HISTORICAL PERSPECTIVES INC.

Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

DDC # SANDRESM1
NYSOPRHP # 15PR02961
LPC # DDC / SANDRESM1
CEQR # 15DPR013M

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March 2016

MANAGEMENT SUMMARY

SHPO Project Review Number (if available): **15PR02961**

Involved State and Federal Agencies: **United States Department of Housing and Urban Development, Community Development Block Grant Disaster Recovery**

Phase of Survey: **Phase IA Archaeological Documentary Study**

Location Information
- Location: **FDR Drive and East River Park from Montgomery Street to Rivington Street**
- Minor Civil Division: **06101**
- County: **New York**

Survey Area
- Length: **Varies**
- Width: **Varies**
- Number of Acres Surveyed: **ca. 25**

USGS 7.5 Minute Quadrangle Map: **Brooklyn**

Archaeological Survey Overview
- Number & Interval of Shovel Tests: **N/A**
- Number & Size of Units: **N/A**
- Width of Plowed Strips: **N/A**
- Surface Survey Transect Interval: **N/A, urban area**

Results of Archaeological Survey
- Number & name of precontact sites identified: **None**
- Number & name of historic sites identified: **None**
- Number & name of sites recommended for Phase II/Avoidance: **None**

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Date of Report: **March 2016**

EXECUTIVE SUMMARY

The proposed East Side Coastal Resiliency (ESCR) project is designed to reduce the risks to Manhattan's East Side from extreme weather and climate change, as well as improve quality of life. This project focuses on neighborhoods along the East River waterfront between Montgomery and East 23rd Streets (and, in one alternative up to East 25th Street). The proposed project will require ground disturbance within two defined locations, the Project Area One and Project Area Two corridors (the project site) (Figure 1). Project Area One includes the southern section of the project site, from Montgomery Street north to East 13th Street, including portions adjacent to Pier 42 and all of East River Park. Project Area Two includes the northern section of the project site, from East 13th Street north to East 23rd Street (and, in one alternative up to East 25th Street), including Captain Patrick J. Brown Walk and Stuyvesant Cove Park. The FDR Drive runs through both of these two Project Areas, with pedestrian bridges over the FDR Drive connecting to locations west of the FDR Drive.

The New York City Office of Management and Budget and the New York City Department of Parks & Recreation consulted with the New York City Landmarks Preservation Commission (LPC) and the State Historic Preservation Office (SHPO) (also known as the New York State Office of Parks, Recreation, and Historic Preservation or NYSOPRHP) and received correspondence indicating that the project site requires an Archaeological Documentary Study (LPC 6/10/15). Similarly, SHPO has determined that the project area is archaeologically sensitive and a Phase IA archaeological study is required.

The first task in response to LPC and SHPO comments was to narrow the project site to establish the Area of Potential Effect (APE), defined as those locations that have potential archaeological sensitivity and that will experience either direct or indirect impacts. The established APE would then be subjected to the more comprehensive Phase IA Archaeological Documentary Study. The scope for establishing the APE was developed in consultation with LPC and SHPO (Sutphin 7/9/15, 8/10/15; Perazio 7/20/15).

In October 2015, Historical Perspectives, Inc. (HPI) completed the requested report, *Refinement of Archaeological Area of Potential Effect, East Side Coastal Resiliency Project, Montgomery Street to East 25th Street, Manhattan, New York County, New York*. The APE refinement report indicated that two portions of the overall ESCR project site should be subjected to Phase IA Archaeological Documentary Studies: the section from Montgomery Street to Rivington Street in Project Area One, and the section from East 23rd Street to East 25th Street in Project Area Two. These recommended studies would focus on historic period archaeological resources; no precontact period sensitivity was identified for any areas. The APE refinement report was submitted to, and accepted by, both the LPC and the SHPO (Sutphin 10/30/15; Perazio 12/10/15).

The present report constitutes the required Phase IA Archaeological Documentary Study for the section of the ESCR project from Montgomery Street to Rivington Street in Project Area One (Figures 1 and 2). The companion study for the section from East 23rd Street to East 25th Street will be addressed in a separate report. This report satisfies the requirements of SEQRA/CEQR, and complies with the standards of the NYSOPRHP and the LPC (New York Archaeological Council 1994; NYSOPRHP 2005; LPC 2002; CEQR 2014).

This Phase IA Archaeological Documentary Study has shown that the entire APE was once under the water of the East River, and was landfilled at various times between the 1810s and about 1850, with city streets created to separate and define newly formed blocks. These blocks supported a range of structures over time, primarily mixed residential/commercial buildings and industrial facilities. Bulkheads and pierheads established the extent of waterfront resource boundaries. The APE became more developed over time and by the 1930s, when the East River Drive (now the FDR Drive) and East River Park were created, each city block was almost completely covered with structures and numerous piers were located along the waterfront. Maps and photographs show that these structures, including the piers, were demolished in preparation for construction of the East River Drive and East River Park.

There are a number of project Alternatives proposed for the East Side Coastal Resiliency project site. The Preferred Alternative has not yet been selected, and plans for each Alternative may still be changed. However, there are certain elements that apply to all the Alternatives. Namely, all of the Alternatives contain a combination of components including Engineered Berms, Floodwalls, and Deployable Systems. For each of these components, proposed excavation would extend ca. 2-4 feet below the existing grade for construction of the component base and pile caps, with sheet piles driven mechanically to ca. 40 feet below grade. It is expected that archaeological testing

or monitoring would only be possible for the upper 2-4 feet of component installation. The sheet pile driving would not allow any visibility of subsurface conditions. The only two project locations that may provide more wide scale excavation windows would be (1) the locations slated for utility work and (2) beneath the tennis courts north of Delancey Street, which is the site of a proposed large storage tank.

There have been several previous archaeological studies within and adjacent to the APE that have identified broad categories of potential historic period archaeological resources. These include those for the East River Waterfront Esplanade and Piers by HPI (2007a, 2007b) and recently for the reconstruction of Pier 42 AKRF (2015), which encompassed areas from Montgomery Street to east of Jackson Street south of the FDR Drive, including portions of the current APE. The above studies have been submitted to, and accepted by, regulatory agencies. Therefore, to retain parity, the same broad resource categories are addressed below. Prior disturbance and archaeological sensitivity are addressed within each resource category.

River bottom remains

River bottom remains are those items discarded onto the river floor prior to or during landfilling. It is possible that archaeologically sensitive deposits are present on the river bottom within the APE. However, the only construction activity within the APE that could affect potential river bottom remains is the proposed storage tank under the present tennis courts north of Delancey Street, where excavation could extend to 50 feet below the current grade. The depth of river bottom deposits would depend on the vertical extent of the landfill and historic strata, which varies considerably across the APE. Soil borings reviewed for this report indicate fill ranges from 12 to more than 40 feet in thickness.

Landfill retaining structures and landfill deposits (including sunken vessels)

Landfill retaining structures can include repurposed historic piers, wharves, and docks, as well as timber structures built specifically for retaining fill, sometimes also referred to as bulkheads. At times, derelict maritime vessels also were used both as landfill retaining structures or part of the landfill. Landfill by nature contains soil, but also may include concentrations of artifacts or other refuse material, such as ash, sometimes referred to as "cinders" in early soil boring logs.

Because the entire APE was once under water, there is potential for the presence of archaeologically sensitive historic landfill retaining structures from the first half of the nineteenth century throughout most of the APE. The exception is the former area bounded by Corlears Street, Water Street, and the East River (now the approximate location of the amphitheater), which was not enclosed by bulkheads and landfilled until the 1870s or 1880s. The current bulkhead that comprises the eastern edge of East River Park dates to the 1930s, when the park was created, and was recently rehabilitated. It is assumed that it will not be affected by any components of this project. It is not expected that there would be any historic landfill retaining structures between the historic bulkhead line and the current bulkhead line, as this area was landfilled in the twentieth century in conjunction with the creation of East River Park in the 1930s.

Current plans indicate that the majority of project related impacts would only extend ca. 2-4 feet below the existing ground surface. While it is possible that landfill retaining structures could be found within this upper reach of the soil column, previous archaeological investigations at other locations along the East River suggest that most of these resources are located deeper in the ground. Additionally, the level of disturbance throughout the APE from various earthmoving episodes, including installation of utilities, construction of foundations and basements, and reconfiguration of the area during roadway and park construction further argues that the likelihood of encountering intact resources is diminished at these relatively shallow depths. Last, recent soil borings did not record any elements at these depths that appear to represent these resources (such as concentrations of wood). Although the sheet pile driving will extend through areas more likely to contain these resources, it will not be possible to observe these areas due to the means of installation.

The locations most likely to uncover landfill retaining structures and any potential sunken vessels by project components are those places where utilities will need to be encased or relocated, and the area of the proposed storage tank under the tennis courts north of Delancey Street where, as described earlier, excavations will extend ca.

50 feet below the current extent of the tennis courts. This area also includes the historic East Street bulkhead, which was in place by ca. 1850 and if not destroyed by subsequent construction in East River Park, might be visible here.

Historic streetbed resources (utilities, transportation elements, artifact deposits)

The APE formerly contained a number of historic streets, including portions of Front Street, South Street, Montgomery Street, Gouverneur Street, Jackson Street, Corlears Street, Water Street, Cherry Street, East Street, Tompkins Street, Grand Street, Broome Street, Delancey Street, and Rivington Street. Most of these street segments were eliminated when the East River Drive and East River Park were built in the 1930s and 1940s.

Each of the former city streets had subsurface utilities under them. The lines of the extant utilities, as shown on civil plan sheets in Appendix B, attest to the former street locations. While it is unlikely that any of the iconic wooden water mains from the pre-1842 Croton water era would be located under any of these streets (those mains were installed further south in Lower Manhattan), it is possible that archaeologically sensitive early water and sewer lines from the 1850s and 1860s could still exist under city streets, if not removed during subsequent utility work.

Some of the historic streets also had streetcar tracks, as shown on historic maps (e.g. Harrison 1867 [Figure 12]; Robinson 1885 [Figure 13]). Those streets with tracks included portions of Montgomery Street, Front Street, South Street, Corlears Street, and Grand Street. While subsequent disturbance to the streetbeds from utility replacement and construction of the East River Drive and East River Park likely eliminated many of these potentially archaeologically sensitive resources, it is still possible that segments could survive beneath these areas. It is also possible that portions of former street pavements, such as cobblestones or paving blocks, may be present beneath some areas.

Finally, archaeological monitoring of utility work in streetbeds of Lower Manhattan has shown that often concentrations or pockets of discarded artifacts can be found beneath historic streets. It is not possible to predict where such dumping grounds may be located, although archaeologists have had some subsequent success tracing the provenance of certain artifact caches to neighboring businesses (e.g. Urbanus 2015).

Portions of the APE that cross former historic street beds might be sensitive for these varied types of resources if later disturbance has not affected them. Within the upper 2-4 feet of the soil column, where the majority of project impacts will occur, there is less likelihood of encountering buried utilities, although it is possible that streetcar tracks, earlier street paving, and possible artifact dumps may be present. HPI concludes that streetbed resources may be present within the APE at depths of one foot below grade and greater.

Former city block resources (foundation remains, historic shaft features)

Those portions of the APE that had been historically developed within city blocks once contained a variety of residential/commercial and industrial buildings and structures, as well as waterfront-related shipyards, coal yards, lumber yards, and the like. The locations that contained commercial open "yards" such as shipyards, lumber yards, coal yards, and lime yards, would not be expected to have a significant archaeological footprint. However, potential archaeologically sensitive resources on former city blocks could include former foundations or other components from these buildings, as well as shaft features, such as privies, wells, and cisterns, from domestic and commercial buildings, predating the introduction of municipal water and sewers in the 1850s and 1860s.

The likelihood of recovering archaeological remains from these resources depends on the level of disturbance, which varies by location. Those former yards that had subsequent buildings with basements would have been disturbed to the deepest extent, ranging from possibly 8-10 feet below grade. Some information is available about which buildings had basements from Sanborn fire insurance maps, although it is possible that not all basements were recorded. Building department records for these former structures, which might also offer confirmation of basements, are no longer extant, as it was common practice of the city to discard records of buildings after they were demolished. Figures 16a-c and 17a-b include locations of former buildings with basements within the APE, based on data from Sanborn maps. The remainder of the former lots likely has been disturbed as well, from episodes of construction and demolition on the blocks, as well as creation of East River Drive and East River Park components. Although the depth of this disturbance is harder to discern, it is probable that at least the upper one foot extent has been affected in all locations, and areas now under roadways (including the FDR Drive and its service roads) have

been disturbed to a minimum of two feet below grade. Further, the construction of the Williamsburg Bridge included portions of historic lots south of Delancey Street, which are likely significantly disturbed.

Although project designs and potential impacts are still not final, it does appear that nearly all proposed components for the different Alternatives are slated for locations on the river side of the FDR Drive. The exceptions are several proposed floodwalls along Montgomery and Front Streets at the southern end of the overall project site, and portions of two pedestrian bridges that cross the FDR Drive. Based on the 1850s historic maps, HPI has identified locations on former city blocks that may be sensitive for domestic, commercial, and/or industrial archaeological resources that were not later covered by buildings with basements, focusing primarily on areas south and/or east of the FDR Drive. Figures 18a-f depict locations of lots with former resources on historic city blocks. It is possible that project impacts within the upper 2-4 feet of the soil column could reveal archaeological resources. Other areas where these resources also could be found are those loci of deeper impacts, such as where utilities may need to be encased or relocated, and the area of the proposed storage tank under the tennis courts north of Delancey Street where, as described earlier, excavations will extend ca. 50 feet below the current extent of the tennis courts.

The conclusions, above, have outlined several broad categories of potentially sensitive archaeological resources that could remain within the APE. Specifically, significant landfill retaining structures may exist throughout the APE (excepting the approximate area where the current amphitheater is located) and other resources may be situated in former streetbeds and historic city blocks. Figures 18a-18f illustrate locations of former lots with potentially sensitive archaeological resources within city blocks as well as those locations that had deep basement construction/disturbance.

At this time, most project impacts are slated to consist of excavation to depths of 2-4 feet below the current grade, for the installation of the upper components of walls and gates, and for pile caps. Impacts below these depths will be by sheet piles, which will be mechanically driven into the ground and will not afford visibility of any underlying soils. Areas where deeper and wider impacts may occur are where existing utilities could be encased or relocated, and the location of the proposed storage tank under the existing tennis courts north of Delancey Street. There may also be additional subsurface impacts outlined as the project moves forward.

Based on these results, and given the large size of the overall APE, HPI recommends that as the project moves forward and impacts are finalized, a scope for additional archaeology may be needed for the archaeologically sensitive areas of the APE, if these locations are chosen for project impacts as part of the selected Alternative. It is also possible that upcoming geotechnical soil borings could provide additional data about existing disturbance or potential resources within the APE. Results of these borings could be summarized in an addendum to this report. HPI recommends that once additional data are available from the forthcoming geotechnical soil boring program and a project Alternative is chosen and finalized, LPC and SHPO should be consulted to determine the scope of any future archaeological investigations.

TABLE OF CONTENTS

MANAGEMENT SUMMARY i

EXECUTIVE SUMMARY ii

TABLE OF CONTENTS vi

I. INTRODUCTION 1
II. PROJECT ALTERNATIVES AND COMPONENTS 1
A. ALTERNATIVES DESCRIPTIONS 1
B. PROJECT COMPONENTS 2
C. PROPOSED COMPONENTS WITHIN THE APE SEGMENTS 4
1. ALTERNATIVE 2, BASELINE FLOOD PROTECTION SYSTEM 4
2. ALTERNATIVE 3: FLOOD PROTECTION SYSTEM WITH PARK AND NEIGHBORHOOD CONNECTION IMPROVEMENTS 4
D. PROJECT SUBSURFACE IMPACTS 5
III. METHODOLOGY 6
IV. CURRENT CONDITIONS AND ENVIRONMENTAL SETTING 6
A. CURRENT CONDITIONS 6
1. MONTGOMERY TO JACKSON STREETS6 6
2. JACKSON TO GRAND STREETS 7
3. GRAND TO RIVINGTON STREETS 7
B. TOPOGRAPHY AND HYDROLOGY 8
C. SOILS 8
1. MONTGOMERY TO JACKSON STREETS 8
2. JACKSON TO GRAND STREETS 9
3. GRAND TO RIVINGTON STREETS 10
4. DISCUSSION 11
V. BACKGROUND RESEARCH/HISTORICAL OVERVIEW 12
A. PREVIOUSLY RECORDED ARCHAEOLOGICAL SITES AND SURVEYS 12
B. HISTORIC PERIOD SUMMARY 13
VI. HISTORIC LANDFILL CONTEXT 20
A. LANDFILL RETAINING STRUCTURES, WHARVES AND PIERS REVIEW 20
1. THE “VERNACULAR TRADITION—THE EIGHTEENTH TO MID-NINE-TEENTH CENTURIES 21
2. POST-1850S—MODERN CONSTRUCTION TECHNIQUES 21
B. LANDFILL RESOURCES IN NEW YORK CITY ARCHAEOLOGICAL CONTEXTS 23
1. LOWER MANHATTAN PROJECTS 23
2. BROOKLYN PROJECTS 25
C. DISCUSSION SUMMARY 25
VII. CONCLUSIONS 26
A. RIVER BOTTOM REMAINS 27
B. LANDFILL RETAINING STRUCTURES AND LANDFILL DEPOSITS (INCLUDING SUNKEN VESSELS) 27
C. HISTORIC STREETBED RESOURCES (UTILITIES, TRANSPORTATION ELEMENTS, ARTIFACT DEPOSITS) 27
D. FORMER CITY BLOCK RESOURCES (FOUNDATION REMAINS, HISTORIC SHAFT FEATURES) 28
VIII. RECOMMENDATIONS 29
IX. REFERENCES 31

FIGURES

PHOTOGRAPHS

APPENDIX A: PROJECT ALTERNATIVES 1, 2, AND 3 SCHEMATIC PLANS

APPENDIX B: PRELIMINARY PREFERRED ALTERNATIVE, DESIGN PLANS, CIVIL PLANS, AND TYPICAL SECTIONS

APPENDIX C: GENERALIZED TYPICAL IMPACTS DRAWINGS

APPENDIX D: SOIL BORINGS

APPENDIX E: 1930s-1950s PHOTOGRAPHS

FIGURES

1. APE on *Brooklyn, N.Y.* 7.5 Minute Topographic Quadrangle (U.S.G.S. 2013).

2. APE and photograph locations on modern street map (DoItt 2015).

3. APE on Alignment of Alternative 2 (Project Area One) (AKRF 2015).

4. APE on Alignment of Alternative 3 (Project Area One) (AKRF 2015).

5. APE on *Sanitary and Topographical Map of the City and Island of New York* (Viele 1865).

6. APE on *New York City Reconnaissance Soil Survey* (U.S.D.A. 2005).

7. APE on *Hooker's New Pocket Plan of the City of New York* (Hooker 1824).

8. APE on *Topographical Map of the City and County of New-York and the Adjacent Country* (Colton 1836).

9. APE on *Map of New-York Bay And Harbor And The Environs* (U.S.C.S. 1844).

10. APE on *Map of the City of New York Extending Northward to Fiftieth Street* (Dripps 1852).

11a. Montgomery Street to Jackson Street APE on *Map of the City of New York* (Perris 1852).

11b. Jackson Street to Grand Street APE on *Map of the City of New York* (Perris 1852).

11c. Grand Street to Rivington Street APE on *Map of the City of New York* (Perris 1852).

12. APE on *Plan of New York City from the Battery to Spuyten Duyvil Creek* (Harrison 1867).

13. APE on *Atlas of the City of New York* (Robinson 1885).

14. APE on *Sectional Aerial Maps of the City of New York* (Bureau of Engineering 1924).

15a. Southern section of APE on *Land Book of the Borough of Manhattan, City of New York* (Bromley 1927).

15b. Northern section of APE on *Land Book of the Borough of Manhattan, City of New York* (Bromley 1927).

16a. Montgomery Street to Jackson Street APE on *Draft Damage Map...East River Drive between Grand Street and Montgomery Street...* (Borough Works 1939).

16b. Jackson Street to Corlears Street APE on *Draft Damage Map...East River Drive between Grand Street and Montgomery Street...* (Borough Works 1939).

16c. Corlears Street to Grand Street APE on *Draft Damage Map...East River Drive between Grand Street and Montgomery Street...* (Borough Works 1939).

17a. Grand Street to Delancey Street APE on *Final Damage Map...East River Drive between Grand Street and East 14th Street...* (Borough Works 1936).

17b. Delancey Street to Rivington Street APE on *Final Damage Map...East River Drive between Grand Street and East 14th Street...* (Borough Works 1936).

18a-f. APE showing areas of archaeological sensitivity within former historic blocks (HPI 2016 and DDC 2015).

PHOTOGRAPHS
(see Figure 2 for locations)

1. South Street, running on north side of elevated FDR Drive. View looking southwest toward Montgomery Street in right background

2. Entrance to elevated FDR Drive at Montgomery Street, with Pier 42 on right. View looking northeast.

3. Pier 42. View looking southeast.

4. East River Bikeway between Pier 42 and FDR Drive. View looking west.

5. Utilities in undeveloped area east of Pier 42 near Jackson Street. View looking northwest.

6. Parking area and storage yard east of Jackson Street in East River Park. View looking east.

7. East River Park storage yard. View looking west.

8. Amphitheatre seating in East River Park. View looking north.

9. Bridge connecting East River Park to Corlears Hook Park. View looking northwest.

10. East River Bikeway and FDR Drive from Corlears Hook Park Bridge. View looking northeast.

11. East River Park near Fire Boat House, with Grand Street in background. View looking northwest.

12. Fire Boat House at foot of Grand Street. View looking southeast.

13. East River Bikeway near Grand Street. View looking southwest.

14. Williamsburg Bridge in East River Park. View looking northeast.

15. East River Bikeway crossing by the Delancey Street Bridge and the Williamsburg Bridge. View looking northeast.

16. Comfort station, currently out of service, with Williamsburg Bridge in background. View looking southwest.

TABLES

Table 1: Archaeological Sites within One Mile of the Project Site 12

Table 2: APE Streets, Years of Establishment.....14

Table 3: Tax Assessment data showing initial entries for APE streets.....14

Table 4: 1851 occupants, Montgomery to Jackson Streets.....16

Table 5: 1851 occupants, Jackson to Grand Streets.....17

Table 6: 1851 occupants, Grand to Rivington Streets 18

I. INTRODUCTION

The proposed East Side Coastal Resiliency (ESCR) project is designed to reduce the risks to Manhattan's East Side from extreme weather and climate change, as well as improve quality of life. This project focuses on neighborhoods along the East River waterfront between Montgomery and East 23rd Streets (and, in one alternative up to East 25th Street). The proposed project will require ground disturbance within two defined locations, the Project Area One and Project Area Two corridors (the project site) (Figure 1). Project Area One includes the southern section of the project site, from Montgomery Street north to East 13th Street, including portions adjacent to Pier 42 and all of East River Park. Project Area Two includes the northern section of the project site, from East 13th Street north to East 23rd Street (and, in one alternative up to East 25th Street), including Captain Patrick J. Brown Walk and Stuyvesant Cove Park. The FDR Drive runs through both of these two Project Areas, with pedestrian bridges over the FDR Drive connecting to locations west of the FDR Drive.

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II. PROJECT ALTERNATIVES AND COMPONENTS

A. Alternatives Descriptions

Within the total Project Area four Alternatives are proposed:

- **Alternative 1**: No-Action Alternative
- **Alternative 2**: Baseline Flood Protection System
- **Alternative 3**: Flood Protection System with Park and Neighborhood Connection Improvements
- **Alternative 4**: Flood Protection System with Integrated Park Facility Resiliency Measures

The following text summarizes the overall components of the Alternatives, taken from the Draft Scoping document (October 30, 2015). Figures 3 and 4 illustrate these components. Additionally, the project is divided into a series of "Reaches," beginning with Reach A at Montgomery Street and continuing to the beginning of Reach F at Delancey Street, as shown on these figures.

- **Alternative 2 – Baseline Flood Protection System**

  Alternative 2, the Baseline Flood Protection System Alternative, meets the project objectives by providing the required flood protection using a combination of berms and floodwalls with a reconstructed shared use path (bikeway/walkway) along the west side of East River Park. Under this alternative, the park and street improvements currently proposed as separate capital projects by DPR and NYCDOT, including the improvements proposed at Pier 42 and the Houston Street overpass, are also assumed to be completed. In Project Area One, depending on the design reach, the essential design features in East River Park include 1) floodwalls with periodic berms that avoid or minimize impacts to existing recreational facilities and other park features; 2) minimally improved park-side bridge landings at three of the five pedestrian bridges (e.g., at Delancey Street, East 6th Street, and East 10th Street) to integrate with the floodwall and berm elements; and 3) modestly enhanced passive recreation and landscaped spaces including a reconstructed bikeway and walkway.

- **Alternative 3 – Flood Protection System with Park and Neighborhood Connection Improvements**

  The Flood Protection System with Park and Neighborhood Connection Improvements Alternative would similarly achieve the flood protection objectives of the Proposed Action, but would provide enhanced neighborhood connections and targeted park upgrades, including a meandering bikeway and walkway, redesign of several pedestrian bridges to provide both enhanced access and flood protection, and more extensive landscaped features in East River Park. A key feature of this alternative that distinguishes it from Alternative 2 is the proposed enhancement and potential realignment of the existing pedestrian bridges at Delancey, East 6th, and East 10th Streets.

- **Alternative 4 – Flood Protection System with Integrated Park Facility Resiliency Measures**

  This alternative would examine a design concept that provides flood protection for the inland neighborhood comparable to the systems provided in Alternative 3, while integrating treatments to enhance and increase the resiliency and usability of park and recreation features within East River Park.

Project plans depicting these Alternatives on existing conditions maps for the APE are included as Appendix A. As of this time, Alternatives 3 and 4 are considered the "Preliminary Preferred Alternative." Detailed surveys of the Preliminary Preferred Alternative are presented in Appendix B.

B. Project Components

The following text, excerpted from the Draft Scoping document (October 30, 2015) describes the different possible components of the proposed project. Appendix C illustrates typical cross sections of these components.

- **Engineered and landscape berm (also referred to as a "bridging berm").** Engineered berms elevate the existing topography to form a line of coastal flood protection and, therefore, require a relatively wide space to be installed. They are typically constructed of a core of compacted fill material, capped by stiff clay to withstand storm waves, with a stabilizing landscaped cover. To avoid seepage, the coastal flood protection berm has an

interior cutoff wall that is constructed of either a stiff clay or slurry. These coastal protection berms can be integrated into a park setting and are also considered adaptable to provide increased protection or accommodate sea level rise to meet future design needs. Floodwalls (see below) are also used in conjunction with a berm at locations where there are horizontal space limitations. In certain reaches of Project Area One, these berms would be integrated with the pedestrian bridges that cross the FDR Drive and touch down in the park; these landings in the park (i.e., the "bridging berms") may then provide the dual benefit of improved access and flood protection. Engineered berms may be used for coastal flood protection within East River Park in Project Area One and within Stuyvesant Cove Park in Project Area Two. Floodwalls (see the description below) can also be used in conjunction with a landscaped berm in design reaches where there are horizontal space limitations. (In this combination, the floodwall provides the coastal protection and the berm is an associated landscape feature.)

- **Floodwalls.** Floodwalls are narrow vertical flood protection structures with below-grade foundations that are designed to withstand both tidal storm surges and waves. They are typically constructed of steel, reinforced concrete, or a combination of materials, with a reinforced concrete cap. Floodwalls can be used where there are horizontal space limitations and where there is a design objective to protect existing recreational facilities by narrowing the footprint of the flood protection system. Typical floodwall designs include I-walls, L-walls, and T-walls, each providing differing degrees of structural protection to withstand tidal surge and wave forces. Floodwalls may be used (in combination with landscape berms) along the interior limits of East River Park in Project Area One (adjacent to the FDR Drive).

- **Deployable Systems.** In many flood protection systems it is necessary to provide an opening to accommodate day-to-day vehicular or pedestrian circulation along a street or sidewalk, for example. In these instances, deployable systems are used. There are several types of deployable systems that may be used in both Project Areas One and Two, each of which is made of steel and structurally reinforced. These deployable systems include the following.
  − **Swing Floodgates.** These gates operate like a hinged door and are deployed to the closed position prior to the anticipated arrival of the surge event. The width limit for these systems is generally about 40 feet.
  − **Roller Floodgates.** A roller floodgate is a deployable system that can be used in openings up to and exceeding 40 feet wide. It is stabilized with a single or double line of wheels and slides into its protection position prior to the anticipated arrival of the storm event.
  − **Crest Floodgates.** Crest floodgates are a deployable flood protection system composed of a series of steel panels that are used along longer openings such as roads, sidewalks, or esplanades. A crest gate is more commonly built to meet site specific requirements (i.e., custom built) and they typically lie flat in a solid foundation that is either flush with the road surface or stored below grade in a recess covered by grating or steel plates. In preparation for a flood event, the gates are deployed and reinforced by retention arms or braces.
  − **Demountable Floodgates.** Demountable floodgates consist of a frame structure with stacked panels that are typically stored off-site. When a flood event is projected, the frame and panels are transported to the site in modular sections and are manually installed.

- The Proposed Action would also require water main, sewer, and utility relocations, an operations and maintenance plan, utility and lighting plans, connections to other flood protection structures (e.g., the protection systems at the Con Edison East River Generating Facility and the VA Medical Center on East 23rd Street), and the repair and replacement of parkland and streets affected by construction. Construction activities may also require improvements of waterfront structures, temporary mooring facilities, and

limited dredging along the East River to provide barge access during construction. Components designed to provide additional sewer capacity could include installation of parallel conveyance conduits, installation of a new in-line pump station, and/or construction of underground storage tanks and above-grade head house within East River Park.

Alternatives 2, 3, and 4 include construction of Engineered Berms, Floodwalls and Deployable Systems at certain locations and in various configurations. Alternative 2 contains the fewest components and Alternative 4 contains the greatest number of components, as well as additional infrastructure such as pedestrian ramps connecting the west side of the FDR Drive with the East River Park.

C. Proposed components within the APE segments

The following text, from the Preliminary Draft EIS for the project (January 22, 2016) provides detailed measures proposed for Alternatives 2 and 3 within each segment of the APE. Alternative 4 is similar to Alternative 3, but with increased resiliency features, generally consisting of above-grade modifications to existing components, and landscaping.

1. Alternative 2, Baseline Flood Protection System

- **Montgomery Street Closure and Pier 42 (Reaches A and B)**. Under Alternative 2, the Montgomery Street closure begins inland at Water Street and would be composed of a series of concrete I-walls and deployable swing gates at street crossings. Park enhancements in this reach would be implemented separately under DPR's Pier 42 project, which at completion would include spaces for active and passive recreation, habitat restoration, a salt marsh, lawns, a playground, and other amenities. A concrete I-wall would extend along the interior edge of the park (adjacent to the FDR Drive) in Reach B.
- **East River Park: Amphitheater and South Ballfields (Reaches C and D)**. In Reach C, the existing raised bridging berm would be integral to the flood protection system where the I-wall proposed in Reach B, is continued and extends into the existing berm at the Corlears Hook Park pedestrian bridge. At this location the existing berm also includes ramps connecting to the Corlears Hook Park Bridge, and an amphitheater. North of the amphitheater, a floodwall would be constructed that is tied into the shared use path that curves around Field 1. Moving north, as the floodwall begins to run parallel to the FDR Drive, it terminates and ties into the proposed elevated shared use path, which would provide the flood protection in Reach D north of the bridge. The shared use path in this reach would primarily continue along its current alignment and at grade, except that it would be relocated to run along the outside toe of the proposed engineered berm.
- **East River Park: Delancey Street Pedestrian Bridge and Tennis Courts (Reach E)**. This reach would involve an engineered bridging berm, which would connect to the existing Delancey Street pedestrian bridge and then transition to a concrete L-wall in the northern end of the reach, beginning just south of the Williamsburg Bridge and continuing under the bridge to the north end of Reach E. The proposed wall would minimize the horizontal design width of the flood protection at this location; therefore, avoiding the relocation of the existing tennis courts in this reach. Off-ramps from the Delancey Street pedestrian bridge into the park would be reconfigured with a low slope access ramp. The shared use path would continue generally along its current alignment and at grade, connecting with the ramp at the base of the bridge; landscaping in this reach would be concentrated on the proposed Delancey Street engineered bridging berm.

2. Alternative 3: Flood Protection System with Park and Neighborhood Connection Improvements

- **Montgomery Street Closure and Pier 42 (Reaches A and B)**. The Montgomery Street closure, which begins inland at Water Street, would be composed of a series of concrete I-walls and deployable swing gates at street crossings (Montgomery Street and the FDR Drive on-ramp). Park enhancements in this reach would be implemented separately under DPR's Pier 42 project, which at completion would include spaces for active and passive recreation. A concrete I-wall would

extend along the interior edge of the park (adjacent to the FDR Drive) in Reach B. However, to limit the visual impact of the floodwall (from the park side), as well as improving public safety by allowing bicyclists to be seen more from the upland side of the floodwall, the shared use bike and pedestrian path would begin to slope up near Montgomery Street, and be elevated above the existing grade by several feet by the middle of Reach A and across Reach B.

- **East River Park: Amphitheater and South Ballfields (Reaches C and D)**. The Montgomery Street closure, which begins inland at Water Street, would be composed of a series of concrete I-walls and deployable swing gates at street crossings (Montgomery Street and the FDR Drive on-ramp). Park enhancements in this reach would be implemented separately under DPR's Pier 42 project, which at completion would include spaces for active and passive recreation. A concrete I-wall would extend along the interior edge of the park (adjacent to the FDR Drive) in Reach B. However, to limit the visual impact of the floodwall (from the park side), as well as improving public safety by allowing bicyclists to be seen more from the upland side of the floodwall, the shared use bike and pedestrian path would begin to slope up near Montgomery Street, and be elevated above the existing grade by several feet by the middle of Reach A and across Reach B.
- **East River Park: Delancey Street Pedestrian Bridge and Tennis Courts (Reach E).** This reach would include a terraced engineered bridging berm with large grassy "sunning" hills, and would connect to a relocated Delancey Street pedestrian bridge (moved south). The relocated and reconfigured park-side bridge ramps would be gentle sloping paths integrated into the berm's landscape, and would require the relocation of the sports courts towards the Williamsburg Bridge. The Delancey Street bridge overpass would be replaced by a wider bridge (with widths between 13 to 30 feet), with both a new pedestrian access from a stair entrance on the FDR Drive service road, facing Grand Street and new bicycle and pedestrian access via a new ramp connecting to Delancey Street. At approximately the location of the existing Delancey Street bridge, the engineered berm would transition to a concrete L-wall under the Williamsburg Bridge. This proposed floodwall would minimize the width of the flood protection at this location to accommodate the shared use path and service road, and minimize any intrusion into the publicly inaccessible area under the Williamsburg Bridge. North of the Williamsburg Bridge, the floodwall would transition back to a terraced and landscaped berm extending to the end of this reach. This engineered berm would result in the elimination of three existing tennis courts. The shared use path would run along the toe of the new berm generally at grade. New landscaping in this reach would be concentrated on the Delancey Street engineered berm, around the relocated sports courts, and on the new terraced berm north of the Williamsburg Bridge.

D. Project subsurface impacts

The project archaeological APE for all the Alternatives includes all of the locations where subsurface impacts or associated earthmoving is proposed. At this time, only those general locations that would experience direct subsurface impacts from Engineered Berms, Floodwalls and Deployable Systems are known. Additionally, a large staging area is proposed for the area immediately south of the Williamsburg Bridge and north of the line of Grand Street in East River Park. However, any areas associated with additional tasks, such as utility relocations, street and parkland reconstruction, and dredging activities have not yet been identified.

Currently, plans indicate that the different project components, including the walls, engineered berms, and deployable systems, would all include both an upper portion and a sheet pile driven lower portion. The upper portion includes the above-grade component, such as the floodwall or gate, and a base upon which it would be installed. The base of the upper portion would extend several feet below grade, depending on the component. For example, installation of floodwalls may require trenching excavation to ca. 2-4 feet below grade for construction of the wall base and pile caps; the lower portion, the sheet pile component, would be driven to ca. 40 feet below grade using equipment that would drive the sheet piling into the soil without any additional trenching. Similarly, deployable gates would rest on a base installed several feet below grade and would include sheet piles driven to ca. 40 feet below grade. The width of trenching for the installation of the different components would depend on the footprint; floodwall trenches may be only several feet wide to accommodate narrow spaces, whereas engineered berms may have wider trenches, depending on location.

An exception to the relatively shallow upper installation project components are areas where existing utilities may need to be encased in protective barriers or relocated, which may entail deeper excavations. Additionally, at this time a large retention tank is proposed to be installed under the tennis courts between Delancey and Rivington Street, which would require excavations up to 50 feet below grade over much of the tennis court footprint (the courts would be reconstructed after the tank is installed).

III. METHODOLOGY

The present study entailed a review of various resources.

- Primary and secondary sources concerning history of the area and specific events associated with the project site and vicinity were reviewed using materials from the New York Public Library, the New York City Municipal Archives, the New York City Register, the library of HPI, and online resources.
- Historic maps and photographs were reviewed using materials from the New York Public Library, the New York City Municipal Archives, the Manhattan Borough President's Topographical Bureau, the library of HPI, and various online websites. These maps and photographs provided an overview of the topography and a chronology of land usage for the project site. A selection of these maps and photographs has been reproduced for this report.
- Land conveyances indices and selected tax assessment records were reviewed. Due to the size of the APE, only selected city directories were reviewed.
- Information about previously recorded archaeological sites and surveys in the area was compiled from data available at the NYSOPRHP, the LPC, and the library of HPI. Particular attention was paid to landfill-related and shoreline archaeological resources.
- Soil borings were reviewed, including Rock Data Maps from the 1930s, several subsequent boring programs from the 1950s through the 1980s, and recent 2015 hazardous materials borings for the targeted project site.
- Existing subsurface utility maps for sewer, gas, and steam were reviewed, as well as summaries of overall utilities from project reports.
- Project plans showing existing conditions and proposed alternative components created for DDC were examined. A selection of these plans is included as Appendix A and Appendix B.
- Last, a site visit was conducted by Julie Abell Horn and Cece Saunders of HPI on August 19, 2015 to assess any obvious or unrecorded subsurface disturbance (Photographs 1-16; Figure 2).

IV. CURRENT CONDITIONS AND ENVIRONMENTAL SETTING

A. Current Conditions

The ESCR APE is extensive, including numerous historic blocks and waterfront areas. For ease of discussion here and throughout this report, the APE is discussed in three segments: Montgomery to Jackson Streets, Jackson to Grand Streets, and Grand to Rivington Streets. Figure 2 illustrates basic current conditions.

1. Montgomery to Jackson Streets

The APE segment in the vicinity of Pier 42, from Montgomery to Jackson Streets, contains portions of South Street, the FDR Drive, and the entrance ramp to the FDR Drive (Photographs 3-7). The FDR Drive is elevated from Montgomery Street to just east of Gouverneur Slip West (with surface parking underneath), and then at grade for the remainder of the segment. The portion of the segment just south of the FDR Drive is part of Block 243, Lot 1. Pier 42 is located immediately adjacent to this segment, and is part of Block 241, Lots 13, 18, and 22.

Pier 42 was constructed in 1967 and operated until 1987. It is now under the jurisdiction of the New York City Department of Parks and Recreation. A Master Plan for Pier 42, adopted in 2013, proposes

transformation of the pier into public parkland, creating a landscape of lawns, shrubs, trees, and pathways. The first phase of the Master Plan is slated to begin in the fall of 2016. The ESCR project area abuts the Pier 42 project area along the East River Bikeway. A cultural resources disturbance memo, described in more detail below, was recently completed for the Pier 42 Master Plan work (AKRF 2015).

There are sewers present under portions of South Street, the parking lot south of FDR Drive for Pier 42, and crossing the segment at Gouverneur Slips East and West and Jackson Street. A gas line crosses Montgomery Street and runs along South Street to service the pier area. Steam lines run along the north side of the FDR Drive, generally under the sidewalks, and cross into the East River Park at Jackson Street.

Proposed project component locations (Appendix A) include portions of the South Street sidewalks and streetbed, where floodwalls and deployable gates are proposed. Additional deployable gates are proposed on the FDR Drive entrance ramp to the south. Floodwalls also are proposed along the south side of the FDR Drive and entrance ramp. Several options include narrow engineered berms adjacent to and south of the floodwalls.

2. Jackson to Grand Streets

The APE segment from Jackson Street to Grand Street includes the FDR Drive and East River Park, which is known as Block 262, Lot 25 (Photographs 8-14). East River Park opened in 1939, following construction of the original at-grade East River Drive (now FDR Drive). A pedestrian bridge links this section of East River Park with Corlears Hook Park, which is located northwest of the FDR Drive. From south to north, East River Park includes a large storage yard, a large amphitheater (constructed in 1941), and a large athletic field with two baseball diamonds and a soccer field. The East River Bikeway runs along the east side of the FDR Drive and the East River Promenade runs along the edge of the waterfront. Extensive renovations were made throughout the park between 1990 and 2010 including the addition of the East River Park Promenade, a new pile-supported walkway along the waterfront. Major work continues on the original bulkhead and seawall, which were built in the 1930s and are now in need of rehabilitation. The Lower East Side Ecology Center, also known as the Fire Boat House, is located at the Grand Street end of this sub-segment. It is a two-story brick building with a hose tower, constructed ca. 1941.

There are sewers crossing below the FDR Drive from Corlears Hook Park, from Cherry Street, and from Grand Street. The Cherry and Grand Street sewers meet in the East River Park and there is an outfall at the East River just south of Grand Street.

Proposed project component locations (Appendix A) include floodwall construction on the southeast side of FDR Drive and in areas near the amphitheater, and engineered berms at various locations within the park, including around the amphitheater.

3. Grand to Rivington Streets

The APE segment from Grand Street to Rivington Street includes the FDR Drive and East River Park, which is known as Block 316, Lot 200 (Photographs 15-20). There is a pedestrian bridge just south of Delancey Street. The Williamsburg Bridge crosses the project site at Delancey Street as well, with bridge foundations located within East River Park. South of the Williamsburg Bridge, East River Park includes recreational parkland and several basketball courts. North of the bridge, there are a series of tennis courts and a W.P.A.-era one-story comfort station (currently out of service). The East River Bikeway runs along the east side of the FDR Drive and the East River Promenade runs along the edge of the waterfront.

There are sewers that cross beneath the FDR Drive and East River Park from the former lines of Broome Street, Delancey Street, and Rivington Street. Locations in the East River Park also have sewers running north-south. Some stretches of the FDR Drive also have sewers.

Proposed project component locations (Appendix A) include floodwall construction on the east side of the FDR Drive and engineered berms at various locations within the park, generally in proximity to the floodwalls and the FDR Drive.

B. Topography and Hydrology

In its natural state, the entire APE was once under the waters of the East River (Viele 1865, Figure 5). As will be described in more detail below, the APE was landfilled in stages beginning in the 1810s. Much of the APE had been landfilled by the 1850s, with a few remaining waterfront areas filled over the course of the nineteenth century. The creation of East River Park in the 1930s concluded the landfilling of the easternmost section of the APE.

Since the APE consists of landfill, topography is artificially level and elevations range from approximately 7-10 feet (NAVD88 datum) throughout most of the area. The exception is the area surrounding the East River Amphitheatre between Jackson and Grand Streets, which ranges from 10.5 – 25.5 feet (NAVD88 datum).

C. Soils

According to the soil survey for New York City (Figure 6), the portion of the APE from Montgomery Street to just northeast of Jackson Street falls within soil mapping unit 4, known as "Pavement & buildings, wet substratum, 0 to 5 percent slopes" and is described as:

> Nearly level to gently sloping, highly urbanized areas with more than 80 percent of the surface covered by impervious pavement and buildings, over filled swamp, tidal marsh, or water; generally located in urban centers (USDA 2005:11).

The remainder of the APE, from just north of Jackson Street to Rivington Street, falls within mapping unit 7, known as "Laguardia-Ebbets-Pavement & buildings, wet substratum complex, 0 to 8 percent slopes" and is described as:

> Nearly level to gently sloping areas filled with a mixture of natural soil materials and construction debris over swamp, tidal marsh, or water; a mixture of anthropogenic soils which vary in coarse fragment content, with more than 15 percent impervious pavement and buildings covering the surface (USDA 2005:11).

Both soil mapping units confirm that the entire project area was formerly under the waters of the East River, and all soils above the natural river bottom deposits are expected to consist of introduced fill.

There have been various programs of subsurface soil borings conducted within the APE. These include Rock Data Maps from the 1930s, several subsequent boring programs from the 1950s through the 1980s, depending on location, and recent 2015 hazardous materials borings for the targeted project site. While the pre-2015 logs are not likely to represent current conditions, they do provide a baseline with which to compare later logs and thereby extrapolate subsequent subsurface disturbance caused by later construction. The following discussion addresses results of soil borings from the 1950s-present, which are expected to most closely represent current subsurface conditions. Particular attention is given to the presence or absence of wood or "timbers," which may represent former landfilling devices, piers, or wharves, and fill materials that might indicate the presence of former structures or associated features. The soil boring plans and logs are included as Appendix D.

1. Montgomery to Jackson Streets

Within the Montgomery to Jackson Streets segment of the APE, a total of 21 borings were reviewed. The general dates of each group of logs are provided parenthetically and arranged geographically, where possible, from Montgomery to Jackson streets:

- Newtown Creek PCP Lower East Side Intercepter [sic] (Sheet 1 of 5, 1961)—8 borings, A-1 to A-8 (northern edge of East River Drive, Montgomery through Jackson streets).

- Newtown Creek PCP East Side Branch Sewers (Sheet 1 of 3, 1962)—3 borings, C-1 through C-3 (south of the southern edge of FDR Drive, Gouverneur Slip East through Jackson Street).
- ESCR Deep Sample Locations (2015)—10 borings south of the southern edge of FDR Drive, SB 82D–73D.

In general, all the boring logs recorded thick fill strata extending from the surface topsoil/paving down to well below mean high water (mhw—considered elevation "0")[1], as would be expected in a filled, once-inundated location.[2] Fill stratum thickness ranged from 14 ft. to more than 40 ft. Surface elevations ranged from approximately 4.3 ft. to as much as 11 ft. (above mhw), the higher elevations being recorded in the 2015 soil borings. Only four soil borings went deep enough to record bedrock, i.e., the 1961 borings A-6, A-7, and A-8, at 37.2, 38.9, and 41.9 ft., respectively. Their locations are clustered along the extreme northern edge of the segment, within 300 ft. of Jackson Street.

The 2015 boring logs tend to describe fairly homogenous fill strata, reporting brick and occasional wood chips as inclusions in a silt, sand, and gravel matrix, but no river mud, and no buried timbers. At one location, SB-79D, a 6 ft. stratum of brick and concrete (6 to 0 ft. above mhw) sits at the water line in the middle of a 20 ft. fill stratum, suggesting the presence of a former building foundation. The location is in the parking lot immediately south of FDR Drive, in the line of the south side of Gouverneur Slip East. Neither of the adjacent 2015 borings records this stratum. The closest boring is from 1962 (C-1), in the location of the north side of Gouverneur Slip East, which records fill to a silt and mud stratum at 26.7 ft. below mhw; although the fill notes the presence of demolition debris, i.e., brick, wood, cinders.

2015 boring SB-82D, about 50 ft. east of the line of Montgomery Street in the parking lot immediately south of FDR Drive, has a greater concentration of brick noted than in most of the other 2015 logs. It appears to be the major component of the fill layer between 1 ft. above and 6 ft. below mhw. The next nearest boring is SB-81D, which records only "little brick" at the corresponding depths.

Although no timbers are noted in the 2015 borings, some are recorded in the 1962 logs. C-3, a timber at 8.9 ft. below mhw, immediately below a 2 ft. layer of rip-rap, timber, and brick. The timber forced the crew to make three additional attempts to complete a boring in the vicinity, and each time the boring was halted by a timber, between 10 and 11 ft. below mhw. These boring locations extended approximately 22 ft. east–west along the north line of Jackson Street in the parking lot south of the FDR Drive.

Three hundred feet south of C-3, also in the parking lot south of the FDR Drive, boring log C-2 records a timber at 14.5 ft. below mhw, within a 27 ft. thick fill stratum of slag, cinders, sand, gravel and silt.

The concentration of deeply buried timbers, the presence of rip-rap in C-3, as well as the fill in the surrounding stratum that appears to be composed of trucked-in fill rather than demolition debris, suggests the remains of old piers and/or landfill retaining devices in this area when the 1960s borings were conducted. Given the distance between the boring locations (300 ft.— the 2015 boring logs, SD-73D and SD-74D record no timbers in the intervening area), it is likely that, at most, two separate pockets of timbers were identified. It also is possible that sewer construction activities in these locations during the 1960s caused these timbers to be removed, which could explain their absence in 2015.

2. Jackson to Grand Streets

Within the Jackson to Grand Streets segment of the APE, a total of 17 borings were reviewed. The general dates of each group of logs are provided parenthetically and arranged geographically, where possible, from Jackson to Grand streets:

[1] The pre-2015 soil borings reference the Manhattan Borough Datum or the Manhattan Highway Datum, both of which are 2.750 feet above mean sea level at Sandy Hook, as established by the U.S. Coast and Geodetic Survey. The 2015 soil borings indicate depths below ground surface, and do not reference a datum.

[2] The three exceptions are from the 1961 boring logs, A-5, A-7, and A-8. These recorded fill only to approximately mhw. Apparently it was difficult to identify the documented fill strata from these cores.

- Newtown Creek PCP East Side Branch Sewers (Sheet 1 of 3, 1962)—5 borings, C-3 through C-7 (East River Park, from the north line of Jackson Street to the south line of Grand Street).
- ESCR Deep Sample Locations (2015)—12 borings, SB 71D–66D and SB 64D–59D (south of FDR Drive, generally in East River Park, from the north line of Jackson Street to the south line of Grand Street)

All the boring logs record thick fill strata extending from the surface paving/asphalt down to well below mhw, as would be expected in a filled, formerly inundated location. Fill stratum thickness ranged from greater than 12 ft. to more than 40 ft. Surface elevations ranged from approximately 5.1 ft. (above mhw) to as much as 16 ft., with the higher elevations recorded in the 2015 soil borings. None of the logs were deep enough to encounter bedrock, since the borings generally ended at or before approximately 40 ft. below the surface.

The 1962 logs noted buried timbers at two locations, the first, as noted above, at C-3 (East River Park, on the north line of Jackson Street), where a buried timber obstructed the boring at approximately 10 ft. below mhw, and three subsequent attempts to complete the boring in the vicinity were also halted by a timber buried at the same depth. The presence of rip-rap in the fill stratum above the timber suggests a pier or landfilling device. The 2015 logs, namely 71D , at approximately the same location, and 70D to the north of C-3, encountered no timbers.

The second timbers encountered in 1962 were at C-7, where two timbers, embedded in fill, were recorded at 14 ft. and 16 ft. below mhw. East (shoreward) of 2015 boring 59D, the 2015 boring log recorded no timbers, ending at 40 ft. below mhw.

As with the other 2015 logs, 59D, 70D, and 71D report fairly homogenous fill strata in a silt, sand, and gravel matrix, no river mud (noted in the boring logs of the 1930s and 1940s), no timbers, and no evidence of foundations, possibly suggesting an excavation and refilling of the East River Park area at the time of its construction. The 1962 timbers appear to be stray components of piers or landfilling devices, left behind when the rest of these structures were removed.

3. Grand to Rivington Streets

Within the Grand to Rivington Streets segment of the APE, a total of 20 borings were reviewed. The general dates of each group of logs are provided parenthetically and arranged geographically, where possible, from Grand to Rivington streets:

- Newtown Creek PCP East Side Branch Sewers (Sheets 2 and 3, 1962)—8 borings in East River Park between Grand and Rivington streets, C-8A, 9D, 10, 10-1, 11E, 11-1, 12C, 12-2.
- NYCDGS Delancey Street Pedestrian Bridge (1984)—3 borings, Nos.1–3, north edge of East River Park along FDR Drive at the Delancey Street.
- ESCR Deep Sample Locations (2015)—9 borings in East River Park, SB 46–49D, 51D, 54D, 56–58D.

All the boring logs record thick fill strata extending from the surface topsoil/paving down to well below mhw, as would be expected in a filled, once-inundated location. Fill stratum thickness ranged from 12.5 ft. to more than 40 ft. Surface elevations ranged from approximately 5.5 ft. (above mhw) to as much as 10 ft., the higher elevations being recorded in the 2015 soil borings. Only four soil borings went deep enough to record bedrock, the three 1984 borings for the pedestrian bridge at Delancey street along the northern edge of the park. In Nos. 1–3, bedrock was noted at 79.4, 73, and 75 ft. below mhw, respectively; and 1962 boring C-12c, at the north edge of the park in the line of Rivington Street, where bedrock was encountered at approximately 45 ft. below mhw.

The 2015 boring logs tend to describe fairly homogenous fill strata, reporting brick and occasional wood chips as inclusions in a silt, sand, and gravel matrix; no river mud, no timbers, and no evidence of

foundations were included in the logs. Only one log, SB-49D, near the line of Broome Street, records a stratum composed predominantly of silt (within fill strata) between 15 and 20 ft. below mhw.

The 1984 logs, clustered around the pedestrian bridge at Delancey Street, provide slightly more evidence of a filled, formerly inundated location, as each of the logs records an organic silt strata of varying thickness directly below fill (1: 2 ft. beginning at 20.4 ft. below mhw; 2: 5 ft. beginning at 14 ft. below mhw, with additional strata to 34 ft. below mhw; and 3: 17 ft. beginning at 5.8 ft. below mhw). On the other hand, although the fill-strata descriptions note "traces" of brick and wood, they are not the concentrations of construction materials expected from a deposit of demolition debris.

In contrast, each of the 1962 logs record construction materials in the fill strata (including brick, wood, glass, plaster, concrete, and asphalt), sitting atop and/or penetrating an organic silt/mud stratum. Along the northern edge of the park, buried timbers were encountered at C-10 in the line of Delancey Street, in the top fill stratum (between +6.8 ft. above and 5.3 ft. below mhw), suggesting probable demolition debris.

Additional timbers were recorded in the eastern half of the park, closer to the river, an area filled during the construction of the present park. This suggests the presence of components of now-demolished docks or bulkheading. Two timbers were encountered at 12 and 14 ft. below mhw in C-8A, in the line of Broome Street, near the base of the fill stratum.

Also adjacent to the current shoreline was one timber in C-12-2 in the line of Rivington Street, at 30.4 ft. below mhw and within a fill-penetrated river-silt stratum; and another at C-10-1, also adjacent to the shoreline, in the line of Delancey Street, at the bottom of a fill-penetrated river-silt stratum, 19 ft. below mhw. The outboard locations might indicate the remains of former piers.

4. Discussion

Results of the soil boring programs completed within the APE present varying data. The 1960s soil boring programs were undertaken in advance of sewer installation and contain the most detailed picture of subsurface conditions. These borings indicate that after construction of the East River Drive and East River Park, there were still discrete pockets of deeply buried timbers and rip rap likely associated with earlier piers, wharves, and landfilling devices that were not completely removed prior to later construction. Following these soil boring programs, though, large and deeply buried sewers were installed in these locations, which presumably would have further disturbed or destroyed these buried resources.

Similarly, the 1984 soil boring program undertaken in advance of work for the Delancey Street Pedestrian Bridge identified the presence of river mud (albeit at varying depths, suggesting some dredging) but no buried timbers or other materials from former piers, wharves, or landfilling devices.

Last, the 2015 soil borings were undertaken for hazardous materials screening purposes, and are the least detailed in terms of recording subsurface conditions. Nevertheless, none of these borings identified any buried timbers or other materials indicative of former piers, wharves, or landfilling devices. Despite the less stringent recording parameters it is assumed that any large obstructions, such as timbers would have been noticeable and worthy of documentation.

The overall soil boring program results suggest that while construction of the East River Drive, East River Park, and utility installations, likely entailed removal or destruction of many former waterfront resources such as piers, wharves, and landfilling devices, there could still be discrete pockets of these deeply buried subsurface features found within the APE. Generally, when timbers have been recorded, they have been at depths of ca. 10-30 feet below mhw (or ca. 14-46 feet below surface elevations). No timbers were noted in any of the 2015 soil borings in the APE.

As part of this project, it is expected that geotechnical soil borings will be completed in locations of planned impacts, particularly for sheet pilings. These geotechnical borings, which will extend deeper than the hazmat borings and have more comprehensive and specific subsurface data, are slated to be undertaken

in February or March of 2016. It is likely that study of these future borings will present further details of subsurface conditions within the APE.

V. BACKGROUND RESEARCH/HISTORICAL OVERVIEW

A. Previously Recorded Archaeological Sites and Surveys

Research conducted using data from the SHPO, the LPC, and the library of HPI revealed a number of archaeological sites that have been documented within a one-mile radius of the APE.

The closest documented site is the Lower East Side Girls Club site, located on Avenue D between East 7th and 8th streets (HPI 2009). Like many of the historical archaeological sites on the Lower East Side, this site yielded remains from domestic water/waste management features, e.g., privies and cisterns. Most notable among the recorded sites is the late nineteenth century cistern complex on Block 378 (Grossman 1995), which yielded over 24,000 artifacts, mostly from the late 1860s. Those sites within a one mile radius (in Manhattan) are listed in Table 1, below.

Table 1: Archaeological Sites within One Mile of the Project Site

NYSM or NYSOPRHP Site Number	Site Name/Description	Location	Site Type/Time Period
NYSM 4060 ACP-NYRK	NYSM 4060 Nechtanc	Corlears Hook	Native American Village/Woodland? & Contact
A06101.017934	Lower East Side Girls Club	E 7th & Ave D Block 377 Lot 42	Foundation and privy/Historical
A06101.017933	Lower East Side Girls Club	E 7th & Ave D Block 377 Lot 47	Privy/1830s–1850s
A06101.015708	School privy	Delancey and Allen Sts.	Privy/Historical
A06101.015723	Historical features	321 E 21st St., E of 2nd Ave	Brick cesspools, bldg. remains/nineteenth cent.
A06101.009530	Bernard Baruch College B	E 25th St., E of Lexington	Horse stables/ nineteenth cent.
A06101.000001	South Street Seaport District and Extension	South Street Seaport	Historic seaport
A06101.000604	209 Water Street	209 Water Street	Historic ship
A06101.000604	Tweed Courthouse Area Deposits	Chambers Street, south side	Historic burials/ structures/deposits
A06101.016117	Columbus Park Pavilion cistern	Columbus Park	Historic cistern deposits
A06101.018336	PSA4 Pre-Civil War Cistern	Avenue C between E. 8th and E. 9th Sts.	Historic cistern deposits
A06101.018564	St. Philip's Cemetery Remnants	235 Bowery Street	Historic cemetery
	Block 405, Lot 1	Avenue A, E 10th–11th Sts.	Privy/drainage system/late nineteenth cent.
	Congregation Moshcisker Chevrah Gur Arye Mikvah	308 E 3rd St., Aves C to D	Mikvah/early twentieth cent.
	Block 378 Lots 58 & 59	E 8th St, Aves C to D	Cistern Complex/mid- to late nineteenth cent.

The single Precontact site, NYSM 4060, was near modern Corlears Hook (about 500 feet west of the project site), which Grumet records as *Nechtanc*, possibly meaning "sandy point" (Grumet 1981:39). Bolton calls it *Rechtanck*, suggesting it was adjacent to a fresh water brook that emptied into the East River

there (Bolton 1971:133). In February 1643, during the Governor Kieft War (1640–1645), the Dutch conducted a sneak attack against Nechtanc and brutally massacred a nonhostile group of lower Hudson River Delewaran refugees, who had gathered there for safety (Grumet 1981:61).

There have been numerous archaeological studies completed for Manhattan's Lower East Side. Most of the archaeological sites in the above table were discovered as part of specific investigations. However, the archaeological studies that were most pertinent in terms of comparing expected results for this project were those in the immediate vicinity of the project site, five of which fall within the project site. These include Phase IA Archaeological Documentary Studies (or their equivalent) for Montgomery Street between Madison and South Streets (AKRF 2009), and the shoreline area, both "inboard" and "outboard," between portions of Montgomery and Jackson Streets for the East River Waterfront Access Project (HPI 2007a, 2007b). A more general study was the East River Reach/Removal of Drift project for the East River between Battery Street and 90th Street (Historic Sites Research 1977).

Several archaeological studies have included Pier 42. The "outboard" section of Pier 42, meaning that section that is located on the river side of the existing bulkhead line, was included in a large study of the East River Esplanade project (HPI 2007b). Results of that study, which is on file at both the SHPO and LPC, indicated that the outboard Pier 42 locus did not have any archaeological sensitivity.

Most recently, a disturbance memo was completed for Pier 42 and the adjoining area extending north to the edge of the FDR Drive, from Montgomery Street to east of Jackson Street, overlapping the present APE (AKRF 2015). The 2015 Pier 42 disturbance memo concluded that the majority of the inboard section of the Pier 42 project area is sensitive for historic period archaeological resources:

> The entire project site is sensitive for archaeological resources associated with landfill and landfill-retaining structures below a depth of 2 feet, except in areas with greater disturbance caused by the installation of utilities or the excavation of basements. The original street surfaces may also be sensitive for the remnants of street car lines (trolley tracks), wooden water mains, and concentrations of historic period artifacts. Finally, those historic lots that were not disturbed by basement excavation… are sensitive for historic shaft features (AKRF 2015:13-14).

The remainder of the APE has not been subjected to archaeological study, other than being part of the early and general study of the East River Reach/Removal of Drift project for the East River between Battery Street and 90th Street (Historic Sites Research 1977).

B. Historic Period Summary

As noted above, the entire APE was originally under the East River. Prior to any landfilling, the natural shoreline was located approximately one-half block inland from the APE between Montgomery and Corlears Hook, and from one to three blocks inland, depending on location, from Corlears Hook to Rivington Street (Viele 1865; Figure 5).

Waterfront development included the expansion of the Island of Manhattan into the East River. With the Dongan Charter of 1686, the City of New York received title to; among other things; all lands and water bodies on Manhattan extending to the low-water mark; and allowing the City to "fill, make up, layout, use and build on" lands then under water. The city began selling water lots to private citizens, provided that the new owner fill and build the street and wharf along the low-water line. The Dongan Charter effectively extended Manhattan 200 feet into the East River, and the Montgomerie Charter of 1730 extended City boundaries from Whitehall to Corlears Hook, another 400 feet beyond the old low water mark. As commerce recovered from the British Occupation during the Revolution, the Outer Streets and Wharves Act of 1789 provided for the creation of South Street beyond the 1730 400-foot line. The Act also provided for greater regulation by the City of new development; including surveying straight streets (South Street) to facilitate commerce, and allowing the City to take action to fill in gaps at the private owners' expense, if necessary (Buttenwieser 1999:28-29, 39-40).

The history of the APE begins just after the turn of the nineteenth century, when the city officially projected the first streets through the APE and granted the first water lots adjoining these streets. The streets within the APE that parallel the original shoreline were constructed both as new streets and extensions of existing streets, whereas the cross streets, many of which already were in place further inland, were then extended to meet the waterfront streets. Table 2, below, indicates years that the chief waterfront streets were established within the APE, based on records of the Common Council and indexed by Stokes.

Table 2: APE Streets, Years of Establishment

Street	First established within the APE
Front Street[3]	1809 (Stokes 1928, Vol. 6:594)
South Street (extended to Gouverneur's Slip)	1817 (Stokes 1928, Vol. 6:600)
Corlears Street (to Water Street)	1808 (Stokes 1928, Vol. 6:592)
Cherry Street (to East Street)	1803 (Stokes 1918, Vol. 3: 997)
Tompkins Street	1822 (Stokes 1918, Vol. 3:998)
East Street	1822 (Stokes 1918, Vol. 3:1010)

Land records and tract maps show that the earliest water lots granted within the APE were in 1806 and 1807. A large water grant from Montgomery Street to the area east of Gouverneur Slip East was granted in 1806 to local landowner Nicholas Romaine, who owned a tract east of inland Montgomery Street. Smaller water lots were granted to other individuals on the south side of Front Street from Romaine's lot to Jackson Street in the mid-1810s. The majority of the water lots conveyed on either side of Corlears Hook were granted to members of the Gardner family beginning in 1807 and continuing through the mid-1810s. Gardner also obtained water lots north of Grand Street during this period. The part of the APE north of Broome Street had water lots granted in 1823, and the final area to be transferred was the square water lot bounded by Water Street, Corlears Street, and the East River, which was granted in 1867 (County of NY 1917).

Landfilling of water lots progressed slowly during the first half of the century. A review of early nineteenth-century tax assessment records for the APE (the earliest extant date from 1808) shows that it was often years before water lots were filled, and even longer until many were developed with structures. The tax records also show that the "established" city streets in the APE actually were not created until many years later, as shown in Table 3, below.

Table 3: Tax Assessment data showing initial entries for APE streets

Street	Tax Assessments
Front Street, south side	Listed for the first time in 1818, one foundry noted, remainder was undeveloped
South Street, north side	Portions listed for the first time in 1819, all undeveloped through 1826, section from Jackson to Corlears was water lots through 1840
Corlears Street, east side	No coverage through 1820s
Water Street, north side east of Corlears Street	Listed for the first time in 1818, all undeveloped, bulkhead at end of street
Cherry Street, south side	Listed for the first time in 1815, all undeveloped, wharf and bulkhead at end of the street in 1818
Tompkins Street, east side from Grand to Broome	Listed for the first time in 1830, one store and office near Grand
Tompkins Street, east side from Broome to Rivington	Listed for the first time in 1834, undeveloped lots from Rivington to Delancey, dock at Delancey end. Dock only from Delancey to Broome.

[3] Historic Front Street is now called South Street and runs along the north side of the FDR Drive. Historic South Street was located one block closer to the East River, just south of the FDR Drive.

Street	Tax Assessments
East Street, west side from Grand to Delancey	Listed for the first time in 1840, water lots from Broome to Delancey, undeveloped lots between Grand and Broome.
East Street, west side from Delancey to Rivington	Listed for the first time in 1834, one slaughterhouse mid-block, and dock at Delancey end.

What the tax assessments did not record, however, were the waterfront uses of newly made land and wharves. In many cases land was listed as vacant because there were no buildings on it to be taxed. However, historic maps and accounts indicate that much of the new waterfront areas in the APE were used as shipyards during the first decades of the nineteenth century. The 1824 Hooker map (Figure 7) illustrates that those sections of the APE that had been landfilled by this time – including the much of the area from Montgomery to Broome Streets – were devoted to wharves and shipyards. It is likely that other "yards" were located in these areas as well, including lumber yards, bituminous coal yards, and other storage yards where raw materials for the shipbuilding and other industries were kept. There was a ferry at the foot of Jackson Street (then known as Walnut Street) that took workers back and forth to the Navy Yard in Brooklyn, and another ferry at the foot of Grand Street that ran to Williamsburg, Brooklyn.

During the 1830s, landfilling continued and the waterfront extended further south and east. The 1836 Colton map (Figure 8) shows the progress of landfilling throughout the APE. By this period, interspersed between the shipyards were other commercial and industrial establishments, which often did appear on tax records. For example, the 1840 tax records indicate that the south side of Front Street contained a foundry, several factories, a distillery, a saw mill, and a few houses in addition to the shipyards. The north side of South Street in this same area contained several stores and an ink factory. However, development was less consistent from Jackson Street north to Rivington Street, with many portions of the APE either undeveloped or still under water. The 1844 U.S.C.S. map (Figure 9) illustrates conditions several years later, and confirms that large sections of the APE were still under water at this time.

There appears to have been a large push for development in the second half of the 1840s, however, with all areas north of South Street and west of East Street being landfilled at this time. The year 1850 marks a critical benchmark in the development of the APE, as by this time nearly all inland areas had been reclaimed from the East River. In 1857 the lines of South Street and East Street were established as the official bulkhead line, with the official pier line established 250 feet into the East River. The areas south of South Street and east of East Street were devoted to piers and wharves, with slips in between where vessels could dock. The 1852 Dripps map (Figure 10) shows that there were piers within the APE at the feet of Grand Street, Broome Street (then Broome Slip) and Delancey Street (then Delancey Slip).

The mid-nineteenth century mark also corresponds to a period with particularly detailed historic records. Both the Dripps map and the Perris series of insurance maps were published in 1852 (Figures 11a-c) and for the first time, provided specific views of both structures on APE lots, and in many cases, names of the businesses and other facilities that existed within the blocks. Summarizing the 1852 Perris maps indicates the following businesses:

- Montgomery to Jackson Street blocks:

Printers ink manufactory, spar maker, coal yard, large oil manufactory complex, steam saw mills, residences and residences with stores underneath, unidentified commercial establishments.

- Jackson to Grand Street blocks:

Lumber, coal, and stone yards, ship timber yard, spar maker, stone yard, Fulton foundry (buildings on several blocks), linseed oil manufactory, residences and residences with stores underneath, unidentified commercial establishments.

- Grand to Rivington Street blocks:

Saw mills, lumber and timber yards, wood yards, lime and brick yards, coal yards, Lawrence's Stores, manure yard, lime yard, residences and residences with stores underneath, unidentified commercial establishments.

Many blocks had residences interspersed between the commercial and industrial buildings, and most non-industrial structures contained businesses on the ground floor with apartments located on the upper floors. The large majority of the non-residential buildings were characterized as "specially hazardous." The green colored structures with one dot (brick) or square (frame) were the least hazardous and the structures with multiple dots or squares were successively more hazardous. Hazards in buildings ranged from bakeries (lowest hazard) to industries requiring highly flammable chemical materials (highest hazard).

Rounding out the data for mid-century, in 1851 a rare "reverse" city directory was published by Doggett, which listed every occupant and their address in Manhattan for that year, organized by street. It is particularly illuminating to discover the range of residents and small businesses on APE lots at this time, especially since the historic maps of the period focus mostly on the larger commercial establishments. Tables 4-6 list the entries for the APE blocks. Although the extent of this large APE precluded close scrutiny of state and federal census records, it should be noted that for many entries in the tables below, there would have likely been additional family members of these household heads also residing on the lots.

Table 4: 1851 occupants, Montgomery to Jackson Streets

Location	**Entries**
Montgomery Street, east side between Front and South Streets	
No listings	
Gouverneur Slip, both sides between Front and South Streets	
No listings	
Front Street, south side between Montgomery and Jackson Streets	
292	J.D. Farrington, liquors; Knapp & Ward, shipsmiths; G.W. Knapp; Stephen Ward; Hannah Wood; Peter Alexander, watchman
296	George Mather, ink
298	C.S. Mingo, laborer; William Brown, laborer; Solomon Peterson; John Leonard, carpenter; George Mather, boatman; Charles Mason, mariner
300	Whitlock & Berrian, shipwrights; Andrew Whitlock; Augustus Berrian
302	Oly Anderson, policeman
304 (corner of Gouverneur Slip)	Thomas Coyne, liquors
308-318 (corner of Gouverneur Slip)	Coalyard
320	Vacant lot
322	Coalyard
326	Anthony Warehof, sailmaker; John Langlin, caulker; Gertrude Braisted; F.W. Emmerson, oysters; Emanuel Smith, rigger; William Wallace, caulker
328	Marks King, stevedore; Thomas Fisher, dockbuilder; Charles James, bandbox maker
330	James Quirk, shipcarpenter; Phillip Andrews, mariner; Peddy Roscoe
332	Jane Pettit; Joseph Gillespie, engineer
334	Charles Heath, caulker; David Latham, moulder
336 to 344	M.P. Julian, sawmill
338	J.W. Flinn, cooper; Elizabeth Doane
340	G.W. Wood, carman; Peter Tyson, rigger; Alex. McFatridge, laborer
342 (corner of Jackson Street)	George Meyer, grocer; Thos. Ritchie, police officer
344 (corner of Jackson Street)	John Sheridan, blacksmith

Location	Entries
350	John Kraus, laborer; Timothy Lyons, laborer; John Harpel, carman; John Nelson, boatman; Michael Hutzinger; Henry Foster, carman; Morris Ryan; Francis Helstand, laborer; John Brauer, tailor
362	Abraham Denike, sparmaker
At the foot of the street	G.W. King, sparmaker; I.C. Smith, shipwright; E. & J.F. Broderick, lumber
South Street, north side between Montgomery and Jackson Streets	
no address	Pritchard, Wing & Co., grocers; John Pritchard; L.B. Wing; A.W. Barnard; J.T. Barnard, wood; J.B. & John Smith, weighers; John Parsons, sparmaker
368	Michael M'Manus, liquors; John Clark, shipwright
369	John Tilton, liquors; M.T. Ruyon, shipchandler
370	Robert Benson, jr., oils
371 (corner of Gouverneur Slip)	G.S. Melserve, liquors
no address (between Gouverneur Slip and Jackson Street)	Richard Squires, liquors
no address (east of Jackson Street)	James Wilson, liquors; ___ Henderson, stevedore; Nathaniel Reeder, boatman; E. & J.F. Broderick, lumber
Jackson Street, west side between Front and South Streets	
79	George Meyers, grocer
81	George Cruise, mariner; James Aiken, tinner; Walter Felter, laborer
83	Theodore Schilling, rigger; William Latham, caulker; William Andolf, tinner
85	William Place, carman; J.L. Saffen, caulker; Richard Green, caulker
87	Richard Squires, porter house

Table 5: 1851 occupants, Jackson to Grand Streets

Location	Entries
Front Street, south side between Jackson Street and Corlears Street	
344 (corner of Jackson Street)	John Sheridan, blacksmith
350	John Kraus, laborer; Timothy Lyons, laborer; John Harpel, carman; John Nelson, boatman; Michael Hutzinger; Henry Foster, carman; Morris Ryan; Francis Helstand, laborer; John Brauer, tailor
362	Abraham Denike, sparmaker
At the foot of the street	G.W. King, sparmaker; I.C. Smith, shipwright; E. & J.F. Broderick, lumber
South Street, north side between Jackson and Corlears Streets	
no address (east of Jackson Street)	James Wilson, liquors; ___ Henderson, stevedore; Nathaniel Reeder, boatman; E. & J.F. Broderick, lumber
Jackson Street, east side between Front and South Streets	
78	Frederick Reyels, grocer
84	Peter Miller; Charles Hoebucken
86	William Acker, boatman; John Seidler, cooper; John Lynch, laborer; Peter Fisher, laborer; Augustus Tolmar, rigger
88	John Robins, porterhouse; Isaac Henderson, stevedore; J.F. Averill, steward
Corlears Street, east side between Water and Cherry Streets	
26-36	Lawrence & Sneden, shipbuilders
38	W.C. Dupignac, porterhouse
Corlears Street, west side between Water and South Streets	
No listings	
Cherry Street, south side between Corlears and East Streets	
488-500	Pease & Murphy, Fulton foundry

Location	Entries
Cherry Street, north side between Corlears and East Streets	
489	Lawrence & Sneden, ship builders
503	John Bridge, oils
Grand Street, south side between Monroe and East Streets	
605	C.W. Hallett, milkman; Silas Swift, joiner; Isaac Holmes, shoemaker; Henry Abell, tailor; Dennis Halen, tailor; Joseph Glan, pedler
607	J.M Gallagher, feed store; John Perry; John Wilson; J.H. Huddleston, clerk
609	M.B. Campbell; William Whalling, carpenter; J.J. Lynch, oysters; Dennis Lynch; Thomas Mahoney, laborer; Horace Mahoney, mariner
611	William Churchill, boarding; Patrick Mansell, stonecutter; H.B. Miller, mariner; John Curtis, plasterer; John Dodd; D.J. Cobb, printer; Edmund Connelly; John Davey, musician
613	William Churchill, liquors; W.C. Molon; S.H. Moser, oysters; Cornelius Whelan, carman; Lovell Mickels, chandler; Nathan Cleland, mason; G.W. Vincent; Ralph Trembley; Peter Lyle, smith; (vacant lots)
619	(vacant lot)
621	(vacant lot)
At the foot of the street	Williamsburgh Ferry
Water Street, north side between Corlears and East Streets	
736	Michael Ward, liquors
738	W.C. Dupignae, liquors
750	Lawrence & Owens, masons; Alexander Lawrence; J.B. Owens

Table 6: 1851 occupants, Grand to Rivington Streets

Location	Entries
Grand Street, north side between Tompkins and East Streets	
608	Henry Fietjen, liquors; John Gildersleeve, segars; G.T. Fussinger; Antoine Revelli, tailor; Raffael Seala, peddler
610	(vacant lot)
612	(vacant lot)
618	Samuel Perry, oysters; James Rafferty, laborer; Bernard Quinn, carman; William Pilkington; W.H. Pollard, mason; Daniel Pryne
620	Alfred Wilson, eatinghouse
622	Alfred Wilson, liquors; C.M. Rogers; H.E. Sanger, carpenter; John Lezerre, clerk; Patrick Instin, mason; J.W. Hyatt; Levant Hughes, saddler; Alexander Bryan, carman
Broome Street, both sides between Tompkins and East Streets	
At the head of the street (no addresses)	Perry Jewett, porterhouse; John Constantine and Brothers, mahogany; A.J. Constantine; Robert Constantine; Thomas Constantine; William Spencer, coals; Walton and Little, lumber; E.L. Walton; G.W. Little
Delancey Street, south side between Tompkins and East Streets	
344	Alexander Trafford, lime (vacant lots)
348	Samuel Lockwood, wood (vacant lots)
354	E.S. Willetts, ship grocery
356	Daniel McPherson, liquors
Delancey Street, north side between Tompkins and East Streets	
343	Vacant lot
Rivington Street, south side between Tompkins and East Streets	
361	W.T. Chapman, blockmaker
367	J.H .Rapp, charcoal
At the foot of Rivington Street	Richard Bullwinkle, lime

Location	Entries
Tompkins Street, east side between Grand and Delancey Streets	
2	L.G. Reynolds; H.T. Summons, carman
4	Bijar Abbott; John Cooper, clerk; John Lowe; William Humphrey, carpenter
6	Obadiah Newcom, carpenter
10	Jesse Rodman, lumber
24	S.I. Smith, lumber
26 & 28 (corner)	A.T. Rafford, lumber
Tompkins Street, east side between Broome and Rivington Streets	
42	(no information)
44	Turner & Co., wool; Baxter & Lawrence, storage; George Baxter; E.N. Lawrence; Alexander Williamson, liquors; William Work, sailmaker
52	(no information)
54	John Godfrey, liquors
East Street, west side between Grand and Rivington Streets	
1	Alfred Wilson, porterhouse; Perry Jewett porterhouse; Oaks & West, shipwrights; George Oaks; J.W. West; George Clotts, shiphandler
20	Daniel McPherson, porterhouse
21	Spencer & Matson, saltrefiner; W.G. Spencer; J.A. Matson
22	Vacant lot
23	Stephen Pangborn, shipsmith
27	Alexander Williamson, porterhouse
29, 30, 31, & 32	Baxter Lawrence storage; George Baxter; E.N. Lawrence
37	Richard Bulwinkle, lime

The 1850s also marked the period when the APE began to receive more municipal services, such as water and sewer lines under the streets. Records of the Croton Aqueduct Department show that water mains were installed under the waterfront streets in the early 1850s, and sewers were installed under most of the cross streets leading to the East River beginning in the mid-1850s and 1860s. By issuance of the 1867 Harrison map (Figure 12), a number of the APE streets (Montgomery, Front, South, Corlears, and Grand Streets) also had horse or cable car lines installed in the roadbeds.

During the 1860s, the character of the businesses within the APE began to shift away from shipbuilding, with fewer yards located in the area and the East River waterfront blocks began to support more factories, storehouses and other larger buildings. Maritime uses became more concentrated along the piers and wharves, which included at least one dry dock outboard of the APE between Montgomery and Jackson Streets. As noted above, the official bulkhead line of 1857 was established by the Harbor Commissioners to run along the east edge of East Street, with the pier head line approximately 220 feet south of historic South Street and 250 feet east of Broome, Delancey and Rivington Streets.

The 1885 Robinson map (Figure 13) shows that over time, the APE blocks became more developed with structures. Also by this period, the small block southeast of Corlears and Water Streets along the river had at last been landfilled behind bulkhead walls. The map also clearly shows the historic bulkhead and pierhead lines, as well as the piers located between them. Within the APE, there were piers just south of the foot of Grand Street (Pier 55) and at the ends of Grand Street (several short piers and slips for two ferries to Grand Street and Broadway in Brooklyn), Broome Street (Piers 56 and 57, with a slip in between), Delancey Street (Piers 58 and 59, with a slip in between), and Rivington Street (Pier 60).

Two key changes came to the APE during the 1890s. First, in 1893 land was purchased by the city to create what would be known as Corlears Park, on the former blocks bounded by Jackson Street on the west, Corlears Street on the east, Cherry Street on the north, and historic South Street on the south. Within the APE, the park covered all of the area between Jackson Street and the former line of Corlears Street. The park opened in 1905. Second, construction of the Williamsburg Bridge, located just south of Delancey

Street, began in 1896 and the bridge opened to traffic in 1903, necessitating razing structures on the historic block south of Delancey Street within the APE.

During the first decades of the twentieth century, the APE blocks and waterfront continued to support numerous structures. A 1924 aerial photograph (Figure 14) and the 1927 Bromley map (Figures 15a and 15b) illustrate conditions just prior to creation of East River Drive in the 1930s. These depictions indicate that the APE blocks were almost entirely covered with brick buildings, many of them garages, warehouses, or factories.

The 1930s brought the greatest change to the APE, with the creation of East River Drive and East River Park. Damage maps from 1939 and 1936 (Figures 16a-c and Figure 17a-b) show the degree to which APE blocks were affected by these two projects. All of the structures between historic Front Street and South Streets were razed, as were structures between Tompkins and East Streets, and portions of three blocks between Jackson Street and Grand Street. Corlears Hook Park was bisected by East River Drive, creating two discrete areas, with the southern portion incorporated into the newly created East River Park. Construction for East River Drive and East River Park occurred during the course of the 1930s, with East River Park opening in 1939. Photographs from the period indicate the large amount of demolition and earthmoving required, and that piers were removed prior to the landfilling that created the park (Appendix E).

Further changes occurred within the APE in the 1940s, 1950s, and 1960s. The East River Park Amphitheatre was constructed in the early 1940s and portions of East River Drive were widened at about the same time. The section of the East River Drive from Montgomery Street to just east of Gouverneur Street was raised to its current height in the early 1950s. Last, as described above, Pier 42 was constructed in 1967 and operated until 1987.

VI. HISTORIC LANDFILL CONTEXT

Due to the fact that the entire APE was once under the East River, and subsequently was landfilled, the most ubiquitous types of potential subsurface resources in the APE should consist of landfill, landfill retaining devices, and piers and wharves. Additional areas of the APE had nineteenth-century development after landfilling. A brief discussion of these resources along the East River follows.

A. Landfill Retaining Structures, Wharves and Piers Review

Historical cribbing and bulkheads—devices for retaining fill—have been a subject of archaeological investigation for many decades (see e.g., Historic Sites Research 1978) and docks and wharves, some of which eventually functioned as landfill retainers, may have existed in some parts of the project site. All utilized similar construction techniques, which evolved from a vernacular tradition in the seventeenth and eighteenth centuries, to be replaced by the documented, standardized construction practices of the late nineteenth century.

In her research on pre-1850s landfill retaining devices and other waterfront features, McDonald (2011) has argued that previous discussions of these features, and attempts to create the neat typologies beloved by archaeologists, have led to a certain amount of confusion. McDonald states that archaeologists should instead describe basic attributes of the features, making clear distinctions between the various aspects of construction: structural material, fill material, form, structure type, and construction method. In New York City, most pre-1850s waterfront features employed log-construction techniques that, McDonald contends, were likely derived from a Germanic/Scandinavian vernacular architectural tradition—these methods and materials are not used in either the UK or the Netherlands, and, in New York City, were rarely, if ever, employed in aboveground structures beyond wharves and bulkheads. With technological advances facilitating efficient, deep pile driving, the log-construction tradition was phased out after mid-nineteenth century, in favor of standardized, pile-supported piers and bulkheading.

1. The "Vernacular" Tradition—the Eighteenth to Mid-nineteenth Centuries

- **Sheet Piling**

Prior to the late eighteenth century, the chief method of land extension and wharf construction in the New York City area was by the creation of sheet-pile seawalls. Debarked logs of American white oak, sharpened to a point at one end and shaped at the head to accommodate a pile cap, would be driven side by side into the mud of the river floor with a log or stone drop hammer. They would then be anchored together with heavy horizontal wood planking secured to the outboard face of the piles. The planking would retain the fill, which would be deposited on the landward side. Sheet piling was also employed to surround riprap embankments; and combinations of piles, planks, stone embankments, and sheet piling were the dominant construction methods to the time of the American Revolution and are mentioned as late as 1840 (Small 1941). This method was also employed in the construction of docks and wharves (Bone 1997:92–96).

- **Cribworks and Cobb-type Log Construction**

By the late eighteenth century, log cribworks—wood-frame, "boxlike receptacles" with solid bottoms and open sides, filled with loose stone and sunk to river bottom—provided larger, sturdier supports for retaining walls and wharves, where pile-supported structures could not be built or proved unstable in the face of strong river currents and ice. The river floor would be dredged, clearing mud and loose debris down to the bedrock or hardpan substratum. The crib bottom was fitted to the river floor's contours, and the cribwork was carefully filled with stone, mud, sand, and sometimes concrete, and pinned to the bottom. If the crib facing was constructed so tightly that earth alone could be used as the fill, it was called a "solid-filled crib" (Bone 1997:96–99; Joseph et al. 2004:178–179).

A cruder construction form, using notched, unhewn logs, and larger fill cells, was known as a cobb wharf, and the fill supposedly consisted entirely of stone (Joseph et al. 2004:179). Often the fill included other materials, such as ballast rock and coral, brush, and tree stumps (Louis Berger 1990:V-3). Cobb construction, with its less accurate joints, was less durable and stable than cribwork (Bone 1997:96–99). The 1690s cobb structure excavated at the Barclays Bank Site (75 Wall Street, corner of Wall and Water Streets) was built with rough logs joined to form a series of 5-foot-square compartments. The structure was secured in place by pilings, and filled with rock and coral (Louis Berger 1983).

Data illuminating eighteenth- and nineteenth-century wharf construction practices in Lower Manhattan has been accumulating since the 1960s, as examples of cobb-type construction have been uncovered at a number of archaeological sites, including Cruger's Wharf, at present Old Slip and Water Street, ca. 1740 (Huey 1984); the Telco Block (site bounded by Water, Fulton, Front and John Streets), a mid-eighteenth-century cobb wharf complex (Soil Systems 1982:60, 64–68, Figures 3.10, 3.12); the Assay Office site (on the block between Front and South Streets, and Wall Street and Gouverneur Lane) plank bulkheads, as well as a cobb wharf complex dating to the 1790s (Greenhouse 1984: 2, 3, 4, 10, 13–14; Louis Berger 1990:Fig. 4.2, IV 3, 14–17; 1991; Cantwell and Wall 2001:230–233).

- **Grillage/Raft Type**

A grillage/raft type wharf employed construction techniques similar to that of a cobb wharf. As the name implies, it was a solid raft-like structure built of timbers laid as headers and stretchers, incorporating layers of stone. Additional "rafts" were built and stacked until the required height was reached. It would then be floated out to the intended location, filled with stones, and sunk (Joseph et al. 2004:179). The 175 Water Street site (on the block surrounded by John, Fletcher, Water, and Front Streets) uncovered wharf construction of this type, dating to ca. 1750 (Geismar 1983:117, 203; Louis Berger 1990).

2. Post-1850s—Modern Construction Techniques

It is no coincidence that McDonald (2011) closes her discussion of the "vernacular" period of pier and bulkhead construction by the 1850s. As archaeologist Michael Raber contends, this was the period in which the vernacular log-building styles were replaced with "modern" construction techniques of a "common

type" (Raber et al. 1985:55), i.e., supported on deep piles (AKRF 2007:V-2). This change was initiated by two inventions of the Scottish engineer James Nasmyth: the steam hammer in 1838/39, and his development of the steam pile driver in 1845. Nasmyth's inventions permitted the driving of a pile in an astounding 4 minutes, when before it would have taken 12 hours (Bensel 1905:7; Tames 2005:84–85).

Although cobb construction did survive, even in New York City, due to its low-cost and simplicity of construction (Greene 1917:52–53, fig. 10), it was eschewed for the rehabilitation/reconstruction of the Manhattan waterfront. A comparison of nineteenth-century historic maps shows a rapid escalation of pier construction in the project site after 1845 and the invention of the steam pile driver (e.g. Hooker 1824 [Figure 7], Colton 1836 [Figure 8], U.S.C.S. 1844 [Figure 9], Dripps 1852 [Figure 10]).

By the 1870s, with the establishment of the New York City Department of Docks (1870) and the advent of Manhattan's upgraded bulkhead and pier system, East River bulkheads and piers/wharves were constructed with deep vertical pilings, following standardized methods and designs, well documented by engineer Carleton Greene and others (Goodrich 1905:21, figs. 4–6; Greene 1917:figs. 44, 47–49). Also supporting Raber's (1985:55) contention that this late-nineteenth-century pier and bulkhead construction was of a "common form," built from "a generally well-understood, common set of designs," is the 1904 statement of J. A. Bensel, engineer-in-chief of New York's Department of Docks and Ferries. Bensel observed that "the manner of building has varied little during the time in which the Port of New York has been in existence," and "nearly all piers along the East River" are pile platforms (Bensel 1905:7). The 1885 Robinson map (Figure 13) shows the continued standardization of piers in the project site by the end of the nineteenth century.

On the new waterfront, crib/cobb structures were no longer employed. Substantial preparatory dredging was involved, and piles, in various combinations, were driven down to bedrock (except where depth of bedrock made this impossible), with the spaces between the piles filled with rip rap or cobbles and stones to provide stability to the piles supporting the masonry bulkhead. For piers, decks of wood or concrete were built and paved atop the wooden piles (Greene 1917:28–33). The 1924 aerial photograph of the project site (Figure 14) shows that by this time, the project site contained numerous piers along the East River waterfront.

- **Bulkhead Construction**

Because of the general depth of mud—in some places up to 170 feet deep—along the entire East River shoreline, the bulkhead had to rest on piles, even though the piles could not extend to the hard bottom in all cases. According to engineer Carleton Greene, the river mud was dredged "for a width of about 85 feet to a depth of 30 feet, more or less, depending on the consistency." As seen in Greene's schematic drawings (Greene 1917:fig. 44, 47–49), this width of dredging extended an equal distance on each side of the proposed bulkhead, therefore, approximately 42.5 ft. both inland and outboard, and to a depth of 35 to 40 feet below mhw.[4] According to Department of Docks annual reports, it was standard practice to remove the timbers of earlier construction ("Removal of old work") when they were encountered in this dredged area (e.g., Docks 1906:177–179). Into that dredged surface the piles were driven, and the open spaces filled in with cobbles and riprap to serve as a base and support for the concrete and masonry bulkhead. The new street area would have been further filled with "earth, ashes, &c." as Greene notes in his 1876 bulkhead drawing (Greene 1917:88–94, fig. 44).

- **Dredging**

Dredging was and is a normal part of harbor and pier slip maintenance that would have been carried out in the slips between piers within the project site. Accurate records of dredging, or even maps of pier slip depths prior to 1857 are not available to document routine dredging impact in now-filled sections within the project site. However, as the nineteenth century progressed, slips needed to accommodate larger and larger ships, and regular dredging deepened the slips, removing earlier river mud and any potential embedded cultural deposits.

[4]Greene's calculations were based on a mean low water of 4.85 feet below mean high water (mhw).

B. Landfill resources in New York City archaeological contexts

There have been a number of archaeological testing programs undertaken in areas of New York City (generally Manhattan and Brooklyn) that were once under water and were landfilled in the eighteenth and nineteenth centuries. Some of the projects are referenced in the above discussion and additional details are presented below. Information about many of the sites has been previously summarized in the South Ferry Terminal Project final report and is excerpted here (AKRF, URS, and Stone 2012: 4-98 to 4-103).

1. Lower Manhattan projects

- **Site 1 of the Washington Street Urban Renewal Area**

Located on the Hudson River, this site was bounded by West Street, Greenwich Street, North Moore Street and Hubert Street and contained sections of Washington and Beach Streets. It was filled during the first two decades of the nineteenth century. Initial testing did not located any landfill retaining structures, but monitoring for foundation work on the north side of Beach Street did reveal segments of a timber wharf running east-west through the project site blocks. The feature was found under a concrete basement floor and despite its fragmentary condition from the basement construction was identified as part of cobb crib wharf (LBA 1987a).

- **The Telco Block**

Archaeologists from Soil Systems Inc. encountered portions of two mid-eighteenth century cobb wharves within the Telco Block, bounded by Fulton, Front, and Water Streets, and Burling Slip (John Street) along the East River waterfront (Soil Systems 1983). The wharves were known as the Van Cortlandt/Berrien Wharf and the Bowne/Byvanck Wharf. Several bulkheads also were found, thought to mark the edges of a filled-in water lot.

- **The Assay Site**

At the Assay Site, bounded by Front Street, South Street, and Old Slip on the East River, archaeologists located the cobb-constructed Bache's Wharf, two sections of another unnamed cobb wharf, and four bulkheads. The structures dated to the late eighteenth century (LBA 1990).

- **175 Water Street**

Extensive landfill features were found at the 175 Water Street site, on the block bounded by Front Street, Water Street, Fletcher Street, and Burling Slip (John Street) along the East River. Recovered resources included a wharf/grillage system and remains of a mid-eighteenth century merchant ship, initially called the *Ronson* after the project developer, but now known as the *Princess Carolina.* The ship was found at ca. 8-9 feet below the modern ground surface (Soil Systems 1983; Riess and Smith 2015).

- **Schermerhorn Row Block**

On the block bounded by Burling Slip (John Street), Fulton Street, South Street and Front Street trenching by archaeologists found timber crib structures two feet below cellar floors, likely dating to the late eighteenth or early nineteenth century (Historic Sites Research 1991). The continued presence of features under later cellars attests to the ability for preservation despite subsequent disturbance.

- **Burling Slip**

Additional archaeological testing more recently was undertaken in the street and parking lot comprising historic Burling Slip (John Street) between Front and South Street (AKRF 2011). This area once contained a wharf constructed in ca. 1790, with the slip itself landfilled in ca. 1830. No landfill retaining structures

were found in the slip, but under an Unanticipated Discoveries protocol, the south side of the ca. 1790 wharf was found on the north side of the slip. A length of the wharf or bulkhead measuring about 200 feet in length and between 2-9 feet below grade subsequently was exposed, extending to about two feet below the water table. The composition of the wharf was described as wall with tie-backs rather than a cribbing block with cross-ties.

- **John Street/Burling Slip**

Also within John Street, archaeological monitoring occurred for sewer replacement in the streetbed. Over this ca. 220-foot length, no landfilling devices were found and landfill dated to the nineteenth and twentieth centuries. All artifacts were in secondary deposition (Chrysalis 2011).

- **Rutgers Slip**

Closest to the current project site, at the intersection of Rutgers Slip and South Street contractors uncovered timbers believed by archaeologists to be portions of intact cribbing used for landfill retaining structures. The timbers were found at depths of ca. 6-8 feet below grade (AKRF 2012). The features could not be dated definitively, but were thought to date after 1835.

- **World Trade Center area**

At the site of the World Trade Center complex, on the former Hudson River shoreline, there have been two ships found. The first was a wooden ship dating to the Dutch period of occupation, and thought to be remains of the *Tyjger*, a vessel that burned and was abandoned along the shoreline in 1613. It was found during excavation for the I.R.T. subway line along Greenwich Street (at Dey Street) in 1916, and documented by amateur historian James Kelly, who was a supervisor on the subway project. The ship, which consisted of a burned keelson and three rib frames, was found beneath about 9 feet of fill and 11 feet of river silt. Archaeologists Ralph Solecki and Bert Salwen returned to the area in 1967, when the World Trade Center was being built, and attempted to find the rest of the ship, which was thought to lie west of the I.R.T. line. Unfortunately, their efforts were unsuccessful, and the remains of the *Tyjger* were never found (Solecki 1974).

The second ship was found at the southern site of the World Trade Center redevelopment project, on both sides of Washington Street between Liberty and Cedar Street. The ship, which consisted of the bottom portion of a hull and a single deck, was found at a depth of between 11.5 and 20 feet below mean sea level, or between about 20 to 30 feet below the modern street grade (AKRF 2013).

Additionally, the New York State Museum documented a portion of the Hudson River bulkhead, which dated to ca. 1903, in the southern end of West Thames Park, near West Thames Street (NYSM 2011).

- **South Ferry Terminal Site**

Extensive archaeological investigations were undertaken at the South Ferry Terminal site, which included land formerly on firm ground as well as land once under water and now covered by landfill (AKRF, URS, and Stone 2012). In the landfilled area, archaeologists encountered both remains of Whitehall Slip timber cribbing and extensive landfill deposits. The timber cribbing was found at ca. 8-10 feet below the ground surface. In total, archaeologists documented resources in Whitehall Slip measuring over 200 feet in length and up to 60 feet in width.

- **East River Esplanade Monitoring**

As part of the East River Esplanade project, which extended along the east side of the FDR Drive, several test trenches were monitored by archaeologists to determine depths and extent of existing column footings for the FDR Drive. Monitoring of these trenches did not encounter any landfill retaining structures or other intact archaeological resources (HPI 2008).

- **Wall Street Triangle Site**

At the Wall Street Triangle site, located on the north side of Wall Street between Front and South Streets, contractors discovered large timbers at ca. 4 feet below grade (Geismar 2005). Inspection by an archaeologist revealed that these were likely former landfill retaining structures that had been broken up and redeposited in the landfill. This area was once known as the Wall Street or Coffee House Slip, and was landfilled in the 1820s and 1830s. While it is possible that the timbers were from former piers or wharves lining the slip, it could not be confirmed.

2. Brooklyn projects

- **Archaeological Monitoring at Joralemon and Furman Streets**

An early archaeological monitoring program by Ralph Solecki (1981) for the Red Hook Water Pollution Control project on the East River in Brooklyn revealed timber retaining structures from ca. 5-12 feet below grade near the intersection of Joralemon and Furman Streets. The structures consisted of timber cribworks filled with various sized stones, as well as an associated bulkhead.

- **Brooklyn Bridge Park project**

Archaeological testing for the Brooklyn Bridge Park project included areas on between Furman Street and the East River from Atlantic Avenue to Old Fulton Street (URS 2008, 2009). This area was once under water and was landfilled in the nineteenth century. Despite sensitivity for landfill retaining structures here, none were found. However, remains of foundations associated with the mid to late nineteenth-century Deforrest Storage Warehouses (later the Martin Stores) and the Jewell Brothers Flour Mill complex were found at relatively shallow depths below grade (the upper reaches were 1-2 feet below the current ground surface). Phase II Archaeological Evaluation determined that the flour mill complex was eligible for the National Register of Historic Places (URS 2012).

- **Dock Street Rezoning project**

Phase IB archaeological testing was completed for the parcel at the western end of the block bounded by Water Street, Dock Street, Front Street, and Main Street (HPI 2013). Although the block straddled the original shoreline and was landfilled to bring it up to a level grade, no intact landfilling structures were found on the site. A number of features and foundations from nineteenth-century industrial buildings were located within the landfilled areas, however.

- **Archaeological Monitoring for Combined Sewer, Water Street, Old Fulton Street and Washington Street**

During rehabilitation of city streets along the East River in Brooklyn, archaeologists monitored installation of a new combined sewer under Water Street between Old Fulton Street and Adams Street, Old Fulton Street between Front Street and Furman Street and Washington Street between York Street and Plymouth Street (Chrysalis 2012). Much of these areas was once under water and was landfilled during the nineteenth century. The results of the monitoring revealed evidence of mid to late nineteenth century landfilling and evidence of mid to late nineteenth century and early twentieth century utilities. However, monitoring did not reveal remains of intact landfill retaining devices or waterfront features such as docks, despite the location of these streets along the natural East River shoreline. All wood found during monitoring was disarticulated and likely redeposited.

C. Discussion summary

The data from the archaeological testing programs on landfilled sites from the eighteenth and nineteenth centuries present a varied picture of resource locations and survival. For landfill retaining structures, most sites that had features were found at least several feet below the modern ground surface. The top of the shallowest buried feature was two feet below grade, but most sites recorded the upper reaches of features at

least 4-5 feet below grade, and often much deeper. Given that these retaining devices would have been installed both above and below the natural water line of the river and that additional landfill may have been placed above these features to raise the area to a modern grade, this is not surprising. Within APE, it is likely that any landfill retaining devices or possible buried ship remains, should they exist, would be located at least several feet below the modern grade. Due to the overall depths of these potential resources, it is also possible that they could be found under former basements.

The archaeological testing programs also underscore the difficulty in predicting where landfill retaining structures still may exist within the modern landscape. The above discussion focuses only on field testing projects, but most of these programs were preceded by Phase IA Documentary Studies that identified areas of sensitivity for these resources that guided the field work. In many cases, archaeologists identified probable locations of resources where field work showed did not exist, whether because they were never located in those spots, or because they were destroyed by subsequent disturbance. In other cases, resources were found during an Unanticipated Discovery Program, often in locations archaeologists had not predicted during the research phase.

These factors considered, there are several patterns worth noting. At least on the East River shoreline of Manhattan, several sites have shown less likelihood of recovering landfill retaining devices in former slips, or the open water between wharves or piers where vessels could dock. Rather, resources have been found more consistently along or within former wharves and bulkheads. Additionally, streetbeds or former streetbeds with multiple or deeply installed utilities appear less likely to contain intact resources, based on later disturbance. Last, the types of project impacts greatly affect the research value of the potential resources. In areas where there is only limited visibility through trenching or narrow monitoring corridors, resources often cannot be properly evaluated. Those sites that have produced the most valuable research avenues are those where large areas have been excavated, such as for new building basements or large infrastructure projects.

VII. CONCLUSIONS

This Phase IA Archaeological Documentary Study has shown that the entire APE was once under the water of the East River, and was landfilled at various times between the 1810s and about 1850, with city streets created to separate and define newly formed blocks. These blocks supported a range of structures over time, primarily mixed residential/commercial buildings and industrial facilities. Bulkheads and pierheads established the extent of waterfront resource boundaries. The APE became more developed over time and by the 1930s, when the East River Drive (now the FDR Drive) and East River Park were created, each city block was almost completely covered with structures and numerous piers were located along the waterfront. Maps and photographs show that these structures, including the piers, were demolished in preparation for construction of the East River Drive and East River Park.

There are a number of project Alternatives proposed for the East Side Coastal Resiliency project site. The Preferred Alternative has not yet been selected, and plans for each Alternative may still be changed. However, there are certain elements that apply to all the Alternatives. Namely, all of the Alternatives contain a combination of components including Engineered Berms, Floodwalls, and Deployable Systems. For each of these components, proposed excavation would extend ca. 2-4 feet below the existing grade for construction of the component base and pile caps, with sheet piles driven mechanically to ca. 40 feet below grade. It is expected that archaeological testing or monitoring would only be possible for the upper 2-4 feet of component installation. The sheet pile driving would not allow any visibility of subsurface conditions. The only two project locations that may provide more wide scale excavation windows would be (1) the locations slated for utility work and (2) beneath the tennis courts north of Delancey Street, which is the site of a proposed large storage tank.

There have been several previous archaeological studies within and adjacent to the APE that have identified broad categories of potential historic period archaeological resources. These include those for the East River Waterfront Esplanade and Piers by HPI (2007a, 2007b) and recently for the reconstruction of Pier 42 AKRF (2015), which encompassed areas from Montgomery Street to east of Jackson Street south of the FDR Drive, including portions of the current APE. The above studies have been submitted to, and

accepted by, regulatory agencies. Therefore, to retain parity, the same broad resource categories are addressed below. Prior disturbance and archaeological sensitivity are addressed within each resource category.

A. River bottom remains

River bottom remains are those items discarded onto the river floor prior to or during landfilling. It is possible that archaeologically sensitive deposits are present on the river bottom within the APE. However, the only construction activity within the APE that could affect potential river bottom remains is the proposed storage tank under the present tennis courts north of Delancey Street, where excavation could extend to 50 feet below the current grade. The depth of river bottom deposits would depend on the vertical extent of the landfill and historic strata, which varies considerably across the APE. Soil borings reviewed for this report indicate fill ranges from 12 to more than 40 feet in thickness.

B. Landfill retaining structures and landfill deposits (including sunken vessels)

Landfill retaining structures can include repurposed historic piers, wharves, and docks, as well as timber structures built specifically for retaining fill, sometimes also referred to as bulkheads. At times, derelict maritime vessels also were used both as landfill retaining structures or part of the landfill. Landfill by nature contains soil, but also may include concentrations of artifacts or other refuse material, such as ash, sometimes referred to as "cinders" in early soil boring logs.

Because the entire APE was once under water, there is potential for the presence of archaeologically sensitive historic landfill retaining structures from the first half of the nineteenth century throughout most of the APE. The exception is the former area bounded by Corlears Street, Water Street, and the East River (now the approximate location of the amphitheater), which was not enclosed by bulkheads and landfilled until the 1870s or 1880s. The current bulkhead that comprises the eastern edge of East River Park dates to the 1930s, when the park was created, and was recently rehabilitated. It is assumed that it will not be affected by any components of this project. It is not expected that there would be any historic landfill retaining structures between the historic bulkhead line and the current bulkhead line, as this area was landfilled in the twentieth century in conjunction with the creation of East River Park in the 1930s.

Current plans indicate that the majority of project related impacts would only extend ca. 2-4 feet below the existing ground surface. While it is possible that landfill retaining structures could be found within this upper reach of the soil column, previous archaeological investigations at other locations along the East River suggest that most of these resources are located deeper in the ground. Additionally, the level of disturbance throughout the APE from various earthmoving episodes, including installation of utilities, construction of foundations and basements, and reconfiguration of the area during roadway and park construction further argues that the likelihood of encountering intact resources is diminished at these relatively shallow depths. Last, recent soil borings did not record any elements at these depths that appear to represent these resources (such as concentrations of wood). Although the sheet pile driving will extend through areas more likely to contain these resources, it will not be possible to observe these areas due to the means of installation.

The locations most likely to uncover landfill retaining structures and any potential sunken vessels by project components are those places where utilities will need to be encased or relocated, and the area of the proposed storage tank under the tennis courts north of Delancey Street where, as described earlier, excavations will extend ca. 50 feet below the current extent of the tennis courts. This area also includes the historic East Street bulkhead, which was in place by ca. 1850 and if not destroyed by subsequent construction in East River Park, might be visible here.

C. Historic streetbed resources (utilities, transportation elements, artifact deposits)

The APE formerly contained a number of historic streets, including portions of Front Street, South Street, Montgomery Street, Gouverneur Street, Jackson Street, Corlears Street, Water Street, Cherry Street, East Street, Tompkins Street, Grand Street, Broome Street, Delancey Street, and Rivington Street. Most of these

street segments were eliminated when the East River Drive and East River Park were built in the 1930s and 1940s.

Each of the former city streets had subsurface utilities under them. The lines of the extant utilities, as shown on civil plan sheets in Appendix B, attest to the former street locations. While it is unlikely that any of the iconic wooden water mains from the pre-1842 Croton water era would be located under any of these streets (those mains were installed further south in Lower Manhattan), it is possible that archaeologically sensitive early water and sewer lines from the 1850s and 1860s could still exist under city streets, if not removed during subsequent utility work.

Some of the historic streets also had streetcar tracks, as shown on historic maps (e.g. Harrison 1867 [Figure 12]; Robinson 1885 [Figure 13]). Those streets with tracks included portions of Montgomery Street, Front Street, South Street, Corlears Street, and Grand Street. While subsequent disturbance to the streetbeds from utility replacement and construction of the East River Drive and East River Park likely eliminated many of these potentially archaeologically sensitive resources, it is still possible that segments could survive beneath these areas. It is also possible that portions of former street pavements, such as cobblestones or paving blocks, may be present beneath some areas.

Finally, archaeological monitoring of utility work in streetbeds of Lower Manhattan has shown that often concentrations or pockets of discarded artifacts can be found beneath historic streets. It is not possible to predict where such dumping grounds may be located, although archaeologists have had some subsequent success tracing the provenance of certain artifact caches to neighboring businesses (e.g. Urbanus 2015).

Portions of the APE that cross former historic street beds might be sensitive for these varied types of resources if later disturbance has not affected them. Within the upper 2-4 feet of the soil column, where the majority of project impacts will occur, there is less likelihood of encountering buried utilities, although it is possible that streetcar tracks, earlier street paving, and possible artifact dumps may be present. HPI concludes that streetbed resources may be present within the APE at depths of one foot below grade and greater.

D. Former city block resources (foundation remains, historic shaft features)

Those portions of the APE that had been historically developed within city blocks once contained a variety of residential/commercial and industrial buildings and structures, as well as waterfront-related shipyards, coal yards, lumber yards, and the like. The locations that contained commercial open "yards" such as shipyards, lumber yards, coal yards, and lime yards, would not be expected to have a significant archaeological footprint. However, potential archaeologically sensitive resources on former city blocks could include former foundations or other components from these buildings, as well as shaft features, such as privies, wells, and cisterns, from domestic and commercial buildings, predating the introduction of municipal water and sewers in the 1850s and 1860s.

The likelihood of recovering archaeological remains from these resources depends on the level of disturbance, which varies by location. Those former yards that had subsequent buildings with basements would have been disturbed to the deepest extent, ranging from possibly 8-10 feet below grade. Some information is available about which buildings had basements from Sanborn fire insurance maps, although it is possible that not all basements were recorded. Building department records for these former structures, which might also offer confirmation of basements, are no longer extant, as it was common practice of the city to discard records of buildings after they were demolished. Figures 16a-c and 17a-b include locations of former buildings with basements within the APE, based on data from Sanborn maps. The remainder of the former lots likely has been disturbed as well, from episodes of construction and demolition on the blocks, as well as creation of East River Drive and East River Park components. Although the depth of this disturbance is harder to discern, it is probable that at least the upper one foot extent has been affected in all locations, and areas now under roadways (including the FDR Drive and its service roads) have been disturbed to a minimum of two feet below grade. Further, the construction of the Williamsburg Bridge included portions of historic lots south of Delancey Street, which are likely significantly disturbed.

Although project designs and potential impacts are still not final, it does appear that nearly all proposed components for the different Alternatives are slated for locations on the river side of the FDR Drive. The exceptions are several proposed floodwalls along Montgomery and Front Streets at the southern end of the overall project site, and portions of two pedestrian bridges that cross the FDR Drive. Based on the 1850s historic maps, HPI has identified locations on former city blocks that may be sensitive for domestic, commercial, and/or industrial archaeological resources that were not later covered by buildings with basements, focusing primarily on areas south and/or east of the FDR Drive. Figures 18a-f depict locations of lots with former resources on historic city blocks. It is possible that project impacts within the upper 2-4 feet of the soil column could reveal archaeological resources. Other areas where these resources also could be found are those loci of deeper impacts, such as where utilities may need to be encased or relocated, and the area of the proposed storage tank under the tennis courts north of Delancey Street where, as described earlier, excavations will extend ca. 50 feet below the current extent of the tennis courts.

VIII. RECOMMENDATIONS

The conclusions, above, have outlined several broad categories of potentially sensitive archaeological resources that could remain within the APE. Specifically, significant landfill retaining structures may exist throughout the APE (excepting the approximate area where the current amphitheater is located) and other resources may be situated in former streetbeds and historic city blocks. Figures 18a-18f illustrate locations of former lots with potentially sensitive archaeological resources within city blocks as well as those locations that had deep basement construction/disturbance.

At this time, most project impacts are slated to consist of excavation to depths of 2-4 feet below the current grade, for the installation of the upper components of walls and gates, and for pile caps. Impacts below these depths will be by sheet piles, which will be mechanically driven into the ground and will not afford visibility of any underlying soils. Areas where deeper and wider impacts may occur are where existing utilities could be encased or relocated, and the location of the proposed storage tank under the existing tennis courts north of Delancey Street. There may also be additional subsurface impacts outlined as the project moves forward.

Based on these results, and given the large size of the overall APE, HPI recommends that as the project moves forward and impacts are finalized, a scope for additional archaeology may be needed for the archaeologically sensitive areas of the APE, if these locations are chosen for project impacts as part of the selected Alternative. It is also possible that upcoming geotechnical soil borings could provide additional data about existing disturbance or potential resources within the APE. Results of these borings could be summarized in an addendum to this report. HPI recommends that once additional data are available from the forthcoming geotechnical soil boring program and a project Alternative is chosen and finalized, LPC and SHPO should be consulted to determine the scope of any future archaeological investigations.

IX. REFERENCES

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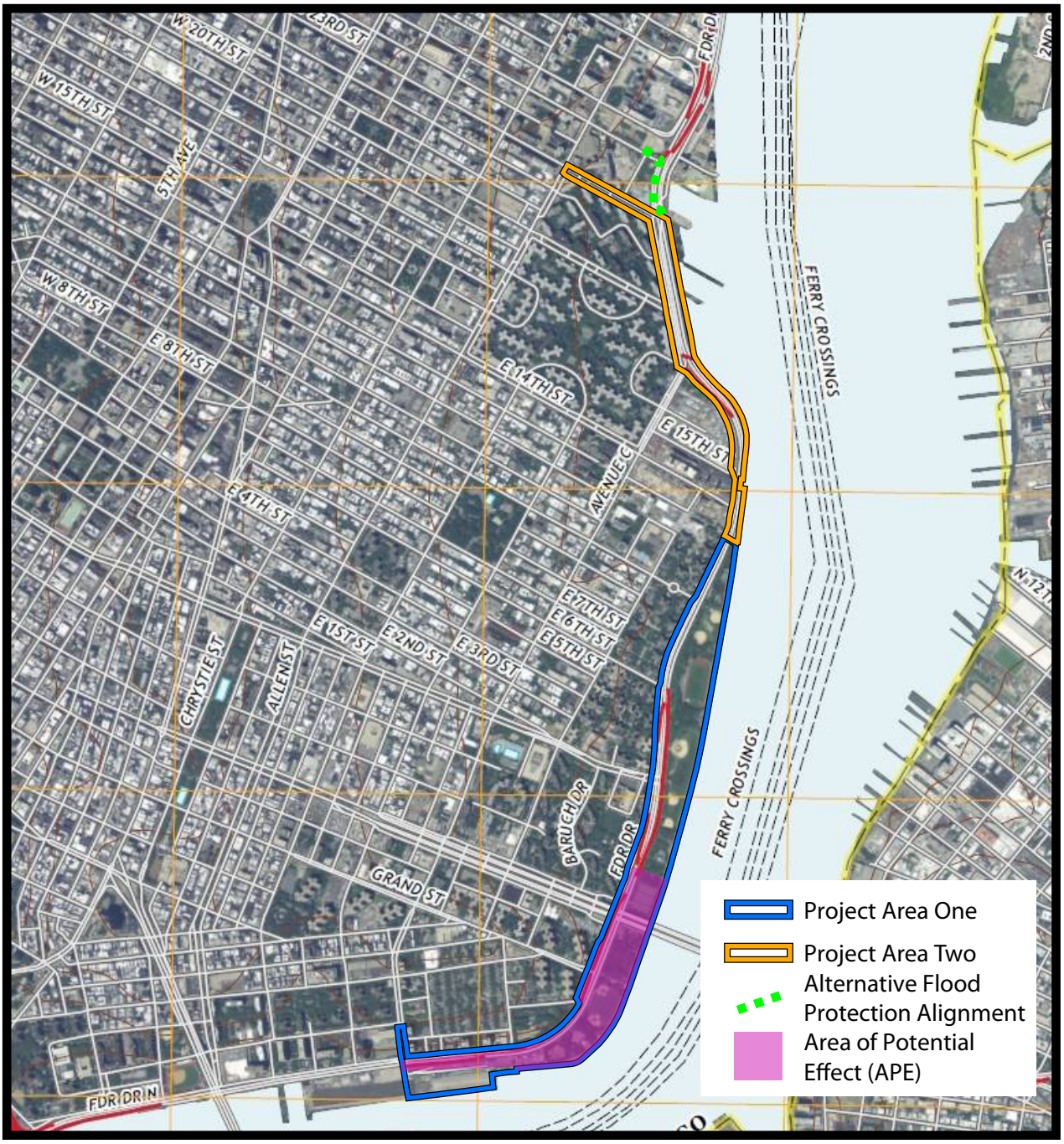
FIGURES



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 1: Project Areas and APE on *Brooklyn, N.Y-N.J.* topographic quadrangle (U.S.G.S. 2013).

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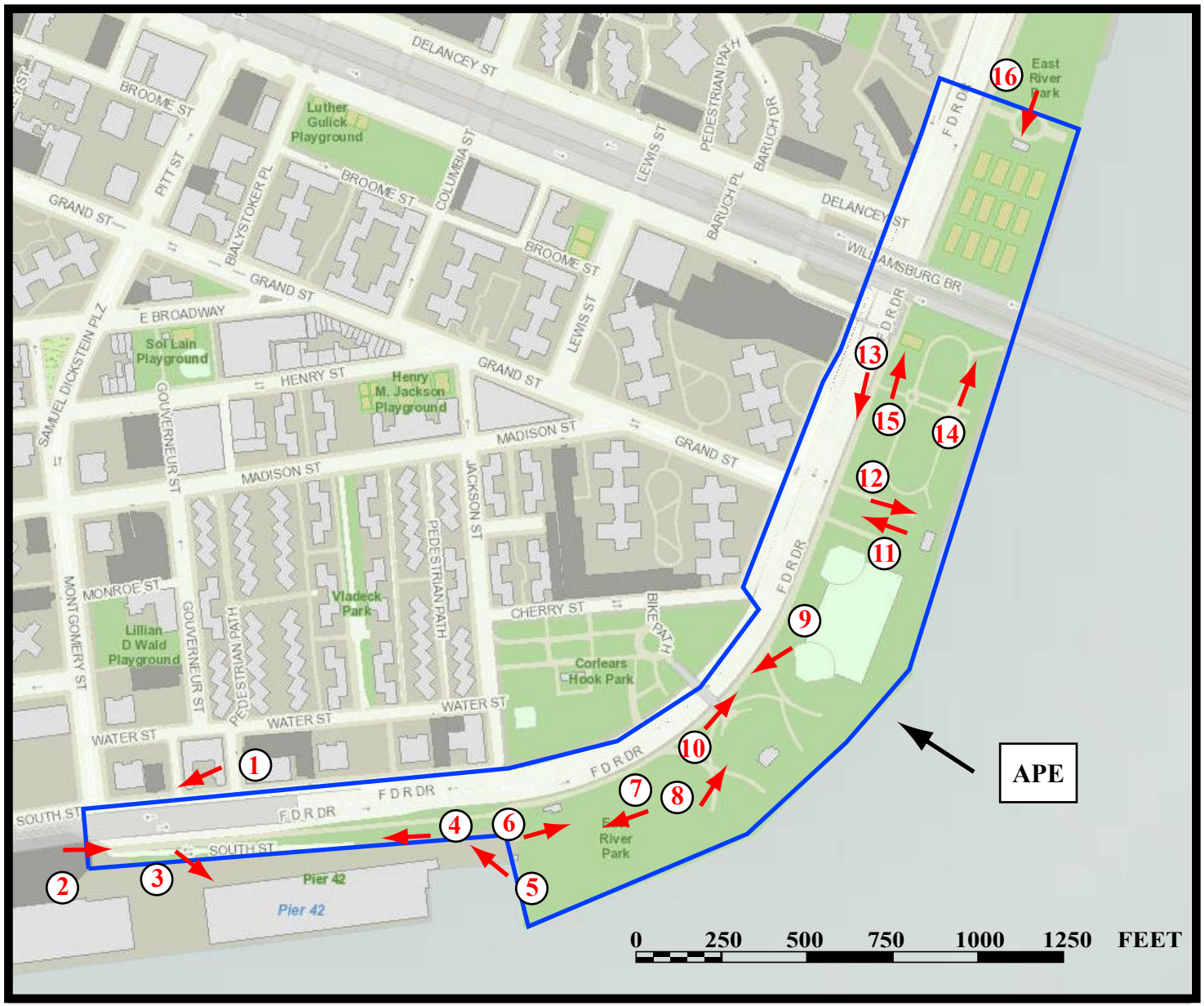

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East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

N

HP

Figure 2: APE and photograph locations on modern street map (DoItt 2015).

9/25/2015

Project Area One

Proposed Project Design Reaches

Existing Open Space

Proposed Open Space (No-Action Project)

Approximate Limits of Alternative 2 Flood Protection System

NOTE: Based on Preliminary Design Concepts

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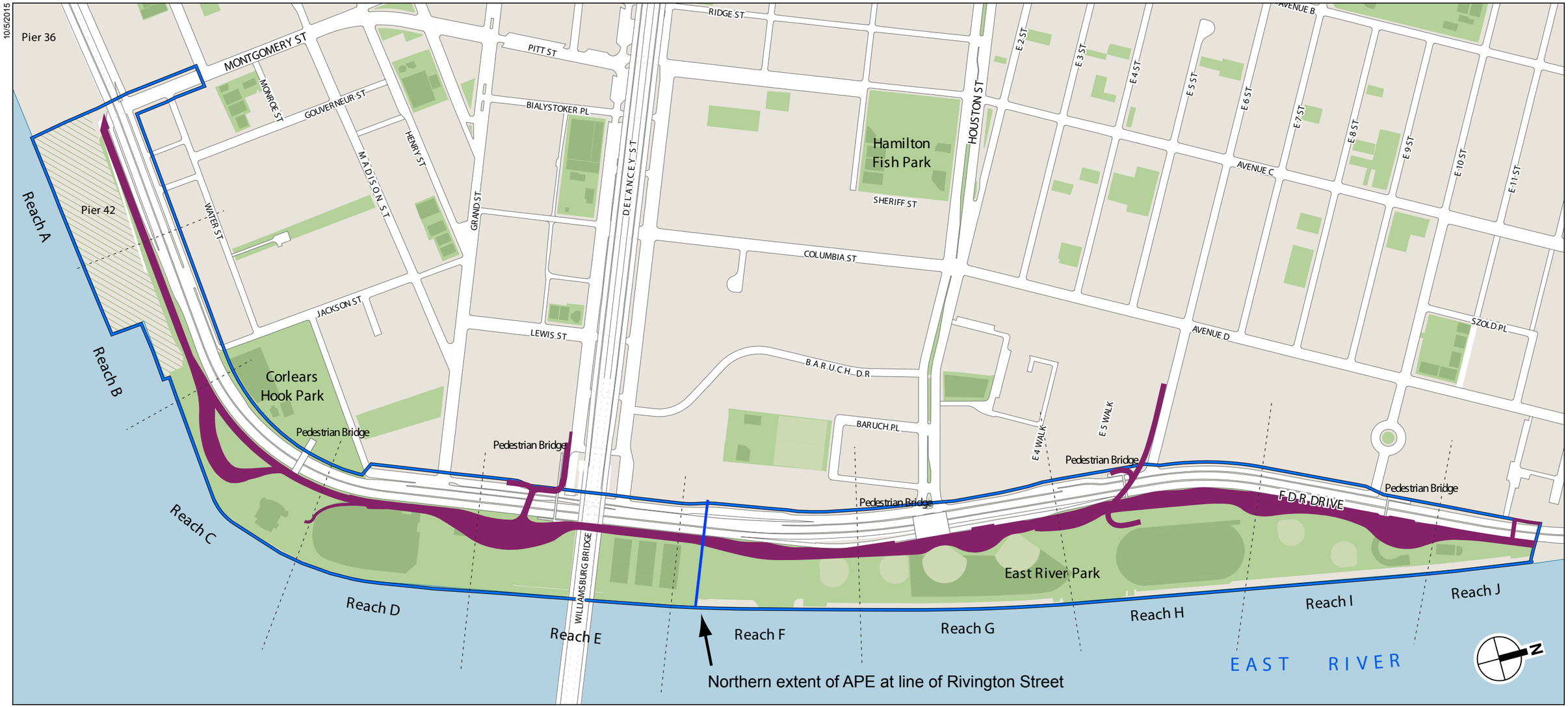
Capital Project SANDRESM1
EAST SIDE COASTAL RESILIENCY PROJECT

APE on Alignment of Alternative 2 (Project Area One)
Figure 3

10/5/2015



Project Area One

Proposed Project Design Reaches

Existing Open Space

Proposed Open Space (No-Action Project)

Approximate Limits of Alternative 3 Flood Protection System

NOTE: Based on Preliminary Design Concepts

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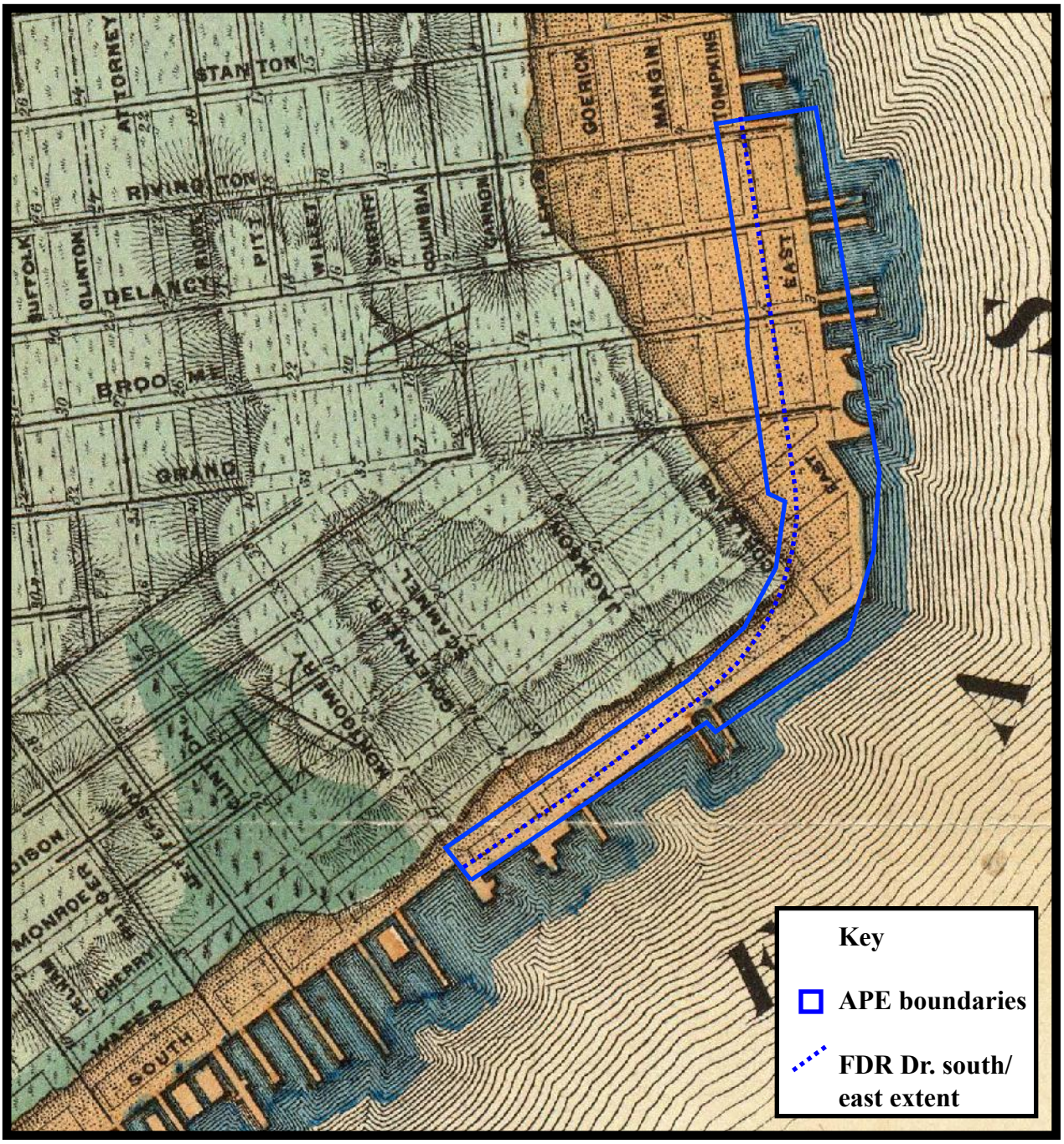
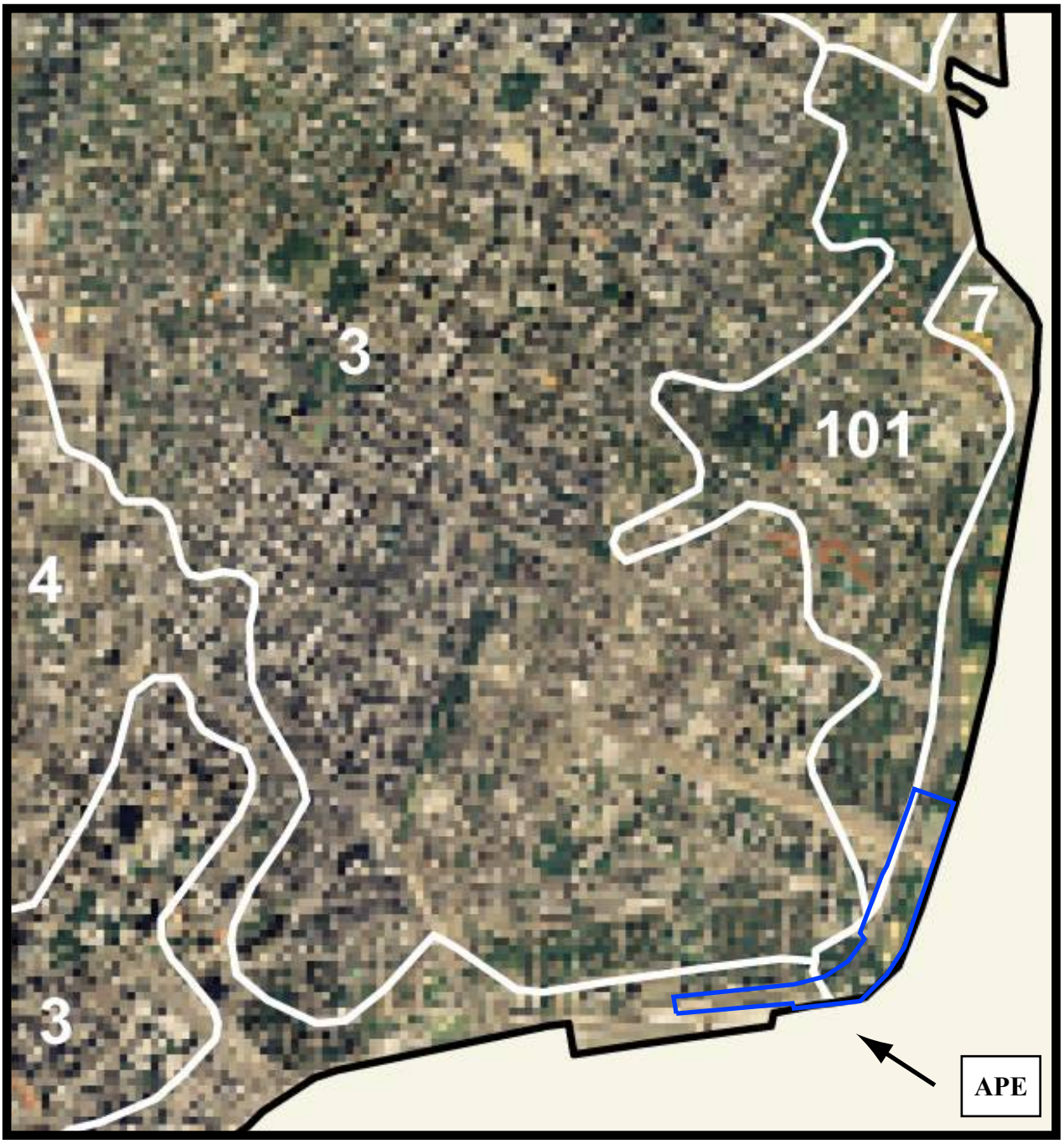
Capital Project SANDRESM1
EAST SIDE COASTAL RESILIENCY PROJECT

APE on Alignment of Alternative 3 (Project Area One)
Figure 4



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 5: APE on *Sanitary and Topographical Map of the City and Island of New York* (Viele 1865).



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

N

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Figure 6: APE on *New York City Reconnaissance Soil Survey* (U.S.D.A. 2005).

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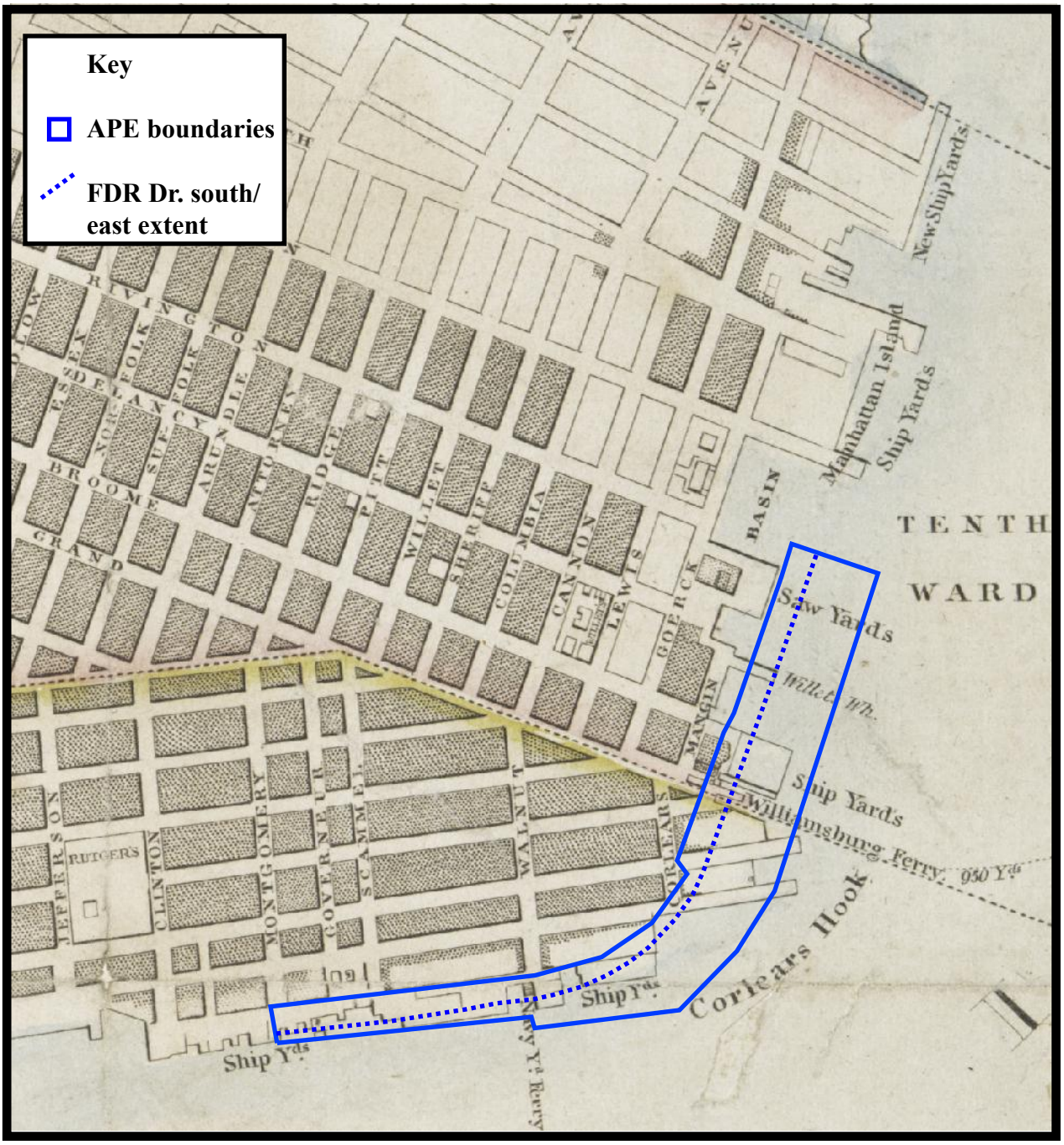
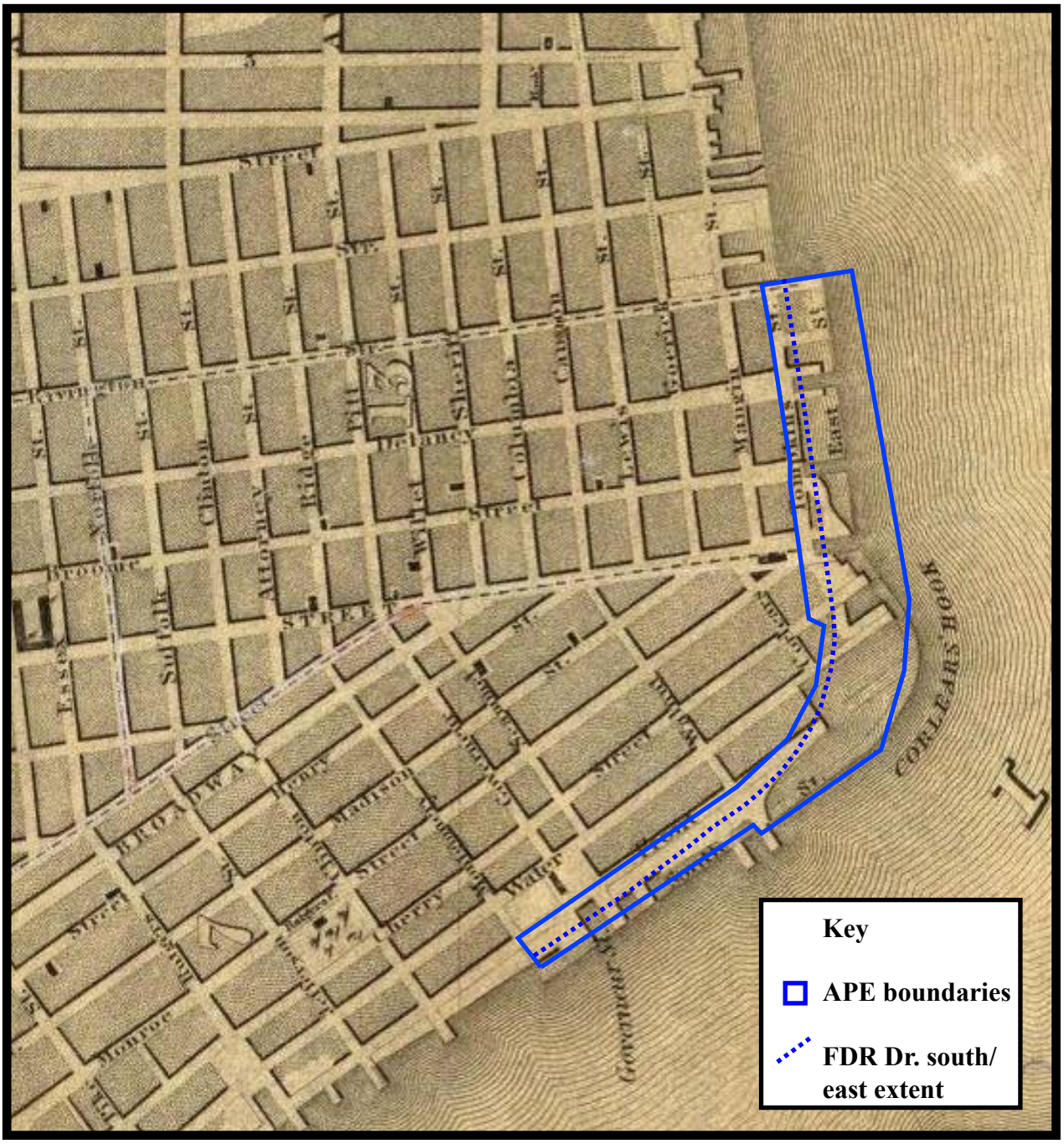


Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 7: APE on *Hooker's New Pocket Plan of the City of New York* (Hooker 1824).

0 400 800 1200 1600 2000 FEET



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 8: APE on *Topographical Map of the City and County of New-York and the Adjacent Country* (Colton 1836).

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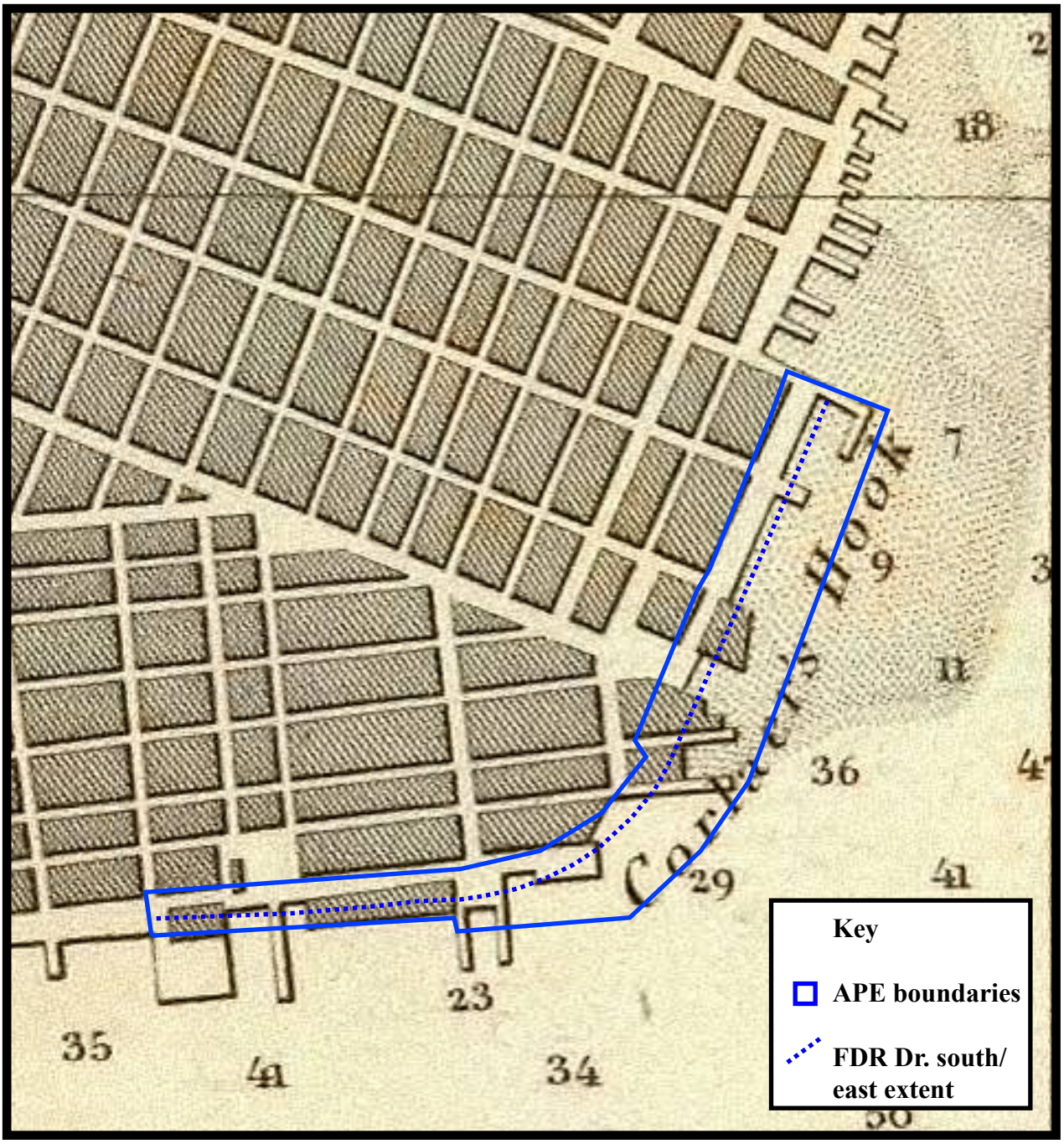
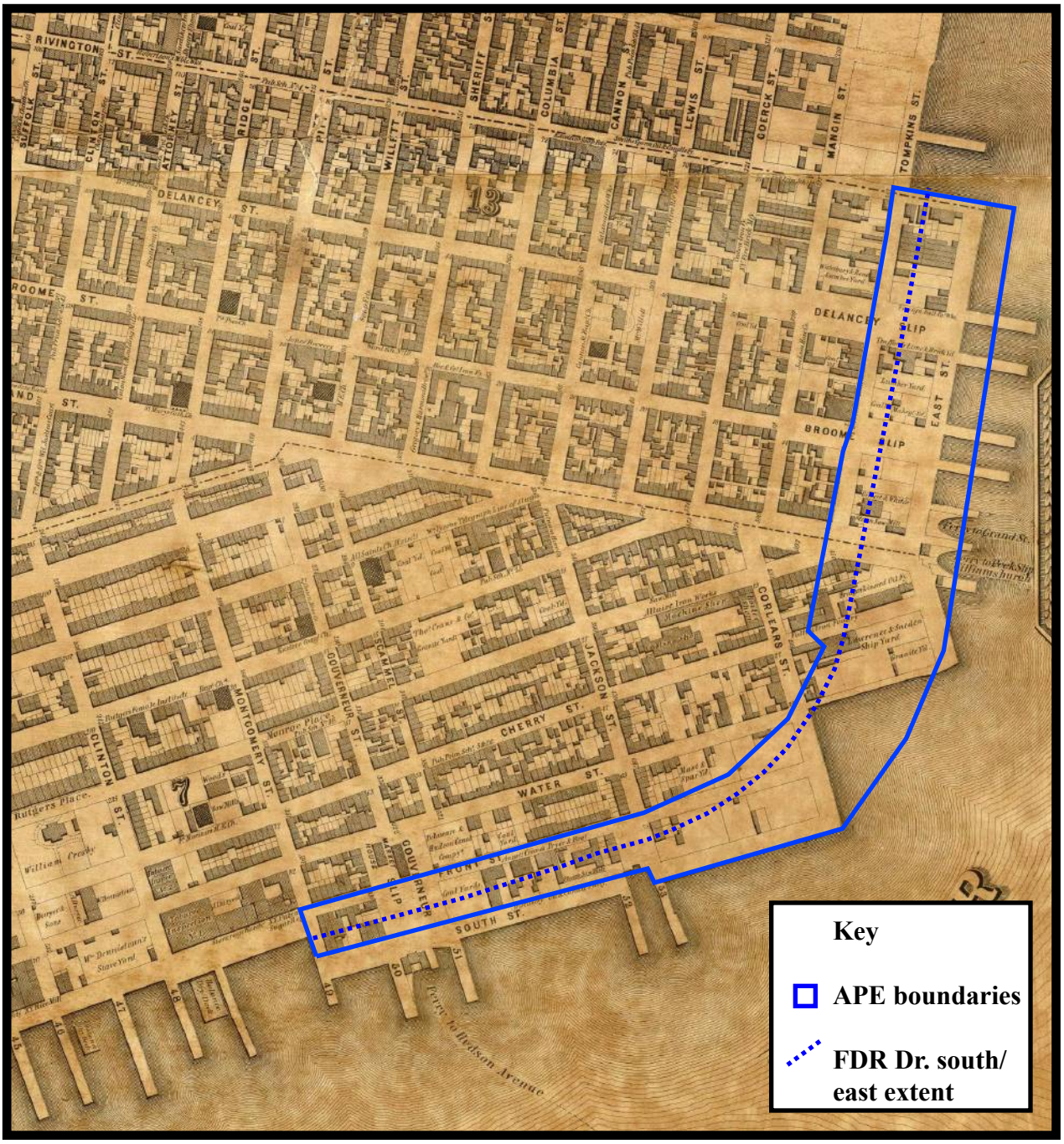


Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 9: APE on *Map of New-York Bay And Harbor And The Environs* (U.S.C.S. 1844).

0 250 500 750 1000 1250 FEET



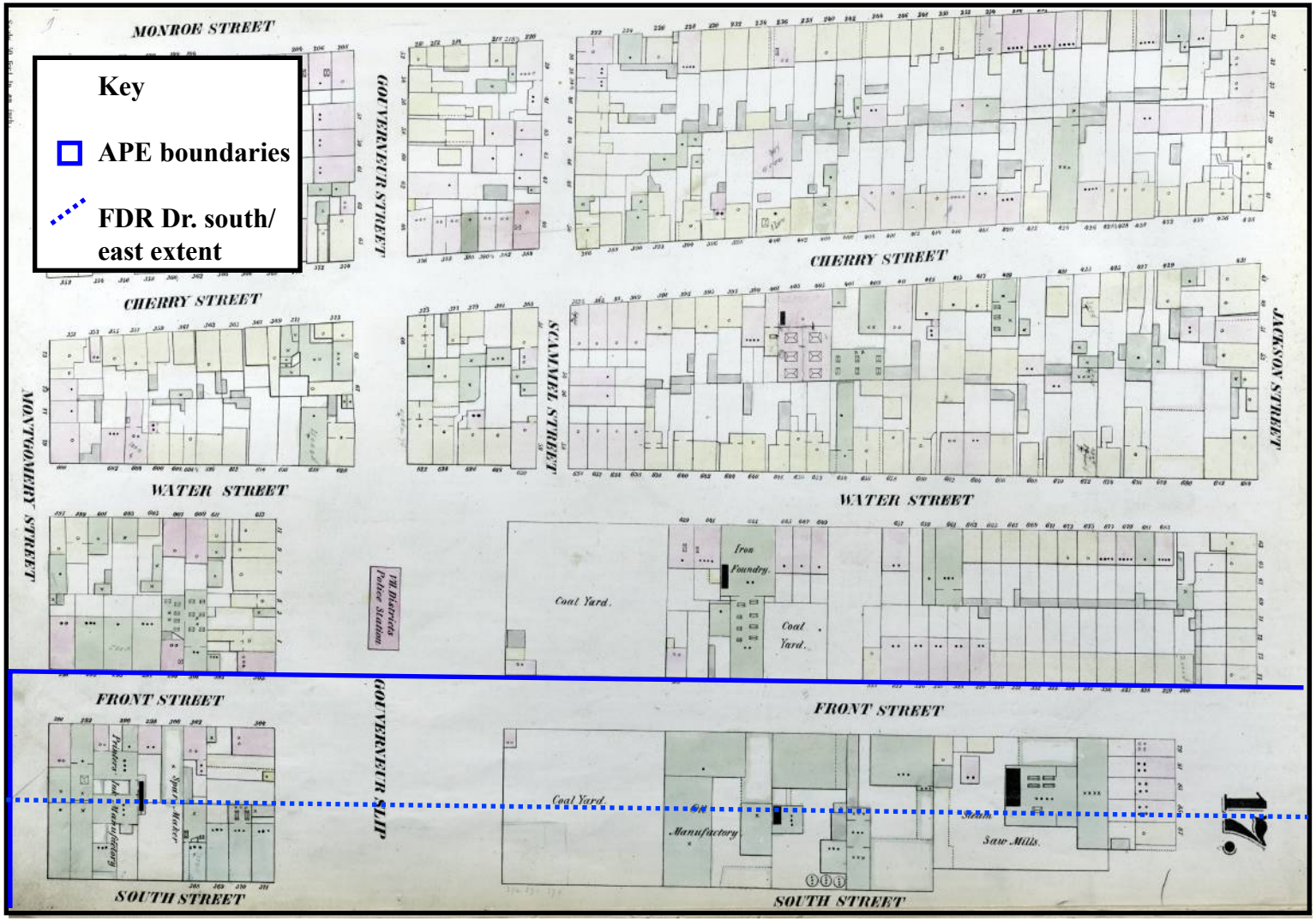
Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

N

HP

Figure 10: APE on *Map of the City of New York Extending Northward to Fiftieth Street* (Dripps 1852).

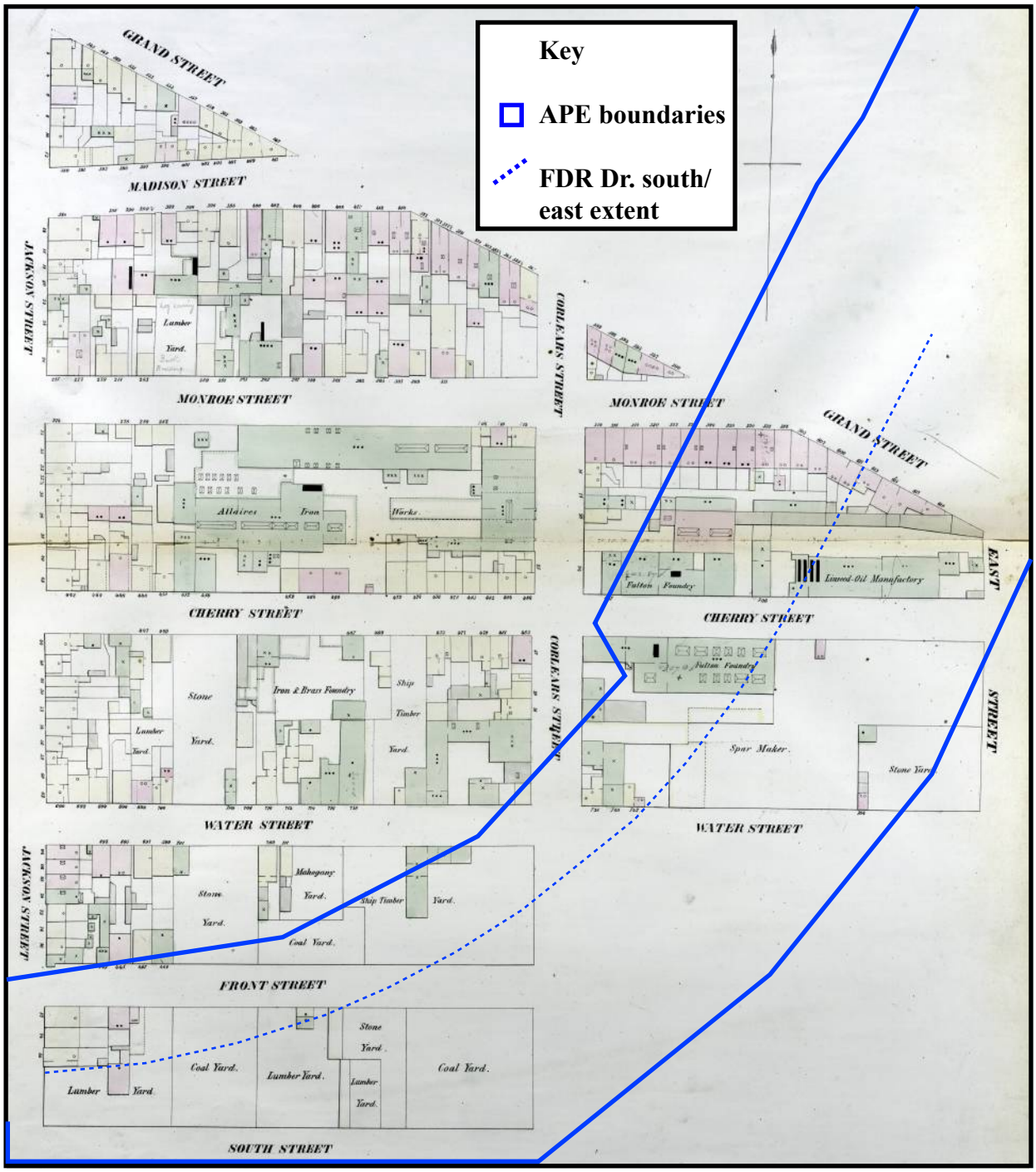
0 250 500 750 1000 1250 FEET



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

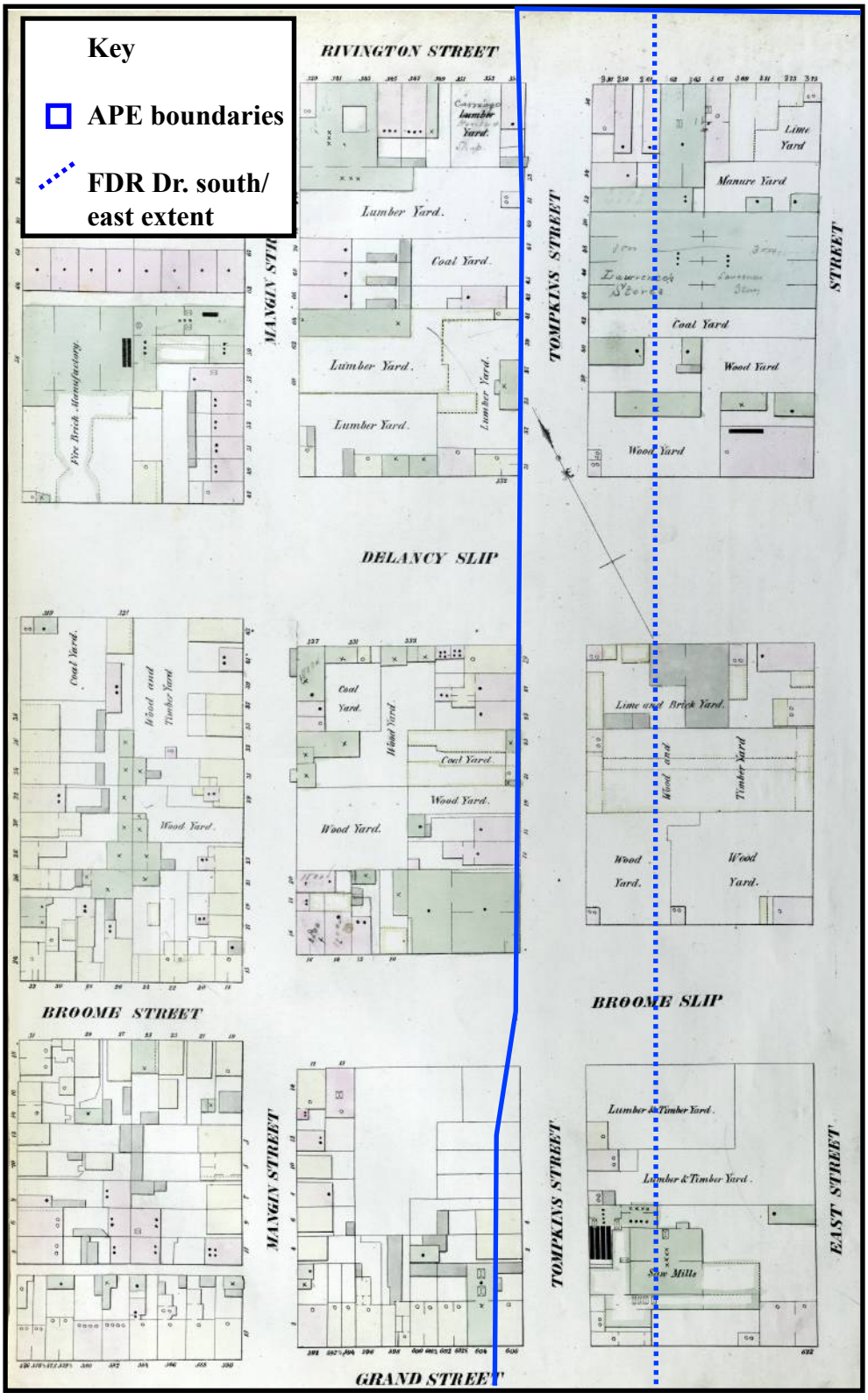
Figure 11a: Montgomery Street to Jackson Street APE on *Map of the City of New York* (Perris 1852).

0 50 100 150 200 250 FEET



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

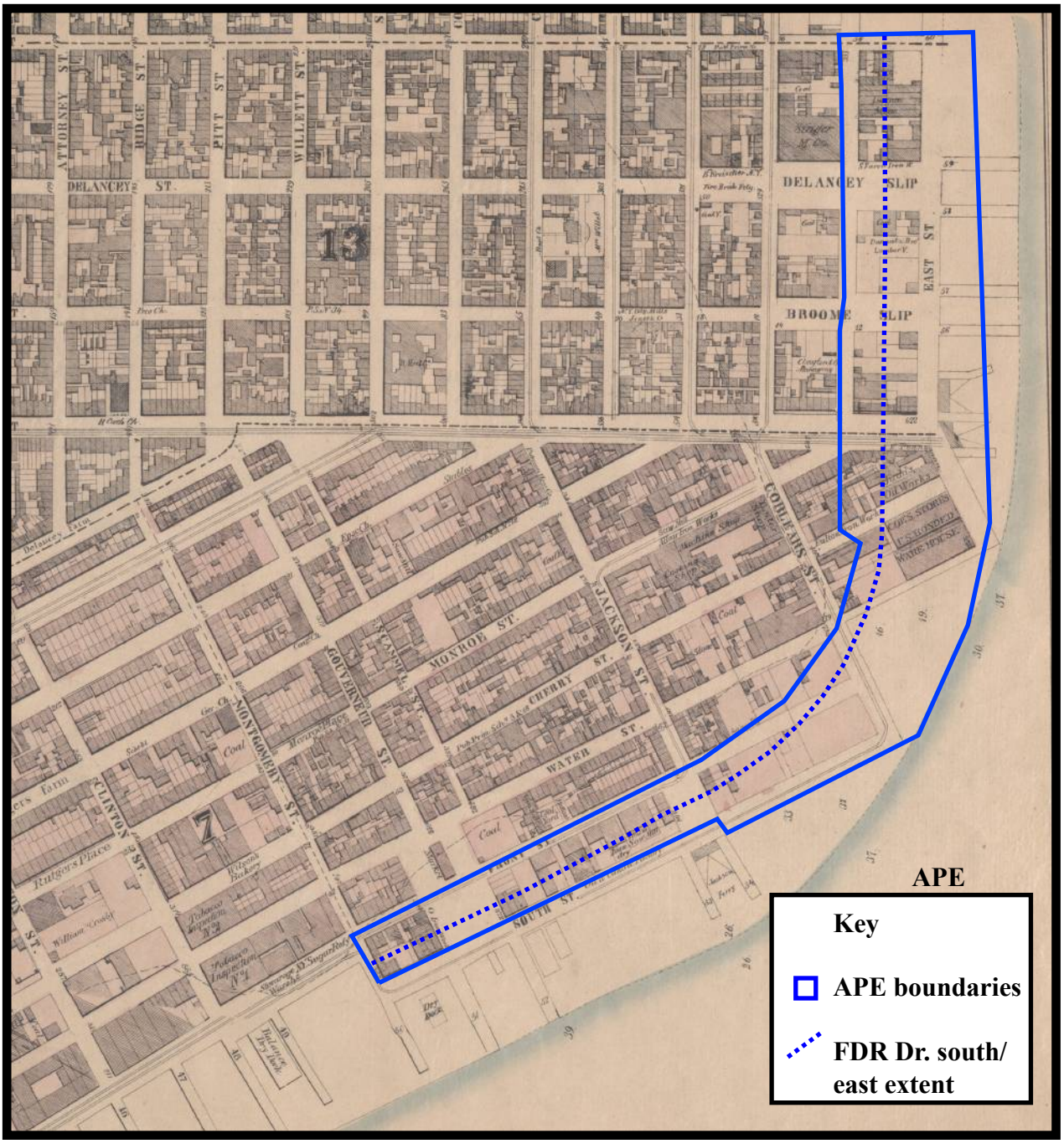
Figure 11b: Jackson Street to Grand Street APE on *Map of the City of New York* (Perris 1852).



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 11c: Grand Street to Rivington Street APE on *Map of the City of New York* (Perris 1852).

0 50 100 150 200 250 FEET



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

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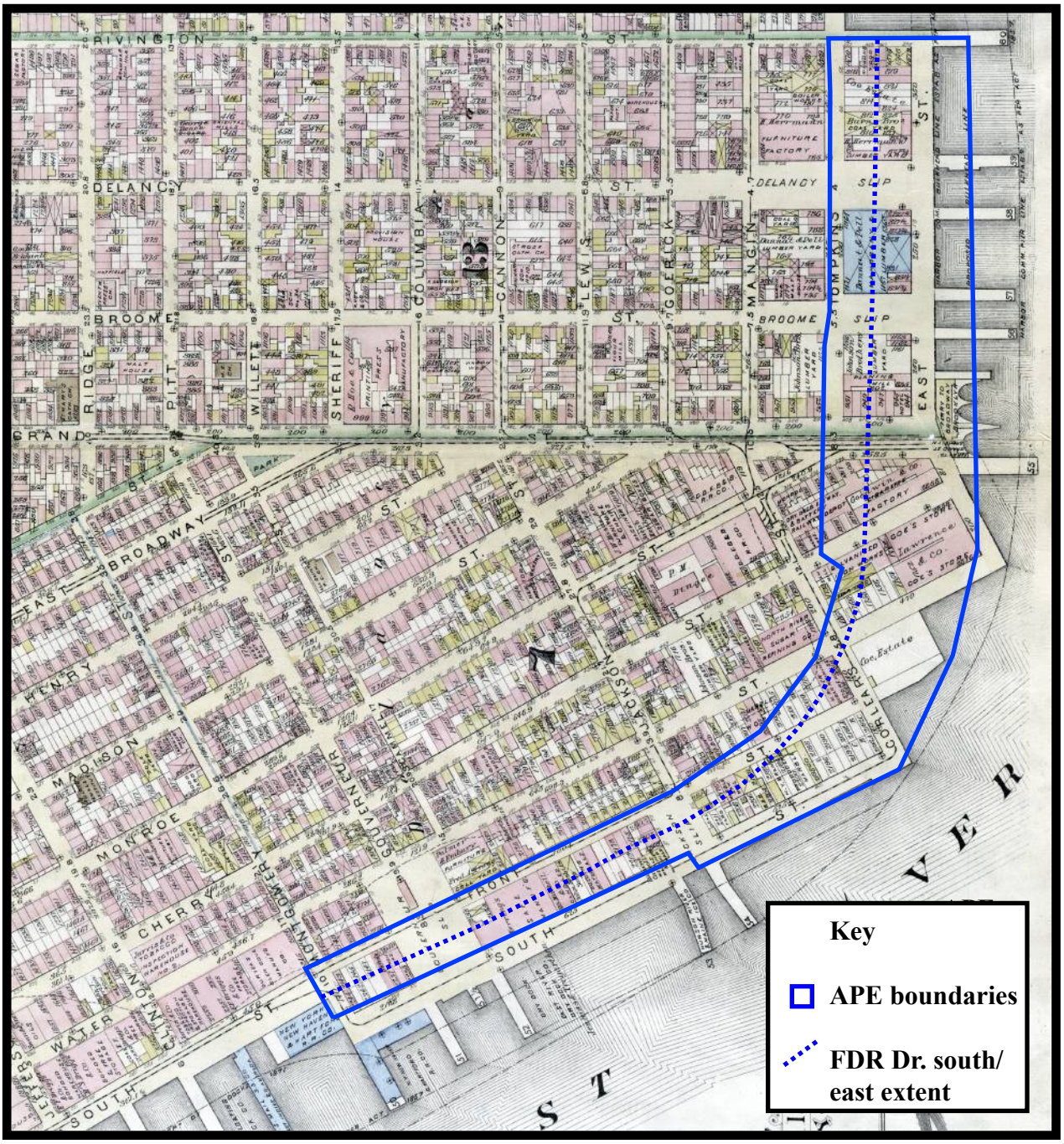
Figure 12: APE on *Plan of New York City from the Battery to Spuyten Duyvil Creek* (Harrison 1867).

0 250 500 750 1000 1250 FEET



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 13: APE on *Atlas of the City of New York* (Robinson 1885).

0 250 500 750 1000 1250 FEET

Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

N

HP

Figure 14: APE on *Sectional Aerial Maps of the City of New York* (Bureau of Engineering 1924).

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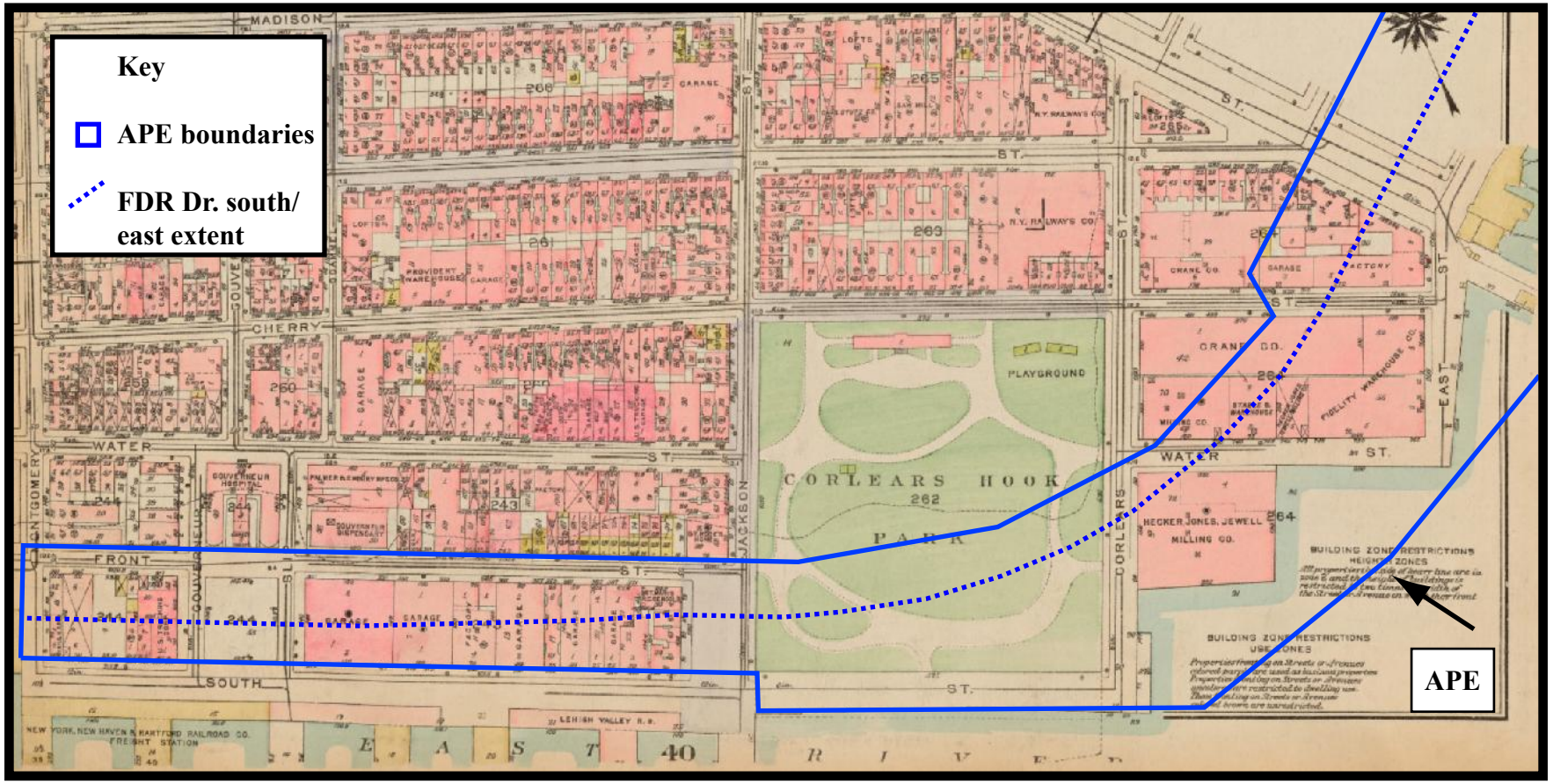
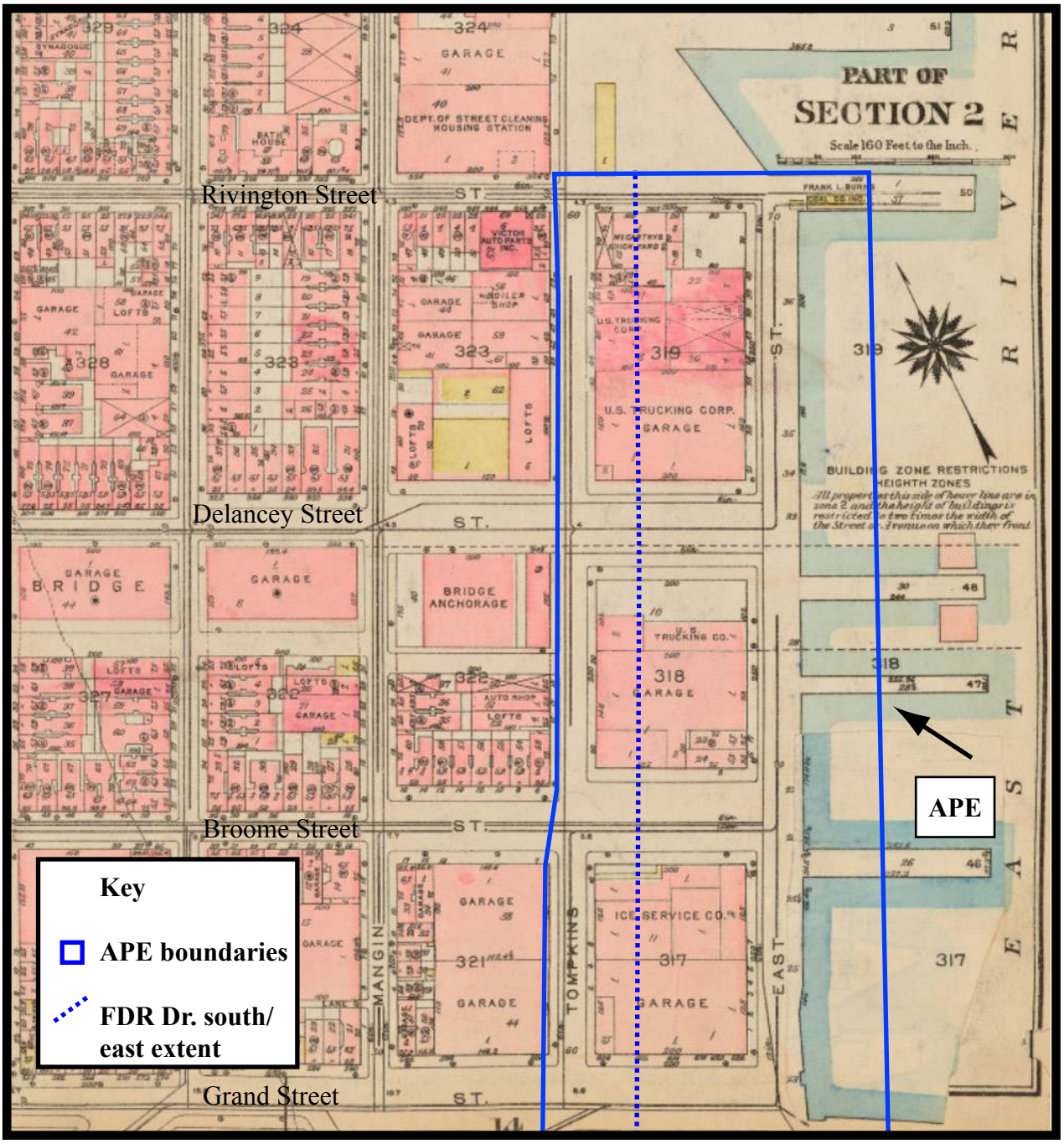


Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

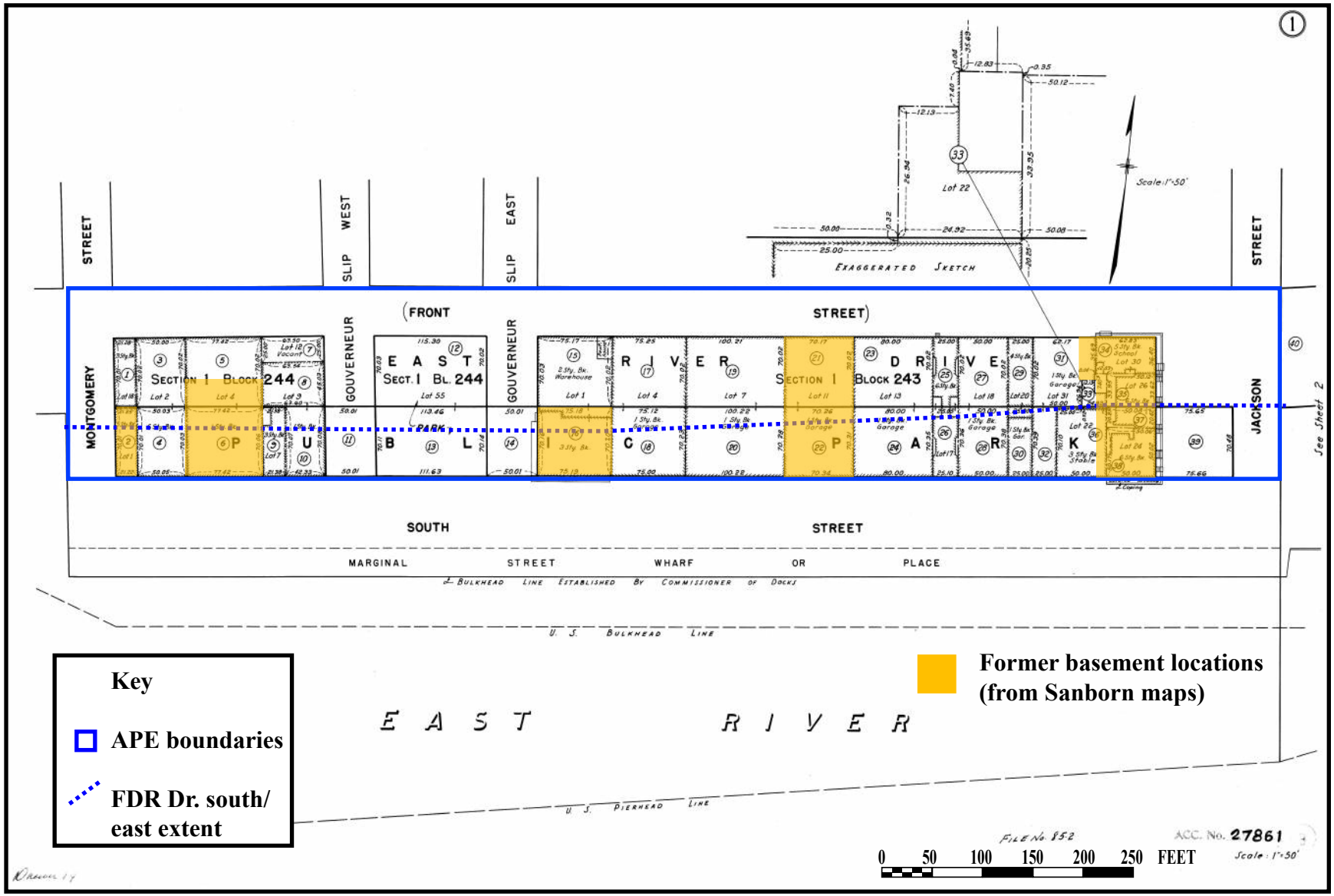
Figure 15a: Southern section of APE on *Land Book of the Borough of Manhattan, City of New York* (Bromley 1927).



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

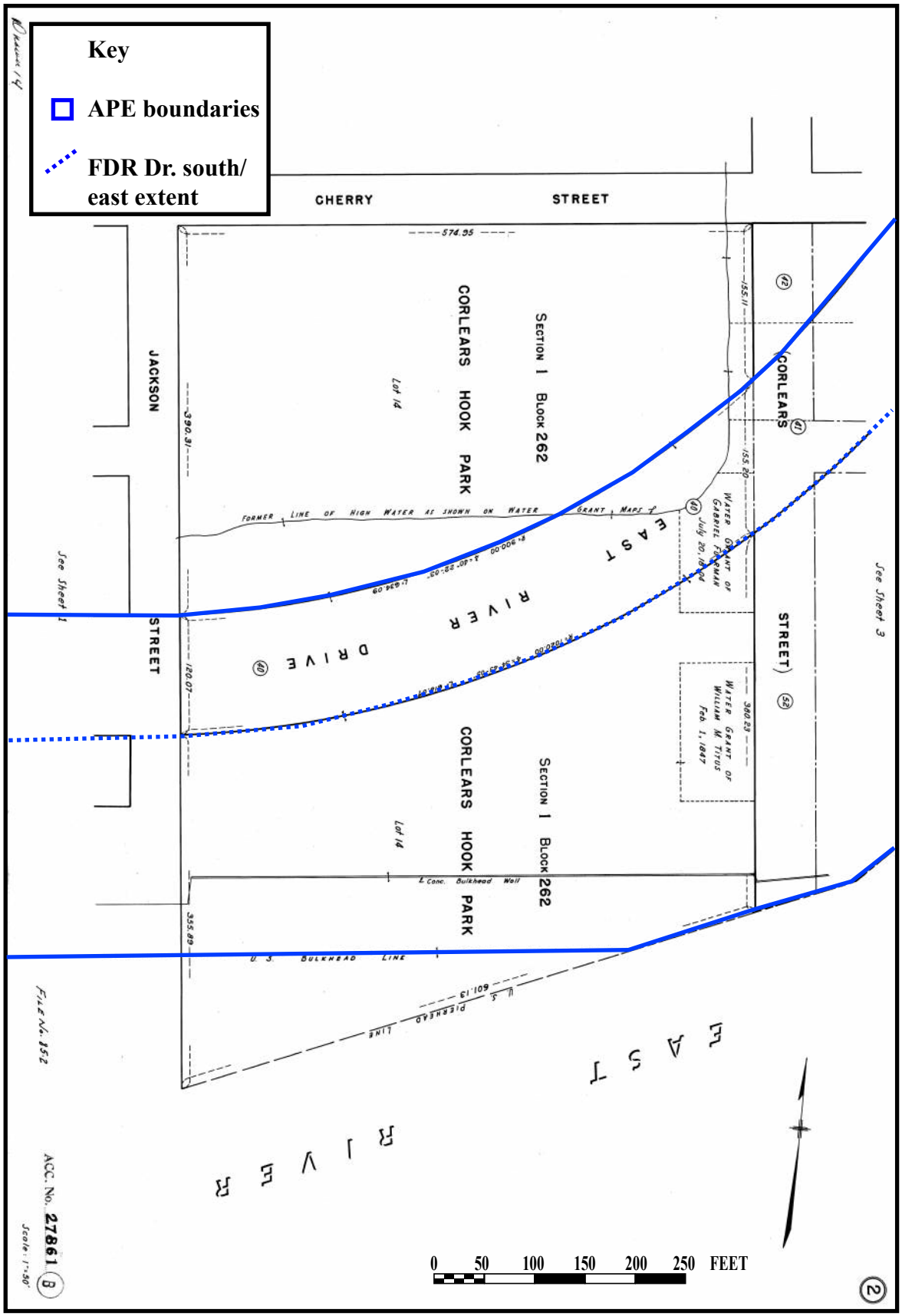
Figure 15b: Northern section of APE on *Land Book of the Borough of Manhattan, City of New York* (Bromley 1927).

0 100 200 300 400 500 FEET



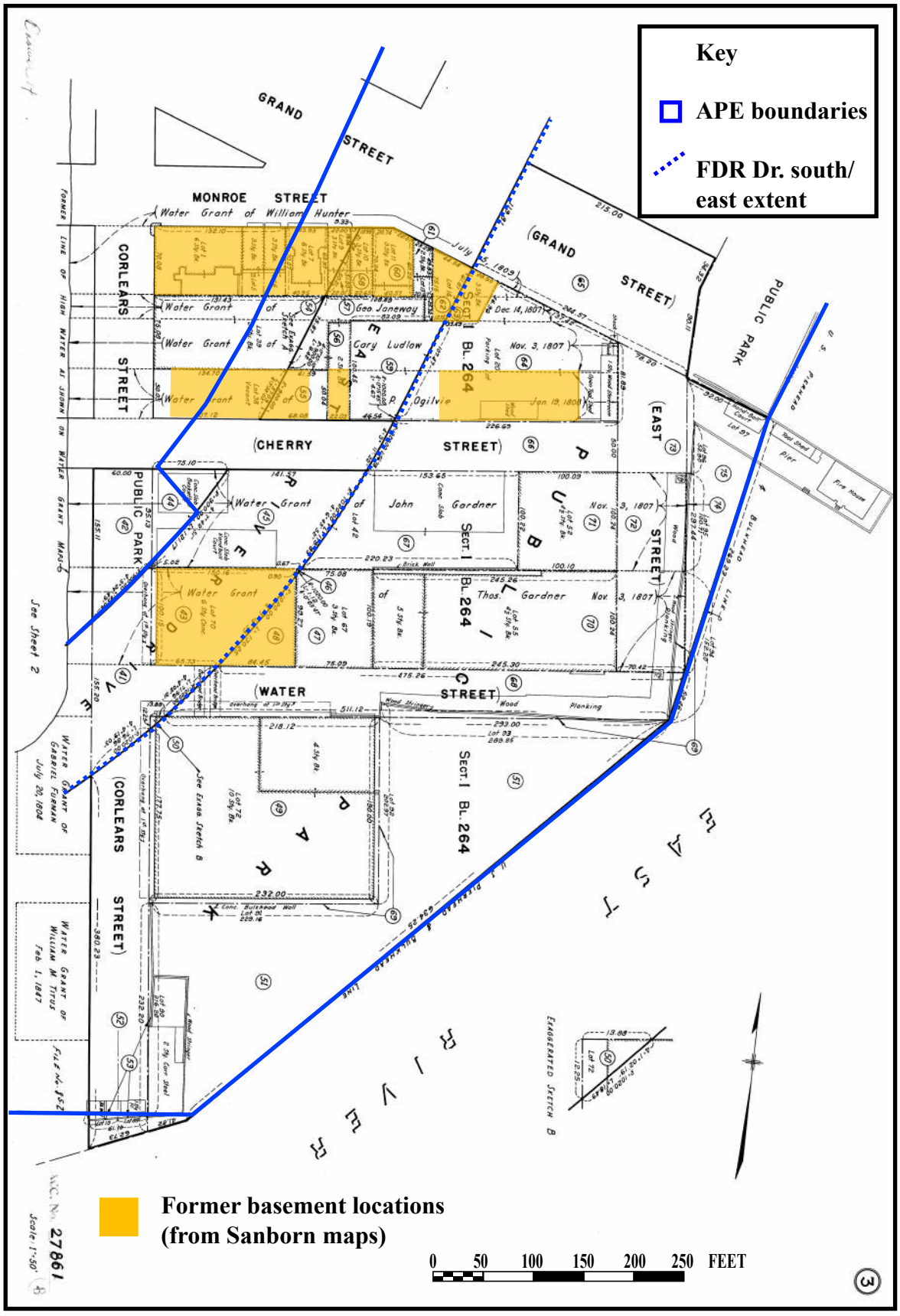
Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 16a: Montgomery Street to Jackson Street APE on *Draft Damage Map...East River Drive between Grand Street and Montgomery Street...* (Borough Works 1939).



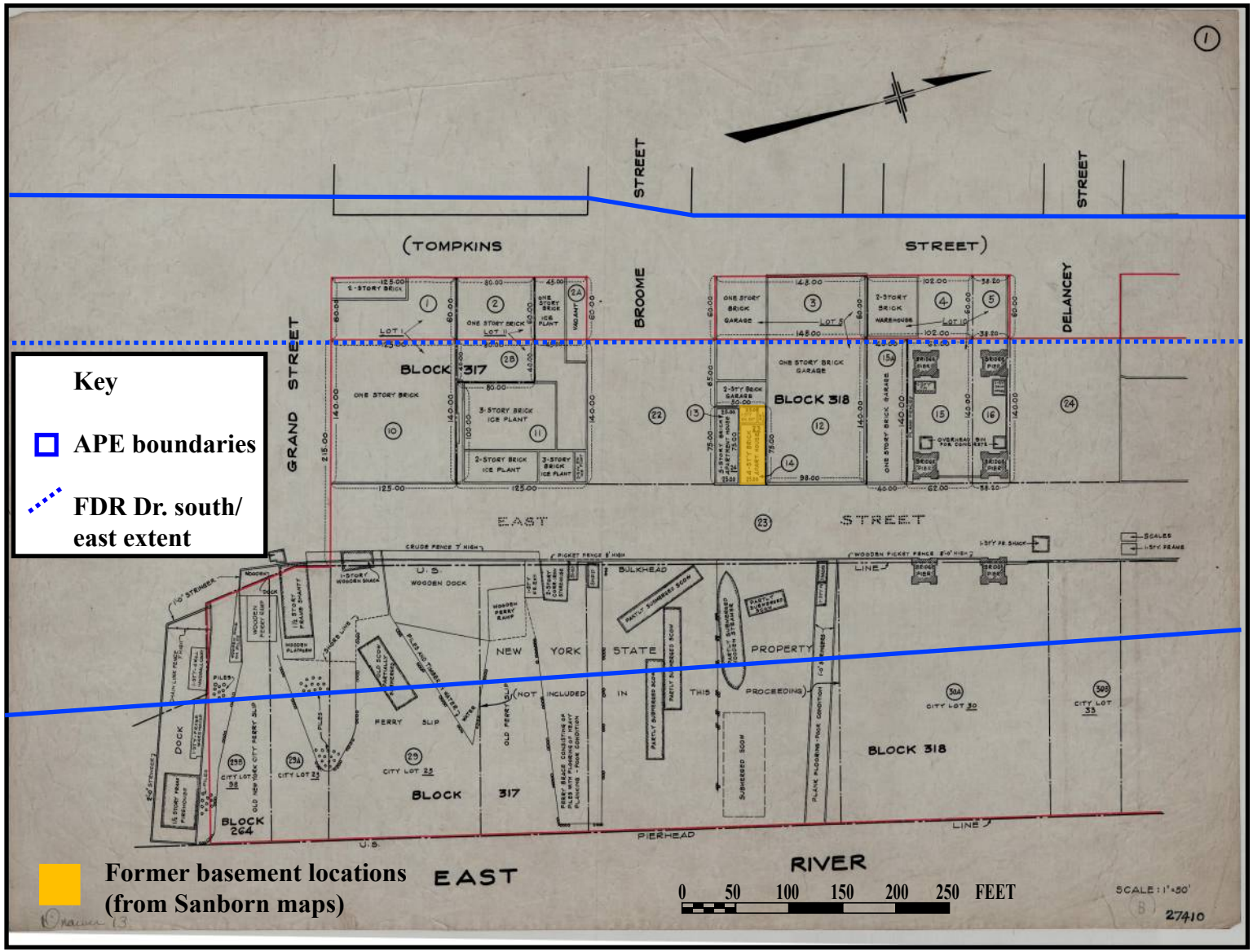
Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 16b: Jackson Street to Corlears Street APE on *Draft Damage Map...East River Drive between Grand Street and Montgomery Street...* (Borough Works 1939).



Phase IA Archaeological Documentary Study
East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 16c: Corlears Street to Grand Street APE on *Draft Damage Map...East River Drive between Grand Street and Montgomery Street...* (Borough Works 1939).



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East Side Coastal Resiliency Project
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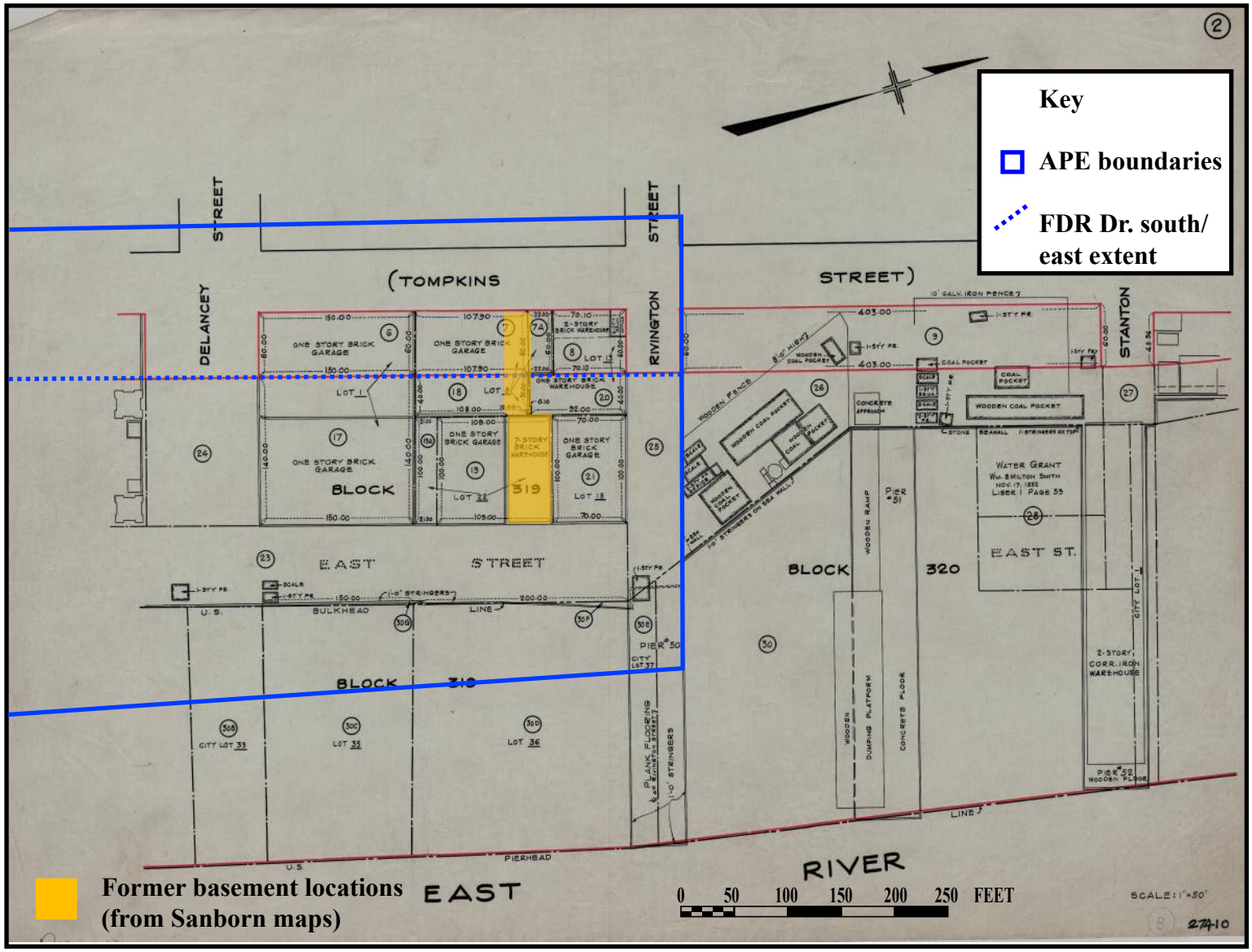
Figure 17a: Grand Street to Delancey Street APE on *Final Damage Map...East River Drive between Grand Street and East 14th Street...* (Borough Works 1936).



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East Side Coastal Resiliency Project
Montgomery Street to Rivington Street
Manhattan, New York County, New York

Figure 17b: Delancey Street to Rivington Street APE on *Final Damage Map...East River Drive between Grand Street and East 14th Street...* (Borough Works 1936).

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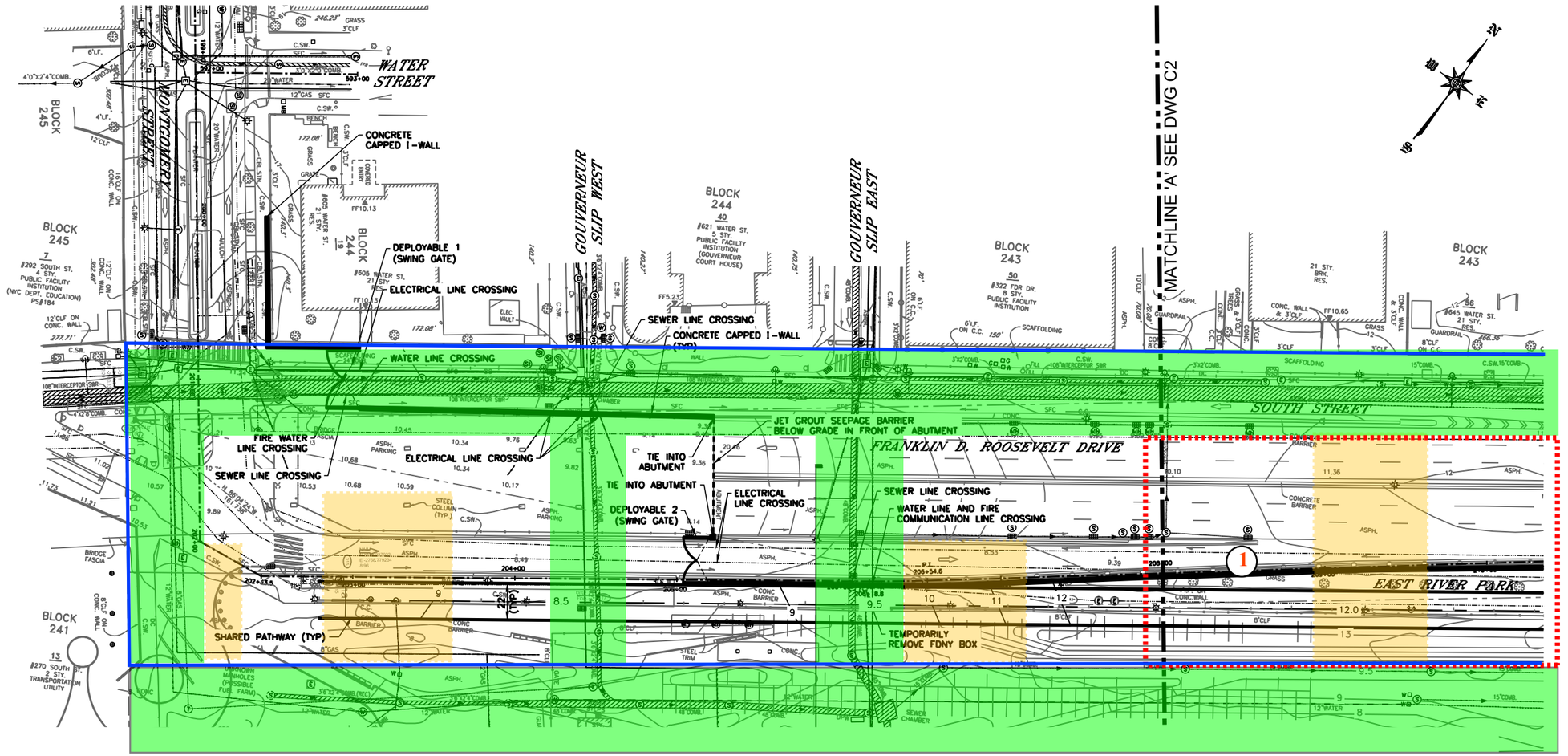

Key

APE

Former basement disturbances (8-10 feet below grade)

Potentially sensitive residential, commercial, and industrial archaeological resources in former historic blocks (1+ feet below grade; 2+ feet below grade under existing roads)

1: Oil manufactory (Perris 1852)

Former historic streets (potentially sensitive resources 1+ feet below grade; 2+ feet below grade under existing roads)

Note: all areas within APE are sensitive for landfill related resources 2+ feet below grade outside of known disturbances

Figure 18a: APE showing areas of archaeological sensitivity within former historic blocks (HPI 2016 and DDC 2015).

0 15 30 60
SCALE: 1" = 30'

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BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 15 OF 63 | C1/C26

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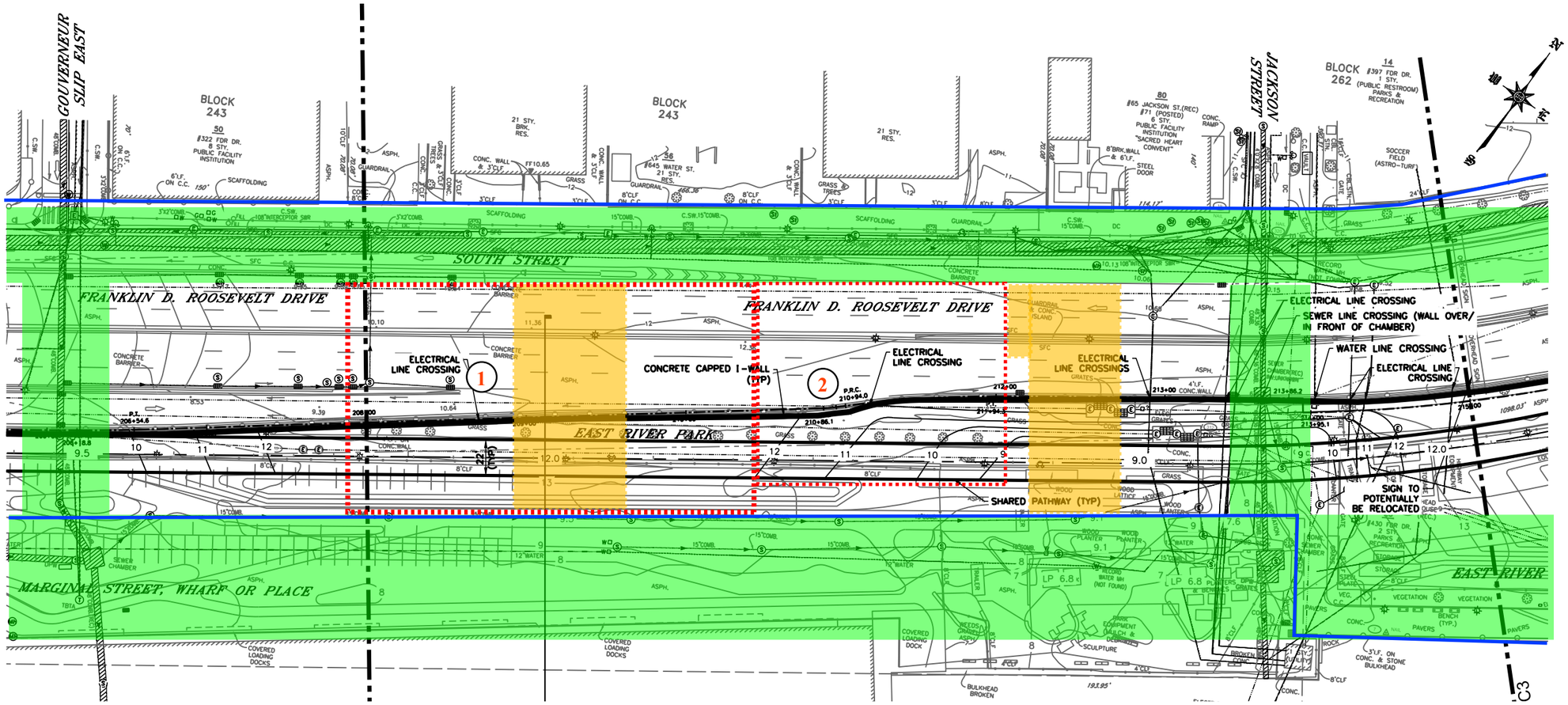

Key

APE

Former basement disturbances (8-10 feet below grade)

Potentially sensitive residential, commercial, and industrial archaeological resources in former historic blocks (1+ feet below grade; 2+ feet below grade under existing roads)

1: Oil manufactory (Perris 1852)
2: Steam Saw Mills (Perris 1852)

Former historic streets (potentially sensitive resources 1+ feet below grade; 2+ feet below grade under existing roads)

Note: all areas within APE are sensitive for landfill related resources 2+ feet below grade outside of known disturbances

Figure 18b: APE showing areas of archaeological sensitivity within former historic blocks (HPI 2016 and DDC 2015).

0 15 30 60
SCALE: 1" = 30'

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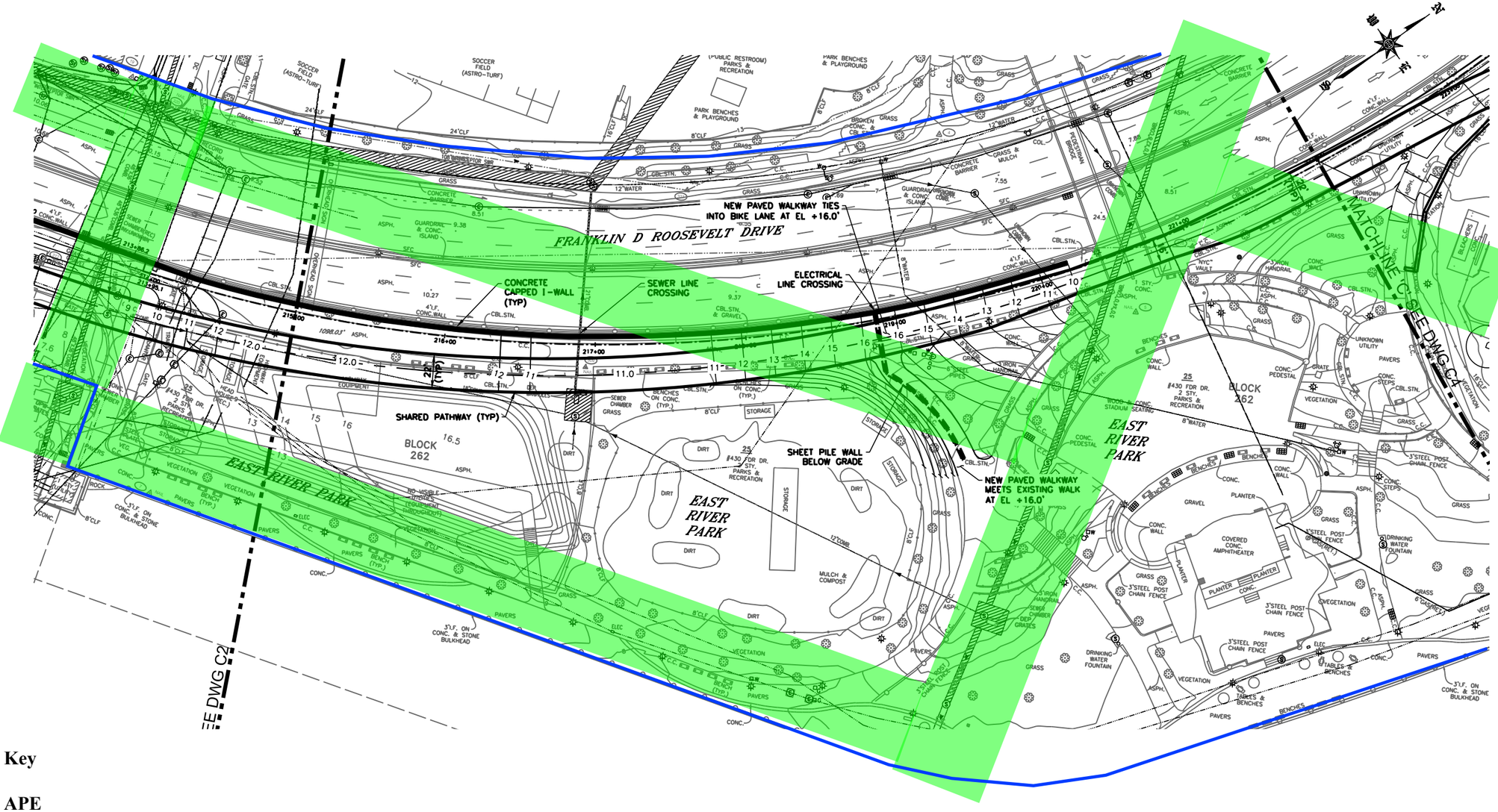

Key

APE

Former basement disturbances (8-10 feet below grade)

Potentially sensitive residential, commercial, and industrial archaeological resources in former historic blocks (1+ feet below grade; 2+ feet below grade under existing roads)

Former historic streets (potentially sensitive resources 1+ feet below grade; 2+ feet below grade under existing roads)

Note: all areas within APE southwest of amphitheater are sensitive for landfill related resources 2+ feet below grade outside of known disturbances

SCALE: 1" = 30'

Figure 18c: APE showing areas of archaeological sensitivity within former historic blocks (HPI 2016 and DDC 2015).

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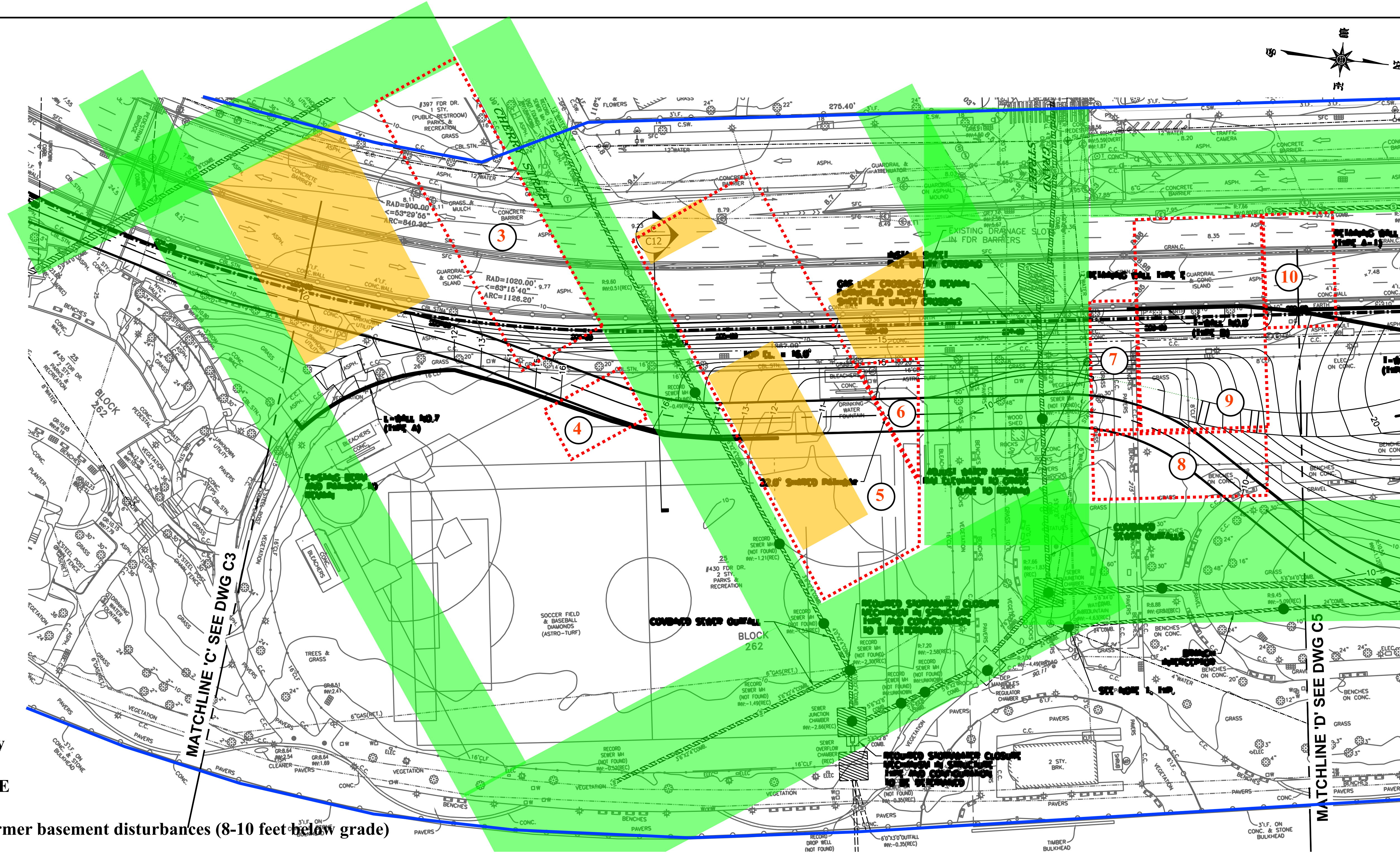

Key

APE

Former basement disturbances (8-10 feet below grade)

Potentially sensitive residential, commercial, and industrial archaeological resources in former historic blocks (1+ feet below grade; 2+ feet below grade under existing roads)

3: Fulton Foundry (Perris 1852)
4: Historic shaft features (Perris 1852)
5: Linseed Oil Factory (Perris 1852)
6: Historic shaft features (Perris 1852)
7: Historic shaft features (Perris 1852)
8: Historic shaft features (Perris 1852)
9: Saw Mills (Perris 1852)
10. Historic shaft features (Perris 1852)

Former historic streets (potentially sensitive resources 1+ feet below grade; 2+ feet below grade under existing roads)

Note: all areas within APE are sensitive for landfill related resources 2+ feet below grade outside of known disturbances

NOTES:
1) COMBINED SEWER MANHOLES ON THE FLOOD SIDE SHALL BE OUTFITTED WITH WATER-TIGHT, MANHOLE COVERS. TOTAL QUANTITY FOR REACH 1D IS 12
2) SEE DRAWING L4 FOR ADDITIONAL PARK RESTORATION AND IMPROVEMENT PLANS.

Figure 18d: APE showing areas of archaeological sensitivity within former historic blocks (HPI 2016 and DDC 2015).

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BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 SHEET 18 OF 63 C4 C25

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Key

APE

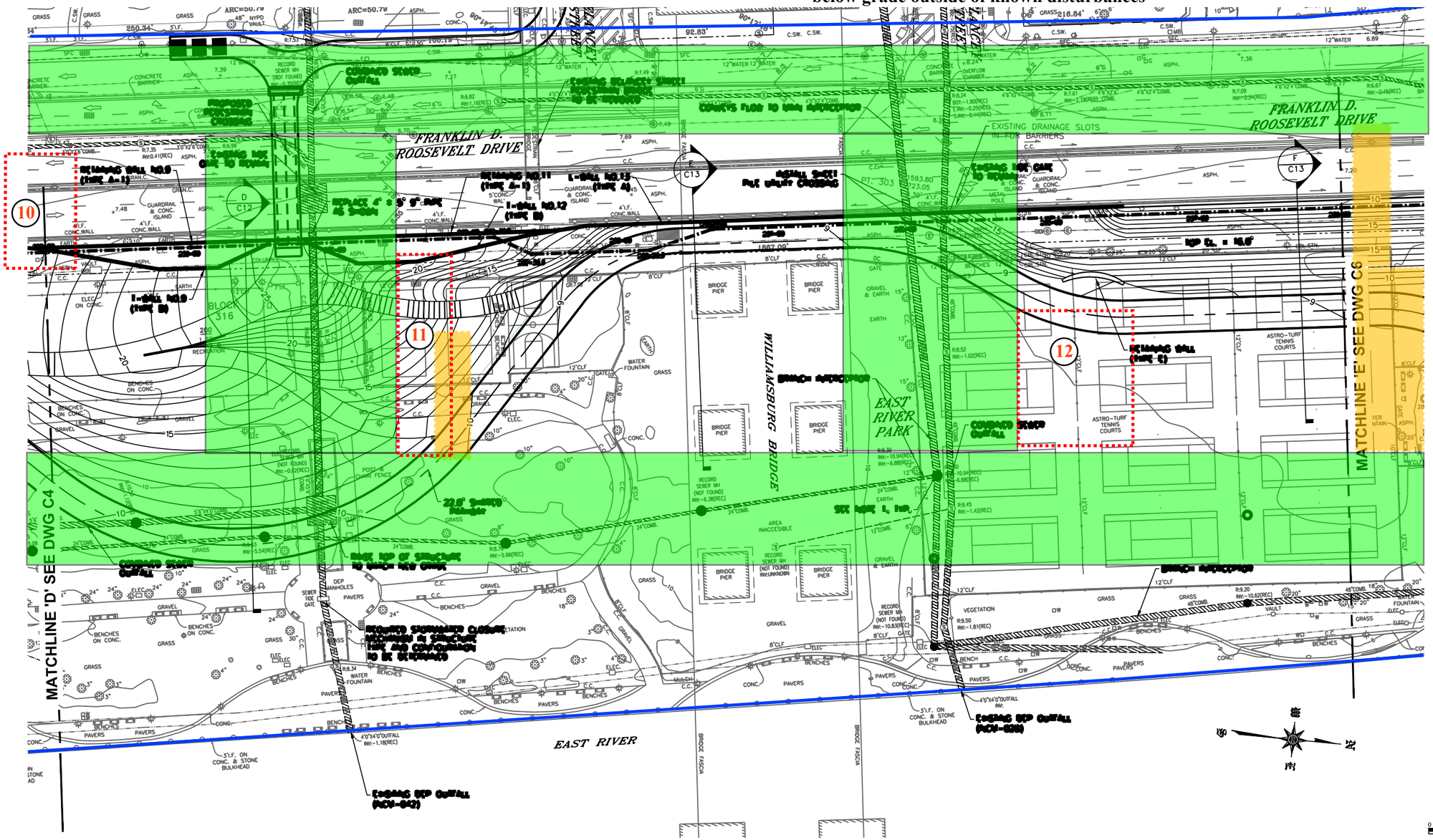
Former basement disturbances (8-10 feet below grade)

Potentially sensitive residential, commercial, and industrial archaeological resources in former historic blocks (1+ feet below grade; 2+ feet below grade under existing roads)

10-12. Historic shaft features (Perris 1852)

Former historic streets (potentially sensitive resources 1+ feet below grade; 2+ feet below grade under existing roads)

Note: all areas within APE are sensitive for landfill related resources 2+ feet below grade outside of known disturbances



NOTES:
1) COMBINED SEWER MANHOLES ON THE FLOOD SIDE SHALL BE OUTFITTED WITH WATER-TIGHT, MANHOLE COVERS. TOTAL QUANTITY FOR REACH E IS 7
2) SEE DRAWING L5 FOR ADDITIONAL PARK RESTORATION AND IMPROVEMENT PLANS.

Figure 18e: APE showing areas of archaeological sensitivity within former historic blocks (HPI 2016 and DDC 2015).

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BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 19 OF 63 | C5 C25

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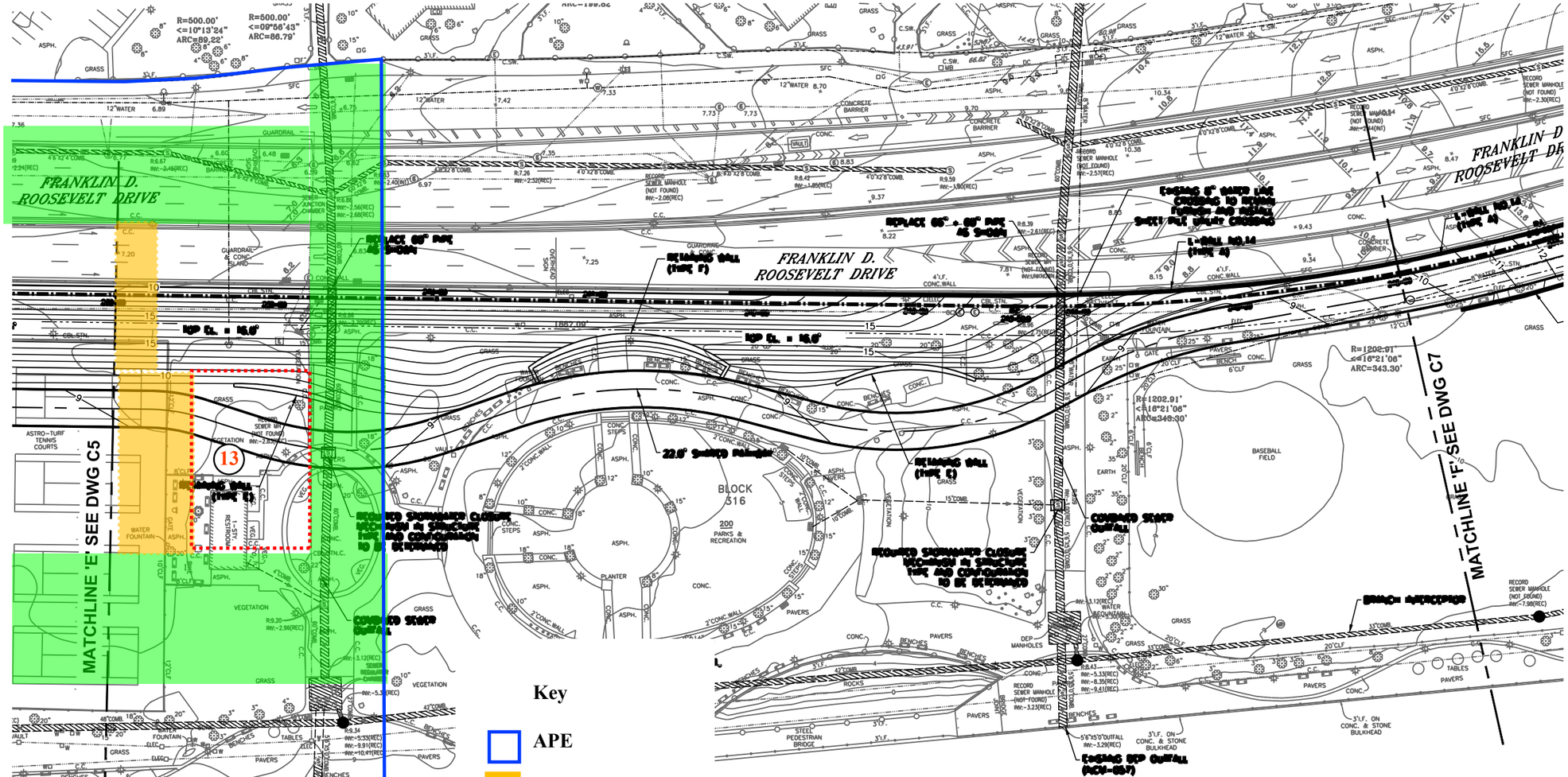

Key

APE

Former basement disturbances (8-10 feet below grade)

Potentially sensitive residential, commercial, and industrial archaeological resources in former historic blocks (1+ feet below grade; 2+ feet below grade under existing roads)

13. Historic shaft features (Perris 1852)

Former historic streets (potentially sensitive resources 1+ feet below grade; 2+ feet below grade under existing roads)

Note: all areas within APE are sensitive for landfill related resources 2+ feet below grade outside of known disturbances

0 15 30 60
SCALE: 1" = 30'

NOTES:
1) COMBINED SEWER MANHOLES ON THE FLOOD SIDE SHALL BE OUTFITTED WITH WATER-TIGHT, MANHOLE COVERS. TOTAL QUANTITY FOR REACH 1F IS 3
2) SEE DRAWING L6 FOR ADDITIONAL PARK RESTORATION AND IMPROVEMENT PLANS.

Figure 18f: APE showing areas of archaeological sensitivity within former historic blocks (HPI 2016 and DDC 2015).

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BOROUGH OF MANHATTAN

CAPITAL PROJECT NO. SANDRESM1 11/24/2015 | SHEET 20 OF 63 | C6/C25

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PHOTOGRAPHS

Photograph 1: South Street, running on north side of elevated FDR Drive. View looking southwest toward Montgomery Street in right background.

Photograph 2: Entrance to elevated FDR Drive at Montgomery Street, with Pier 42 on right. View looking northeast.

Photograph 3: Pier 42. View looking southeast.

Photograph 4: East River Bikeway between Pier 42 and FDR Drive. View looking west.

Photograph 5: Utilities in undeveloped area east of Pier 42 near Jackson Street. View looking northwest.

Photograph 6: Parking area and storage yard east of Jackson Street in East River Park. View looking east.

Photograph 7: East River Park storage yard. View looking west.

Photograph 8: Amphitheatre seating in East River Park. View looking north.

Photograph 9: Bridge connecting East River Park to Corlears Hook Park. View looking northwest.

Photograph 10: East River Bikeway and FDR Drive from Corlears Hook Park Bridge. View looking northeast.

Photograph 11: East River Park near Fire Boat House, with Grand Street in background. View looking northwest.

Photograph 12: Fire Boat House at foot of Grand Street. View looking southeast.

Photograph 13: East River Bikeway near Grand Street. View looking southwest.

Photograph 14: Williamsburg Bridge in East River Park. View looking northeast.

Photograph 15: East River Bikeway crossing by the Delancey Street Bridge and the Williamsburg Bridge. View looking northeast.

Photograph 16: Comfort station, currently out of service, with Williamsburg Bridge in background. View looking southwest.