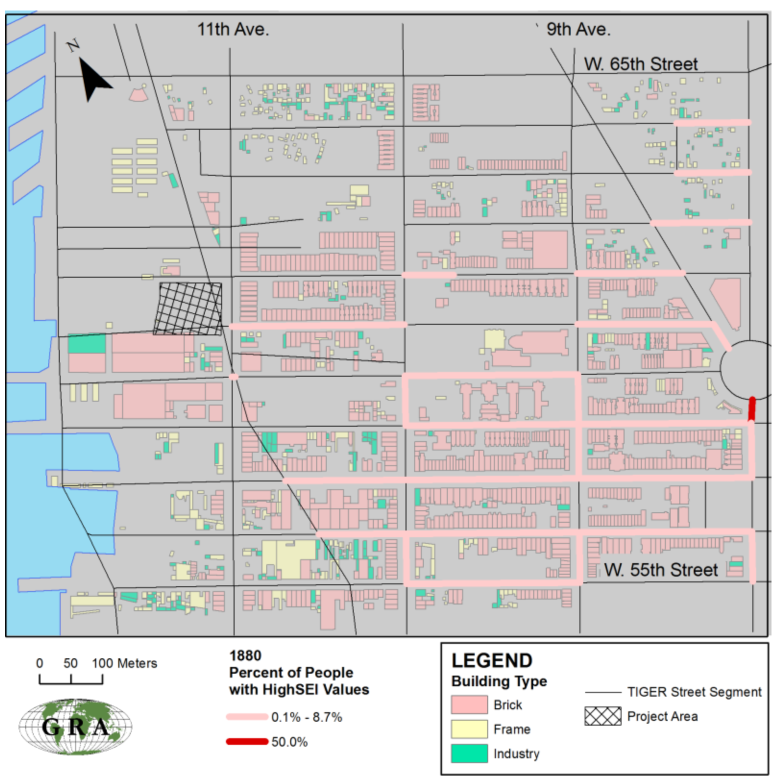


Figure 2.33. Percent of the population with high SEI values for 1880.

CHAPTER 3: RESEARCH DESIGN and METHODS

Introduction

This chapter lays out the research design for this project and explains the field and laboratory methods employed in pursuit of fulfilling that research design. The landscape perspective guiding this research is concisely discussed followed by an elaboration of the four research domains identified for this project and their associated objectives. Specific field methods are explained for Phase IB and Phase II of the project. The chapter concludes with an explanation of laboratory methods and the procedure for artifact processing. Throughout this section, each method is explicitly related to relevant research domains and objectives.

Theoretical Context

Understanding human-environmental interactions has a long-standing history in archaeology (Yesner 2008; also see Dincauze 2000; Jochim 1990; Reitz et al. 1996; Turck 2012). This includes approaches focusing on the landscape as the unit of analysis (Anschuetz et al. 2001). Such approaches are important because the landscape reflects the intersection between the natural world and human action (Anschuetz et al. 2001:185; see also Wobst 2005), with those interactions being adaptive responses to each other (Delcourt and Delcourt 2004). Thus, understanding changes to the landscape, i.e., knowing the local geomorphology and geology, allows for better interpretations of the archaeological record (Turck and Alexander 2013).

Research Domains and Objectives

The overall objective of this project was to evaluate Parcel 2 of the Riverside Center Development property for archaeological sensitivity, and to test whether those areas of proposed sensitivity contained intact cultural remains. This included determining if initial shell deposits correlated with the original Hudson River shoreline. Data gathered were used to understand trends in human settlement and landscape change for the Upper West Side of Manhattan. These data collecting activities fall under the umbrella of four main research domains, which include attendant objectives (Figure 3.1).

Research Domain 1 (R1): Baseline Signatures

This research objective focused on the development of a descriptive baseline, or signature, for each occupational time period represented at the project area. This included processing and describing environmental data and cultural materials, such as sediments, artifacts, features, and preserved plant and animal remains. These primary data were used to create the foundation for the rest of the interpretations regarding landscape change and human occupation of the project area.

Research Domain 2 (R2): Modeling Site Formation Processes

The primary objective of this domain included the identification of the environmental and human processes which formed the many layers (formally, stratigraphic units) of the project area, in order to understand landscape change over time. This was done in accordance with transform-based modeling schemas developed for linked archaeological occupation and landscape interpretations (Schiffer 1976; Butzer 1982). Strata related to different phases of land-use at the project area were examined to discern insights into the impacts of waterfront activities, urbanization, and land-filling on the local environment.

Research Domain 3 (R3): Multi-scalar Relationships

The third research domain sought to link past human activities and environmental changes on a variety of scales. The objective was to compare landscape change and settlement /occupation/urban history of the project area to greater New York City and beyond. In order to place the historical development of the project area within the proper context, the Riverside project was examined and described in relation to a set of multi-scalar connections, beginning at the level of the immediate neighborhood, and extending out to city, national, and ultimately global, connections. This included determining the origins (i.e., time and place) of artifact manufacture through the use of maker's marks to find specific businesses information, or more generally, through the identification and analysis of the raw materials and technologies used in their manufacture.

Research Domain 4 (R4): Methodological Significance

Finally, the fourth research domain focused on assessing the human-ecological findings of the project area and examining them in relation to broader archaeological and anthropological methodology. Specifically, GRA called into question the writing off of "fill" as disturbed and not worth studying. This follows the pioneering work of Rathje and Murphy (1992) on the anthropological significance of contemporary garbage heaps, who found that features eligible for the National Register are readily preserved in sediments not qualified as formally stratified.

Field Methods: Phase IB Geoarchaeological Testing

The initial assessment of the project area for buried, but intact, archaeological surfaces began with a geoprobe survey on July 17 and 18, as well as August 28, 2012. This deep-testing method allowed us to penetrate the 3-9 m (10-30 ft) of artificial fill, and assess the sediment below for archaeological sensitivity. The results of the geoprobe survey then allowed GRA to efficiently target specific areas of sensitivity for further testing (i.e., shovel testing and excavation).

Nine borings (GRA-1 through 6, and GRA-9 through 11) were collected using a geoprobe mobile hydraulic drill rig operated by ZEBRA Environmental (Figure 3.2). Each boring measured about 5 cm (2 in) in diameter, and was extracted in 1.5 m (5 ft) segments, extending to a depth of 6.1 m (20 ft) below the surface of the ground, or to bedrock, depending on conditions (Figure 3.3). Each core segment was split, cleaned, photographed, and described by GRA using standard terminology for structure, texture, consistence, and stratigraphic boundaries (see Appendix B). Sediment colors were recorded using the Munsell system. These borings were also sub-sampled at 5-cm (2-in) intervals, collecting diagnostic sediments and organic inclusions for detailed environmental analysis and radiocarbon dating. Most of the boring analysis was performed in the field, but some were taken back to GRA's Brooklyn laboratory for more controlled analysis. A Nikon total station (model number DTM-322) was used to obtain detailed elevation and location data for all borings. The arbitrary points of the total station system were translated to UTM coordinates (NAD83 Zone 18N), and uploaded into ESRI's ArcGIS 9.2 for later spatial analysis and interpretation.

This geoarchaeological analysis was supplemented by performing in-field descriptions of 29 environmental borings collected by Langan Engineering. Eleven geotechnical borings collected in 2011 by Mueser Rutledge Consulting Engineers (MRCE) were also consulted. The stratigraphic findings from these borings, which include basic descriptions of sediments classified as fill, silty clay, sand, and bedrock, were re-interpreted as part of the present study. One split-spoon auger sediment core was described during this phase as well.

Field Methods: Phase II Monitoring and Testing

The results of the geoprobe survey and analysis located estuarine deposits (associated with the original shoreline) and two areas with potential archaeological sensitivity (Sensitive Areas 1 and 2, see Figure 1.3). This included historic materials within artificial fill layers, as well as the potential for prehistoric cultural materials beneath the fill. Guidelines for a Phase II monitoring and testing program were developed to test and mitigate this idea. The monitoring and testing program was carried out between December 2012 and May 2013 in Sensitive Areas 1 and 2, with additional monitoring in Sensitive Area 1 during August and September 2013. Fieldwork included:

Monitoring during machine-stripping of artificial fill.
Collecting cultural material during monitoring, including at randomized locations, at wells, and in the area being excavated for a pool.
Mapping, documentation, and excavation of features and anomalies.
Bucket auger testing.
Shovel test pit (STP) excavation.
Excavation of Archaeological Units and Trenches of select portions of the project area.

Monitoring and testing occurred in two discrete areas: Sensitive Area 1, on the western portion of Parcel 2 (and measuring 1,872 m^2), and Sensitive Area 2, a smaller (312 m^2) portion on the eastern side of Parcel 2. Monitoring included the collection of cultural materials at 67 randomized collection locations (or "surface" collections), at eight wells (wells 1 through 4, "5 Old" and "5 New," 6, and 7), and at 13 locations within the area being excavated for a pool. Archaeological excavations included a standardized distribution of 104 STPs, five Archaeological Units (1 through 5), and nine Archaeological Trenches (4 through 12). Analysis of four Machine Trenches (1, 2, 3, and one of Modern fill), 11 Machine Cut Profiles (1 through 11, and one unlabeled profile), and two Augers (1 and 2) also occurred to better understand stratigraphy.

Sensitive Area 1 Methods

In cooperation with Tishman Construction and Scalamandre Construction**,** GRA monitored the use of an excavator to systematically remove the upper-most fill sediments in Sensitive Area 1 (Figure 3.4). GRA excavated 19 preliminary STPs (12-18-TP1, TP2, and TP3, as well as STPs 1-4, and 8-19), in order to document the historic surfaces containing evidence of human occupation. These were randomly placed throughout Sensitive Area 1. In two specific locations, bucket augers were used to extract column samples, to understand the original harbor better.

Monitoring continued, with the excavator removing fill to within 0.15 m (0.5 ft) of the estuarine deposit. Diagnostic artifacts exposed by the excavator were collected and labeled. The transition zone (where artificial fill was first deposited) was excavated by hand in order to recover historic artifacts while carefully exposing the surface of the clay silt. Fifty-four more STPs were excavated in Sensitive Area 1. These were more systematic, placed along seven transects (labeled 1 through 7) in a grid of ~5 m (16.4-ft) intervals. The STP grid was laid out with measuring tape, and locations were designated with marked flags. The typical STP measured 50 cm in diameter, with an average of 0.8 m (2.5 ft) in depth (due to groundwater). STPs were excavated in stratigraphic layers, with sediment passed through 0.6 cm (1/4 in) mesh screen (Figure 3.5). Some STPs were re-excavated within a meter of the original grid location due to flooding issues or impasses. Profiles were photographed and drawn, noting changes in stratigraphy, upon completion. It should be noted here that groundwater filled the tests on a regular basis, requiring the use of a pump (supplied by the construction crew) to pump the water out.

In general, all cultural material was collected for analysis. However, when certain artifact types were found in abundance (e.g., oyster shells), representative samples were collected. Documentation of cultural material was according to context (i.e., stratigraphic level, proximity to features, etc.). Sediment samples and most ethnobotanicals were bagged separately, due to fragility or to reduce cross-contamination. Sample numbers were assigned in the field, with different sample numbers for each stratigraphic context encountered within STPs, Archaeological Units, and random collections (outside of proper tests). Provenience information was also written on the bag, including STP or Archaeological Unit number, top and bottom depths below surface, and notes on basic stratigraphy. Sample numbers were assigned on a “first come/ first serve” basis, with each new stratigraphic context with artifacts given the next number in sequential order. When a test encountered a new stratigraphic context without artifacts, sample numbers were not assigned.

Additional methods were used specifically with Archaeological Units (Units 1 through 3, in Sensitive Area 1). The depth and coordinates of all cultural material in the Archaeological Units were collected using a total station. Archaeological units were dug in both stratigraphic layers and arbitrary 10-cm levels, with sediment passed through 0.6 cm (1/4 in) mesh screen. Stratigraphy and important features were drawn and photographed. The excavator was also used to make a deep cut to the western wall of Archaeological Unit I in an effort to find the bottom of posts 2 and 3. This cut was 127 cm (50 in) wide by 127 cm (50 in) deep. A shoring box was inserted into the cut in order to enable GRA to safely clean and examine the profile and posts. The profiles were photographed and drawn, and 28 sediment samples of 10 cm^3 (0.6 in^3) were taken in two columns near the posts. Four additional sediment samples were taken nearby. Archaeological Unit 3 was dug at the base of the cut, and extended down 50 cm (20 in). The excavator cut seven profiles (Machine Cut Profiles 1-3, one unlabeled Machine Cut Profile, and Machine Trenches 1-3) that were then cleaned, photographed, and drawn, for sedimentological analyses.

Extra monitoring occurred in Sensitive Area 1 to observe excavation of a swimming pool (the deepest aspect of development). The task required monitoring the removal of sediment to prepare for the placement of caissons for the pool foundation. Artifacts noted in the bucket of the machine excavator were set aside, and GRA bagged and labeled them according to protocols described above. Features and structures were also recorded as they were encountered. No formal excavation was conducted during this phase of the project.

Sensitive Area 2 Methods

For the most part, methods in Sensitive Area 2 followed the same procedures used in Sensitive Area 1. In addition to monitoring the use of an excavator to remove the artificial fill, GRA also monitored the insertion of pylons/caissons. We observed the sediment expelled during this process to look for artifact displacement. Exactly 31 STPs were excavated in Sensitive Area 2, at 5-m intervals, and in six transects (numbered 8 through 13). However, this was along a scattered grid (as opposed to a regular grid). As in Sensitive Area 1, some STPs were relocated (no more than two meters) due to impasses. STPs 8.1-8.3 are considered to be judgmentals, as they were more randomly placed to get a better idea of the landscape contours prior to major excavation. Two archaeological units (4 and 5) were excavated in Sensitive Area 2, as well as all nine of the archaeological trenches (4 through 12). Archaeological trenches followed the same methods as the archaeological units. Seven Machine Cut Profiles (4 through 10) were also analyzed, photographed, and drawn. One Machine Trench of modern fill was also analyzed. One different method in Sensitive Area 2 was that excavators cut an east-west profile across the entire area for an in-depth landscape reconstruction. Multiple sediments samples, 10 cm^3 in size, were taken in a column running the height of the profile for analysis.

Laboratory Methods and Artifact Processing

Initial processing of cultural material was conducted in the field in an on-site trailer. Most materials were cleaned in buckets with plastic colanders, distilled water, and small brushes, and left to dry overnight. Sediment samples, organic samples, and leather artifacts were not cleaned. Some leather artifacts were sent out for conservation at this time. Preliminary inventory of artifacts was also conducted, with sample numbers assigned in the field, in chronological order of artifact and feature discovery. Although the in-field sample numbers no longer have any real bearing on the organization of the artifacts, they were retained (i.e., recorded on new bags and spreadsheets), as field notes and drawings utilized this original numbering system.

All artifacts were transported back to GRA's Brooklyn laboratory for further processing, including additional cleaning if necessary. Catalog numbers were assigned in the lab during processing, to further standardize the numbering system. Catalog numbers were created by reorganizing the collection by provenience, depositional unit, depth, and material type. Material types were organized under the following general categories: ceramics, glass, leather, metal, wood, ethnobotanical remains, bone, shell, and soil samples. After analysis, artifact numbers were assigned to each individual artifact, acting as the unique identifier. This was done by adding decimal numbers to the catalog numbers in ascending order. For example: In STP 8.01, metal, glass, and ceramics were found within a depth of 430-350 cm (these all have the same sample number of 1495). Catalog numbers for these items are 2627 (metal), 2628 (glass), and 2629 (ceramics). The glass category consists of three glass fragments, whose catalog/ artifact numbers are: 2628.01, 2628.02, and 2628.03. These catalog/ artifact numbers were applied to each artifact, printed on acid-free paper and using a custom-made adhesive. With small or fragile artifacts, the label was tied on using string. Thus the catalog/ artifact numbers are the unique identifier and main organizational component of the artifact catalog. A complete artifact inventory can be seen in Appendix C, and is also included with this report as a digital file. The artifact collection is organized by provenience location and within each provenience location by depositional unit.

Analytical Methods

In order to address the research domains defined above, a broad range of analytical methods were employed beyond the more typical laboratory methods. These are outlined in detail below, with reference to the particular research questions they address.

Establishing General Site Chronology

Site chronology was built in a number of ways. Cultural materials were analyzed for diagnostic characteristics sensitive to time periods. These included maker's marks, ceramic decoration and composition, glass type/color/size/shape, nail type, etc. (see Robinson 1951). Precise dates, or more often, a general time frame of artifact use, can be established in this way.

Ceramics. With ceramics, many maker's marks appear in *Godden's Encyclopedia of British Pottery and Porcelain Marks* (1991) and/or the online British pottery database. Ceramics are especially sensitive to time frames, and were analyzed thoroughly, with the main categories being porcelain, stoneware, and earthenware. Distinctions between coarse and refined earthenware led to the classification of several ceramic varieties, including general earthenware, Rockinghamware (which occurs mostly on earthenwares), creamware, whiteware (including blue willow pattern, and alphabet/proverb plates), redware, yellowware, and ironstone. Non-vitreous, white-bodied wares present in the collection include creamware, defined by its opaque and off-white color, and whiteware, the whitest and most refined of the wares. Ironstone is a semi-vitreous white-bodied ware. Yellowware, redware, and Rockinghamware are named after their distinctly colored slips (see Majewski and O'Brien 1987). The frequencies of both counts and weights demonstrate a correlation with temporal changes in ceramic production. Creamware was generally produced prior to the 1820s and succeeded by whiteware. Ironstone gained popularity between 1850 and 1880, while yellowware and redware were produced throughout the late eighteenth and early nineteenth centuries (Hume 1978; Majewski and O'Brien 1987).

Clay tobacco pipes are one of the most useful artifacts for dating historic sites (Walker 1970; Dallal 1984), and thus will be treated separately from the ceramics section. By the nineteenth century, pipes were mass-produced by several different countries, including England, Scotland, France, and Germany (Walker 1970). The manufacture of more expensive pipes in the United States began about 1860. Analysis of the clay pipe assemblage with this project included discerning the origin, location, date, and significance of pipe bowls and stems. When the interface between the bowl and stem were present, further analysis and classification were performed. Measurements included bore diameter (in 64ths of an inch), stem length, and bowl volume. A reliable Minimum Number of Pipes (MNP) was also discerned from the assemblage.

Glass. Glass was categorized under the following criteria:

Window Glass: Flat glass fragments with a thickness ranging from 0.92 to 3.2 mm (Moir 1982; Rivers 1999; Weiland 2009).
Bottles: Closed vessels, shaped with a distinctive bottle finish, body, and base (Lorrain 1968; Reher & Wedel 1990).
Drinking Vessels: Open vessels with distinctive cup body with flat base or supported by a stem and base.
Lantern Glass: Undecorated glass with a curved body with and an oval-shaped lip.
Miscellaneous: Other diagnostic glass artifacts, such as a bowl, beads, marbles, spectacle lenses, etc.

It is the general consensus that window glass not recovered from defined households cannot be dated properly (Day 2001; Weiland 2009). In addition, there was little uniformity in the production of window glass. Each batch of glass could vary in tint color and thickness, even within the same glass manufacturing house (Rivers 1999). Traditionally, statistical methods are used to analyze window glass, which is then used to determine the construction date of historic buildings. Due to the nature of the present glass assemblage, it cannot be dated using these standards. However, it is important to try to get some general dating information from these artifacts. Moir (1982) observed that the thickness of window glass increased over time, ranging between 0.92 and 3.2 mm. Analysis applied Moir's (1982) general scheme of increasing thickness over time to the Riverside assemblage, and referred to it as Moir Sorted (MS) window glass. Thickness also plays a role in classifying window panes by manufacturing type. Panes manufactured before 1840, known as Crown glass, have an average thickness of 0.92 mm to 1.14 mm while Cylinder glass typically has a thickness of 1.28 mm to 1.42 mm. Plate glass averaged around 1.70mm by 1860 although the mechanization of production during the early twentieth century set the standard of Plate glass thickness at 2.0 mm (Day 2001; Ison 1990; Moir 1982; Rivers 1999).

Bottles were typed based on the diagnostic markers presented in Lindsey's (2010) Historic Glass Bottle Identification and Information website. The most time sensitive features of a bottle are the seam, base, lip, and maker's mark. Seam variation is a reflection of bottle manufacture. Three manufacturing techniques are represented in the collection: Free Blown, Mold Blown, and Automatic. Handmade free blown bottles began to decline in the mid-1860s in favor of a more uniform shape. Mold blown bottles used partial molds and shaping tools to create more variety in body styles. The process was completely automated by the beginning of the twentieth century (Firebaugh 1983; Lorrain 1968) (Table 3.1). Similar to the seam, bottle bases are directly linked to bottle manufacture (Table 3.2). Pontil marks are commonly associated with free blown and early mold blown vessels, while hinge, cup, key mold, and post bottom molds are exclusive to mold blown bottles. The automatic valve base is a product of the press-and-blow process whereas suction scars are only present on blow-and-blow automatic machines. The lip of the bottle can be analyzed for the tool used to create the rim and the style of lip since lip styles are created with different tools. It should also be noted that some lip style dates are different depending on bottle type (Table 3.3). Bottle shape is considered but limited to medicinal and ink bottles in this analysis (Table 3.4). Though shape can be used as a chronological marker, it is more useful as an indicator of a particular brand of bottle or the bottle's contents. Shape is also important for distinguishing ink bottles from ink wells. Ink wells are often made of polished, heavy glass so as to compliment other desk accessories. With glass bottles, makers marks' refer to the embossed letters found on the body and/or base of a bottle. Marks can feature the name of the company, the name of the product, as well as manufacturing codes. Some marks are time sensitive depending on the arrangement of letters, font style, or a change in the company's name. A conclusive date range was determined for each bottle by marking the period at which all five attributes overlap (referred to as date range overlap).

Metal. Certain metal artifacts such as nails are chronologically sensitive and can therefore be used for dating purposes. Due to heavy corrosion, many of the metal artifacts were cleaned prior to identification. Methods included removing excess oxidation with brushes and dental picks, and desalinating corroded irons.

Radiocarbon Dating. Radiocarbon analysis was also employed. This method uses the decay of carbon-14 (14C) to estimate the age of organic materials (Reimer et. al. 2009) and is the industry standard for dating archaeological materials and sediments (Bowman 1990). Suitable materials include, but are not limited to: wood, charcoal, mollusc shells, and sediments and soils with microscopic organic components. By dating the sediments themselves, the sequence of events can be reconstructed. This would include the pattern of geomorphic activity and episodes of sustained stability (registered in "A" or "B- horizons" of soils) that monitor the variability in landscape dynamism. Samples of organic sediment and/or macroscopic organics from the machine-cut Profile 10 and boring GRA-10 were sent to Beta Analytic for radiocarbon analysis.

The criterion and methods listed above for establishing site chronology addressed the following research domains:

R1. By identifying the ages of artifacts and sediment layers, both human and environmental chronology could be established.

R2. In general this approach identified the timing of site formation processes. Dating revealed the timing of various onsite processes, such as the degree of erosion, stability, or sedimentation. Those determinations, in turn, helped pinpoint the ages of the known sequence of environmental dynamics in the area.

R3. Dating, along with other methods (such as background documentary analysis), narrowed down the timing of relationships, and how those relationships changed over time.

R4. Along similar lines, the sequence, pattern, and possible integrity of landfill components was determined without simply dismissing depositions as homogeneous and vertically stacked through time. Ages can be affixed to discrete fill types, and lateral variability for such fills can be segregated from a parent sediment matrix.

Dendrochronology

Dendrochronology provides absolute and relative dates for wooden artifacts and features that retain intact sequences of growth rings. The precise year that a tree was cut down can be determined using dendrochronological methods. In addition, dendrochronology can furnish abundant information about past climates, past environments and human activities. By identifying the region from which the trees originally came, dendrochronology registers, to some degree, transitions in forest cover and preferred procurement and selection strategies of building materials (i.e., along the shoreline and for fencing of local households). Furthermore, this analysis can provide information on trade connections (McGovern 1995). GRA submitted wood samples to the Lamont Doherty Tree Ring Laboratory to determine the ages of the samples and to try to identify the purposes of these features (see Appendix F). The construction crew used a chainsaw to make two cuts on each post to obtain samples with adequate cross-sections about 20 cm (8 in) thick. This method addressed the following research domains:

R1. The tree remains supplied an absolute chrono-stratigraphic marker. Moreover, the dendro-based stratigraphy provided a cross-correlation for the absolute chronology.

R2. When used in conjunction with radiocarbon dating, the floating tree-ring sequence can be tied into a particular point in time. This information was used to understand what the landscape was like at certain times, and how it evolved.

R3. Dendrochronological analysis also reveals the species of the trees, which can then be used to suggest a likely place of origin. Identification of these wood-based structures can also lead to how people utilized the landscape.

Faunal and Ethnobotanical Analyses

Faunal and Botanical analyses examine the plant and animal remains preserved at the project area (e.g., see Behrensmeyer et. al. 2000). Analytical parameters range from the zooarchaeological and paleoethnobotanical examination of macroscopic animal and plant remains to the microscopic identification of indicators of past environmental conditions (such as pollen). Zooarchaeological analysis identifies animal species, and analyses food preparation indicators (e.g., butchering), in order to understand the ways in which people used and consumed animals (Landon 2005). Ethnobotanical analysis is the identification of plant species and the analysis of food preparation indicators in order to understand the ways in which people used and consumed plants (Hastorf and Popper 1988). Due to the waterlogged nature of the lower levels of the project area, a large amount of plant remains were preserved and recovered during field excavations. Most of these remains consisted of seeds and pits indicative of foodstuffs consumed by residents of nineteenth century Manhattan. Ethnobotanical remains also have the potential to establish season-of-use, and seasonality studies were performed to narrow down the timing of the fill deposit. The *New York Tribune* provides weekly market reports of foodstuffs imported into Manhattan throughout 1874 and 1875. In addition to the ethnobotanical remains recovered through typical survey and excavation, two noticeably large caches of ethnobotanicals were found within Archaeological Unit 2 and STP 2.10. These caches were removed in their entirety (sediment and all). These samples were screened through a colander, into a clean bucket, with visible ethnobotanicals being removed. This was then used as a make-shift flotation device, with distilled water poured over the sediment. Larger remains were removed from the colander, as were the remains floating on the surface of the water in the bucket. The water and sediment remaining in the bucket were then poured over cheesecloth as a last precaution to insure that no ethnobotanicals were missed. In order to identify these macro-botanical remains, multiple sources were consulted (Kirkbride, Gunn, and Dallwitz 2006; Martin and Barkley 1961; Wilson 2014), including online image searches. Most remains were large enough to be identified with the naked eye and microscopic analysis. Martin and Barkley (1961:124) caution the feasibility of identifying most seeds down to the species level, but historical records were helpful in narrowing down several logical species with a fair degree of certainty. Although certain ethnobotanicals are difficult to identify based on physical characteristics alone, market reports have helped to logically clarify specific varieties.

Palynological analysis examines microscopic pollen remains retained in sedimentary units in order to reconstruct plant communities, which also serve as proxies for past climatic conditions (Davis and Jacobson 1985). Select sediment samples from Boring GRA-10 were submitted to Archaeological Consulting Services, Ltd. in Tempe, AZ. for high resolution pollen analysis. Malacological analysis examind the snails and bivalves preserved at the site to determine the composition and variability of the estuarine vs. riverine components of the landscape (Rousseau et. al. 1993; Surge et. al. 2003). Bulk samples of shell and sediment samples from Augers 1 and 2 were sent to the laboratory of Dr. Lynn Wingard at the U.S. Geological Survey, for species identification. These methods addressed the following research domains:

R1. GRA defined baseline subsistence data of the plant and animal communities utilized by past people. Baseline faunal analyses included species and skeletal identifications, preservation of bone elements, and diagnostic marks or features. The paleoethnobotanical assemblages were classified to species, and examined for diagnostic features.

R2. Analysis of pollen, and to some extent, the plant and animal remains aided in the reconstruction of past environments and landscapes. Specifically, the palynological study identified changes in vegetative communities related to human-activity (e.g., land-clearing, filling, etc.). Identification of plant and animal species within the estuarine and historic sediments also revealed how urbanization and industrialization impacted environmental conditions along the waterfront.

R3. Identification of the species of plants and animals discarded as food waste also provided insight into larger trade networks, both domestic and exotic. Changes in food species over time may reflect larger geopolitical and socioeconomic changes. Particular plant remains may reflect folk medicine practices rather than simple nutrition (see Yamin 2000).

R4. The condition of the faunal remains after deposition (i.e., broken, whole, gnawed by rodents, etc.), was used to determine whether the artificial fill was exposed or covered immediately, adding to an understanding of waste-dumping practices, and ultimately the use of fill as a landscape extender.

Sediments and Strata

GRA proposed using an allo-stratigraphic strategy to develop a master sequence for the stratigraphy present in the project area. For soil and sediment studies, field descriptions were assimilated to develop a site-wide stratigraphic framework. The structure, texture, consistence, and color of different layers are the result of specific depositional events in the past, and similar layers in different parts of the site can be linked together to create a comprehensive model. These links provided a detailed record of the environmental and cultural history of the property. This strategy included grain size analysis, which quantifies the texture of a sediment or soil, and looks at percentages of grain size classes (i.e., sand, silt, and clay) within a sediment sample (Stinchcomb et al. 2012). This informs on environmental processes, such as weathering and sedimentation, as well as human deposition. Twenty-three sediment samples were submitted to Randa Harris of Soil and Water Solutions in the Geosciences Department at the University of West Georgia for more detailed sedimentological analyses in September of 2014. These samples were collected from a single column (Boring GRA-10), from 209 cm to 610 cm below surface (cmbs). Sedimentological analyses performed included: percentages of gravel, sand, silt, and clay; particle size analysis by the Fleaker Method (following Indorante et al. 1990); sand fractions at half-phi intervals; soil pH; organic carbon by Loss on Ignition (LOI); and calcium carbonate ($CaCO_3$) content (by LOI) (see Dean 1974). The majority of the samples weighed at least 30g, although two samples (3370 and 3343) were too small for pH analysis. A Denver Instruments UB-5 tabletop pH meter was used, in conjunction with a modified version of the GLOBE program soil pH protocol (accessed at: https://www.globe.gov). These methods addressed the following research goals:

R1. The unique characteristics of each stratum, whether a depositional unit or soil horizon, was described in full. This provided information on the pattern and sequence of events that led to each stratum's formation and the depositional history of the site as a whole. These description and identified patterns were then used to contextualize the cultural material found within each strata, in order to better understand the objects' depositional environment and history.

R2. These stratigraphic data, in conjunction with other analyses (e.g., dating, dendrochronology, faunal, etc.), were used to reconstruct the dominant processes accounting for sedimentation and/or weathering, and ultimately geomorphic changes in the landscape over time.

R4. The descriptions of the artificial fill sediments revealed the nature and timing of the various land-filling events that occurred to create multiple former occupation surfaces leading up to the present.

Extended Documentary Research

In addition to the typical background research that is part of Phase IA archaeological studies, GRA performed extensive documentary research, examining primary and secondary textual and illustrated sources in order to place our findings within a larger context (Beaudry 1993). While historical documents are useful for providing firsthand, they can also be analyzed for ancillary information. Some examples include historic advertisements to classify diagnostic characteristics of commercial goods, census records to specify the demographics of the local community, and newspaper articles to understand community response to government activities (Brown 1973). Extended documentary research addressed the following research goals:

R1. Historic maps were an essential component of the baseline models of the various episodes of site development. Dated maps were linked to specific natural landscape features as well as structures uncovered within the project area. This made it possible to affix dates to different layers of the model and also clarified the specific use of the property over time.

R2. Historic maps also showed the evolution of the landscape over time, typically due to land-filling activities. By analyzing these maps, GRA could identify changes in the shape and function of the waterfront over time, correlating waterfront changes with land-use transitions.

R3. Insurance maps and census reports provided carefully recorded information on the locations and types of industries in the neighborhood while historic business directories and industry maps provided precise addresses.

This information was then linked to items with local address stamps, such as bottles and pipe stems. Primary accounts from newspapers gave insight into the effects improved transportation technologies such as railroads had on local industry and society. Railroad surveys indicated which regions were linked to the study area by rail. Local news reports were examined for information on the local community's response to changes in neighborhoods. Census records contained precise information on immigration, occupation, and mortality, and because they are linked to specific addresses this information they were used to contextualize the objects and structures excavated within the project area. The variety of documentary data consulted provided additional context at varying scales for the artifacts and site.

R4. The correlation of documents and maps to both the cultural material, and the stratigraphy noted in the artificial fill of the project area, provided corroborating evidence for changes with artificial fill.

Geographic Information Systems Analysis

Integrating data within a Geographic Information Systems (GIS) allows for the mapping and analysis of spatial relationships between cultural material and landscape change over time. GIS provided the seminal strategy for grouping coeval assemblages and structuring chronologies. This method addresses all four research domains.

R1. Raw counts of cultural materials, as well as landscape information (i.e., the location and depths of different strata), were input into the GIS as point data. These data served as the analytical starting point for further analysis.

R2. The former surfaces of buried landforms were interpolated (based on the previously-mentioned point data), for a more complete understanding of landscape change over time.

R3. Various historic maps were georeferenced in the GIS, connecting the evidence collected at the project area to the larger area.

R4. GIS was used to identify spatial patterns among certain cultural materials, reflecting patterns of waste deposition, and land-filling over time.

Summary

In sum, GRA utilized a landscape approach with attendant field, laboratory, and analytical methods to understand both landscape change and human settlement over time at parcel 2, 17-29 West End Avenue. The work undertaken represents the most comprehensive archaeological investigations to date for the Upper West Side of Manhattan. The project area offers a unique window on the changing paleoenvironments of the Hudson River coastline, and the human settlement and human-induced landscape changes that have occurred there. Specific field methods were explained for Phase IB and Phase II of the project along with laboratory methods and the procedure for artifact processing. Each method utilized in the course of this project was explicitly related to relevant research domains and objectives.

Table 3.1. Date Range for Bottle Manufacture.

Seam Type	**Est. Date Range**
Free Blown (No Seam)	1820-1865
Turn Mold (No Seam)	1880-1905
Dip Mold (No Seam)	1820-1870
Mold Blown (General)	1820-1905
Mold Blown: 3-Part Mold	1820-1910
Automatic: Press and Blow	1900-1940
Automatic: Blow and Blow	> 1905

Table 3.2. Date Range for Bottle Bases.

Base Type	**Est. Date Range**
Pontil Mark	< 1870
Hinge	1820-1865
Cup	1850-1880
Key Mold	1855-1875
Post Bottom Mold	1860-1890
Valve	1900-1940
Suction Scars	> 1905

Table 3.3. Date Ranges for Lip Manufacture and Style.

Lip Manufacture	Est. Date Range
Fired Polish	< 1860
Rolled	1830-1870
Flare	1825- 1865
Laid-on Ring	< 1865
Applied (General)	1820-1890
Tooled (General)	1870-1905*

Lip Styles	Est. Date Range
Wide Bead	1840-1905*
Oil	1850-1900
Double Ring	1850-1910
Blob	1840-1920
Club Sauce	1850-1930
Wide Prescription	1800-1870
True Prescription	1875-1920
Patent	1850-1905
Brandy	1860-1920
Champagne	1860-1920
Mineral	1840-1870

Table 3.4. Date Ranges for Medical and Ink Bottle Shapes.

Proprietary Medicinal Bottles by Shape	Est. Date Range
Cylindrical	1860-1880
Rectangle	1870-1920
Oval	1876-1910
Square	1870-1920
French Square	1850-1890

Ink Bottles by Shape	Est. Date Range
Cylindrical/Conical	1830-1920
Multisided/Conical (Umbrella)	1840-1890
Multisided/Vertical	1835-1865

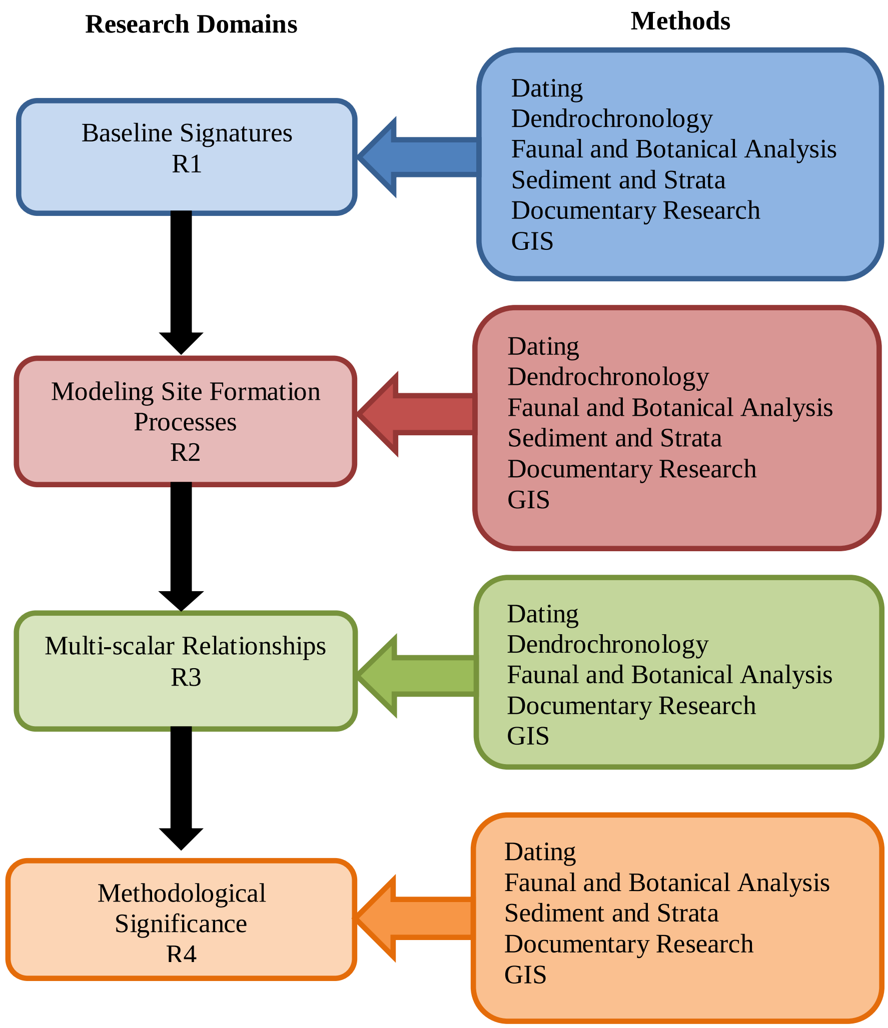


Figure 3.1. Research domains and attendant methods.

Figure 3.2. GRA crew observing the implementation of the geoprobe.

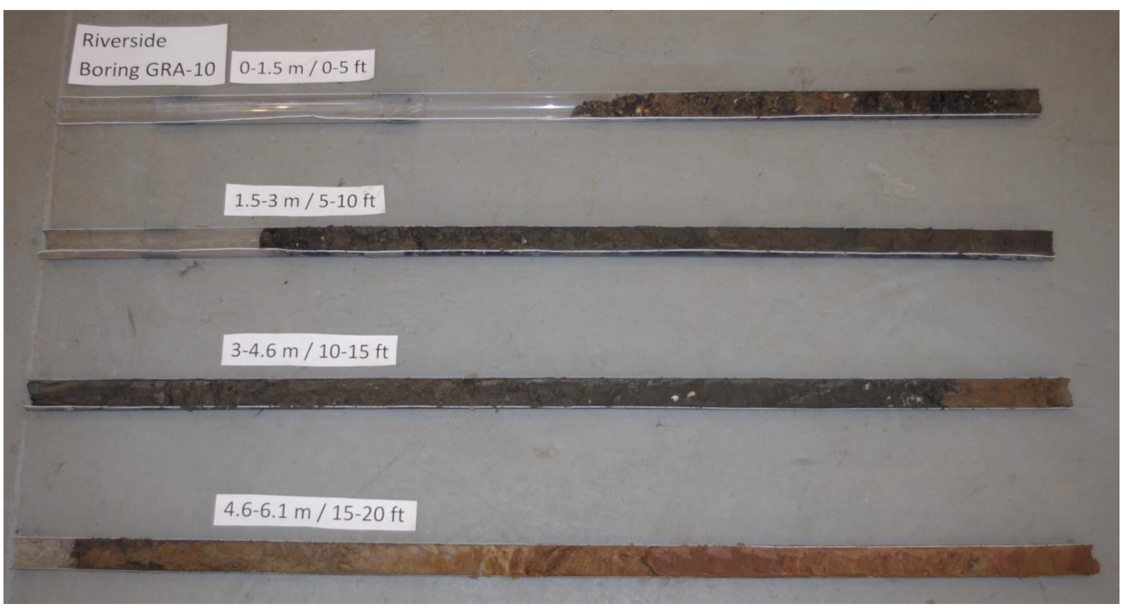


Figure 3.3. Example of a boring after being split in the laboratory.

Figure 3.4. Large excavator removing sediment in Sensitive Area 1.

Figure 3.5. Excavation of an STP.

.

CHAPTER 4: RESULTS

Introduction

Fieldwork and analyses for this project were conducted in two distinct phases: an initial assessment phase and an excavation and monitoring phase. During the initial assessment, the previously determined sensitive areas within the project area were confirmed and defined (see AKRF 1992). Within these two sensitive areas, the second phase excavations and monitoring were performed. Overall, these investigatory activities resulted in a wealth of data including the collection of 9208 artifacts and ecofacts, 9 geoarchaeological borings, and 332 additional sediment samples. Analyses of these data sources culminated in the development of a stratigraphic sequence for the project area based upon a set of depositional units. These depositional units correspond with significant and observable shifts in the landscape and use of this place. Furthermore, these units serve as a key organizing structure in the presentation of the results in this chapter. What follows is an explanation of the two phases of fieldwork, a description of the two sensitive areas identified within the project area, an explanation of the depositional units, and a thorough description of the material remains recovered from those units. The results presented here form the foundation for the interpretation of the site.

Phase IB

The initial Phase IB geoarchaeological assessment of Parcel 2 of the Riverside Center Development property was performed to determine if pristine sedimentological deposits dating to before AD 1492 (i.e., Pre-Contact Period) were likely to occur within the project footprint, and if they correlated with the original shoreline of the Hudson River.

Based on the analysis of historic maps and borings, the location of the shoreline prior to major historic landscape modification was determined (Figure 4.1). This led to the identification of two discrete areas of potential archaeological sensitivity within the project area. Sensitive Area 1 appears to lie within the estuary or mudflats of the Hudson River, an environment that would have been utilized by Native Americans during initial contact with Europeans, as well as prior to the Contact Period. Sensitive Area 2 was part of the upland area adjacent to the shoreline at the time of European contact. Thus, this area has the potential for intact upland surfaces, making it moderately sensitive for historic and prehistoric cultural resources. GRA's interpretations of Geoprobe and split-spoon auger borings extracted and analyzed by GRA, Langan Engineering, and Mueser Rutledge Consulting Engineers, Inc., led to the construction of a depositional sequence consistent with that registered throughout the New York City area. In general, the basal layers are Manhattan Schist bedrock, with an overlying till, or glacial deposit, that consists of reddish-brown sand and silt with gravel inclusions. The tills are of Pleistocene age (i.e., pre-15,000 B.P.) and pre-date the earliest known human occupations of the area. The till was recorded at the base of nearly all of the MRCE borings, although GRA borings contained no till above 6.1 mbs. Overlying the till is a very dark grey (10YR 3/1), fine- to medium-grained sand, deposited by water. This stratum returned a radiocarbon date of 6090 ± 40 BP (Beta-329982) for organic sediment at a depth of 6.07 mbs in Boring GRA-1. This mid-Holocene date is contemporaneous with Middle Archaic peoples. Rising sea levels stabilized over time, and estuarine environments along the Manhattan shoreline formed, seen as a layer of very dark grey (10YR 3/1), organic silts and clays with trace shell fragments. This stratum returned a radiocarbon date of 2920 ± 30 BP (Beta-329983) for organic sediment at a depth of 4.82 mbs in GRA-1. This date is of the Late Archaic to Early Woodland cultural periods, for which artifacts and features are prolific in the Eastern United States. The uppermost portions of all borings reveal a layer of artificially-deposited fill from the historic period that varies in thickness from 3.2 to 8.7 m.

Phase II

Results of the Phase IB investigation led to additional fieldwork, including monitoring, archaeological test excavations, and stratigraphic profile examinations, to further test the idea of pristine sedimentological deposits and archaeological sensitivity. This additional fieldwork revealed no evidence of prehistoric occupation in the project area. However, historic human occupation and associated surfaces were documented in both sensitive areas, in association with artificial fill.

Sensitive Area 1

Multiple features were found within Sensitive Area 1 (Figure 4.2). Among these were squared-log structures that appear to have been built to stabilize the artificial fill. A square brick utility structure was also identified in the highest layers of twentieth century sediment (Figure 4.3). The sediment inside this structure produced twentieth century materials. A concrete cap had been poured in place where the brick structure met the ground surface. A structure is present in this location on the Bromley 1955 map, and this brick structure was a later replacement which would have served the railyard. The structure was removed under the supervision of GRA's monitors. These features are recent constructions, dating to the mid-twentieth century. Cobblestone pavement was also encountered in Sensitive Area 1, and extended over much of the western portion of the property. In the field, it was surmised that this most likely was remnants of Belgian block pavers associated with the late nineteenth century stockyard (as described in "The New Cattle Yards" 1875 and "The New Stock Yards Opened" 1875, and discussed in detail in the background section).

Investigations (via STPs) at the level of the surface of the cobblestone pavement yielded few artifacts. Most of these items were found at the western edge of the project area, which was also the lowest point of elevation for the pavement surface. The cobblestones were set into a 0.31-0.61 m (1-2 ft) thick sandy base that contained very little historic material. Beneath this homogeneous sand was a 1.5-2.1 m (5-7 ft) thick layer of fill containing ash, slag, stone, and large numbers of historic artifacts. The lower 0.61 meters (2 feet) of the fill was increasingly silty. The bottommost layer was of fine clay silt, and contained no stones, slag, or ash. There were few artifacts from this stratum, but many shells.

Dense concentrations of artifacts were found within the fill underneath the cobblestone surface. This included preserved organic artifacts, such as plant remains and leather, due to waterlogged sediment. Diagnostic finds consistently dated to the mid-to-late nineteenth century (see discussion below), corresponding to land construction related to the Hudson River Railroad and the Union Stockyards. Specific artifact types recovered are discussed in detail later in this chapter.

Archaeological Units 1, 2, and 3 (Figure 4.4, Figure 4.5, and Figure 4.6) were dug in Sensitive Area 1, to further examine the relationship between the fill and the underlying clay silt. This led to the discovery of five wooden posts (Figure 4.7). Archaeological Unit 1 contained vertical posts, Post 2 (Figure 4.7, b) in the northwest corner, and Post 3 (Figure 4.7, c) in the southwest corner. Although artifacts were found around the posts, there was no evidence of builder's trenches. Post 1, found within STPs 3.2 and 3.2B (Figure 4.7, a), was horizontal within the clay silt layer, measuring 4 m (13 ft) in length and 0.5 m (1.5 ft) in diameter, with a tapered end. Post 4 (Figure 4.7, d) was horizontal and broken on both ends, and only a few meters from Post 5. Post 5 (Figure 4.7, e) was vertical, and the base was too deep to reach. While remnants of bark remained on Posts 2, 3, and 4, all five posts had been worked. After the machine excavator cut away sediment below Archaeological Unit 1, Archaeological Unit 3 was opened up. However, the bottom of Posts 2 and 3 were still too deep to reach. Small amounts of shell, animal bone, wood, brick, and coal were found within the clay silt layers around Post 2 (Figure 4.8) and Post 3 (Figure 4.9).

The machine cut at Archaeological Unit 1 (near Post 2) provides a clear profile of the clay silt layer (see Figure 4.8). Alternating dark and light bands can be seen where sediment was deposited as water lapped against the post, likely indicating a subaqueous environment. In other words, after the posts were sunk into the floor of the Hudson River, the clay silt was deposited around them during riverine or estuarine processes of the harbor. Our conclusion is that these posts belonged to a breakwater or docking structure when the area was a harbor along the Hudson River (i.e., before artificial filling occurred).

Historic artifacts were recovered in the clay silt layer below the fill layer. In a 100 x 100 x 25 cm (39 x 39 x 10 in) subsection of Archaeological Unit 1, 56 artifacts were found. However, this excavation confirmed that the vast majority of these artifacts were concentrated near the top of the clay silt layer. Although one brick fragment was found over one meter into the clay silt layer, we surmise that the artifacts were associated with the overlying fill, and sunk into the clay silt when deposited in the water during land filling. No definitive prehistoric finds were found in the clay silt context.

Sensitive Area 2

The degraded remains of a post (i.e., a post mold with some highly decomposed wood remains) were found within the upper layers of STP 8.1, extending from 5 to 3 m (15 to 9 ft) above sea level (Figure 4.10). These sandy layers correspond to the upper-most twentieth century fill. Artificial fill corresponding to the pre-cobblestone, nineteenth century fill was noted in Sensitive Area 2 as well, underlying the twentieth century fill [e.g., when STP 8.2 was expanded from 0.5 m^2 (5.4 ft^2) to 1.0 m^2 (10.8 ft^2)] (Figure 4.11). At the very northern end of Sensitive Area 2, STP 8.3 quickly met refusal due to stones. Another post mold was found about 1.5 m (5 ft) to the southeast of the first one, and a shovel test was excavated to examine it in profile. Courses of stones running northwest to southeast at the eastern end of Sensitive Area 2 were found. Comparison with the 1892 Sanborn Insurance map suggests that the stones may be related to a foundation for rail beds of the New York Central railroad (Figure 4.12). From this, we suggest that these post molds are also related to the railroad (e.g., switch or light posts).

Many of the STPs penetrated into a mix of sandy and rocky fill, with large fragments of schist often impeding progress. One area with these stones (at the northern end of Sensitive Area 2) ran roughly north to south, in a linear fashion, and also looked like they had been cut. Unfortunately, opening up Archaeological Trench 4 (Figure 4.13) did not resolve any potential relationship between the stones and the post molds. Additional archaeological trenches were excavated to better determine the structure of the potential feature. Two trenches (Archaeological Trenches 5 and 7) ran the length of the course of stones, and revealed cut stones that appeared to be part of a wall. Two STPs were excavated within Archaeological Trenches 5 and 7 to find the bottom course of stones. STP 12.1 (in Archaeological Trench 5) exposed the bottom of the wall at 84 cm (33 in) below the surface. STP 12.2 (in Archaeological Trench 7) found a paving stone 10 cm (4 in) above the bottom course of stones (Figure 4.14). Other than the one stone, there was no other evidence of a floor. However, this STP did reveal that the stones were cut and dressed, and belonged to the corner of a foundation, identified thereafter as "Eastern Foundation Wall." We speculate that this relates to a switch house for the railroad, although it is also possible that it belonged to a small building shown on the 1871 Perris and Browne Map. Unfortunately no diagnostic artifacts were found in context that might have dated the construction of the building.

The stones at the northern end of the foundation wall were disturbed by another course of rough-cut stones (revealed in the western end of Archaeological Trench 7). These rough stones ran parallel to those identified as railbeds in the eastern end of Sensitive Area 2. A fourth course of rough stones was found several meters to the west, and also parallel to the previous stones. Both courses of rough stones seem to correspond spatially to the New York Central rails as seen on the 1892 Sanborn map (see Figure 4.12 above).

More trenches (Archaeological Trenches 6, 8, and 10) were excavated perpendicular to the foundation, to better understand the extent of this course of stones and its relation to the rough-cut stone railbed (Figure 4.15). Archaeological Trench 9 was excavated perpendicular to Archaeological Trench 8 (and parallel to Archaeological Trenches 5 and 7) to further uncover the rough-cut stone railbed. A small machine excavator operated by Scalamandre was then utilized to clear the interior of the foundation wall and verify its stratigraphic context within the hill. This revealed that the foundation was within a disturbed context, surrounded by redeposited hillside material and a remnant A Horizon.

An abandoned well was found at the southeastern end of Sensitive Area 2, and Archaeological Unit 4 was opened up to test it (Figure 4.16). A large stone cap with a hole in it was found on top of the well, sealing the interior. The excavator removed sediment around the well to a depth of 2.1 m (7 ft) asl, bisecting the shaft to expose the profile and the courses of stone. This revealed two features in relation to the well. The first was a stone wall protruding from under the construction lagging, which could possibly be a retaining wall for the Hudson River Railroad as seen by previous investigations to the north of the project area (Geismar 1987, 1995). The second feature was a wooden beam on the northern end of the well that extended east towards the stone wall. STP 13.1 was placed at the northern end of the well to explore the beam's relation to the well, recovering a paving stone. STP 13.3 was placed along the wall to determine its relation to the wooden post, finding the bottom course of stones at about 1.5 m asl. Archaeological Unit 5 (1x1 m) was opened up just south of the well, to investigate the stony fill immediately surrounding the well. Very little cultural material (two brick fragments, one piece of leather scrap, one wood stake, and one probable commensal rat pelvis) was recovered from this unit.

Cultural Materials by Depositional Unit

Overview

In the course of this project, a total of 9540 artifacts (7159), ecofacts (2049), and sediment samples (332) were collected. To get a general sense of what materials were found and in what depositional context, it is useful to consider the relative frequency of material types across Depositional Units (Figure 4.17) and also the proportion of each material type recovered from each Depositional Unit (Figure 4.18). These two visualizations taken together provide a general overview of what material remains were collected through excavation and monitoring during this project. Table 4.2 and Table 4.3 provide the corresponding data from which these charts were generated and Table 4.1 displays the raw summed numbers for all material types, depositional units, and subunits. In Figure 4.17, columns represent the sum of percentages of counts of the seven listed material types for each of the depositional units that yielded artifacts or ecofacts. Sediment samples were excluded from the totals in these representations. These columns are arranged youngest to oldest, left to right. For example, the first column shows that the material recovered from Depositional Unit 8 (Parking Lot Fill) consisted of 33.3% ceramic, 9.3% faunal material, no floral material, 34.1% glass, 0.8% leather, 15.9% metal, and 0.8% wood. For each of the seven depositional units represented, over 90 percent of the recovered material came from these seven primary material categories. In Depositional Unit 8, the remaining 5.7 % not represented came from the remainder of the minor material categories. Essentially, this chart compares the relative frequency of these material types between the different depositional units.

Figure 4.18 shows what percentage of counts of each material type came from which depositional unit. This figure clearly indicates that the vast majority of collected material came from Depositional Unit 3. For each of these seven primary material types, Depositional Unit 3 yielded over 80 percent of the collected material. What follows is a detailed description of the cultural materials recovered in each Depositional Unit.

Depositional Unit 1

Within the post glacial landform (Depositional Unit 1) from Sensitive Area 2, 23 ceramic items were found (Table 4.4). This includes ironstone, porcelain, earthenware, stoneware, whiteware, and redware. The majority of these were determined to be dishware (cups, plates, etc.). An ironstone cup and saucer was dated to between 1860 and 1899. Three clay smoking pipe stem fragments were also recovered from this depositional unit, one of which dated to around 1850.

A total of 26 glass artifacts were collected, the majority of which (18) were unidentifiable. One of these was a lip (from an unidentifiable vessel), and has a possible date range from 1820-1860. Seven flat window glass fragments were found: five aqua, and two clear (Table 4.5). One aqua-colored medicinal bottle was recovered (Table 4.6), with the partial maker's mark of "slow" (artifact #3016.03). This is most likely from "Ms. Winslow's Soothing Syrup," and dates to around 1865-1875 (see Table 4.7 for a list of all bottles found with verified maker's marks and corresponding date ranges).

No wood artifacts were recovered from this depositional unit (Table 4.8). The majority of metal artifacts (46) are Type B cut nails (Table 4.9), which in general date between 1810 and 1900. Three wire nails were also found. Their position in this depositional unit is most likely due to disturbance, as wire nails only became more common in the United States after the 1890s. Miscellaneous artifacts from this depositional unit include tarpaper, mortar, charcoal, and an unidentified textile (Table 4.10).

Fifteen faunal specimens were recovered, including cow, pig, large ungulate, UID mammal, UID bird, and two unidentified bones (Table 4.11). Six oysters were also recovered from this depositional unit (Table 4.12). No ethnobotanical remains were recovered (Table 4.13).

Depositional Unit 2

No cultural material was found in the lower portion of the estuarine cove sediments (Depositional Units 2a and 2b). However, unidentified shell material was recovered from these depositional units in Boring GRA-10. In the upper portion of the estuarine cove sediments (Depositional Unit 2c), which was only encountered in Sensitive Area 1, 44 ceramics were found, including 12 ironstone, 6 whiteware, and 6 earthenware. Two blue transfer print ceramics were also found in this stratum: a pitcher (artifact #3359.01) and plate (artifact #3359.02). These date to around 1830-1870, indicating that trash was deposited into an estuary of the Hudson River at least by this time. Porcelain, stoneware, and yellowware sherds were found in lower numbers. Miscellaneous fired clay items include four brick fragments, one button, one flowerpot fragment, and one toy marble. Two pipe stem and one pipe bowl fragments were also found.

A total of 82 glass artifacts were found, the majority of which (63) were unidentifiable. Ten window glass fragments (mostly clear and aqua) were found in this stratum. Three wine, one champagne, and one soda/water bottle fragments were also found. Three medicinal bottles were also found, one of which had the maker's mark of "Chemists Hegeman & Co., New York" dating to around 1850-1870.

Many (40) wood artifacts were found in this depositional unit, including 22 unidentified fragments. Eighteen posts were also found, including Post 2 and 3 in Archaeological Unit 1, indicating a wooden docking structure was built into the estuarine cove of the Hudson River.

Of the 135 metal objects found here, 73 are Type B cut nails (dating between 1810 and 1900). One Type A cut nail (1790-1820) and five wire nails (basically the 1900s) were also found, indicating a mixed deposit and/or longer range of time when refuse was deposited into the estuarine cove. Other metal artifacts found include a Japanese coin (Figure 4.19), known as a *Bunkyou Eihou* 4-*mon* coin. The 4-mon coin had been used for two centuries with minimal changes. However, in 1863 the Tokugawa Shogunate government issued a change in the characters on the coin which reads "eternal currency of the Bunkyou Era." The government collapsed in 1867, along with the currency, providing a narrow date range between 1863 and 1867 (Izumika 1997; Roberts 2013). Miscellaneous artifacts from this depositional unit include eight corks, one, rope/twine, and one rubber band.

Faunal specimens include pig, sheep/goat, cow, chicken, and domestic duck, as well as UID mammals, birds, and fish. Other faunal remains include oyster and clam, as well as indeterminate bivalves, gastropods, and cephalopods. Four rat specimens and an insect casing were also recovered, most likely representing commensal species. Ethnobotanical remains include 26 peach pits, 9 squash seeds, and 1 walnut shell. Molluscan remains not associated with foodstuffs, obtained from sediment samples in Augers 1 and 2, were also analyzed. Wingard (Appendix I) concludes that the molluscan fauna in these samples were originally from a shallow, quiet water, mudflat/intertidal environment. The salinities of these waters ranged from 18-30 ppt. Changes in dominance of species with depth may indicate changes in water depth or sediment distribution.

Depositional Unit 3a, 3b, and 3c

A total of 460 ceramics were found in the lower portion of the landfill deposit (Depositional Units 3a, 3b, and 3c), which was encountered in both Sensitive Area 1 (3b and 3c) and Sensitive Area 2 (3a and 3b). This includes 97 ironstone, 90 whiteware, 87 earthenware, 45 porcelain, and 23 stoneware sherds. Yellowware, salt-glazed stoneware, Rockinghamware, and redware sherds were found in lesser numbers. Six blue transfer print sherds were also found, three of which had the blue willow pattern, dating these strata to as early as the early 1800s. Miscellaneous fired clay items included: 24 flower pot fragments, 7 bricks, 1 sewer pipe, 2 porcelain doll face fragments, and 5 toy marbles. Seven pipe bowls and 13 pipe stem fragments were found, one of which (artifact #1121.07) has a maker's mark stating "MEERSCHA…" and "54TH STREET." This was manufactured by Thomas Smith, a tobacco-pipe maker based out of New York City. Thomas Smith first appears in the Doggett's 1843/44 New York City Directory as a "tobacco pipe maker" at 287 West 18th Street. He remains at this location until 1850 when he is listed at West 54th Street (Doggett's New York City Directory 1849/50). Smith continues to be listed in the directory until 1883/84. Measuring three cm in length, and 5/64 of an inch bore diameter, this example dates between 1850 and 1884. A partial smoking pipe bowl from the runoff deposit (3c), also has a bore diameter of 5/64 of an inch, and dates to 1891 or 1892 (artifact # 1121.01).

A total of 409 glass artifacts were collected from these depositional units. The categories with the largest numbers include unidentified glass (167), window fragments (134), and wine bottles (54). Other glass bottles include non-liquid food (19), liquor (12), medicinal (5), water (2), soda/water (2), beer (1), and an ink bottle. Other glass objects include a bead, buttons, clear tumblers, and lantern glass.

The majority (94 of 98) of wood material was unidentified fragments, with a wheel from a pulley, a stake, and a log sample also found, in addition to non-cultural wood vegetation. Approximately 109 metal objects were found in these depositional units, 174 of which are Type B cut nails (dating between 1810 and 1900). Six wire nails (dating to the 1900s) were also found. However, these were found exclusively in Sensitive Area 2, where no cobblestone pavement was found, indicating a possible mixed deposit. An Indian Head copper penny (artifact #2781.01) dating to the 1870s was also found in Sensitive Area 2. Unfortunately, the last digit was indecipherable, so a more accurate *terminus post quem* could not be pinpointed. Other metal objects include a belt buckle, a button, a salt shaker top, and a fork. Miscellaneous artifacts include items such as 12 corks, charcoal, coal/anthracite, tar paper, rope/string, and a rubber comb.

Faunal specimens include relatively large numbers of pig, sheep/goat, cow, chicken, and UID mammal, as well as UID small artiodactyl, and UID bird. Other species recovered include rabbit, rat, large ungulate, turkey, domestic goose, and UID fish. Oysters, clams, one mussel, and one UID gastropod were also found, mostly in depositional unit 3b. Ethnobotanical remains include 32 peach pits, six melons seeds, one coconut shell, five squash seeds, and one UID floral remain.

Depositional Unit 3d

Ceramics. The vast majority (1,568) of ceramics were found in the upper portion of the landfill deposit (Depositional Unit 3d). Although this stratum was found in both Sensitive Areas 1 and 2, only one sherd was found in Sensitive Area 2. The ceramic assemblage includes dishware (bowls, cups, plates, etc.), household and kitchen items (bottles, jars, pitchers, etc.), building materials (e.g., tiles), personal items (cosmetic jars, smoking pipes, etc.), and toys. The main ceramic types identified include ironstone (446), porcelain (222), whiteware (187), earthenware (168), and stoneware (120). Salt-glazed stoneware, redware, Rockinghamware, yellowware, and creamware were found in relatively smaller numbers. Taken together, the ceramic evidence from Depositional Unit 3d indicates a probable date range from the mid-to-late 1800s.

The lack of discoloration and cracking on porcelain ceramics suggests the assemblage was hard paste porcelain. Objects found include cups and mugs (e.g., Figure 4.20), plates, serving ware, and toys. The relatively high translucency is most notable in plates, further supporting the proposed paste type (Majewski and O'Brien 1987).

Undecorated white-bodied wares are well represented in the upper portion of the landfill deposit (Figure 4.21). These were very popular in the mid-nineteenth century, with households often buying unmolded or simple molded designs. Both hexagonal and octagonal paneling are present in the collection, which were popular from the 1840s through the 1880s. Gothic-paneled wares were found, including teacups, serving ware, and plates (Figure 4.22). Molded ceramics, such as the Rockinghamware pitcher in Figure 4.23, were common in both urban and rural households through much of the nineteenth century. The harvest motif was also popular for most of the nineteenth century with peak production dates between 1860 and 1900 (Figure 4.24) (Wetherbee 1985). Thirty-seven transfer-printed wares were also present in this stratum (Figure 4.26). By the first few years of the 1860s, transfer-printed wares had virtually disappeared, but they were revitalized in the late decades of the nineteenth century by the low-cost and time-saving technique of sheet patterns. The copper transfers were designed to fit on various-sized plates or hollow wares, thereby reducing the number of copper plates being used in the production of sets of tea- and tableware. Notable is the alphabet plate (Figure 4.27), which was child-size, and would have been considered appropriate for the proper raising of children.

Many ceramics, predominantly plain white-bodied vessels, had maker's marks. The English pottery manufacturers all originated from the Staffordshire region of England. Many of these were dateable, with seven of them having British diamond registry stamps, which provided an exact date of manufacture. Notable are the ironstone teapot (Figure 4.28) and the egg cup (Figure 4.29) which were not broken, even though they were deeply buried.

Germany was another predominant source of ceramics that made their way into the upper portion of the landfill deposit (Figure 4.30), although locally-produced wares without maker's marks are probably present as well. The majority of stoneware/salt-glazed stoneware items found at the site were undecorated utilitarian objects, such as bottles, pots, jugs, and lids with a simple form and style. Stoneware bottles held liquids such as seltzer water, beer, and ginger beer. German stoneware bottles include seltzer bottles from the Westerwald region of Germany, as well as a mineral water bottle labeled "Apollinaris-Brunnen" (Figure 4.31). The larger stoneware jugs contained mineral water.

Numerous vessels were identified relating to kitchen activities. Of particular interest are a yellowware mold (Figure 4.32), and a marrow jar (Figure 4.33). The mold was for jelly (or perhaps jello) and has the characteristics of late (i.e., post 1860) nineteenth century yellowware (i.e., turned lip and a foot). These vessels were common and inexpensive, but indicate that some care was taken in the presentation of food. Many general household items were also recovered. Examples include a porcelain candlestick holder (artifact #260.01) originating in England from the late-nineteenth century and a vase base fragment (artifact #3336.01) with the partial maker's mark "…& sons" with a blue transfer-printed design. The maker's mark is W. Adams & Sons from Stoke-on-Trent, which dates from 1835 to 1855. A ceramic lid (artifact #3316.01) from an unglazed porcelain trinket box lid with a floral/ leaf decoration and relief was also recovered. Other miscellaneous fired clay items include 62 flower pot fragments, 2 tiles, 7 door and cabinet knobs, 1 checker gaming piece, and 3 toy marbles. The knobs are of the Bennington-style dating from 1851 to 1930. They were crafted with a clear glaze composed mainly of feldspar and flint, which permitted the marble-like swirls of the various clays used in the knob body to show through (Figure 4.34). This technique made these naturally-derived products look similar to marble.

Thirteen brick fragments were also found. Most new buildings in the nineteenth century were a combination of brick and timber, though stone was also used as a structural and as a facing material (Lockwood 1976). This was in spite of the fact that iron came into use as a building material as early as the 1830s in Manhattan, and cast-iron architecture became iconic of the new commercial metropolis in the 1850s. Even as late as 1882, nearly 27 percent of Manhattan's buildings were still built entirely of wood, with only 73% considered fireproof or semi-fireproof. Most of the latter were the "ordinary" construction used in buildings of six stories or less: brick load-bearing walls supporting the timber joists and rafters of wooden floors and roofs, with wood-framed and wood-lathed walls for the interior. The fireproof and semi-fireproof buildings, even those with cast-iron fronts, were often heavy users of brick for exterior side and rear walls.

A number of personal ceramic items were recovered from this depositional unit. This includes eight ceramic buttons, and seven porcelain figurine parts, representing a male holding a basket of fruit (catalog #3335), a duck, and one undetermined base. Personal health and hygiene practices can also be deduced from this collection. This includes items such as a Victorian Cold Cream pot lid (Figure 4.35), and spittoons. Skincare was important in the late nineteenth century, with a proliferation of skin care suppliers selling their remedies and perfumed products to the upper class. Complexion whiteners were mass-produced to remove skin spots, freckles, and socially inferior signs of sunburn (Marsh 2009). New skincare remedies came from Theron T. Pond, who discovered that the Oneida people of New York used a concoction of boiled witch hazel to salve burns and wounds. By the 1880s, Pond had expanded the line to include toilet cream, lip salve, and soap, and although advertisements stressed their healing properties for women specifically, women were turning to these products for beauty. A near-whole (when assembled) porcelain spittoon was also found (catalog #2176). It is highly decorated, with gilt enameling and annular rim transfer-print. This suggests that this particular spittoon would have belonged in a public room of a well-to-do home or establishment.

Children's artifacts are sometimes overlooked in the archaeological record. However, by examining toys, archaeologists can extrapolate childhood and domestic life. A predominant classification within children's artifacts is children's toys. At the Riverside project, this included 2 porcelain dolls and 14 doll parts. The two intact dolls are both Frozen Charlottes dolls (Figure 4.36). Frozen Charlotte is a name used to describe a specific form of china doll made from c. 1850 to 1920. The name comes from the American folk ballad, Fair Charlotte, which tells the story of a young girl called Charlotte who refused to wrap up warmly to go on a sleigh ride for fear it would cover up her pretty dress. She froze to death during the journey. The Frozen Charlotte doll is made in the form of a standing, naked figure molded all in one piece. These dolls are sometimes described as pillar dolls, solid chinas, or bathing babies. The dolls ranged in size from under an inch to 18 inches plus. The smallest dolls were sometimes used as charms in Christmas puddings and smaller sizes were very popular for putting in doll's houses. Occasionally versions are seen with a glazed china front and unglazed stoneware back. This enabled the doll to float on its back when placed in a bath. Frozen Charlotte dolls were popular during the late nineteenth and early twentieth centuries in the United States. Smaller versions of the dolls were also known as penny dolls, because they were often sold for a cent. Most were made in Germany.

Smoking pipe fragments totaled 55, with 13 bowls and 42 stem fragments. Of those that were able to yield a bore diameter, 15 are 5/64th of an inch. One of these has a partial label of "meer…" and "street," probably representing Meerschaum, from Vienna, Austria (artifact # 833.01), and dates to 1873. Another pipe stem (artifact #581.01), made out of white kaolin, bears the stamp "…OTHEE TRIMM." This appears to be a reference to Timothee Trimm, a pseudonym for Léo Lespès, writer for the extremely popular *Petit Journal*, a major newspaper publication in France before WWII. Despite being a French citizen, Monsieur Trimm was world-renowned as one of the most eccentric and curious figures of the Parisian Boulevards. Evidently, this formidable public figure created quite a sensation during the mid-nineteenth century. Champagne was named after him, a polka dance was created in his honor, and at least one pipe with his name on it found its way to the shore of the Hudson River on the Upper West Side.

The Scottish pipe-making industry was represented by one pipe stem identified as made by D. McDougall & Co. (artifact # 236.01). This pipe stem has the partial text of "ASGOW" on the stem, and dates between 1879 and 1891. Another pipe stem (artifact # 236.02) was recovered with "WW," "79," and "SGOW." This probably reads 79 W WHITE and GLASGOW molded on L/R faces. The 79 is molded in relief on the left face of the distal stem. This pipe has a wide manufacturing date, ranging from 1805-1891. It most likely dates to the latter portion of this range, as the word "GLASGOW" on pipe stems occurred frequently in the late nineteenth century (Sudbury 2006:37).

There are a number of smoking pipes with Dutch Gouda marks in this collection. Unfortunately, the Dutch marks have long date ranges making it difficult to establish dates of manufacture. The right to use specific marks could be bought or inherited by several generations of pipe makers. Dutch pipes have been found on many New York City sites (Louis Berger and Associates 1987; Rothschild and Pickman 1990; Reckner and Dallal 2000), especially pipes made in Gouda. Gouda was a center of pipe making from the seventeenth to the twentieth centuries, with production organized during much of this time under the guild system (Dallal 2004; Brongers 1964:31-48). Some of the smoking pipe fragments recovered display decoration representative of the Peter Dorni-style pipes (e.g., #1090.01 and #2463.01), which were in their height of popularity in the 1870s and are considered to have been produced in Gouda. The Dorni-style postdates 1850, when the supposed originator of the design, Peter Dornier, is believed to have begun producing pipes in the north of France (Walker 1983: 32-33; Sudbury 2006:36). An example of an American-made, Thomas Smith pipe (artifact #563.01) was recovered with the text of "Meerschaum Pipes" and "444 54th street." This pipe stem fragment is a product of Smith's when he was located in the shop at 54th Street, indicating that it dates between 1850 and 1884.

While the high incidence of European-made pipes may reflect the influence of Old World trends, the presence of locally-made clay pipes suggests the beginning influence of New World trends. The analysis of pipes, including maker's marks and stylistic elements on diagnostic pipes and pipe fragments, indicate that the majority of these date from the mid-to-late 1800s.

Glass. A total of 979 glass artifacts were collected from depositional unit 3d. The categories with the largest numbers include window glass fragments (396), and unidentified glass (337). Window glass from depositional unit 3d ranges from 1.1 to 27.5 mm. However, only four fragments are larger than 10 mm thick, with the average thickness of the MS (Moir Sorted) window glass being 2.2 mm. With the previously mentioned caveats in dating window glass in mind, this analysis indicates that the glass fragments are mainly from plate glass, produced in the late 1800s.

Bottles found included wine (59), beer (10), beer/wine (1), champagne (2), wine champagne (2), liquor (4), soda (1), water (3), non-liquid food bottles (22), medicinal bottles (68), cosmetic (3), glue (1), and ink bottles (4), as well as wine and liquor stoppers. Of the 192 glass bottle/bottle fragments recovered from this stratum, just over 70% were made using mold blown technology (Figure 4.37). The next most prevalent manufacture type is free blown, at 16%. For medicinal bottles, proprietary styles outnumber all other types. These styles were used with unregulated medicinal products claiming to cure a number of ailments, such as depression, hysteria, kidney disease, constipation, etc. (see Fike 1987). This includes the French Square style (Figure 4.38), Philadelphia Oval (Figure 4.39), and a significant number of cylindrically-shaped vessels like Mrs. Winslow's Soothing Syrup vials (Figure 4.40). This was a popular morphine-based elixir, used to calm crying children. The two particular styles of wine bottles found more often than others were green, free blown bottles, and dark green, 3-Part mold bottles (Figure 4.41). Despite differences in color and height, the push up base indicates that both of these types were used for wine. The two champagne bottles recovered in this stratum were identified by lip style. The five brown beer bottles post-date 1860, as brown colored glass was in general use for beer or liquor bottles after this time (Fike 1987:13). One whole green/black beer bottle (artifact #574.01) has a maker's mark indicating the brewery A.B. & Co. (Figure 4.42). Food bottles include condiments and pickling containers, such as Crosby's Tomato Sauce (Figure 4.43) dating from 1830-

1905, the popular four-sided bottle with gothic-molding dating from 1850-1866 (Figure 4.44), and the common round, wide mouth pickling bottle dating from 1870-1890 (Figure 4.45). Spring water bottles have very similar attributes, such as their emerald green color and Saratoga jug shape, such as a Saxe & Co bottle from Vermont Spring, in Sheldon, VT dating from 1860-1880 (Figure 4.46). Flavored soda bottles have smaller, shorter bodies made of a thicker glass. While the lower body of glass bottles is the most common placement for maker's marks, an exception is a 10-sided bottle with vertical embossing (Figure 4.47). This cobalt blue soda water bottle from W.P. Knickerbocker in New York City dates to between 1830 and 1855, and is typical of early made bottles (as opposed to machine-made bottles which were limited to using clear and brown glass). Tumblers and stemware are the only drinking vessel types represented in this assemblage, being examples of American pressed glass from the mid- to late-nineteenth century. The majority of tumblers are short and paneled, characteristic of bar tumblers, although the varying paneling sizes made it difficult to pinpoint a specific manufacturing date (see Figure 4.48). Names of style patterns are not consistent in historical documents. For example, the Blackwell/Pears catalog calls their bar tumbler style "Ashburton" whereas the tumblers in the King/Son's catalog are considered "Victorian Gothic." Stemware, used for drinking wine, champagne, and port were mostly recovered as stem and foot fragments. A matching wine glass (artifact #648.01) and decanter stopper (artifact #652.01) have a cut diamond body on cranberry-colored tinted glass (Figure 4.49). Several wine glasses with a similar style have also been found (Figure 4.50). These are typical of Victorian era (i.e., mid- to late-nineteenth century) dining ware, which is best known for its intricate patterns and matching sets. This general mid- to late-nineteenth century time frame for drinking vessels is because very few pressed glass styles can be traced back to a specific glass house (Lee 1936). There were also difficulties with distinguishing which vessels were made of flint or lime glass. Flint glass production began to decline in the early 1870s in favor of the cheaper and lighter lime glass. A bell-tone test is often used to recognize flint glass; however, most of the fragments were too small for accurate results (Watkins 1950).

An effort was made to correlate the lantern glass found in this stratum with the type of lighting fixtures they would have belonged to, by measuring the shape and diameter of the lip. Three clear fragments (artifact #2245.01, #2359.01, and #2394.01) have small base diameters (2.0-2.5 cm), and appear to be chimneys used for dead flame lamps. Another clear fragment (artifact # 2089.01) has a slightly wider base (2.75 cm) with a flared lip, and is most likely associated with a hot-blast lantern. Two other clear fragments (artifact #1086.01 and #1821.01) have smooth lips, indicating they were probably chimneys for oil lamps. A third clear fragment (artifact #2002.01) has a base diameter too wide to fit on an oil lamp. It is also smooth. This suggests that it is most likely a remnant of a dead-flame lantern (see Figure 4.51 for a comparative image). In general, chimneys are smaller (< 2.5 cm) than globes, despite the lip style (Table 4.15). Identifying chimneys and globes by manufacture is difficult, since most glassware was imported from glass houses unaffiliated with the lantern company (Hobson 1991).

Wood. The majority of wood artifacts (over 80%) are unidentified fragments. However eight clothes pins, five spools, and other miscellaneous wood artifacts (e.g., a barrel plug, bucket fragment, button, comb, and two toothbrushes) were also found.

Metal. Of the 1,158 metal artifacts recovered, the categories with the most items are Type B cut nails (719), wires (137), and unidentified metal (84). One Type A cut nail (dating from 1790-1820), as well as 21 wire nails (typically dating to the 1900s) were also found. Although this suggests the possibility of a mixed deposit, the vast majority of items dating from the mid-to-late 1800s suggest the wire nails found may be early examples, in use prior to their explosion in popularity. The majority of nails are thin, and 3-8 cm in length, consistent with everyday household needs (e.g., carpentry, or hanging items on walls). Three coins were recovered from depositional unit 3d. One was a 2-cent coin with an embossed eagle and striped shield, as well as a date of 1864. Two 1-cent coins had dates of 1864 and 1865. One of the more unique artifacts is a shell card (Figure 4.52). Shell cards were thin, embossed tokens that usually advertised a business or service. These shell cards were used like business cards to advertise a product or service and could offer promotional deals and discounts. One side of the token has an image of Liberty and the year 1868. The other side of the token would have been a cardboard disk or another sheet of embossed metal with text indicating business info, advertisements, or other promotional details. These shell cards probably would have circulated better than newspaper ads. A pair of nickel-alloy spectacles with octagonal-shaped frames was also recovered (Figure 4.53). This was a popular design between the 1850s and 1870s (McBrayer and Valenza 2012:4-5). The straight/lady's temple wire with large loop suggests that this pair would have belonged to a female, though lady's temple wires were sometimes worn by men as well. Of the lamp parts in this depositional unit, a patent was found that matches one of the copper alloy wick holders (Figure 4.54). This dates the object to about 1863 (Atwood 1863). A civil war cavalry hatpin was also recovered, with a crossed sabre insignia (Figure 4.55), generally dating to

1858-1864. Other metal artifacts include sardine cans, tins, knives and spoons, a comb, a cuff link, a key and key hole, scale parts, a sickle, rods and bars, and sheet metal. Miscellaneous artifacts recovered from the upper portion of the landfill include corks (80), coal/ anthracite (30), charcoal (12), textile fabric (6), and rubber combs (5).

Faunal Remains. A total of 1,226 faunal specimens were recovered from the upper portion of the landfill. This includes large numbers of sheep/goat, pig, cow, and chicken, as well as UID mammal, UID small artiodactyl, UID bird, and UID fish. Other species recovered include large ungulate, domestic duck, cat, domestic goose, rat, turkey, pigeon, and raccoon. Oysters (69), clams (12), and small amounts of miscellaneous fauna (e.g., bivalves, brachiopods, gastropods, fish scales, crab claw, egg shell) were also found. As detailed in the specialized faunal analysis by Crabtree (Appendix H), very few of the bones from Depositional Unit 3d were burnt or calcined, and most seem to have been buried rapidly. This indicates very little exposure of the bones to the elements. However, about 6% of the assemblage shows some degree of weathering, indicating that at least part of the assemblage was exposed to the elements prior to final burial. The body part distribution, degree of fragmentation, and butchery traces indicate that these animal bones were derived from household consumption, rather than butchery waste. The bones indicate a diet based on beef, pork, and mutton, supplemented by poultry (primarily chickens) and some fish.

Ethnobotanical remains. Ethnobotanical remains include 110 peach pits, 88 melons seeds, 68 squash seeds, and 25 coconut shells, as well as smaller amounts of pear, pumpkin, plum, peanut, walnut, rubus family, acorn, and tree nut (Figure 4.56 and Figure 4.57). The majority of these were collected from waterlogged sediment lower than 1 meter above current sea level. Of special note are the finds in Archaeological Unit 2, which yielded a cache of melon seeds which were collected with much of the surrounding soil. Within this soil one possible raspberry/blackberry was found.

A seasonality study of the identified ethnobotanicals, in association with their market availabilities from the *New York Tribune* from 1874 and 1875, shows a noticeable overlap in late September and early October of 1874, when most of the assemblage would have been on the market (Figure 4.58). The market availability of black walnuts is somewhat troublesome to this chronology. However, since they were found with intact shells, it is possible that these walnuts were not food products but naturally deposited. Although the *Rubus* finds are also outliers, identification to this genus and species is contestable.

Seasonality: The Rosaceae Family. The great abundance of peach (*Prunus persica*) pits, the endocarp of the peach fruit, is by far the most prevalent ethnobotanical remains. The majority of peach pits recovered from the project area (63%) come from Depositional Unit 3d. Considering the great abundance of these finds spread over multiple contexts throughout the site, these finds warrant a fair amount of attention. Peaches have had a presence in New York City since the early days of colonialism when European migrants brought them from Europe (Rothschild 2009:51). Peaches are attested to in American cuisine back to George Washington's presidency, when a guest for one of his lavish dinners in the then capital of New York mentions the fruit (Maclay 1890:137-138). By the 1870s, peaches were fairly abundant throughout the United States. Until refrigerated rail cars started being used in 1875 ("Transportation of Peaches" August 26, 1875), New York had to rely on regional growers along the Hudson River, Delaware River, and Chesapeake Bay for fresh peaches ("The Peach Trade" August 22, 1870"). Delaware and Maryland were the major markets for selling peaches to New York, especially from large orchards such as St. George's Hundred in Newcastle County, Delaware. While closer, New Jersey farms typically worked on a much smaller scale of production and distribution than those in Maryland and Delaware ("The Peach Trade" August 22, 1870; "The Fruit Crops" June 30, 1874). Small quantities shipped during mid-summer from areas such as South Carolina were not unheard of at this time as well (*New York Tribune* July 1, 1874). The high incidence of peach pits found in the project area strongly suggests that they were deposited when the fruit was well into season, which, in late-nineteenth century America, would have been in the late summer and autumn. Although they could be dried or canned, this fruit was not commonly consumed outside of this season ("The Peach Trade" August 22, 1870). Even though the 1874 crop started early in late July, market reports from the *New York Tribune* and *New York Times* indicate that the Delaware and Maryland crop was unusually low in August and September, with as few as five cars a day coming in from Delaware and none from Maryland ("The Delaware Peach Crop" August 2, 1874; "Failure of the Maryland Peaches" August 26, 1874; *New York Tribune* July 29, 1874:7; *New York Tribune* August 5, 1874:8; *New York Tribune* August 12, 1874:8). Even though the Delaware shipments increased, the *Tribune* noted that New Jersey saw its largest peach crop being sold to New York in the past 5 years (August 26, 1874:3), and the crop sold well through mid-October, well after Delaware peaches stopped being sold in New York (*New York Tribune* September 2, 1874:8; September 9, 1874:3; September 16, 1874:8; September 23, 1874:2; September 30, 1874:8;

October 7, 1874:10; October 14, 1874:5). In general, a high point seems to have been reached in early September (*New York Tribune* September 9, 1874:3). By the end of September, the majority of peaches being sold were for preserving, and the *Tribune* notes that there were too many compared to the demand (*New York Tribune* September 30, 1874:8).

One plum (*Prunus sp.*) stone was found in Depositional Unit 3d. Plums were first recorded on the market in late July and early August 1874, coming all the way from California (*New York Tribune* July 29, August 5). "Southern" (*New York Tribune* August 5) and "river section" plums (*New York Tribune* August 26) were noted but where these locations refer to is unclear. Those without any location information assumedly came from New Jersey. By early September there was a good supply, high demand, and variety of cultivars, such as Blue and Gages plums (*New York Tribune* September 2). However, their sales quickly became sluggish within a week (*New York Tribune* September 9). Prunes are also noted in early and mid-September (*New York Tribune* September 2, September 16). After this point, shipments from the non-descript locations made up the bulk of supplies with somewhat sporadic loads from California. Fresh plums no longer appeared on the market by mid-October (*New York Tribune* October 14). Dried varieties from the non-descript "south" and New York State were available starting in early December (*New York Tribune* December 2).

Two pear (*Pyrus sp*.) seeds were found in Depositional Unit 3d. California pears appeared on the market alongside plums in late July and early August (*New York Tribune* July 29, August 5). By early September shipments were arriving from New Jersey as well (*New York Tribune* September 2). At this point the shipments are noted to be of better supply and better quality than before, with several varieties including Bartlett's pears (*New York Tribune* September 2, September 9, September 16). Local varieties fade out by mid-November (*New York Tribune* November 18) while those from California continued through early February and beyond (*New York Tribune* February 10). No dried or canned varieties were described in the *Tribune*.

One small seed, which appears to be from the *Rubus* genus (raspberry or blackberry), was found alongside the many melon seeds and two unknown seeds in Archaeological Unit 2. Observation under a microscope supports this distinction, but the seeds are too contaminated with fill particles to confirm with a high level of certainty. According to the *Tribune*, in 1874 fresh raspberries and blackberries were first available to New Yorkers in late June (*New York Tribune* July 1) and had a lively market by mid-July (*New York Tribune* July 8). Raspberries faded off the market quickly by the end of the month (*New York Tribune* July 29) while blackberries continued into the end of August (*New York Tribune* August 26). Blackberries are stated to be shipped from as far as Delaware while raspberries originated from the Philadelphia area (*New York Tribune* July 15). Dried or canned varieties were also available well into winter, though never at great demand (*New York Tribune* December 30). Besides being a food product, these remains could reflect medicinal usage by historic New Yorkers. Blackberries and other small, seeded fruits were valued for their alleged astringent properties and their use as laxatives ("Gathering of fresh vegetables and fruits" November 12, 1874).

Seasonality: The Cucurbitaceae Family. Remains associated with the taxonomic family *Cucurbitaceae* are the second-most prevalent ethnobotanical remains from the project area. Of the 178 seeds, 158 were found in Depositional Unit 3d. Many were found in clusters, suggesting that large chunks of fruit were discarded instead of residual waste. Analysis has grouped them into two genera: *Cucimus* (melons) and *Cucurbita* (squash, gourds, and pumpkins). Although the similarity of seeds between different species makes it difficult for species identification (see Martin and Barkley 1961:124), historic documents were used to make probable identifications. Popularly grouped under the term "muskmelon", *Cucumis melo* contains numerous varieties including cantaloupes and honeydews. According to Downing (1872:559), melons grown in late 1870s America were easy to grow throughout the country and great numbers ripened in August. Muskmelons were indeed available on the market between the end of July and the end of September in 1874 (*New York Tribune* July 29 - September 30). Unfortunately, the market breakdowns within the *Tribune* or *Times* do not name any specific variety of muskmelon sold. The *Tribune* does note that muskmelons sold in late July and early August of 1874 were being shipped from Virginia (*New York Tribune* July 29:7; August 5:8). Additional muskmelons noted in the *Tribune* between that time and late September (September 30, 1874) are not explicitly given an origin. These melons likely came from New Jersey given the perishable nature of the fruit ("Gathering of fresh vegetables and fruits" November 12, 1874). If cantaloupes are in fact part of the assemblage, the *Times* does discuss a small amount imported from Malaga, Spain in 1872 ("Foreign Fruit" May 14, 1873), so foreign imports are certainly a possibility as well. The seeds identified within the *Cucurbita* genus align best with those from *C. pepo*, a species which includes various cultivars of squashes and gourds including pumpkins. Produce from the *Cucurbita* genus attested to in the *Tribune* (July 1, 1874 – February 10, 1875) notes various types of seasonal squashes, vegetable marrow, and pumpkins. Market availability of each of these types occurred at different points of the year. When all types are taken together they are virtually perennial. If these remains do specifically represent pumpkins, then they would have been available on the market from mid-September to mid-December (*New York Tribune* September 16 – December 16, 1874).

Seasonality: The Arecaceae Family. All but one of the 26 coconut (*Cocos nucifera*) shell fragments, were found within Depositional Unit 3d. Biologically, the shell is classified as the endocarp of the coconut palm fruit. Some of the coconut husks (mesocarp) were also preserved. Several of the fragments appear to be cut, but it is unclear if this fact actually indicates any industrial use. Commonly spelled as "cocoa-nuts" in the primary sources, these are the most exotic ethnobotanical finds in the assemblage. Coconuts are not native to any area near New York, and would have needed to be transported very long distances to be consumed. This does not mean that the coconut was a stranger to the citizens of Manhattan. An 1870 plate from *Harpers Ferry* shows exotic fruits and vegetables from the Caribbean and South America being unloaded at New York City docks (in Grafton 1977:230) (Figure 4.59). Sources contemporaneous to our finds are somewhat lacking regarding this drupe, forcing a look at slightly later times. Two sources from the early twentieth century state that coconut palms were still not being cultivated on a commercial scale within the United States by the 1920s (Cook 1910:335; Walker 1920:11). Instead, coconuts were imported from Central America and the Caribbean with New York acting as a distribution hub for the rest of the United States (Walker 1920:9, 11). Sources contemporaneous to the Riverside site agree with these geographic origins. A search of the online archive of The *New York Times* cites ships docking in New York with coconuts from St. Andrews (assumedly Barbados), San Blas (assumedly Panama), Cartagena (assumedly Colombia), and Kingston, Jamaica ("Marine Intelligence" January 29, 1874; "Marine Intelligence" February 14, 1874; "Marine Intelligence" June 9, 1874; "Marine Intelligence" October 18, 1874). The dates of these articles found in the *Times* also show that coconuts were available for most, if not all, of the year in New York. The merchants sited in the *Times* were cross-referenced to the 1874 and 1875 Trow's Directories, but none were explicitly linked to our site, suggesting that the Riverside finds were probably not commercial waste. Another report in the *Times* further cites 174 shipments of coconut into New York harbor in 1872: 143 from Baracoa (Cuba) and the rest from San Blas, "San Andreas" (likely St. Andrew, Bermuda), "San Antonia" (likely a misprint of "San Antonio", which could refer to various places throughout the Caribbean and Central America), San Domingo (modern Dominican Republic), Cartagena, Ruatan (Honduras), Old Providence (Providence Island), and Kingston; almost 8 million coconuts were imported over these shipments ("Foreign fruit" May 14, 1873). Interestingly, the *Tribune* does not have any record for coconuts on the market. The sheer number cited above suggests that coconuts were not exactly rare commodities. In fact, as reported in the *Times*, the market value of coconuts sold at the Washington Market in September 1874 does not indicate that they were prohibitively expensive compared to other fruits ("Family Market" September 12, 1874). Smith (2009:60) concurs that Caribbean fruits were being imported into the city by the late eighteenth century at fairly low cost, so it does seem possible that middle class families would have purchased them. In terms of use, according to O.F. Cook, the meat of the coconut was mostly used for pastries and confectionaries in the United States (1910:290). Coconut oil could have been used for cooking (Cook 1910:290) and making soap (Walker 1920:19). Cook (1910:290) also mentions the use of coconut "milk" as a beverage, although by native peoples in the Caribbean and Pacific. With this thought in mind, though, the occurrence of coconut in our assemblage could very well reflect a lack of safe drinking water in the chronically underdeveloped neighborhood of the site. Smith (2009:40) does note that there was a relative lack of clean drinking water in the city at this time, coinciding with the high consumption of alcoholic beverages. Alcohol containers are quite evident in the assemblage, possibly reflecting such a lack of drinking water. In addition, Meredith Linn (2008:508) suggests a possible medicinal use for coconuts. Irish immigrants may have tried to utilize the exotic nature of coconuts in an attempt to treat tuberculosis. Linn (2008: 726) also cites coconut oil as being used in hair tonic for baldness.

Seasonality: The Fabaceae Family. Peanuts (*Arachis hypogaea*) were available on the New York market virtually year round according to the 1874 *Tribune* articles, though interest in them seemed to slow by the middle of October (October 14; December 30). Their origin varied throughout the months of 1874, ranging from Wilmington (likely Delaware) (*New York Tribune* June 10; September 9; October 7; December 30), Virginia (*New York Tribune* September 9; October 7; November 18; December 30), and Tennessee (*New York Tribune* September 9; October 7; November 18). Some were even evidently imported from Africa, though exact countries or regions are not specified (*New York Tribune* August 12, 1874; September 9, 1874; October 7, 1874).

Seasonality: The Juglandaceae Family. One of two black walnuts (*Juglans nigra*) recovered from the project area comes from Depositional Unit 3d. There is no mention of black walnuts until the second week of December 1874, and sold until the opening of the Union Stockyards in early February 1875 (*New York Tribune* February 10, 1875). The other walnut was found in the underlying estuarine cove sediments (Depositional Unit 2), however the disturbed nature of the boundary between these two depositional units suggests that both walnuts are from the upper portion of the landfill deposit (Depositional Unit 3d).

Seasonality: The Fagaceae Family. The first mention of chestnuts (*Castenea sp.*) in the *New York Tribune* in 1874 comes in early October (October 7). They continued to be sold through the end of November (*New York Tribune* November 25, 1874). The condition of the artifact (Figure 4.60) may indicate it was not a commercial product, with a great part of the shell intact. An acorn was also found, likely from an oak tree (genus *Quercus*). The find was in the lower portion of Depositional Unit 3d, along with several other ethnobotanicals. Whether the acorn was consumed as food or is merely a natural deposit is unclear.

Depositional Unit 3e

For the well that was found in Sensitive Area 2, a separate depositional unit was designated for the artifacts and sediments found in its interior (Depositional Unit 3e). Within this stratum, 119 ceramic items were found, including 35 earthenware, 35 yellowware, 10 ironstone, and 10 porcelain sherds. Redware, Rockinghamware, salt-glazed stoneware, stoneware, and whiteware were also found, in lower numbers. One of the ironstone plates with a maker's mark of "Imperial Parisian Granite, Elsmore and Forster" dates from 1853-1871. Ceramic analysis generally dates the assemblage to between 1830 and 1900. Five flowerpot fragments and one smoking pipe stem fragment were also found.

A total of 167 glass artifacts were found, the majority of which (92) were window glass and unidentified glass (51). A fair number of tumblers and/or tumbler fragments (19) were also recovered from inside the well. One of the three bottles found is a whole, dark green beer bottle with the maker's mark of "Hachman and Hulle New York/Philad/Porter and Ale," dating to around 1870 to 1880. Ten window glass fragments (mostly clear and aqua) were found in this stratum. Three wine, one champagne, and one soda or water bottle fragments were also found. Three medicinal bottles were found, one of which had the maker's mark of Chemists Hegeman & Co., New York, dating to between 1850-1870.

No wood artifacts were recovered from the well interior. Only nine metal artifacts were found, four of which are Type B cut nails (dating between 1810 and 1900). Miscellaneous artifacts include two coal/anthracite, one cork, and one rubber button, among others.

A relatively small number (14) of faunal specimens were recovered from the interior of the well. Species include cow, chicken, sheep/goat, rat, small artiodactyl, UID mammal, and UID bird. Four oysters and two clams were also recovered. Only one ethnobotanical remain (a peach pit) was found in the interior of the well.

Depositional Unit 4

The cobblestone pavement for the stockyard (Depositional Unit 4), which includes the cobblestones themselves (4b), the sandy substrate they were placed on (4a), and the contact surface of the cobblestones (4c), was only found in and around Sensitive Area 1. A total of 111 ceramics were found within this depositional unit. This includes 35 salt-glazed stoneware, 20 ironstone, 19 earthenware, 12 porcelain, and 10 whiteware sherds. Stoneware, yellowware, and creamware ceramics were found in lower amounts. Two ceramics found from the surface of the cobblestone blocks have maker's marks (artifact #1334.01 and #1336.01), suggesting this dates to the late 1800s and early 1900s. An ironstone plate with "T&P Royal/Ironstone" dates between 1890 and 1906. One piece of Onondaga Pottery (a porcelain saucer with "O.P. Co. Syracuse/China") dates to around 1921.

Of the 25 glass artifacts, most (14) were unidentified, with the rest being window and bottle fragments (including wine, liquor, water, and soda/water). Six unidentified wood fragments were recovered. A total of 26 metal items were found, the majority of which were either unidentified (8), or Type B cut nails (7), which date from between 1790 - 1820. A .22 caliber bullet cartridge (Figure 4.61) was recovered, and is the only one in the collection. It seems to be a rimfire cartridge, with two lateral grooves toward the head. It dates to after 1850, as bullets prior to this date were more ball-like in shape (Horn 2005:6). Dentures made of a molded platinum alloy, with porcelain gum and teeth molding (Figure 4.62) was found on the cobblestone surface, and dates to as early as the 1830s. Miscellaneous artifacts include a cork, coal/anthracite, charcoal, and unidentified rubber.

A total of 38 faunal specimens were recovered from the cobblestone pavement. This includes sheep/goat, cow, chicken, and UID mammal. Pig, turkey, and large ungulate specimens were also recovered, as well as oysters and clams. Ethnobotanical remains consist of two peach pits, one from the sandy substrate, and one from the surface.

Depositional Unit 5

Redeposited sandy material (Depositional Unit 5) was only found in Sensitive Area 2. A total of 42 ceramics were found in this stratum, the majority of which (24) are earthenware. Ironstone, stoneware, porcelain, and whiteware ceramics were found in lesser amounts. Miscellaneous fired clay items include one door knob, and one porcelain doll fragment (the left shoulder). The door knob is a brown Bennington style knob, which dates between 1851 and 1930.

A total of 46 glass artifacts were found, the majority of which were unidentified (25) or window fragments (17). Among the few bottles found, one was a free-blown, green wine bottle, which generally dates to around 1860-1870. No wood artifacts were recovered from this depositional unit. Of the 14 metal artifacts recovered, nine were Type B cut nails (dating from 1790-1820), and two were wire nails (typically dating to the 1900s). Once again, this suggests a possible mixed deposit. No miscellaneous artifacts were recovered from this depositional unit.

A total of 17 faunal specimens were recovered from this depositional unit, including chicken, one pig, one sheep/goat, and one dog, as well as small artiodactyl, UID mammal, UID bird, oyster, and clam. No ethnobotanical remains were recovered.

Depositional Units 6 and 7

The railbeds (Depositional Unit 6) found exclusively in Sensitive Area 2 contain no artifacts. The rail embankment improvements (Depositional Unit 7), also encountered exclusively in Sensitive Area 2, did contain artifacts. Twenty nine ceramic items were found, including nine earthenware, six whiteware, and five ironstone, as well as porcelain, stoneware, and salt-glazed stoneware. Miscellaneous fired clay objects include two smoking pipe stem fragments, one brick, and one tile.

A total of 27 glass artifacts were found, the majority of which (19) were unidentified glass. Seven green/black wine bottles were also found. These were all mold blown, with a three-part mold, and generally date to around 1850-1870. No wood artifacts were recovered from this depositional unit. The six metal artifacts recovered are five Type B cut nails (dating from 1790-1820), and one wire nail (typically dating to the 1900s). Once again, this suggests a possible mixed deposit. No miscellaneous artifacts were recovered from this depositional unit.

Five faunal specimens were recovered from this depositional unit, including sheep/goat, cow, chicken, and UID mammal. Other fauna include three clams, an oyster, and an unidentified bivalve. No ethnobotanical remains were recovered.

Depositional Unit 8

The fill directly under the modern parking lot (Depositional Unit 8), encountered throughout the project area, contains 82 ceramics. This includes 16 porcelain, 11 whiteware, 11 earthenware, and 10 ironstone sherds. Salt-glazed stoneware, stoneware, Rockinghamware, creamware, redware, and yellowware ceramics were also found. Maker's marks, including one on a whiteware lid (artifact #2696.01) stating that it is "Oriental toothpaste, prepared by Jewsbury and Brown, chemists, 113 Market Street, Manchester," and an ironstone toilet bowl spout (artifact #3283.01) from "T.C. Brown Westhead Moore & Co." date the ceramic assemblage between the mid-1800s to the early 1900s. Miscellaneous fired clay items include two bricks, one terracotta block, one porcelain tile, one button, and one porcelain doll part. Six smoking pipe bowls, and five smoking pipe stem fragments were also found. Analysis of the bowls, showing a leaf pattern along the mold seams, with even-spaced fluting, indicate that the bowls date to between 1820 and 1840. American-made, thick, undecorated, plate fragments belonging to Carr Pottery Co. were found in this stratum, and date between 1916 and 1952. Building materials had diagnostic markings. One earthenware fragment (artifact #30.01) had the partial inscription "[…]HENE." One terracotta fragment (artifact #29.01), and one cut brick fragment (artifact #2930.01) have the inscription "S.E.T. Co" (Figure 4.63).

Of the 84 glass artifacts, most (43) were unidentified. Twenty window glass fragments were found, all aqua colored. Multiple bottles were recovered, including beer, wine, liquor, soda, soda/water, and milk. Analysis indicates this stratum is mixed with both nineteenth and twentieth century materials. A whole, aqua-colored soda or water bottle with a maker's mark of "Merriam and Schreiber, Cor 3rd Ave and 66th Street," along with the date of 1873. The clear milk bottle fragments (artifact #3275.01 and #3275.02) have maker's marks stating they originated in "John H. Muller Dairies Inc." located at "617-19 W46th Street, New York City." These date from 1905 to 1920. A whole, aqua-colored Coca-Cola bottle was also found, stating "Coca-Cola, Trademark Registered, Content 6 Fl. Ozs" and dating to around 1988.

Date range overlap is demonstrated with a mold blown bottle with a hinge base and applied patent lip (Figure 4.64). These diagnostic features appear on bottles for a longer time range. However, the style of the maker's mark, "B&P Lyons Powder," appears on bottles between 1859-1865. Therefore, the conclusive date range for this bottle is based on the maker's mark.

Two unidentified wood fragments were recovered from this depositional unit. Of the 39 metal artifacts recovered, 21 are Type B cut nails (dating from 1790-1820), and one is a wire nail (typically dating to the 1900s). Once again, this suggests a possible mixed deposit. Miscellaneous artifacts include two cement fragments, and two charcoal fragments.

A total of 20 faunal specimens were recovered from this stratum. This includes rat (5), cow (3), chicken (2), pig (1), sheep/goat (1), as well as UID mammal, small artiodactyl, and UID bird. Other species recovered include oysters (2), and clam (1). No ethnobotanical remains were recovered from this depositional unit.

Stratigraphic Sequence in the Project Area

Analysis of borings, excavations, and machine-cut profiles reveals eight separate depositional units represented at the site (Table 4.16). In addition, some of the strata contained evidence for multiple, discrete phases of deposition. The following describes the specific results of the extensive analytical methods performed on the fairly intact Boring GRA-10 (Figure 4.65), as well as the depositional units and overall stratigraphic sequence of the project area (Figure 4.66). The strata are described from the bottom (Depositional Unit 0) to the upper-most layer (Depositional Unit 8).

Boring GRA-10: Sedimentology, Palynology, and Radiocarbon Dating

The bottom-most depositional unit (472-610 cmbs) is comprised of multiple sand and silt layers, ranging from light yellowish brown (10YR 6/4) to reddish brown (5YR 4/4). This unit is equivalent to Harris' Zones 4 (516-541 cmbs) and 5 (560-610 cmbs) (Table 4.17 and Table 4.18). These zones were designated on the basis of parameters measured (texture, carbon content, pH, and sand percentages and statistics). In general, the sand fractions and their statistics indicate variability with depth for both Zones 4 and 5, and these two zones contain strata that can be interpreted as distinct enough to be treated as separate from the rest of the boring. Zone 4 begins with a discontinuity (between 492 and 516 cmbs), with finer textures below. Zone 4 is comprised of silt loam overlying a sand at 541 cm. The sand statistics, especially for samples at 521 and 531 cmbs, are distinct from those of the overlying and underlying sands. Overall this zone is less homogenous than the other zones. Zone 5 (560-610 cmbs) may also begin with a discontinuity, as the uppermost sample is different from the lower three. The lowermost part of the core is comprised of silt and silt loam. It should be noted that pollen was not preserved below 482 cmbs, except in the uppermost samples which contained a few poorly preserved grains (see Appendix G, Pollen). It is likely that these sediments underwent periodic exposure, allowing for the oxidation of organic materials (e.g., when sea levels were lower). Dates of 6,739-6,507 cal. B.P. (534 cmbs) and 4,853-4,644 cal B.P. (506 cmbs) were obtained for this layer by the bulk sediment method.

Above this basal unit are silts, clays, and sands (from 311-472 cmbs). These layers most likely represent an estuarine cove/harbor of the Hudson River prior to major human-induced land modifications. The top layers are very dark gray (2.5Y 3/1), transitioning to browns (10YR 4/4, 6/4, and 7/3). This is equivalent to Harris' Zone 3 (408-492 cmbs), which exhibits a fining-upward sequence from gravelly loamy sand at the base, up to silt loam at the uppermost sample. The coarsest texture in the entire boring occurs in the 436-492 cm range, with gravelly and very gravelly sediment. The upper two samples in this zone are substantially finer, lacking gravel, and having much lower sand contents. Interestingly, despite large swings in sand/silt/clay proportions within this zone, the half-phi sand fractions remain fairly similar throughout. This consistency in the sand fractions and sand statistics help define this zone. There is variability in LOI and pH within this zone, and this might reflect changes in silt and clay content (although some change could be due to carbon contents). Towards the top of this unit, Harris found a relatively thin zone of sandy loams, represented by only two samples (what she designated as Zone 2, from 349-369 cmbs). Sand content is 76%, silt content is 16%, and clay 8%. No gravel is present. The sand fraction is dominated by fine and very fine sands and is better sorted than anywhere else in the core. Pollen within the top of this depositional unit appears to be perfectly preserved (Jones' Zone 1, from 390-436 cmbs in Appendix G). Dominant pollen taxa include *Asteraceae* and grasses, and indicate that the Manhattan area was covered in *Quercus* (oak) – *Carya* (hickory) forests, with a significant amount of *Pinus* (pine) and *Tsuga* (eastern hemlock) pollen. The high percentages of both pine and oak suggest that they were a substantial part of the nearby forest. Charcoal concentrations also indicate that human activity (i.e., burning) had started taking place. Basal samples have relatively low pollen concentration values, and low particulate charcoal counts. This loss of pollen reflects that these sediment layers were oxidized at some point in the past, further suggesting possible fluctuating water levels. Aquatics and herbs and cultigens are fairly low within this zone, suggesting that human activity was more limited than in previous zones. A date younger than 500 cal B.P. was obtained from a shell fragment towards the top of this section (370 cmbs). Near the bottom of this unit (437-439 cm) there is a possible piece of crushed coal, along with a radiocarbon date of 1,366-646 cal. B.P. obtained on a shell fragment. Even deeper, (449 cmbs), a date of 6,466-6,292 cal B.P. was obtained with the bulk sediment method. These complexity of the dating sequence indicates more turbidity and/or more disturbance of the harbor floor than previously thought (see Chapter 5 for further discussion).

On top of the harbor silts, clays, and sands are layers of grayish (2.5Y 5/2) and dark gray (2.5Y 4/1) clays and silts with black (2.5Y 2.5/1) bands and mottling (from 199-311 cmbs). These layers seem to represents the floor of the estuarine cove/harbor during the early 1800s, upon which refuse and artificial fill were initially deposited. This is equivalent to Harris' Zone 1 (209-331 cmbs), which has a sequence of silty clay loam and silt loam. Silt is the dominant particle size class, ranging from 57-69%. Clay makes up 25-34% of these samples, higher than anywhere lower in the core. Sand is nowhere more than 12% of the clastic weight and gravel is absent. LOI and pH values are high; perhaps partially as a result of the high clay content, which can contribute to LOI as well as increased carbon. Though the sand fraction is small (<12%) for this zone, a closer inspection of the half-phi sand fractions suggests a possible discontinuity at 269 cmbs. There is a break in all of the statistical parameters at this depth. Between 209 and 269 cmbs, the sands are coarser, with modes in the coarse and very coarse sand fractions, more poorly sorted, and more positively skewed than are the sands at and below 269 cmbs, which have modes in the very fine sand fraction. The sand fractions are also more poorly sorted than that in Harris' sedimentological Zone 2. Pollen towards the top of this depositional unit (Jone's pollen Zone 2, in Appendix G) shows an increase in the sedge family, cattails, ragweed group, and grasses, as well as alder, birch and *Salix* (willow) when compared to zones below. This can indicate the presence of a well-developed stream-side plant community in the area. Forests essentially remained the same as in the basal section, although changes in some taxa are apparent (such as a decline in hickory and hemlock pollen). Cheno-Am pollen was found in this zone, which is a common weed associated with clearing and human settlement (although it can also be associated with saltmarsh environments). Low spine *Asteraceae* and grasses also rise notably during this zone. These can be associated with the natural shoreline, or they could represent field grasses associated with agricultural efforts. A large amount of particulate charcoal was also noted in this zone, indicating local burning was taking place at this time. This burning could represent clearing of agricultural fields. A single *Cerealea* pollen grain was noted at the base of this zone (384-388 cmbs) indicating European agricultural efforts. Taken together, the increased weeds and disturbance vegetation, along with a large amount of particulate charcoal, indicate forest clearing and sustained burning occurred at this time, further suggesting human modification of the landscape. A date of 2,858-2,758 cal B.P. was obtained from 239 cmbs, utilizing the bulk sediment method. This date is much older than expected, again indicating a large amount of mixing of the sediments on the harbor floor, and confirming the idea that humans were altering the environment.

The uppermost layer of Boring GRA-10 (the top 199 cm) is interspersed with coal ash, slag, and brick, and represents artificial fill from the historic period. This artificial deposit is fairly heterogeneous, made up of sandy clay loam, sand, and clay. Colors are equally heterogeneous, ranging from black (10YR 2/1), to grays (10YR 3/1 and 7/1), to browns (10YR 3/4 and 4/3). The deepest artifact (not including the possible piece of crushed coal at 437-439 cmbs) is a brick fragment found at 146 cmbs. Palynology confirms this (see Jones' Zone 3, from 146-291 cmbs in Appendix G). There is a decrease in sedge, cattail, and grass pollen, which is most likely associated with land-clearing. One pollen taxa of European origin was identified (white or red clover from 245-250 cmbs), along with two *Cerealea* grains (representing one of the domesticated Old World grains, wheat, barley, rye, or oats from 259-264 cmbs), indicating the timing of this deposit was historic, and that agricultural activities were occurring. Charcoal concentrations rise dramatically in this section (compared to the lower layers) reflecting intensified industrial and/or agricultural activities. Forest composition remains the same, and is dominated by oak, hickory, pine, TCT (**T**axodiaceae (bald cypress family), **C**upressaceae (cypress family), and the genus ***Thuja*** (arborvitae)), and hemlock. There is no evidence of southern or red maple, indicating deforestation by people.

Final Stratigraphic Sequence

Allostratigraphy is a comprehensive approach to depositional histories that can serve as a bridge for ordering contemporaneous relationships between geomorphic events, landforms, and cultural occupations (NASCN 2005). Its utility for this study is twofold. First, the presence of several natural site landscapes--undulating (Middle to Late Holocene) estuarine and basin bottomlands and higher (terminal Pleistocene) moraine elements---allows for reconstructing a prehistoric terrain that effectively formed a lush, rich, and diverse subsistence environment. Second, cultural horizons themselves can be tied directly to landscape elements and strata. In the former case, the prehistoric contexts can be viewed in an overarching perspective. In the latter, the complexities of landfill sequences, on large or small scales, can be directly indexed by chronology.

As presented in the following descriptions of the nine depositional units, we follow a “bottom up” (oldest to youngest) chronological presentation per the classic geologic descriptive protocols. The summary table (Table 4.16) also identifies the key sub-units of the sequence stratigraphy.

Depositional Unit 0

Within the generalized stratigraphic sequence in the project area, Depositional Unit 0 represents refusal at bedrock, for those cores that include it (Figure 4.67). When exposed by machine excavation, this depositional unit was characterized by large, rounded to subangular schist boulders indicative of glacial redeposition of bedrock belonging to the Manhattan Formation. This depositional unit is not sensitive for prehistoric cultural resources because of glacial scouring.

Depositional Unit 1

The oldest sediments in the project area were found with Depositional Unit 1. Although previous borings in the area were reported to contain samples of till (MRCE Report 2011), GRA did not document such a stratum. As of the writing of this report, the presence of till within the project area can be neither confirmed nor denied. Depositional Unit 1 seems to be composed of reworked till materials, and therefore post-dates the late Pleistocene till.

Within the basin of the former cove, the deepest stratum overlying the Depositional Unit 0 bedrock and moraine deposit is a firm, fine-grained, platy silt, which is reddish brown (7.5YR 4/4) and finely laminated. These laminae have been repeatedly folded, indicating significant post-depositional disturbance. Black inclusions within this stratum contained no organic material, and represent mineral concentrations. The uppermost 15 cm (6 in) of this stratum contains mica flecks. The laminae below, and the mica flecks above, suggest deposition of sediments within a fluvial environment. The fine texture and reddish color suggest that the parent material was glacial till, which would have been redeposited during the post-glacial period. These lowest sediments contained no datable organic material.

An unconformity separates this deformed stratum from 15 cm (6 in) of poorly-sorted micaceous sand containing clay rip-up clasts, deposited as a result of erosion from elsewhere. A possible source of this sandy sediment is the adjacent sandy hillside.

The parent material of the elevated hillside is a cross-stratified series of well-sorted, fine-grained sands. The deepest layers documented by GRA are horizontally bedded. Above this, the bedding pattern becomes diagonal, with the upper surface of each stratum facing eastward and away from the present-day river (Figure 4.68). This pattern resembles cross-stratification in Pleistocene lacustrine deposits (Eyles and Clark 1986). The elevation of this deposit indicates that it was laid down when water levels were much higher than they are today. This water level was last reached during the Lake Bayonne phase, prior to 13,000 years ago (Figure 4.69). The bedding pattern suggests that this may have been the sandy edge of Lake Hudson/Lake Albany.

Datable organic sediment was recovered downslope from this profile, within a relict streambed which used to run from east to west through the property. The deepest documented stratum here is a coarse-grained, poorly sorted sand and gravel deposit typical of a high-energy erosional environment, in this case an active streambed (Figure 4.70). Adjacent archaeological excavation revealed that schist bedrock or large boulders lay just beneath this stratum. Organic sediment returned a date of 10,245 to 10,160 cal. B.P. (Beta-374382). This places the deeper strata at the site within the very early Holocene, if not earlier.

The three areas (the harbor basin, the sandy hill, and the streambed) reflect three very different depositional environments. Within the streambed, the coarse sands and gravels grade clearly, though not abruptly, into friable, granular micaceous sand which fines upwards from coarse sand at the interface with the gravel deposit, to fine sandy clay in the space of 40 cm (16 in). This sand deposit contained numerous stick fragments and returned a radiocarbon date of cal BP 1,525 to 1,350, significantly younger than the gravel deposit. The upper margin of this stratum, which is fine-grained sandy clay, grades continuously to 30 cm (12 cm) of homogeneous sandy clay. The increasingly fine-grained deposit reflects a quieting of the depositional environment as the level of the Hudson River rose to inundate the western edge of the project area. Instead of sediment being swept downslope by the stream and out of the property, fine-grained sediment began to accumulate into a thick layer around the mouth of the stream as it entered the cove. These fines were then abruptly capped by alternating bands of clay sand with mica flecks and small stones, and an interval of coarser fine-medium grained sand. As the stream flow became shallow over the mudflat, seasonal changes in precipitation led to episodic changes in sediment transport, resulting in surges of water carrying pebbles downstream, or in one case a sustained flow capable of depositing 2.5 cm (1.0 in) of poorly-sorted sand. In the end, this sequence terminates with the development of an A horizon, indicating that water flow had largely ceased, and organic matter had begun to accumulate at the surface of what was now a soil.

Soil formed upslope from the streambed as well. In many places, the A and B horizons have been stripped away by historic human activity, such as on the top of the hill which had been leveled, and a schist railbed constructed (Figure 4.71). The best evidence for soil development on the higher elevations is found in areas which were protected by a layer of re-deposited parent material that had been removed from other parts of the hill and laid down over low areas, leveling the area for rail lines. Machine cut Profile 8 (see Figure 4.71) clearly shows the A horizon, as well as a thin, peaty O horizon, beneath the re-deposited material and one of the schist railbeds. The A horizon contained numerous charcoal flecks, as well as fragments of brick, glass, and ceramic.

Traces of A and B soil horizons were also found in the vicinity of the stone foundation (Figure 4.72). This stone foundation was found in the approximate location of a house recorded on the 1871 Perris and Browne insurance map, adjacent to a stone-cutting workshop (Figure 4.73). Within the basin of the cove, the sandy erosional surface and churned re-depositional layer were abruptly capped by a homogeneous 90 cm (35 in) layer of firm, subangular blocky clay silt with redoximorphic features, which becomes increasingly reddish and oxidized towards the upper portion of the deposit. These sediments represent a period of accumulation, and returned several radiocarbon possibilities ranging from cal BP 4,845 to 4,655 (Beta-374389). Given that sediments of this age are not documented within the stream bed, this would be a likely final resting place for those missing sediments. The redoximorphic weathering resulted from frequent waterlogging by the stream.

Depositional Unit 2

Depositional Unit 2 begins with a sudden change in the depositional environment, and is marked by an abrupt transition to dark gray clay silt. Numerous shells were recovered from the bottom of this clay silt, and these returned a radiocarbon date of cal BP 1,365 to 645 (Beta-374387). The abrupt transition represents an erosional surface that developed when the river rose and inundated the cove basin within the project area. The clay silt, which is completely unweathered, began to siltate out of the calm water within the cove. The lowermost shells date to the earliest phases of cove sedimentation. This sedimentation continued unabated for a full meter. An eastern mudsnail shell collected from 50 cm (20 in) above the base of the deposit returned a radiocarbon date of cal BP 490 to present, indicating a Contact Period age at the earliest. This period of stable siltation is interrupted by 20 cm (8 in) of loose, single-grain fine sand and mica, which represents a shift to a higher energy environment. This sandy band may have accumulated as the harbor was modified by humans, and opened for boat access. Harbor posts dating to ca. 1807 were found within this layer (as opposed to this layer having accumulated after the posts were put in). After the harbor posts were installed, calmer water and siltation resumed. This silt eventually engulfed the posts for most of their height, to a depth of 1.5 meters (4.9 feet).

The radiocarbon dates for the silty clay layer within the cove are considerably older than expected (Figure 4.74). For example, historic artifacts such as brick and cattle bone were recovered from this sediment layer. Shell may be a better indicator of the age of the sediment in an estuarine system such as the lower Hudson River estuary. Within the cove, long-decayed organic matter has been re-circulated and redeposited. This is apparent in the numerous reversals in radiocarbon dates within the sediment.

Malacological analysis of the snails and bivalves trapped within the sediment indicates a stable population of organisms adapted to a brackish environment, characteristic of estuarine mudflats. Although some molluscs burrow beneath the surface into older sediment (like clams), others, like the eastern mudsnail, live on the surface of cove sediment, and their remains should indicate the level of the buried surface (see Appendix I).

Depositional Unit 3

Depositional Unit 3 consists of artificial landfill deposits that cap the A horizon within the streambed and on the hillside (Depositional Unit 1), as well as the clay silt of the former cove (Depositional Unit 2). This landfill represents the beginning of urbanization in the area. The earliest episode of land filling took place within the streambed (see Figure 4.70). This filling is associated with the construction of a well directly over the stream, and artifact TPQs indicate that the fill was deposited as the property line was reinforced along the edge of the Hudson River railroad, which was first built in 1850. It appears that railroad improvements required cutting off access to the original stream. The well was built to allow continued access to fresh water even as the land was built up. The deepest layers of fill are stone and brick fragments. This was topped off by a layer of sandy loam containing numerous schist cobbles.

The uppermost portion of the well was surrounded by two distinctive, ash-rich, gray (10YR 5/1), friable, granular bands of landfill composed largely of residential and commercial waste (Figure 4.75). This artifact rich deposit extends across the entire property. Over the sediments of the cove, it lies as thick as 1.8 m (5.9 ft). Over the filled stream and the hilltop itself, it lies no more than 30 cm (12 in) thick. The ashy landfill displays lensing, and the strata slope locally, although not in one consistent direction across the entire site. The overall pattern suggests discrete episodes of dumping.

The artifacts within this fill layer date from the mid- to late-nineteenth century. Artifact type and maker's mark analysis, in conjunction with newspaper sources, indicate that the deposit was laid down by 1874. A band of sandy sediment (Figure 4.76) separates the deposit into two layers, but the ages of the artifacts above and below the sandy band indicate that these layers date to the same time. The lowermost 1 cm (0.4 in) of the sandy band contains a coarse fraction composed of redeposited fragments of material from the trash deposit below. The upper section of the sandy band consists of alternating bands of fine sandy sediment and coarse material containing particles of brick and other historic debris (Figure 4.77). These resemble runoff deposition, resulting from water flowing in surges over the trash fill from higher elevations (Griffiths, Hereford, and Webb 2006).

It is notable that a tropical storm (Storm 6 of the 1874 hurricane season) tracked directly over New York City on September 29, 1874 (Partagas and Diaz 1995). Although it had begun to dissipate at this time, it impacted the city as a "heavy gale" and the rains would have caused localized flooding. This may have been the source of the sandy deposit, and provides circumstantial evidence for the seasonality of the land-filling. Evidence can be seen in the fill at higher elevations as well, with two episodes of filling. Runoff from the surrounding area may have accumulated around the well, or perhaps silty sediment was deliberately added to stabilize the upper surfaces before filling resumed.

The artifact assemblage contains a large amount of scrap metal, glass bottles, leather, and even a handful of coins, all of which would have value as either scrap for resale by trash pickers or as legal tender (Craven 1899). The presence of these items within the deposit shows that the dump was not picked over, which is uncharacteristic of open dump sites within the city during the nineteenth century (Corey 1994).

Animal scavengers are notably absent from the assemblage as well, despite the presence of a large amount of food waste. Of the 1,764 faunal specimens collected, only three were gnawed by carnivores, and just two by rodents (see Appendix H for a detailed discussion of the faunal remains).

Only 2% of the bones were burned or calcined, and 1% of the ceramic assemblage (26 of 2,417 pieces) showed signs of charring or spalling. The vast majority of this trash was not burned. This is particularly interesting given that in 1873, New York City passed a law that unburned trash could not be used as landfill within the city. The unburned artifacts were embedded within an ashy matrix, and it is likely that the land was filled with alternating layers of unburned waste, which was then covered with ash.

These lines of evidence (single-event filling, an un-scavenged assemblage with a *terminus ante quem* of 1874, and a filling strategy which appears to skirt the law at the time) suggest that this water lot was purposely, rapidly filled prior to construction of the Union Stockyards in 1875 (with newspaper articles stating that it opened on February 8, 1875, as discussed in the background section of this report). In addition, circumstantial evidence of seasonality within the deposit suggests a fall and winter landfilling effort. First, there is the possibility of a late September storm deposit near the bottom of the fill. Second, multiple elements of the fill are highly seasonal when fresh. Seed and pit remains within the fill, especially the large number of peach pits, represent fresh fruits available from late summer to late autumn. Furthermore, oyster shells were so common within the deposit, only a representative sample was collected. Such an abundance of oyster shell suggests the deposit is indicative of the fall and winter months, when oysters were typically harvested and sold; demand for oysters in the summer was weak (Ingersoll 1881:116, 117, 127). It is true that oyster shells may have been saved for secondary uses, and peach pits may have come from dried rather than fresh fruit. However, by February of 1875, the trash was sealed beneath the cobblestone pavement, making it likely that the majority of the landfilling effort took place during the Fall and Winter of 1874-1875.

Depositional Unit 4

The cobblestone pavement and associated substrate is considered its own depositional unit. The pavement was composed of tightly set cobble paving stones, measuring approximately 15 cm (6 in) square when viewed from the top, and approximately 20 cm (8 in) in height when viewed in profile (Figure 4.78). The surface of the pavement held organic residue in places, and a few artifacts were recovered directly from the residue on the surface. These stones are set in a bed of loose, granular to single-grain sand measuring 30 cm (12 in) thick in places. The upper portion of the sand bed around the stones is black (10YR 2/1) and contains decomposed organic material. The lower portion of the sand bed is light yellowish brown (2.5Y 6/3) and homogeneous, and contains isolated artifacts characteristic of the landfill layer below. There is a clear interface between the sand bed and the artifact-rich landfill below. The pavement was continuous until it reached the top of the slope near the Amtrak embankment. Here, the pavement terminated in a ragged edge running parallel with the Amtrak easement (Figure 4.79). The pavement here may have been removed during the West Side Improvements of the early 1930s, as discussed under Depositional Unit 7.

Depositional Unit 5

This depositional unit is composed of redeposited material removed from the surface of the original sandy hill. It has already been referred to in its role as a preserving element over the buried A horizon of the original hillside. This is granular to weakly subangular blocky, friable silty sand, yellowish brown (10YR 5/4) and mottled with iron oxidation. The sediment contains a few angular stones measuring 1-5 cm (0.4-2 in) in length, indicating disturbance. The transition to the buried A horizon below is abrupt, and there is no continuity with earlier sedimentation and soil formation processes. The redeposited material lies up to 50 cm (20 in) thick on top of the A horizon that formed on the former surface of the hill. This depositional unit occupies a restricted area in the vicinity of the schist railbeds (Depositional Unit 6). However, this layer is discontinuous and is deeper over areas where the original hillside had a lower elevation. It is completely missing from the high point of the hill, which has also lost any trace of the A horizon. It is therefore likely that as the hill was leveled to make a flat surface for the railbeds, this material was removed from the high points and deposited over the low points, smoothing out the topography. This unit has relatively little cultural material. The apparent association between this layer and Depositional Unit 6 suggest that Depositional Unit 5 may in fact post-date stockyard construction (i.e., 1874 and 1875). The ashy material of Depositional Unit 3 did not extend to cover this area, whether through removal or by design, and therefore the chronological relationship between the redeposited material and the stockyard is tentative.

Depositional Unit 6

The schist railbeds are composed almost entirely of loose, un-mortared angular schist cobbles and pebbles, within a matrix of dark yellowish brown (10YR 4/6) granular, friable sandy loam. No artifacts were recovered from the stony features (see Figure 4.14). The two documented railbeds cut across the northeast corner of the property at an angle, and closely match the angle and location of tracks depicted on the 1892 Sanborn insurance map (see Figure 4.12). These railbeds cut across, and subsequently buried, the remains of the stone foundation.

On the west side of the project area, the sequence of events is clearly displayed in Machine Cut Profile 8 (see Figure 4.71). An old surface with a well-developed A horizon and a thin layer of peat indicates a gently-sloping surface watered by a spring, perhaps associated with the stream nearby. Within and below the A horizon, charcoal flecks and fragments of glass and brick reflect long-standing historic use of the hill. Two lenses of laminated fine sand suggest at least one episode of gentle runoff deposition. Above this is considerable evidence for late nineteenth century land modification. The parent material of the hillside was redeposited on top of the surface to build a level surface for railbeds supported by boulders and cobbles of local schist.

Depositional Unit 7

The West Side Improvement of the 1930s transferred rail service from Eleventh Ave/West End Ave to a rail cut further up the west side, which is the present-day Amtrak corridor (New York Central Railroad 1934). These improvements included the construction of the High Line between TriBeCa and 30th Street, and the improvement of public access to Riverside Park north of 72nd Street (New York Central Railroad 1934). At 60th Street and West End Avenue, the railbed was set below the existing surface to guide the train into subterranean tunnels which would direct it beneath the flow of motor and pedestrian traffic aboveground. This work included the construction of the West Side express highway which, based on images on file with the NYC Department of Records, was in operation by 1933 (Figure 4.80 and Figure 4.81). The 1930s rail cut is clearly visible in the stratigraphy of the project area.

Both the original surface and the built-up surface beneath the railbeds were cut at nearly a 45-degree angle. This exposed cut was covered with four successive layers of fill to form the embankment for the present-day railroad tracks (Figure 4.82). Stony rubble (not exclusively schist as in Depositional Unit 6) containing historic debris was noted in STP 9.1, 9.2, 9.3, and 9.5 (Figure 4.83). This parallels the Amtrak embankment more closely than it does the nearest schist railbed, and appears to be a mid-twentieth century addition to the stratigraphy. The rubble would have reinforced the slope of the embankment.

Depositional Unit 8

Immediately above the stockyard pavement was a thin (1 cm) layer of fine sand, on which sat several rectangular structures made of squared logs held together with long zinc spikes resembling round wire nails. The structures were surrounded and filled with homogeneous, very friable, granular sandy fill, which contained occasional bricks and mid-twentieth century bottles. The logs resembled those used as cribbing in New York City during the twentieth century. Discussions with engineers and construction contractors during the monitoring process led to the hypothesis that these were support structures laid down to support the filling of the stockyard. The fill would not have securely interfaced with the smooth paved surface below, and the new land would have been unstable. The rectangular log cribbing was set into the surface of the stockyard in places, and would have held the upper fill in place. The zinc spikes post-date the nineteenth century. The historic sediments above the late nineteenth century surface produced a collection of ceramic and glass bottles dating from the early-to-mid twentieth century.

Summary

This chapter presented the results of fieldwork and analyses for this project. Through Phase IB, two sensitive areas were confirmed and delineated within the project area. During Phase II, excavations and monitoring were performed. Overall, these investigatory activities resulted in a wealth of data including the collection of 9,208 artifacts and ecofacts, nine geoarchaeological borings, and 332 additional sediment samples. Analyses of these data sources culminated in the development of a stratigraphic sequence for the project area based upon a set of depositional units. These depositional units correspond with significant and observable shifts in the landscape and use of this place. These results represent the basis for the interpretation of the site.

It proved to be most effective to apply a stratigraphic scheme built on the concepts of allostratigraphy. Field and analysis observations and results were structured in terms of site formation chronologies that viewed the entire landscape as differentiated physical terrain. In general, the prehistoric landscape consisted of two primary allostrata (or depositional units) that highlighted the upper terrain overlooking the Hudson estuary proper (see Table 4.16). In prehistoric times both allostrata (Master Unit 1 and subunits) were key components of a diverse subsistence landscape. In the early 19th century near-shore development began, initially in the form of small agricultural fields with properties extending shoreward as early docks were constructed (Master Unit 2 and subunits). The balance of the historic occupations is archaeologically manifest as discrete forms of "Landfilling" elements, disrupted or interdigitated with structural features (Master Units 3 and 4 with subunits). That pattern continued well into the early 21st centuries (Master Units 5-8) Taken together, what emerges is a broad, extensive, and comprehensive accounting for neighborhood change (writ large) that is readily envisioned as a series of stacked and diagnostic natural and activity loci, whose histories are as diverse as they are informative.

Table 4.1 Counts of artifact material type by Depositional Unit.

Dep.Unit \ Material	Ceramic	Charcoal	Coal	Concrete/Mortar/Cement	Cork	Faunal (non-spec)	Faunal (zooarch analy)	Faunal Artifact	Fiber	Floral	Glass	Leather	Metal	Paper	Plastic	Rubber	Sediment	Stone	Tar	Textile	Undetermined	Wood	Total Count
8	82	2	0	2	0	3	21	0	0	0	84	2	39	0	0	0	0	10	0	0	0	2	247
7	29	0	0	0	0	5	5	0	0	0	27	0	6	0	0	0	0	1	0	0	0	0	73
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
5	42	0	0	0	0	6	17	0	0	0	47	0	14	0	0	0	11	0	0	0	0	0	137
4c	102				1		9			1	20	18	17				3	1			1	2	175
4a	9	1	2			3	29			1	5		9			2		1				4	66
4 total	111	1	2	0	1	3	38	0	0	2	25	18	26	0	0	2	3	2	0	0	1	6	241
3e	119		2	2	1	6	14			1	167		9			2							323
3d	1568	12	30	2	80	105	1221	5	5	303	980	91	1158		2	12	5	18	1	6	14	133	5751
3c	44				1	1	65			1	19	3	85				1					11	231
3b	331		8		11	28	260		1	44	313	19	188	1		2	2	4	1	1	12	82	1308
3a	85	5				2	34				77	1	23				29	6			1	5	268
3 total	2147	17	40	4	93	142	1594	5	6	349	1556	114	1463	1	2	16	37	28	2	7	27	231	7881
2c	44				8	68	118		1	36	81	3	135			1	153				1	42	691
2b						1											11						12
2a						5											28						33
2 total	44	0	0	0	8	74	118	0	1	36	81	3	135	0	0	1	192	0	0	0	1	42	736
1 c	10	1		1			17				18		21				1		7				76
1b	13					6					8		33				29			1			90
1a/1b																	26						26
1a																	32						32
1 total	23	1	0	1	0	6	17	0	0	0	26	0	54	0	0	0	88	0	7	1	0	0	224
Total Count	2478	21	42	7	102	239	1810	5	7	387	1846	137	1737	1	2	19	332	41	9	8	29	281	9540

Table 4.2 Percent of Primary Material Types within Each Depositional Unit.

Dep.Unit \ Material	Ceramic	Faunal	Floral	Glass	Leather	Metal	Wood
8	33.3	9.7	0.0	34.1	0.8	15.9	0.8
7	39.7	13.7	0.0	37.0	0.0	8.2	0.0
5	33.3	18.3	0.0	37.3	0.0	11.1	0.0
4	46.6	17.2	0.8	10.5	7.6	10.9	2.5
3	27.4	22.1	4.4	19.8	1.5	18.7	2.9
2	8.1	35.3	6.6	14.9	0.6	24.8	7.7
1	16.9	16.9	0.0	19.1	0.0	39.7	0.0

Table 4.3 Percent of Primary Material Types Recovered from Each Depositional Unit.

Dep.Unit \ Material	Ceramic	Faunal	Floral	Glass	Leather	Metal	Wood
8	3.3	1.1	0.0	4.6	1.5	2.2	0.7
7	1.2	0.5	0.0	1.5	0.0	0.3	0.0
5	1.7	1.1	0.0	2.5	0.0	0.8	0.0
4	4.5	2.0	0.5	1.4	13.1	1.5	2.1
3	86.6	84.8	90.2	84.3	83.2	84.2	82.2
2	1.8	9.4	9.3	4.4	2.2	7.8	14.9
1	0.9	1.1	0.0	1.4	0.0	3.1	0.0

Table 4.4. Ceramic Material from the Project Area.

Ceramic Type	Depositional Units 1		2		3a		3b		3c		3d		3e		4		5		7		8	
	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt
Creamware											26	213.4			1	16.4					1	43.1
Earthenware	3	34.4	6	77.4	20	262.7	61	722.6	6	61.1	168	6,604.3	35	648.0	19	386.2	24	669.0	9	147.9	11	241.2
Ironstone	8	134.2	12	401.9	17	486.8	72	2,752.2	8	182.0	446	21,447.7	10	251.8	20	725.1	5	191.2	5	46.2	10	785.3
Porcelain	4	27.8	3	58.5	10	264.4	33	644.7	2	6.5	222	6,140.0	10	150.7	12	113.3	4	3.5	3	24.1	16	457.1
Redware	1	3.1			3	31.4	6	73.7	1	2.3	41	998.2	8	62.7							1	56.2
Rockinghamware					3	188.8	7	74.2			37	3,202.6	5	70.3							4	182.2
Stoneware	2	38.3	3	645.0	11	608.3	12	560.7			120	13,144.1	3	154.1	2	18.3	5	147.4	1	7.8	4	1,309.7
Salt-glazed stoneware					2	22.4	11	717.7	1	115.5	48	14,004.5	4	293.6	35	279.5			1	18.9	6	1,602.0
Transfer print			2	179.2	2	8.4	4	336.8			37	1,052.5										
Alphabet/ proverb plate											5	50.4										
Whiteware	2	2.4	6	41.2			76	1,209.2	14	247.2	187	2,540.4	3	36.1	10	44.7	2	4.7	6	28.0	11	218.0
Yellowware			2	11.9			19	653.4			33	2,647.5	35	1,687.9	2	47.6					1	6.7
Flowerpot			1	1,085.8	6	112.9	17	248.0	1	31.6	62	2,452.1	5	44.1	3	118.2						
Cabinet knob											1	53.3										
Door knob											6	361.7					1	28.9				
Button			1	1.0							8	7.3									1	1.3
Smoking pipe	3	7.3	3	5.7	5	23.2	5	25.1	10	28.3	55	398.4	1	4.3					2	2.3	11	19.3
Porcelain figurine					2	32.0					23	570.8			1	104.9	1	3.0			1	6.3
Toy checker piece											1	6.2										
Toy marble			1	6.3	1	4.9	4	26.7			3	20.3										
Brick			4	133.8	3	126.2	3	449.1	1	255.2	13	1,870.0			1	20.7			1	25.8	2	88.0
Sewer Pipe							1	175.8							3	297.0						
Terracotta block																					1	13.4
Tile											2	31.2			2	321.2			1	64.6	1	5.5
Unidentified ceramics											24	21.4										
TOTALS	23	247.5	44	2,647.7	85	2,172.4	331	8,669.9	44	929.7	1,568	77,838.4	119	3,403.6	111	2,493.1	42	1,047.7	29	365.6	82	5,035.3

Table 4.5. Window Glass.

Window Glass	**Depositional Units**																					
	1		**2**		**3a**		**3b**		**3c**		**3d**		**3e**		**4**		**5**		**7**		**8**	
	Ct	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**
Aqua	5	5.6	4	N/A	22	N/A	90	16.3	6	N/A	254	291.7	52	51.2	1	2.4	7	N/A	1	7.4	20	77.4
Clear	2	N/A	5	1.2	1	N/A	11	3.5	3	N/A	106	75.8	40	53.0	1	N/A	9	1.7				
Frosted											3	N/A										
Frosted clear											2	2.3										
Painted white											1	N/A										
Undetermined			1	1.1			1	N/A			30	23.4					1	0.4				
TOTALS	7	5.6	10	2.3	23	0.0	102	19.8	9	0.0	396	393.2	92	104.2	2	2.4	17	2.1	1	7.4	20	77.4

Table 4.6. Bottle Glass.

Glass Bottles and Stoppers		Depositional Units																					
		1		2		3a		3b		3c		3d		3e		4		5		7		8	
Type	**Color**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**
Beer	Aqua									1	83.0	3	408.0	1	6.7							2	864.0
	Brown											5	831.0									1	62.0
	Green											1	75.0	1	474.0								
	Green/ black											1	451.0										
Beer/ Wine	Brown											1	97.0										
Wine	Aqua							1	169.0	1	35.0	14	425.0										
	Brown			2	135.0			34	526.0														
	Clear											1	98.0										
	Green			1	49.0			9	279.0			31	3,333.0			2	849.0	1	75.0				
	Green/black					4	89.0	5	192.0			13	3,226.7	1	318.0					7	242.7	2	553.0
Wine stopper	Brown											1	55.0										
	Clear with red											1	62.0										
Wine/ Champagne	Green											1	14.0										
	Green/ black											1	422.0										
Champagne	Brown											1	57.0										
	Green			1	14.0							1	93.0										
Liquor	Aqua																	1	54.0				
	Brown							12	347.0			4	362.0									1	12.0
	Green															1	256.0						
Liquor stopper	Aqua											1	9.0					1	14.0				
Soda	Aqua											1	26.0									1	398.0
	Brown																					1	388.0
	Clear																					1	372.0
Water	Aqua											1	419.0										
	Black															1	4.0						
	Green							2	23.0			2	466.0										
Soda/ water	Aqua			1	136.0	2	44.0					2	392.0									2	561.0
	Clear																					1	402.0
	Cobalt blue											2	743.0										
	Green							1	332.0			5	1,473.0			2	445.0						
Milk	Clear																					2	272.0
Non-liquid Food bottle						9	194.0	10	307.6			22	1,949.2			1	452.0					2	38.0
Cosmetic bottle												3	187.0	0	0.0	1	63.0						
Medicinal bottle		1	5.0	3	529.0			4	664.0	1	6.0	68	4,711.6			1	63.0					3	280.0
Glue bottle												1	0.0										
Inkwell								1	23.0			4	186.0									1	87.0
	TOTALS	1	5.0	8	863.0	15	327.0	79	2,862.6	3	124.0	192	20,571.5	3	798.7	9	2,132.0	3	143.0	7	242.7	20	4,289.0

Table 4.7. Verified Embossed Bottles.*

Artifact Number	Maker's Mark	Product Info	Est. Date Range
10.01	Liebmann Breweries Inc	Beer	1884-1920[B]
11.01	Welz & Zermeck Brewers	Beer	1883-1920[B]
166.01	Coca-Cola/Trademark Registered/Content 6 1/2 FL. Ozs.	Soda	1988-1988[W]
542.01	Geniune Fluid Extract/H.T. Helmbold/Philidelphia	Extract for depression, all diseases of bladder and kidneys	1850-1890[F]
550.01	Murray and Lanman's Florida Water	Toilet Water	1835-1904[S]
574.01 2972.01	A B Co.	Unknown	1905-1915[T]
578.01	Lubin/Parfumeur/Paris //HP	perfume	1798-1920[W]
587.01	Dawson's/Benzine/C.N. Crittenton/N.Y.	Unknown	1860-1909[W]
589.01	Congress and Empire Spring Co/Saratoga NY/Congress Water	Mineral Water	1856-1884[W]
604.01	Henry Menken/New York	Soda	1872-????[W]
613.01 799.01 946.01 3016.03	Mrs. Winslow's Soothing Syrup/Curtis & Perkins Proprietor	Teething Syrup	1854-1859[F]
696.01 2688.01	Lea & Perrins//Worscestershire Sauce//ACB Co	Worcestershire Sauce	1840-1920[L]
828.01	Societe Anonyme Bordelaise/ Bordeaux//Produits Alimentaires/Marque D Brique 1867, 1865	Unknown	1865-????
941.01 2672.01	B&P/Lyon's Powder	Dusting Powder	1853-1910[F]
971.01	Dr. D. Jayne's Alternative/242 Chest(nut) St. Phila.	Blood purifier	1857- ????[F]
976.01	Great Radium/Spring Water Co. Inc./Pittsfield/Mass.	Radon Water	1919-1922[W]
998.01	Christie's Magnetic Fluid	Used with Plaster Casts	1845-????[F]
1220.02	E&J/Burke/Dublin	Beer	1874-1953[W]
1866.01	Ellenville Glass Works	Liquor	1836-1896[M]
1948.01	W.P./Knicker/Bocker/Sodawater/164 18th St NY 1848	Soda	1848-????
1958.01	Hale's Honey of Horehound and Tar//C. N. Crittenton//New York	Balm for irritations and inflammations	1864-????[NYT]

2291.01	Composse Huile de Fou de Morue//Fougera's Compound Iodinised Cod Liver Oil/New York Brooklyn	Cod Liver Oil	1870-1881[W]
2662.01	Batchelor's Liquid Hairdye No 2	Hair dye	1850-1920s[F]
2701.01	W. M. Olliffe, Druggist/New York/No. 6 Bowery	Unknown	1865-1890[H]
3346.03	CB/K (Kilner Bros. Glass Co.)	Fruit	1857-1937[C]
3357.01	Chemists//Hegeman & Co.//New York	Florida Water	1862-1870s[F]

* The / or // marks are used to indicate the arrangement of words on the label (Fike 1987). Sources for date ranges are marked in superscript with the first letter of the author's last name, except for "[W]" to denote a website. Literary sources: [B] Bull et al. (1984); [T] Toulouse (1971); [S]Sullivan (1994); [F]Fike (1987); [L]Lunn (1981); [M]McKearin and McKearin (1948); [NYT]New York Times (1864); [H] Hotchkiss (1934); [C]Creswick (1995).

Table 4.8. Wood Artifacts.

	Depositional Units										
Wood Artifact Counts	**1**	**2**	**3a**	**3b**	**3c**	**3d**	**3e**	**4**	**5**	**7**	**8**
Barrel plug						1					
Bucket						1					
Button						1					
Clothes Pin						8					
Comb						1					
Possible cork/other wood item						1					
Dowel						1					
Handle						1					
Knob						1					
Leg, possible						1					
Log sample			1								
Pulley wheel				1							
Spool						5					
Stake			1			1					
Toothbrush						2					
Post		18				1					
Vegetation (non-cultural)			1			1					
Unidentified wood fragment		22	2	81	11	106		6			2
TOTALS	0	40	5	82	11	133	0	6	0	0	2

Table 4.9. Metal Artifacts.

Metal	Depositional Units 1		2		3a		3b		3c		3d		3e		4		5		7		8	
	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt
Type A cut nail			1	0.6							1	1.0										
Type B cut nail	46	233.7	73	51.1	8	0.0	99	1107.9	67	0.0	719	1321.1	4	0.0	7	16.6	9	0.0	5	18.0	21	69.6
Cut nail			1	0.0							2	8.6										
Nail (unknown type)							4	0.3			5	16.4	1	11.9	1	0.0					1	5.4
Wire nail	3	0.0	5	2.6	2	0.0	4	0.0			21	13.8					2	0.0	1	10.6	1	0.0
Coin- Japanese 4-mon			1	N/A																		
Coin- 1 cent					1	N/A	1	N/A			2	N/A										
Coin- 2 cent											1	N/A										
Shell card token (1868)											1	N/A										
Bottle top seal											1	N/A										
Salt shaker top							1	12.1														
Sardine can											6	133.4										
Sardine can, lid											1	N/A										
Tin, for mints											1	N/A										
Wrapper			2	1.7							1	0.3										
Bowl											2	N/A										
Flatware (fork, knife, spoon)							1	0.0			9	30.5			1	0.0					1	0.0
Comb											1	N/A										
Dentures															1	26.7						
Buckle									1	12.7	5	9.6			1	1.6						
Button			1	0.0	1	0.0					3	1.0										
Cuff link											1	N/A										
Hairpin											1	1.5										
Hatpin											1	N/A										
Spectacles											1	N/A										
Unknown roundish metal	1	1.4																				
Key											2	19.6										
Key hole											1	18.0										
Hex key			1	39.2																		
Lamp and lamp parts											6	27.0										
Scale part											5	8.4										

Scissor handle											1	6.7										
Bullet cartridge															1	2.4						
Wire nail or Pin			1	0.1			1	0.2			3	27.1										
Pin							3	0.1			19	2.8										
Screw			3	1.4					2	0.0	8	11.7									1	0.0
Nozzle											3	20.4										
Nut											1	41.2										
Pipe, end			1	75.5																		
Pipe or Coil			9	0.0																		
Plate											2	56.9										
Plate, with nail											1	6.5										
Railroad spike																	2	613.2				
Rim											3	76.6										
Ring							2	4.1			1	6.6										
Rod			3	10.4	1	90.0	1	6.4			12	371.2	1	22.1	1	16.3					1	2.5
Rod or hook											1	8.1										
Rod or nail							1	25.6														
Rod or wire			1	9.5							1	2.5										
Axle							1	28.3														
Bar	1	69.5					3	186.2			13	440.1										
Base											2	8.2										
Base or Bell					4	2.7																
Bell											1	N/A										
Bolt											1	N/A										
Bracket											1	4.2										
Bracket for gaslight											1	N/A										
Casing/ Tubing			1	0.2			2	10.1			5	229.6										
Chain									1	5.8	1	4.4										
Coil			10	13.3			10	41.9														
Decoration											4	3.5										
Fastener									1	3.2	7	5.2										
Ferrule			1	6.8							1	1.1					1	1.3				
File											2	N/A										
Gear											1	20.8										
Gear or cog wheel			1	92.8							1	10.2										
Handle											1	29.8										
Hanging tab															1	2.5						
Hinge											3	442.3										

Hinge with screw											1	17.8										
Hook							1	0.0			1	26.9										
Latch											1	33.0										
Sheet metal			5	16.6			5	145.6			27	625.6			2	62.4						
Sickle											1	N/A										
Spike							1	43.9			1	196.3										
Steel wool											1	N/A										
Tack											1	N/A										
Thimble											2	N/A										
Tie, for bale							1	13.3	1	8.7												
Umbrella frame							1	18.9														
Wheel			1	17.6					1	27.6												
Wire (tie, fastener, loop, etc.)			11	9.5			29	91.3	7	56.2	137	1027.6	2	3.3	2	10.4					3	11.2
Unidentified metal	3	597.1	2	0.0	6	137.4	15	17.2	4	17.9	84	1641.7	1	289.2	8	248.8					10	70.1
TOTALS	54	901.7	135	348.9	23	230.1	187	1753.4	85	132.1	1,158	7016.8	9	326.5	26	387.7	14	614.5	6	28.6	39	158.8

Table 4.10. Miscellaneous Cultural Material.

Material	Depositional Units																					
	1		2		3a		3b		3c		3d		3e		4		5		7		8	
	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt
Charcoal	1	5.2			5	13.4					12	7.9			1	2.4					2	28.2
Coal/ Anthracite/ Slag							8	31.0			30	125.8	2	13.8	2	25.2						
Concrete/ Mortar/ Cement	1	N/A									2	276.0	2	N/A							2	43.2
Tarpaper/ Tar	7	33.0					1	N/A			1	50.0										
Cork			8	N/A			11	N/A	1	N/A	80	3.8	1	N/A	1	N/A						
Rope (string, twine, etc.)			1	N/A			1	N/A			3	N/A										
Cording/ Wadding/ Hemp											1	N/A										
Horsehair stuffing											1	N/A										
Textile (misc. fabric)	1	N/A					1	N/A			6	N/A										
Paper							1	N/A														
Plastic																						
Button											1	1.3										
Unidentified plastic											1	0.2										
Rubber																						
Button													1	1.7								
Comb							1	1.5			5	26.2										
Rubber band			1	N/A							1	0.0										
Rubber ring											1	0.0										
Unidentified rubber							1	N/A			5	5.6	1	24.1	2	N/A						
Undetermined artifacts			3	8.9	1	0.0	12	N/A			14	N/A			1	N/A						
TOTALS	10	38.2	13	8.9	6	13.4	37	32.5	1	0.0	164	496.8	7	39.6	7	27.6	0	0.0	0	0.0	4	71.4

Table 4.11. Faunal Remains.

Faunal Remains	1		2		3a		3b		3c		3d		3e		4		5		7		8	
	Depositional Units																					
	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt	Ct	Wt
Cow (*Bos taurus*)	1	0.0	14	525.3	3	4.0	24	28.0	11	0.0	138	173.3	2	0.0	7	0.0			1	27.1	3	0.0
Pig (*Sus scrofa*)	2	0.0	29	0.0	1	0.0	27	14.0	14	0.0	179	431.6			3	0.0	1	6.1			1	0.0
Sheep or goat (small caprine)			20	0.0	1	53.4	28	52.2	13	0.0	193	483.7	1	0.0	9	0.0	1	0.0	2	0.0	1	0.0
Rabbit (*Oryctolagus cunniculus*)					1	21.3	1	14.0														
Raccoon (*Procyon lotor*)											1	0.0										
Rat (*Rattus sp.*)			4	0.0	1	0.0					6	8.0	1	0.0							5	0.0
Rodent													1	0.0								
Cat (*Catus domesticus*)											17	0.0										
Dog (*Canis familiaris*)																	1	0.0				
Large ungulate	3	0.0	5	0.0	1	0.0	9	50.9	1	0.0	41	144.2			3	0.0						
Small artiodactyl			16	0.0	3	46.9	28	33.0	6	0.0	137	357.8	2	0.0			2	0.0			2	0.0
Unidentified mammal	5	0.0	9	0.0	16	227.4	78	374.9	8	0.0	196	403.9	2	0.0	7	0.0	3	0.0	1	0.0	3	0.0
Chicken (*Gallus gallus*)			7	0.0	3	57.3	26	42.0	3	0.0	114	924.3	1	0.0	6	0.0	2	0.0	1	24.8	2	0.0
Domestic goose (*Anser anser*)							1	0.0			6	0.0										
Domestic duck/ Mallard (*Anas platyrhynchos*)			4	0.0							17	28.6										
Turkey (*Meleagis gallopavo*)							8	16.9			5	0.0			2	0.0						
Pidgeon (*Columba livia*)											1	0.0										
Unidentified bird	2	0.0	5	0.0	4	12.1	21	96.4	6	0.0	80	353.4	3	0.0			3	0.0			3	0.0
Unidentified fish			4	0.0			2	0.0	1	0.0	62	129.3										
Unidentified faunal remains	2	0.0	2	0.0			7	56.0	2	0.0	33	82.8	1	0.0	1	0.0	4	0.0				
TOTALS	15	0.0	119	525.3	34	422.4	260	778.3	65	0.0	1,226	3,520.9	14	0.0	38	0.0	17	6.1	5	51.9	20	0.0

Faunal Artifacts	1 Ct	1 Wt	2 Ct	2 Wt	3a Ct	3a Wt	3b Ct	3b Wt	3c Ct	3c Wt	3d Ct	3d Wt	3e Ct	3e Wt	4 Ct	4 Wt	5 Ct	5 Wt	7 Ct	7 Wt	8 Ct	8 Wt
Bone brush											2	12.2										
Button											3	0.2										

Table 4.12. Miscellaneous Faunal Remains.

Misc. Faunal Remains	**Depositional Units** 1		2		3a		3b		3c		3d		3e		4		5		7		8	
	Ct	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**
Oyster	6	45.7	24	681.3	1	6.2	13	98.4	1	59.2	69	1,333.1	4	125.7	2	18.8	5	88.9	1	4.0	2	3.5
Clam			18	104.7	1	4.6	13	58.3			12	156.5	2	105.0	1	9.7	1	4.3	3	6.5	1	N/A
Mussell							1	1.7														
Indeterminate bivalve			6	15.4							3	1.8							1	1.5		
Indeterminate brachiopod											1	0.2										
Indeterminate gastropod			2	2.0			1	2.2			2	2.3										
Indeterminate shell			21	0.3							8	6.9										
Barnacle																						
Coral											1	8.1										
Crab claw											1	N/A										
Indeterminate Cephlapod			1	2.3																		
Fish scale											2	N/A										
Egg shell											1	N/A										
Insect casings			1	N/A																		
TOTALS	6	45.7	73	806.0	2	10.8	28	160.6	1	59.2	100	1,508.9	6	230.7	3	28.5	6	93.2	5	12.0	3	3.5

Table 4.13. Ethnobotanical Remains.

Ethnobotanical Remains	1		2		3a		3b		3c		3d		3e		4		5		7		8	
	Ct	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**	**Ct**	**Wt**
Rosaceae Family																						
Peach			26	73.9			32	63.4			110	330.2	1	2.1	2	9.0						
Plum											1	0.3										
Pear											2	0.1										
Raspberry/ Blackberry											1	N/A										
Cucurbitaceae Family																						
Melon							6	0.6			88	5.2										
Pumpkin											2	0.2										
Squash			9	0.6			5	0.3			68	31.2										
Arecaceae Family																						
Coconut							1	6.2			25	250.1										
Fabaceae Family																						
Peanut											1	0.4										
Juglandaceae Family																						
Walnut			1	8.3							1	2.0										
Fagaceae Family																						
Chestnut (Tree Nut)											1	2.0										
Acorn											1	N/A										
Unidentified floral remains									1	N/A	2	N/A										
TOTALS	0	0.0	36	82.8	0	0.0	44	70.5	1	0.0	303	621.7	1	2.1	2	9.0	0	0.0	0	0.0	0	0.0

Table 4.14. Maker's Marks on Ceramic Objects.*

Artifact Number	Ceramic Artifact Type	Maker's Mark	City	Country	Start Date	End Date
8.01	Bottle	A NATTER 72		United States		
29.01	Brick	…S.E.T. Co				
30.01	Brick	..SENE				
140.02	refined earthenware	Partial maker's mark: striped shield with "Edward" written in ribbon below	Tunstall	England	1865	1877
153.01	Door Knob			England	1850	1899
181.03	Plate	"E.PE….CO…N"			1840	
185.05	Vessel	RO…FURGE …			1840	
186.01	whiteware egg cradle	"L.M. & C. … DEPOSÉ. … L ET MONTE	Creil/Montereau	France	1840	1875
196.02	Plate		Burslem	England	1860	1894
209.01	Jar			England		1880
236.01	pipe stem	stem with "ASGOW" probably read GLASGOW, MCDougall and Glasgow Pipe?	Glasgow	Scotland	1879	1891
236.02	pipe stem	WW "79" and "SGOW" (79 W WHITE and GLASGOW)// 79	Glasgow	Scotland	1854	1891
238.01	Vessel	S…JOHN…M ADE	Tunstall	England	1853	1871
238.08	Plate	PARISIAN…G			1840	
258.01	Doll - Face			Germany	1860	1860
267.01	whiteware bowl	"JOHN E […]"// : HAVR (on base)	Longton/Fenton	England	1847	1900
359.01-359.10	Copper Luster Octagonal sugar bowl			England	1845	1855
446.05-446.10 and 446.14	Plate	Thomas Hughes Burslem	Stoke-on-Trent	England	1860	1895
464.01	jug		Westerwald	Germany		1899
525.01	storage pot	13 WS Corwin and Company,	New York	United States		

		Groceries, 867 Sixth Ave, NY				
539.01	stoneware mineral water bottle		Westerwald	Germany	1871	1871
540.01	Vessel	Porcelain Opaque				
553.01	stoneware bottle		Glasgow	Scotland	1866	1929
553.01	bottle	H. Kennedy./Barrowfield -3- Pottery/Glasgow.				
557.01	bottle	..Moore…				
560.01	refined earthenware dishware	Porcelain/Anthony Shaw/Opaque	Newport/ Burslem	England	1851	1882
561.01	ironstone serving bowl	..Granite….Forster	Tunstall	England	1853	1871
562.01	refined earthenware dishware	Porcelaine De Terre/trademark /John Edwards	Longton/ Fenton	England	1880	1900
563.01	Smoking Pipe	Meerschaum Pipes "444 54th street"	New York	United States	1850	1884
564.02	food mold				1830	1900
565.01	bowl	wedgwood				
568.01	plate	imperial stone china/chetwynd &co				
572.01	refined earthenware dishware		Glasgow	Scotland	1866	1929
573.01	bottle	H Doerrbecker Z				
575.01	ironstone plate	Maddock & Son/ Burslem	Burslem	England	1855	1870
576.01	ironstone saucer	Edward Clark/Porcelain Opaque/Tunstall	Tunstall	England	1865	1877
581.01	pipe stem	Timothee Trimm Petit	St. Omer	France	1833	1892
585.01	jug	Nassau Selter's		Germany		
586.01	ironstone plate	Royal Patent/ironstone /turnergoddard	Tunstall	England	1867	1874
592.01	ironstone plate	T&R Boote	Burslem	England	1890	1906
593.01	ironstone bowl	Turner Goddard	Tunstall	England	1867	1874
614.01	stoneware mineral water bottle	SELTERS. HERZOGTHUM NASSAU.	Westerwald	Germany		1899

636.01	blue willow platter			England	1790	
641.01	ironstone plate		Staffordshire	England	1865	1877
663.01	ironstone plate		Cobridge	England	1853	1873
671.01	Doll - Body			Germany	1860	1860
707.02	jar lid	X Bazin Succesor to E Roussel 114 chestnut street Philadelphia	Philadelphia	United States		
748.01	Bottle	JOHN A HOEPB				
765.08	Bowl	[…] A				
765.09	Bowl	[…] CHINA				
765.10	Bowl	[…] RCE JONES […] ON TRENT [..] 1867 MEDAL				
808.01	pipe stem	pipe stem with partial "D 79 white": W.White Co. of Glasgow Mold No. 70, bore diameter 1/16 of an inch, charring (light) on exterior, red staining,	Glasgow	Scotland	1805	1955
811.01	Bottle	KAHTH & SNYDER				
812.01	Jug	eagle with crown emblem. "B. fum 4" underneath handle//SELTERS. NASSAU.	Westerwald	Germany		
829.01	Jug	[…] OGTHUM NASSAU				
833.01	pipe stem		Vienna	Austria		1873
866.01	pipe stem		Gouda, Holland; or Germany	Netherlands or Germany	1850	1891
869.01	ironstone plate fragments	JOHN E […]	Longton/Fenton	England	1873	1900
901.02	pipe stem		Gouda, Holland; or Germany	Netherlands or Germany	1850	1891
917.01	Bottle	D.L.O. & Son.				
917.02	Bottle	MORGAN & BRO				
917.03	Bottle	M MCO				
918.01	ironstone plate	GEORGE JONES	Stoke-on-Trent	England	1861	1873

		STOKEON TRENT				
938.01	ironstone plate fragments		Staffordshire	England	1865	1887
938.02	Plate	EDW[ARD CLARKE] PORCELAIN				
938.03	Plate	[EDW] ARD CLARKE				
945.01	Doll			Germany	1860	1860
949.01	Doll			Germany	1860	1860
951.01	pipe bowl		Gouda, Holland; or Germany	Netherlands or Germany	1850	1891
952.01	Figurine- Chick Head			England	1830	1870
955.01	pipe bowl		Gouda, Holland; or Germany	Netherlands or Germany	1850	1891
958.01	Doll- Head			Germany	1860	1860
963.01	ironstone saucer	IRONSTONE CHINA. POWELL & BISHOP	Hanley	England	1867	1878
963.02	ironstone plate	[…]KE… OPAQUE	Staffordshire	England	1865	1887
969.01	ironstone basin	AD. MOORE & Co. […] OINTMENT […] HER MAJESTY […] DROIT	Cauldon Place, Stoke-on- Trent	England	1862	1904
970.01	ironstone plate	EDWARD TUNSTALL CLAR […] OPAQUE PORCELAINE	Tunstall	England	1865	1877
970.02	Plate	[…] TRADE […]				
973.01	Saucer	ROYAL IR […] GE		England		
974.01	ironstone plate	IMPERIAL PARISIAN GRANITE. ELSMORE & FORSTER	Tunstall	England	1853	1871
1008.01	Vessel	CARR CHINA Co.				
1010.01	ironstone saucer	BRIDGEWOOD & CLARKE	Burslem/Tunstall	England	1857	1864
1011.01	ironstone plate	IRONSTONE CHINA. POWELL & BISHOP	Hanley	England	1869	1869
1017.01	ironstone saucer	MADDOCK & SON	Burslem	England	1855	1870

1028.05	Plate	CLARKE				
1045.01	ironstone plate	RO […] IRO […] BURGESS	Longton	England	1840	1899
1062.01	Jug	B. Num 3				
1066.01	ironstone plate	STONE CHINA. HOPE & CARTER BURLSEM	Burslem	England	1860	1865
1067.01	ironstone plate	STONE CHINA. JAMES EDW [ARD] & SON. DALEH [ALL]	Burslem	England	1851	1882
1068.01	ironstone plate		Burslem	England	1862	1880
1070.01	mineral water jug	Apollinaris- Brunnen- M-W George Kreuzberg Ahrweiler Rheinpreussen		Germany	1852	1879
1074.01	ironstone plate	IRONSTONE. EDWARD PEARSON COBRIDGE	Cobridge	England	1853	1873
1090.01	pipe stem		Gouda, Holland; or Germany	Netherlands or Germany	1835	1898
1121.07	Smoking Pipe	(1) white clay stem, measures 3cm in length, 5/64 of an inch bore diameter, text: recto: "MEERSCHA[…]", verso: "54TH STREET")	New York	United States	1850	1884
1178.01	ironstone saucer		Tunstall	England	1841	1860
1209.02	ironstone oval platter	Cockson Chetwynd & CO/Cobridge	Cobridge, Stoke-on-Trent	England	1866	1875
1218.01	ironstone saucer	Davenport	Longport	England	1853	1853
1239.04	Bottle	G schotts?				
1239.05	bottle	DL Olmsby & SG				
1291.01	Bottle	GEILS & STEINECKE'S				
1306.01	ironstone decorative dish	HONI SOIT QUI MAL Y PENSE. BAKE […]	Fenton, Staffordshire	England	1839	1893
1307.01	ironstone plate	IMPERIAL IRONSTONE CHINA	Cobridge	England	1866	1875

		COCKSON. CHETWYND & Co.				
1308.01	ironstone plate	IMPERIAL. IRONSTONE. CHINA. COCKSON. CHETWYND & C'	Cobridge	England	1866	1875
1309.01	ironstone plate	TRADE MARK. EDWARD TUNSTALL CLARKE. OPAQUE PORCELAINE.	Tunstall	England	1865	1877
1334.01	Saucer	O.P. CO. SYRACUSE - CHINA.				
1336.01	ironstone plate	T. & P. ROYAL [..] IRONSTONE	Burslem	England	1890	1906
1425.01	Bottle	F.Munch				
1425.02	Bottle	...A HOFRBR…				
1467.01	alphabet/proverb plate fragments		Hanley	England	1830	1870
1863.01	Bottle	SCHARMANN & GLUCK				
2063.01	ironstone plate		Shelton	England	1845	1858
2063.01	Plate	F. MORLEY & CO.				
2063.02	Plate	REAL STONE CHINA				
2064.01	Plate	PEARL IRONSTONE CHINA. W & C. H.				
2065.01	ironstone washbasin		Cobridge	England	1853	1873
2065.02	Basin	STONE CHINA EDWARD PEARSON COBRIDGE				
2066.01	Serving dish	IRONSTONE CHINA. JOHN FARRALL.	Stoke-on-Trent	England	1854	1854
2189.01	ironstone muffin plate	T&R BOOTE	Burslem	England	1856	1856
2190.01	ironstone plate	IMPERIAL IRONSTONE CHINA. COCKSON.	Cobridge	England	1866	1875

		CHETWYND & Co				
2194.01	ironstone plate		Staffordshire	England	1865	1887
2463.01	pipe stem		Gouda, Holland; or Germany	Netherlands or Germany	1850	
2586.01	ironstone plate	[…] TERRE […] ARK […] EDWARDS	Longton/Fenton	England	1880	1900
2643.01	Plate	[…] TRADE […] STAFFORDSH IRE				
2644.01	ironstone plate		Burslem	England	1864	1864
2652.02	Plate	IRON […]				
2677.01	stoneware mineral water jug		Westerwald region	Germany	1875	1899
2696.01	jar lid	ORIENTA[L TOOTH PASTE/ FOR] CLEANSIN[G BEAUTIFYIN G]/ AND PRESERVING [THE TEETH AND GUMS]/ PRE[PARED BY]/ JEWSB[URY AND BROWN/ CHEMISTS]/ 113 MAR[KET STREET MANCHESTE R	113 Market Street, Manchester	England	1857	1892
2699.01	ovular serving bowl	TRADE MARK. EDWARD TUNSTALL CLARKE. OPAQUE PORCELAINE	Tunstall	England	1865	1877
2700.01	ironstone plate	ROYLSTONE CHINA. WEDGWOOD & Co. STONE GRANITE WEDGEWOD OD & Co	Tunstall	England	1860	1899
2715.01-2715.05	pipe bowl		Nottingham	England	1820	1840
2766.01	dishware	STONE CHINA.	Newport/Bursle m	England	1851	1882

		ANTHONY SH […] BURS […]				
2766.02	Vessel	IRONST […] R […]				
2788.01	ironstone plate		Burslem/ Tunstall	England	1863	1863
2798.01	Doll - Face			Germany	1854	1930
2798.02	Doll- Face			Germany	1854	1930
2799.01	Plate	[…] HAW […] EM	Burslem	England	1851	1882
2802.01	ironstone plate	Ironstone/ J. Wedgwood/ China	Burslem/ Tunstall	England	1841	1860
2802.02-2801.07	saucer	Ironstone/ J. Wedgwood/ China			1860	1900
2830.01	ironstone bowl	ROYAL IRONSTONE CHINA LIVESLEY & DAVIS HANLEY	Hanley	England	1867	1871
2831.01	Vessel	WARRANTED STAFFORDSHIRE				
2930.01	Brick	[…] USET Co				
2943.01	Candlestick Holder			England	1875	1899
2971.01	Bottle	MORGAN & BRO				
2980.01	ironstone plate		Staffordshire	England		
2980.02	Vessel	[…] AL…CHINA.. L COCK				
2983.02	Vessel	SOO [..]				
3017.01	pipe stem		Gouda, Holland; or Germany	Netherlands or Germany	1850	
3198.01	ironstone plate	IMPERIAL PARISIAN GRANITE. ELSMORE & FORSTER	Tunstall	England	1853	1871
3279.01	ironstone plate	[..] ORG […] EDWARD […] TUNST […]	Tunstall	England	1865	1877
3283.01	toilet bowl spout	T.C. BROWN WESTHEAD MOORE & CO	Cauldon Place, Stoke-on-Trent	England	1862	1904
3327.01	ironstone plate	A KOCH	Burslem	England	1851	1882
3328.01	bottle	JH DOERRBECKER				
3328.02	bottle	W ROOS				

3329.01	bottle	W ROOS				
3330.01	plate	Por[celaine Opaque] Bridgwood & Son				
3336.01	ironstone pitcher/bowl	Stone China/Bola blue/[W. Ada]ms & Sons	Tunstall	England	1835	1855
3340.01	ironstone saucer	Edward Clar[ke/ Porcelaine Opaque]/Tunstal	Tunstall	England	1865	1877
3362.01	pipe stem			Netherlands or Germany	1850	

* Note: Brackets denote incomplete text, and backslashes indicate space and line change.

Table 4.15. Diagnostic Features of Chimney/Lantern Glass Recovered from Depositional Unit 3d.

Artifact Num.	**Glass Covering Type**	**Lip Style**	**Lip Diameter (cm)**	**Lamp/Lantern Type**
Archaeological Unit 2				
1821.01	Chimney	Smooth Lip	1.5	Oil Lamp
2002.01	Globe	Smooth Lip	3.2	Dead-Flame Lantern
2089.01	Globe	Flared Lip	2.75	Hot-Blast Lantern
2245.01	Chimney	Flared Lip	2.0	Oil Lamp
2359.01	Chimney	Flared Lip	2.5	Oil Lamp
2394.01	Chimney	Flared Lip	2.0	Oil Lamp
STP 7.6				
1086.01	Chimney	Smooth Lip	2.0	Oil Lamp

Table 4.16. Description of Depositional Units.

Unit	Characteristics	Cultural materials	Age
8 Parking lot fill	Heterogeneous strata of friable, granular sandy loam and black, loose coal slag, capped by concrete and asphalt.	Mixed 19th and 20th century materials. The brick foundation and wooden cribbing were surrounded and filled by this stratum.	AD 1988 (TPQ)
7 Rail embankment improvements	Friable, granular, sandy loam with coal, brick, angular cobbles and pebbles, primarily of schist.	Mixed 19th and 20th century artifacts.	ca. 1931-1933 (archival sources)
6 Railbeds	Loose, angular schist cobbles and sand.	None.	ca. 1892 (archival sources)
5 Redeposited sandy material	Friable, granular sandy loam, oxidized.	Artifacts include building materials, food waste, and dishware.	AD 1890 (TPQ)
4: Stockyard pavement			
4c Surface of Belgian block pavement	Compact, firm plant material and sand in the crevices of the paving blocks.	Sparse residential, commercial, and industrial debris.	AD 1890 (TPQ)
4b Belgian block pavement	Rough, hand-cut stone blocks with the tops measuring 15 X 15 cm (6 X 6 in).	Layer is entirely cultural in origin.	AD 1874 (TPQ)
4a Sandy substrate	Well-sorted, granular medium-grained sand.	Sparse residential, commercial, and industrial debris.	AD 1874 (TPQ)
3: Landfill			
3d Final trash landfill	Friable, granular sandy silt loam with ash, burned material, and artifacts.	Numerous residential, commercial, and industrial items. This stratum and 3b contain the vast majority of artifacts recovered during the excavation.	AD 1874 (TPQ)
3c Runoff deposit	Alternating bands of coarse and fine sand.	Small fragments of brick and other historic debris.	ca. September 29, 1874
3b Initial trash landfill	Like 3d.	Like 3d.	AD 1870 (TPQ)
3a Stony landfill	Firm to friable, granular sandy loam with 50% cobbles and boulders, mostly schist. Primarily around the exterior of the well in the bed of the former stream.		AD 1870 (TPQ)
2: Estuarine cove			
2c	Firm, subangular blocky	Accumulated around the	ca. AD 1807-1874 (age

Historic clay silt	clay silt with lighter and darker laminations. 5% mica flecks and shell fragments.	wooden harbor posts. Contained occasional brick, cattle bone, and shell. The upper surface contained numerous materials which migrated downwards from the landfill above.	of post to date of stockyard construction)
2b Sand	Loose, single grain, well sorted f sand, coarsens downward to poorly sorted, fmc sand with 10% mica flecks.	The wooden harbor posts were set into this layer.	ca. AD 1807 (dendrochronological results for post)
2a Early silts and clays	Alternating bands of firm, subangular blocky silty clay and friable, granular fine sand. Increasing gravel component with depth. Many bivalve shells.	None.	Cal BP 1365 to 645/ Cal AD 585 to 1305 (Beta-374387)

1: Sandy post-glacial landform

1b Historic surface of landform (A and B horizons)	Mature horizonation. Gradual transition to C horizon below.	Charcoal, brick, and glass fragments present in A horizon, decreasing with depth. The stone foundation was built into this surface, as was the base of the well.	AD 1870 (TPQ)
1a Parent material of landform (C horizon)	Friable, granular to weakly subangular blocky fine silty sand.	None.	Cal BP 10245 to 10160/ Cal BC 8295 to 8210 (Beta-374382)

0 Schist boulders and bedrock	Large boulders of schist. Visible in places through the surface of the harbor sediment, and exposed by machine cuts into the sediment.	None.	Paleozoic with Pleistocene disturbance

Table 4.17. Texture, Carbon Content, and pH of Sediment Samples.

Depth (cmbs)	Sample #	Zone	Texture	gravel %	sand%	silt%	clay%	Org. Carbon LOI 550	CaCO3 LOI 1000	pH
209	3370	1	Silty Clay Loam	0.0	7.0	58.9	34.2	7.64	2.01	
229	3374	1	Silty Clay Loam	0.0	12.0	60.7	27.3	6.24	2.69	6.25
250	3379	1	Silty Clay Loam	0.0	8.4	57.7	33.9	6.29	2.00	4.01
269	3383	1	Silty Clay Loam	0.0	3.7	63.8	32.6	6.10	2.02	5.87
291	3389	1	Silt Loam	0.0	5.9	68.7	25.4	5.91	2.15	5.77
316	3395	1	Silty Clay Loam	0.0	6.9	62.4	30.8	6.10	2.34	6.64
331	3398	1	Silty Clay Loam	0.0	8.2	60.3	31.5	5.66	2.40	6.14
349	3402	2	Sandy Loam	0.0	75.6	16.5	8.0	2.35	1.68	5.75
369	3406	2	Sandy Loam	0.0	75.6	16.6	7.9	2.40	1.30	4.62
408	3415	3	Silt Loam	0.0	15.8	63.7	20.5	5.29	1.69	3.32
428	3419	3	Loam	0.0	40.2	41.3	18.5	4.92	1.44	3.00
436	3421	3	Gravelly Sandy Loam	26.3	67.3	20.2	12.5	2.83	1.04	4.18
449	3429	3	Very Gravelly Sandy Loam	40.9	79.0	9.4	11.7	1.58	0.83	5.64
477	3433	3	Gravelly Loamy Sand	34.6	81.9	12.3	5.8	1.56	0.90	
492	3436	3	Gravelly Loamy Sand	27.9	81.1	11.5	7.4	1.33	0.91	5.61
516	3441	4	Silt Loam	0.0	18.2	66.4	15.5	1.55	1.34	6.63
521	3442	4	Silt Loam	0.0	2.7	82.8	14.5	2.14	1.13	6.56
531	3444	4	Silt Loam	0.0	4.4	79.2	16.3	2.40	1.33	7.24
541	3448	4	Sand	0.0	89.8	6.4	3.8	0.82	0.32	6.15
560	3453	5	Silt Loam	0.0	27.0	64.3	8.7	2.19	1.13	7.08
580	3457	5	Silt	0.0	2.5	89.5	8.0	2.41	2.89	6.13
600	3461	5	Silt	0.0	1.7	91.3	7.0	2.41	1.06	6.40
610	3463	5	Silt	0.0	1.3	91.8	7.0	2.21	0.95	6.77

Table 4.18. Sand Percentages in Each Sample with Statistics.

Depth (cmbs)	Samp. #	-1.0 to -0.5 phi	-0.5 to 0.0 phi	0.0 to 0.5 phi	0.5 to 1.0 phi	1.0 to 1.5 phi	1.5 to 2.0 phi	2.0 to 2.5 phi	2.5 to 3.0 phi	3.0 to 3.5 phi	3.5 to 4.0 phi	Sand Statistics Mean	Std. Dev.	Skew	Kurt.	<2 mm Statistics Mean	Std. Dev.	Skew	Kurt.
209	3370	17.43	8.25	9.35	0.04	11.42	15.65	10.36	0.00	21.11	6.39	1.45	1.52	-0.10	1.67	7.05	2.44	-0.47	3.56
229	3374	51.88	3.82	5.26	5.24	5.92	4.66	3.96	3.61	2.51	13.14	0.57	1.68	0.87	2.20	6.44	2.84	-0.76	3.81
250	3379	0.57	7.28	34.93	4.40	4.74	6.25	5.75	4.93	9.40	21.75	1.65	1.52	0.25	1.40	6.99	2.50	-0.46	3.32
269	3383	0.00	2.55	0.21	6.23	2.82	4.15	2.50	7.08	12.77	61.68	3.13	1.05	-1.75	4.93	7.20	2.03	0.36	2.18
291	3389	3.48	2.63	3.23	2.54	4.23	7.06	9.88	8.71	11.20	47.04	2.76	1.29	-1.27	3.62	6.82	2.03	0.29	3.28
316	3395	3.36	1.99	2.86	4.35	6.03	4.23	5.23	6.76	10.55	54.65	2.85	1.30	-1.36	3.65	7.02	2.17	0.09	2.81
331	3398	1.62	5.37	3.88	3.63	5.01	4.54	6.18	11.53	8.66	49.57	2.75	1.33	-1.18	3.12	6.99	2.25	-0.03	2.85
349	3402	1.39	0.45	0.67	1.25	2.83	6.61	16.95	32.74	23.62	13.50	2.71	0.82	-1.56	7.02	3.83	2.29	1.41	4.67
369	3406	0.41	1.12	0.79	1.56	3.41	7.72	17.43	32.24	23.14	12.17	2.67	0.80	-1.28	5.62	3.80	2.29	1.43	4.65
408	3415	5.19	2.84	4.08	6.96	10.72	14.52	8.50	14.67	12.15	20.37	2.16	1.31	-0.55	2.40	6.21	2.42	-0.21	3.4
428	3419	6.35	6.03	7.52	9.82	11.20	10.91	10.49	17.84	11.39	8.45	1.77	1.32	-0.31	2.04	5.04	3.15	0.06	2.12
436	3421	3.95	7.03	8.21	8.07	10.38	11.35	14.10	23.74	8.44	4.72	1.78	1.21	-0.44	2.17	3.66	3.08	0.81	2.71
449	3429	1.92	3.96	5.54	8.22	10.78	10.93	13.40	27.66	10.80	6.78	2.04	1.12	-0.59	2.55	3.35	2.86	1.29	3.8
477	3433	3.38	5.40	6.78	7.87	10.04	11.11	14.37	26.25	9.43	5.37	1.91	1.18	-0.57	2.40	2.88	2.46	1.34	4.78
492	3436	2.83	5.24	5.98	7.10	8.38	9.37	12.54	30.63	11.45	6.47	2.04	1.18	-0.71	2.56	3.09	2.55	1.32	4.55
516	3441	3.47	3.40	4.23	8.27	11.67	11.53	14.41	21.23	14.21	7.57	2.04	1.16	-0.60	2.62	5.9	2.36	-0.21	3.54

521	3442	0.00	0.00	14.97	34.57	5.84	6.13	7.84	14.65	7.20	8.80	1.62	1.17	0.49	1.78	6.46	1.63	0.64	6
531	3444	0.00	0.29	4.22	7.61	11.11	16.17	16.10	15.77	11.69	17.04	2.30	1.02	-0.21	2.11	6.49	1.74	0.6	4.77
541	3448	2.68	6.91	12.09	14.97	18.75	15.75	12.33	10.34	3.51	2.66	1.39	1.05	0.11	2.43	2.01	2.18	2.06	7.71
560	3453	1.33	1.34	0.25	0.30	1.67	1.24	3.77	5.75	22.16	62.19	3.33	0.85	-3.06	13.12	5.63	1.84	0.36	4.55
580	3457	5.06	0.93	2.50	2.43	4.92	6.92	4.92	11.06	11.77	49.50	2.82	1.29	-1.43	4.08	6.24	1.23	1.47	10.26
600	3461	0.00	2.87	1.80	4.19	9.82	11.26	7.43	18.56	10.42	33.65	2.63	1.11	-0.75	2.63	6.22	1.13	1.86	11.57
610	3463	1.14	8.24	0.00	0.00	11.21	4.00	8.01	14.53	12.70	40.16	2.68	1.27	-1.15	3.30	6.24	1.1	2.14	12.17

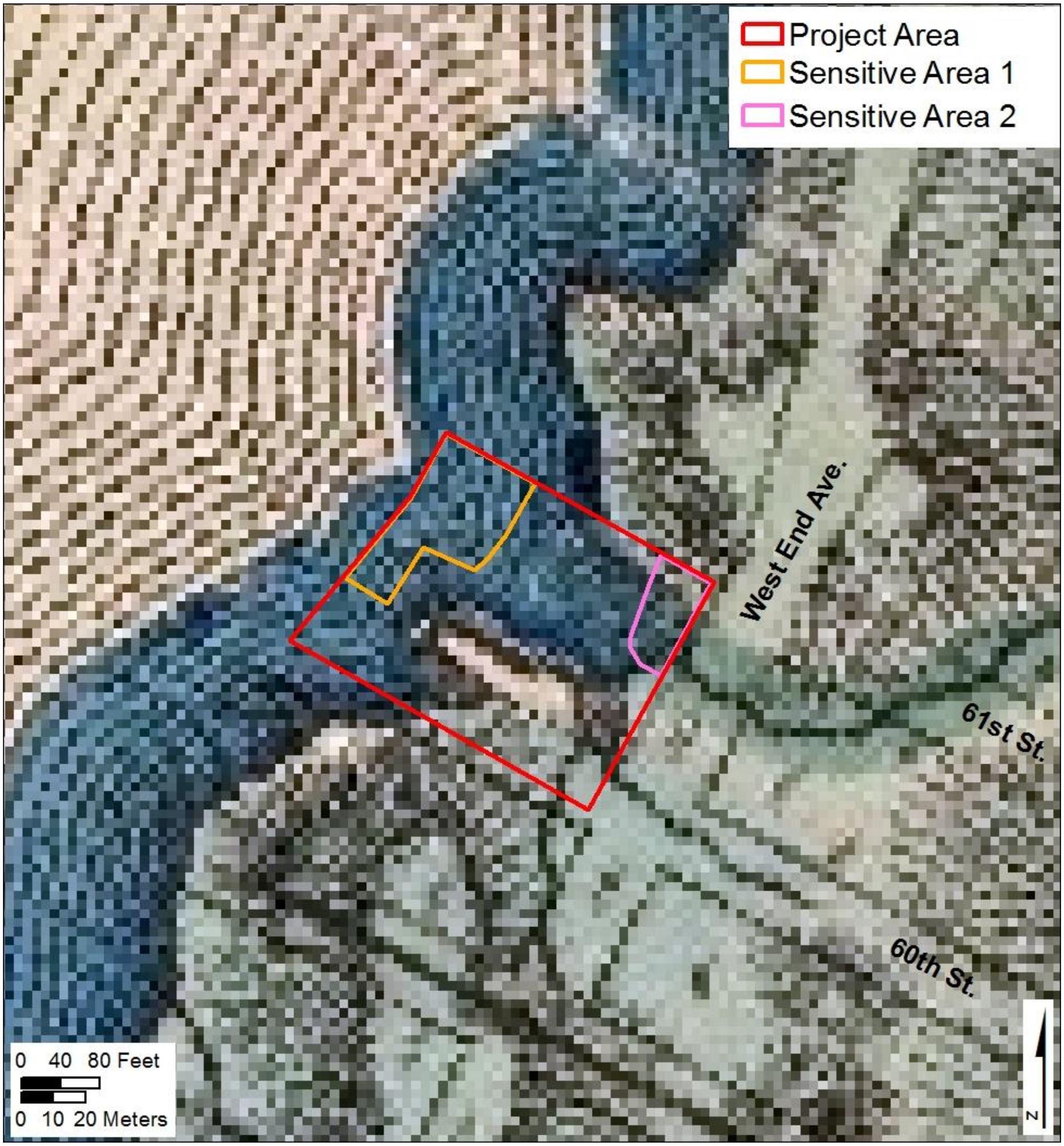


Figure 4.1. Project area with sensitive areas overlayed on to the Viele (1865) map of Manhattan.

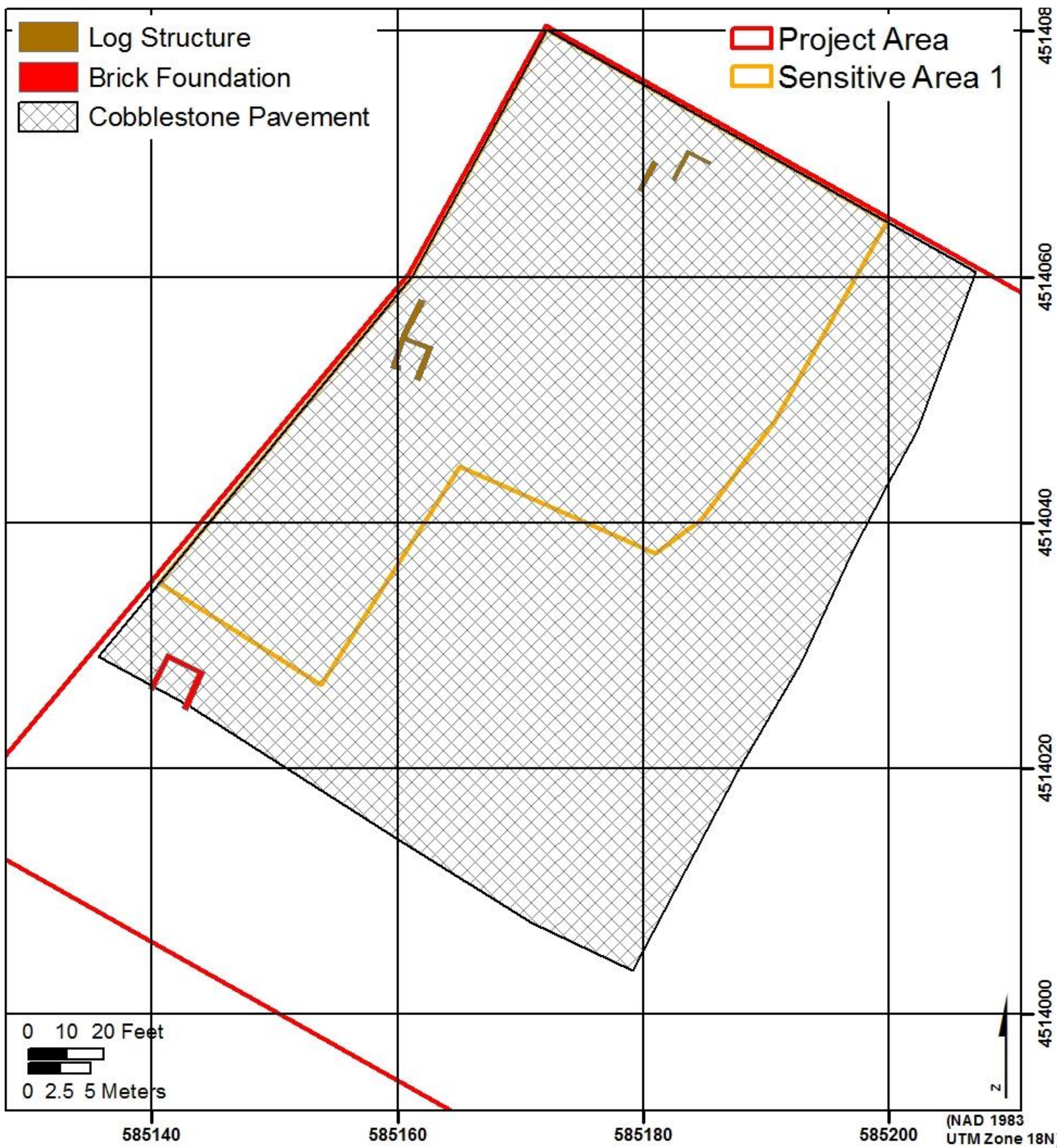


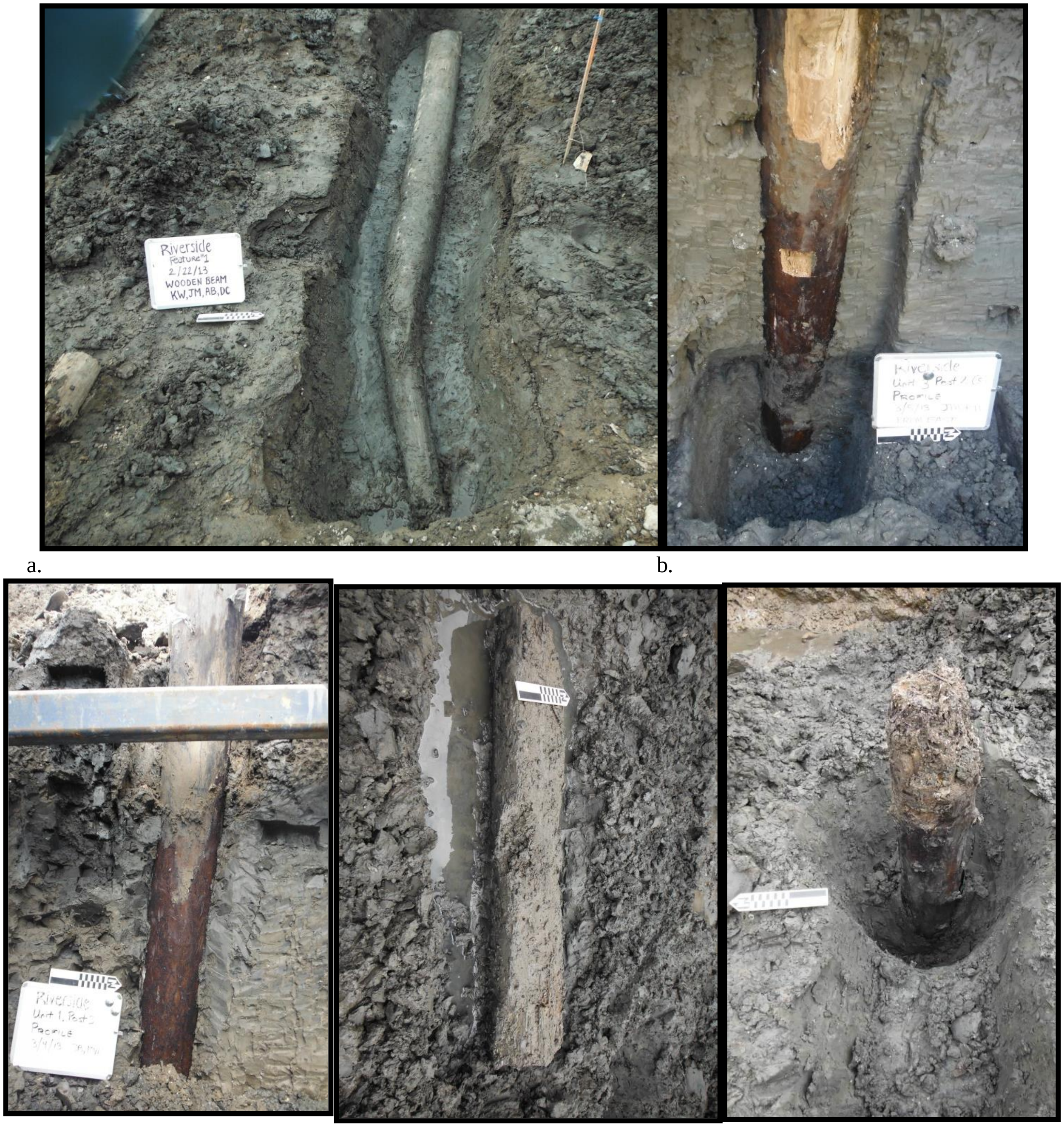
Figure 4.2. Features found in Sensitive Area 1.

Figure 4.3. Composite photograph of the brick foundation.

Figure 4.4. Archaeological Unit 1, showing wooden posts 2 and 3. Also note the flooding due to groundwater seeping.

Figure 4.5. Closing photograph of Archaeological Unit 2.

Figure 4.6. Archaeological Unit 3 with wooden post 2.

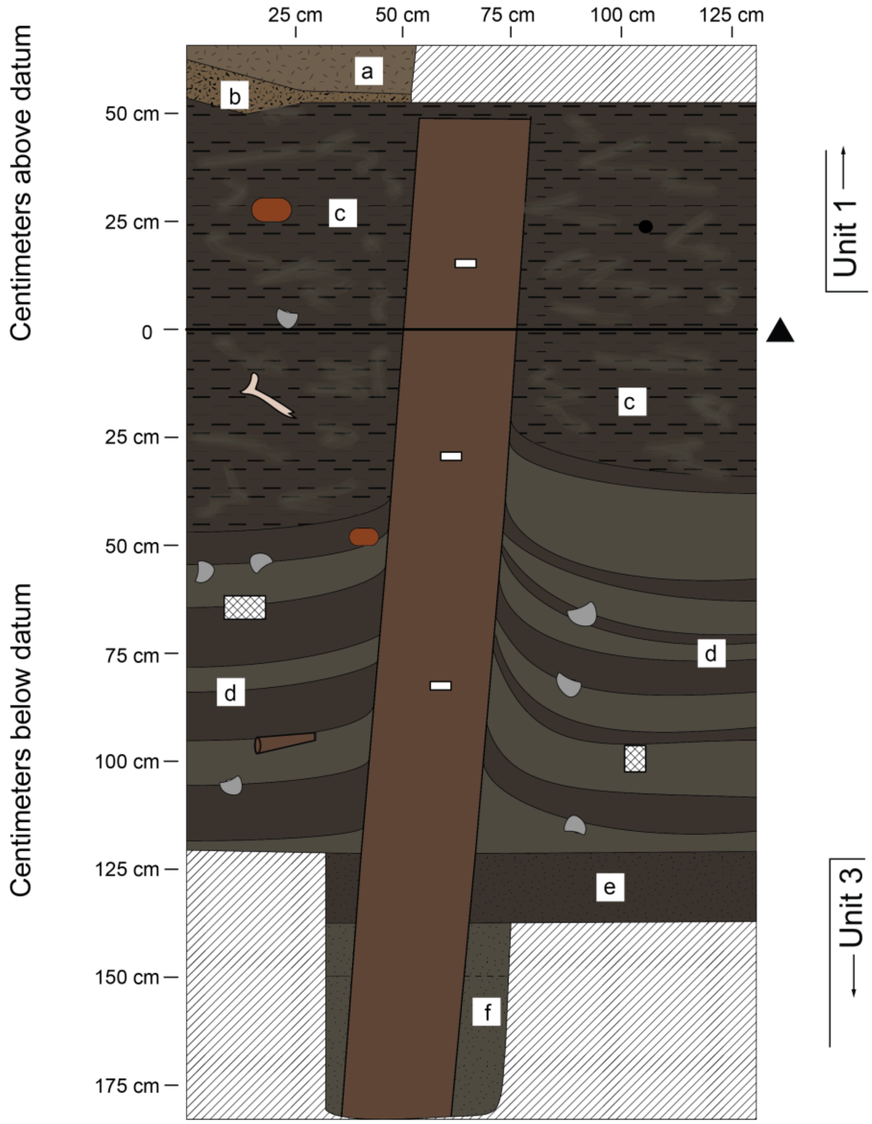


a. b.

c. d. e.

Figure 4.7. Excavations around wooden posts 1 (a), 2 (b), 3 (c), 4 (d), and 5 (e) in Sensitive Area 1.

Post 2 East Profile



Key

a: Historic Fill: 10yr 4/2 sandy loam
b: Historic Fill: 10yr 4/3 medium gravel and coal ash
c: Upper Historic Clay Silt: 10YR 2/1 clay silt with 5Y 3/1 mottling
d: Lower Historic Clay Silt: alternating bands of darker (10YR 2/1) and lighter (5Y 3/1) clay silt (band width exaggerated for this illustration)
e: Estuarine Sand: 10yr 2/1 well sorted silty-sand, fines downward
f: Estuarine Deposit: 5Y 3/1 sandy clay, with a higher clay composition below the dashed line

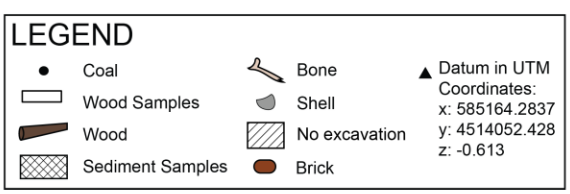


Figure 4.8. Digitized profile of wooden post 2. Note the clay silt banding in relation to the post.

Post 3 East Profile

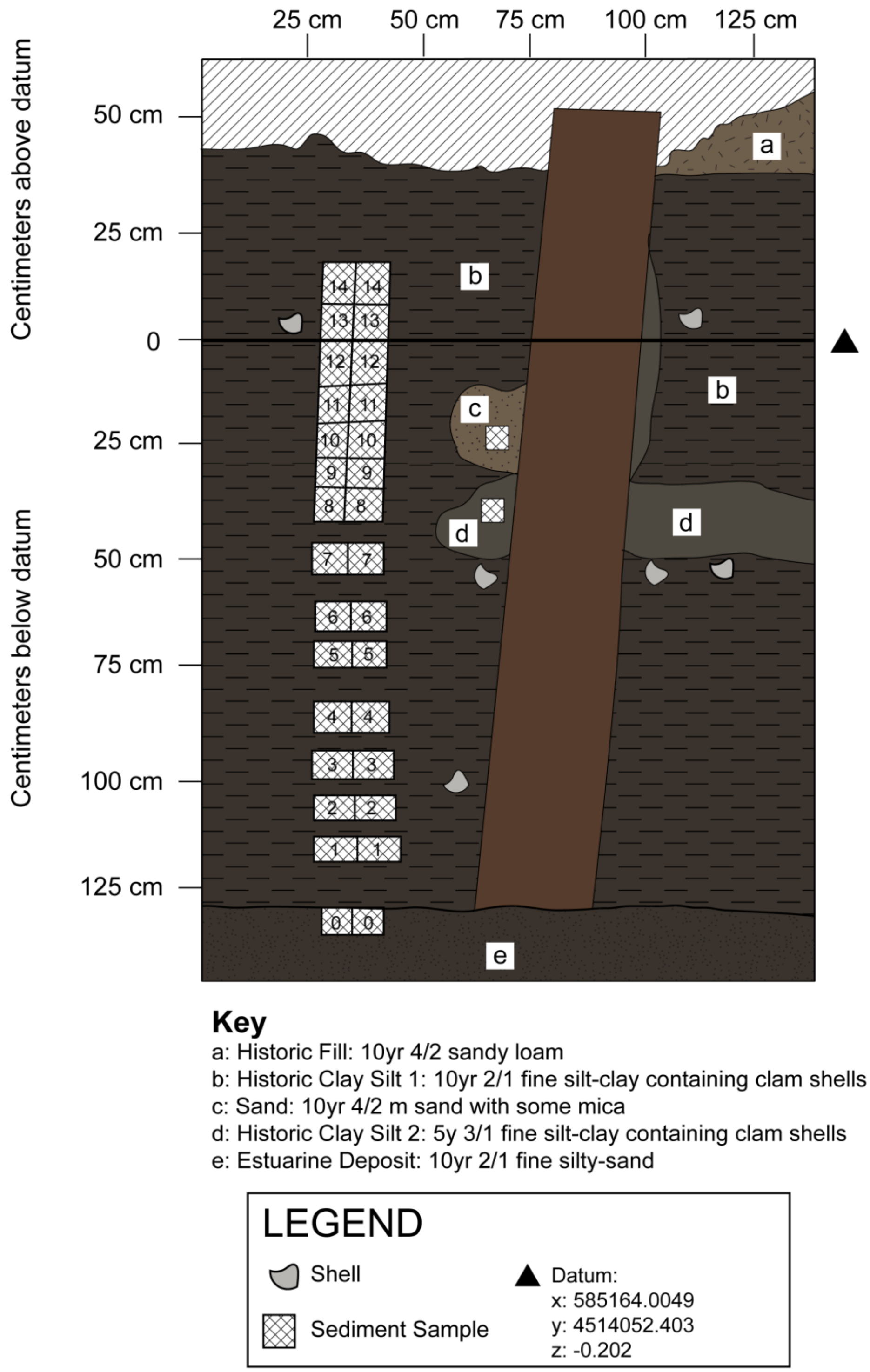


Figure 4.9. Digitized profile of wooden post 3.

Figure 4.10. STP 8.1, showing post mold/degrading post.

Figure 4.11. STP 8.2 showing more recent fill, a sandy layer, and older fill underneath.

Figure 4.12. The 1892 Sanborn map of the property showing the 60th Street Railyard and railbeds. Note the points of surveyed railbeds.

Figure 4.13. Archaeological Trench 4, showing second post-hole.

Figure 4.14. Remains of the stone foundation of a building found in Archaeological Trench 7, looking north. Note that the foundation wall had been impacted by a later railbed feature constructed on top of it.

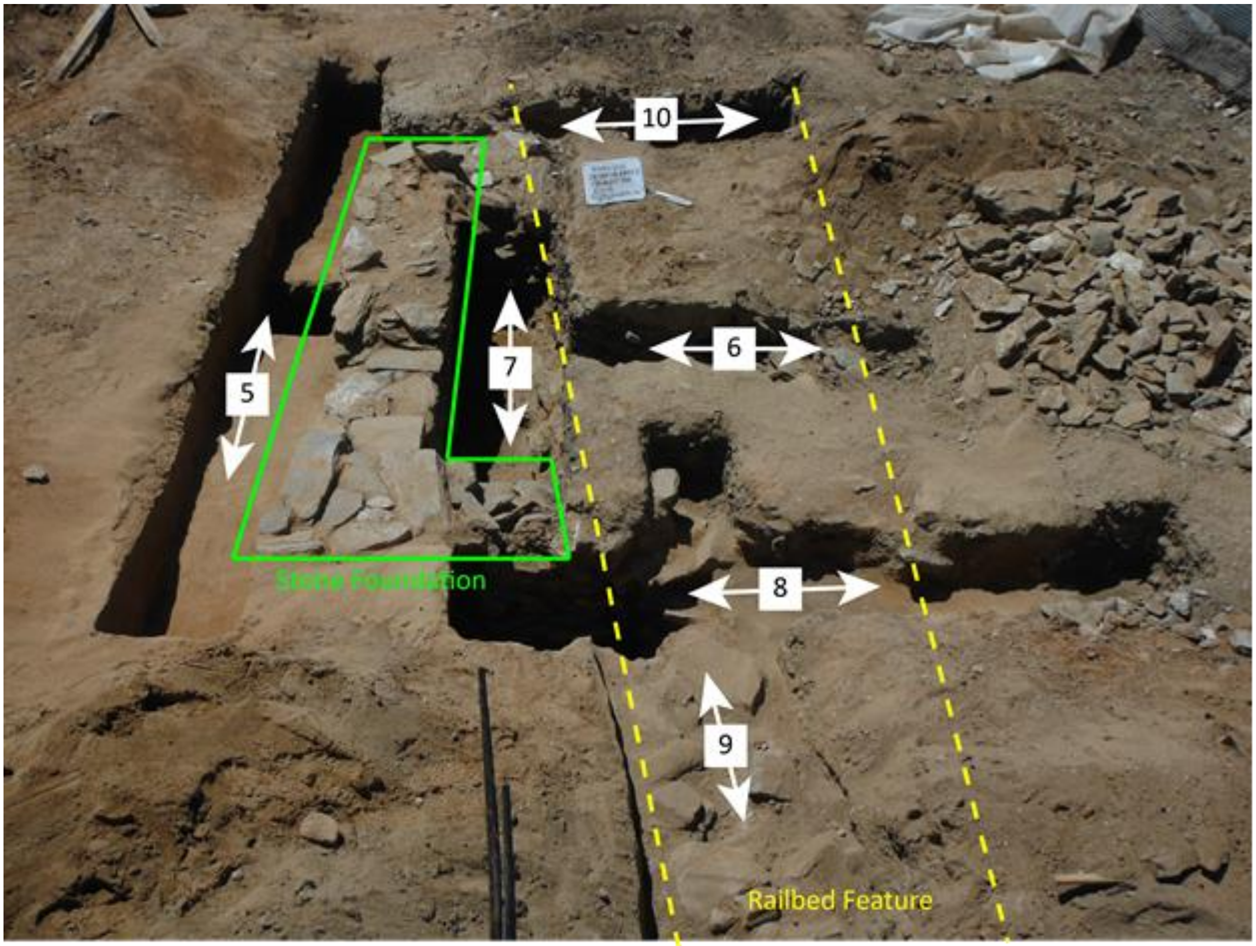


Figure 4.15. Archaeological Trenches 5 through 10, with estimated location of railbed feature and underlying stone foundation illustrated (facing southwest).

a.

b.

Figure 4.16. Archaeological Unit 4 (a) and Archaeological Unit 5 (b). Note the location of the well in both photographs.

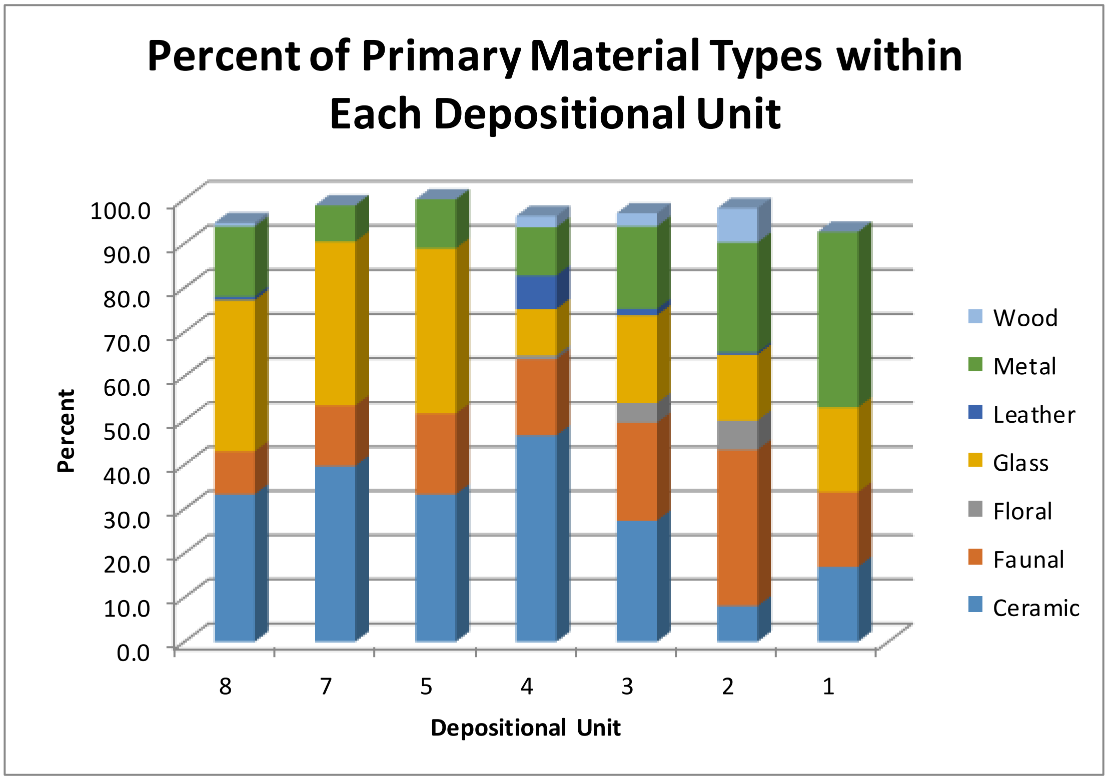


Figure 4.17. Percent of Primary Material Types within each Depositional Unit.

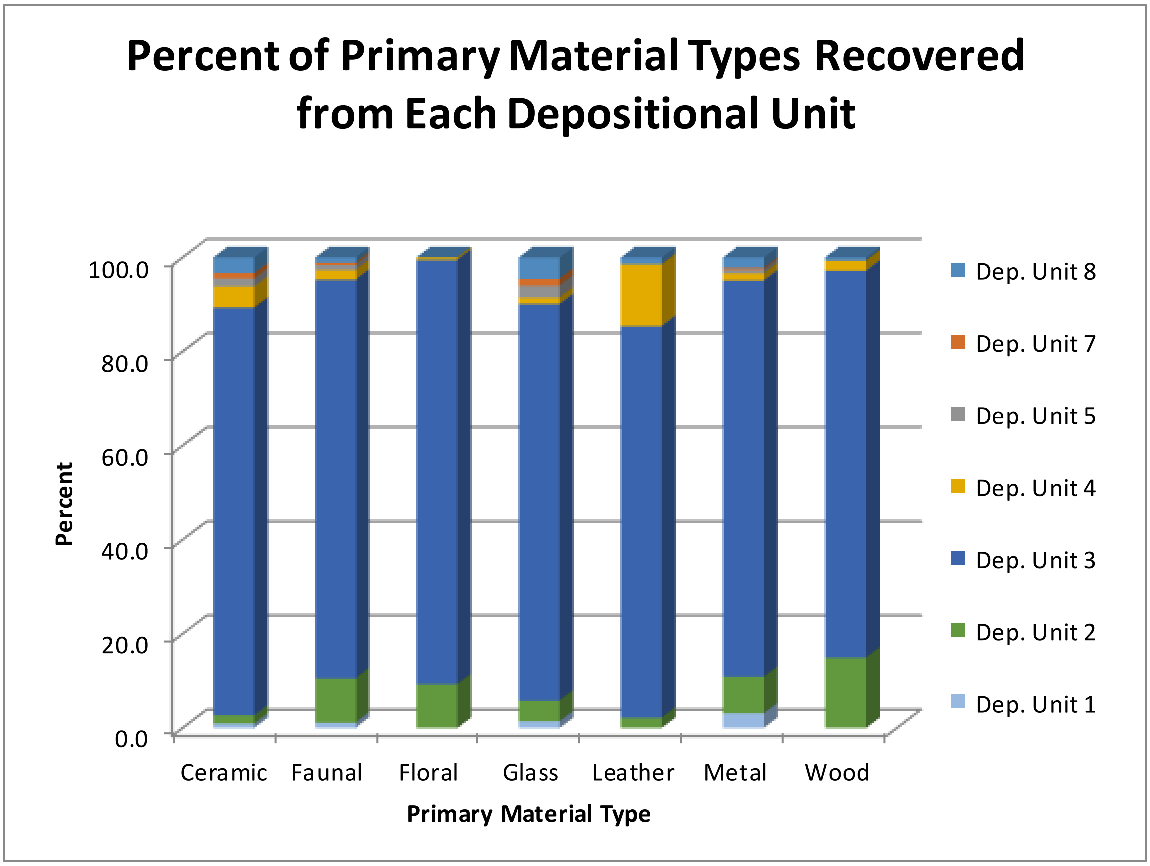


Figure 4.18. Percent of Primary Material Types recovered from each Depositional Unit.

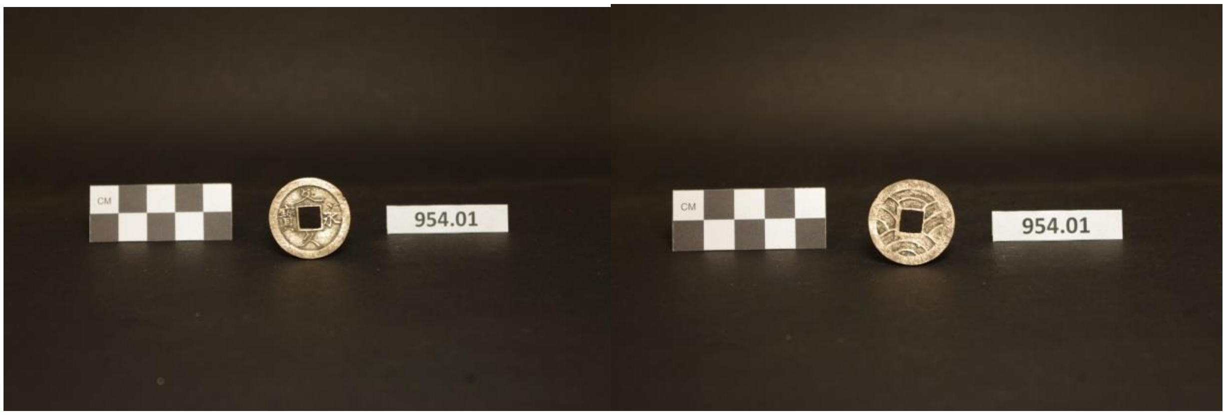


Figure 4.19. A Japanese, or *Bunkyou Eihou* 4-*mon*, coin front (left) and back (right) [artifact #954.01].

Figure 4.20. Porcelain cup fragment [artifact #616.06].

.

.

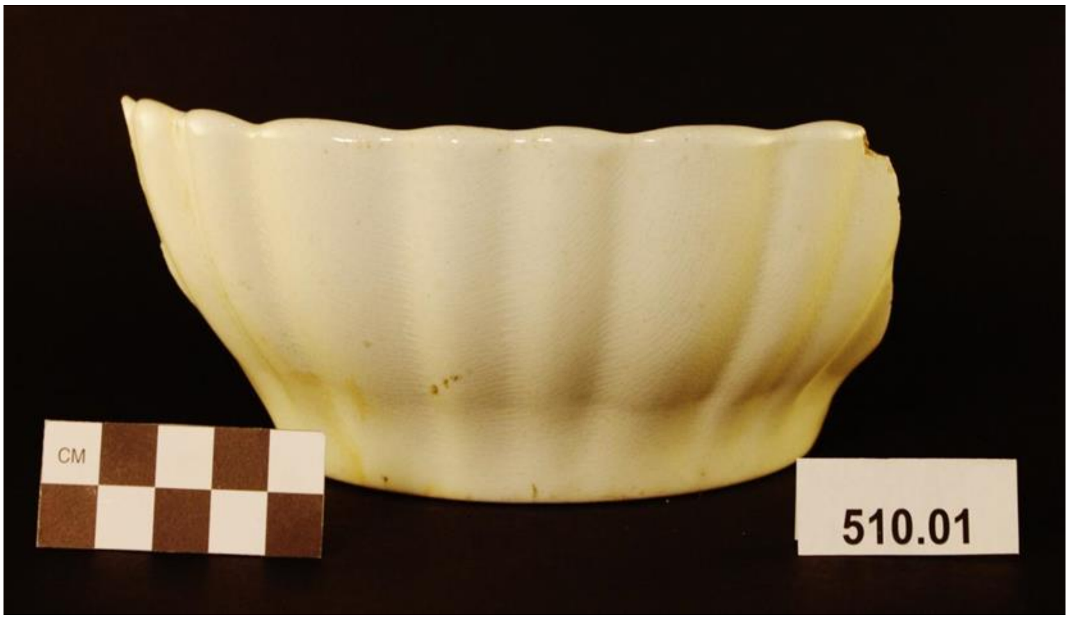


Figure 4.21. Scalloped serving bowl [artifact #510.01].

Figure 4.22. Gothic paneled tea cup [artifact #1071.01].

Figure 4.23. Rockingham pitcher with "Rebecca at the Well" motif [artifact #2846.01].

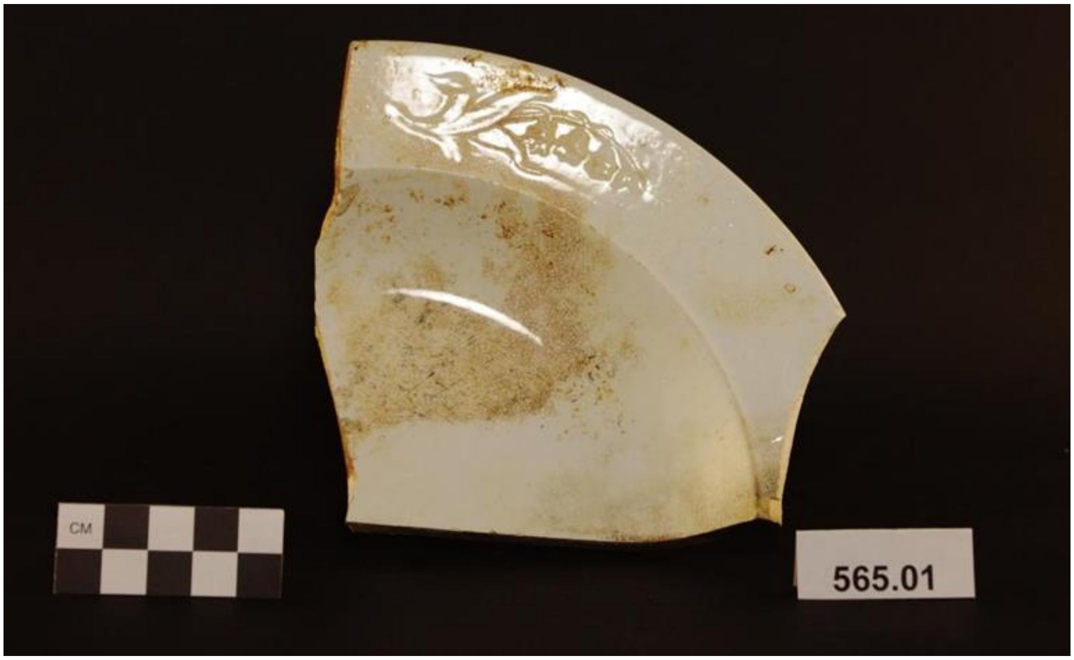


Figure 4.24. Harvest motif on rim of bowl [artifact #565.01].

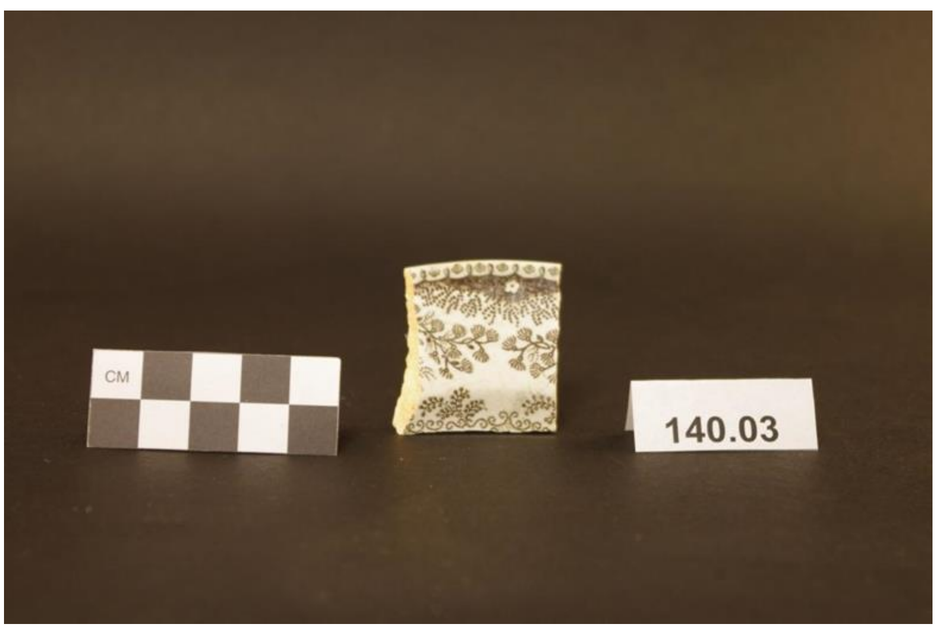


Figure 4.25 Sepia transfer print [artifact #140.03].

Figure 4.26. Examples of transfer-print wares, including a sepia fragment (a), and a Blue Willow platter (b) [artifact #636.01 - #636.18].

Figure 4.27. Plate with pastoral transfer-print and molded rim with alphabet [artifact #1467.01 - #1467.04].

Figure 4.28. Almost complete ironstone teapot [artifact #2178.01].

Figure 4.29. Egg Cradle [artifact #186.01].

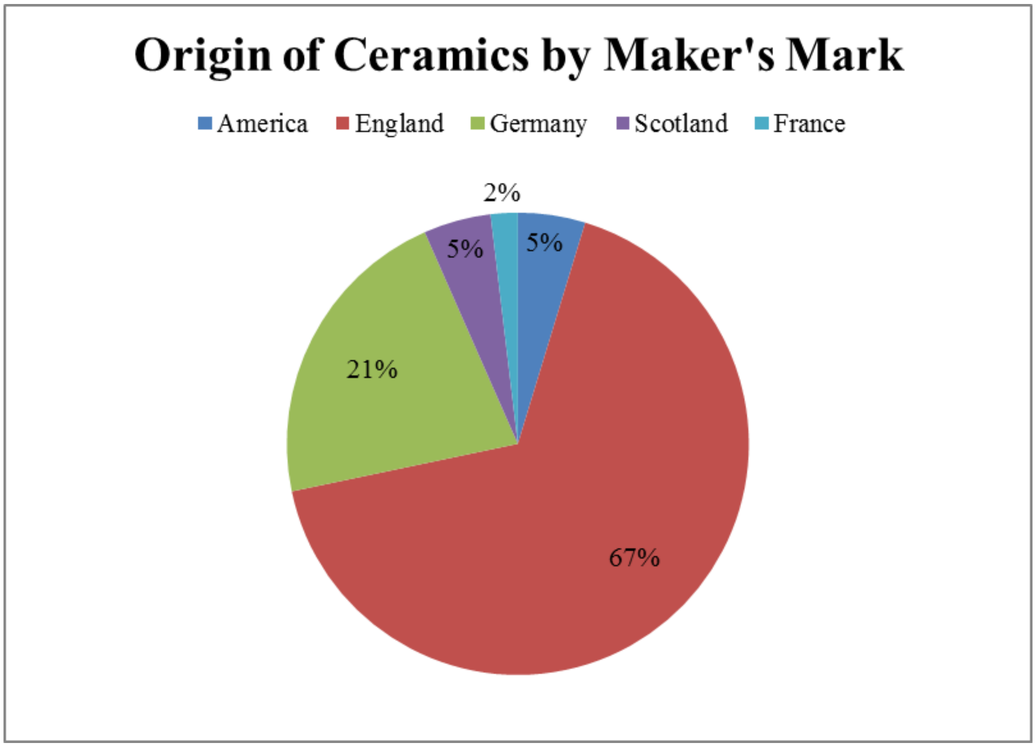


Figure 4.30. Maker's marks by country of origin.

Figure 4.31. German mineral water bottle labeled "Apollinaris-Brunnen" [artifact #1070.01].

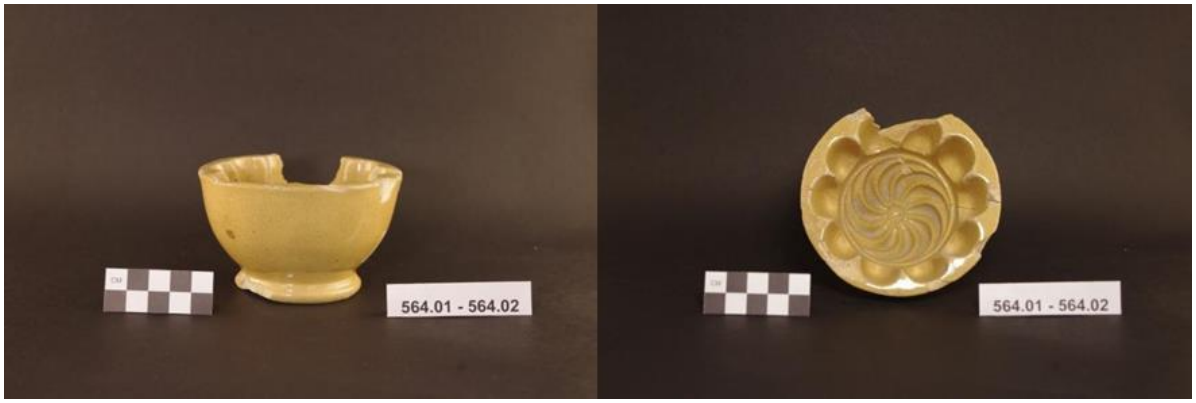


Figure 4.32. Ceramic food mold [artifact #564.01 – 564.02].

Figure 4.33. Marrow jar [artifact #707.01 – 707.02].

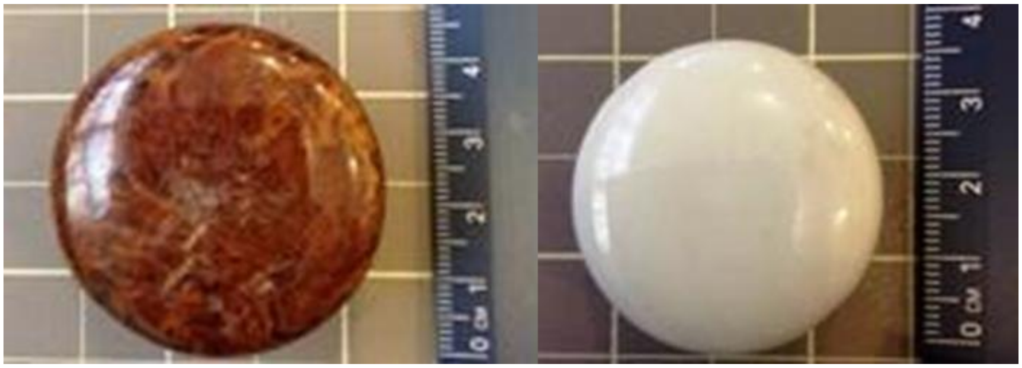


Figure 4.34. Two varieties of ceramic doorknobs.

Figure 4.35. Ceramic cosmetic jar with the inscription "Cold Cream" [artifact #643.01].

Figure 4.36. Frozen Charlotte dolls and other recovered doll parts.

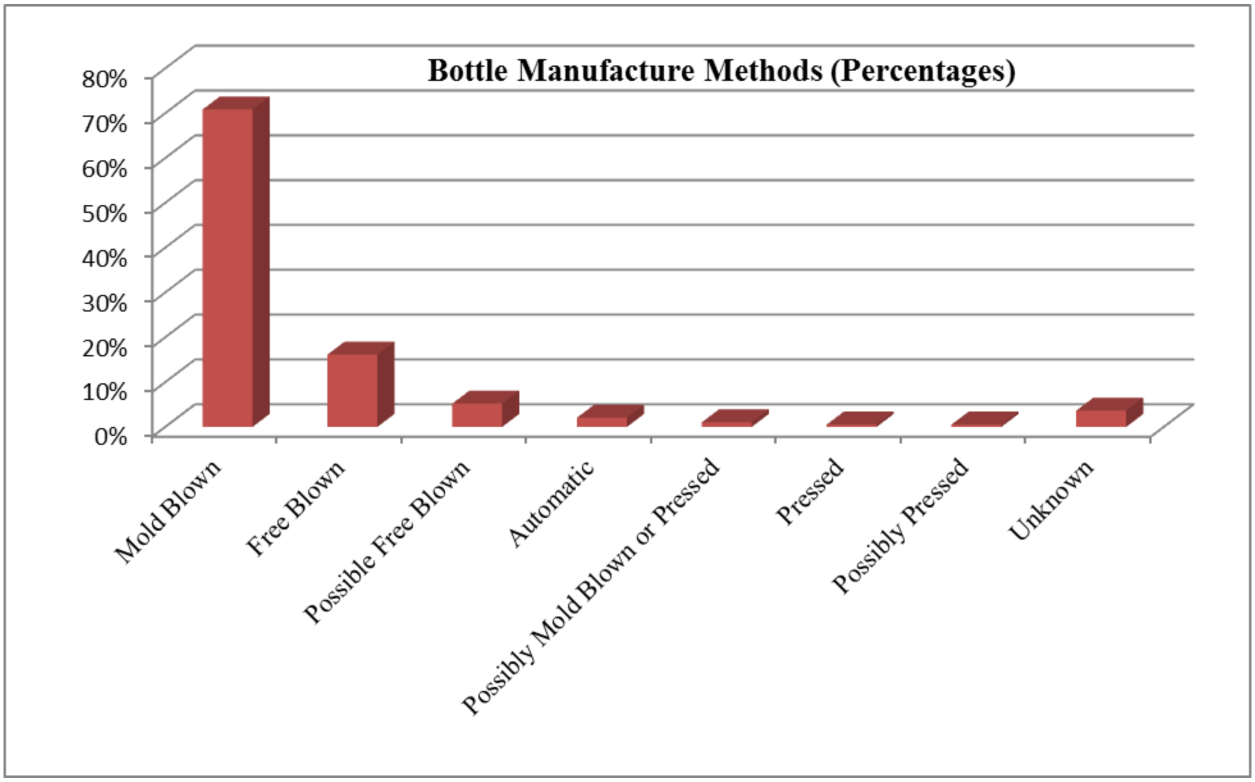


Figure 4.37. Percentages of manufactured bottle types.

Figure 4.38. French square medicinal bottles.

Figure 4.39. Philadelphia oval medicinal bottles.

Figure 4.40. Mrs. Winslow's soothing syrup bottle shape [artifact #799.01].

Figure 4.41. The two most common styles of wine bottles found at the project area: tall, free-blown green and 3-part mold green/black.

Figure 4.42. Whole bottle with mark "A.B. & Co." [artifact #574.01].

Figure 4.43. Fragment of a Crosby's Tomato Sauce bottle [artifact #3322.01].

Figure 4.44. Fragment of a Gothic pickle vessel [artifact #537.01].

Figure 4.45. A whole wide mouth pickling bottle [artifact #3346.03].

Figure 4.46. Vermont spring water in a "Saratoga" shaped water bottle [artifact #3361.01].

Figure 4.47. A 10-sided, cobalt blue soda water bottle [artifact #1948.01].

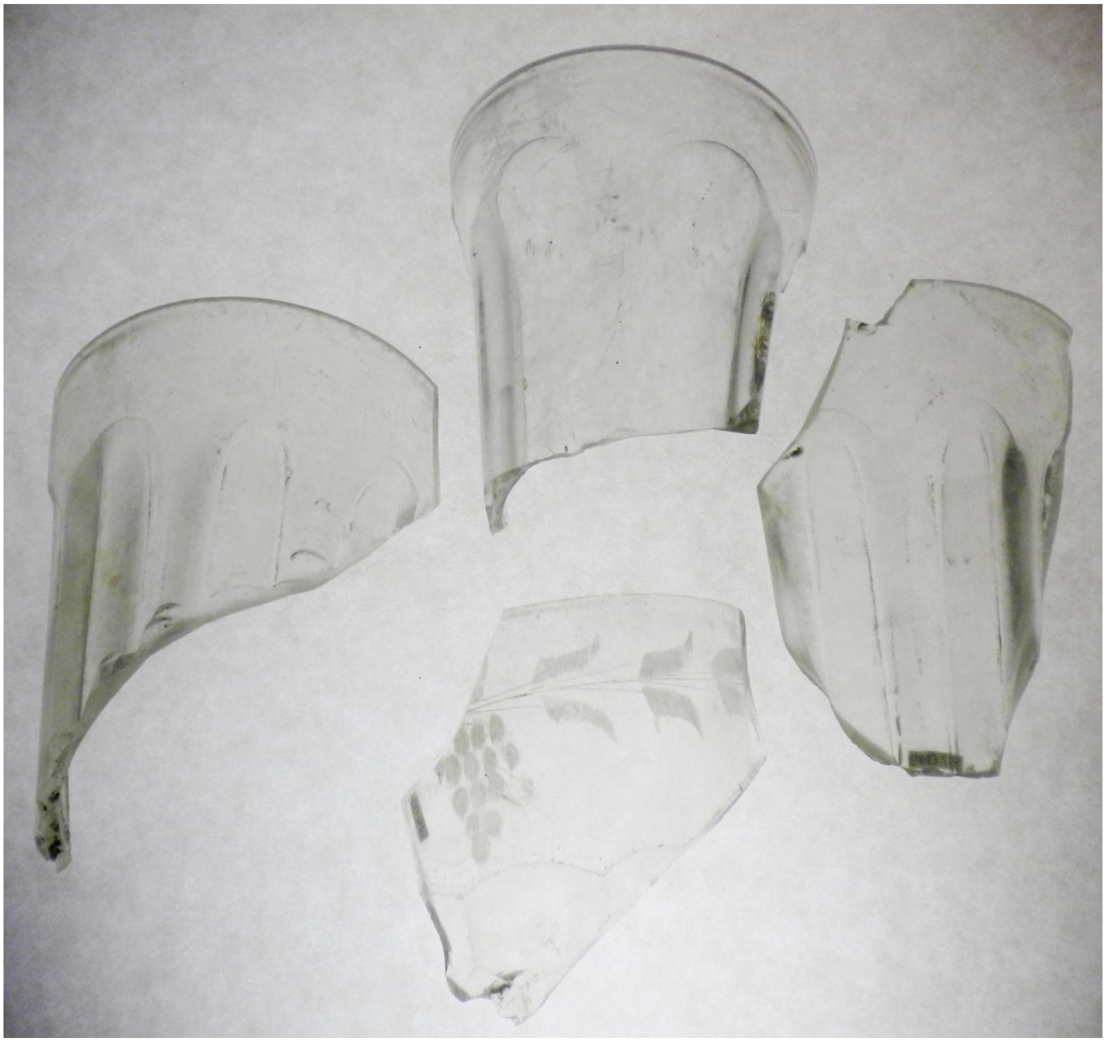


Figure 4.48. The range of paneled tumbler styles.

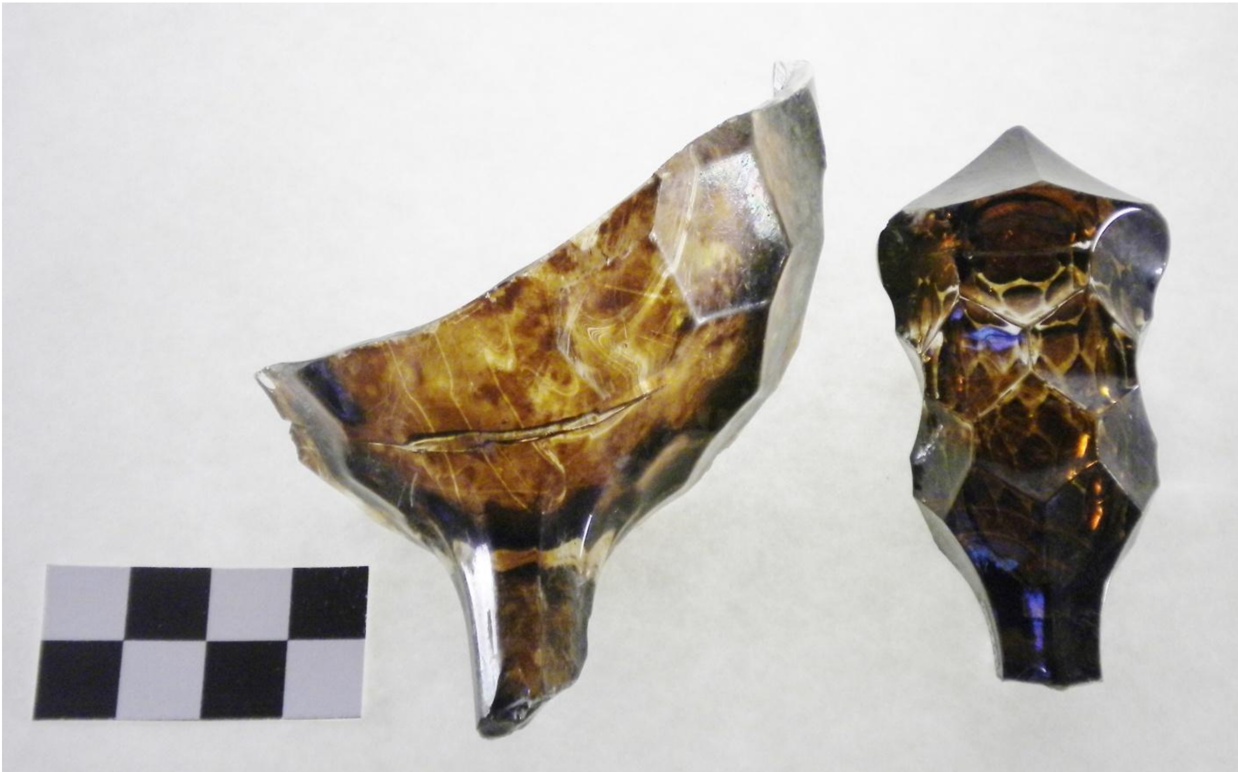


Figure 4.49. A matching wine glass [artifact #648.01] and decanter stopper [artifact #652.01].

Figure 4.50. Similar foot motif found on three different wine glass stems.

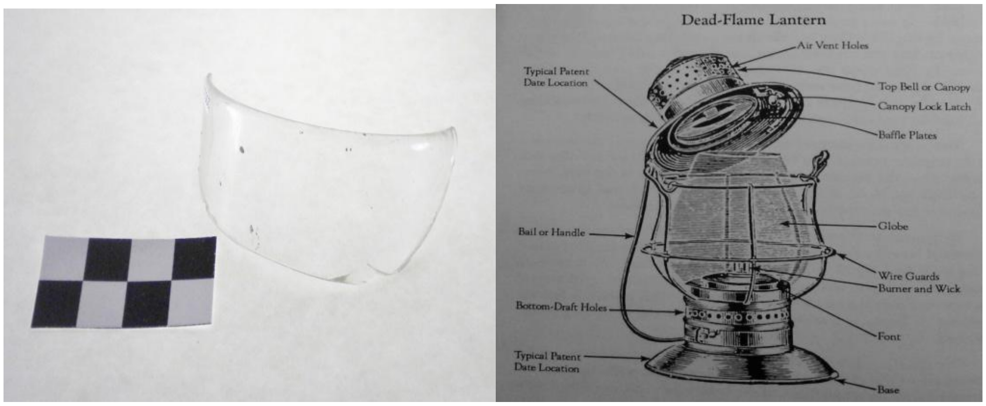


Figure 4.51. Comparative analysis of a lip fragment and an illustration of a dead flame lantern.

Figure 4.52. An embossed token, known as a Shell Card, that usually advertised a business or service [artifact #640.01].

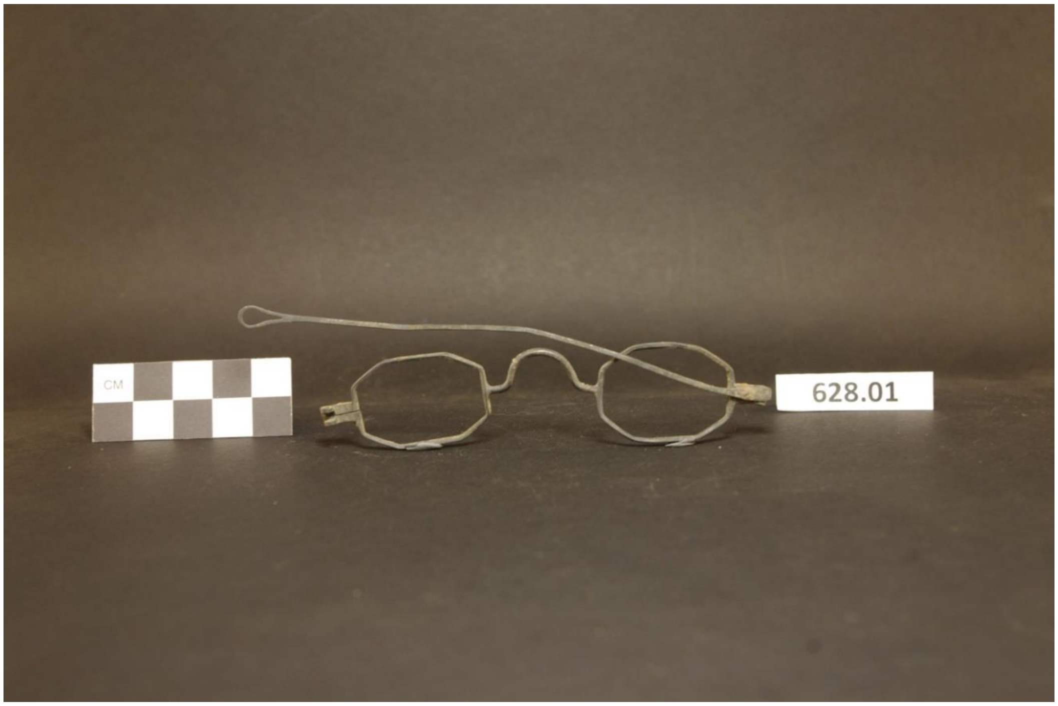


Figure 4.53. A pair of nickel-alloy spectacles [artifact #628.01].

Figure 4.54. Oil lamp fixtures [artifact #625.01] from around 1863.

Figure 4.55. A civil war cavalry hatpin with a crossed sabre insignia (c. 1858-1864) [artifact #751.01].

Figure 4.56. Representative photograph of seeds, nuts, and pits from the Riverside Site. Clockwise from top left: coconut (*C. nucifera*) [artifact #1901.01], plum (*Prunus*) [artifact #849.01], peach (*P. persica*) [artifact #921.01], muskmelon (*C. melo*) [artifact #1720.01], black walnut (*J. nigra*) [artifact #1102.03], squash/pumpkin (likely *C. pepo*) [artifact #835.01], peanut (*A. hypogaea*) [artifact #2057.01], and chestnut (*Castenea*) [artifact #1006.01].

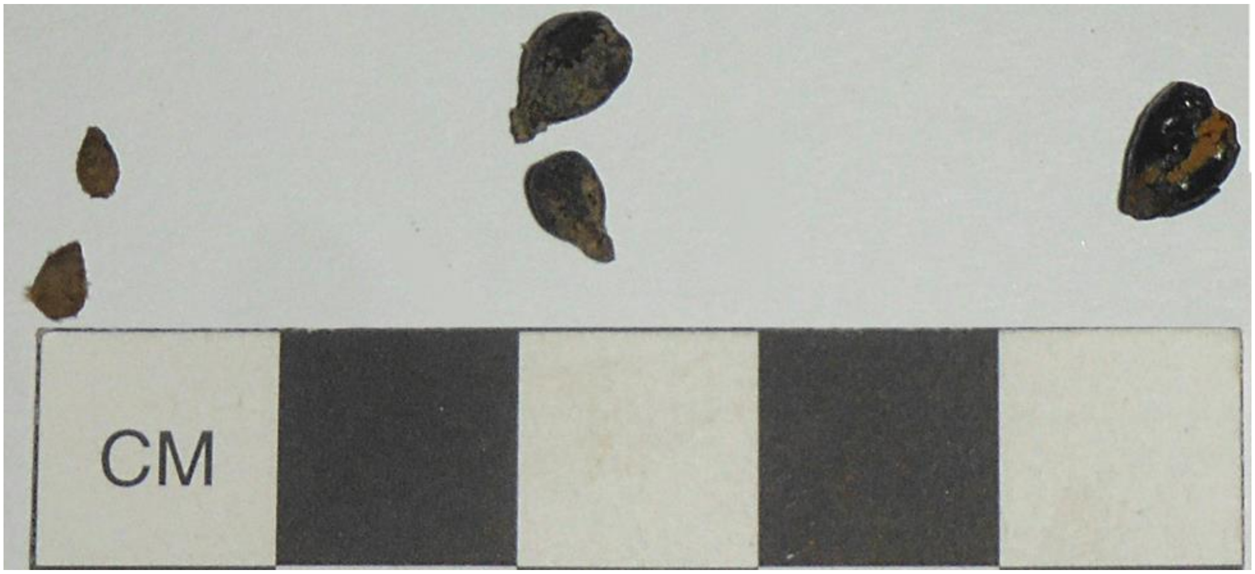


Figure 4.57. Seed remains under 1 cm in length. Left to right: Likely raspberry/blackberry (*Rubus*) [artifact #1720.02], pear (*Pyrus*) [artifact #835.02], and unknown (possibly *Cydonia*) [artifact #1720.03].

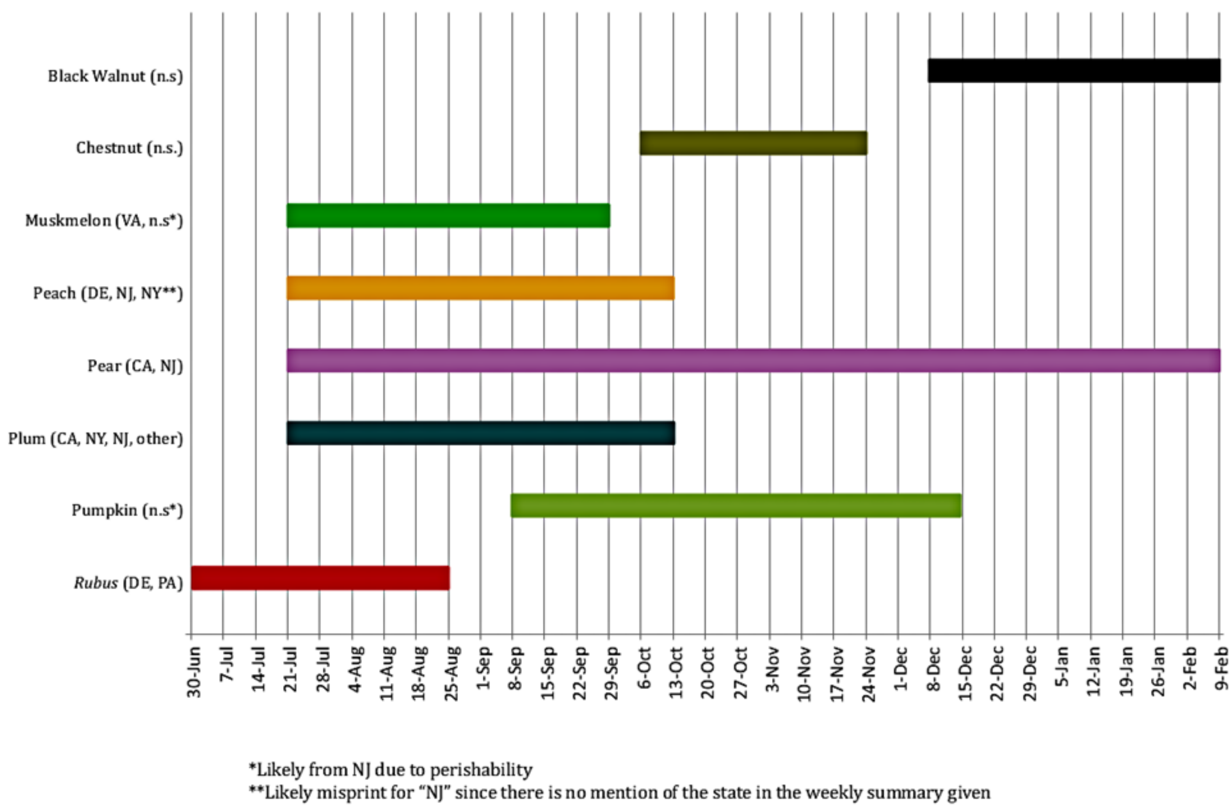


Figure 4.58. Availability of foodstuffs found at the project area on the New York market according to the *New York Tribune* (Jul 1, 1874-Feb 10, 1875).

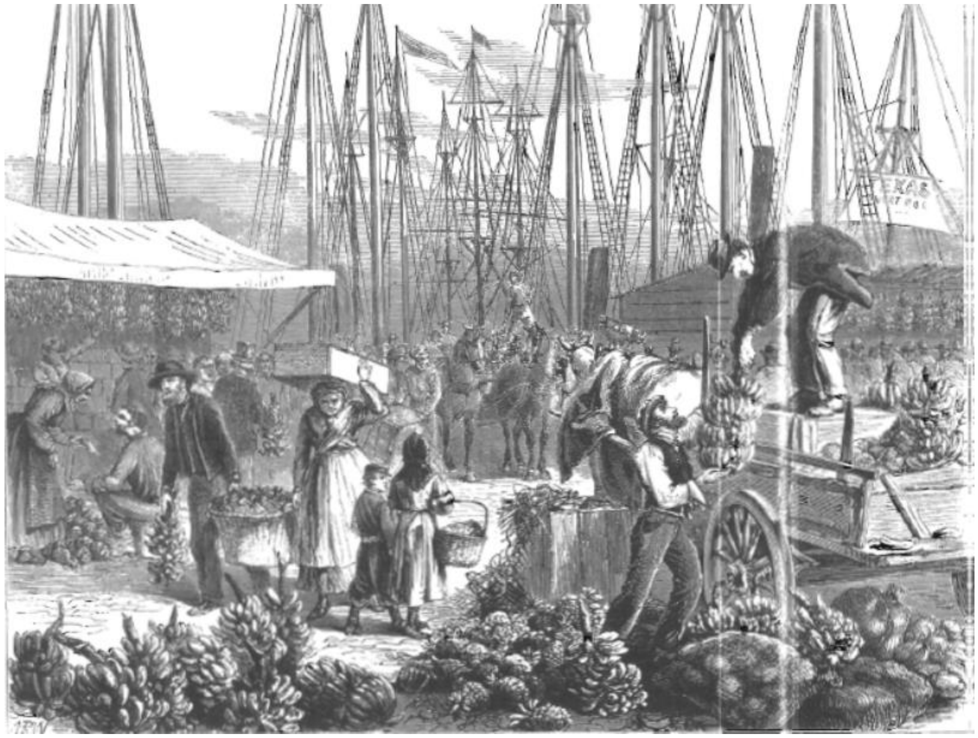


Figure 4.59. Exotic produce from the Caribbean and South America unloaded in New York (*Harper's Weekly* 1870, from Grafton 1977; 229).

Figure 4.60. Chestnut [artifact #1006.01] close-up. Note the size and position of the hole in the shell.

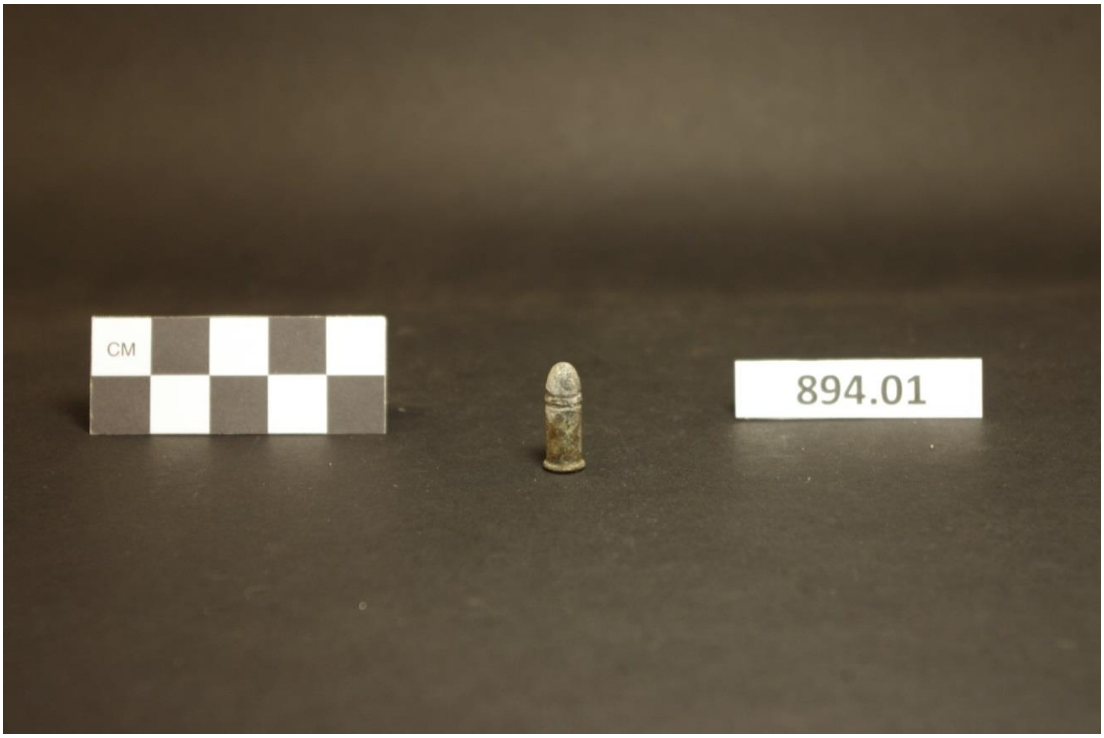


Figure 4.61. A .22 caliber bullet cartridge [artifact #894.01].

Figure 4.62. Household waste: dentures [artifact #14.01].

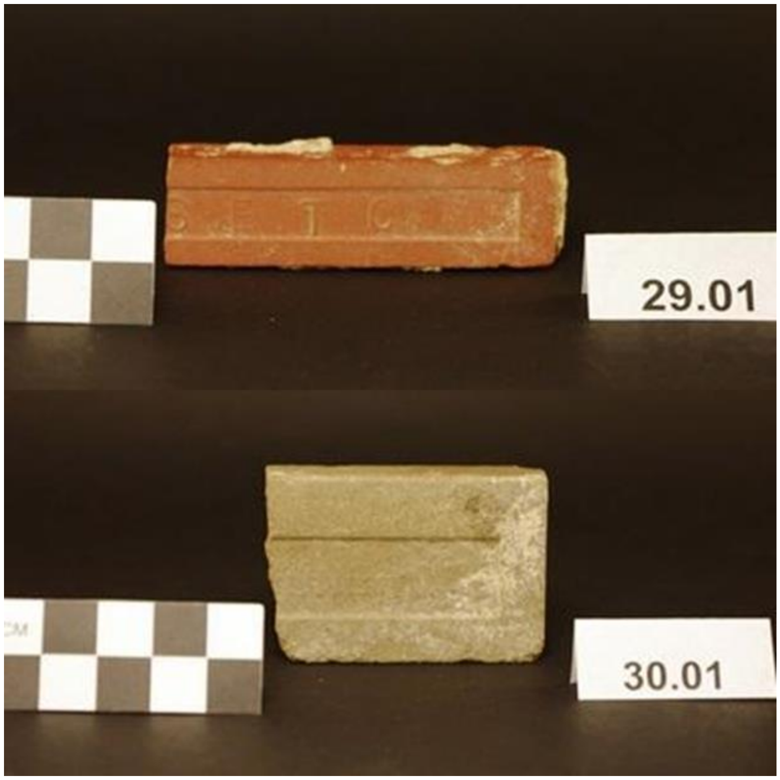


Figure 4.63. Two brick fragments with unknown maker's marks [artifact #29.01 and artifact #30.01].

Figure 4.64. Mold blown bottle, with B&P Lyons Powder maker's mark [artifact #2672.01].

M below surface Start	End	Depositional Units Boring GRA-10	Sediment: Zones	Sediment: Descriptions	Pollen: Zones	Pollen: Descriptions	Dating
0.00	0.85	N/R					
0.85	0.95	3d- Final Trash Landfill					
0.95	1.15						
1.15	1.25						
1.25	1.36						
1.36	1.41						
1.41	1.45						
1.45	1.46						Brick frag.
1.46	1.52				3	Land-clearing, agriculture, European taxa.	
1.52	1.90	N/R					
1.90	1.99	Slump					
1.99	2.93	2c- Historic clay silt	1	Silt is dominant, with more clay then anywhere below. High pH and LOI. Sands are more poorly sorted. Discontinuity at 2.69m (with coarse sands above this).			2850-2750 B.P.
2.93	3.00				2	Stable landcape: well-developed stream-side plant community. Forest clearing, agricutlure, European taxa.	
3.00	3.02	2b- Sand					
3.02	3.05						
3.05	3.11	N/R					
3.11	3.44	2a- Early silts and clays					
3.44	3.88		2	Well-sorted sand layer.			445-0 B.P.
3.88	4.36		3	Fining upwards sequence, with gravelly loamy sand at base, up to silt loam at top. Half-phi sand fractions stay the same throughout this zone. pH and LOI change.	1	Pine and oak forests, with some indications of human activity (i.e. increase in charcoal). Poor preservation of pollen and low human activity at bottom.	
4.36	4.39						1366-646 B.P.
4.39	4.54						6470-6300 B.P.
4.54	4.55						
4.55	4.57						
4.57	4.72	N/R					
4.72	5.06	1a/ 1b- Parent Material/ Surface of Landform					
5.06	5.34		4	Least homogenous zone. Silt loam on top, sand at bottom. Discontinuity between 4.92 and 5.16m, with finer textures below it.		No pollen preservation: indicates exposure/ oxidation	4850-4650 B.P.
5.34	5.36						6750-6500 B.P.
5.36	5.38						
5.38	5.41						
5.41	5.45			(Sand fraction statistics indicate variability with depth in Zones 4 and 5, indicating the zones are disctinct from the rest of the core.)			
5.45	5.46						
5.46	5.50						
5.50	5.65						
5.65	6.10		5	Silt loam and silt.			

Figure 4.65. Depositional Units represented in Boring GRA-10 with corresponding sediment pollen, and dating analyses.

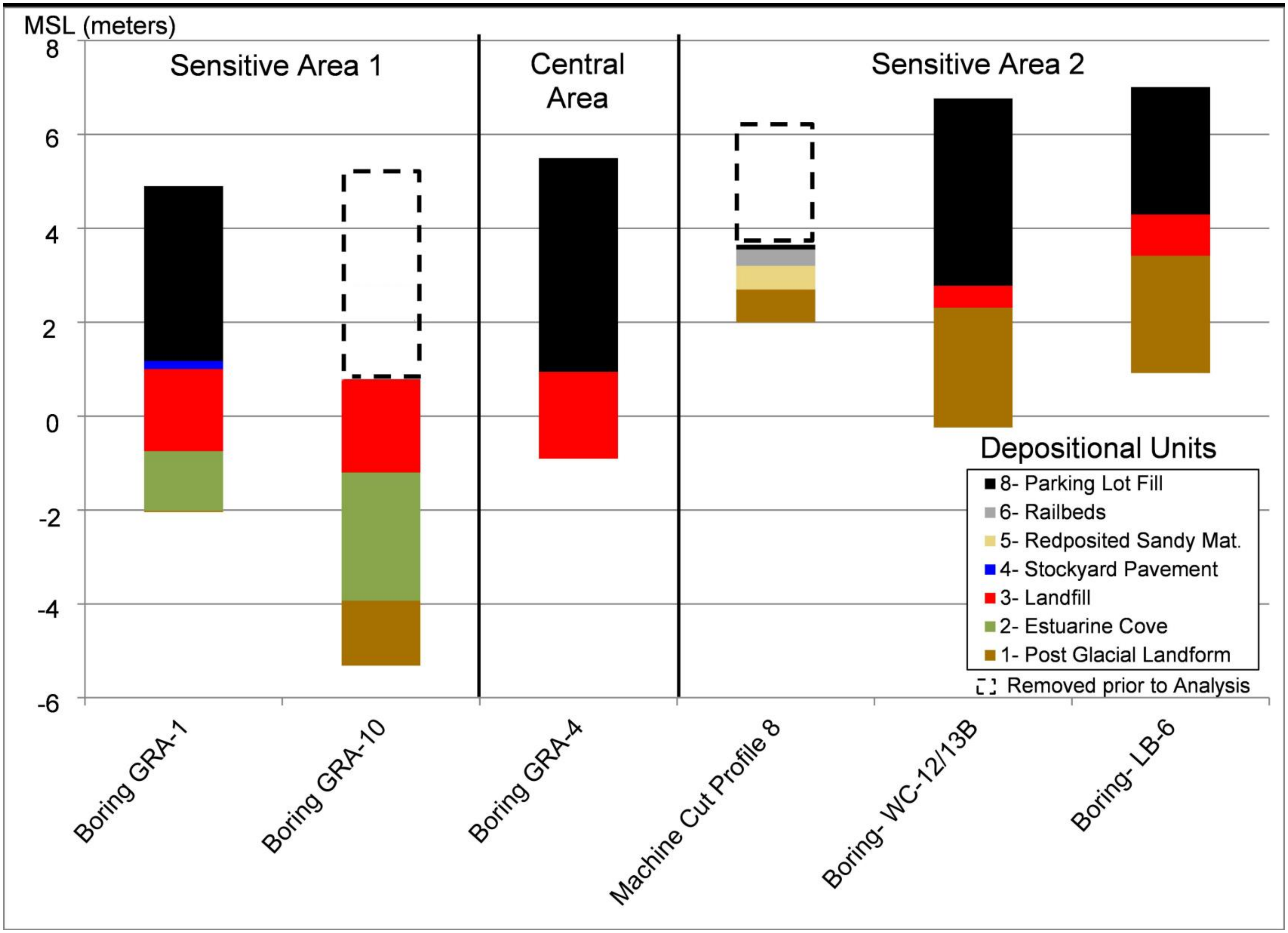


Figure 4.66. Depositional Units from select locations throughout the project area.

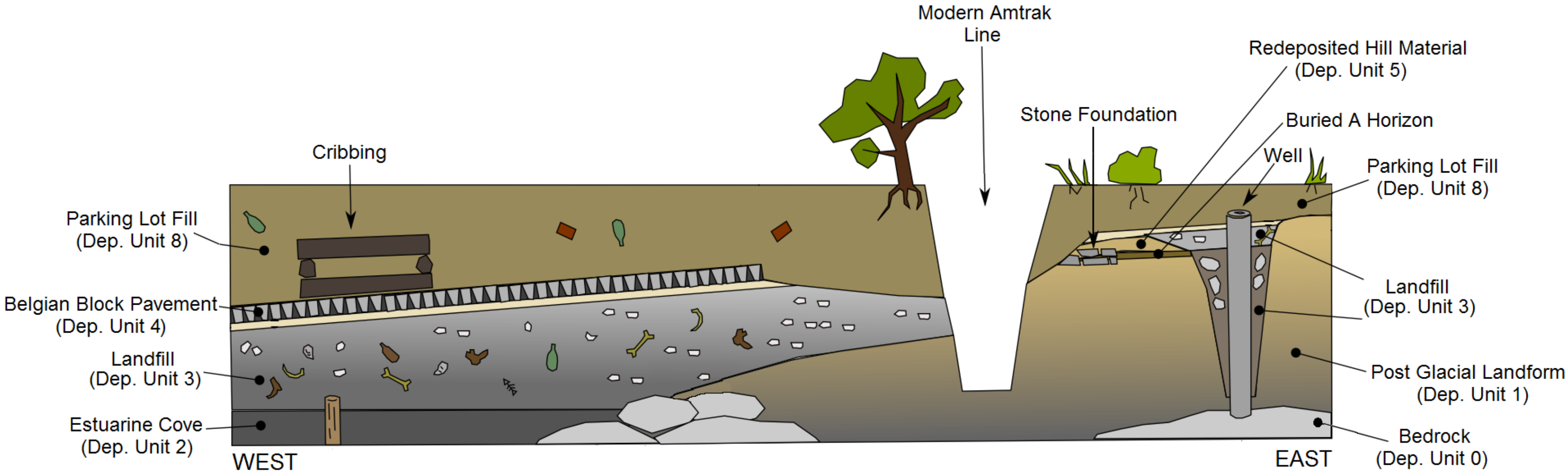


Figure 4.67. Generalized stratigraphic sequence of the project area, with labeled depositional units.

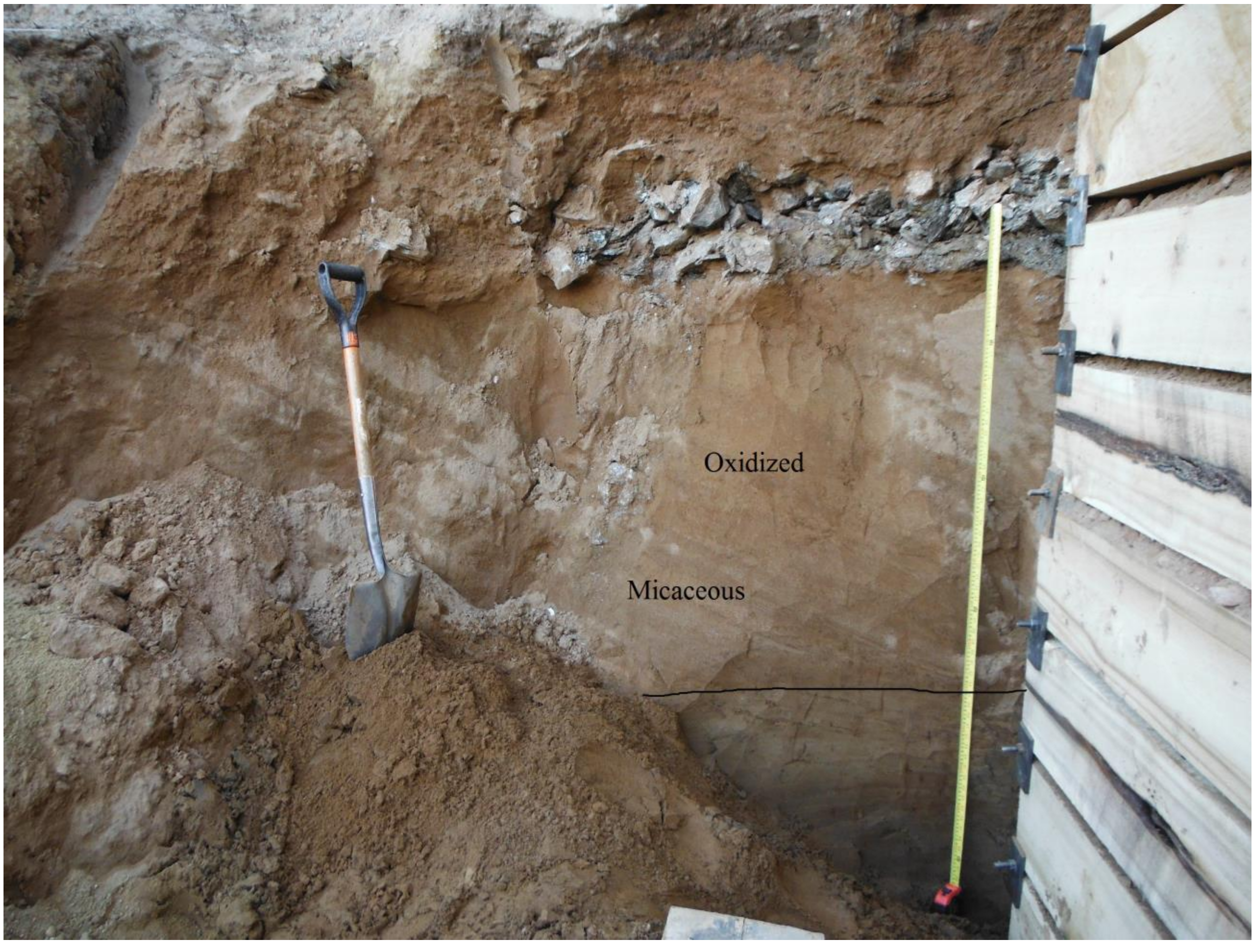


Figure 4.68. Profile of sandy hill, showing horizontal bedding layers below the line.

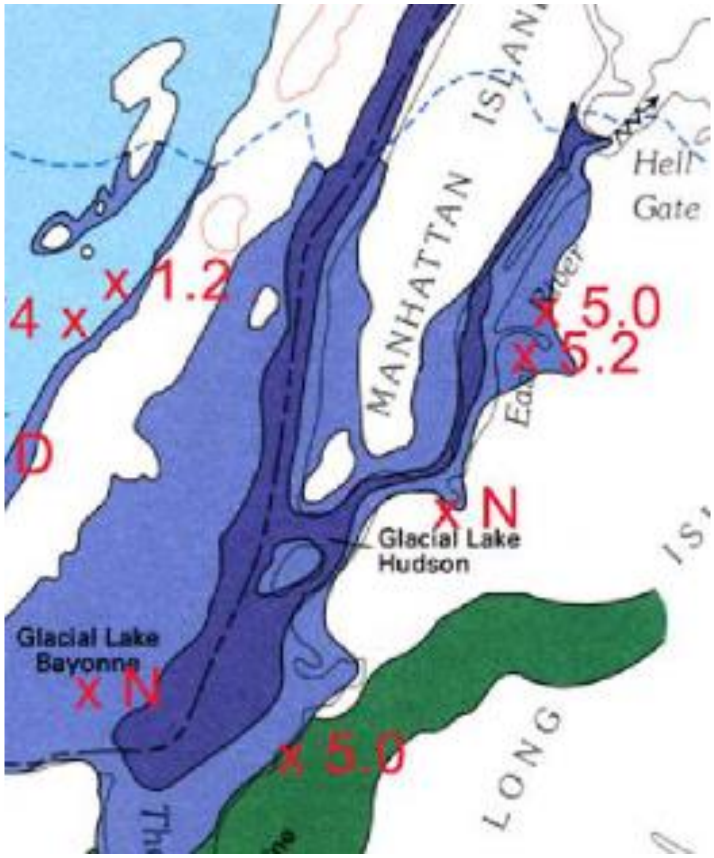


Figure 4.69. Map showing the boundaries of glacial Lake Bayonne and glacial Lake Hudson, as they impacted the western and eastern edges of Manhattan.

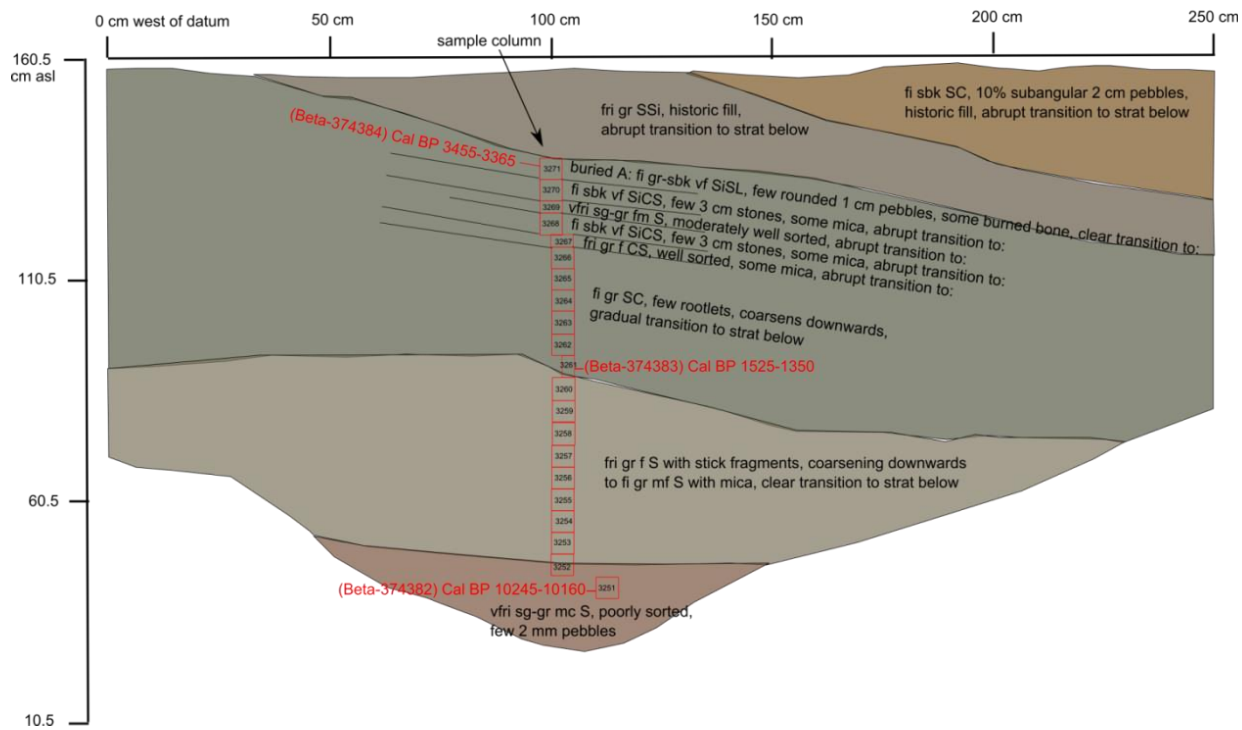


Figure 4.70. South profile of Machine Cut Profile 10, a profile adjacent to the well basin.

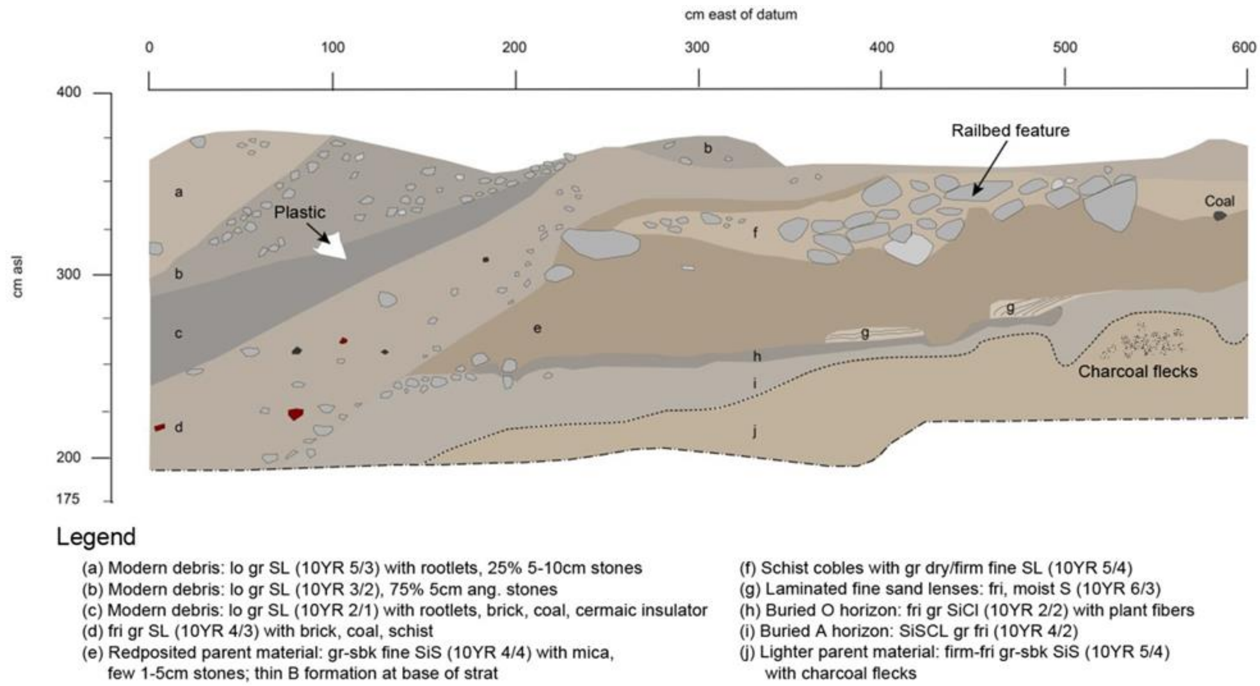


Figure 4.71. North profile of Machine Cut Profile 8, at the top of the sandy hill adjacent to the modern Amtrak line.

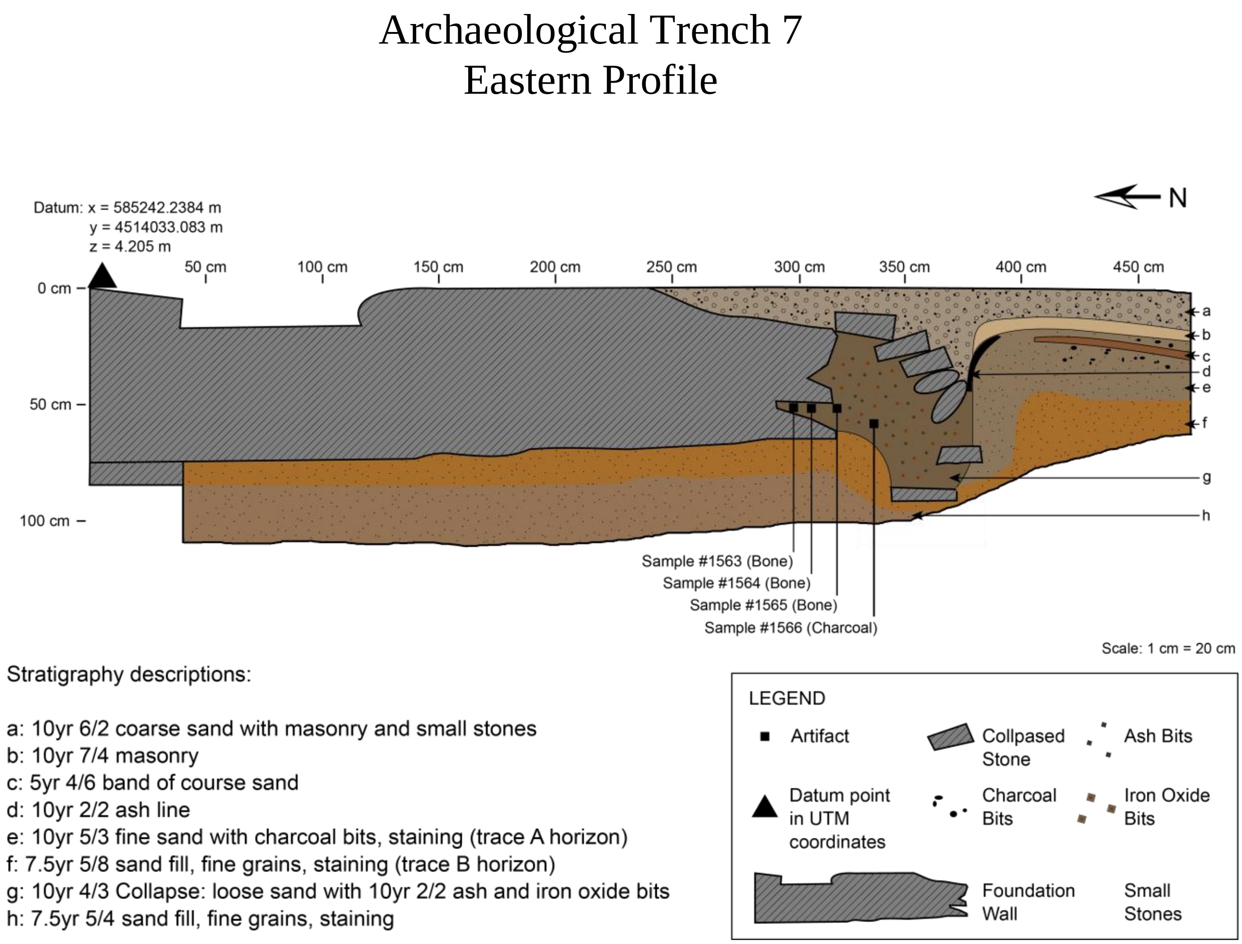


Figure 4.72. Eastern profile of Archaeological Trench 7, showing stone foundation. The remnant A horizon is labeled as stratigraphic unit "e."

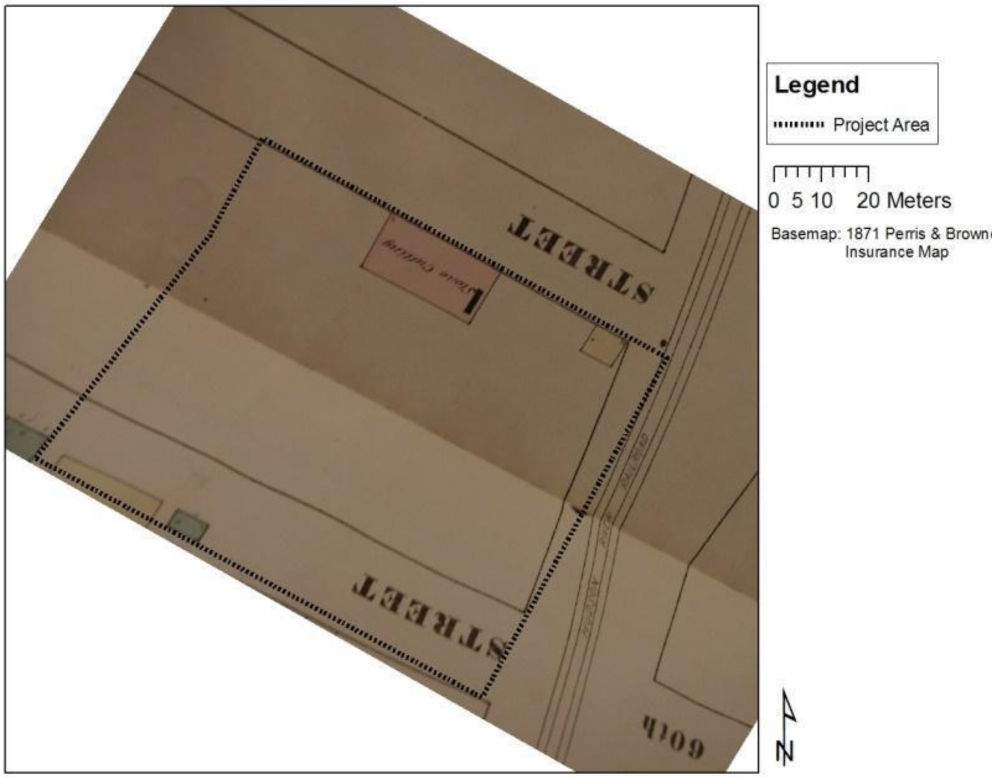


Figure 4.73. Perris and Browne insurance map from 1871 showing the location of a house and stone-cutting workshop within the current project area.

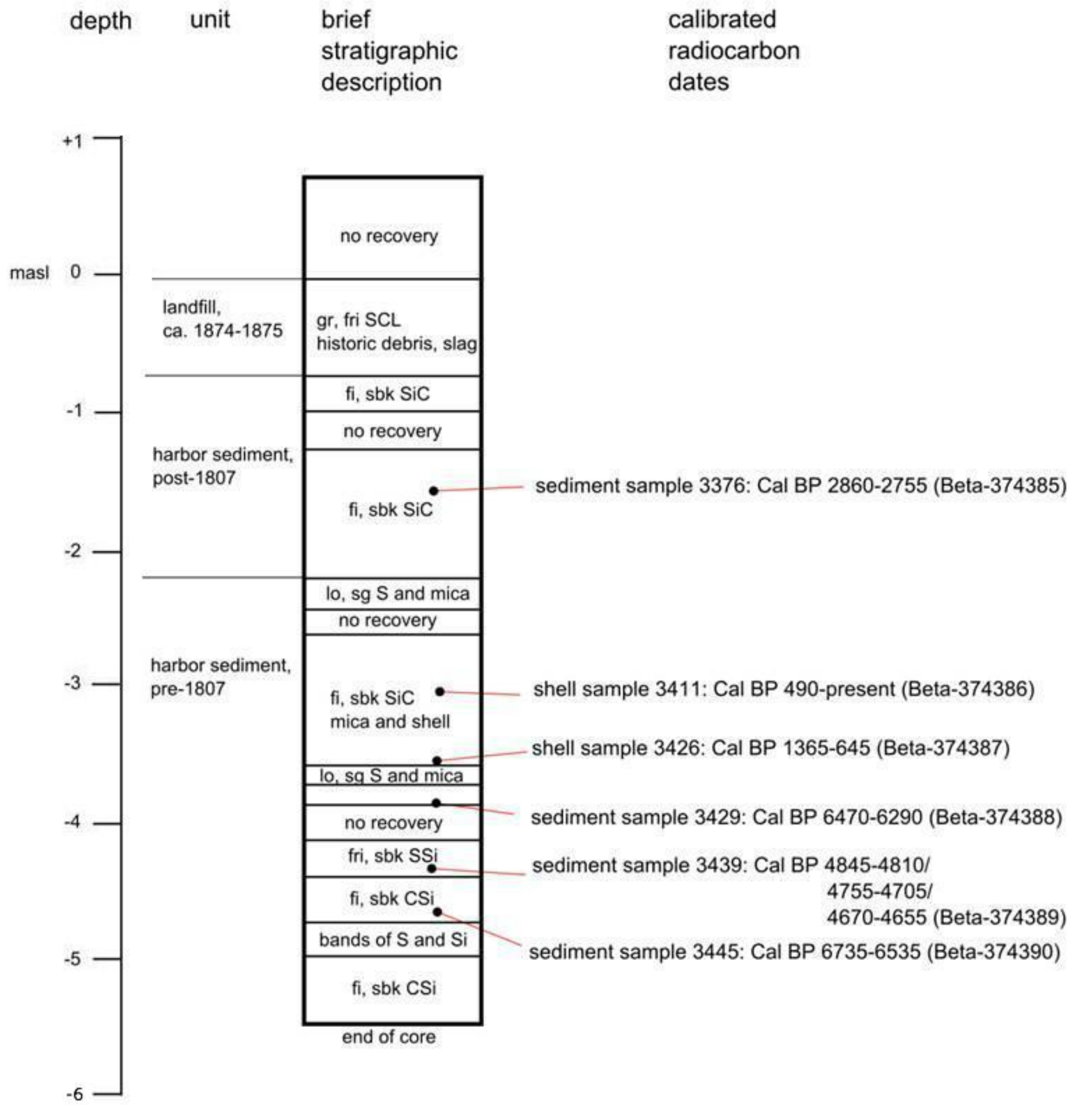


Figure 4.74. Depositional units and radiocarbon dates from Boring GRA-10.

Figure 4.75. Profile showing slope of stratigraphy and lensing.


Figure 4.76. Sandy band within the trash fill (west end of Sensitive Area 1).

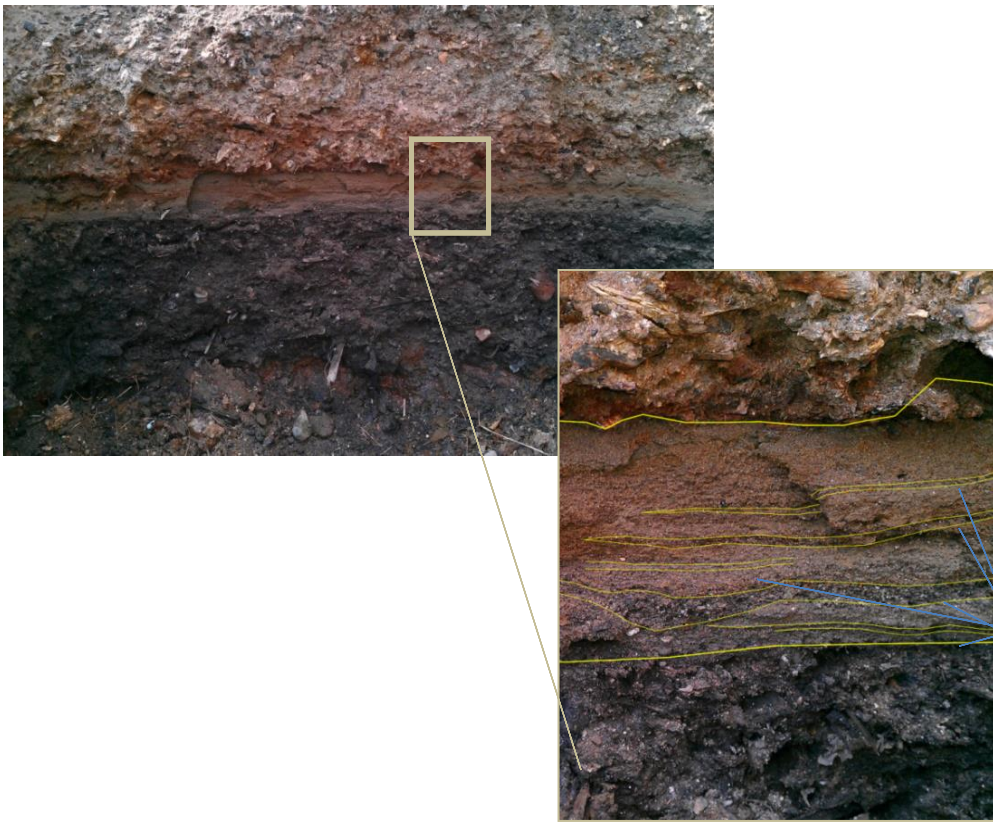


Figure 4.77. Close up of a sandy band within the trash fill.

Figure 4.78. Profile of initial STP 12, showing pavers.

Figure 4.79. The ragged edge of the paved surface.

Figure 4.80. NY Central Railroad entering Eleventh Avenue at 60th Street, view looking north from 59th Street (Sperr 1930-1933).

Figure 4.81. View of the project area prior to New York Central's West Side Improvement, looking northwest from the intersection of 60th Street and West End Avenue/Eleventh Avenue (Sperr 1933).

Figure 4.82. Looking north within the east side of Parcel 2, during removal of the uppermost twentieth century fill sediments. 61st Street lies behind the light blue construction fencing.

Figure 4.83. Shovel tests containing stony rubble fill.

CHAPTER 5: DISCUSSION

Introduction

As discussed in Chapter 4, the vast majority of material recovered from this project relates to the land reclamation event that likely occurred in the late fall/early winter of 1874/75. Functionally, the sequence stratigraphy of the Riverside 2 is overwhelmingly dominated by historic sedimentation due to the transformation of the prehistoric and (presumably) early historic landscapes through systematic upbuilding of the land surfaces by various land reclamation efforts. This chapter seeks to explore further the processes that sculpted the property from its pristine setting through the various phases of historic sedimentation. We explore why the generic term "landfill" is not representative of a single generic episode, but rather represents a composite signature of broadly similar, but nevertheless separable stages indicative of changing human impacts to the environment over the past 150 years. The site history begins, however, with a discussion of the prehistoric landform histories that were the target of initial investigations in Phase 1.

Prehistoric Environments and the Near Absence of an Archaeological Record

For archaeologists, New York City epitomizes, perhaps more than any other urban location, the difficulties in reconstructing synchronic landscape and prehistoric archaeological records. The depth of development efforts, that extended vertically to more than 10 m (33 ft) as early as the mid-nineteenth century (Cantwell and Wall 2003), was a precursor to sequential destruction of prehistoric resources, was a trend only destined to accelerate further with time and the emergence of the densest urban environment in North America. As discussed earlier, several factors converged to guarantee the sparseness of the buried prehistoric record.

The frequency of flooding and attendant submergence of farm fields and threats to the early urban infrastructures of colonial New York resulted in the construction of the deep fills surrounding Manhattan Island. It was a practical matter whose short and long term threats were clearly recognized by early urban planners. In addition to the obvious needs to limit the ravages of uncontrolled coastal flooding, it should be noted first, that post-glacial sea-level rise progressively submerged former terrestrial settings of the Early to Middle Archaic periods (see Figure 2.1 and discussion in Schuldenrein et al. 2013). Moreover, population densities at those times were extremely low. Landward encroachment of near-shore environments was also accompanied by re-adjusting base levels and dynamically shifting stream channels. Taken together, marine-based wave action and terrestrial stream erosion compounded destruction of lightly populated Archaic camp and shell sites, as well as the seasonally occupied, short duration Woodland sites (after 3000 B.P.).

The history and long record of archaeological research in the greater New York City area has demonstrated that the greatest potential for locally preserved prehistoric sites is found in the undeveloped areas of naturally higher terrain. Functionally, such relatively "high preservation" localities are found in Staten Island and the Bronx, both landscapes which are characterized by terrains of significant relief. In the case of the former, both the borough's rugged geography at the margins of the classic (terminal Pleistocene) Harbor Hills moraine as well as (until recently) its relatively low levels of development rendered isolated settings as ideal for site preservation (Schuldenrein et al. 2013). In the Bronx, somewhat lower site densities, even at higher elevations, are a product of surface bedrock outcrops that are inimical to preservation and a somewhat higher modern population density.

Clearly, lower Manhattan, in proximity of tidal encroachments, and its enormous levels of development since the 19th century would be expected to be have a low preservation potential for prehistoric sites. The only areas in which even minor evidence of Holocene prehistoric presence has been recorded is in the higher terrain of Upper Manhattan; from Harlem into Inwood.

Riverside 2: Potential Prehistoric Site and Aboriginal Landscape

While New York City may provide an extreme example for minimal buried prehistoric site expectation, similarly low settlement, preservation levels are common across the Northeast. There are, however, significant exceptions to that rule. In general, such exceptions occur within deeply alluvial and terrace sites of primary drainages such as the Delaware (McNett 1985; Schuldenrein 2003) and the Hudson (Funk 1976).

Just as significant, however, is the long history of paleoenvironmental reconstruction in the Northeast. The widespread documentation of rich vegetation histories, Holocene pollen chronologies, offshore geologic investigations, and sea level rise chronologies represent a major trend in documenting environmental and geomorphic change in the region. Such studies are often part and parcel of larger scale human ecological investigations in which, often, the prehistoric records are sparse but the Holocene models and multi-faceted paleoenvironmental reconstructions tend to provide local and even regional patterns in climate history, biotic transformations, and, where there are archaeological sites, unique records of synchronous development in the parallel cultural and ecological chronologies.

The initial impetus for prehistoric investigations at Riverside 2 stemmed from an Environmental Impact Statement generated by AKRF in 1992, wherein it was recommended that archaeological investigations be performed in the vicinity of a stream that cut through the northern parcel. In fact, several archaeological sites have been found in such locations along the Hudson, most recently by Claason (1992) in conjunction with high and wide deposits rich in both marine and terrestrial shells. The potential seemed analogous at Riverside 2 because of the Phase 1 investigations that produced organic radiocarbon in the archaeologically sensitive time frame, 6000-3000 B.P. Moreover, Riverside was unique in that there was clear evidence of a broad array of prehistoric landscape components, both prominently differentiated from one another and collectively constituting a uniquely rich and varied biome.

The estuary was the signal landform as it produced the radiocarbon dates. The borings revealed, moreover, that the unconformity with the base of the presumed landfill was an undulating surface. The importance of the buried terrain contours lay in the fact that such microenvironments, replete with a potential ridge and swale topography, may have been the site of converging fresh and saline water sources, settings that would have been ideal for encampments, as they provided ready access to a broad range of aquatic habitats. Further, the boundaries between the estuarine and riverine resources were dynamic, as they mirrored advancing sea level rise. The implications here were that not only were there potentially preserved cultural resources, but that they also may have varied through time, given the relatively rapid rates of sea level rise (Figure 2.16). Multiple groups with possibly highly adaptive lifeways may have been drawn to the project area. Finally, the surviving remnant of the primary glacial hill afforded a vista from which all activities across the entire landscape could have been monitored by both local and regional aboriginal groups (Figure 5.1 and Figure 5.2 provide a reconstructed estuarine landscape and an interpolated post-glacial, pre-estuarine landform surface, respectively.)

In conjunction with the deep-testing program, specialists from allied Late Quaternary disciplines were brought in to initiate investigations of the paleoenvironments. The principal topics of investigations bearing on the Holocene landscapes were vegetation and climate; shell studies to determine if the fluctuating estuarine vs. terrestrial margins could be determined; and radiocarbon specialists to work with the geomorphologist concerning the issue of landform antiquity. Perhaps most significantly, the geomorphology was key to addressing the following questions:

To what degree did the paleo-vegetation and malacological investigations date and facilitate a reconstruction of landscape change through time?
Was there sufficient evidence to demonstrate variability at the transition from the prehistoric to historic landscape?
What were the geomorphic processes that explained the radiocarbon chronology and how do these explain the absence of an unequivocal prehistoric archaeological component?

Each of these topics is addressed in turn.

Paleo-environmental reconstructions: the pollen and mollusc population. The pollen analysis (Appendix G) succeeded in identifying a relatively intact succession over the uppermost 4.4 m (14.5 ft) beneath the landfill.

Three distinct vegetation zones were identified in the pollen sequence above 436 cms. The basal zone, Zone 1 (4.4-4.0 m [14.5-13.0 ft])), was attributable to the (probable) Woodland period. While there was no evidence for agriculture there were indications of human activity. Abundant oak, hickory, pine, and hemlock pollen reflect an admixture of human colonization of the vegetation. Zone 2 (3.9-2.9 m [13.0-9.5 ft]) denotes early European colonization of the area. There is a subtle transition to aquatic taxa, while pine, hickory, and hemlock decrease in response to deforestation. The uppermost Zone 3 (2.9-1.5 m [9.5-5.0 ft]) represents probable 19th to 18th century deposits. Agricultural prominence is recorded by the presence of maize pollen. Charcoal increases later in the 19th century and confirms a trend to more intensive land use.

The malacological record (Appendix I) is more fragmentary and less diagnostic. All identified specimens were consistent with deposition in a shallow estuarine environment. While no stratigraphic trends were apparent, the clam, *Mulinia lateralis*, was more abundant in older sediments and this is significant since it lives in soft substrates with relatively high salinities. *Macoma balthica* also is common in the intertidal zone in low energy muddy bays of the mid-Atlantic and Arctic coasts. A third highly salt tolerant species, *Ilyanassa obsoleta* is common as a shallow water gastropod found feeding on detritus and scavenging on mud-flats. The upper core depths featured more diverse molluscan fauna – oyster fragments, mussel fragments, hinge fragments most likely belonging to *Mya arenaria*, and the gastropod *Odostomia trifidia.* The oysters and mussels were probably carried in from nearby hard-substrates, but were still indicative of shallow water estuarine deposition. The overall molluscan fauna were characteristic of a shallow, quiet water, mudflat/intertidal environment, with consistent salinities. Changes in dominance of species with depth indicated changes in water depth or sediment distribution.

Change in the transition from the Prehistoric to Historic landscapes. The three zones in the pollen record would seem to provide relatively compelling results in this connection. These zones are time transgressive and reflect threshold transitions from pristine woodlands to slightly anthropogenic intrusions and mixed woodland and open (non-arboreal) pollen profiles to an agricultural signature in the Colonial period. The malacological record appears fairly uniform, a sign that shallow estuarine conditions were relatively consistent over the life history of the late prehistoric time frame and into the mid-nineteenth centuries.

Geomorphic process and the radiocarbon record. The radiocarbon chronology exhibits some noteworthy inconsistencies (Appendix D). A total of 8 radiocarbon specimens were subject to assays. Of these two were from GRA-1, the till-related feature and the surfaces above it and the stabilized soil. Preliminary indications from the coring and field observations showed that the till sediment body was subject to extensive localized erosion so that organic sediment may be in mixed context. Six determinations were from GRA-10, derived from the lower-lying estuarine sequence. Of these, two were from shell components and measurements utilize different calibrations. Figure 5.3 shows a time-depth plot of the population of dates (uncalibrated) linked to their depositional units. This sample population is statistically too small to draw meaningful interpretations of significance. However, several points are noteworthy. The till and upland derived dates (GRA-1) are appropriately older and reflect a glacial source associated with the hill and elevated terrain associated with the glacial feature. The estuarine dates are generally well aligned and could almost be statistically correlated. Those middle to Late Holocene determinations grade from oldest and deepest (Unit 1b at ±4.5 m) to youngest and shallowest (Unit 2a at ±3.0 m) with an outlier at 2a. The sample from 2c is also somewhat problematic and may represent some reworking of organics incorporated within eroded sediment from a variety of sources.

Our in-field assessment was that some organic units were displaced and even reversed because of wave action associated with 2a; construction of the docks coupled with wave action in the former swash zone could have mobilized sediment bodies as landward encroachments cyclically receded and advanced. This hypothesis, however, is provisional in the absence of additional radiocarbon specimens.

Landfills: Rethinking Contexts of Integrity and Stratigraphy for 21st Century Archaeology

Since landfills are the product of relatively recent and large scale sediment redeposition (often with the use of heavy equipment), their emplacements are not commonly accorded the status of primary historic-age activities. This tends to minimize their archaeological significance. Yet, the scale and extent of the twentieth century and subsequent landscape development is of such magnitude that future archaeologists will necessarily examine landfill contents and processes of formation when reconstructing the functional landscapes of the modern era (now increasingly referred to as the “Anthropocene”).

Traditionally landfills are taken to be (internally) undifferentiated bodies of sediment that may have to be penetrated or removed to gain access to pristine surfaces that potentially contain sites or artifact assemblages in "primary context" (locations of original use). Paradoxically, those ostensibly pristine surfaces can themselves be sheet middens, which are essentially ancient discard surfaces and, in places, localized "dumps." Methodological advances in the study of the dumps of antiquity are at the heuristic core of advances in archaeological site formation studies. Yet, archaeologists either deliberately or circumstantially avoid collecting data on what the pioneering scholar of cultural landfills, W. Rathje, called "the archaeology of us" (Rathje et al. 1992; Shanks et al. 2004). Archaeologists who work in historic periods are increasingly drawn to studying older dumps and landfills since they represent early phases of large-scale discard, in the case of the earliest municipalities. In addition to documenting historic patterns of land use, dumps and landfills also inform on land management strategies applied by the predecessors of today's city planners. The development of zoning and building codes is directly linked to the use of space for accommodating the various activities attendant to urban life; the discard footprints and processing activities of waste staging areas explain changing urban layouts, infrastructure configurations, and the legalities governing the patterned growth of cities. It is ultimately short sighted to evade studies of contemporary landfills especially since, in the United States and elsewhere, formally designated landfills are in excess of 50 years old and may qualify for assessments of integrity according to the statutes of Section 106 of the National Historic Preservation Act guidelines (King 2013). Decay of historic features, historic drainage technologies, historic surface recontouring are, in fact, research domains that should be considered primary archaeological contexts for the 20th and 21st century since they reflect contemporary practices that result in the production of the urban archaeological record.

The entire question of designating a sediment as "fill" may now be called into question insofar as both ancient and modern dumps and landfills must be considered features that preserve the material evidence of an expanding scale of discard strategies. For early agricultural periods and villages (i.e., Neolithic and onward) progressively expansive discard strategies are reflective of the growing magnitude of human activity. With time, material evidence for declining social, political, and economic organizations became part of the buried archaeological record. Those material complexes comprise the internal fabric (i.e., stratigraphy) of Near Eastern tells and Archaic or later shell mounds (see Stein 1992), to cite classic examples. With time, the signatures of such discard features became progressively larger, more complex, and multifaceted even as discrete disposal loci were exposed to the ravages of erosion and landscaping, often losing their integrity over the course of post-site abandonment. Those features are functionally akin to dumps. Thus, the study of these most ancient of dumps and landfills is central to the study of archaeology in a variety of settings, scales, and contexts. Viewed in a developmental context, the emergence and proliferation of complex societies have been accompanied by increasingly broader and deeper "discard" footprints as urban centers expanded outward and grew in size and frequency across global landscapes. Neolithic villages in Europe and Asia gave way to medieval cities, while urban-like complexes in Mesoamerica and South and North America witnessed more punctuated and sporadic growth in later prehistoric times before giving way to the Euro-American expansions in the seventeenth century. Discard features changed in size, shape, and function in response to complexities in human socialization, commerce, and administrative organization. Discard features will become more prominent structural and functional components of the twenty-first-century landscape. The prominence of what may be called "dump and landfill archaeology" is magnified further by the recent push to recalibrate and redefine geological epochs in the wake of humanly induced climate change and impact on ecological systems. Many scientists are now accepting the designation Anthropocene as a formal geological epoch based on climatic and geomorphic changes that have been either initiated or catalyzed by large-scale human impacts (Ruddiman 2003; Price et al. 2011; Zalasiewicz et al. 2011; Brown et al. 2013). Amid considerable debate, the start of this Anthropocene epoch has been variously dated to the age of the European Industrial Revolution (ca. AD 1850).

It follows that the disposition of "fill" across buried urban neighborhoods generates considerable interest and provides new information on site formation chronologies across time and in connection with changing historic settlement geography. It can be argued, *sensu lato*, that today's fill is tomorrow's archaeological sediment because the former sediment bodies in fact reflect previous fill functions (i.e., relandscaping, recontouring). In many cases, their disposition, textural and compositional properties, and patterned redeposition may be associated with properties linked to the process of site burial and subsequent land For example, lime-rich sediment is often used to neutralize acidic and corrosive impacts in modern tank farms (oil depots). Accordingly, it is questionable as to whether or not those sediments should be designated as fill or more accurately "historic sediment." The former term is generic, implying undifferentiated and unsourced depositional complexes, while the latter is suggestive of primary, semi-primary, or displaced contexts linked to demonstrable functions and known periods.

Given the growing acceptance of the Anthropocene concept and advances in site formation reconstructions (facilitated by high-technology applications), the latter designation of "historic sediment" should emerge as an umbrella for a nascent taxonomy centered on historic-age processes of site emergence, florescence, and abandonment. The use of the latter classificatory scheme would then restrict the term "fill" to situations wherein human engineering of the terrain produces artificially constructed or degraded landforms whose functions are mapped out in advance. That definition is more consistent with the growth of scientific methodologies, and it focuses on the dynamism of landscape archaeology and an overarching geoarchaeological perspective.

Interpretations of the Landfill Complexes at Riverside 2

GRA approached the artificial landfill in the project area as man-made sedimentological units that were purposefully deposited, creating numerous occupational surfaces. This is not unlike the large-scale prehistoric shell midden constructions seen on the southwest Gulf coast of Florida (e.g., Marquardt and Walker 2013), or earthen mounds found throughout the southeast and Midwest (e.g., Sherwood and Kidder 2011). This approach allowed us to realize the potential source of information about the local community and industrial activities that the artificial fill contained.

Many archeological studies have used remains of refuse, midden, or waste to address a wide range of cultural and chronological problems (Hayden and Cannon 1983; King and Miller 1987; Moran 1976; Murray 1980; Rathje 1989; Schiffer 1972; Staski 1991; Wilson 1991, 1994). However, it is unusual to subject the contents of nineteenth and twentieth century landfill to the kind of exhaustive analysis presented here. William Rathje and colleagues have studied relatively recent landfills, but their attention has basically focused on volumes of various kinds of garbage, including such things as fast food containers, polystyrene, and baby diapers, rather than specific artifact types like glass and ceramics (Rathje and Murphy 1992:95). This project provided a rare opportunity to study the contents of New York City landfills dating to the nineteenth and twentieth centuries. Although previous studies (as well as archival literature and topographic maps) provide important information concerning estimates of the amounts of, and locations of, local landfills, there is practically no data available relating to the composition of these deposits (Buttenwieser 1987; Teotia 2013; Walsh et al. 2001; Walsh and LaFleur 1995). Fill deposits are sometimes overlooked due to budgetary and time constraints within contract archaeology. Unfortunately, this relegates such deposits to a secondary status, even though they may be the largest historic feature on many urban properties. The de-contextualized nature of the artifacts within the fill typically means that the fills themselves are not considered archaeologically sensitive. However, dumps can be eligible for the National Register if they are intact, because they can provide important information about the community that created them, that is, if the community can be clearly defined (Rathje and Murphy 1992). They may also represent important developments in the history of waste management. In many cases, dumps are the only surviving source of material culture pertaining to industrial and household activities, because waste management practices dictated the removal of trash to a common area (Sullivan, Griffith, and Majewski 2005). In the present case, the historic trash fills of New York City provide a detailed chronology of the urbanization of the city over time. Within the city, land-filling was an important means of claiming space for new construction, and it took place in episodes that can be easily distinguished from one another. Much of the waterfront in New York City was already being filled by the end of the nineteenth century, and at present over 45,000 acres of the city are filled (Walsh 1991).

New York City and Nineteenth Century Waste Management

More than 10 percent of Manhattan's land area is manmade landfill (Buttenwieser 1987; Walsh 1991; Walsh and LaFleur 1995). Landfilling began in New York City as early as 1640 (Buttenwieser 1987:32). The rise in population and the progress of industrialization sharply increased the volume of solid waste generated in the city. This led to the development of a formal strategy for using the accumulating waste as a new way of physically expanding the city and improving its infrastructure (Walsh 1991). Most of the historic local landfills were located in tidal wetlands or in close proximity to large water bodies (Walsh and LaFleur 1995).

Though using trash as foundation material had become general practice, New York City made several attempts to move waste out of the city in an effort to diminish city-wide viral outbreaks. During the 1860s and 1870s, laws were passed against the dumping of trash in privies, school sinks, and cesspools. Trash collection and street cleaning ordinances were enacted and arrests were made for illegally dumping in harbors. In spite of these efforts, trash continued to be dumped along the eastern shore of the Hudson River until the 1880s (Corey 1994; Alonso and Recarte 2008; Yamin 2000).

While garbage dumping transformed the coastal landscape, informal scavenging re-valued particular waste materials. Since the late eighteenth century, poor people used scavenging as a source of income. Rags, bone, leather, scrap metal, and glass were highly valuable for their reusable properties. Manufacturers were also willing to pay small wages for the retrieval of these materials. Cotton rags were made into paper or pieced together to make clothing, rugs, and blankets. Recycled bone and leather scrap contributed to glue production. Scrap metal and broken glass were melted and recycled into new wares, and whole glass bottles were washed and resold to bottling companies. The city eventually used scavengers as a source of labor to sort through the mixed trash found in the streets and off scows in the harbor (Alonso and Recarte 2008; Medina 2007).

Wilson (1994) discusses the mobility of refuse, and distinguishes trash dumps by their artifact value as well as artifact frequency and density. Trash discarded at its place of use is considered primary refuse while secondary refuse refers to the movement of trash away from its place of use. Artifact values are defined by the fill's reusable properties. Frequency and density describe the amount and distribution of particular types of refuse.

There are difficulties with determining the origin of fill in an area that was not residential (Sullivan and Griffith 2005). It is possible, however, to match artifacts associated with certain industries to the industries present in the vicinity of the site. It is also possible to distinguish between production waste and household waste. Production waste is the outcome of commercial manufacturing (i.e., scrap, unfinished wares, and defects). Commercial refuse appears unused and/or found in bulk. Household waste consists of consumed goods that reflect consumer choices, economic wherewithal, health, and dietary trends. Artifact frequencies can be used to supplement this information, bolstering claims on fill origin.

Fill Analysis

The assemblage of the nineteenth century artificial fill (Depositional Unit 3) contained many artifacts with high resale value (such as scrap metal and leather). In addition, very few animal bone fragments show evidence of weathering or animal gnaw marks. These are uncharacteristic for dump sites in the city that were left open (Corey 1994). The presence of high-valued materials within the fill indicates that little-to-no human scavenging occurred. The absence of bone fragments with evidence of weathering or animal gnaw marks indicates that little-to-no animal scavenging occurred. Scavenging is common among trash dumps that have been exposed for long amounts of time. This further suggests that the refuse was deposited within a short time frame. Laws at the time prohibited the dumping of trash on Manhattan, as well as the mixing of trash and ash. The layer of ash that caps the fill can be interpreted as an attempt to conceal the refuse within the fill from the public eye, which would have had to occur fairly quickly after the initial deposition of the fill to be effective. Therefore, we surmise that the artificial fill and associated artifacts were deposited over a short period of time, most likely in the late fall and/or early winter of 1874-1875.

Production and Commercial Waste

Metal objects (excluding nails or screws) recovered from the nineteenth century artificial fill layer may reflect various stages of sheet metal production. Wire and other miscellaneous metal items (bars, coils, pins, nozzles) may also be factory refuse. The majority of the Type B cut nails exhibit no sign of use-wear. Of the glass alcohol bottles, two plain wine bottle types out-numbered all other utilitarian alcohol bottles found at the site. These two types had bases that showed evidence of long term reuse. We interpret the metal artifacts and at least a portion of the glass alcohol bottles as most likely coming from production and/or commercial waste.

There is no way to be certain that these materials, which we assume are from production and commercial waste, derived from the surrounding neighborhood. However, the assemblage is historically consistent with a survey of local business directories. Industries in the vicinity of the project area included an iron foundry, building material supplier, and multiple breweries (Figure 5.4). The large iron factory may have been a production center for sheet metal or other foundry activities. The business listed as "Building Materials" is the closest business to the site, and may have sold various building supplies such as nails, screws, etc. The breweries may also have been responsible for the frequency of utilitarian wine bottles.

Household Waste
Other cultural materials recovered have attributes indicating use in households or other private venues. They are finished products that directly reflect activities and consumer trends (see Allison 2002; LeeDecker 1994) of the nineteenth century. It is impossible to associate the artifacts with specific local households. However, the frequency of certain objects reflects both the regional and international distribution of goods. Brief descriptions of representative artifacts from different functional contexts are presented below.

Personal Items. A black rubber button with a wasp design and the platinum alloy based metal in the dentures represent the adoption of newly available materials. Other items recovered were made of metal which had become a cheaper and easier material from which to manufacture goods by the 1860s. These include the Civil War cavalry hatpin, octagonal-shaped spectacle rims, and a .22 caliber bullet cartridge. Several forms of currency were also recovered from the fill. The coins date to the mid-1860s. The shell card was an early mode of advertising business deals. One side of the token is a thin embossed sheet of metal with an image of Liberty and the year 1868. The other side, which is missing, would have been a cardboard disk or another sheet of embossed metal with text indicating where the token could be redeemed. A large number of worn soles, as well as whole shoes with worn soles, were recovered. This suggests that the shoes were related to everyday use, with people using them until they were worn out, and then discarding them (see Appendix E).

Clay pipes, the most abundant of the personal items found, were made of white ball clay and identified by their bowl or stem fragments. Historically, pipes were predominantly manufactured in Europe (Walker 1970). Several fragments have diagnostic features representative of production in Gouda, Netherlands, St. Omer, France, Glasgow, Scotland, and Vienna, Austria.

Kitchen Ware. Residential waste was mostly represented by kitchen and/or dining related objects. A number of Victorian trends were present in the ceramic and glassware assemblages. For example, Gothic paneling is present on objects ranging from ironstone cups to bar tumblers. Plate fragments exhibited trendy designs including mold reliefs, blue transfer prints, and harvest/wheat ornamentation. In addition to these motifs, matching dining sets were observed including a honey comb-patterned wine glass and matching decanter top.

Recovered lighting fixtures show a range of styles and options available in the mid nineteenth century. A porcelain candle stick holder was recovered along with several oil lamp bases and wick holders. In addition, gas light brackets and several lantern glob fragments show a transition in lighting technology.

Toys. Several toys, including glass marbles and “Frozen Charlotte” dolls, were manufactured in Germany. The glass marbles were distinctly handcrafted from two types of glass, a method that creates different patterns in the core and exterior of the marble. “Frozen Charlotte” is a name used to describe a specific form of china doll made from c. 1850 to c. 1920. The doll is made in the form of a standing, naked figure molded in one piece. Additional clay marbles and fragments of ceramic dolls were also recovered as well as several miniature tea cups, saucers, sugar bowls.

Health. A spittoon recovered was made of porcelain decorated with gilt enameling and an annular rim transfer-print. Spittoons are generally found in public places (e.g., taverns, hotels). Lice combs were also found in abundance, most of them made from vulcanized rubber patented in 1851 by Goodyear. The fill also contained an assortment of the remains of proprietary medicines, which were unregulated medicinal products claiming to cure a number of ailments (Fike 1987). Ms. Winslow’s Soothing Syrup was a popular morphine-based elixir to calm crying children. Others like H.T. Helmbold’s Genuine Fluid Extract promised to cure physical depression, hysteria, kidney disease, constipation, etc.

Foodstuff. Cow, chicken, pig, and goat were well represented in the fill. Many of the remains showed cut marks indicative of butchering, and were most likely representative of household diet. Other food types show seasonal preferences, for example, peaches were commonly sold in the late summer and early fall (Ingersoll 1881). The number of beverage containers outnumbered those for preserved food and condiments. The maker’s marks suggest water preferences: seltzer in bottles labeled in German and one from Vermont.

Artifact Values

Artifact values were assigned to the artifact types based on their reuse potential during the mid-nineteenth century (Table 5.1). This information was used to understand the amount of human scavenging for recyclable materials that could have occurred after the refuse was deposited. Items like ceramics had low artifact values because they were not considered a reusable resource. Other items, such as seashells, were very valuable because they could be used in lime production. Because people would have targeted high-valued items during scavenging, we expect low fragment counts of the highly valued resources at a secondary refuse site.

The presence of high-valued materials within the fill indicates that little-to-no scavenging occurred within the project area. This further suggests that the refuse was deposited within a short time frame. Faunal analysis supports this claim (see Appendix H). Very few bone fragments show evidence of weathering or animal gnaw marks, which are common features of faunal remains that have been exposed for long amounts of time. The availability of fruit pits (peach) and seeds (pumpkin/squash and muskmelon) as well as seafood remains suggests that the filling took place in the late summer and early fall when these products were available. In conjunction with the artifact value data, and the timing of the stockyard construction (finished in January of 1875), these data indicate that the fill was deposited fairly rapidly during 1874.

Spatial Distribution of Artifacts in the Fill

Spatial analysis of artifacts from the nineteenth century fill (Depositional Unit 3) was performed to elucidate subtle patterning in dumping. STP data lends itself to point pattern analyzers (e.g., Thompson and Turck 2010; Turck and Thompson 2012), as it is collected in a standardized fashion. Since the initial STPs were more randomized, only the 54 STPs from transects 1 through 7, and only from Sensitive Area 1, were analyzed spatially. Artifacts from other contexts, and from Sensitive Area 2, were excluded from this analysis.

Results. Faunal remains of domestic cattle (n=102), pigs (n=108), and chickens (n=80) seem to be scattered throughout Sensitive Area 1, and overlap with each other to a considerable degree (Figure 5.5, Figure 5.6, and Figure 5.7, respectively). This suggests a similar dumping pattern for the different species, which can further suggest a simultaneous dumping event. It is possible that food remains were collected from different households and dumped all at one time. Health department records mention garbage containers, referred to as “boxes,” along access walkways to tenements on the east side of Manhattan during this period, and would account for joint dumping episodes.

Other items exhibit a more complex dumping pattern. Ceramic dishware/kitchen/household items were found in all but 9 STPs (Figure 5.8). Although 11 of these STPS had 17 or more ceramic fragments, the general pattern is that of an even distribution of ceramics across the entirety of Sensitive Area 1, perhaps indicating regular dumping of such items (or, that these were the most common items, i.e., getting dumped every time dumping occurred).

Window glass is more difficult to interpret (Figure 5.9). Over 44% (24) of the STPs had window glass, but 20 of those only contained 1-4 fragments. The majority of the fragments (n=63) were found in two STPS (STPs 3.1 and 5.6). Glass alcohol bottles seem to have a more localized dumping pattern (Figure 5.10). Only 13 of the 54 STPs contain bottle fragments or bottles, with 12 of those having counts of only one or two. Clay pipes also seemed to be concentrated (Figure 5.11), with only 15 STPs containing evidence of pipe stems, bowls, or other fragments. Toys are the most extreme example of concentrated dumping (Figure 5.12), with only 8 of the 54 STPs containing artifacts such as figurines, marbles, etc. However, this could also be due to the low number of toys found in the entire collection, as well as the low number (15) of toys within the standardized STPs of Sensitive Area 1, and associated with the artificial fill analysis. These concentrations of certain artifact types can be used to suggest the idea that individual households were responsible for individual dumping episodes. At the very least, artifact concentrations indicate that those items were probably dumped together in one place, and were not disturbed afterwards.

Artificial Fill: Conclusions

The results of the present work show significant discard activity patterns that cannot be seen as a random scattering or the result of a long-term, open air secondary disposal area. The differences between the spatial distributions of the various remains indicate differential discard behaviors. Implied in the results is that residential discard behavior, at least of food remains, was probably a communal effort while local small business owners probably did their own dumping.

By analyzing the distribution of artifacts within the artificial fill under the cobblestone surface, this study illuminates the characteristics of discard behavior at a specific moment in time. It also reveals how the community, if this is indeed where the cultural material came from, contributed to a significant building project in the midst of a major depression. This analysis shows that this area did not act as a traditional dumping ground for the surrounding neighborhood. Instead, trash was collected and intentionally dumped onto the site relatively quickly. This assessment is corroborated by the background document research. The water lots for this area were conveyed to William H. Vanderbilt, eldest son of Comelius Vanderbilt in 1873. In 1875, the Union Stockyards opened at this location. It was also noted in the background section that Vanderbilt's control of the New York Central and Hudson River Railroad was closely tied to the construction of the Union Stockyards. This timeline provides strong circumstantial evidence that the land reclamation process was intentionally undertaken for the purpose of creating land for the Union Stockyards. It is probable that the trash was collected mainly from residential properties in the neighborhood. Industrial and commercial products were also present, and in at least one instance (leather), they may have been deposited by the shop that generated them.

People and Artifacts: Connecting the Census Data to the Cultural Material in the Fill

As no absolute direct connection can be drawn between the populace of the neighborhood in around the site area, a few questions must be considered in accessing the relation of the fill material to the people of the surrounding neighborhood. Is the recovered material and its spatial patterning observed through excavation consistent with a local origin? Given the relatively short duration of this land reclamation process, could the local population have generated the sheer volume of refuse required to execute the filling in of this location? The demographics noted in the census analysis are consistent with the assemblage. This alignment lends support to the interpretation that the local neighborhood was the source of the refuse in the fill. The origins of artifact manufacture were examined in conjunction with census data, to elucidate how the artifacts may be related to the local population, in a general sense. The following takes the previous analysis of census data with the added context of artifact origins to understand ethnic and socioeconomic aspects of the nineteenth century population of the upper west side of Manhattan.

U.S. Connections

Of the 7,045 artifacts recovered from the nineteenth century fill, 128 had identifiable origins of manufacture. Eighteen of these artifacts originated from states outside of New York. Examples include a bone marrow container from Philadelphia, and "Mrs. Winslow's Soothing Syrup" bottles from Maine (Table 5.2). Two ceramic artifacts originated in West Virginia. Sixteen artifacts came from states such as Pennsylvania and Maine, where people had migrated into the neighborhood from, according to the census data.

Global Connections

The remaining 110 artifacts with identifiable origin correspond with foreign manufacturing (Table 5.3). Most (80) were determined to be manufactured in the United Kingdom. Only one bottle was identified as having an Irish origin, with five sourced to Scotland. No "Home Rule" or other distinctively Irish-marked clay pipes were found. The remaining identifiable artifacts originated from Germany (15), Germany/ Netherlands (8), France (4), Austria (1), Spain (1), and Japan (1).

Although the census indicates many Irish-born residents in the local area, the almost total absence of Irish artifacts on the site is not surprising. The only artifact that can be sourced from Ireland are one glass bottle with a marking from Dublin, and several fragments of Lea and Perrins Worscestershire Sauce bottles, which have been associated with Irish communities elsewhere in New York City (Cantwell and Wall 2001:60). As has been shown in many studies, ethnicity is expressed in different ways in different situations. Chris Matthews (2010:109) has suggested that the artifacts associated with private life in an Irish tenement at Five Points were in no way specifically Irish although the Irish used their ethnicity in public life to obtain work. Paul Reckner's (2000) study of the clay pipes associated with Irish tenements at Five Points found that the Irish avoided the patriotic imagery that characterized the pipes associated with German households. The Germans tended to identify with the Nativist political party which used patriotic symbolism to express their presumed superiority over recently arrived (and Catholic) immigrants. As Reckner says, "The hesitancy of the Irish of 472 Pearl Street to use objects decorated with patriotic motifs is more comprehensible when we can see their neighbors raising the American flag against them" (Reckner 2000:108). Ethnicity is expressed situationally; it is a matter of context (Beaudry et al. 1991:160; Orser 2007:169). In other words, the absence of Irish artifacts does not mean that the Irish had lost their identity. It means it was expressed in different ways.

As noted above, German-made artifacts were found within the fill. Although there is no way to know whether they had anything to do with the expression of German ethnicity within the community, such items may have been comforting reminders of home. "Today's historical archaeologists have grown significantly more sophisticated in understanding the linkage between artifact usage and social meaning, and most have abandoned the search for single identity markers" (Orser 2007:169). Other artifacts from the fill may relate to other foreign-born residents in the neighborhood. The occurrence of coconut shells could be explained by the small group of residents who were born in the West Indies and the Spanish sardine container, likely from the mainland, might reflect the presence of Spanish-speaking immigrants (possibly from Cuba). The Japanese artifact, a 4-mon coin piece, is especially intriguing when considering the census data. The 1880 Census shows two Japanese immigrants, Renzo and Kuma Yezoye, living at 307 W. 59th Street, near 9th Avenue. Renzo was marked as an "importer," which may explain how he ended up in a neighborhood next to a train. Although a search of ancestry's database could not confirm when the Japanese couple moved into the neighborhood, it is tempting to associate this couple with the coin.

Food Connections

The ethnobotanical remains identified from Depositional Unit 3d have given insights into the diet, economic relationships, and possible health care practices of past Manhattanites. While it is not known for certain if these are the remains of products consumed by those living near the site in the Upper West Side, some insights can still be drawn. In a socioeconomic sense, the food remains present in the Riverside assemblage does not strongly associate with a certain class of consumers. As shown in the Five Points excavations (2000:60) and corroborated by Rothschild (2009:58-60), even households which were not wealthy contained the remains of expensive fruits including coconut, coffee, peanuts, and Brazil nuts, as well as evidence of condiments such as chives, mustard, and poppy seeds. According to Smith (2006) there was a great diversity of produce in New York City since the days of New Amsterdam. By the late eighteenth century exotic tropical fruits such as pineapples, limes, oranges, lemons and figs were being imported from the Caribbean and were generally available in season at relatively low cost (Smith 2009:60). The peddlers and street vendors who filled the streets of New York with their push-carts were instrumental in making these foods accessible to the public, even making some "niche" foods universally consumed by the end of the century (Smith 2009:38). Historic accounts attest to the diversity of foodstuffs available at the dinner table in New York City during the nineteenth century. The ethnobotanical assemblage is not extraordinary. This conforms to the rest of the artifact assemblage as a whole (Rebecca Yamin, personal communications), aligning with the neighborhood around the project area. It is probable that these ethnobotanical remains give us a view of life for the historic residents who once lived in the surrounding area.

Spatial Connections

As noted above, clustered concentrations of certain artifact types indicate that individual households were responsible for individual dumping episodes. At the very least, artifact concentrations indicate that those items were likely dumped together in one place, and were not disturbed afterwards. Transportation of refuse from elsewhere would have led to a mixing of materials and a greater homogenization than observed. But could the people of this neighborhood generated the required amount of refuse? To consider this question, some estimates are necessary. The most recent data on per capita garbage creation in the United States is 4.4 lbs. of municipal solid waste per person per day. Looking at the historical trend back to 1960 (2.68 lbs. per capita/day), a reasonable value for 1875 is taken to be 2.4 lbs. per capita/day. This value reflects the the diminishing slope of the downward trend projected linearly into the past. The total population of the surrounding neighborhood (within approximately 1 km^2 of the project area) considered in this report is not known for 1875, roughly the time of this deposition event. However, in 1870, the population was 4,129 and in 1880, 15,113. For a sense of the neighborhood's transformation over this general timeframe, compare the area reconstructions in Figure 5.13 and Figure 5.14. Taking a simple average gives an estimated population in 1875 of 9,621. It is likely that the population growth of the neighborhood, quite explosive over this decade in comparison with the rest of the city, was not a strictly linear relation. Thus, a fair and likely conservative overall estimate for this figure is taken to be 10,000 people. Taking these two pieces of information together, it can be concluded that the neighborhood population generated 24,000 lbs. of refuse/day. An accepted conversion value for weight to volume of domestic refuse is 481 kg (1060.42 lbs.) per cubic meter. The neighborhood population would have been able to generate landfill at a pace of 22.63 m^3/day. If we assume that the deposition took place in 1874, over a year's time between the conveyance of the water lots to William H. Vanderbilt in 1873 and the opening of the Union Stockyards in early 1875, the total volume of landfill the population could have created is 8,260 m^3. The footprint of the project area measures approximately 8088 m^2. The thickness of the fill layer varies from 1.8 m at its deepest in the cove to .3 m at its thinnest on the hill. Using a simple average of these values, the estimated volume of the fill in the project area is 8,492 m^3. This figure is reasonably close to the volume the population of the neighborhood could have generated. This estimation and extrapolation demonstrates that it would have been possible for the area surrounding the project area to have served as the source for the landfill material.

Conclusions on Possible Artifact-Census Ties

Because the 1875 state census no longer survives, the population that may be most relevant to the artifacts in the fill could not be profiled. Instead the 1870 and 1880 census documents were used to get a general idea of who was living in the neighborhood during the time the Union Stockyard was built. The ethnic study revealed a neighborhood not dominated by any particular ethnic group, but with noticeably growing Irish-born and fading German-born contingents. The socioeconomic study revealed a neighborhood that contained a wide range of people from all walks of life, but was predominantly "working class," at least in the pre-stockyard years. Many people were still working class in 1880, but a considerably greater diversity of occupations was represented, many of them falling somewhere in the middle range in terms of socioeconomic ranking. The artifacts found in the fill are the kinds of things the working class people of the neighborhood would have been able to afford; however, they do not present particularly strong ethnic connections.

Summary

This chapter dealt with interpreting the material recovered from the artificial fill. Most significantly, this chapter presents arguments for interpreting the fill as part of a land reclamation process, rather than as simply a convenient location to dispose of waste. The monetary value of some of the recovered artifacts, the short period of exposure of faunal remains, and the undisturbed deposition of artifacts provide strong lines of evidence to support this interpretation. This material was laid down relatively quickly; humans and animals were not afforded the opportunity to scavenge this material to extract remaining value. Such a circumstance indicates that the purpose of dumping this material was not just waste deposal, but was actively creating new land. The connection between the recovered artifacts and the people of the neighborhood near the project area is more tenuous. The distribution of waste material from the people and businesses of the area would not be inconsistent with the material recovered from this project. Finally, the volume of material from the landfill deposit could have been generated by population of the surrounding area. However, no direct material or historical link could be established. Thus, such a connection must remain only a possibility, though still considered here a likely one.

Table 5.1. Values of Reuse for Materials from Depositional Unit 3.

Material	**Count**	**Reuse Value**
Ceramics	1,763	Low
Charcoal/Coal	20	Low
Consumed Fruits and Nuts	126	Low
Cork	129	Low
Seafood Discard	57	High
Consumed Animal Bone	1,157	High
Cloth/Fiber	8	High
Glass	1,035	High
Leather	94	High
Metal	1,272	High
Rubber	9	High
Wood	96	High

Table 5.2. Artifacts Manufactured within U.S. States other than New York.

State of Origin	Artifact#	Description	Type	Material	Start Date	End Date	Location/ Address
Connecticut	2664.01	rectangular bottle	bottle	glass	1855	1875	
Connecticut	916.02	pronged buckle	clothing	metal	1855		
Massachusetts	2182.01	aquamarine bottle	bottle	glass	1870	1880	
Massachusetts	2182.03	glass fragment	bottle	glass	1870	1880	
Massachusetts	2182.04	glass fragment	bottle	glass	1870	1880	
Massachusetts	976.01	glass water bottle	bottle	glass	1919	1920	
Maine	799.01	glass bottle labeled "Mrs Winslow's soothing syrup"	bottle	glass	1865	1875	
Maine	613.01	glass bottle labeled "Mrs Winslow's soothing syrup"	bottle	glass	1865	1875	
Maine	946.01	glass bottle labeled "Mrs Winslow's soothing syrup"	bottle	glass	1865	1875	
Maine	3016.03	bottle fragment	bottle	glass	1865	1875	
New Jersey	917.03	stoneware bottle	bottle	ceramic	1857	1857	Hoboken
New Jersey	2846.01	Pitcher	household	ceramic	1858	1860	South Amboy
Pennsylvania	707.01	food jar	dishware	ceramic	1849	1852	114 Chestnut Street, Philadelphia
Pennsylvania	542.01	glass medicinal/druggist bottle	bottle	glass	1855	1865	
Pennsylvania	971.01	bottle	bottle	glass	1870	1880	
Vermont	3361.01	bottle	bottle	glass	1860	1880	
West Virginia	12.01	ironstone plate	dishware	ceramic	1916	1952	Grafton
West Virginia	1008.01	refined earthenware bowl	dishware	ceramic	1916	1952	Grafton

Table 5.3. Artifacts Manufactured Outside of the United States.

Country of Origin	Artifact #	Description	Type	Material	Start Date	End Date	Location/ Address
Austria	833.01	pipe stem	personal	ceramic		1873	Vienna
England	140.02	refined earthenware	dishware	ceramic	1865	1877	Tunstall
England	153.01	door knob	household	ceramic	1850	1899	
England	196.02	plate	dishware	ceramic	1860	1894	Burslem
England	209.01	jar	household	ceramic		1880	
England	238.01	vessel	miscellaneous	ceramic	1853	1871	Tunstall
England	267.01	whiteware bowl	dishware	ceramic	1847	1900	Longton/Fenton
England	560.01	refined earthenware	dishware	ceramic	1851	1882	Newport/Burslem,
England	561.01	ironstone serving bowl	dishware	ceramic	1853	1871	Tunstall
England	562.01	refined earthenware	dishware	ceramic	1880	1900	Longton/Fenton
England	575.01	ironstone plate	dishware	ceramic	1855	1870	Burslem
England	576.01	ironstone plate	dishware	ceramic	1865	1877	Tunstall
England	586.01	ironstone plate	dishware	ceramic	1867	1874	Tunstall
England	592.01	ironstone plate	dishware	ceramic	1890	1906	Burslem
England	593.01	ironstone bowl	dishware	ceramic	1867	1874	Tunstall
England	636.01	blue willow platter	dishware	ceramic	1790		
England	641.01	ironstone plate	dishware	ceramic	1865	1877	Staffordshire
England	663.01	ironstone plate	dishware	ceramic	1853	1873	Cobridge
England	869.01	ironstone plate frags	dishware	ceramic	1873	1900	Longton/Fenton
England	918.01	ironstone plate	dishware	ceramic	1861	1873	Stoke-upon-Trent
England	938.01	ironstone plate frags	dishware	ceramic	1865	1887	Staffordshire
England	952.01	Figurine- Chick Head	household	ceramic	1830	1870	
England	963.01	ironstone saucer	dishware	ceramic	1867	1878	Hanley
England	963.02	ironstone plate	dishware	ceramic	1865	1887	Staffordshire
England	969.01	ironstone basin	dishware	ceramic	1862	1904	Cauldon Place, Stoke-Upon-Trent
England	970.01	ironstone plate	dishware	ceramic	1865	1877	Tunstall

England	973.01	saucer	dishware	ceramic			
England	974.01	ironstone plate	dishware	ceramic	1853	1871	Tunstall
England	1010.01	ironstone saucer	dishware	ceramic	1857	1864	Burslem/Tunstall
England	1011.01	ironstone plate	dishware	ceramic	1869	1869	Hanley
England	1017.01	ironstone saucer	dishware	ceramic	1855	1870	Burslem
England	1045.01	ironstone plate	dishware	ceramic	1840	1899	Longton
England	1066.01	ironstone plate	dishware	ceramic	1860	1865	Burslem
England	1067.01	ironstone plate	dishware	ceramic	1851	1882	Burslem
England	1068.01	ironstone plate	dishware	ceramic	1862	1880	Burslem
England	1074.01	ironstone plate	dishware	ceramic	1853	1873	Cobridge
England	1178.01	ironstone saucer	dishware	ceramic	1841	1860	Tunstall
England	1209.02	ironstone oval platter	dishware	ceramic	1866	1875	Cobridge, Stoke-on-Trent
England	1218.01	ironstone saucer	dishware	ceramic	1853	1853	Longport
England	1306.01	ironstone decorative dish	dishware	ceramic	1839	1893	Fenton, Staffordshire
England	1307.01	ironstone plate	dishware	ceramic	1866	1875	Cobridge
England	1308.01	ironstone plate	dishware	ceramic	1866	1875	Cobridge
England	1309.01	ironstone plate	dishware	ceramic	1865	1877	Tunstall
England	1336.01	ironstone plate	dishware	ceramic	1890	1906	Burslem
England	1467.01	alphabet/proverb plate frags	dishware	ceramic	1830	1870	Hanley
England	2063.01	ironstone plate	dishware	ceramic	1845	1858	Shelton
England	2065.01	ironstone washbasin	dishware	ceramic	1853	1873	Cobridge
England	2066.01	erving dish	dishware	ceramic	1854	1854	Stoke-upon-Trent
England	2189.01	ironstone muffin plate	dishware	ceramic	1856	1856	Burslem
England	2190.01	ironstone plate	dishware	ceramic	1866	1875	Cobridge
England	2194.01	ironstone plate	dishware	ceramic	1865	1887	Staffordshire
England	2586.01	ironstone plate	dishware	ceramic	1880	1900	Longton/Fenton
England	2623.01	toothbrush	miscellaneous	misc	1840	1860	
England	2644.01	ironstone plate	dishware	ceramic	1864	1864	Burslem
England	2696.01	jar lid	dishware	ceramic	1857	1892	113 Market Street, Manchester
England	2699.01	ovular serving bowl	dishware	ceramic	1865	1877	Tunstall

England	2700.01	ironstone plate	dishware	ceramic	1860	1899	Tunstall
England	2715.01	pipe bowl	personal	ceramic	1820	1840	Nottingham
England	2715.02	pipe bowl	personal	ceramic	1820	1840	Nottingham
England	2715.03	pipe bowl	personal	ceramic	1820	1840	Nottingham
England	2715.04	pipe bowl	personal	ceramic	1820	1840	Nottingham
England	2715.05	pipe bowl	personal	ceramic	1820	1840	Nottingham
England	2766.01	vessel	dishware	ceramic	1851	1882	Newport/Burslem
England	2788.01	ironstone plate	dishware	ceramic	1863	1863	Burslem/Tunstall
England	2799.01	plate	dishware	ceramic	1851	1882	Burslem
England	2802.01	ironstone plate	dishware	ceramic	1841	1860	Burslem/Tunstall
England	2830.01	ironstone bowl	dishware	ceramic	1867	1871	Hanley
England	2943.01	candlestick holder	household	ceramic	1875	1899	
England	2980.01	ironstone plate	dishware	ceramic			Staffordshire region
England	3198.01	ironstone plate	dishware	ceramic	1853	1871	Tunstall
England	3279.01	ironstone plate	dishware	ceramic	1865	1877	Tunstall
England	3283.01	toilet bowl spout	dishware	ceramic	1862	1904	Cauldon Place, Stoke-Upon-Trent
England	3327.01	ironstone plate	dishware	ceramic	1851	1882	Burslem
England	3336.01	ironstone pitcher/bowl	dishware	ceramic	1835	1855	Tunstall
England	3340.01	ironstone saucer	dishware	ceramic	1865	1877	Tunstall
France	186.01	whiteware egg cradle	dishware	ceramic	1840	1875	Creil/Montereau
France	578.01	parfume glass bottle	personal	glass	1860	1880	
France	581.01	pipe stem	personal	ceramic	1833	1892	St. Omer
France	828.01	glass jug sherds	bottle	glass	1820	1870	
Germany	258.01	doll - face	toy	ceramic	1860	1860	
Germany	464.01	jug	bottle	ceramic		1899	Westerwald
Germany	539.01	stoneware mineral water bottle	bottle	ceramic	1871	1871	Westerwald
Germany	614.01	stoneware mineral water bottle	bottle	ceramic		1899	Westerwald
Germany	671.01	doll - body	toy	ceramic	1860	1860	
Germany	812.01	jug	bottle	ceramic			Westerwald

Germany	945.01	doll	toy	ceramic	1860	1860	
Germany	949.01	doll	toy	ceramic	1860	1860	
Germany	958.01	doll- head	toy	ceramic	1860	1860	
Germany	1070.01	mineral water jug	bottle	ceramic	1852	1879	Apollinaris Spring
Germany	2677.01	stoneware mineral water jug	bottle	ceramic	1875	1899	Westerwald region
Germany	2798.01	doll - face	toy	ceramic	1854	1930	
Germany	2798.02	doll- face	toy	ceramic	1854	1930	
Germany	1013.01	glass marble	toy	glass			
Germany	548.01	glass marble fragment	toy	glass			
Ireland	1220.02	bottle neck/mouth w/ seal	bottle	glass	1874	1874	
Japan	954.01	coin	money	metal	1863	1867	
Netherlands or Germany	866.01	pipe stem	personal	ceramic	1850	1891	Gouda, Holland; or Germany
Netherlands or Germany	901.02	pipe stem	personal	ceramic	1850	1891	Gouda, Holland; or Germany
Netherlands or Germany	951.01	pipe bowl	personal	ceramic	1850	1891	Gouda, Holland; or Germany
Netherlands or Germany	955.01	pipe bowl	personal	ceramic	1850	1891	Gouda, Holland; or Germany
Netherlands or Germany	1090.01	pipe stem	personal	ceramic	1835	1898	Gouda, Holland; or Germany
Netherlands or Germany	2463.01	pipe stem	personal	ceramic	1850		Gouda, Holland; or Germany
Netherlands or Germany	3017.01	pipe stem	personal	ceramic	1850		Gouda, Holland; or Germany
Netherlands or Germany	3362.01	pipe stem	personal	ceramic	1850		Gouda, Holland; or Germany
Scotland	236.01	pipe stem	personal	ceramic	1879	1891	Glasgow
Scotland	236.02	pipe stem	personal	ceramic	1854	1891	Glasgow
Scotland	553.01	stoneware bottle	bottle	ceramic	1866	1929	Glasgow
Scotland	572.01	refined earthenware	dishware	ceramic	1866	1929	Glasgow
Scotland	808.01	pipe stem	personal	ceramic	1805	1955	Glasgow
Spain	1949.01	sardine can	food	metal	1830	1870	

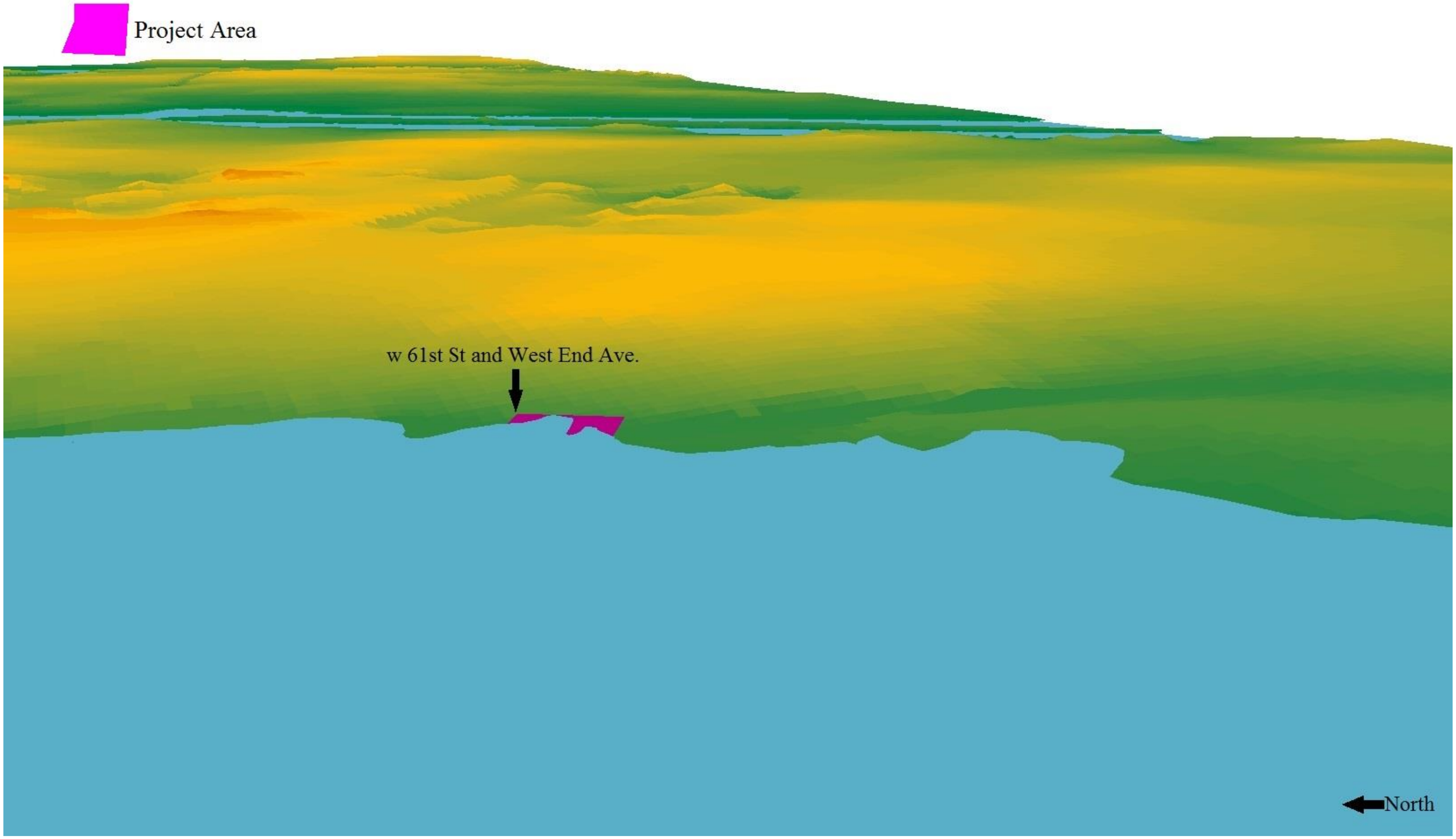


Figure 5.1. The Upper West Side of Manhattan at Contact Period prior to land modifications by Euro-Americans. Note the location of the project area in comparison to the original landscape.

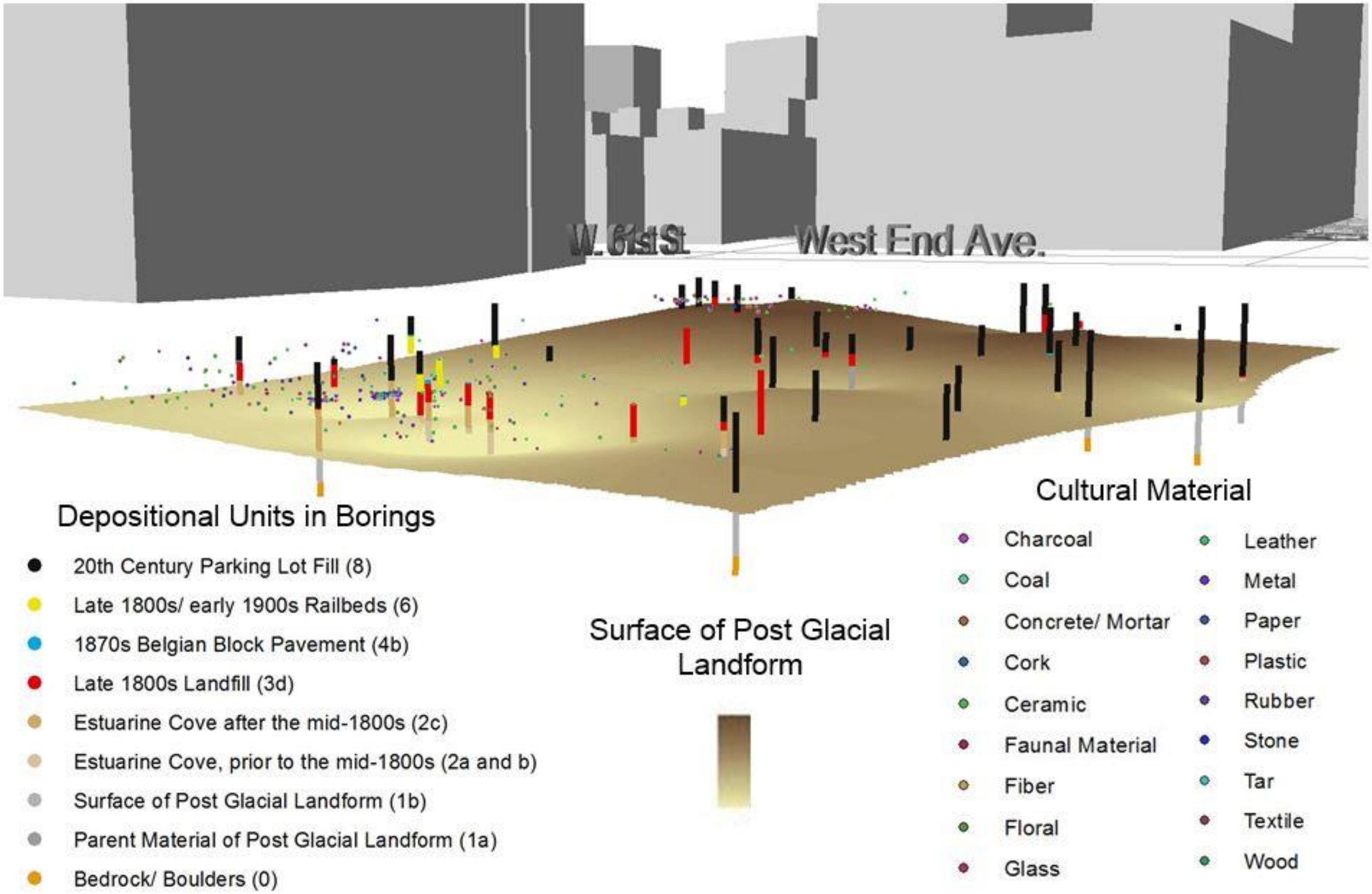


Figure 5.2. Locations of borings and artifacts in 3-D space. Note the post-glacial landform, prior to estuarine development.

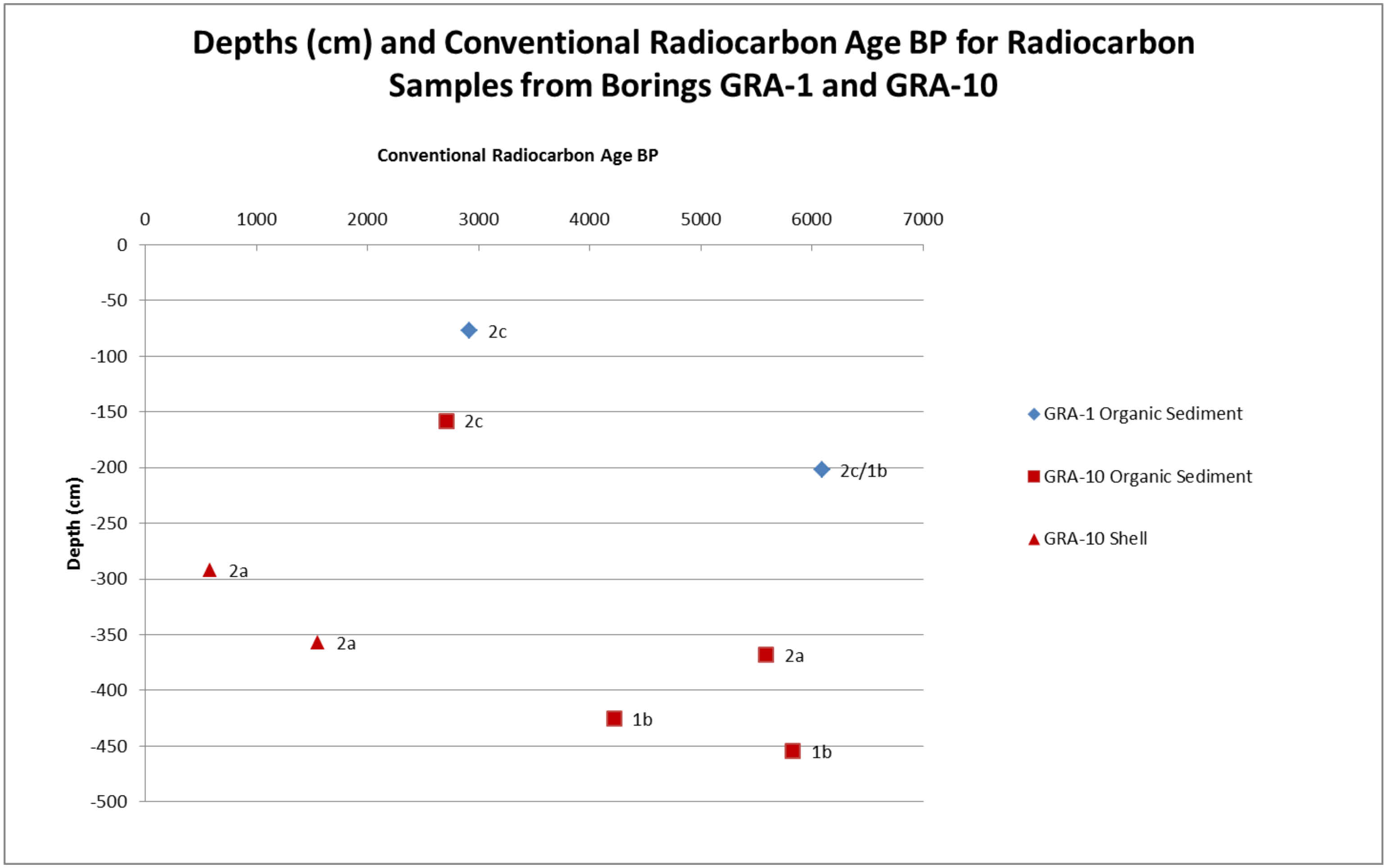


Figure 5.3. Depths (cm) and Conventional Radiocarbon Age BP for Radiocarbon Samples from Borings GRA-1 and GRA-10

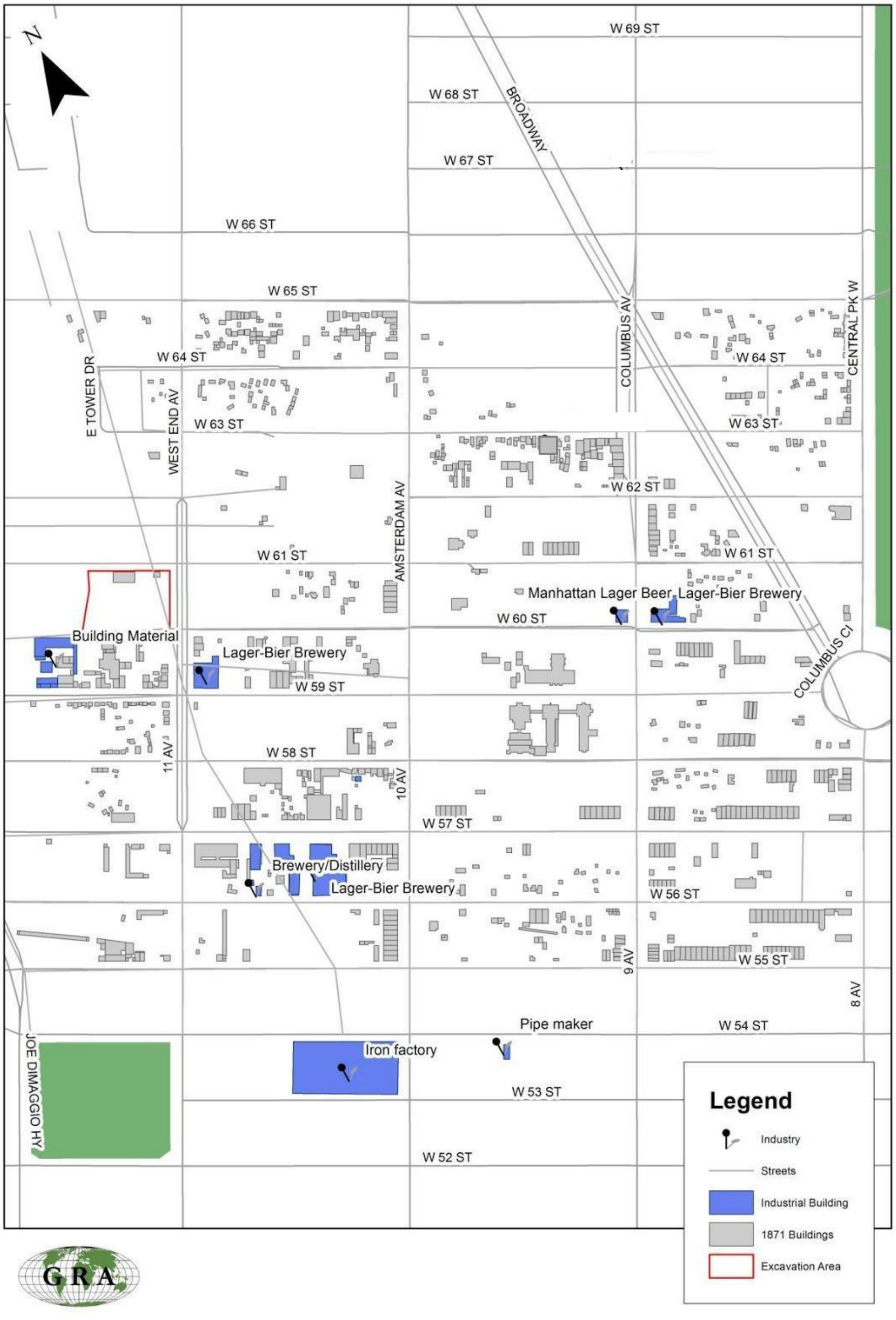


Figure 5.4. Possible sources for non-household artifacts found in Depositional Unit 3b/3d. Based on the 1871 Perris and Browne map.

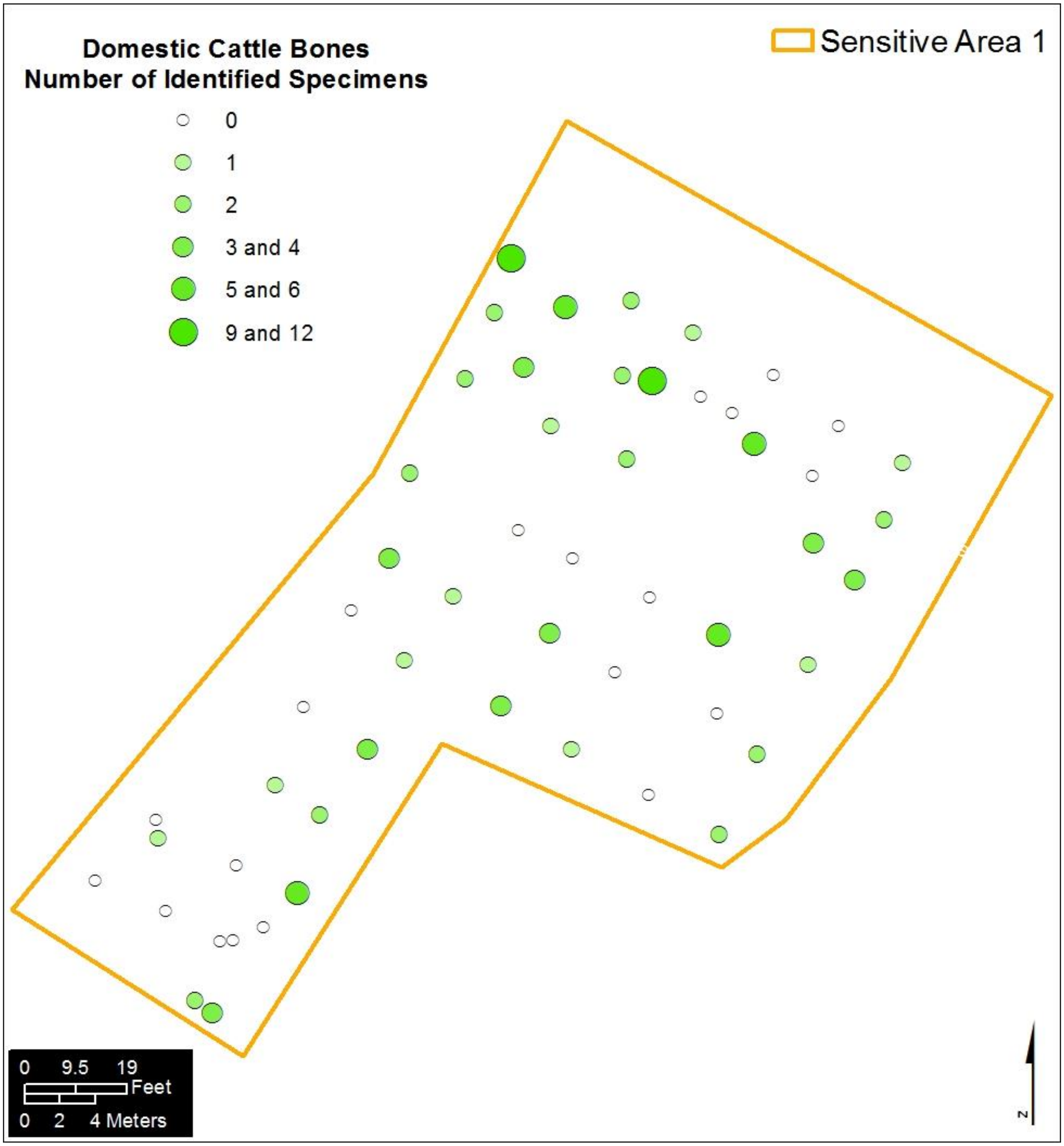


Figure 5.5. Domestic cattle bone distribution in Sensitive Area 1.

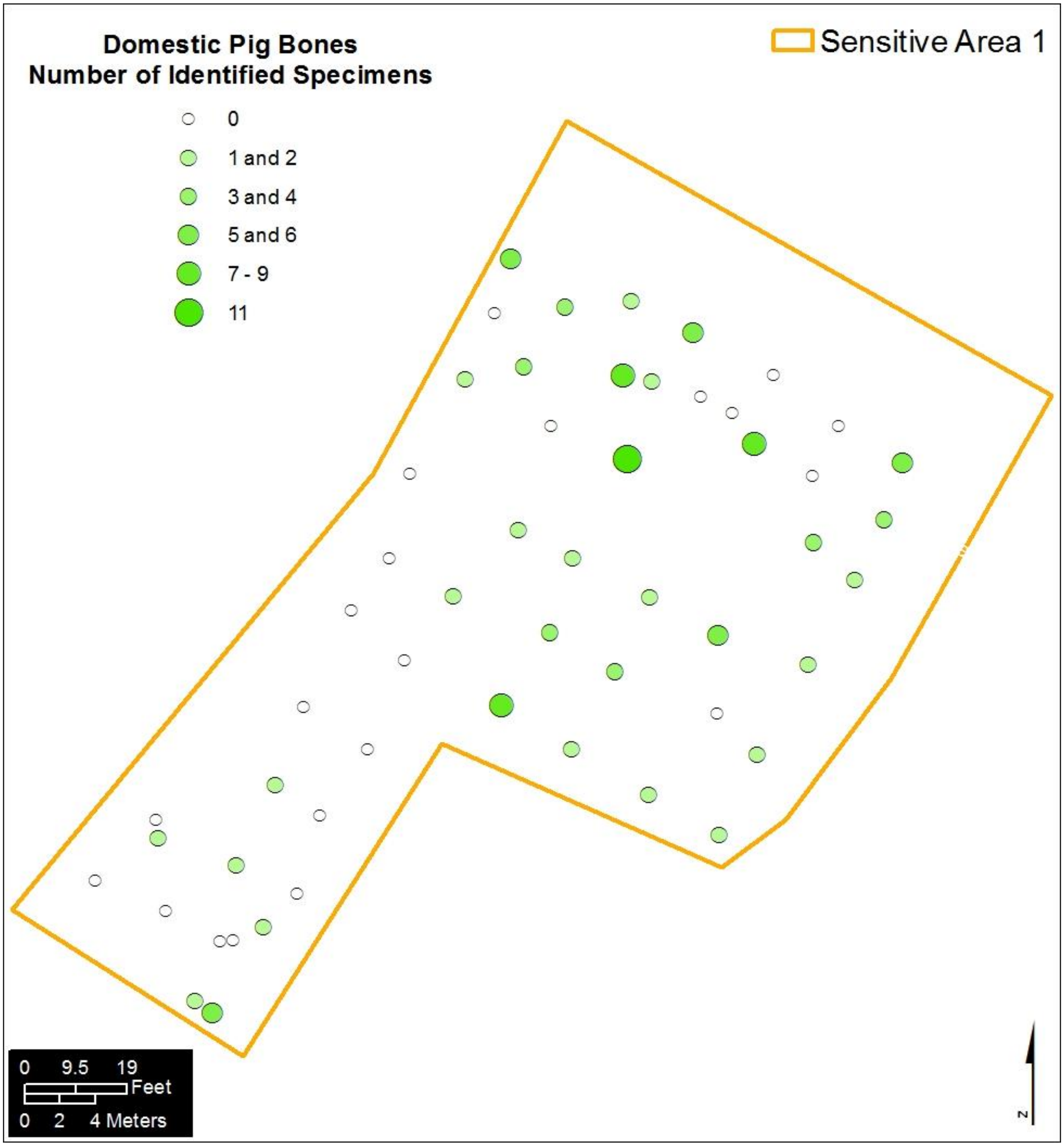


Figure 5.6. Pig bone distribution in Sensitive Area 1.

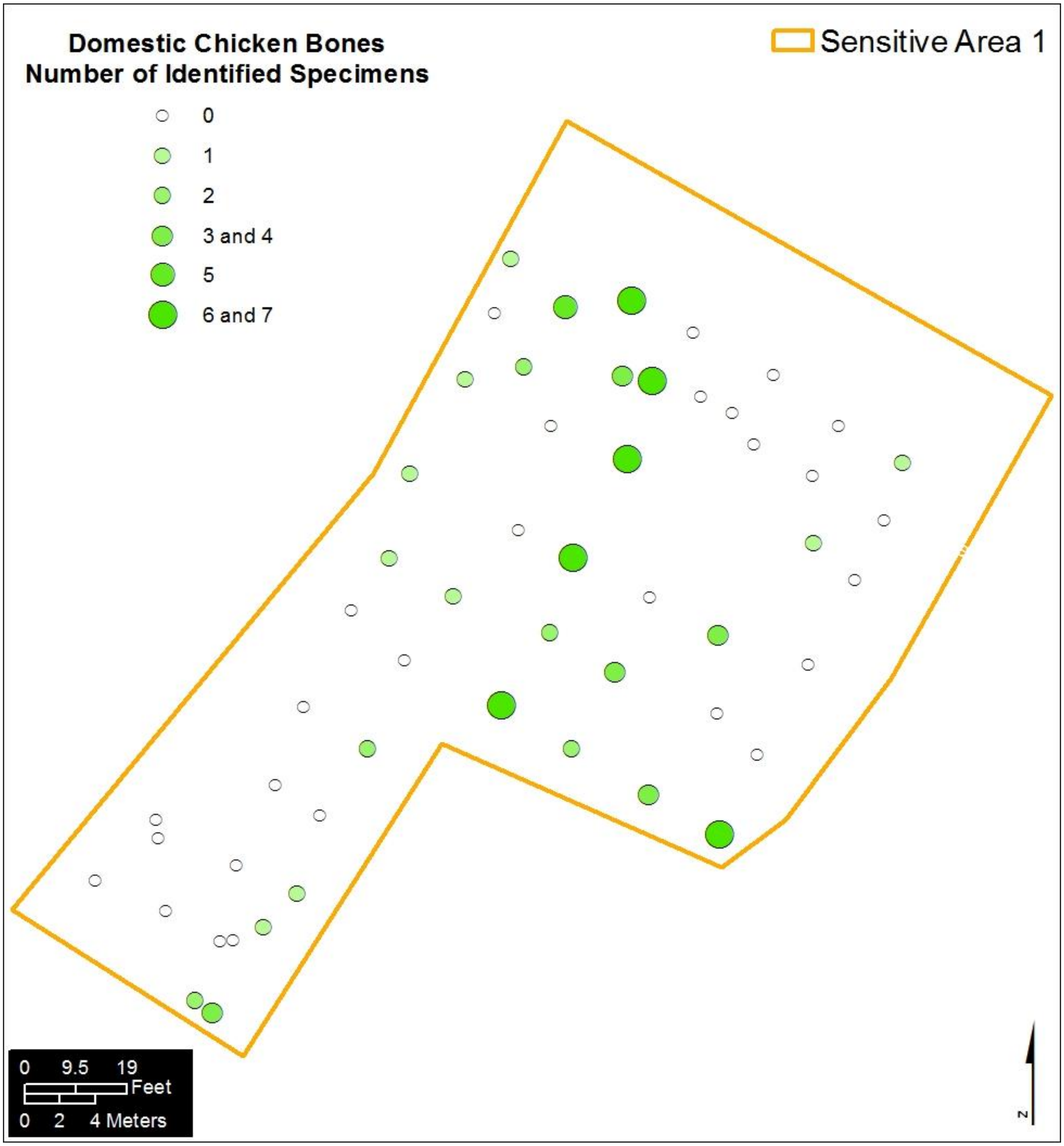


Figure 5.7. Chicken bone distribution in Sensitive Area 1.

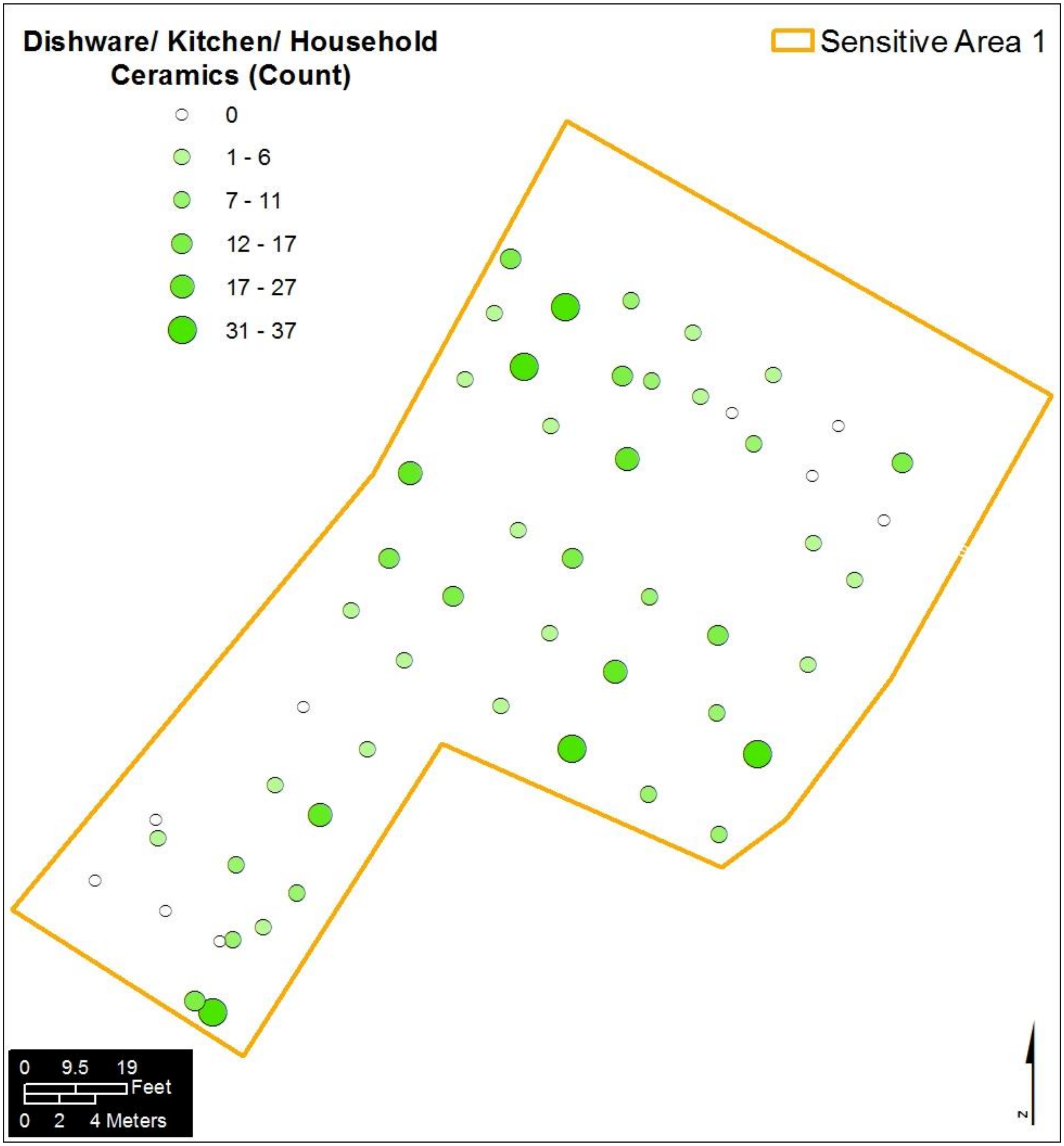


Figure 5.8. Distribution of dishware, kitchen, and household ceramics in Sensitive Area 1 by count.

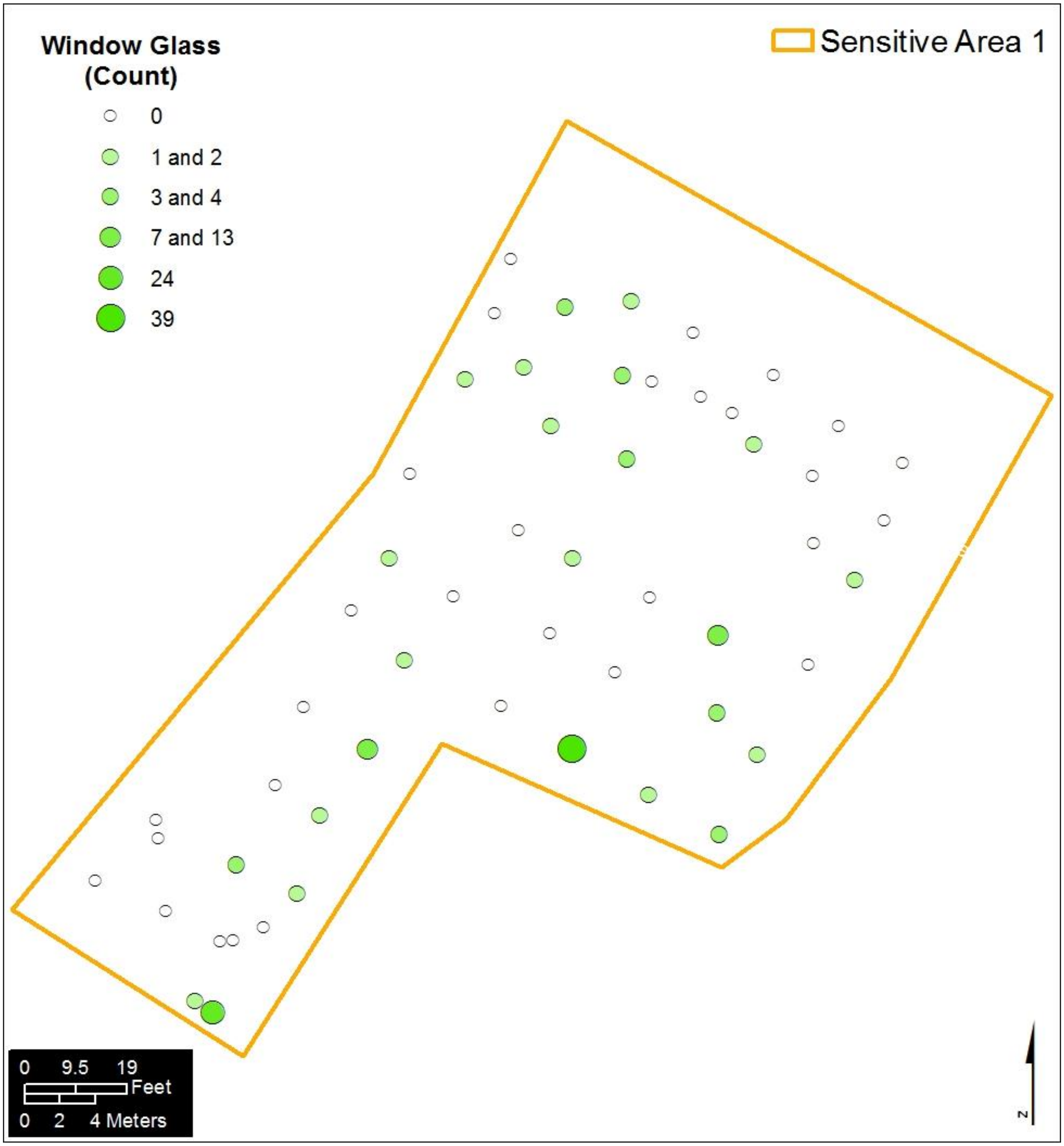


Figure 5.9. Distribution of window glass in Sensitive Area 1 by count.

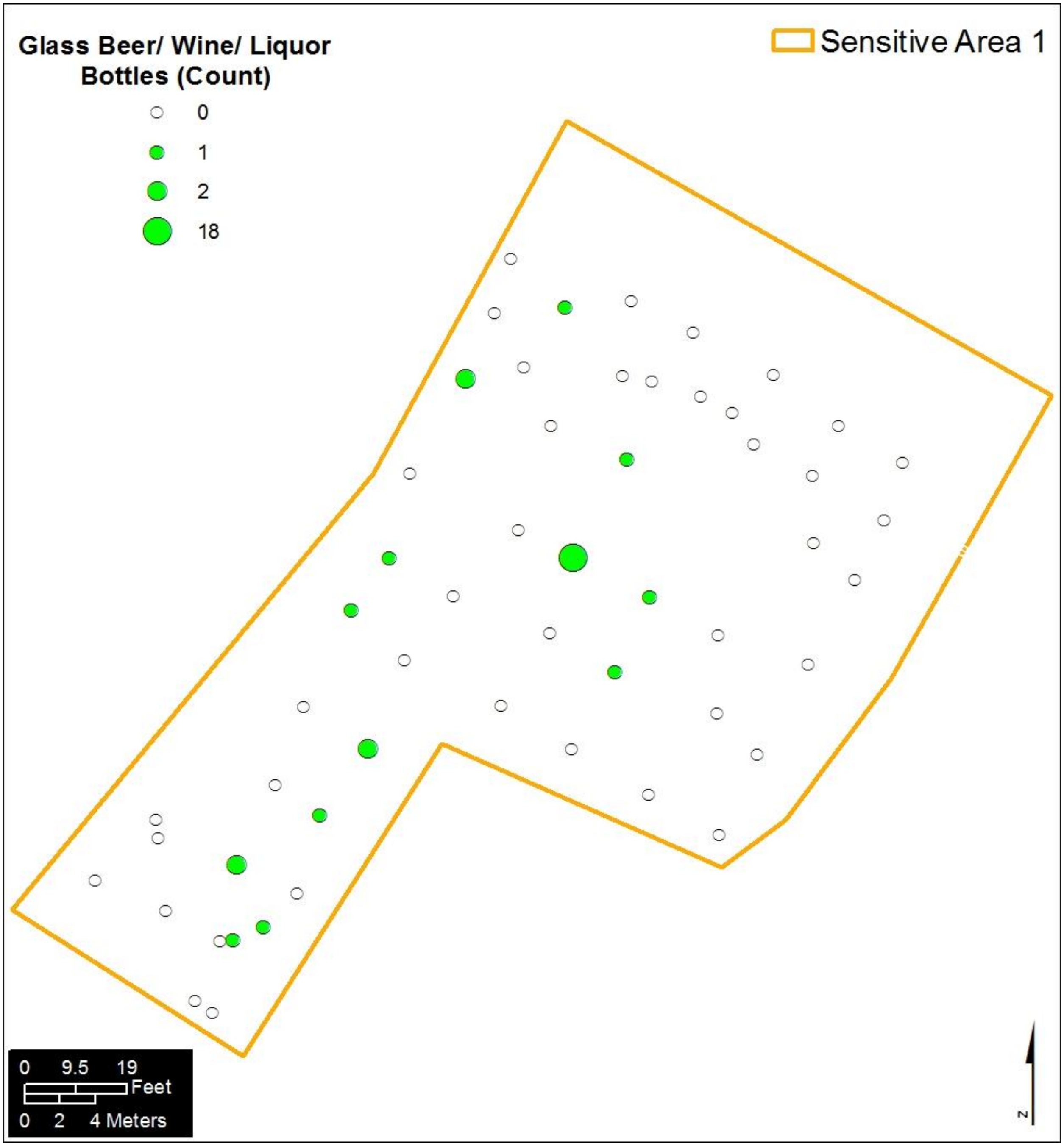


Figure 5.10. Distribution of glass alcohol bottles in Sensitive Area 1 by count.

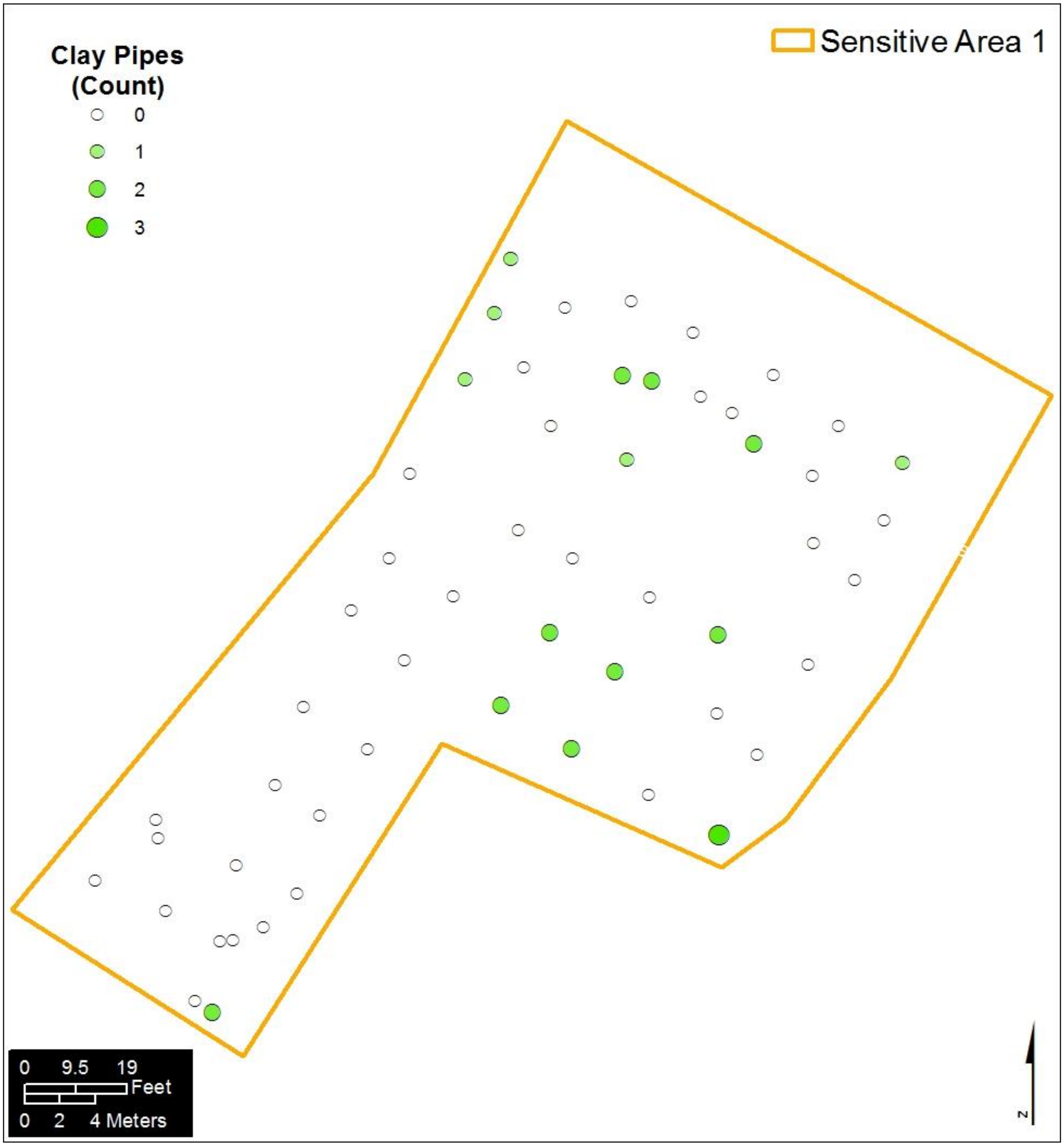


Figure 5.11. Distribution of clay pipes in Sensitive Area 1 by count.

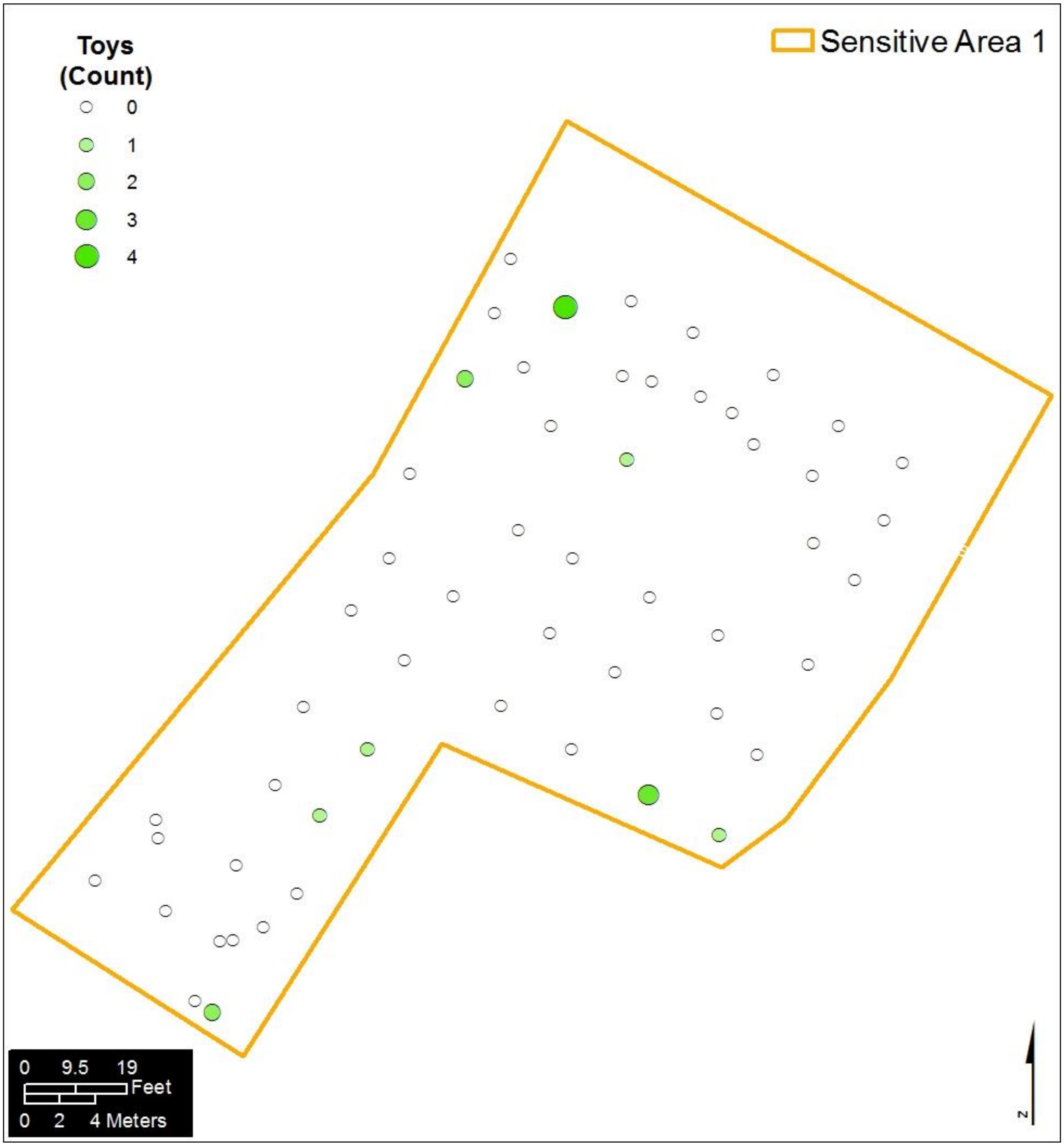


Figure 5.12. Distribution of toys in Sensitive Area 1 by count.

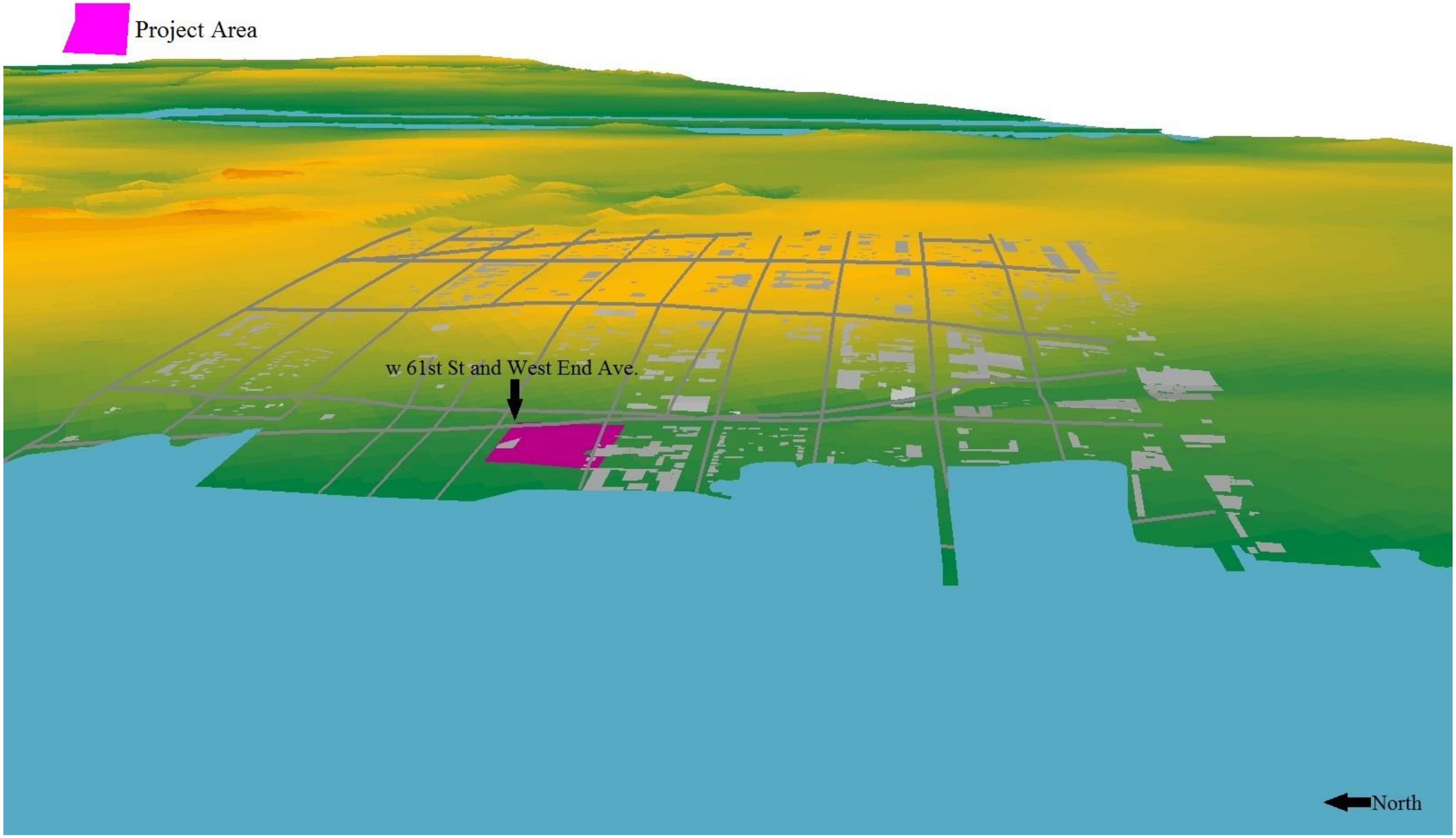


Figure 5.13. The Upper West Side of Manhattan in 1871.

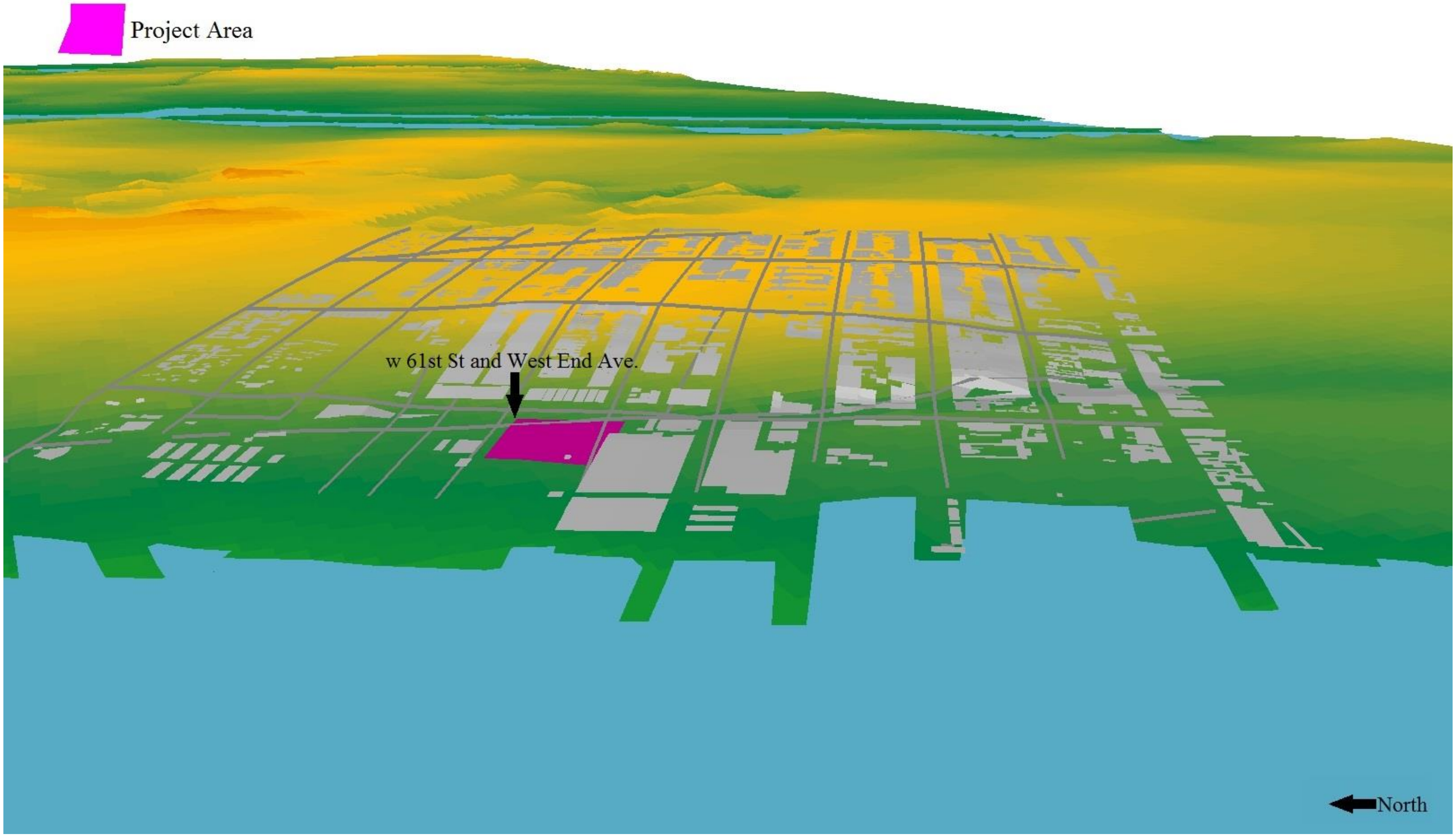


Figure 5.14. The Upper West Side of Manhattan in 1885.

CHAPTER 6: CONCLUSIONS

The Riverside 2 Project has revealed both human and environmental changes to the Manhattan landscape over the last few thousand years. Through a combination of deep testing, monitoring, and typical archaeological survey methods, GRA has reconstructed a place that has undergone dramatic transformations through time. Post-glacially, the setting of the project area, located on the Upper West Side of Manhattan, became that of an estuarine cove along the Hudson River, with a low, sandy hill along the edge of the shoreline and a running stream. This location would have been inviting to prehistoric peoples in that it afforded access to a rich and varied biome.

Analysis of the borings provided the best means of understanding the project area diachronically (see Appendix B). The borings encompass 4,500 years of deposition (back to the Late Archaic), though with notable discontinuities early in the sequence. Post-glacial sea-level rise progressively submerged former terrestrial settings of the Early to Middle Archaic periods (see Figure 2.1 and discussion in Schuldenrein et al. 2013). The pollen analysis (Appendix G) identified a zone likely attributable to the Woodland period (Zone 1 (4.4-4.0 mbs)). No evidence of agriculture is represented in this Zone; however, the levels of particulate carbon present in the sample attest to human activity in the vicinity. The estuary served as the signal landform as it produced the radiocarbon dates (Appendix D). The borings revealed that the unconformity with the overlying base of the landfill was an undulating surface. The buried terrain contours indicate microenvironments, which may have been the site of converging fresh and saline water sources, and thus an ideal setting for encampments, as they provided ready access to a broad range of aquatic habitats. Unfortunately, marine-based wave action and terrestrial stream erosion likely destroyed any traces of lightly populated Archaic camp and shell sites, as well as the seasonally occupied, short duration Woodland sites, eliminating the possibility of archaeological recovery of prehistoric remains within the project area.

Sedimentological analyses and archaeological examination of the artificial fill layers provide a clear picture of landscape modifications over time, especially those associated with land reclamation, improvements to the Hudson River Railroad, the construction of the Union Stockyard, as well as various twentieth century construction activities. Along with the historical record and maps, the archaeological examination allowed for more precise dating of events. The large wooden posts recovered represent a former docking structure or breakwater, confirming the location as a harbor along the Hudson River during the early-to-mid-1800s (see Appendix F for dendrochronological analysis). During the mid-to-late 1800s, artificial landfill was deposited in this harbor or cove, greatly extending the area of buildable land. This artificial fill is comprised of a mix of refuse, soil, and ash, and is capped with a distinct layer of ash. Artifacts within this artificial landfill date predominantly to the late nineteenth century. In addition, there is a thin sandy deposit that bisects the fill, and exhibits characteristics of a more turbid depositional environment, (i.e., a storm event). Tropical storms tracked over New York City in October of 1872 and September of 1874, with the 1874 date matching up fairly well with the timing of the cultural material and the construction of the stockyard.

A cobblestone pavement was found in Sensitive Area 1, on top of, and set into, the nineteenth century artificial landfill. This most likely represents the remnant occupational surface of Belgian blocks associated with the Union Stockyard, which opened in February of 1875. In Sensitive Area 2, the nineteenth century fill was initially deposited within a streambed that ran through the area. The well that was found was within the location of the former streambed, and was constructed in the mid-to-late nineteenth century to allow continued access to fresh water, even as the land was built up. In a sense, the artificial landfill can be thought of as building material, allowing for the existence of the cobblestone pavement, and all of the human activities that occurred on it.

Other historic human occupational surfaces were also documented above this. Un-mortared angular schist cobbles and pebbles were found within a sandy matrix above the artificial landfill and sandy hill. The schist cobbles cut across Sensitive Area 2 at an angle that closely matches the angle and location of railroad tracks from 1892 (as seen on the Sanborn insurance map). This feature was interpreted as the remains of railbeds from the very late nineteenth century. There are also the remains of a structure associated with a stonecutter's workshop dating to 1862 (again as seen on historic maps). A square brick structure was found that matches with the location of a structure seen on the 1955 map by Bromley, and it is surmised that the structure was a later replacement of the one noted on the 1955 map. Both of these structures would have served the mid-to-late twentieth century railyard. These structures were found just underneath or within the artificial parking lot fill, which has mixed nineteenth and twentieth century cultural remains, and whose surface represents the modern-day landscape.

The domestic artifacts in the nineteenth century assemblage, if indeed from the local population, suggest that the people partook in the consumer goods that were available in New York City in the last quarter of the nineteenth century. They owned Gothic style ceramics, considered a mark of genteel values, at least earlier in the century (Fitts 1999), and appear to have taken advantage of technological improvements like gas lighting. They also provided their children with toys, another indication that to some extent, at least, they subscribed to the cult of domesticity, which emphasizes the raising of children with proper values (Wall 1994). While there is nothing in the artifact assemblage to suggest luxury, it definitely suggests respectability. The Upper West Side of Manhattan was not the most fashionable place to live in the late nineteenth century, but it was a solidly respectable place, even within sight of a rail-side stockyard.

Ultimately, landscape modifications during the mid- to late-nineteenth century transformed the project area from a coastal boundary with a running stream, to an upland landscape that eventually supported the construction of the Union Stockyard, and various rail lines. The land reclamation process that radically transformed the landscape at this location was the source of the vast majority of archaeological material recovered through this project.

Through this project, GRA has demonstrated that landfill can contain important information on past human activities, past environments, and the interplay between humans and their ecosystem. By documenting the harbor prior to land-filling, a nineteenth century stockyard within fill, early railroad construction, and part of a structure from a stonecutter’s workshop, all beneath a present-day parking lot, GRA has revealed the necessity of deep coring and sedimentological analysis at urban sites, followed up by monitoring and archaeological testing. Urban sites and areas with fill can no longer be written off as "disturbed" without any investigation. Supporting the argument made by Schuldenrein and Aiuvalasit (2011), deep testing is necessary to understand landscape change prior to and during land-filling.

REFERENCES

Adams, Arthur G.
1996 *The Hudson River through the Years*. Fordham University Press.

AKRF
1992 *Riverside South Final Environmental Impact Statement.*

2008 *44th Street and Eleventh Avenue: Block 1073, Lot 1, Manhattan, New York County, New York*.

Allison, P
2002 *The Archaeology of Household Activities*. Routledge, New York.

Alonso, Enrique, A. N. A. Recarte and Scholars Debate
2008 *Pigs in New York City; a Study on 19th Century Urban Sanitation*. 2008 ed.

Anderson, Albert
1976 Early Man on Richmond Hill. *Staten Island Historian* (July-Sept.).

Anschuetz, Kurt F., Richard H. Wilshusen and Cherie L. Scheick
2001 An Archaeology of Landscapes: Perspectives and Directions. *Journal of Archaeological Research* 9(2):157-211.

Antevs, Ernst V.
1925 Conditions of Formation of the Varved Glacial Clay. *Geological Society of America Bulletin* 36.

Atwood, L.J.
1863 Improvement in Lamps. Google Patents.

Averill, S. P., R. R. Pardi, W. S. Newman and R. J. Dineen
1980 Late Wisconsin-Holocene History of the Lower Hudson Region: New Evidence from the Hackensack and Hudson River Valleys. In *Field Studies of New Jersey Geology and Guide to Field Trips: 52nd Annual Meeting of the New York Geological Survey*, edited by W. Manspeizer, pp. 160-186. Rutgers Press, New Brunswick.

Beaudry, Mary C.
1993 *Documentary Archaeology in the New World*. Cambridge University Press.

Beaudry, Mary C. , Lauren J. Cook and Stephen A. Mrozowski
1991 Artifacts and Active Voices: Material Culture as Social Discourse. In *The Archaeology of Inequality*, edited by R. H. McGuire and R. Paynter, pp. 150-191. Blackwell, Oxford.

Beers, F.W
1868 Atlas of New York and Vicinity. A.D. Ellis & C.C. Soule, New York.

Behrensmeyer, A.K., S.M. Kidwell and R.A Gastaldo
2000 Taphonomy and Paleobiology. *Paleobiology* 26:103-147.

Belknap, D. F. and J. C. Kraft
1977 Holocene Relative Sea-Level Changes and Coastal Stratigraphic Units on the Northwest Flank of the Baltimore Canyon through Geosyncline, pp. 235-262. vol. 63.

Bettinger, Robert
1987 Archaeological Approaches to Hunter-Gatherers. *Annual Review of Anthropology* 16:121-42.

Bloom, Arthur L. and Minze Stuiver
1963 Submergence of the Connecticut Coast, pp. 332-334. vol. 139.

Bolton, Reginald Pelham
1922 *Indian Paths in the Great Metropolis*. Indian Notes and Monographs. Museum of the American Indian, New York.

1976 An Indian Settlement at Throg's Neck. *Indian Notes* 11:111-25.

Booth, Nathaniel
1982 The Archaeology of Long Island. In *The Second Coastal Archaeology Reader*, edited by J. Truex. Suffolk County Archaeological Society, Stony Brook, N.Y.

Bowman, Sheridan
1990 *Interpreting the Past: Radiocarbon Dating* 1. University of California Press, Berkeley.

Braun, David
1980 On the Approprateness of the Woodland Concept in Northeastern Archaeology. In *Proceedings of the Conference on Northeastern Archaeology*, edited by J. Moore, pp. 93-108. University of Massachusetts, Amhert.

Brennan, Louis A.
1974 The Lower Hudson: A Decade of Shell Middens. *Archaeology of Eastern North America* 2:81-93.

Bromley, G.W.
1879 Atlas of the City of New York. G.W. Bromley and Co. , New York.

1880 Atlas of the 19th &; 22nd Wards of the City of New York. G.W. Bromley and Co. , Philadelphia.

1891 Outline and Index Map of New York City. Manhattan Isalnd. G.W. Bromley and Co. , New York City.

1924 Atlas of the Borough of Manhattan, City of New York. G.W. Bromley and Co. , Philadelphia.

1930 Atlas of the Borough of Manhattan, City of New York. G.W. Bromley and Co. , Philadelphia.

1955 Manhattan Land Book of the City of New York. G.W. Bromley and Co. , New York.

1967 Atlas of the Borough of Manhattan, City of New York. G.W. Bromley and Co. , Philadelphia.

1974 Atlas of the Borough of Manhattan, City of New York. G.W. Bromley and Co. , New York.

Brongers, George A.
1964 *Nicotiana Tabacum: The History of Tobacco and Tobacco Smoking in the Netherlands*. Enschede En Zonen, Haarlem.

Brown III, Marley
1973 The Use of Oral and Documentary Sources in Historical Archaeology: Ethnohistory at the Mott Farm. *Ethnohistory* 347-360.

Brown, A, Tooth, S, Chiverrell, R, Rose, J, Thomas, D, Wainwright, J., Bullard, J., Thorndycraft, V., Aalto, R., and P. Downs.
2013 The Anthropocene: is there a geomorphological case? *Earth Surface Processes and Landforms 38(4): 431-434.*

Brumbach, Hetty Jo

1986 Anadromous Fish and Fishing: A Synthesis from the Hudson River Drainage. *Man in the Northeast.* 32:35-66.

Bull, Donald, Manfred Friedrich and Robert Gottschalk
1984 *American Breweries*. Bullworks Trumbull, CT.

Burrows, Edwin G. and Mike Wallace
1999 *Gotham: A History of New York City to 1898*. Oxford University Press, New York.

Buttenwieser, Ann L.
1987 *Manhattan Water-Bound: Planning and Developing Manhattan's Waterfront from the Seventeenth Century to the Present*. New York University Press, New York.

Butzer, Karl W.
1982 *Archaeology as Human Ecology*. Cambridge University Press.

Cantwell, Anne-Marie and Diana diZerega Wall
2001 *Unearthing Gotham*. Yale University Press, New Haven, Conn.

Ceci, Lynn
1979 Maize Cultivation in Coastal New York. *North American Archaeologist* 1(1):45-74.

1990 Radiocarbon Dating "Village" Sites in Coastal New York: Settlement Pattern Change in the Middle to Late Woodland. *Man in the Northeast.* 39:1-28.

Citizens' Association of, New York
1865 *Report of the Council of Hygiene and Public Health of the Citizens' Association of New York Upon the Sanitary Condition of the City*. 2 ed. D. Appleton and Co.

Claassen, Cheryl (editor)
1995 *Dogon Point: A Shell Matrix in the Lower Hudson Valley*. 14. Archaeological Services, Bethlehem, Conn.

Cleveland, Frederick A. and Fred Wilbur Powell
1909 *Railroad Promotion and Capitalization in the United States*. Longmans, Green, and Co., New York, New York.

Cohn, N.M. and G. Armelagos
1988 The Pugsley Avenue Site. *Bulletin, Journal of the New York State Archaeological Association* 96:5-7.

Cook, O. F.
1910 History of the Coconut Palm in America. In *Contributions from the United States National Herbarium*. vol. 14 part 2. Government Printing Office, Washington.

Corey, Steven H.
1994 King Garbage: A History of Solid Waste Management in New York City, 1881-1970. New York University.

Cotter, J. F. P., E. B. Evenson, L. A. Sirkin and R. Stuckenrath
1986 The Interpretation Of "Bog-Bottom" Radiocarbon Dates in Glacial Chronologies. In *Correlation of Quaternary Chronologies,* edited by W. C. Mahaney, pp. 299-316. Geo Books, Norwich.

Craven, M.
1899 Waste Disposal and Its Advances, pp. 293. vol. 25.

Creswick, Alice
1995 *The Fruit Jar Works Vol. I, Listing Jars Made Circa 1820 to 1920's*.

Dallal, D.
1984 Reject Pipes Exported to New York. *Society for Clay Pipe Research Newsletter* 4:9.

2004 The Tudor Rose and the Fleurs-De-Lis: Women and Iconography in Seventeenth-Century. Dutch Clay Pipes Found in New York City. In *Smoking and Culture.The Archaeology of Tobacco Pipes in Eastern North America*, edited by S. M. Rafferty and R. Mann. The University of Tennessee Press, Knoxville.

Davis, R. B. and G. L. Jacobson
1985 Late-Glacial and Early Holocene Landscapes in Northern New England and Adjacent Areas of Canada. *Quaternary Research* (23):341-368.

Day, Grant L.
2001 Window Glass Dating: When Was the Mcconnell's Homestead Built? In *The 4th Annual South Central Historical Archaeology Conference*, Little Rock, Arkansas.

Dean Jr, Walter E.
1974 Determination of Carbonate and Organic Matter in Calcareous Sediments and Sedimentary Rocks by Loss on Ignition: Comparison with Other Methods. *Journal of Sedimentary Research* 44(1).

Delcourt, Paul A. and Hazel R. Delcourt
2004 *Prehistoric Native Americans and Ecological Change: Human Ecosystems in Eastern North America since the Pleistocene*. Cambridge University Press, Cambridge.

Department of Agriculture
1872 Monthly Report of the Department of Agriculture, edited by U. S. D. o. Agriculture, pp. 184.

Dincauze, Dena
2000 *Environmental Archaeology: Principles and Practice*. Cambridge University Press, Cambridge.

Dincauze, Dena and M. Mulholland
1977 Early and Middle Archaic Site Distributions and Habitats in Southern New England. In *Amerinds and Their Paleoenvironments in Northeastern North America*, edited by W. Newman and B. Salwen, pp. 439-456. Annals of the New York Academy of the Sciences. vol. 288.

Dobbin, Frank
1994 *Forging Industrial Policy: The United States, Britain, and France in the Railway Age*. Press Syndicate of the University of Cambridge, New York.

Doggett, John
1849-1850 *Doggett's New-York City Directory for 1849/1850*. J. Doggett Jr., New York.

Downing, Charles
1872 The Fruits and Fruit-Trees of America. In The Culture, Propagation, and Management, in the Garden and Orchard, of Fruit-Trees Generally : With Descriptions of All the Finest Varieties of Fruit, Native and Foreign, Cultivated in This Country. vol. 2. Wiley and Halsted, New York.

Dripps, Mathew
1867 Plan of New York City from the Battery to Spuyten Duyvil Creek. Based on Surveys by Messrs. Randall & Blackwell and the Special Survey by J.F. Harrison, C.E, New York.

Eisenberg, Leslie
1982 The Goodrich Site (Std 11-1). *Proceedings of the Staten Island Institute of Arts and Science* 31(2, 3):37-61.

Elquist, Ora
2015 Archaic Estuarine Resource Use in the Lower Hudson Valley: New Information from the Old Place Neck Site, Staten Island, New York. In *The 80th Annual Meeting of the Society for American Archaeology*, San Francisco.

Eyles, Nicholas and Bryan M. Clark
1986 Significance of Hummocky and Swaley Cross-Stratification in Late Pleistocene Lacustrine Sediments of the Ontario Basin, Canada. *Geology* 14(8).

Fagan, Brian
2000 *Ancient North America: The Archaeology of a Continent*. 3rd ed. Thames and Hudson, New York.

Fairbridge, R. W. and W. S. Newman
1968 Postglacial Coastal Subsidence of the New York Area. *Zeitschr. f. Geomorph., NF* 12(3):296-317.

Federal Writers' Project
1939 *New York City: Vol 1, New York City Guide*. Random House New York.

Fike, Richard E.
1987 *Bottle Book: A Comprehensive Guide to Historic Embossed Medicine Bottles*.

Firebaugh, G. S.
1983 An Archaeologist’s Guide to the Historical Evolution of Glass Bottle Technology. *Southwestern Lore* 49(2):9-29.

Fitts, Robert K.
1999 The Archaeology of Middle-Class Domesticity and Gentility in Victorian Brooklyn. *Historical Archaeology* 33(1):39-62.

Fleming, Kevin, Paul Johnston, Dan Zwartz, Yusuke Yokoyama, Kurt Lambeck and John John Chappell
1998 Refining the Eustatic Sea-Level Curve since the Last Glacial Maximum Using Far- and Intermediate-Field Sites, pp. 327-342. vol. 163.

Funk, Robert E.
1976 *Recent Contributions to Hudson Valley Prehistory*. New York State Memoir 22, Albany.

1991 Late Pleistocene and Early Holocene Human Adaptations in the Lower Hudson. In *The Archaeology and Ethnohistory of the Lower Hudson Valley and Neighboring Regions: Essays in Honor of Louis A. Brennan*, edited by H. Kraft. Occasional Publications in Northeastern Anthropology, Bethlehem, Conn.

1996 Holocene or Hollow Scene? The Search for the Earliest Archaic Cultures in New York State. *Review of Archaeology* 17:11-25.

1997 An Introduction to the History of Prehistoric Archaeology in New York State. *Bulletin: Journal of the New York State Archaeological Association* 113:4-59.

Funk, Robert E. and William A. Ritchie
1973 *Aboriginal Settlement Patterns in the Northeast*. New York State Museum Memoir 20. The State Education Department, Albany, NY.

Ganzeboom, Harry B. G., Paul M. De Graaf and Donald J. Treiman
1992 A Standard International Socio-Economic Index of Occupational Status, pp. 1-56. vol. 21.

Geismar, Joan
1987a *An Archaeological Evaluation of the Manhattan West Site, New York City*.

1987b *An Archaeological Evaluation of the Manhattan West Site, New York City. Ceqr No. 86-268m*. Prepared for Konheim & Ketcham.

1995 *Manhattan West Field Testing: The Hudson River Railroad Platforms. Ceqr No. 86-268m*. Prepared for The Brodsky Organization.

Glaeser, Edward L. and Jacob L. Vigdor
2001 Racial Segregation in the 2000 Census: Promising News. *Center on Urban & Metropolitan Policy*:1-16.

Godden, G.A.
1964 Encyclopaedia of British Pottery and Porcelain Marks. 1991 ed. Random House.

Grafton, John
1977 New York in the Nineteenth Century: 321 Engravings From "Harper's Weekly" And Other Contemporary Sources. Dover Publications, New York.

Gregory, Ian N. and Richard G. Healey
2007 Historical Gis: Structuring, Mapping and Analysing Geographies of the Past. *Progress in Human Geography* 31:17.

Griffiths, P. G., R. Hereford and R. H. Webb
2006 Sediment Yield and Runoff Frequency of Small Drainage Basins in the Mojave Desert, California and Nevada. pp. 232-244. vol. 74.

Grumet, Robert S.
1981 *Native American Place Names in New York City*. Museum of the City of New York, New York.

2009 *The Munsee Indians: A History*. University of Oklahoma Press, Norman, Okla.

2013 *Manhattan to Minisink: American Indian Place Names in Greater New York and Vicinity*. University of Oklahoma Press, Norman, OK.

Hadley, Arthur T.
1897 *Railroad Transportation: Its History and Its Laws*. The Knickerbocker Press, New York.

Hartgen Archaeological Associates
1990 *Route 9a Reconstruction Project, Draft Archaeological Assessment Report, West 44th Street to West 59th Street. For: New York State Department of Transportation with Federal Highway Administration and the City of New York*. For: New York State Department of Transportation with Federal Highway Administration and The City of New York.

Hastorf, Christine A. and Virginia S. Popper
1988 *Current Paleoethnobotany*. Prehistoric Archeology and Ecology Series. University of Chicago Press, Chicago.

Hauser, Robert M. and John Robert Warren
1996 Socioeconomic Indexes for Occupations: A Review, Update, and Critique. University of Wisconsin-Madison.

Hayden, B. and A. Cannon
1983 Where the Garbage Goes: Refuse Disposal in the Maya Highlands. *Journal of Anthropological Archaeology* 2(2):117-163.

Hill, John William

1829 View on the Erie Canal, New York Public Library Digital Gallery.

Hilliard, E.
2001 *Chandeliers*. Little, Brown.

Historical Perspectives
1997 *Existing Conditions Report: Archaeological Resources, Hudson River Park Project, West 46th Street to West 59th Street, Manhattan, New York*.

2000 *Cultural Resources Assesment Report, Studio City Project, West 45th Street, Manhattan, New York*.

Hobson, Anthony
1991 *Lanterns That Lit Our World: How to Identify, Date, and Restore Old Railroad, Marine, Fire, Carriage, Farm, and Other Lanterns*. Golden Hill Press, Inc., Spencertown, New York.

Horn, Jonathon C.
2005 Historic Artifact Handbook. Alpine Archaeological Consultants, Inc. , Montrose, CO.

Hume, Ivor Noël
1978 *A Guide to Artifacts of Colonial America*. Knopf.

Ihm, P.
2005 A Contribution to the History of Seriation in Archaeology. In *Classification - the Ubiquitous Challenge, Proceedings of the 28th Annual Conference of the Gesellschaft fur Klassifikation*, pp. 307–316. V ed, C. Weihs and W. Gaul, general editor. Studies in Classification, Data Analysis, and Knowledge Organization, University of Dortmund.

Indorante, S. J., R. D. Hammer, P. G. Koenig and L. R. Follmer
1990 Particle-Size Analysis by a Modified Pipette Procedure. *America Journal of Soil Science Society* 52(2):560-563.

Ingersoll, E.A.
1881 The Oyster-Industry of the United States. In *The History and Present Condition of the Fishery Industries, 1879-1889,* edited by G. B. Goode. Government Printing Office, Washington DC.

Isachsen, Y. W., E. Landing, J. M. Lauber, L. V. Rickard and W. B. Rogers
1991 *Geology of New York: A Simplified Account*. New York State Museum, Albany.

Ison, Betty Sue
1990 *Window Glass in Kentucky 1790 to 1940: Potential Characteristics and Variation of the Archaeological Assemblage as Produced by the Processes of Manufacture, Distribution, Use, and Deposition*, University of Kentucky.

Izumika, Shizuoka
1997 *Anasen Nyuumon Kan'ei Tsuuhou: Shin Kan'ei No Bu*. Shoshinkan, Tokyo.

Jacobson, Jerome
1980 *Burial Ridge, Tottenville, Staten Island, N.Y.: Archaeology at New York's Largest Prehistoric Cemetery*. Staten Island Institute of Arts and Sciences, St. George, New York.

Jervis, John B.
1846 Report on the Hudson River Railroad. J.F. Trow & Co., New York.

Jochim, Michael
1990 The Ecosystem Concept in Archaeology. In *The Ecosystem Approach in Anthropology: From Concept to Practice*, edited by E. F. Moran, pp. 75-90. University of Michigan Press, Ann Arbor.

Johnson, Emory R., T. W. Van Metre, G. G. Huebner and D. S. Hanchett
1922 *History of Domestic and Foreign Commerce of the United States*. Carnegie Institution of Washington, Washington, D.C.Â Â

Kaeser, Edward
1963 The Morris Estate Club Site. *New York State Archaeological Society Bulletin* 27:38-45.

King, J. A. and H. M. Miller
1987 The View from the Midden: An Analysis of Midden Distribution and Composition at the Van Sweringen Site, St. Mary's City, Maryland. . *Historical Archaeology* 21(2):37-59.

King, T.
2013 Cultural Respource Laws and Practice. Rowman and Littlefield: MD.

Kirkbride Jr, J. H., C. R. Gunn and M. J. Dallwitz
2006 Family Guide for Fruits and Seeds, Vers. 1.0.

Kraft, Herbert
1977 The Paleo-Indian Sites at Port Mobil, Staten Island. *New York State Archaeological Association, Researches and Transactions* 17:1-19.

1986 *The Lenape: Archaeology, History, and Ethnography*. New Jersey Historical Society, Newark, N.J.

Landes, Joel B. and Rudolph P. Frizzi
2005 *Phase I and Ii Environmental Site Assessment Report*. Langan Engineering and Environmental Services, Elmwood Park, NJ.

Landon, David B.
2005 Zooarchaeology and Historical Archaeology: Progress and Prospects12(1):1-36.

LaPorta, P.C., L. E. Sohl, M.C Brewer, K.L. Elder, C.E. Franks, V.M. Bryant Jr, J. Jones, D. Marshall and M. Glees
1999 *Cultural Resource Assessment of Proposed Dredged Material Management Alternative Sites in the New York Harbor-Apex Region*. Report prepared for U. S. Army Corps of Engineers, New York District.

Larsen, Curtis E. and Inga Clark
2006 A Search for Scale in Sea-Level Studies. *Journal of Coastal Research* 22(4):788-800.

Larsen, Curtis E., M.A. Smith and Joseph Schuldenrein
2010 *Geoarcheological Study of Cores for the Tappan Zee Bridge Hydrographic Survey, I-287 Corridor*. Report prepared for Earth Tech, Inc., New York, NY. New York.

Latham, Roy
1953 Notes on the Orient Focus of Eastern Long Island, New York. *Pennsylvania Archaeologist* 23:108-110.

1978 More Notes on the Stone Utensils in the Orient Burials. In *The Coastal Archaeology Reader*, edited by G. Levine. Suffolk County Archaeological Association, Stony Brook, N.Y.

Lavin, Lucianne
1980 Harik's Sandy Ground: A Report of the 1967 Salvage Excavations. *Bulletin and Journal of the Archaeology of New York State* 78:17-30.

Lee, Ruth Webb
1936 *Ruth Webb Lee's Handbook of Early American Pressed Glass Patterns*. Framingham Centre, Massachusetts.

LeeDecker, Charles H.
1994 Discard Behavior on Domestic Historic Sites: Evaluation of Contexts for the Interpretation of Household Consumption Patterns. *Journal of Archaeological Method and Theory* 1(4):345-375.

LeeDecker, Charles H., Terry H. Klein, Cheryl A. Holt and Amy Friedlander
1987 *Nineteenth Century Households and Consumer Behavior in Wilmington, Delaware*. Consumer Choice in Historical Archaeology. Plenum Press, New York.

Lenik, Edward J.
1989 Cultural Contact and Trade in Prehistoric Staten Island. *Proceedings of the Staten Island Institute of Arts and Science* 38(25-32).

Lindsey, Bill
2010 Historic Glass Bottle Identification and Information Website. Website, Http://Www.Sha.Org/Bottle, Accessed 2013.

Linn, Meredith B.
2008 *From Typhus to Tuberculosis and Fractures in Between: A Visceral Historical Archaeology of Irish Immigrant Life in New York City 1845--1870*. UMI Dissertations Publishing.

Lockwood, Charles
1976 *Manhattan Moves Uptown*. Barnes and Noble, New York.

Logan, J.R., S. Spielman, H.W. Xu and P.N. Klein
2011 Identifiying and Bounding Ethinic Neighborhoods. *Urban Geography* 32 (3):334-359.

Lorrain, Dessamae
1968 An Archaeologist's Guide to Nineteenth Century American Glass. *Historical Archaeology* 2 35-44.

Louis Berger and Associates
1987 *Phase I Archaeological Investigation of Proposed Sewage/Plumbing Lines and Seepage Basin at Van Cortlandt Mansion, Broadway and 242nd Street Van Cortlandt Park, Bronx, New York*. Louis Berger and Associates, Inc., New York.

Louis Berger Group
2004 *Proposed Fulton Street Transit Center*. New York.

Lovegreen, J. R.
1974 *Paleodrainage History of the Hudson Estuary*. Unpublished Masters Thesis, Columbia University, New York.

Lunn, Kevin
1981 Identification and Dating of Lea and Perrins' Worcestershire Sauce Bottles on Canadian Historic Sites: Interpretations Past and Present. *Canadian Journal of Archaeology*:1-177.

Maclay, William
1890 *Journal of William Maclay: United States Senator from Pennsylvania, 1789-1791*. New York, D. Appleton and company.

Majewski, T. and M.J. O'Brien
1987 *The Use and Misuse of Nineteenth-Century English and American Ceramics in Archaeological Analysis*. Advances in Archaeological Method and Theory, Vol 11 11. Academic Press, Inc.

Marquardt, William H. and Karen J. Walker

2013 *The Archaeology of Pineland: A Coastal Southwest Florida Site Complex, A.D. 50-1710* University of Florida Press, Gainesville.

Marsh, Madeleine
2009 *The History of Compacts and Cosmetics: From Victorian Times to the Present Day*. Pen and Sword.

Martin, Alexander C. and William D. Barkley
1961 *Seed Identification Manual*. University of California Press.

Matthews, Christopher N.
2010 *The Archaeology of American Capitalism*. University Press of Florida, Gainesville.

McBrayer, Alan R. and Thomas F. Valenza
2012 History on Your Face - Common Spectacle Styles before, During and after the Civil War, 1835-1870. The Historic EyeWear Company.

McCarthy, John P.
1997 Material Culture and the Performance of Sociocultural Identity: Community, Ethnicity, and Agency in the Burial Practices at the First African Baptist Church Cemeteries, Philadelphia, 1810-1841. . In *American Material Culture: The Shape of the Field*, edited by A. S. Martin and J. R. Garrison, pp. 359-379. Henry Francis du Pont Winterthur Museum (distributed by University of Tennessee Press, Knoxville), Winterhur.

McGovern, P.E. and et al.
1995 Science in Archaeology: A Review. *American Journal of Archaeology* 99(1):79-142.

McGrew, J. Chapman Jr. and Charles B. Monroe
2000 *An Introduction to Statistical Problem Solving in Geography*. 2nd ed. McGraw-Hill Companies, Inc., Boston.

McKearnin, George and Helen McKearnin
1948 *American Glass*. Crown Publishers, New York.

McNett, C.W. (Jr.)
1985 Shawnee-Minisink: A Stratified Paleoindian-Archaic Site in the Upper Delaware Valley of Pennsylvania. Academic Press: Cambridge, MA.

Medina, Martin
2007 The World's Scavengers: Salvaging for Sustainable Consumption and Production. AltaMira: MD.

Melosi, M.V.
1973 "Out of Sight, out of Mind": The Environment and Disposal of Municipal Refuse, 1860-1920. *Historian* 35(4):621-640.

Merguerian, Charles and J. E. Sanders
1994 *Staten Island and Vicinity: Guidebook for the on-the-Rocks 1994 Fieldtrip Series, Trip 33*. New York Academy of Sciences, New York.

Merriam, C. Hart
1895 The Geographic Distribution of Animals and Plants in North America. *Yearbook of the United States Department of Agriculture 1894*:203-214.

Meyer, Balthasar Henry, Caroline Elizabeth MacGill and Staff
1917 *History of Transportation in the United States before 1860*. Carnegie Institution of Washington, Washington.

Moir, Randall W.
1982 Windows and Pane Fragments: Sources of Chronological Data for Historic Archaeologists. Department of Anthropology, Southern Methodist University, Dallas.

Moran, G.P.
1976 Trash Pits and Natural Rights in the Revolutionary Era: Excavations at the Narbonne House in Salem, Massachusettes *Archaeology* 29(3):178-185.

Morgan, Richard Price
1842 Report to the Hudson River Railroad Committee. Egbert B. Killey, Poughkeepsie.

Mott, Hopper Striker
1908 *The New York of Yesterday: A Descriptive Narrative of Old Bloomingdale*. G.P. Putnam's Sons, New York.

Mueser Rutledge Consulting Engineeers
2011 *Subsurface Investigation Report, River Center, Building 2, New York, New York*. Report prepared for Extell Development Company.

Mulholland, Mitchell T.
1988 Territoriality and Horticulture: A Perspective for Prehistoric Southern New England. In *Holocene Human Ecology in Northeastern North America*, edited by G. P. Nicholas, pp. 137-166. Plenum, New York.

Murray, P.
1980 Discard Location: The Ethnographic Data. *American Antiquity* 45(490-502).

Myers, Gustavus
1900 The History of Public Franchises in New York City (Boroughs of Manhattan and the Bronx). Reform Club Committee on City Affairs, New York.

Newman, Walter S., David Thurber, Harvey S. Weiss, Allan Rokach and Lillian Musich
1969 Late Quaternary Geology of the Hudson River Estuary: A Preliminary Report. *Transactions of the New York Academy of Sciences* 31(5):548-570.

New York Central Railroad
1934 West Side Improvement: Initial Stage, Dedicated June 28, 1934.

New York Times
1851 Hudson River Railroad. New York.

1853 The Improvements of Modern Travel. New York.

1854 Proposal to Tear up the Rails. New York.

1855 Railroads. New York.

1855 Stopping Steam on the Hudson River Railroad. New York.

1856 Dummy Engines on the Hudson River. New York.

1856 Steam Below Forty-Second Street. New York.

1858 City Items: The Harlem Railroad Company Vs. The City and Police Commissioners. New York.

1860 Live Stock Markets. New York.

1864 Directors' Minutes, Hrr, Reel 26, Box 242, Nycrr.

1864 Executive Committee Minutes, Hr, Oversize Vol. 249, Nycrr.

1865 Directors' Minutes, Hr, Oversize Vol. 248, Nycrr.

1866 Abattoirs. New York.

1867 Steam on the Eleventh-Avenue. New York.

1870 The City Census. New York.

1870 The Complaints against the Census- More Flase Statements Exposed. New York.

1870 Current Notes. New York.

1870 Mayor Hall and the Census. New York.

1870 More Census Complaints Disproved. New York.

1870 The New Census of the City. New York.

1870 New Jersey Ferries. New York.

1870 The Ninth Census. New York.

1870 The Peach Trade: How Our National Fruit Is Grown and Where It Comes from--Importance of the Traffic--Prospects of This Season. New York.

1870 Politics and the Census. New York.

1870 Retaking of the Census. New York.

1871 The New Census Complete. New York.

1871 New York. New York.

1871 New York Cattle Market. New York.

1871 The Second Census. New York.

1873 Railroad Monopoly. New York.

1873 Wife-Murder in One of the Santies on the Rocks. New York.

1874 Another Abattoir to Be Erected. New York.

1874 The Board of Health. New York.

1874 The Delaware Peach Crop. New York.

1874 Family Market. New York.

1874 The Fruit Crops: An Abundant Yield Expected This Season. . New York.

1874 Marine Intelligence. New York.

1874 Marine Intelligence New York.

1874 The Proposed Abattoir. New York

1875 City and Suburban News. New York.

1875 City Questions. New York.

1875 The Fifty Ninth Street Abattoir. New York.

1875 The Health of the City. New York.

1875 The New Abattoir. New York.

1875 The New Cattle Yards. New York.

1875 The New Stock Yards Opened. New York.

1875 The Stock Yards.120-125. New York.

1875 Transportation of Peaches: How They Are Sent East, West, and to England Success of the Express Peach Trains. New York.

1876 Slaughter-Houses Inspected. New York.

1889 Millions Swept Away. New York

New York Tribune

1866 The Butchers and the Board of Health. New York.

1870 The Erie Railway. New York.

1870 Map of the City of New York, Showing Its Political Divisions and Subdivisions.

1873 Foreign Fruit. New York.

1874 Failure of the Maryland Peaches. New York.

1874 Gathering of Fresh Vegetables and Fruits. New York.

1874 Live Stock Markets. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Feb 9, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Aug. 11, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Dec. 1, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Dec. 29, 1874. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Jul. 7, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Jul. 14, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Jul. 29, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending July 28, 1874: Fruits.7. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Jun. 30, 1874: Fruit. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Nov. 17, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Oct. 6, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Sep. 1, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Sep. 8, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Sep. 15, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Sep. 29, 1874. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Sept. 22, 1874: Fruits. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Sept. 29, 1874: Fruits. New York.

1874 The Railway Kings' Purposes. New York.

1874-1875. New York.

1874 Ny Wholesale Prices of Country Produce for the Week Ending Oct. 13, 1874: Fruits. New York.

1875 A Railroad and Gas Company at Issue.2. New York.

1974 Ny Wholesale Prices of Country Produce for the Week Ending Aug. 4, 1874: Fruits New York.

1984 Ny Wholesale Prices of Country Produce for the Week Ending Aug. 25, 1874: Fruits. New York.

Nikitina, D. L., J. E. Pizzuto, R. A. Schwimmer and K. W. Ramsey
2000 An Updated Holocene Sea-Level Curve for the Delaware Coast, pp. 7-20. vol. 171.

Orser Jr, Charles E.
2007 The Archaeology of Race and Racialization in Historic America. University Press of Florida, Gainesville.

Partagas, J. F. and H. F. Diaz
1995 *A Reconstruction of Historical Tropical Cyclone Frequency in the Atlantic from Documentary and Other Historical Sources : 1851-1880,Â part Ii: 1871-1880*. Climate Diagnostics Center, NOAA. Boulder, CO.

Perris and Browne
1871 Insurance Maps of the City of New York. Perris and Browne, New York.

1885 Insurance Maps of the City of New York. Perris and Browne, New York.

Perris, William
1862 Insurance Maps of the City of New York, New York.

Pfeiffer, John

1990 The Late and Terminal Archaic Periods of Connecticut Prehistory: A Model of Continuity. In *Experiments and Observations on the Terminal Archaic of the Middle Atlantic Region*, edited by R. W. Moeller. Archaeological Sevices, Bethlehem, Conn.

Price, S., Ford, J., Copper, A. and C. Neal
2011 Humans as major geological and geomorphological agents in the Anthropocene: the significance of artificial ground in Great Britain. Philosophical Transactions. Series A 369(1938): 1056-1084.

Rampino, M. R. and J. E. Sanders
1981 Upper Quaternary Stratigraphy of Southern Long Island, New York. *Northeastern Geology* 3:116-128.

Rathje, W.L.
1989 Rubbish! *The Atlantic Monthly* 246(6):99-109.

Rathje, W.L., Hughes, W., Wilson, D., Tani, M., Archer, G., Hunt, R., and T. Jones
1992 The Archaeology of Contemporary Landfills. *American Antiquity* 57(3): 437-447.

Rathje, W.L. and C. Murphy
1992 *Rubbish! The Archaeology of Garbage*. Harper Collins, New York.

Reckner, P.F. and D. Dallal
2000 *The Long and the Short, Being a Compendium of Eighteenth- and Nineteenth-Century Clay-Tobacco Pipes from the Five Points Site, Block 160, New York City*. John Milner Associates. Pennsylvania.

Reckner, Paul
2001 Negotiating Patriotism at the Five Points: Clay Tobacco Pipes and Patriotic Imagery among Trade Unionists and Nativists in a Nineteenth-Century New York Neighborhood, pp. 103-114. vol. 35.

Redfield, A. C. and M. Rubin
1962 The Age of Salt Marsh Peat and Its Relations to Recent Change in Sea Level at Barnstable, Massachusetts, pp. 1728-1735. vol. 48.

Reeds, C. A.
1925 Glacial Lake Hackensack and Adjacent Lakes. *Geological Society of America Bulletin* 36:155-.

1926 The Varved Clays at Little Ferry, New Jersey. *American Museum Novitates* 209:1-16.

Reher, C.A. and D.L. Wedel
1990 Analysis of Glass Containers. In *The Territorial Prison Archaeology Project, C.A.,* C. A. Reher and M. K. Kornfeld, general editor. Department of Anthropology, University of Wyoming.

Reimer PJ, Baillie MGL, Bard E, Bayliss A, Beck JW, Blackwell PG, Bronk Ramsey C, Buck CE, Burr GS, Edwards RL, Friedrich M, Grootes PM, Guilderson TP, Hajdas I, Heaton TJ, Hogg AG, Hughen KA, Kaiser KF, Kromer B, McCormac FG, Manning SW, Reimer RW, Richards DA, Southon JR, Talamo S, Turney CSM, van der Plicht J and Weyhenmeyer CE
2009 Intcal09 and Marine09 Radiocarbon Age Calibration Curves, 0–50,000 Years Cal Bp. *Radiocarbon* 51(4):1111-1150.

Reiss, Albert J.
1961 *Occupations and Social Status*. Free Press, Glencoe, IL.

Reitz, Elizabeth J., Lee A. Newsom and Sylvia J. Scudder
1996 Issues in Environmental Archaeology. In *Case Studies in Environmental Archaeology*, edited by E. J. Reitz, L. A. Newsom and S. J. Scudder, pp. 3-13. Plenum Press, New York.

Ritchie, William A.

1944 *The Pre-Iroquoian Occupations of New York State* Memoir No. 1. Rochester Museum of Arts and Sciences, Rochester, N.Y.

1959 The Stony Brook Site and Its Relation to Archaic and Transitional Cultures on Long Island. *New York State Museum and Science Service Bulletin* 367.

1971 *A Typology and Nomenclature for New York Projectile Points*. Revised edition ed. New York State Museum and Science Service Bulletin Number 384. The State Education Department, Albany, N.Y.

1980 *The Archaeology of New York State*. Rev. ed. ed. Harbor Hill Books, Harrison, N.Y.

Ritchie, William A. and Robert E. Funk

1971 Evidence for Early Archaic Occupations on Staten Island. *Pennsylvania Archaeologist* 41(3):45-59.

Rivers, Sara J.

1999 Window Glass and the Gower House (15lv178): An Application of Donald Balls' Dating Formula. vol. 29.

Roberts, Luke

2013 4 Mon Kan'ei and Bunkyuu Coins. vol. 2013.

Robinson, E.

1883 Atlas of the City of New York, Embracing the 19th and 22nd Wards. Second ed. vol. 1, New York.

Robinson, William S.

1951 A Method for Chronologically Ordering Archaeological Deposites. *American Antiquity*:293-301.

Rosenzweig, Roy and Elizabeth Blackmar

1992 *The Park and the People: A History of Central Park*. Cornell University Press, Ithaca, NY.

Rothschild, Nan A.

2009 Digging for Food in Early New York City. In *Gastropolis: Food and New York City*, edited by A. H.-L. a. J. Deutsch. Columbia University Press, New York.

Rothschild, Nan A. and Arnold Pickman

1990 *The Archaeological Excavations on the Seven Hanover Square Block*. New York City Landmarks Preservation Commission.

Rothschild, Nan and Susan A. Dublin

1985 *Penn Yards Development Area, New York, New York. Phase 1: Cultural Resources Summary*.

Rothschild, Nan and Lucianne Lavin

1977 The Kaeser Site: A Stratified Shell Midden in the Bronx, New York. *Bulletin and Journal of the Archaeology of New York State* 70:1-27.

Rousseau, D.D., N. Limondin and J.J. Puissegur

1993 Holocene Environmental Signals from Mollusk Assemblages in Burgundy (France). *Quaternary Research* 40.

Rubertone, Patricia

1974 *Inventory and Assessment of Archaeological Potential of Distrigas Property, Rossville, Staten Island, New York: Final Report*.

Ruddiman, William F.
2003 The Anthropogenic Greenhouse Era began Thousands of Years Ago. *Climate Change* 61: 261-293.

Ruggles, Steven, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder and Matthew Sobek
2010a Integrated Public Use Microdata Series: Version 5.0 [Machine-Readable Database]. In *United States Federal Census, New York, New York 1880*. University of Minnesota, Minneapolis.

2010b Integrated Public Use Microdata Series: Version 5.0 [Machine-Readable Database]. In *United States Federal Census, New York, New York 1870*. University of Minnesota, Minneapolis.

Salisbury, R. D.
1902 *The Glacial Geology of New Jersey*. Annual Report of the State Geologist of New Jersey, Trenton.

Salisbury, R. D. and H. B. Kummel
1893 *Lake Passaic: An Extinct Glacial Lake*. Annual Report of the State Geologist of New Jersey, Trenton.

Salwen, Bert
1962 Sea Levels and the Archaeology in the Long Island Sound Area. *American Antiquity* 28:46-55.

1965 *Sea Levels and the Archaic Archaeology of the Northeast Coast of the United States.* Dissertation, Columbia University.

1975 Post-Glacial Environments and Cultural Change in the Hudson River Basin. *Main in the Northeast* 10:43-70.

Sanborn
1892 Insurance Maps of the City of New York. Atlas 117. vol. 6. Sanborn-Perris and Co., New York.

1907 Insurance Maps of the City of New York. Borough of Manhattan (Atlas 118, Vol. 6). Sandborn Map Company.

1922 New York Harbor Pier Map 6. In *Manhattan W. 54th St. to W. 72nd St. Pier 94 to Pier 108*, New York City.

Sanderson, Eric W.
2013 *Mannahatta: A Natural History of New York*. Harry N. Abrams, New York.

Schiffer, M.B
1972 Archaeological Context and Systemic Context. *American Antiquity* 37(2):156-165.

1976 *Behavioral Archaeology*. Academic Press, New York.

Schuberth, Christopher J.
1968 *The Geology of New York City and Environs*. Natural History Press, Garden City.

Schuldenrein, J.
2003 *Buried Landscapes Along the West Shore of the Lower Hudson River: Geoarchaeological Observations of Core R15-4, Jersey City, New Jersey.* Report submitted to Joan Geismar LLC, New York, NY.

Schuldenrein, J., E. Hulse and R. Winter-Livneh
2013 *Geoarchaeological Reconstruction of Old Place Neck, Nj-Ny Expansion Project, Staten Island, Richmond County, New York*. Report prepared for Extell Development Company.

Schuldenrein, Joseph and Michael Aiuvalasit
2011 Urban Geoarchaeology and Sustainability: A Case Study from Manhattan Island, New York City, USA. *Geological Society of America Special Papers* 476 153-172.

Schuldenrein, Joseph, Curtis E. Larsen, Michael Aiuvaslasit and Mark A. Smith
2014 *Geomorphology/Archaeological Borings and Gis Model of the Submerged Paleoenvironment in the New York and New Jersey Harbor and Bight in Connection with the New York and New Jersey Harbor Navigation Project Port of New York and New Jersey*. Report prepared for NEA, under contract to the U.S. Army Corps of Engineers, New York District; prepared by Geoarcheology Research Associates, under subcontract to and prepared in conjunction with Hunter Research Inc.

Series, Integrated Public Use Microdata
2013 New Detailed Birthplace Codes for Germany for 1860, 1870 & 1900, edited by U. o. M. Minnesota Population Center.

Shanks, M., Platt, D., and W. Rathje
2004 The Perfume of Garbage: Modernity and the Archaeological. The Johns Hopkins University Press: MD.

Sherwood, Sarah C. and T.R. Kidder
2011 The Davincis of Dirt: Geoarchaeological Perspectives on Native American Mound Building in the Mississippi River Basin. *Journal of Anthropological Archaeology* 30(1):69-87.

Silver, Annette
1984 The Smoking Point Site (Std 14-3). *Proceedings of the Staten Island Institute of Arts and Science* 33:1-46.

Sirkin, L.
1986 Pleistocene Stratigraphy of Long Island, New York. In *The Wisconsinan Stage of the First Geological District, Eastern New York. Bulletin 455*, edited by D. H. Caldwell, pp. 6-21, Albany.

Sirkin, L. and R. Stuckenrath
1980 The Portwashingtonian Warm Interval in the Northern Atlantic Coastal Plain. *Geological Society of America Bulletin* 91:332-336.

Skinner, Alanson
1915 *Indians of Manhattan Island and Vicinity*. American Museum of Natural History, New York.

1919 *Explorations of Aboriginal Sites at Throgs Neck and Clasons Point, New York City*. Contributions from the Museum of the American Indian, Heye Foundation V(4), New York.

1920 *Archaeological Investigations on Manhattan Island, New York City*. Indian Notes and Monographs 2. Museum of the American Indian, Heyes Foundation, New York.

Smith, Andrew F.
2009 The Food and Drink of New York from 1624-1898. In *Gastropolis: Food and New York City*, edited by A. H.-L. a. J. Deutsch. Columbia University Press, New York.

Smith, B.D
2006 Seed Size Increase as a Marker of Domestication in Squash (Curcurbita Pepo). In *Documenting Domestication: A New Genetic and Archaeological Paradigms*, edited by M. Zeder, pp. 25-31. University of California Press, Berkeley.

Smith, Carlyle S.
1950 The Archaeology of Coastal New York. *American Museum of Natural History, Anthropological Papers* 43(2).

Snow, Dean
1978 Late Prehistory of the East Coast. In *Handbook of North American Indians*, edited by W. C. Sturtevant and B. G. Trigger, pp. 58-69. vol. 15. Smithsonian Institution, Washington.

1980 *The Archaeology of New England*. Academic Press, New York.

Sobek, Matthew
1996 Work, Status, and Income: Men in the American Occupational Structure since the Late Nineteenth Century. *Social Science History* 20(2):169-207.

Society, New York State Agricultural
1868 *Transactions of the New-York State Agricultural Society for the Year*. Van Benthuysen & Sons' Steam Printing House, Albany, NY.

Sperr, P. L.
1930 Manhattan: West End Avenue - 59th Street (West).

1933 Manhattan: West End Avenue - 60th Street (West).

Stanford, S. D.
2010 Onshore Record of Hudson River Drainage to the Continental Shelf from the Late Miocene through the Late Wisconsinan Deglaciation, USA: Synthesis and Revision. *Boreas* 39(1):1-17.

Stanford, Scott D.
1997 Pliocene-Quaternary Geology of Northern New Jersey: An Overview. In *Pliocene-Quaternary Geology of Northern New Jersey, Guidebook for the 60th Annual Reunion of the Northeastern Friends of the Pleistocene*, edited by S. D. Stanford and R. W. Witte, pp. 1-26. New Jersey Geological Survey, New Jersey.

Stanford, Scott D. and D.P. Harper
1991 Glacial Lakes of the Lower Passaic, Hackensack, and Lower Hudson Valleys, New Jersey and New York. *Northeastern Geology* 13:277-286.

Staski, E.
1991 Where and How the Litterbug Bites: Unaurhorized Refuse Disposal in Late 19th Century American Cities. . In *The Ethnoarchaeology of Refuse Disposal: Issue 42 of Arizona State University Anthropological Research Papers*, edited by E. S. a. L. D. Sutro, pp. 33-40. Arizona State University, Tempe.

Stein, J.
1992 Deciphering a Shell Midden. Academic Press: Cambridge, MA.

Stevens, Gillian and David L. Featherman
1981 A Revised Socioeconomic Index of Occupational Status. *Social Science Research* 10(4):364-395.

Stiles, T. J.
2009 *The First Tycoon: The Epic Life of Cornelius Vanderbilt*. Alfred A. Knopf, New York.

Still, Bayard
1956 *Mirror for Gotham, New York Seen by Contemporaries from Dutch Days to the Present*. University Press, New York.

Stinchcomb, Gary E., S. G. Driese, L. C. Nordt and P. M. Allen
2012 A Mid to Late Holocene History of Floodplain and Terrace Reworking Along the Middle Delaware River Valley, USA. *Geomorphology* 169 123-141.

Stokes, I.N. Phelps
1922 *The Iconography of Manhattan Island: 1498 to 1909* IV. Robert H. Dodd, New York.

1928 *The Iconography of Manhattan Island: 1498 to 1909* VI. Robert H. Dodd, New York.

Sudbury, J. Byron
2006 *Historic Clay Tobacco Pipe Studies Volume 1*. Lulu.com.

Suggs, Robert C.
1966 *The Archaeology of New York State*. Thomas Y. Crowell Company, New York.

Sullivan, Catherine
1994 Searching for Nineteenth-Century Florida Water Bottles. *Historical Archaeology* 28(1):78-98.

Sullivan, M., C. Griffith and T. Majewski
2005 *Down in the Dumps: Context Statement and Guidance on Historical-Period Waste Management and Refuse Deposits*. Phoenix.

Surge, Donna M., Kyger C. Lohmann and Glenn A. Goodfriend
2003 Reconstructing Estuarine Conditions: Oyster Shells as Recorders of Environmental Change, Southwest Florida. *Estuarine, Coastal and Shelf Science* 57:737-756.

Teotia, M.
2013 Managing New York City Municipal Solid Waste - Using Anaerobic Digestion. Pratt Institute, School of Architecture.

Thieler, E. R., B. Butman, W. C. Schwab, M. A. Allison, N. W. Driscoll, J. P. Donnelly and E. Uchupi
2007 A Catastrophic Meltwater Flood Even and the Formation of the Hudson Shelf Valley, pp. 120-136. vol. 246.

Thieme, Donald M. and Joseph Schuldenrein
1996 *Quaternary Paleoenvironments in the Hackensack Meadowlands: A Geological and Palynological Study of Borings for the Proposed North Arlington Force Main and Pumping Station, North Arlington, N.J*. Report prepared for Neglia Engineering Associates, Lyndhurst, NJ. New York.

1998 *Paleoenvironmental Analysis of the Combined Sewer Overflow Planning Study, Planning Area 1a, North Bergen (West), Hudson County, New Jersey*. Report prepared for Richard Grubb and Associates, Inc., Cranbury, NJ. New York.

Thompson, Victor D. and John A. Turck
2010 Island Archaeology and the Native American Economies (2500 B.C. – A.D. 1700) of the Georgia Coast, USA. *Journal of Field Archaeology* (TBA).

Toulouse, Julian Harrison
1971 *Bottle Makers and Their Marks*. T. Nelson, New York.

Trow, John Fowler
1874 Trow's New York City Directory. J.F. Trow.

1875 Trow's New York City Directory. J.F. Trow.

Turck, John A.
2012 Where Were All of the Coastally Adapted People During the Middle Archaic Period in Georgia, USA *Journal of Island and Coastal Archaeology* 7(3):404-424.

Turck, John A. and Clark R. Alexander
2013 Coastal Landscapes and Their Relationship to Human Settlement on the Georgia Coast. In *Life among the Tides: Recent Archaeology of the Georgia Bight*, edited by V. D. Thompson and D. H. Thomas, pp. 423-437. Anthropological Papers of the American Museum of Natural History, No. 98, New York.

Turck, John A. and Victor D. Thompson
2012 *An Archaeological Survey of Little Sapelo Island (Little Sapelo S-9mc353 and N-9mc352), Mcintosh County, Georgia*. Report on file at the Georgia Archaeological Site File, University of Georgia, Athens.

Uchupi, E., N. Driscoll, R. D. Ballard and S. T. Bolmer
2001 Drainage of Late Wisconsin Glacial Lakes and the Morphology and Late Quaternary Stratigraphy of the New Jersey-Southern New England Continental Shelf and Slope. *Marine Geology* 172(1-2):117-145.

van der Donck, Adriaen
2008 *A Description of New Netherland: The Iroquoians and Their World*. University of Nebraska Press, Lincoln.

van Leeuwen, Marco H.D., Ineke Maas and Andrew Miles
2002 *Hisco: Historical International Standard Classification of Occupations*. Leuven University Press, Leuven.

Viele, E.
1874 *Topographic Atlas of the City of New York*. Ferd. Mayer & co. Lithographers, New York.

Wagner, D.P. and P.E. Siegel
1997 *A Geomorphological and Archeological Analysis of the Arthur Kill-Howland Hook Marine Terminal Channel, Richmond County, New York, and Union County, New Jersey*. Report prepared for the New York District, U.S. Army Corps of Engineers.

Walker, I.C.
1970 Nineteenth-Century Clay Tobacco Pipes. *Ontario Archaeology* 16:19.

1983 Nineteenth Century Clay Tobacco Pipes in Canada. *Davey 1983* 1-60.

Walker, Thomas
1920 Survey of the American Coconut Products Industry. United States Tariff Commission, Washington.

Wall, Diana diZerga
1994 *The Archaeology of Gender: Separation of Spheres in Urban American*. Plenum Press, New York.

Walling, H. F.
1867 Walling's Route Guides: The Hudson River. Taintor Brothers, New York.

Walsh, D. C.
1991 Reconnaissance Mapping of Landfills in New York City. In *Proceedings: FOCUS Conference on Eastern Regional Ground Water Issues, NGWA*, Dublin, OHÂ

Walsh, D. C., S.N. Chillrud, H.J. Simpson and R.F. Bopp
2001 Refuse Incinerator Particulate Emissions and Combustion Residues for New York City During the 20th Century. *Environmental Science and Technology* 35:2441-2447.

Walsh, Daniel C. and Robert G. LaFleur
1995 Landfills in New York City: 1844-1994. *Groundwater* 33(4):556-560.

Watkins, Lura Woodside
1950 *American Glass and Glassmaking*. Cracker Barrel, Southampton.

Weil, Jim
1971 Excavations at Wort's Farm in 1971. *Proceedings of the Staten Island Institute of Arts and Science* 28:3-17.

Weiland, Jonathan
2009 A Comparison and Review of Window Glass Analysis Approaches in Historical Archaeology, pp. 29-40. vol. 4, Technical Briefs in Historical Archaeology.

Weiss, Dennis
1974 Late Pleistocene Stratigraphy and Paleoecology of the Lower Hudson River Estuary. *Geological Society of America Bulletin* 85(10):1561-1570.

Wetherbee, Jean
1985 *A Second Look at White Ironstone*. Wallace-Homestead Book Company.

Williams, Lorraine
1968 The Wort Farm: A Report of the 1963/64 Excavations. *Proceedings of the Staten Island Institute of Arts and Science* 22:39-46.

Wilson, D.C.
1991 *Structure and Dynamics of Household Refuse: Archaeological Approaches to Characterization and Estimation*, University of Arizona.

Wilson, D.G (editor)
1977 *Handbook of Solid Waste Management*. Van Nostrand Reinhold, New York.

Wilson, Douglas C.
1994 Identification and Assessment of Secondary Refuse Aggregates, pp. 41-68. vol. 1.

Wilson, Hugh
2014 Flowering Plant Gateway. vol. 2014.

Wisniewski, Stanley H.
1986 The Bay Terrace Creek Site. *Bulletin and Journal of the New York State Archaeological Association* 93:1-26.

Wobst, H. Martin
2005 Power to the (Indigenous) Past and Present! Or: The Theory and Method Behind Archaeological Theory and Method. In *Indigenous Archaeologies: Decolonizing Theory and Practice*, edited by C. Smith and H. M. Wobst, pp. 17-32. Routledge, New York.

Yamin, Rebecca
2000 *Tales of Five Points: Working-Class Life in Nineteenth-Century New York*. John Milner Associates. Prepared for Edwards and Kelcey Engineers, Inc.

Yesner, David R.
2008 Ecology in Archaeology. In *Handbook of Archaeological Theories*, edited by R. A. Bentley, H. D. G. Maschner and C. Chippindale, pp. 39-56. Altamira, New York.

Zalasiewicz, J., Williams, M., Fortey, R., Smith, A., Barry, T., Coe, A., Brown, P., Rawson, P., Gale, A., Gibbard, P., Gregory, F., Hounslow, M., Kerr, A., Pearson, P., Knox, R., Powell, J., Waters, C., Marshall, J., Oates, M., and P Stone.
2011 Stratigraphy of the Anthropocene. *Philosophical transactions, Series A* 369(1938): 1036-55.