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ARCHAEOLOGICAL OVERVIEW SURVEY
TEXAS EASTERN TRANSMISSION, LP
New Jersey-New York Expansion Project
FERC Docket No. CP11-__-000

Staten Island, Manhattan, and Ramapo, New York

Ora Elquist
Suzanne Cherau
Nichole Gillis
Gregory R. Dubell

Submitted to:

Spectra Energy Transmission, LLC
150 Warren Street
Jersey City, New Jersey 07304

Submitted by:

PAL
210 Lonsdale Avenue
Pawtucket, Rhode Island 02860

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PAL Publications

CARTOGRAPHERS
Dana M. Richardi/Jane Miller

GIS SPECIALIST
Jane Miller

GRAPHIC DESIGN/PAGE LAYOUT SPECIALISTS
Alytheia M. Laughlin/Gail M. Van Dyke

EDITOR
Ken Alber

MANAGEMENT SUMMARY

SHPO Project Review Number : OPRHP File No. 09PR05949

Involved State and Federal Agencies: FERC

Phase of Survey: IA (sensitivity assessment)

Location Information

Location: Private Parcels and Road Beds (Lambert Avenue, 3rd Avenue, Western Avenue, Richmond Terrace) in Staten Island; Sanitation Pier-Gansevoort Street and Road Beds (Hudson River Greenway, West Street, 10th Avenue) in Manhattan
Minor Civil Division: New York City – Boroughs of Manhattan and Staten Island
County: New York and Richmond

Survey Area

Length: Staten Island – 5.95 kilometers (km) (3.7 miles)
Manhattan – 1.13km (0.7 miles)
Depth: N/A
Width: 30.5 to 35.1 meters (m) (100 to 115 feet (ft)) of pipeline route workspace
Number of Acres Surveyed: Approximately 24.9 hectares (61.4 acres)
Number of Square Meters & Feet Excavated (Phase II, Phase III only): N/A
Percentage of the Site Excavated (Phase II, Phase III only): N/A

USGS 7.5 Minute Quadrangle Map: Elizabeth, Jersey City, and Arthur Kill, NJ

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

Results of Archaeological Survey

Number & name of prehistoric sites identified: N/A
Number & name of historic sites identified: N/A
Number & name of sites recommended for Phase II/Avoidance: N/A

Report Authors: Ora Elquist, Suzanne Cherau, Nichole Gillis, and Gregory R. Dubell

Date of Report: December 2010

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CHAPTER ONE

INTRODUCTION

Spectra Energy Corp (Spectra Energy) is proposing to expand its pipeline systems in the New Jersey-New York region to meet the immediate and future demand for natural gas in the largest United States metropolitan area. To accomplish this, Spectra Energy pipeline companies, Texas Eastern Transmission, LP (Texas Eastern) and Algonquin Gas Transmission, LLC (Algonquin) are seeking a Certificate of Public Convenience and Necessity (Certificate) from the Federal Energy Regulatory Commission (FERC) pursuant to Section 7(c) of the Natural Gas Act (NGA) authorizing the construction and operation of the New Jersey-New York Expansion Project (the Project or NJ-NY Project) located in New Jersey, New York, and Connecticut (Figure 1-1). The NJ-NY Project will create a new transportation path for 800,000 decatherms per day (Dth/d) of natural gas from multiple receipt points on the Spectra Energy systems to new delivery points in New Jersey and New York.

This report presents the results of an archaeological overview survey (Phase IA archaeological assessment) prepared by The Public Archaeology Laboratory, Inc. (PAL) on behalf of Spectra Energy for the **New York** portions of the NJ-NY Project. An earlier version of this report (Elquist et al. 2010) was prepared as part of the FERC Pre-Filing Application in September 2010 (FERC Docket #PF10-17-000). The New Jersey portions of the Project are addressed in a separate report. Historic architectural/industrial properties overview and identification surveys for the New Jersey and New York portions of the Project have also been conducted by PAL and are addressed in separate reports. A marine archaeological sensitivity assessment was conducted by Southeastern Archaeological Research, Inc. (SEARCH) for two areas on the edge of the Hudson River that will be impacted during horizontal directional drill (HDD) activities.

Project Description

The Project consists of approximately 20.3 miles of multi-diameter pipeline, associated pipeline support facilities, and six new metering and regulating (M&R) stations. The proposed facilities are located in New Jersey, New York, and Connecticut. The new and replacement portions of the pipeline for the Project facilities are located in a region that was heavily industrialized in the early and middle twentieth century with petroleum refining and storage facilities, railyards, and shipyards. The area for the pipeline facilities continues to be dominated by industrial and commercial facilities.

Texas Eastern Facilities

Proposed Pipeline Facilities

- Take-up/Relay – install approximately 4.8 miles of 42-inch diameter pipeline that will replace a segment of existing 12-inch and 20-inch diameter pipelines from the existing Linden Compressor Station at milepost (MP) 0.0R in Linden, New Jersey to the existing M&R Station 058 at MP 4.76R in Staten Island, New York (Figures 1-2 and 1-3);
- New Pipeline – construct approximately 15.5 miles of new 30-inch diameter pipeline from the existing M&R Station 058 at MP 4..76R through Staten Island, New York and Bayonne, Jersey City, and Hoboken, New Jersey to MP 20.04 in Manhattan, New York (Figures 1-3 through 1-6);
- Removal – remove approximately 2.4 miles of 12-inch diameter pipeline in Linden, New Jersey and Staten Island, New York and approximately 2.3 miles of 20-inch diameter pipeline in Linden, New Jersey (see figures 1-2 and 1-3); and
- Abandonment – abandon approximately 3.0 miles of 12-inch diameter pipeline in Linden, New Jersey and Staten Island, New York and 0.1 mile of 20-inch and 0.09 miles of 24-inch diameter pipeline in Linden, New Jersey (see Figures 1-2 and 1-3).

Proposed Horizontal Directional Drills

Texas Eastern will use the horizontal directional drill (HDD) methodology at several locations to construct the Project. A total of nine (9) HDDs are proposed, eight (8) of which will cross 17 waterbodies, including associated tidal wetlands in most cases. The nine (9) HDDs include (see Appendix G):

- 42-inch I-95 HDD – MP 1.90R in New Jersey, includes Piles Creek and Winians Creek and associated tributaries/tidal wetlands;
- 42-inch Arthur Kill HDD – MP 3.14R in New Jersey and New York, includes an unnamed pond;
- 42-inch Goethals Bridge HDD – MP 4.07R in New York, includes Old Place Creek and associated tidal wetlands;
- 30-inch Kill Van Kull HDD – MP 5.68R in New York and New Jersey;
- 30-inch 1st Street Alternative HDD – MP 7.86R in New Jersey, includes the Kill Van Kull;
- 30-inch Bayonne Inlet Channel HDD – MP 10.90 in New Jersey;
- 30-inch Merseles Street HDD – MP 16.43 in New Jersey;
- 30-inch 18th Street/Long Slip HDD – MP 17.9, includes Long Slip Canal; and
- 30-inch Hudson River HDD – MP 18.94 in New Jersey and New York.

The HDD method typically involves establishing land-based staging areas along both sides of the proposed crossing. The process commences with the boring of a pilot hole beneath the waterbody to the opposite bank and then enlarging the hole with one or more passes of a reamer until the hole is the necessary diameter to facilitate the pull-back (installation) of the pipeline. In the case of the Hudson River crossing and the 18th Street/Long Slip HDD, Texas Eastern will conduct a land-to-water HDD. This will involve establishing temporary staging areas on floating barges for the water side of the HDD adjacent to the river banks. The drilling process will commence in the same manner as a land-based HDD. Once the reaming passes are completed, a prefabricated pipe segment is then pulled through the hole to complete the crossing.

Proposed Launchers and Receivers / Mainline and Block Valves

- Install one (1) 42-inch diameter launcher and relocate/replace two (2) 20-inch and one (1) 36-inch diameter receiver facilities to within the existing property line of the Linden Compressor Station in Linden, New Jersey (see Figure 1-2);
- Remove two (2) 12-inch diameter launchers and related piping within the existing property line of M&R Station 187 in Linden, New Jersey (see Figure 1-2);
- Install one (1) 30-inch launcher and one (1) 30-inch diameter receiver within the proposed Jersey City M&R Station in Jersey City, New Jersey (see Figure 1-6);
- Install one (1) 30-inch diameter launcher and one (1) 42-inch diameter receiver and relocate an existing 30-inch diameter receiver within the property of M&R Station 058 in Staten Island, New York (see Figure 1-3);
- Install two (2) 30-inch remote controlled mainline valves (MLV) in Bayonne and Jersey City, New Jersey (see Figures 1-4 and 1-5); and
- Install a permanent 30-inch diameter block valve with a blind flange in an underground vault in Manhattan, New York to accommodate installation of temporary receiver facilities (see Figure 1-6). Such temporary receiver facilities include a portable pig barrel to accommodate both "smart pigging" and "cleaning pigging" of the 30-inch diameter pipeline from the Jersey City M&R Station to the Manhattan terminus.

Proposed M&R Stations

- Bayonne M&R Station – construct a new M&R station, including a gas heater and regulation, for delivery to Public Service Electric & Gas Company (PSES&G), in Bayonne, New Jersey (see Figure 1-5);
- Jersey City M&R Station – construct a new M&R station, including gas heaters and regulation, for delivery to Consolidated Edison Company of New York, Inc. (Con Edison), as well as a tap for future meter station delivery point to PSE&G, in Jersey City, New Jersey (Figure 1-7); and

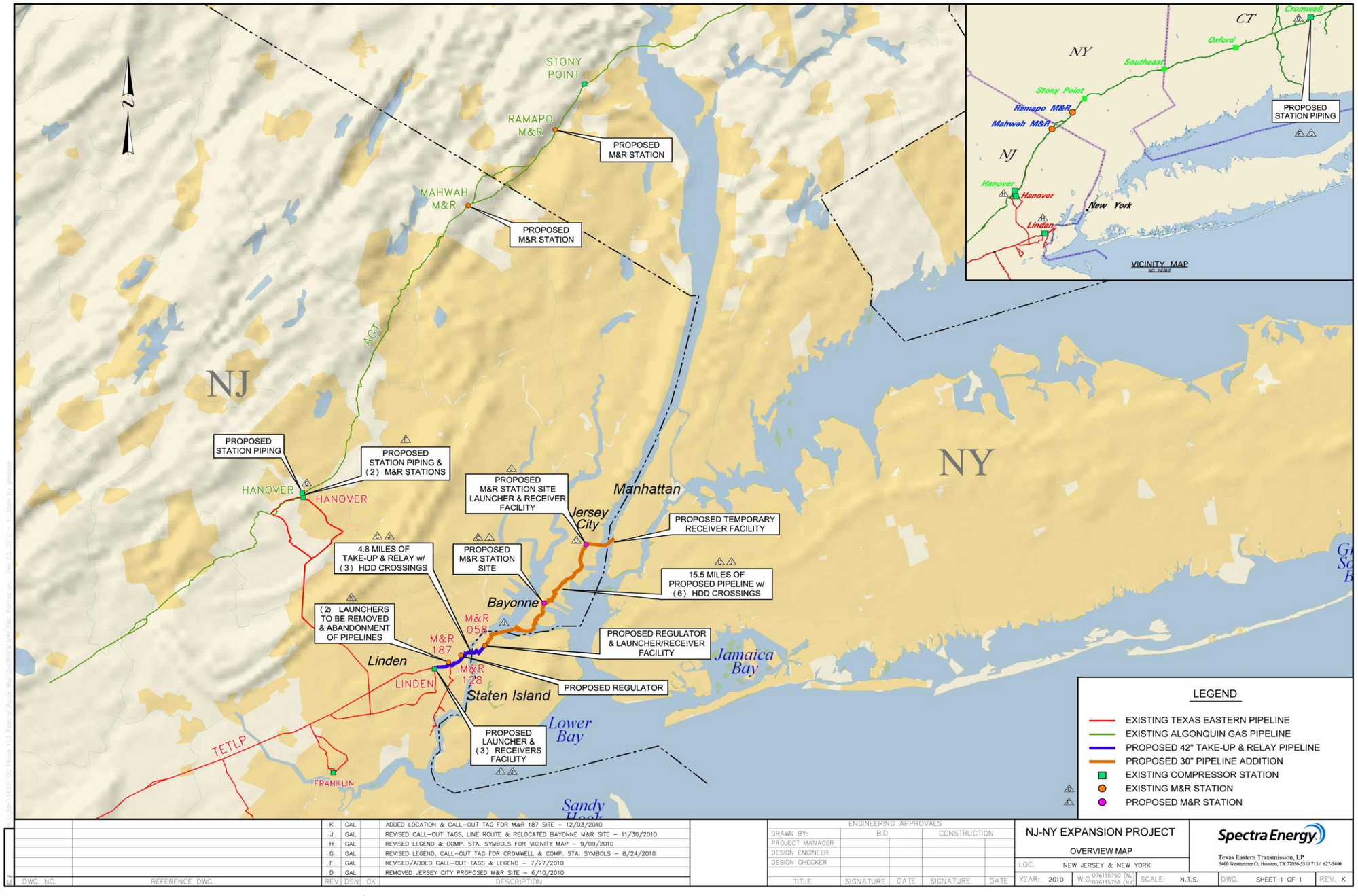

Figure 1-1. Overview map showing the various locations of the NJ-NY Project.

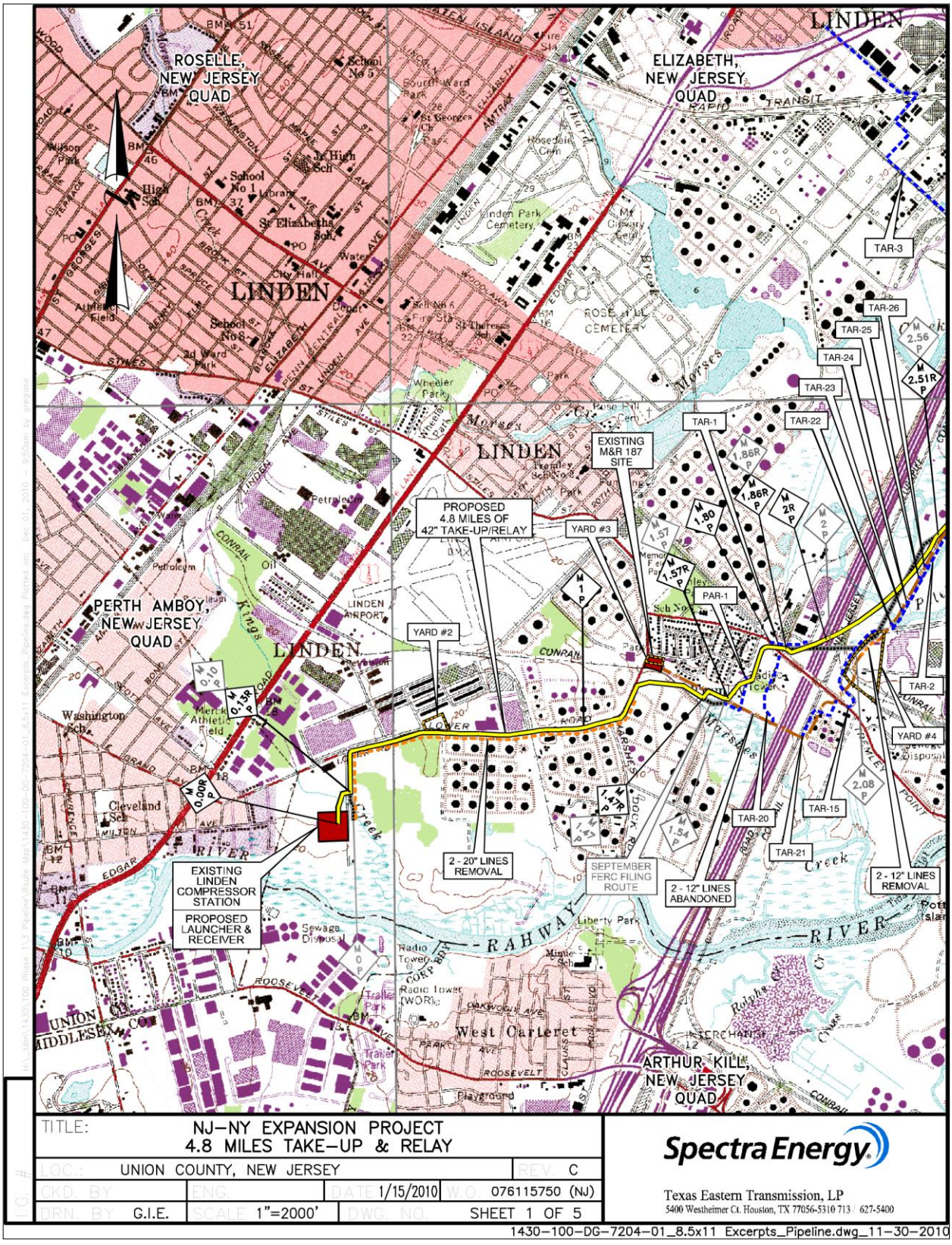

Figure 1-2. Location of the NJ-NY Project area, proposed 42-inch take-up/relay, proposed Access Roads, proposed Pipe Yards, existing Linden Compressor Station, and proposed Launcher/Receiver Facility on the Roselle, Elizabeth, Perth Amboy, and Arthur Kill, NJ, USGS topographic quadrangles, 7.5 minute series.

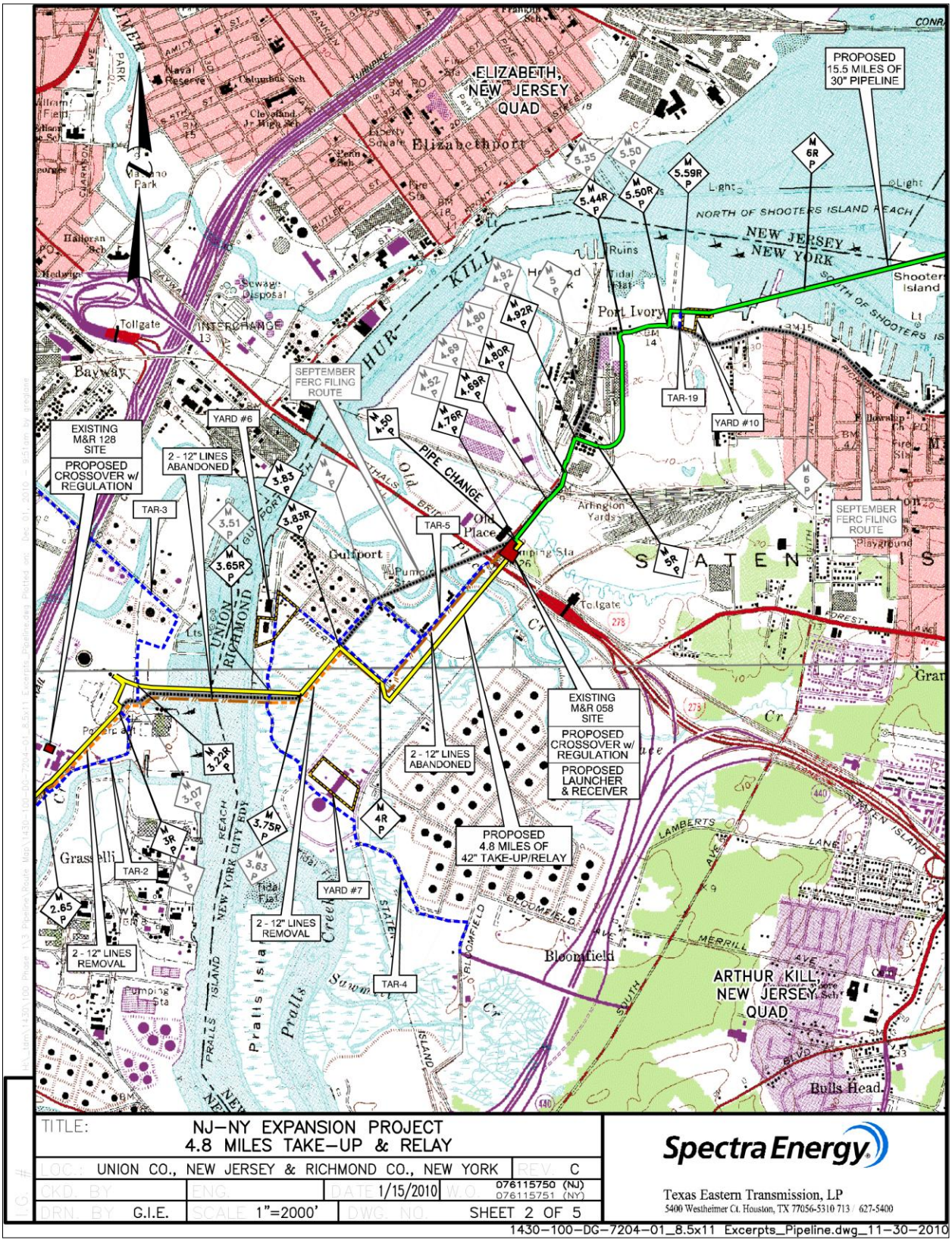

Figure 1-3. Location of the NJ-NY Project area, proposed 42-inch take-up/relay and 30-inch pipeline, existing M&R #128 and #058, proposed Access Roads, proposed Pipe Yards, and proposed Launcher/Receiver Facility on the Elizabeth and Arthur Kill, NJ, USGS topographic quadrangles, 7.5 minute series.

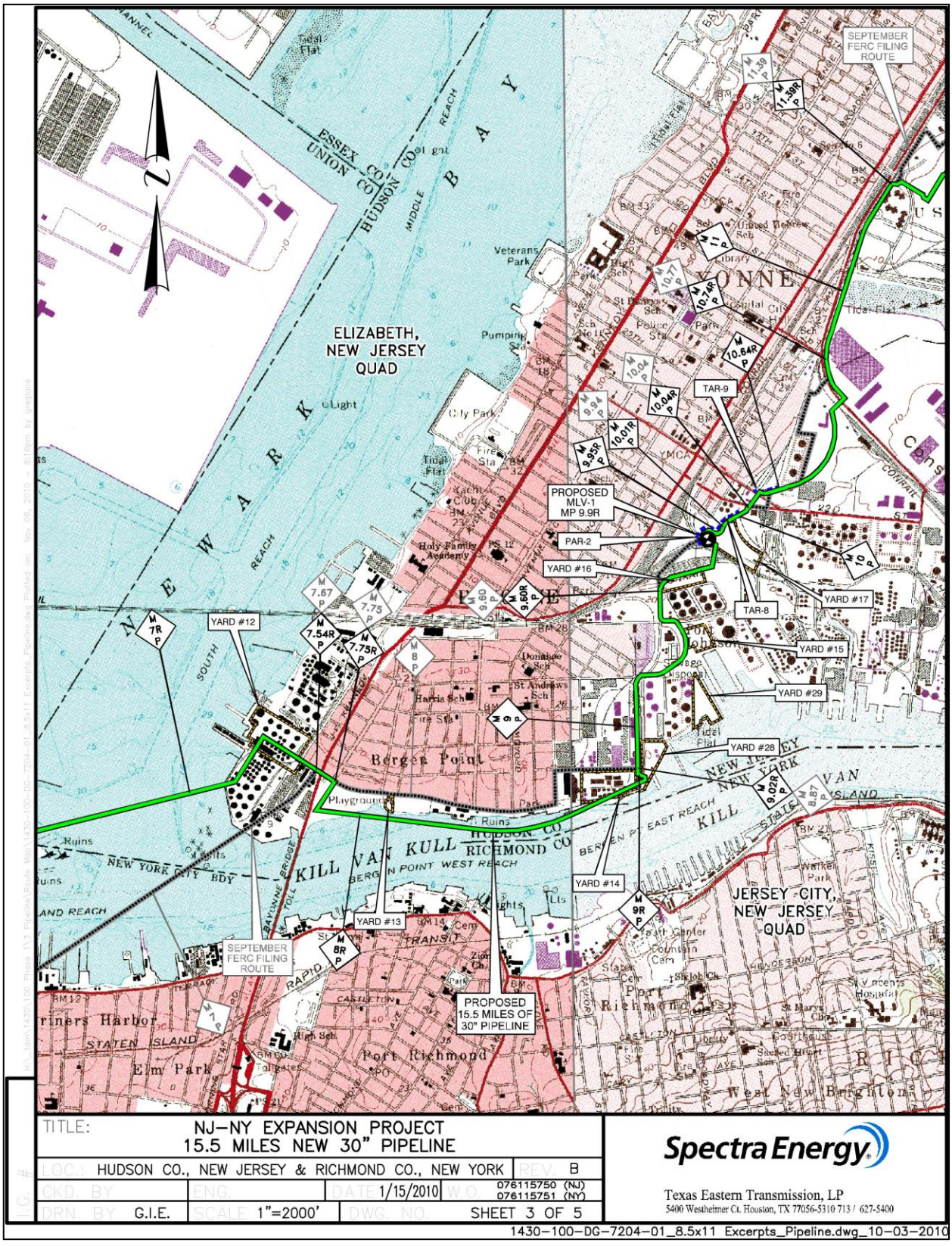

Figure 1-4. Location of the NJ-NY Project area, proposed 30-inch pipeline, proposed MLV-1, proposed Access Roads, and proposed Pipe Yards on the Elizabeth and Jersey City, NJ, USGS topographic quadrangles, 7.5 minute series.

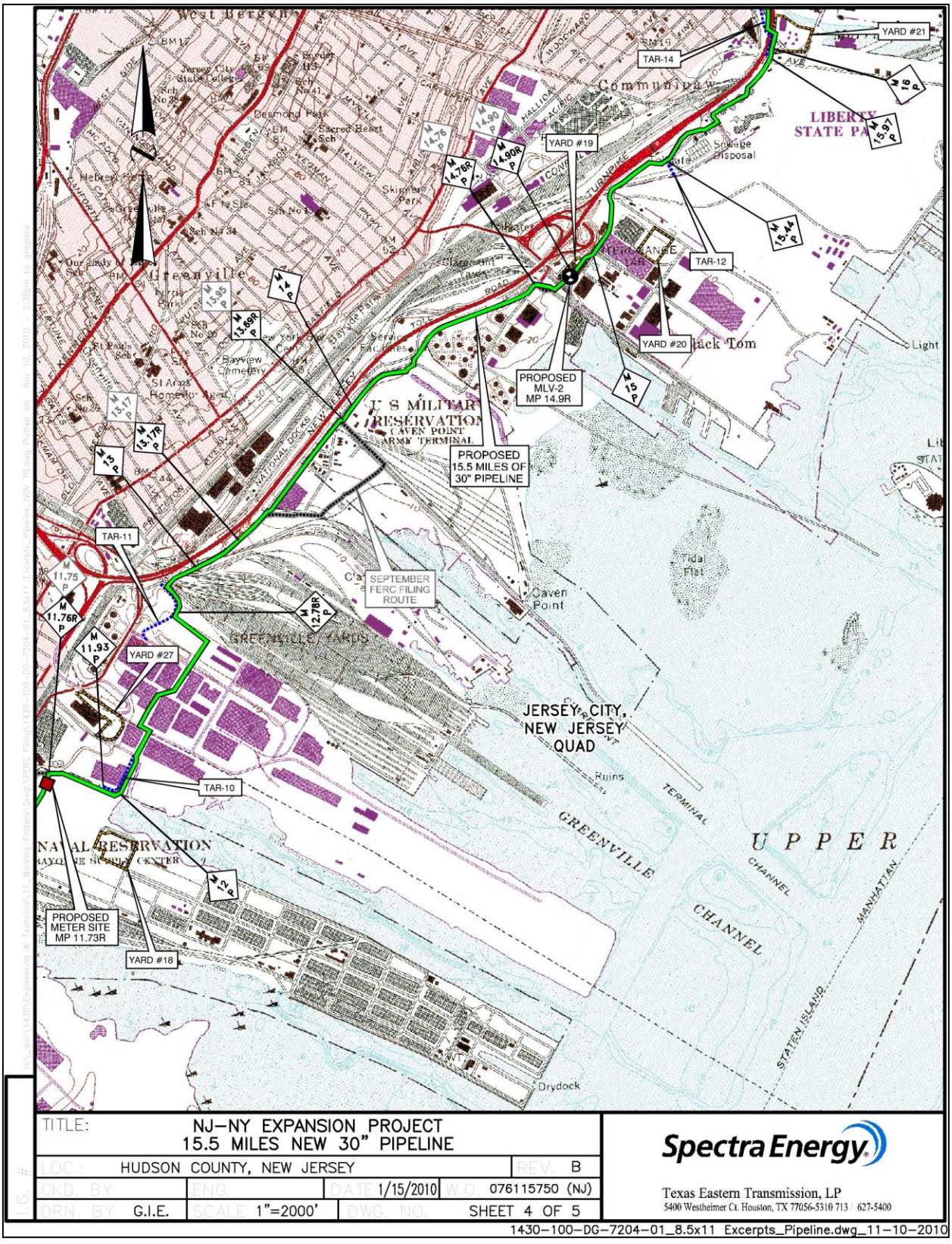

Figure 1-5. Location of the NJ-NY Project area, proposed 30-inch pipeline, proposed Bayonne M&R Station, proposed MLV-2, proposed Access Roads, and proposed Pipe Yards on the Jersey City, NJ, USGS topographic quadrangle, 7.5 minute series.

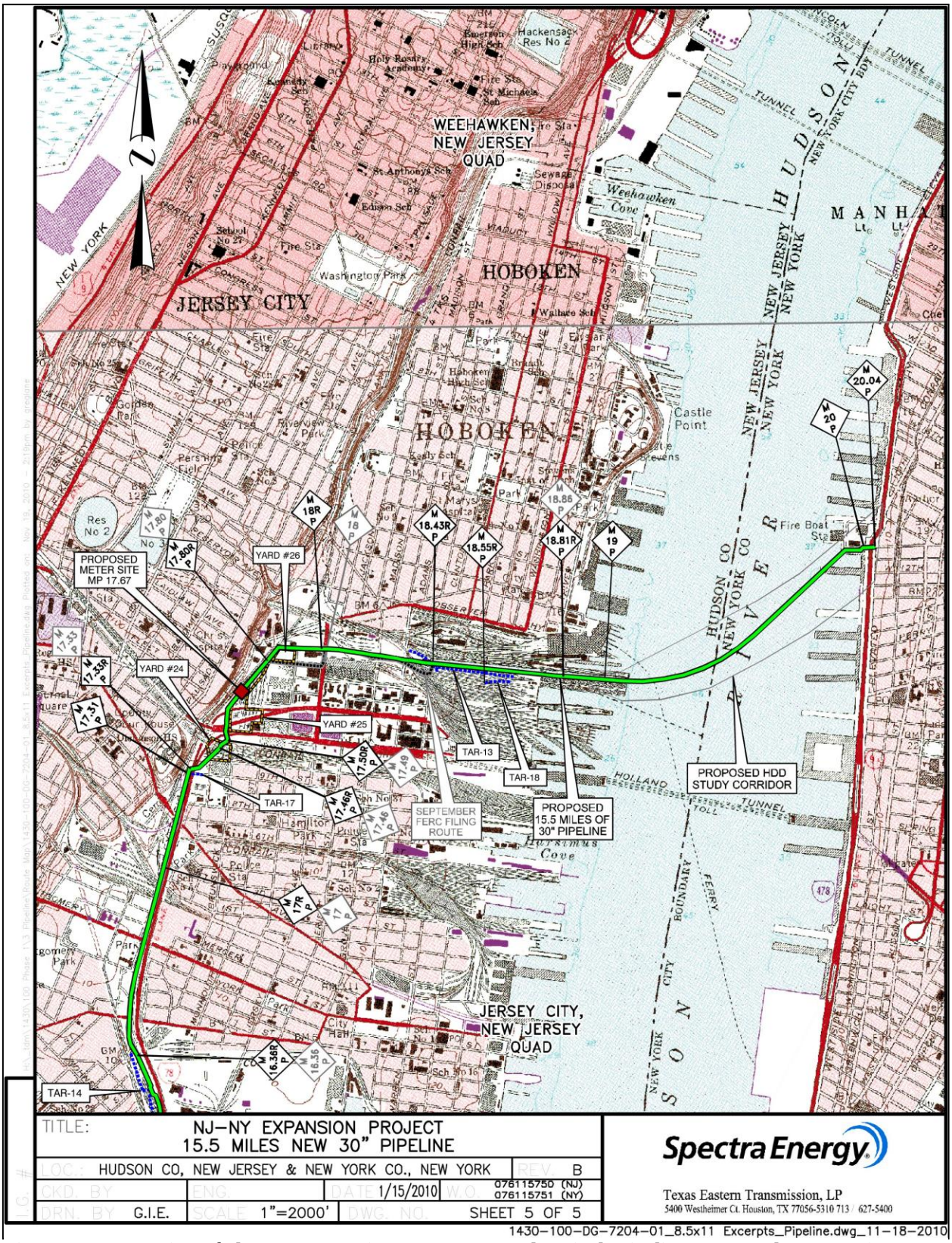

Figure 1-6. Location of the NJ-NY Project area, proposed 30-inch pipeline, proposed Jersey City M&R Station, proposed Access Roads, proposed Pipe Yards, and proposed Hudson River HDD Study Corridor on the Jersey City and Weehawken, NJ, USGS topographic quadrangles, 7.5 minute series.

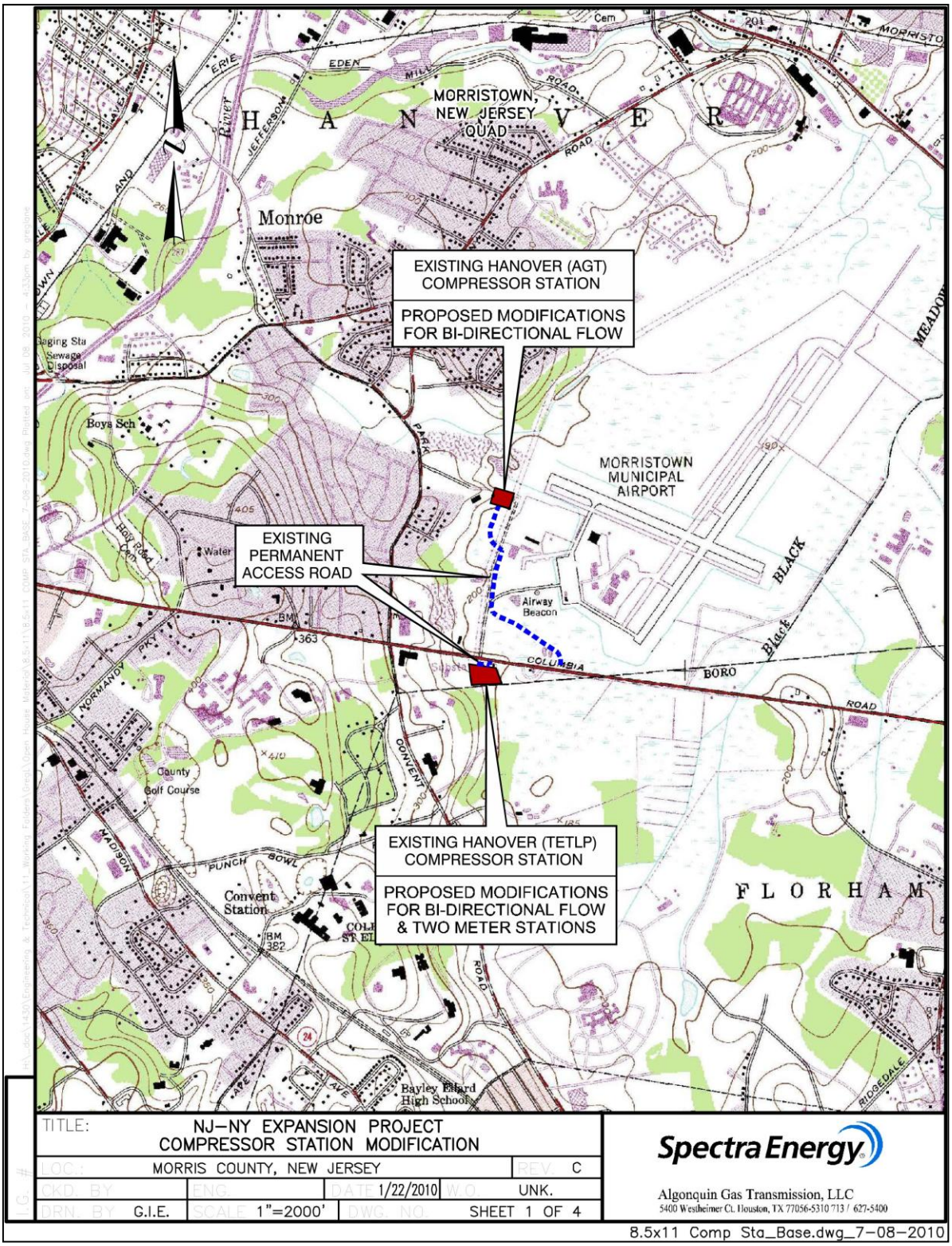

Figure 1-7. Location of the NJ-NY Project area, proposed modifications for bi-directional flow at two M&R stations at the Algonquin Gas Transmission, LLC and Texas Eastern Transmission, LP Hanover Compressor Stations and two existing permanent access roads on the Morristown, NJ, USGS topographic quadrangle, 7.5 minute series.

- Hanover M&R Stations – construct two (2) new M&R stations, including regulation, at the existing Hanover Station in Hanover, New Jersey (Figures 1-7 through 1-10).

Miscellaneous Work at Existing Facilities

- Hanover Compressor Station – install reverse suction and discharge in Hanover, New Jersey (see Figure 1-7); and
- Texas Eastern M&R Stations – install tap valves and regulation at M&R Station 128 in Linden, New Jersey and M&R Station 058 in Staten Island, New York (see Figure 1-3).

Algonquin Facilities

Proposed M&R Stations

- Mahwah M&R Station – construct a new M&R station, including gas heaters and regulation, within the property lines of the existing Mahwah M&R in Mahwah, New Jersey (Figures 1-11a through 1-11c); and
- Ramapo M&R Station – construct a new M&R station, including gas heaters and regulation, adjacent to the existing Ramapo M&R in Ramapo, New York (Figure 1-12 and 1-13).

Miscellaneous Work at Existing Facilities

- Cromwell Compressor Station – install additional yard piping to accommodate bi-directional flows in Cromwell, Connecticut (Figure 1-14 and 1-15) and Hanover, New Jersey, respectively (see Figure 1-8 and Figure 1-9b).
- Hanover Compressor Station – install additional yard piping to accommodate bi-directional flows in Hanover, New Jersey (see Figures 1-7 and 1-9).

A significant portion of the approximate 20.3 miles of the proposed pipeline facilities will be within existing right-of-way (ROW), consisting of pipeline ROW owned by Texas Eastern, public roadways, railways, and/or other utility ROW.

Construction Right-of-Way

The amount of land required to construct a pipeline depends on a number of factors, including the type of construction technique being employed, the topography of the area being worked in, and the current land-use along the pipeline route. In general, Spectra Energy proposes to use a minimum 100- to 115-foot-wide construction ROW based on detailed evaluation of a variety of conditions experienced during the construction and installation of other pipeline systems in New Jersey and New York.

Access Roads

The proposed Project is readily accessible by an extensive system of roads, including private, local, collector, and arterial roads. Spectra Energy has identified 25 roads (two permanent access roads [PAR] and 23 temporary access roads [TAR]) along the proposed pipeline route for use during construction (see Figures 1-2 through 1-6). All existing road surfaces are either dirt, gravel, or asphalt and no upgrades for any of the proposed access roads along the pipeline portion of the Project will be necessary.

Spectra Energy has also identified existing PARs at the two Hanover Compressor Stations, one existing PAR and one proposed TAR at the Mahwah M&R station, one existing TAR and one proposed TAR to be used during construction at the Ramapo M&R station, and one existing PAR at the Cromwell Compressor Station for use during construction.

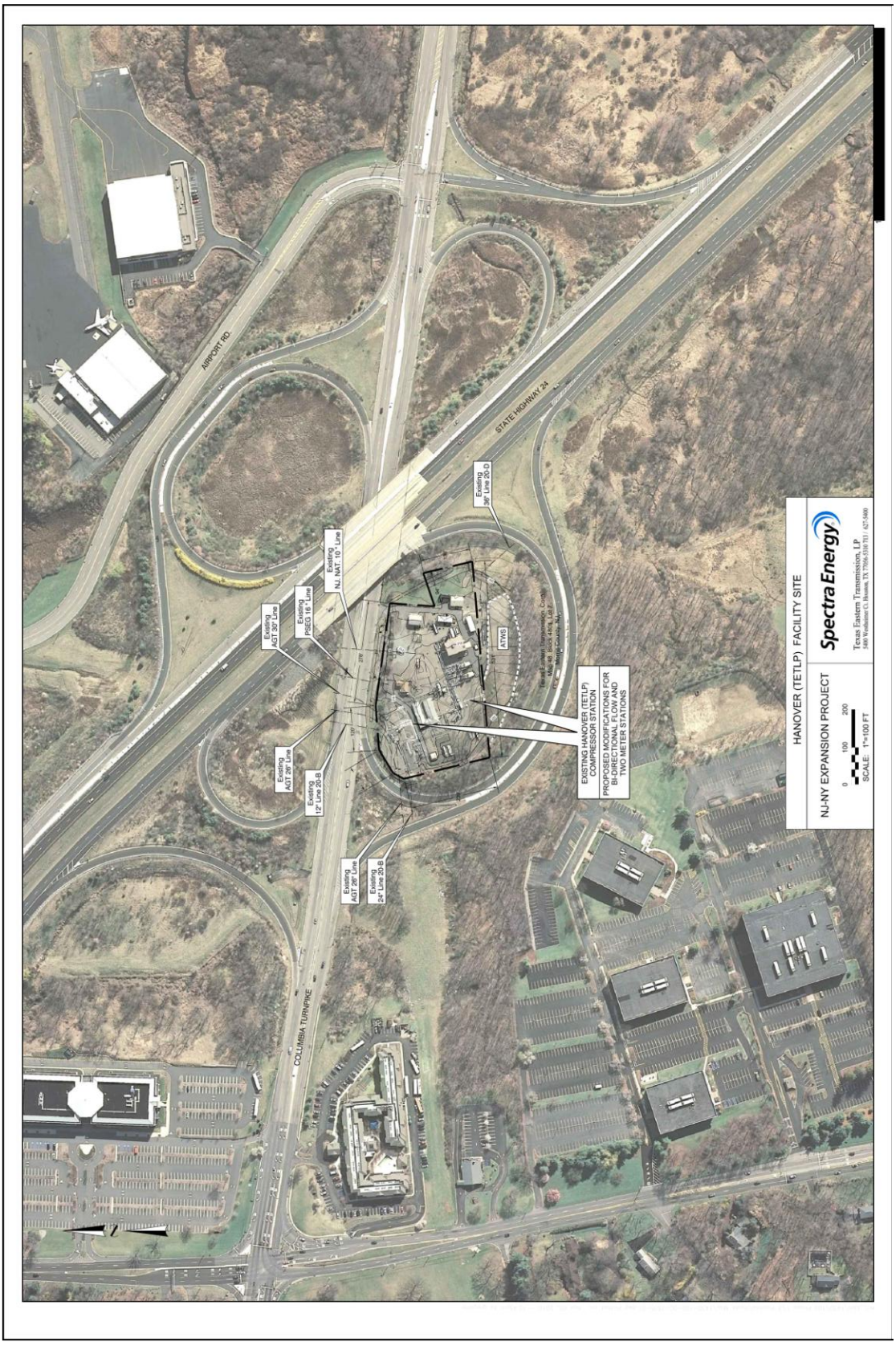

Figure 1-8. Location of the NJ-NY Project area, existing Texas Eastern Transmission, LP Hanover Compressor Station, aerial locus map.

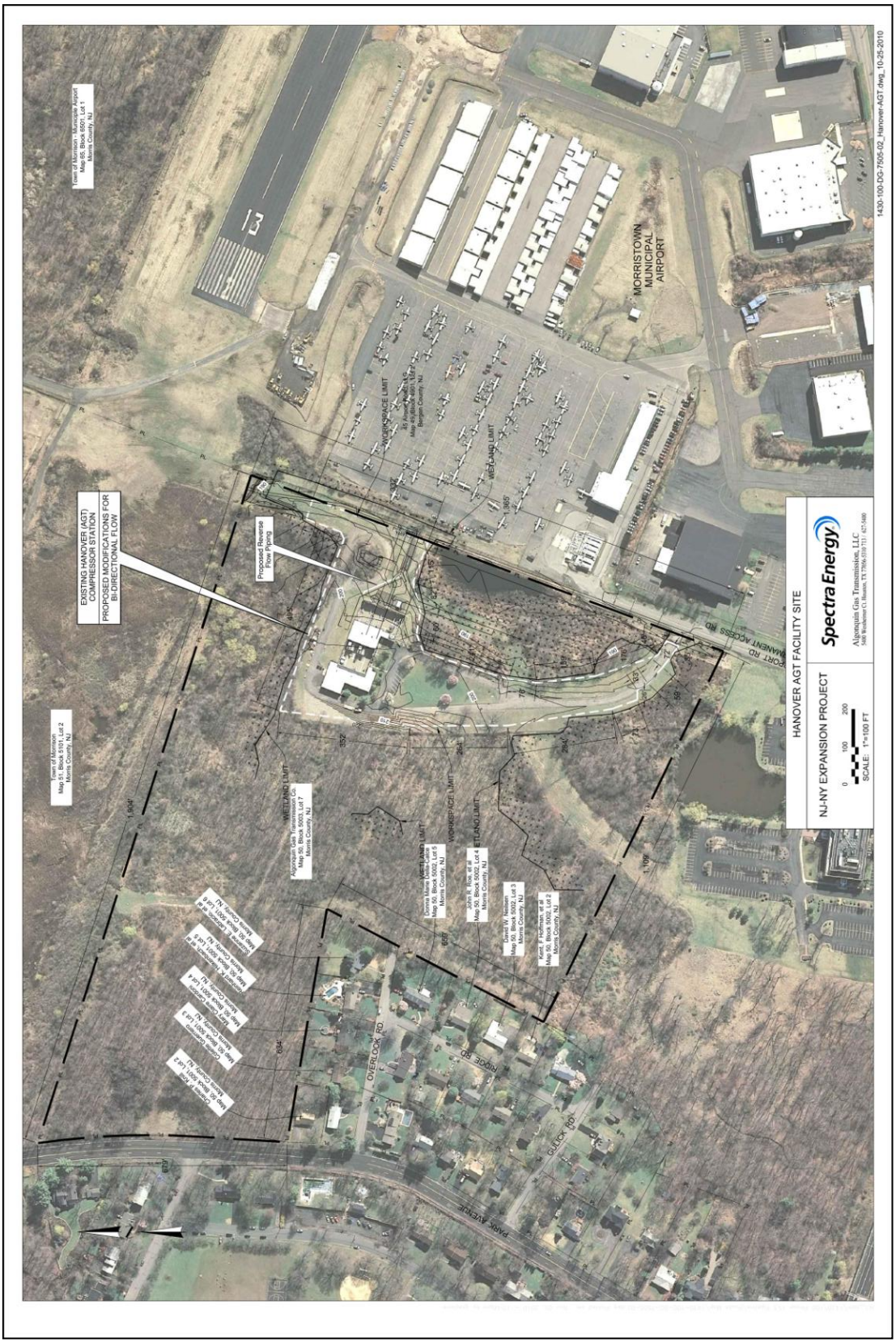

Figure 1-9. Location of the NJ-NY Project area, existing Algonquin Gas Transmission, LLC Hanover Compressor Station, aerial locus map.

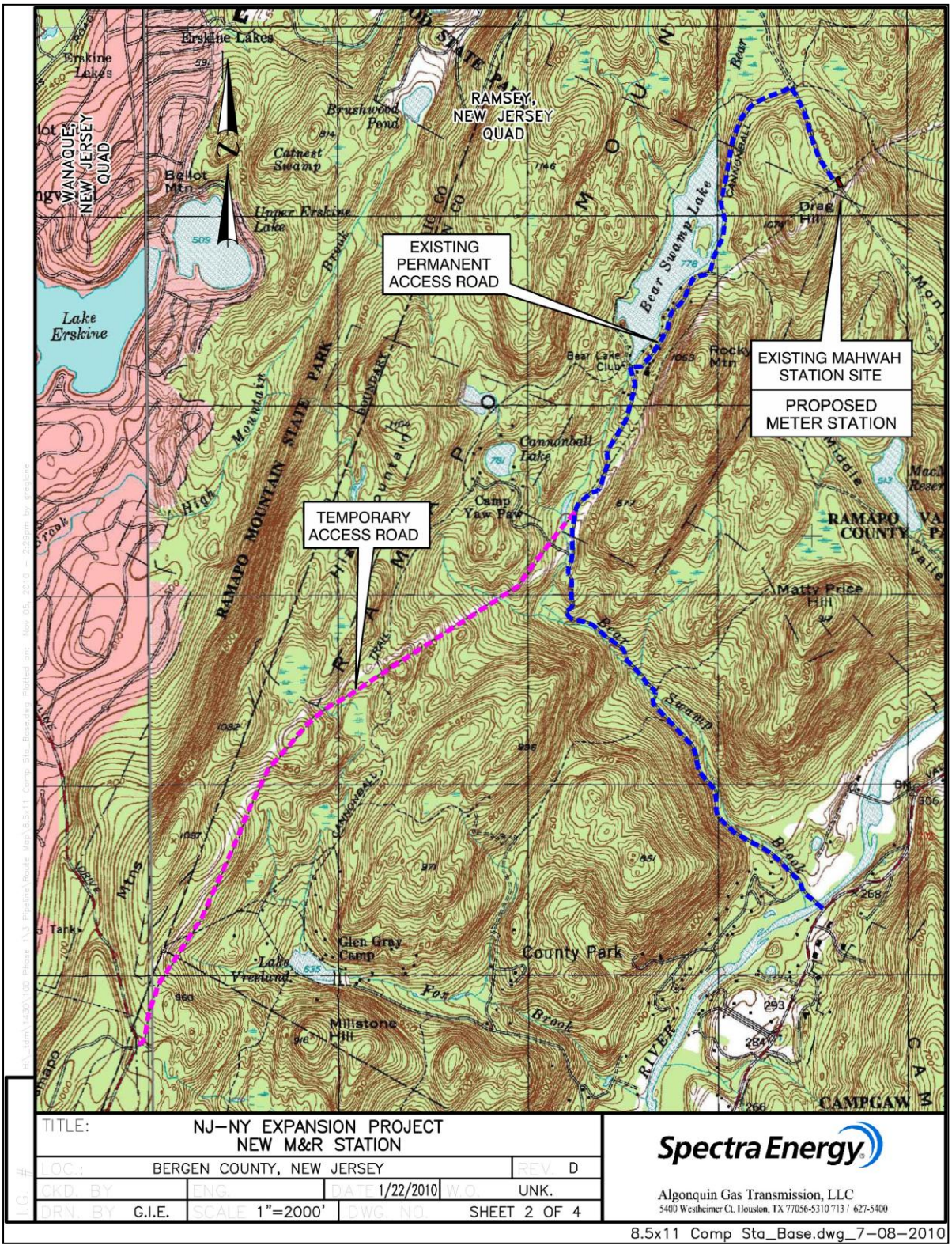

Figure 1-10. Location of the NJ-NY Project, proposed M&R station at the existing Mahwah M&R Station, existing permanent access road, and proposed temporary access road on the Ramsey, NJ, USGS topographic quadrangle, 7.5 minute series.

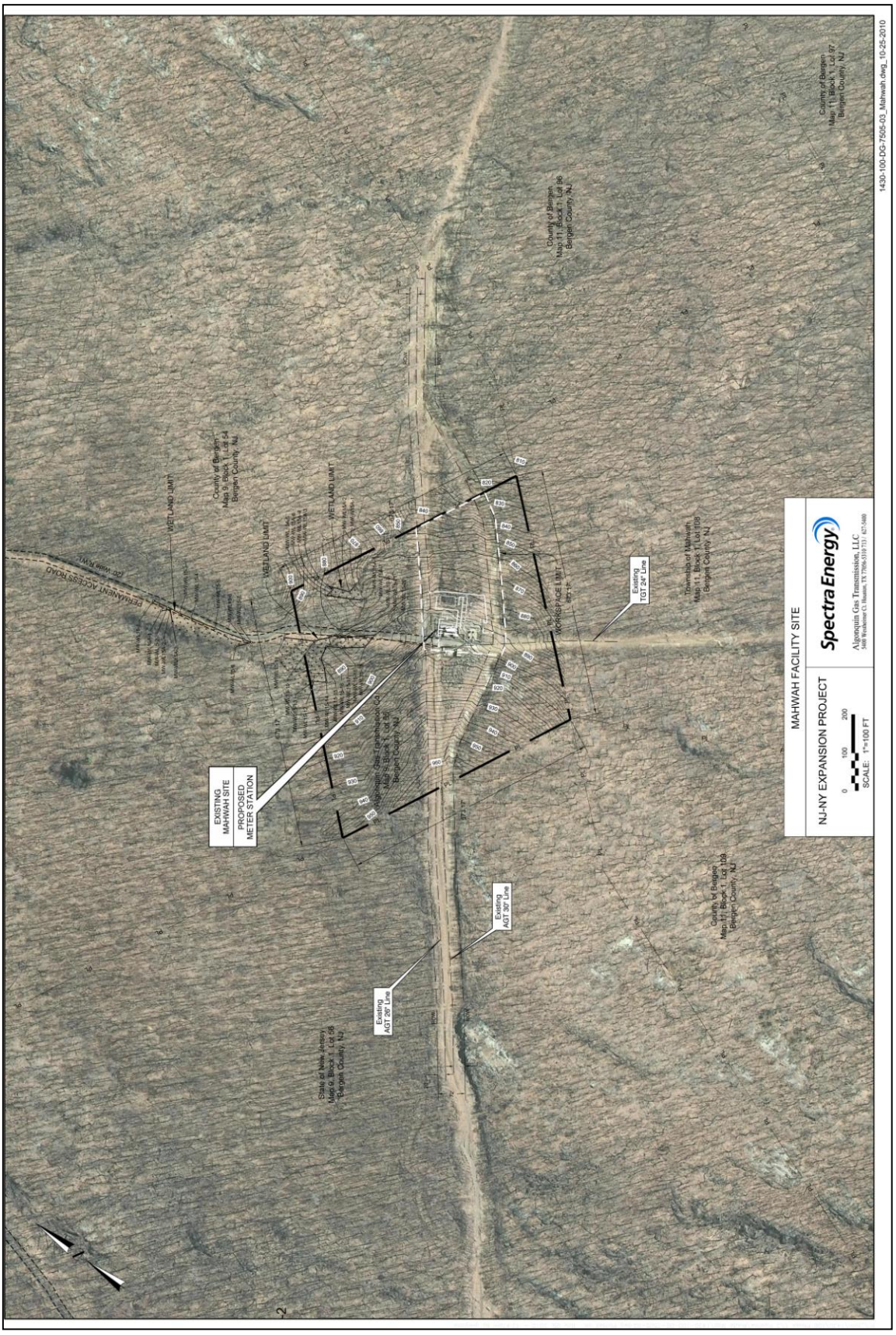

Figure 1-11a. Location of the NJ-NY Project, existing Algonquin Gas Transmission, LLC Mahwah M&R Station, aerial locus map.

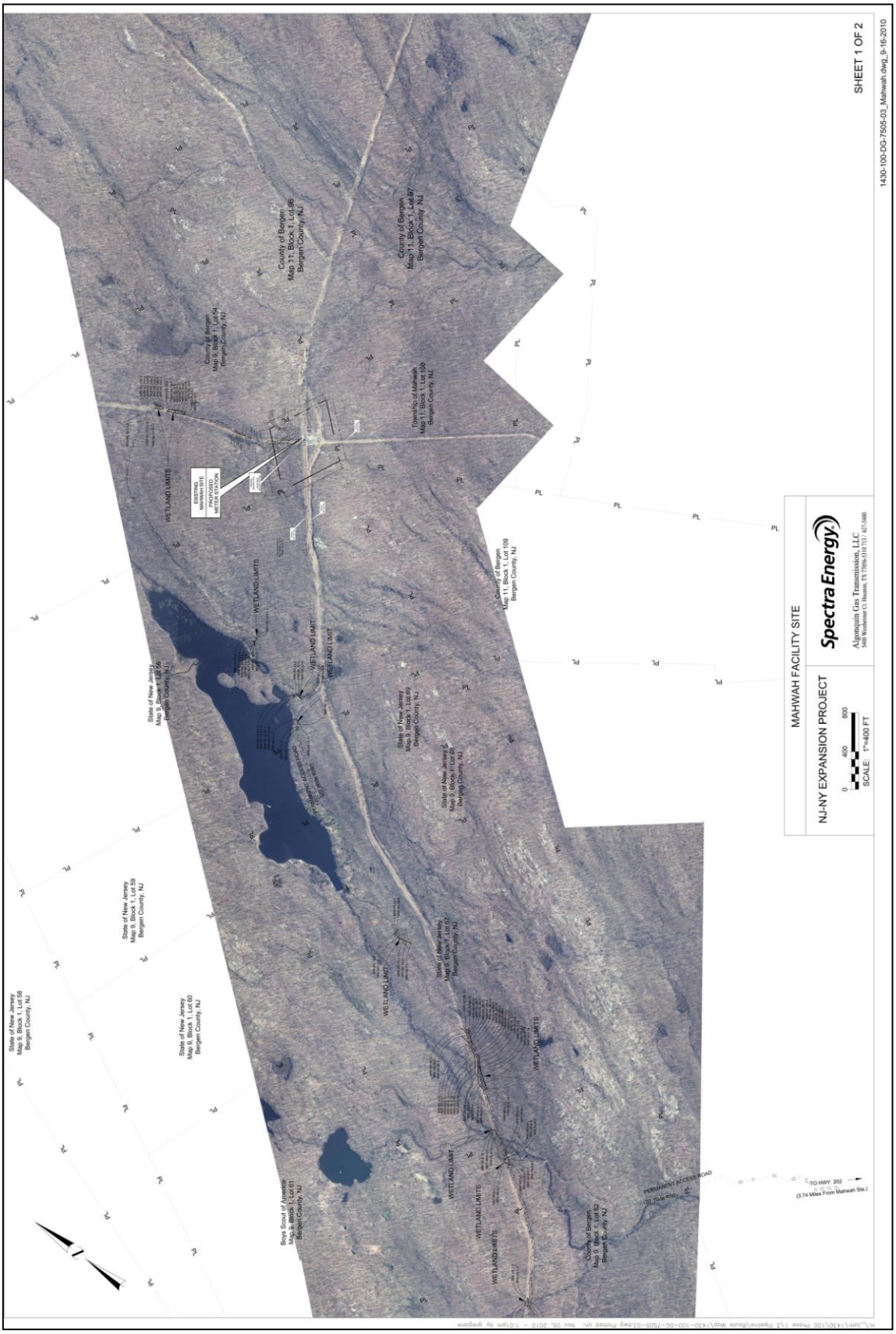

Figure 1-11b. Location of the NJ-NY Project, existing Algonquin Gas Transmission, LLC Mahwah M&R Station along with existing permanent access road and proposed temporary access road, aerial locus map.

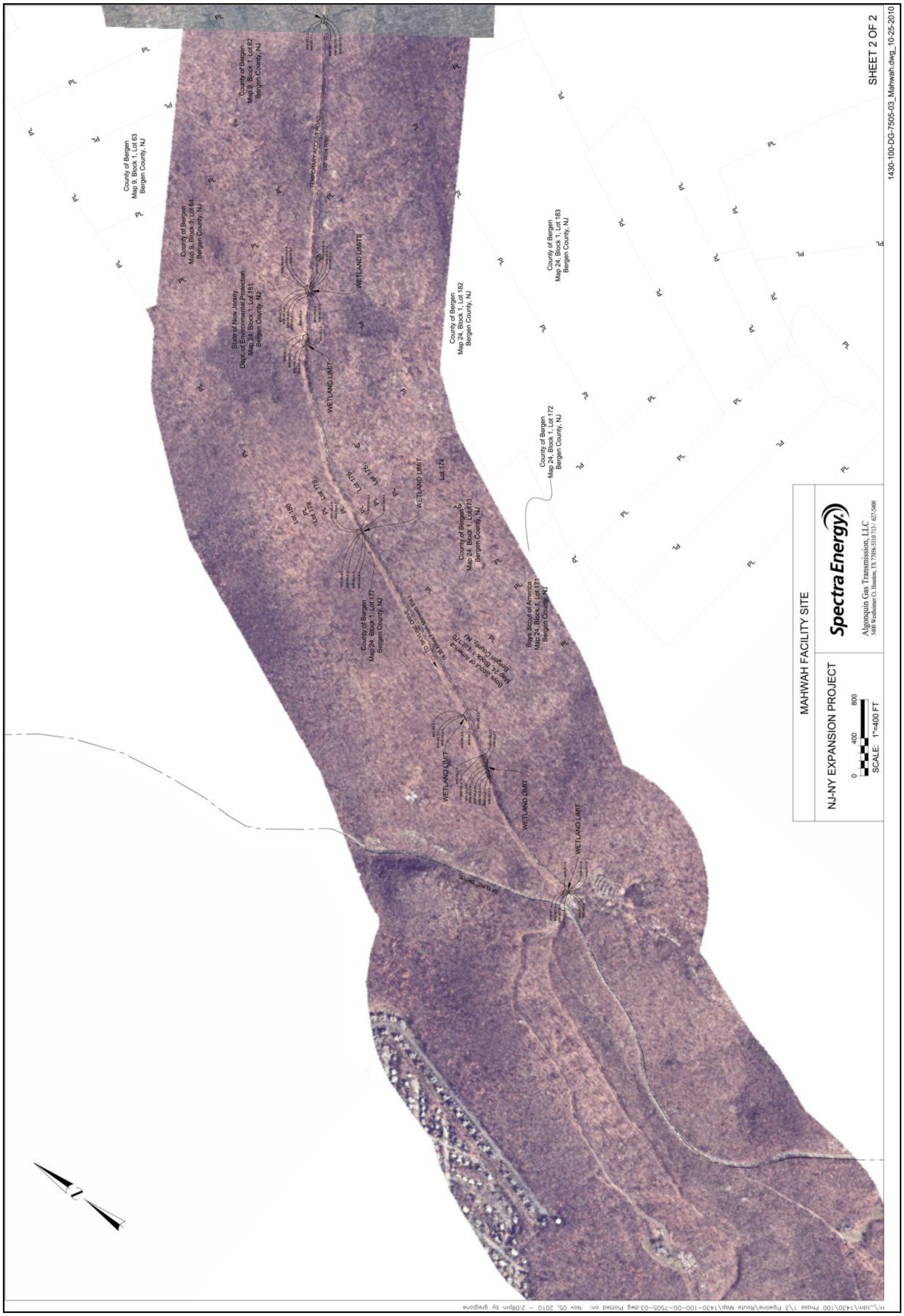

Figure 1-11c. **Location of the NJ-NY Project, existing Algonquin Gas Transmission, LLC Mahwah M&R Station along with proposed temporary access road, aerial locus map.**

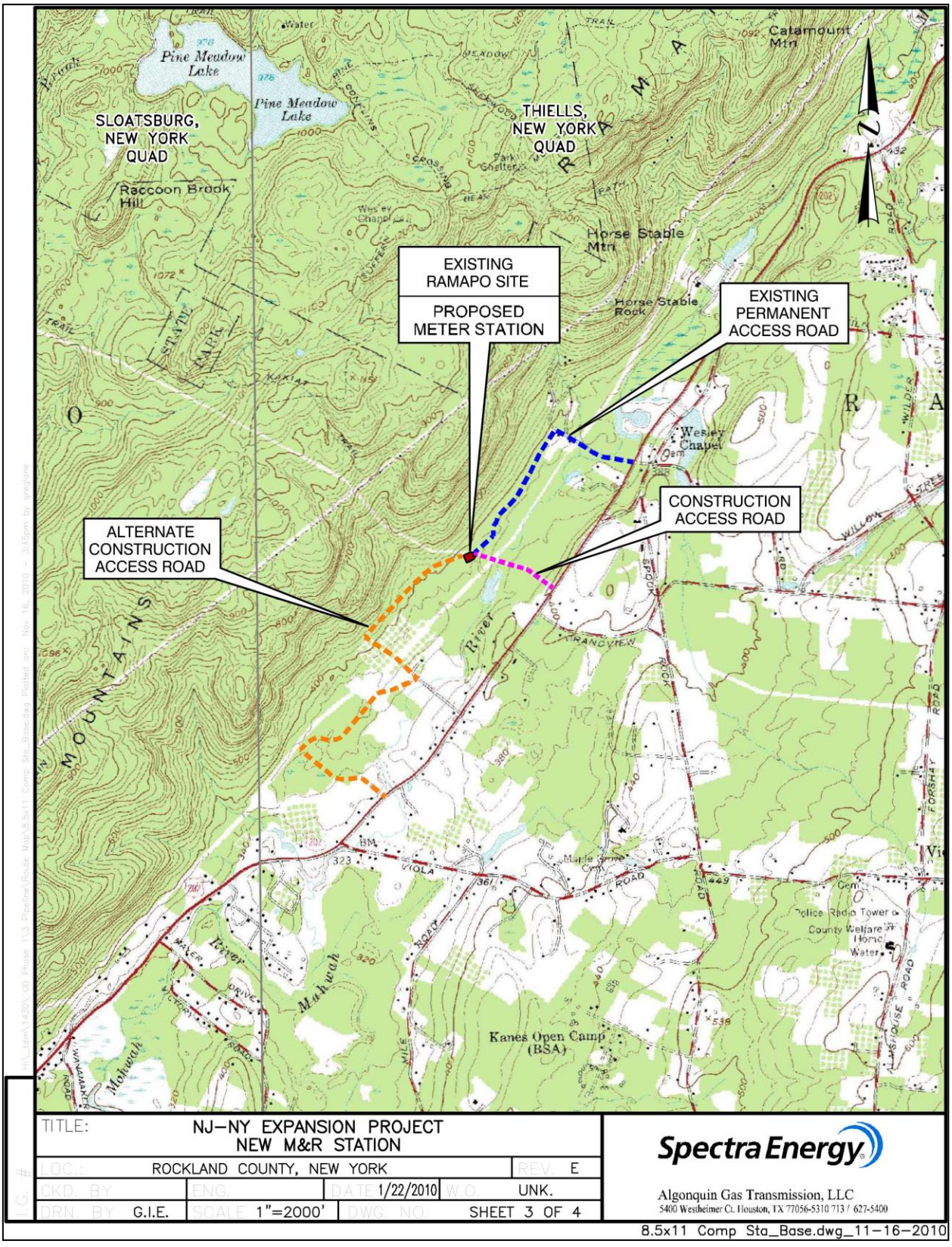

Figure 1-12. Location of the NJ-NY Project, proposed M&R station at the existing Ramapo M&R Station, existing permanent access road, and proposed temporary access roads on the Sloatsburg and Thiells, NY, USGS topographic quadrangle, 7.5 minute series.

Figure 1-13. Location of the NJ-NY Project, existing Algonquin Gas Transmission, LLC Ramapo M&R Station, aerial locus map.

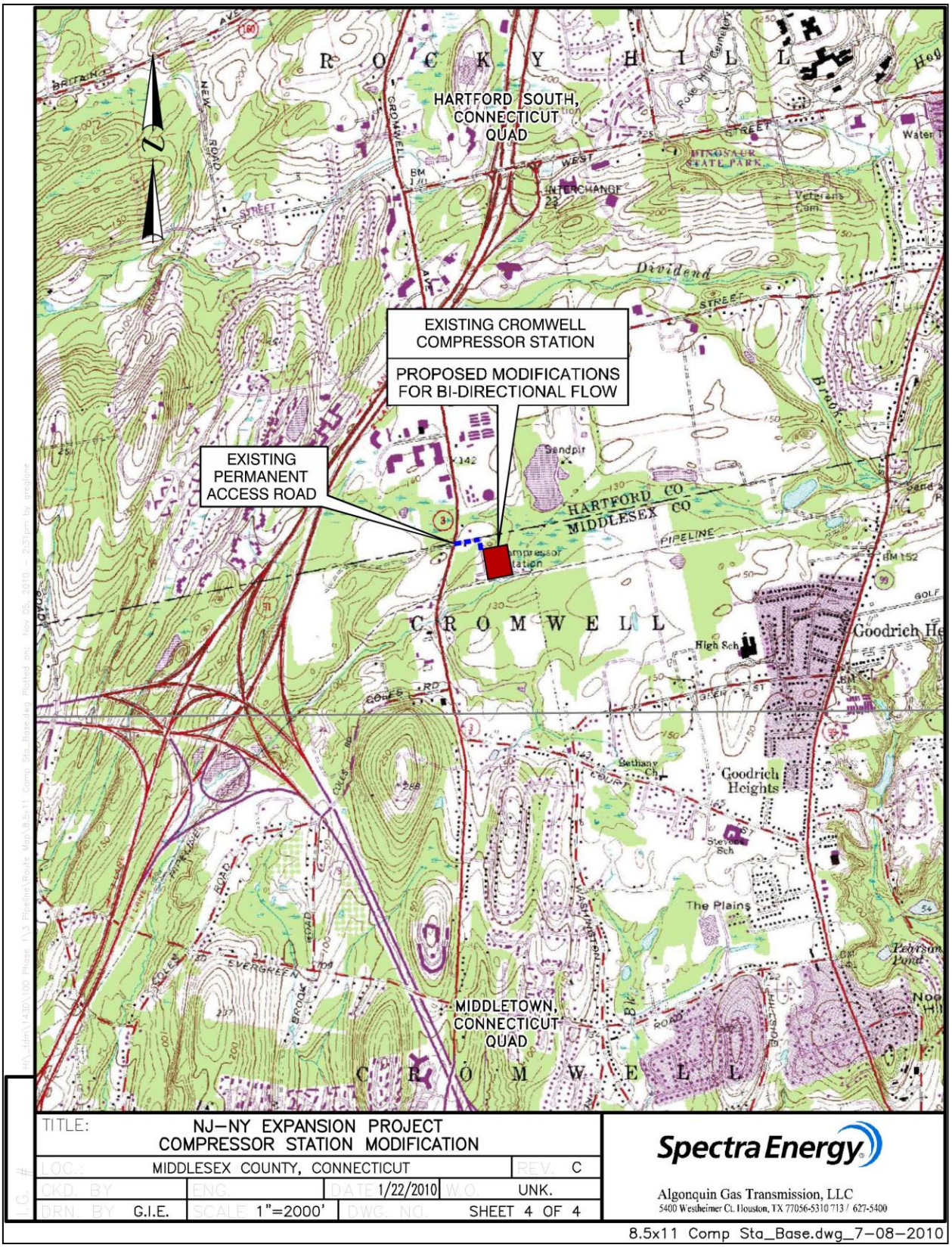

Figure 1-14. Location of the NJ-NY Project, proposed modifications for bi-directional flow at the existing Cromwell Compressor Station and existing permanent access road on the Hartford South and Middletown, CT, USGS topographic quadrangle, 7.5 minute series.

Figure 1-15. Location of the NJ-NY Project, existing Algonquin Gas Transmission, LLC Cromwell Compressor Station, aerial locus map.

Pipe Yards

Pipe yards are large tracts of open land usually located away from the construction ROW and used for office trailers, equipment storage and repair, and construction employee reporting and parking. Spectra Energy has identified 22 pipe yards along the proposed pipeline route for use during construction (see Figures 1-2 through 1-6).

Area of Potential Effect

The area of potential effect (APE) is the "geographic area or areas within which an undertaking may directly or indirectly cause changes in the character of or use of historical properties, if any such properties exist" (36 CFR 800.16(d)). The APE is defined based upon the *potential* for effect, which may differ for aboveground resources (historic structures and landscapes) and subsurface resources (archaeological sites). The APE includes all areas where ground disturbances are proposed, where land use (i.e., traffic patterns, drainages, etc.) may change, or any locations from which the undertaking may be visible.

For archaeological resources, the APE consists of any areas of ground disturbance for the proposed pipeline trench, associated temporary work space, proposed M&R stations, launcher/receiver facilities, access roads, and pipe yards. The vertical APE for the proposed pipeline trench is a minimum of seven feet (ft) below surface to a maximum depth of approximately 20 ft below surface, depending on conditions encountered during construction (e.g., depth of existing utilities). The archaeological assessment presented in this report encompasses all areas where ground disturbances are currently proposed.

"Upstream" Project facilities, or Spectra Energy pipeline facilities located upstream from the proposed pipeline portion of the Project, include the Mahwah and Ramapo M&R stations and the Hanover and Cromwell compressor stations. New construction will occur at the Mahwah and Ramapo M&R stations and at one of the Hanover compressor stations. Bi-directional flow will be altered at the other Hanover Compressor Station and at the Cromwell Compressor Station. The area of ground disturbance at the existing Mahwah M&R Station has been surveyed by PAL. The results are summarized in Chapter 5 and a separate report will be submitted to the FERC, the New Jersey Historic Preservation Office, and other Native American groups and consulting parties. All other upstream facilities and any workspace required at these locations for this Project have been surveyed either by PAL or other cultural resource consultants for other projects.

Scope and Authority

The Spectra Energy NJ-NY Project requires approvals and permits from federal, state, and local entities. One of the primary Project approval requirements at the federal level is a FERC Certificate of Public Convenience and Necessity under Section 7(c) of the Natural Gas Act. Consequently, the Project is being reviewed under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. Prior to authorizing an undertaking (e.g., the issuance of a FERC approval or Certificate), Section 106 of the NHPA requires federal agencies, including the FERC, to take into account the effect of that undertaking on cultural resources listed or eligible for listing in the National Register of Historic Places and afford the Advisory Council on Historic Preservation (ACHP) the opportunity to comment on the undertaking. The Section 106 process is coordinated at the state level by the State Historic Preservation Officer (SHPO), represented in New York by the Office of Parks, Recreation, and Historic Preservation (OPRHP), in New Jersey by the Historic Preservation Office (HPO) and in Connecticut by the Historic Preservation and Museum Division of the Connecticut Commission on Culture and Tourism. In accordance with Section 106, FERC, as the lead Federal agency for the Project, must consult with the SHPO regarding the effects of the Project on historic properties.

The primary goals of cultural resource investigations conducted as part of the Section 106 review process are to:

- locate, document, and evaluate buildings, structures, objects, landscapes, and archaeological sites that are listed, or eligible for listing, in the National Register of Historic Places (National Register);
- assess potential impacts of the project on those resources; and
- provide recommendations for subsequent treatment, if necessary, to assist in complying with Section 106.

In addition to Section 106, the cultural resources investigation was conducted for the Project in accordance with FERC's Office of Energy Project's *Guidelines for Reporting on Cultural Resources Investigations* (2002), the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (NPS, 48 Fed. Reg. 44716-42, Sept. 29, 1983), the guidelines set forth in the New York State OPRHP *Standards for Cultural Resource Investigations and the Curation of Archaeological Collections in New York State* (New York Archaeological Council [NYAC] 1994) with specific reference to the revised *Cultural Resource Standards Handbook, Guidance for Understanding and Applying the New York State Standards for Cultural Resource Investigations* (NYAC 2000); the standards and guidelines set forth in *Landmarks Preservation Commission's Guidelines for Archaeological Work in New York City* (2002); and the standards and guidelines set forth in *New Jersey Historic Preservation Office Guidelines for Phase I Archaeological Investigations: Identification of Archaeological Resources* (2004). Because of the sensitive nature of some of the material contained in the report pages are labeled "CONTAINS PRIVILEGED INFORMATION – DO NOT RELEASE" in accordance with FERC guidelines and 36 CFR 800.11(c)(1).

Administrative Record

New York State Historic Preservation Office Consultation

PAL initiated Section 106 consultation with the New York SHPO by submitting a Project information package for review and comment on October 2, 2009. On November 17, 2009, the New York SHPO responded, requesting that the proposed Project be subject to a comprehensive cultural resource study for both the terrestrial and submerged sections of the proposed pipeline. The New York SHPO also indicated that the Ramapo M&R Station has been previously surveyed and no historic properties have been identified. Based on the information provided in the Project information package, the New York SHPO communicated that it has no concerns with the Ramapo M&R Station portion of the Project.

Project representatives met with New York SHPO staff on February 23, 2010 to discuss the cultural resources component of the proposed Project. Discussion topics covered the proposed Project facilities and routing, status of cultural resources review, and New York SHPO staff expectations for addressing archaeological and architectural/industrial resources. Project representatives indicated that the three major river crossings (Arthur Kill, Kill Van Kull, and the Hudson River) will all be crossed via HDD technology and no marine archaeological resources will be impacted. However, Project representatives communicated that a water-to-water or a water-to-land HDD alternative across the Hudson River is being evaluated. PAL indicated that it will provide a formal response to the New York SHPO's November 17, 2009 letter requesting a marine archaeological survey. PAL also provided notification to the New York SHPO of the Project Open House schedule on May 26, 2010.

On September 2, 2010, PAL submitted a draft archaeological overview survey report to the New York SHPO as part of the FERC Pre-Filing Application. On September 2, 2010, PAL also submitted to the New York SHPO a draft *Procedures Guiding the Discovery of Unanticipated Cultural Resources and Human Remains*. On October 12, 2010, the New York SHPO concurred with the *Procedures* and on October 22, 2010 they commented on the archaeological overview report.

New Jersey State Historic Preservation Office Consultation

PAL also initiated consultation with the New Jersey SHPO by submitting a Project information package for review and comment on October 2, 2009. On December 1, 2009, PAL provided additional Project information to the New Jersey SHPO regarding proposed modifications to the existing Mahwah M&R Station. On January 27, 2010 PAL forwarded the New Jersey SHPO documentation of correspondence between two Native American tribal entities. Project representatives met with New Jersey SHPO staff on February 18, 2010 to discuss the cultural resources component of the proposed NJ-NY Project. Discussion topics covered the proposed Project facilities and routing, status of cultural resources review, and New Jersey SHPO staff expectations to address archaeological and architectural/industrial resources. Project representatives indicated that the three major river crossings (Arthur Kill, Kill Van Kull, and Hudson River) will all be crossed via HDD technology and no marine archaeological resources will be impacted. However, Project representatives communicated that a water-to-water or a water-to-land HDD alternative across the Hudson River is being evaluated. New Jersey SHPO indicated that if any water impacts are proposed in the future, then a marine archaeological sensitivity assessment should be performed to evaluate the

proposed impacts on potentially significant marine archaeological resources. PAL also provided notification to the New Jersey SHPO of the Project Open House schedule on May 26, 2010.

On September 2, 2010, PAL submitted a draft archaeological overview survey report to the New Jersey SHPO as part of the FERC Pre-Filing Application. On September 2, 2010, PAL also submitted to the New Jersey SHPO a draft *Procedures Guiding the Discovery of Unanticipated Cultural Resources and Human Remains*. PAL also submitted a draft archaeological identification survey for the Mahwah M&R Station component of the Project to the New Jersey SHPO on October 22, 2010. On November 30, 2010, the New Jersey SHPO provided comments on the Mahwah M&R Station component of the Project. No other comments have been received from the New Jersey SHPO to date.

Government Agency and Non-Governmental Organization Consultation

In New York, PAL initiated consultation with the New York City Landmarks Preservation Commission, the Hudson River Park Trust, and three other non-governmental organizations (Professional Archaeologists of New York City, Inc. [PANYC], Greenwich Village Society for Historic Preservation, and the Preservation League of Staten Island). PAL also initiated consultation with three municipal historic preservation commissions (Bayonne, Jersey City, and Mahwah), and two non-governmental organizations (Canal Society of New Jersey and Jersey City Landmarks Conservancy), in New Jersey. On September 2, 2010, PAL submitted draft archaeological survey reports to all local and non-governmental consulting parties as part of the FERC Pre-Filing Application. On September 24, 2010, the New York City Landmarks Preservation Commission provided comments on the draft cultural resources reports. No other comments have been received to date.

Native American Consultation

PAL initiated consultation with ten federally recognized Native American groups to provide an opportunity to identify any concerns about properties of traditional religious or cultural significance that may be affected by this undertaking. Of the ten federally recognized Native American groups, four (the Delaware Nation of Oklahoma, Delaware Tribe of Indians, Oneida Indian Nation, and the Saint Regis Mohawk Tribe) responded indicating that they should continue to be consulted during Project planning activities; the Absentee Shawnee Tribe of Oklahoma, the Onondoga Nation, and the Seneca Nation of Indians indicated that the proposed Project is outside their area of concern. Responses from two federally recognized groups (Shawnee Tribe of Oklahoma and Shinnecock Indian Nation) are pending.

PAL also initiated consultation with eight non federally recognized Native American groups. Of the eight non federally recognized groups, three (the Nanticoke Lenni-Lenape Indians, New Jersey Commission on Native American Affairs, and the Ramapough Lenape Indian Nation) responded indicating that they continue to be consulted; the Sand Hill Historical Association indicated that the proposed Project is outside their area of concern. Responses from four non federally-recognized groups (Cherokee Nation of New Jersey, Powhatan Renape Nation, Sand Hill Band of Indians, and Unkechaug Nation) are pending.

On September 2, 2010, PAL submitted a draft archaeological overview survey report to all consulting Native American groups as part of the FERC Pre-Filing Application. On September 2, 2010, PAL also submitted to the Native American groups a draft *Procedures Guiding the Discovery of Unanticipated Cultural Resources and Human Remains*. The Stockbridge-Munsee responded on November 2, 2010 and the Delaware Tribe of Indians responded on November 3, 2010, commenting on the archaeological survey report.

Project Personnel

Archival research for the Project was conducted from October 2009 to June 2010 and a walkover survey of the pipeline route was completed in January and February 2010. PAL personnel involved in the Project include Deborah C. Cox (president), Gregory R. Dubell (energy projects manager), Suzanne Cherau (senior archaeologist/principal investigator), Ora Elquist and Nichole Gillis (project archaeologists); and Amelia Bidwell, Michael Hubbard, Kristen Jeremiah, and Erik Smith (archaeologists).

Disposition of Project Materials

All project information (e.g., field notes, maps, photographs and copies of the report) is currently on file at PAL, 210 Lonsdale Ave., Pawtucket, Rhode Island. PAL serves as a temporary curation facility until a permanent state repository is designated.

CHAPTER TWO

METHODOLOGY

The goal of the archaeological overview survey was to inventory previously recorded archaeological sites within the New York terrestrial portion of the Project APE, identify any areas of archaeological sensitivity where previously unrecorded sites may exist, and to identify any areas that could be excluded from future survey through the documentation of previous disturbances. To accomplish this objective, the following research strategies were used:

- archival research, including a review of town histories, maps, environmental data, utilities information, and other relevant literature;

- field investigations, consisting of a "walkover" visual reconnaissance survey of the Project APE.

The archival research and walkover survey provided the information needed to develop environmental and historic contexts for the Project APE and apply the regional predictive model for archaeological sensitivity. Archaeological sensitivity is defined as the probability for belowground cultural resources to be present, and is based on various categories of information including:

- locational, functional, and temporal characteristics of previously identified cultural resources in the Project area or vicinity; and

- local and regional environmental data reviewed in conjunction with existing project-area conditions documented during the walkover survey, and archival research about the project area's land alteration and land use history.

Evaluating Significance and Historic Contexts

The different phases of archaeological investigation (Phase IA reconnaissance, Phase IB survey, Phase II site evaluation, and Phase III data recovery) reflect preservation planning standards for the identification, evaluation, registration, and treatment of cultural resources (National Park Service [NPS] 1983). The 1994 NYAC's publication of *Standards for Cultural Resource Investigations and the Curation of Archaeological Collections in New York State* as adopted by the New York SHPO, reflect the NPS planning recommendations. This planning structure is based on the eligibility of cultural resources for inclusion in the National Register. The National Register is the official federal list of properties that meet the criteria for historic significance. The results of a Phase IB survey and Phase II site examination are used to make recommendations about the significance and National Register eligibility of any resource.

The standards used to determine the significance of cultural resources, a task required of federal agencies, have been the guidelines provided by the NPS (36 CFR 60): the National Register Criteria for Evaluation. Four criteria are listed by which the "quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling and association:

A. that are associated with events that have made a significant contribution to the broad patterns of our history;

B. that are associated with the lives of persons significant in our past;

C. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. that have yielded, or may be likely to yield, information important to prehistory or history (36 CFR 60.4).

Most archaeological sites listed in the National Register have been determined eligible under criterion A or D. For eligibility under these criteria, a number of issues must be addressed including the kind of data contained in the site, the relative importance of research topics that can be addressed by the data, whether these data are unique or redundant, and the current state of knowledge relating to the research topic(s) (McManamon 1990:14–15). A defensible argument must establish that a site "has important legitimate associations and/or information value based upon existing knowledge and interpretations that have been made, evaluated, and accepted" (McManamon 1990:15).

The criteria used to evaluate the significance of cultural resources are applied in relation to the historical contexts of the resources. An historic context is defined as follows:

> A historic context is a body of thematically, geographically, and temporally linked information. For an archaeological property, the historic context is the analytical framework within which the property's importance can be understood and to which an archaeological study is likely to contribute important information (Little et al. 2000).

Historical contexts provide an organizational format that groups information about related historical properties, based on a theme, geographic limits, and chronological period. A historical context may be developed for Native American, historic, and/or modern cultural resources. Each historical context is related to the developmental history of an area, region, or theme (e.g., agriculture, transportation, waterpower), and it identifies the significant patterns that particular resource can represent.

Historical contexts are developed by:

- identifying the concept, time period, and geographic limits for the context;
- collecting and assessing existing information about these limits;
- identifying locational patterns and current conditions of the associated property types;
- synthesizing the information in a written narrative; and
- identifying information needs.

"Property types" are groupings of individual sites or properties based on common physical and associative characteristics; they serve to link the concepts presented in the historical contexts with properties illustrating those ideas (NPS 1983:44719).

A summary of an area's history can be developed by a set of historical contexts. This formulation of contexts is a logical first step in the design of any archaeological survey. It is also crucial to the evaluation of individual properties in the absence of a comprehensive survey of a region (NPS 1983:9). The result is an approach that structures information collection and analyses. This approach further ties work tasks to the types and levels of information required to identify and evaluate potentially important cultural resources.

The following research contexts were developed to organize the data relating to the pre- and post-contact period cultural resources identified within the proposed project area:

1. Pre-contact land use and settlement within the Lower Hudson River Valley, circa (ca.) 12,500 to 300 years before present (B.P.); and

2. Historic land use and settlement patterns in the New York City boroughs of Manhattan and Staten Island, ca. A.D. 1650 to present.

Historic contexts, along with expected property types and locational patterns, are discussed in detail in Chapter 4. The potential research value of the known and expected archaeological resources identified within the Project APE is evaluated in terms of these historic contexts. The evaluation, along with management recommendations, is presented in Chapters 5 and 6.

Archaeological Sensitivity

The regional predictive model for coastal portions of New England, New York, and New Jersey considers various criteria to rank the potential for project areas to contain archaeological sites. The criteria considered during archaeological assessments in this region include proximity of recorded and documented sites, local land use history, environmental data, and existing conditions. For the current Project APE, areas of archaeological sensitivity have been ranked into four categories of probability. Segments of the Project APE are characterized as having high, moderate, low, or no potential for archaeological resources to be present. Areas with no potential to contain sites are those that can be excluded from further field investigations because of extensive disturbances. Table 2-1 is a summary of the different factors used to develop the archaeological sensitivity rankings for the Project APE.

Absent specific information on disturbances, the portion of Staten Island containing the Project APE has previously been determined to be highly sensitive for pre-contact archaeological resources (Boesch 1994; NY SHPO 2010). Factors complicating the actual identification of archaeological sites on both Staten Island and Manhattan include marine transgression and historic/modern period developments. Marine transgression in the Project APE has transformed land that would have been previously available for human occupation into present-day offshore or marsh environments. Additionally, the pre- and post-contact archaeological potential of the APE has possibly been affected by substantial urban development and industrial activity. However, there is potential for deeply buried older archaeological resources to be present in sediments underlying marsh and/or fill deposits in these environments. Even those areas that have undergone extensive urban development may contain pre-contact remains. Recent examples of in situ pre-contact finds including a pre-contact and contact period site, as well as numerous secondary deposits, are known from Manhattan (Kirkorian et al. 1997:II-3). Furthermore, the presence of development can preserve as well as destroy sites. As Sydne Marshall noted in his analysis of the survival of archaeological resources in urban contexts:

> "Clearly, modern development often impacts earlier cultural materials by intruding into and truncating archaeological features. Urban development, however, may also preserve archeological sites by limiting access to them and curtailing impacts from natural erosional processes. . . . Eliminating urban areas from consideration for archeological potential because of extensive development is no longer a defensible management strategy." (Marshall 1984:14).

Thus, determination of a lack of archaeological potential in the Project APE was largely reliant on the ability to identify documented belowground disturbance related to urban development activities rather than observations of surface conditions.

Archival Research

The development of a historic context and a predictive model of expected archaeological resources within the Project APE began with archival research, consisting of an examination of primary and secondary documentary sources. These sources include written and cartographic documents relating both to past and present environmental conditions as well as documented/recorded sites in the general project vicinity. The information contained in archival sources formed the basis of the predictive model developed for the Project APE, and was an integral part of the sensitivity assessment.

Table 2-1. Archaeological Sensitivity Rankings Used for the NJ-NY Expansion Project.

Presence of Sites		Proximity to Favorable Cultural/Environmental Characteristics			Degree of Disturbance			Sensitivity Ranking
Known	Unknown	< 150 m	≥ 150 ≤ 500 m	> 500 m	None/Minimal	Moderate	Extensive	
•		•			•			High
•		•				•		High
•		•					•	Low
•			•		•			High
•			•			•		High
•			•				•	Low
•				•	•			High
•				•		•		High
•				•			•	Low
	•	•			•			High
	•	•				•		Moderate
	•	•					•	No
	•		•		•			Moderate
	•		•			•		Moderate
	•		•				•	No
	•			•	•			Moderate
	•			•		•		Low
	•			•			•	No
							•	No

Specific sources reviewed as part of the archival research for the New York terrestrial portion of the NJ-NY Expansion Project include:

State Site Files, Cultural Resource Management Reports and Archaeological Studies

The state site files at the New York SHPO were reviewed to locate any recorded archaeological sites in or close to the Project APE. The New York SHPO inventory includes sites listed in the inventories maintained by the New York State Museum and the American Museum of Natural History as well as resources listed in or eligible for listing in the National Register of Historic Places (National Register). The New York SHPO inventories were also reviewed to identify any previous archaeological surveys in, or in proximity to the Project, and reports documenting cultural resource management (CRM) investigations conducted in the project vicinity were reviewed for information salient to the current Project work areas and sensitivity assessments (Table 2-2).

Table 2-2. Cultural Resource Management Reports Reviewed for the NY Terrestrial Portion of the NJ-NY Expansion Project.

SHPO # or other Designation	Author/Year	Title
LPC 357	Hartgen Archeological Associates, Inc 1990	Route 9A Reconstruction Project, Draft Archeological Assessment Report, Harrison Street to West 18th Street.
LPC 411	Kirkorian, et al. 1997	Existing Conditions Report, Archaeological Resources, Hudson River Park Project, West Houston Street to Little West 12th Street, Manhattan, New York
LPC 665	Boesch 1994	Archaeological Evaluation and Sensitivity Assessment of Staten Island, New York
LPC 673	Cox Jr. 1998	Field Support of Dredged Material Management Alternative for New York District Dredged Material Management Plan (DMMP)
LPC 675	Flagg 1991a	Cultural Resource Evaluation, Newark Bay Site, Staten Island, NY
LPC 676	Flagg 1991b	Cultural Resource Survey, Newark Bay Site: Main Parcel and Pier Parcel, Staten Island, NY. New York City Long Range Sludge Management Plan GEIS III
LPC 677	Flagg, et al., 1992	Reconnaissance of Marine Cultural Resources at the Newark Bay Site, Staten Island, New York. New York City Long Range Sludge Management Plan GEIS III. New York City Department of Environmental Protection
LPC 684	Geoarcheology Research Associates 1997	Staten Island Bridges Program- Modernization and Capacity Enhancement Project, Goethals Bridge Phase 1B/3 Geomorphological Analysis Report on Coring and Additional Radiocarbon Dating
LPC 690	Roberts and Farkas 1986	Phase IA Archaeological and Historical Sensitivity Survey for the Proposed Richmond Avenue and Forest Avenue Shopping Plaza, Staten Island, New York
LPC 708	Greenhouse Consultants, Inc. 1999	Stage 1A Archaeological/Historical Sensitivity Evaluation of the Nicholas Avenue and Richmond Terrace Project, Borough of Richmond, New York
LPC 711	Greenhouse Consultants, Inc. 2000a	Archaeological Testing Report, Nicholas Avenue and Richmond Terrace Project, Borough of Richmond, New York
LPC 713	Greenhouse Consultants, Inc. 2000b	Stage 1A Archaeological/Historical Sensitivity Evaluation of the John Street Project, Borough of Richmond, New York
LPC 721	Hartgen Archeological Associates, Inc 1995	Goethals Bridge Expansion, Staten Island Bridges Program, Richmond County, New York and Union County, New Jersey
LPC 722	Hartgen Archeological Associates, Inc. 2002	Phase IA Literature Review and Archeological Sensitivity Assessment, Cross Harbor Freight Movement Project, Port Ivory Yard, Arlington Yard, Eleven Railroad Crossings and Proposed Tunnel, Staten Island, Richmond County, New York

Table 2-2. Cultural Resource Management Reports Reviewed for the NY Terrestrial Portion of the NJ-NY Expansion Project.

SHPO # or other Designation	Author/Year	Title
LPC 727	Kardas and Larrabee 1980	Cultural Resource Reconnaissance, New York Harbor Collection and Removal of Drift, Area of Elizabeth, Union Co., NJ and Channel Dredging, Elizabethport and North and South of Shooters Island Reaches
LPC 728	Kardas and Larrabee 1982	Archaeological Field Survey of the Foreign Trade Zone Project at Howland Hook, Staten Island, New York
LPC 734	Kearns, et al. 1991a	The New York City Long Range Sludge Management Plan, Generic Environmental Impact Statement III, Newark Bay, Staten Island, Phase 1A Archaeological Assessment
LPC 735	Kearns, et al. 1991b	The New York City Long Range Sludge Management Plan, Generic Environmental Impact Statement III, Proctor and Gamble, Staten Island, Phase 1A Archaeological Assessment
LPC 752	Wagner and Siegel 1996	A Geomorphological and Archeological Analysis of the Arthur Kill-Howland Hook Marine Terminal Channel, Richmond County, New York and Union County, New Jersey
LPC 758	Rubinson 1988	Phase IA Documentary Study of Archaeological Potential, Harbor Road Site, 349 Harbor Road, Staten Island
LPC 783	Duncan 1996	Draft Report Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach; Arthur Kill, New Jersey Reach and Kill Van Kull, New York Reach
LPC 802	Raber Associates 1996	Reconnaissance Cultural Resource Investigations, Arthur Kill New Jersey Reach, Union, and Middlesex Counties, New Jersey, New York Harbor Collection and Removal of Drift Project, U.S. Army Corps of Engineers, New York District.
LPC 1112	Panamerican Consultants 2008	Recordation of Six (6) Vessels in Connection with the New York and New Jersey Harbor Navigation Study Upper and Lower Bay, Port of New York and New Jersey, Staten Island, Richmond County, New York, Elizabeth, Union County and Bayonne, Hudson County, New Jersey. Volumes I and II Final Report.
Goethals Bridge EIS	The Louis Berger Group 2007, and others	Goethals Bridge Replacement, Richmond County, New York and The City of Elizabeth, Union County, New Jersey.
Cross Harbor EIS	New York City Economic Development Corporations 2004 (NYCEDC)	Cross Harbor Freight Movement Project, Draft Environmental Impact Statement
MAAR 1986	Payne and Baumgardt 1986	Howland Hook Marine Terminal Expansion Cultural Resources Reconnaissance

Table 2-2. Cultural Resource Management Reports Reviewed for the NY Terrestrial Portion of the NJ-NY Expansion Project.

SHPO # or other Designation	Author/Year	Title
Gansevoort Market Historic District	New York City Landmarks Preservation Commission 2003 (NYCLPC)	Gansevoort Market Historic District Designation Report
Hudson River Park EIS	Empire State Development Corporation 1998	Hudson River Park Final Environmental Impact Statement
NY DOT	Mueser Rutledge Consulting Engineers 1989a Mueser Rutledge Consulting Engineers 1989b	Appendix A, Summary of Field Investigations: Underwater Survey, August 1989, Route 9A Reconstruction. Route 9A Reconstruction Project, Battery Place to Fifty Ninth Street, Bulkhead Condition Review Gansevoort St. to W 13th St.
New York Cultural Resource Report. 63	James and Duncan 1999	Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach; and Kill Van Kill, New York Reach, Volume I: Final Report
Westside HWY Cultural Resources Survey Archaeological Work Program HCI 1983	Historic Conservation and Interpretation, Inc. 1983	Westside Highway Cultural Resource Survey, Archeological Work Program: Cultural Resources Research (Contract No. D-202836)

Histories and Maps

Primary and secondary histories and historical maps and atlases of the Staten Island and Manhattan boroughs were examined to assess changes in land use, shoreline development and infilling, to locate any documented structures, and to trace the development of transportation networks and industries, important variables in the location of post-contact period archaeological sites. Town, county, state, and regional histories and historical maps and atlases were consulted to locate possible sites dating to this period within and close to the Project APE. Table 2-3 provides a list of all cartographic sources reviewed for the Project APE in Manhattan and Staten Island. The local and regional histories reviewed for the Project are included in the References Cited section of the report.

In addition to a standard paper review of the cartographic materials, select historic maps were georeferenced using geographic information system (GIS) software. Georeferencing is the process of defining how raster (imagery) data is situated in map coordinates. Georeferencing raster data allows it to be viewed, queried, and analyzed with other geographic data.

A georeferenced map is a map that has been transformed or "rubbersheeted" using the spatial calculation abilities of a GIS to achieve the best fit between two geographic representations. In order to georeference an historic map, identifiable landmarks on the historic map are matched to a modern map (base map) or orthophotograph (corrected aerial photograph) and the historic map is stretched, shrunk, enlarged, reoriented, or otherwise altered to achieve a good fit with the modern map. The transformation used to georeference the historic maps was a first-order (affine) transformation. First-order transformations are the most common georeferencing transformations and are appropriate for georeferencing two maps that represent the same geographic space. Because of differing cartographic technology, methods, and standards in the past, georeferenced historic maps do not provide a perfect correlation with modern maps, but they are one of the most accurate and efficient means currently available to

Table 2-3. Cartographic Sources Reviewed for the NY Terrestrial Portion of the NJ-NY Expansion Project.

Year	Author	Title	Publisher
1775	Montresor, John	A Plan of the City of New York and its Environs	A. Drury, England
1776-1783	McMillen, Loring	A Map of Staten Island During the Revolution	Unknown, published 1933
1807	Bridges, William	Map of the City of New York and Island of Manhattan, as laid out by the commissioners appointed by the legislature, April 3d, 1807	City of New York 1811
1821	Randel, John	The City of New York as Laid Out by the Commissioners with the Surrounding Country	P. Maverick, New York
1828	Goodrich, A.T.	Plan of the City of New York and the Island as Laid Out by the Commissioners, Altered and Arranged to the Present Time	A.T. Goodrich, New York
1832	Burr, David H.	Map of the City and County of New York with Adjacent Country	David H. Burr, NY
1845	Hassler, F.R.	Map of New York Bay and Harbor and the environs	U.S. Coast Survey, Washington, DC
1852	Dripps, Matthew	Map of the City of New York, Extending Northward to 50th Street	M. Dripps, New York
1855	N.Y. City Surveyors	Maps of the wharves and piers on the Hudson and East rivers from the Battery to 13th St., New York	G. Hayward, New York
1856	Colton, G.W.	Map of New York and the Adjacent Cities	J.H. Colton & Co., New York
1859	Perris, William	Maps of the City of New York, Volume 4	Perris & Browne, New York
1860	Walling, H.F.	Map of the City of New-York and its Environs	S.D. Tilden, New York
1865	Viele, Egbert L.	Topographical Map of the City of New York: Showing Original Water Courses and Made Land	Ferd. Mayer & Co., New York
1867	Dripps, Matthew	Plan of New York City from the Battery to Spuyten Duyvill	M. Dripps, New York
1872	Dripps, M.	Map of Staten Island (Richmond County), New York	M. Dripps, New York
1873	New York City Department of Docks	Map Showing the High and Low Water Marks and the Original City Grants of Land Under Water Made to Various Parties	NYC Department of Docks, NY
1874	Beers, F.W.	Map of Staten Island, Richmond County, New York	J.B. Beers & Co., New York
1879	Bromley, G.W.	Atlas of the City of New York	G.W. Bromley & Co., NY
1880	New York City Department of Docks	Map of the City of New York Showing Existing and Proposed Piers and Bulkheads	NYC Department of Docks
1880	Spielman and Brush	Sanitary and Topographic Map of Hudson County, New Jersey	Snyder and Black, New York
1891	Bien, Julius and C.C. Vermeule	Atlas of the Metropolitan District and Adjacent Country, engraved in 1890, based on U.S. Coast and Geoditic Survey	Julius Bien & Co., New York
1891	Bromley, G.W.	Atlas of the City of New York	G.W. Bromley & Co., Philadelphia
1891	United States Geological Survey	Staten Island, New York quadrangle sheet	United States Geological Survey, Washington, D.C.
1895	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1898	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro	Sanborn Map Co., New York
1899	Bromley, G.W.	Atlas of the City of New York, Borough of Manhattan, Vol. I	G.W. Bromley & Co, Philadelphia
1904	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1909	unknown	Borough of Richmond, Topographical Survey	Unknown
1910	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro	Sanborn Map Co., New York
1911	Bromley, G.W.	Atlas of the City of New York, Borough of Manhattan	G.W. Bromley & Co., Philadelphia
1916	Bromley, G.W.	Atlas of the Borough of Manhattan, City of New York	G.W. Bromley & Co., New York
1917	Bromley, G.W.	Atlas of Richmond County, New York	G.W. Bromley & Co., New York
1917	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York

Table 2-3. Cartographic Sources Reviewed for the NY Terrestrial Portion of the NJ-NY Expansion Project (continued).

Year	Author	Title	Publisher
1920	Bromley, G.W.	Atlas of the City of New York, Borough of Manhattan	G.W. Bromley & Co., Philadelphia
1921	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1930	Bromley, G.W.	Atlas of the City of New York, Borough of Manhattan	G.W. Bromley & Co., Philadelphia
1937	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1937	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1950	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1950	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1962	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1969	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1975	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1977	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1979	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1980	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1981	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1983	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1983	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1985	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1986	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1986	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1987	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1987	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1988	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1988	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1989	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1990	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1991	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1992	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1992	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1993	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1993	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1994	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1995	Sanborn Insurance Co.	Insurance Maps of New York, Manhattan and Bronx Boros, Vol. 3	Sanborn Map Co., New York
1995	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York
1996	Sanborn Insurance Co.	Insurance Maps of New York, Richmond Boro, Vol. 2	Sanborn Map Co., New York

compare the historic features of modern locations. In many instances it is necessary to visually compare the georeferenced map and the base map; if two features appear nearly identical and are parallel, but do not exactly geographically correspond it is very likely that they are the same feature.

The spatial accuracy (the variance between a feature on a map and the real world location of that feature) of the georeferenced maps can be no better than the accuracy of the base map. In most cases, historic maps were georeferenced using the USGS 7.5 minute topographic quadrangle series as base maps. The USGS 7.5 minute series has a horizontal accuracy of approximately 40 feet. The spatial accuracy of the historic maps is unknown. The spatial accuracy of the georeferenced historic maps can be assumed to be *at best* 40 feet, but will vary greatly from map to map depending on the quality of the historic map. In the case of the historic maps reviewed for this Project, the variance could be as much as 500 feet. In such instances, the Project pipeline route was adjusted to most closely match its approximated location based on reference points taken from the Project alignment sheets.

Environmental Studies

Bedrock and surficial geological studies provided information about the region's physical structure and about geological resources near the project area. The United States Department of Agriculture (USDA) Soil Conservation Service soil survey for New York City (Natural Resources Conservation Services [NRCS] 2005) supplied information about soil types and surficial deposits within the Project APE and the general categories of flora and fauna that these soil types support. Soil boring information obtained from previous environmental site characterization reports for remediation work and construction projects conducted over the past 25 years within and in close proximity of the Project APE were also examined to document fill depths and whenever possible, the potential for buried intact soils to be present. In addition, studies of past environmental settings of the regional northeast and Lower Hudson River valley were consulted.

Walkover Survey

A walkover survey was conducted of the Project APE to document and assess present conditions of the pipeline route and other work areas. Field notes and digital photographs were taken for each segment. Although environmental information documented on project maps during the walkover included the presence, types, and extent of fresh water; and natural features of the terrain such as hills, ridges and terraces, the current physical condition of the Project APE is largely defined by the presence of modern period alterations to the pre-1900 landscapes.

Typically encountered disturbances within a given project area may include those resulting from agricultural plowing, gravel or soil mining, or previous construction, grading, development and infilling activities. Experience indicates that such disturbances can reduce the probability for encountering contextually intact archaeological sites. Although infilling and other types of visible development is likely the most common type of disturbance in a given area and can remove artifacts from their primary context, visual evidence of development and infilling on the surface does not necessarily mean subsurface cultural deposits are compromised. For example, it is possible that the creation of made land by infilling could cap and preserve intact Holocene land surfaces that could contain archaeological resources.

Another purpose of the walkover survey was to document surface indications of archaeological sites. Due to the urban setting of the Project APE, it was considered likely that post-contact archaeological resources could be identified through surface inspection. Post-contact archaeological site types that are typically visible in such urban settings include foundations or other building remnants, features associated with former transportation networks, and trash deposits.

CHAPTER THREE

ENVIRONMENTAL CONTEXT

The environmental context of a given area, including its geology, topography, hydrology, and natural resources, played an important role in influencing the settlement and land use of human populations in the past. This chapter presents an overview of the environmental setting of the lower Hudson Valley and New York Bay, with specific reference to the study area. The overview focuses on local physiography, bedrock and surficial geology, soils, and hydrology.

Geology and Geomorphology

The Project APE lies within two physiographic provinces. The Staten Island portion of the Project area is situated in the northwest part of Staten Island within the Piedmont Lowland physiographic province, just west of the Atlantic Coastal Plain province and east of the Ridge and Valley province (Figure 3-1). The Manhattan portion of the Project area lies within a narrow, southern projecting extension of the New England Uplands. Both areas lie along the eastern edge of the broad lowland known as the Newark basin that extends from Watchung Mountain on the west to the Hudson River on the east.

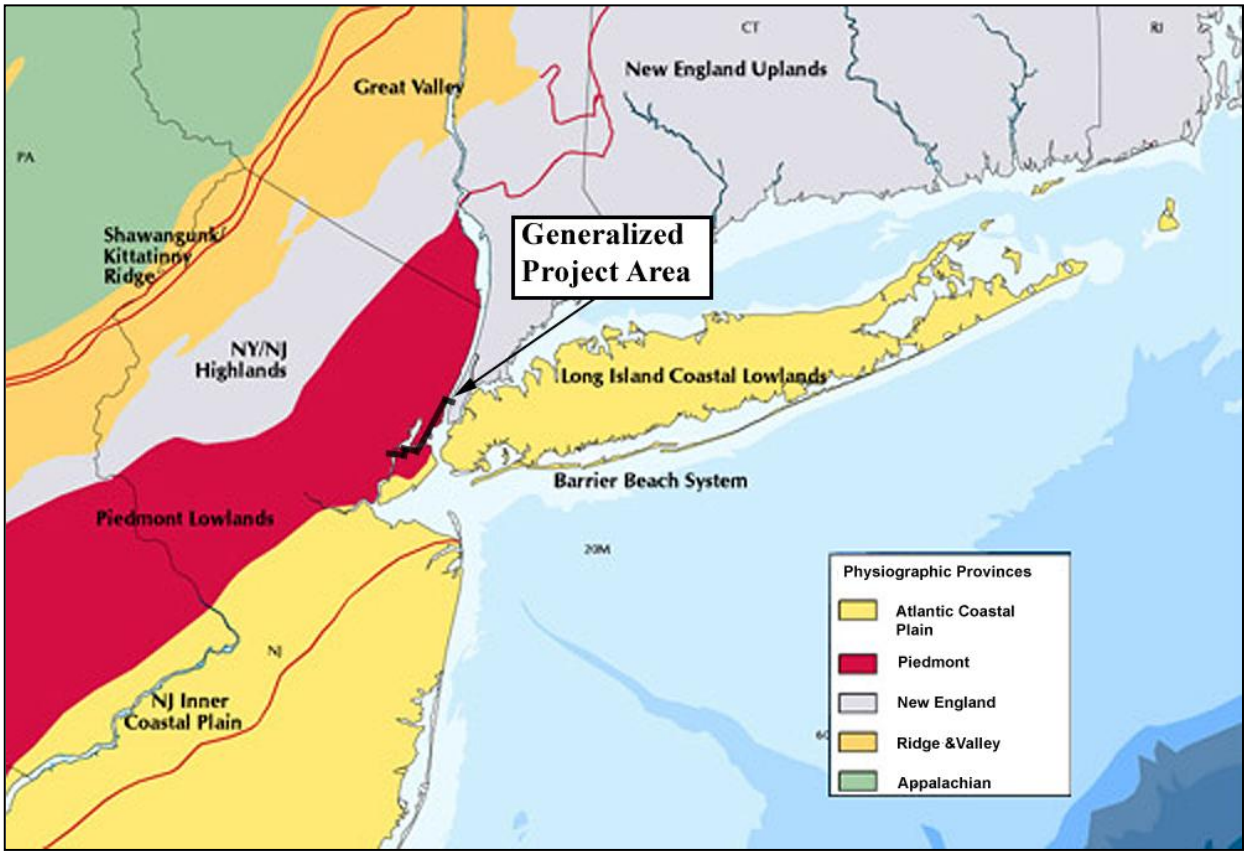

Figure 3-1. Map of physiographic provinces and the Project (source: USFWS 1997).

The final Pleistocene glaciation, known as the Wisconsin Stage, occurred about 22,000 years ago. The glacier was largely confined to Canada and northern New York, but one lobe (the Hudson-Champlain Lobe of the Woodfordian ice sheet) expanded to New York Harbor at its maximum (Sirken and Bokuniewicz 2006). Over the next several thousand years, the slow advancing and rapid melting of the ice sheets depressed and shaped the land while scouring its surface and depositing debris. The most recent glacial advance scoured the Hudson valley to a depth of approximately 488–650 feet and glacial retreat yielded the deep U-shape trough characteristic of the Hudson River valley (Levinton and Waldman 2006).

The maximum extent of the Hudson-Champlain Lobe is marked by the Harbor Hill terminal moraine, which traversed from near Perth Amboy across the New York Harbor area/Staten Island to the northern portion of western Long Island. By around 19,000 years ago, glacial meltwater lakes began to form behind the natural dams created by the Watchung Mountains, the Palisades, and the terminal moraines. The three principal proglacial lakes in the area include Hudson, Hackensack, and Bayonne. The freshwater lakes covered much of the area for a period of approximately 2,500 years and deposited varved clay layers (Sanders 1974:24–25). The lakes appear to have rapidly drained toward the end of the glaciation. Catastrophic drainage of Lake Hackensack, which occupied the Hackensack Valley west of the Project area, breached the Harbor Hill moraine and established the Arthur Kill fluvial valley.

With the retreat of the massive ice sheet, land formerly covered by ice began to undergo isostatic rebound, accompanied by a rising sea level (Lewis 1997). It is estimated that at the glacial maximum, about 19,000 years ago, the world sea level was 400 to 460 ft lower than at present and the shoreline was about 100 to 120 miles from the Lower Hudson Harbor. As the glaciers melted, sea levels rose faster than the rate of glacial rebound, resulting in a marine transgression over time of the Hudson River valley.

Bedrock underlying the region is composed of Triassic age (ca. 225-200 million years ago) fluviate and lacustrine reddish-brown shales and fine-grained sandstones, collectively known as the Newark Group, which lie up to 250 ft below sea level in some areas. The sedimentary strata are broken in places by the Palisades Sill and other localized diabase igneous rock outcrops that resulted from intrusive late Triassic lava flows. Triassic period deposits are overlain by a sequence of glacial lacustrine clays and glacial drift deposited during repeated episodes of glacial advance and retreat throughout the Pleistocene period, between approximately 2.5 million to 11,500 years ago. These sediments underlie Holocene age marsh and estuary deposits, which are, in most shoreline areas, buried by historic fills of variable thickness.

The bedrock formation underlying the Staten Island portion of the Project area consists of Early Jurassic period Palisades Diabase Sill (Trp) comprised of plagioclase feldspar, augite, and quartz (Pagano 1994). It occurs in a belt that stretches northeast to southwest in the northwest portion of western Staten Island, NY, adjacent to a belt of Lockatong Formation (Figure 3-2). The Manhattan Formation (Om) underlies the Manhattan portion of the Project area and is predominantly comprised of Cambrian period Manhattan Schist, other schistic materials and gneiss.

Surficial geologic outcrops of limestone and other formations (e.g., Jacksonburg, Kittatinny, and Onandaga) located some 25 miles west of the Project area are potential local sources of chert materials utilized by the former Native American inhabitants of the region. Glacial moraine deposits in the form of cobbles and pebbles are also possible sources of lithic raw materials (Marshall 1982).

Hydrology

The Project area is located in the northwest corner of Upper New York Bay, a tidal estuary at the mouth of the Hudson River. The study corridor parallels or traverses major stream channels (Arthur Kill, Kill Van Kull, and the Hudson River) as well as a number of tributary streams and marshes, including Old Place Creek and Bridges Creek on Staten Island. Historically, the major stream channels of Upper New York Bay have played an important role in New York City area commerce and transportation.

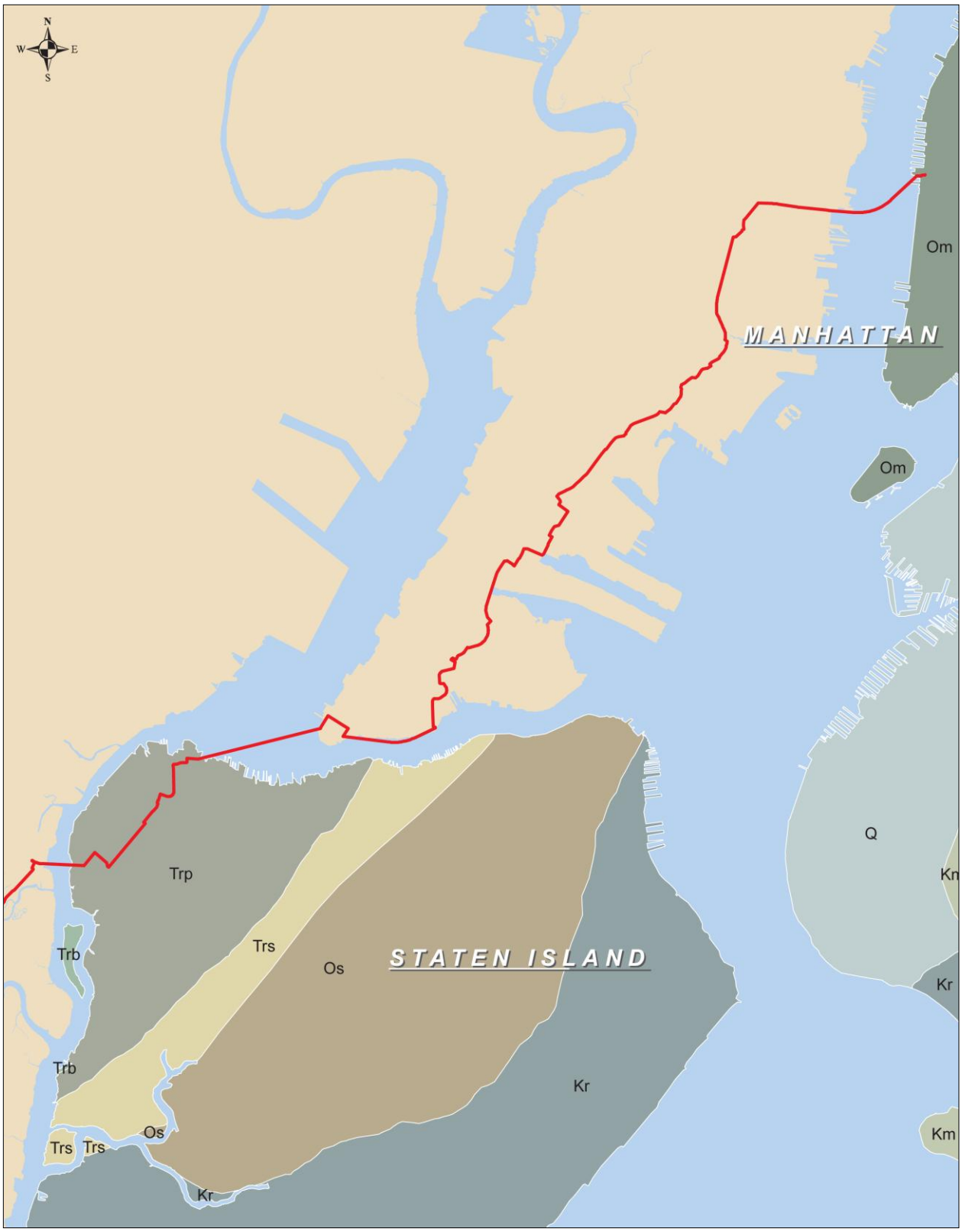

Figure 3-2. Map of the bedrock geology of Staten Island and Manhattan, Lower Hudson, New York (source: Dicken et al. 2008).

The Hudson River is a 315 mile river that flows from its headwaters in the Adirondack Mountains to its mouth in Upper New York Bay. The Hudson River is fed by 25 tributary rivers and creeks, its principal tributary being the Mohawk River. The lower half (more than 150 miles) of the river, south of Troy NY, is a tidally influenced estuary. The lower half of the river flows through the Hudson Highlands, the Hudson lowlands, and the terminal moraine of the last glaciation at the narrows before reaching the Atlantic Ocean (Sirken and Bokuniewicz 2006).

The Hudson has been known by many names including *Muh-he-kun-ne-tuk*, (meaning "great waters in constant motion" or "the river that flows both ways") by the Iroquois, *Muhheakantuck* by the Lenape, the *Manhatees* by Henry Hudson, and officially *the River of Prince Mauritius* (of Nassau) by the Dutch (NYDEC 2009). The Hudson River was also named the North River by the Dutch in the 1700s, a name that continued to be used by inhabitants of New York until the early 1900s, and continues to be used by mariners. In 1664, the English applied the name Hudson, after the Englishman who explored the river in 1609 for the Dutch East India Company.

Geologically, the Hudson is sometimes referred to as a drowned river. During maximum draw-down at around 16,000 years ago, sea level was approximately 400 feet lower than present day and the mouth of the Hudson River was about 120 miles east of its present site extending to near the edge of the continental shelf (Boyle 1979). As the glaciers melted, waters filled the valley trough, dammed by glacial moraines (Geyer and Chant 2006). Rising sea levels that followed moraine collapse resulted in a marine incursion that drowned the coastal plain, including portions that contained the Hudson River channel. The drowned portion of the riverbed is clearly delineated beneath the waters of the Atlantic Ocean and referred to as the Hudson Canyon (NOAA 2005) (Figure 3-3).

The Kill Van Kull and the Arthur Kill are tidal straights. The name *kill* comes from the Dutch word *kille*, meaning riverbed or water channel. The Arthur Kill channel is approximately 10 miles long and connects Raritan Bay on its south end with Newark Bay at its north end. The Staten Island shoreline along Arthur Kill is lined with salt marshes, while the New Jersey side is primarily industrial, built over marshland. The Arthur Kill channel was created when glacial Lake Hackensack breached the terminal moraine and catastrophically drained. The channel may have been the primary drainage in the region for a short period, during a time when the main channel of the Hudson was still blocked at the narrows by the moraine. Its principle tributaries include the Rahway, Elizabeth, Passaic, and Hackensack rivers.

Kill Van Kull is an approximately 3-mile long channel that separates Staten Island from Bayonne, New Jersey. The channel connects Newark Bay with Upper New York Bay and, as passage for marine traffic between Manhattan and the industrial towns of New Jersey, is historically one of the most important channels for commerce in the region.

Estuarine conditions began to develop in the Hudson by approximately 12,000 years ago, reaching Manhattan by approximately 10,000 years ago (Sirken and Bokuniewicz 2006). At that time, currently submerged shoreline areas along Staten Island and the oyster ridge along the eastern coast of New Jersey would have been exposed land. By about 5,000–4,000 years ago, rising sea levels would have reached the edges of the shallow shoreline ridges and small salt marshes would have gradually formed in lowland areas. As rising sea levels gradually inundated the bay, between approximately 2,000 and 4,000 years ago, these ridges became first meadow and then marsh. This sequence was followed by the development of oyster bay habitat that typified the area in the early post-contact period. These oyster beds likely formed within the past 2,000 to 2,500 years (HRI 1993; Kardas and Larrabee 1976; Pousson 1986; Wolfe 1977).

Soils

The Project area traverses six mapped soils, all of which consist of disturbed anthropogenic soils (Figure 3-4). Specific descriptions of each mapped soil unit are provided in Table 3-1.

On Staten Island, these soil units consist of Ipswich-Pawcatuck-Matunuck mucky peats, Laguardia-Ebbets-Pavement and buildings, Inwood-Laguardia-Ebbets complex, Pavement and buildings, wet substratum-Laguardia-Ebbets complex, and Pavement and buildings-Windsor-Verrazano complex. The Manhattan portion of the Project area contains Pavement and Buildings, wet substratum. All these soils either of mucky peats associated with tidal marsh, or sandy and loamy anthropogenic soils consisting either of a mixture of natural soil material and construction debris or fill (NRCS 2005). Many of the units contain extensive surface areas of impervious pavement and buildings.

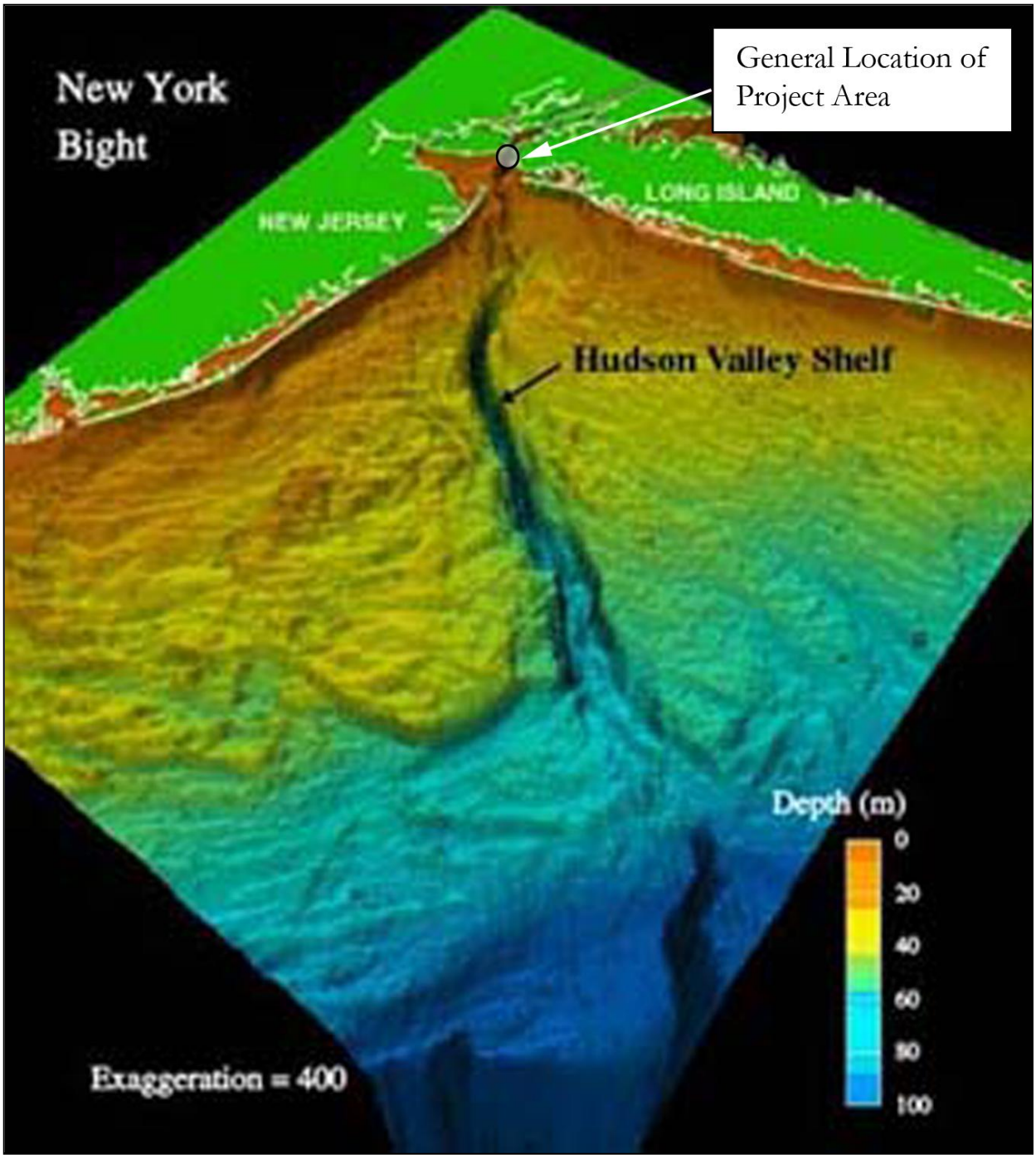

Figure 3-3. Map showing the Hudson Canyon (source: NOAA 2005).

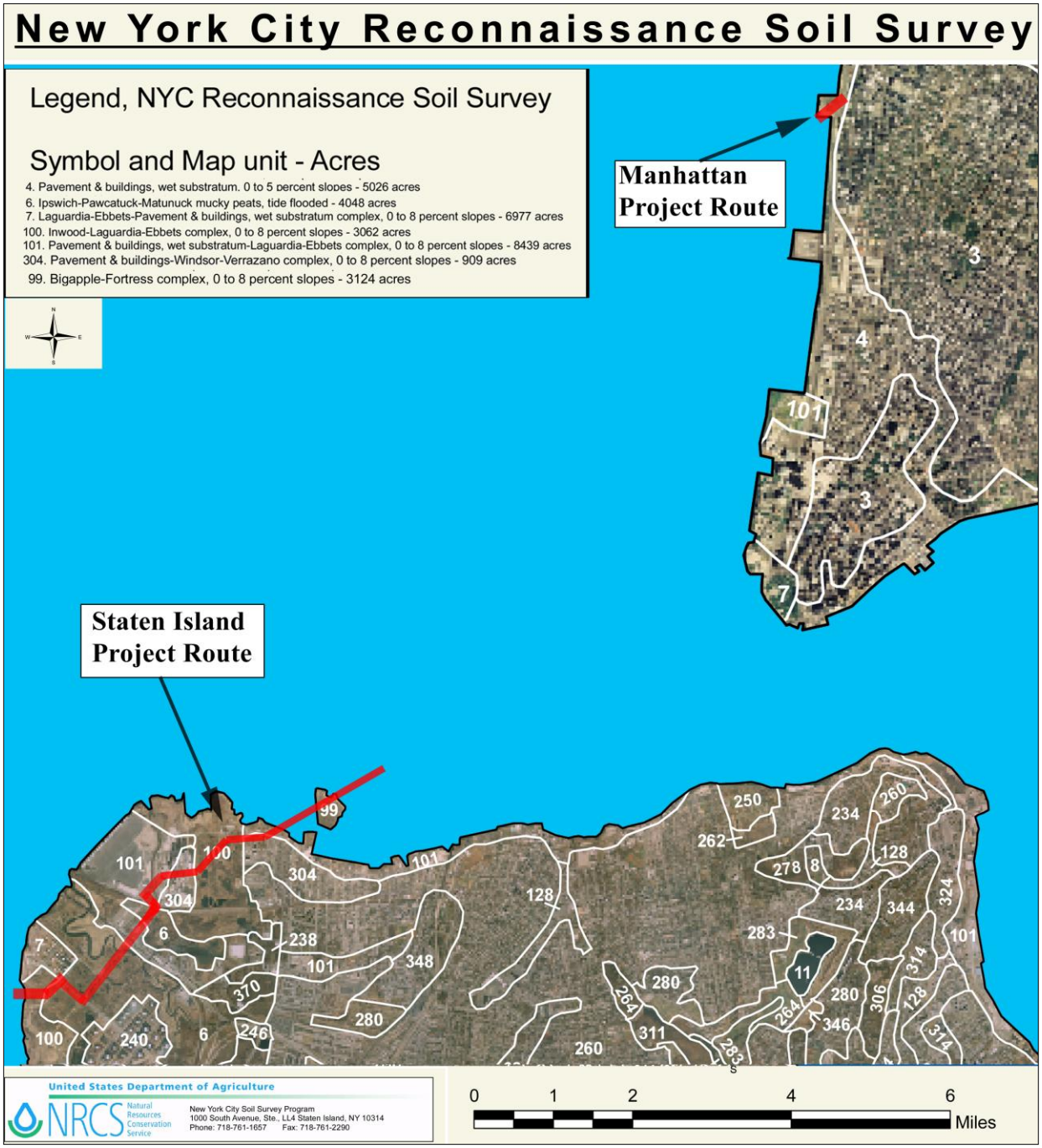

Figure 3-4. Map of soils in the Project (source: NRCS 2006).

Table 3-1. NJ-NY Project Pipeline Route Soils.

Map Unit No.	Map Unit Name	Location	Slope %	Description
4	Pavement & buildings, wet substratum	Manhattan	0-5	More than 80 percent impervious surface of pavement and buildings overlying filled swamp, tidal marsh or water.
6	Ipswich-Pawcatuck-Matunuck mucky peats	Staten Island	None given	Mucky peats overlying sand in low-lying area tidally inundated twice daily.
7	Laguardia-Ebbets-Pavement & buildings	Staten Island	0-8	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 surface.
99	Bigapple-Fortress complex	Shooters Island	0-8	Mixture of natural soil materials and construction debris; a mixture of anthropogenic soils which vary in coarse fragment content.
100	Inwood-Laguardia-Ebbets complex	Staten Island	0-8	Mixture of natural soil materials and construction debris; a mixture of anthropogenic soils which vary in coarse fragment content.
101	Pavement & buildings, wet substratum-Laguardia-Ebbets complex	Staten Island	0-8	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 up to 80 percent impervious pavement and buildings covering surface.
304	Pavement & buildings-Windsor-Verrazano complex	Staten Island	0-8	Sandy outwash plains and dunes that have been partially filled for residential and commercial use; mixture of sandy outwash soils and loamy-capped anthropogenic soils, with up to 80 percent impervious pavement and buildings covering surface.

The mucky peats consisting of natural soil, are all situated within existing tidal marsh areas in Staten Island. The remaining portions of the Staten Island and Manhattan Project area have undergone extensive urban development and contain the anthropogenic soils and pavement and buildings (see Figure 3-4). The Pavement and buildings, wet substratum soil unit in Manhattan and the Laguardia-Ebbets-Pavement and buildings and Pavement and buildings, wet substratum-Laguardia-Ebbets complex soil units in Staten Island all consist of made land deposited over swamp, tidal marsh, or water. The remaining units represent original dry land subsequently filled or disturbed by urban development.

Vegetation and Fauna

Climate and vegetation in the northeast United States has exhibited significant variability since the last glacial maximum. Prior to 9,000 years ago, vegetation regimes are difficult to reconstruct as no modern analogs exist. However, based on the persistence of an abundance of sedges and grasses in paleoenvironmental records dating to between ca. 14,000 and 11,600, tree pollen assemblages dominated by spruce and containing other boreal species

are interpreted as reflecting more open spruce-dominated parkland than that seen in modern, closed boreal forests (Davis 1969; Overpeck et al. 1992). Following the retreat of glaciers and attendant warming, pine began to increase at the expense of more cold tolerant species like spruce in the region, though the warming trend was temporarily reversed during two cooling periods between 13,000 and 8,000 years ago known as the Younger Dryas and "8.2kyr" events (Broecker et al. 1985, Shuman et al. 2002).

In southeastern New York, pine, spruce and sedges dominated an open landscape ca. 12,600 years ago after which a mixed boreal-temperate forest developed containing pine and spruce mixed with oak, ash, hornbeam and fir moving into the area (Maenza-Gmelch 1997). Pine and oak became increasingly abundant in the general region after 11,600 years ago and an aridity maximum was reached by 9,000 years ago (Shuman et al. 2004; Webb et al. 1993). Over time as conditions become warmer, vegetation changes on a regional scale reflect less abundant pine and increases in oak, beech, and hemlock, though pine likely remains abundant on well-drained soils. Vegetation development after this time reflects the establishment of oak-dominated woods mixed with hickory, chestnut, beech and other deciduous trees that moved into the region from the south in successive expansions until forest composition resembled that of today ca. 2,000 years ago (Davis 1969; Webb et al. 1993). Fossil pollen records indicate declines in tree pollen throughout the region after European settlement due to impacts from logging, wood cutting, and agriculture.

Terrestrial faunal resources available for exploitation by pre-contact inhabitants of the region prior to the Holocene could have included big game such as caribou and elk, and megafauna species such as giant beaver, mammoth, and mastodon. Remains of both of these latter megafauna have been found on both Staten Island and nearby New Jersey (Boesch 1994). Finds from the Shawnee-Minisink Site in Pennsylvania suggest that people during this time could also have been utilizing other types of resources other than big game, such as waterfowl, fish, and plants (Kauffman and Dent 1982). Following the onset of warming after the glacial period, the "modern" suite of Holocene fauna was present in the area including deer, elk, bear, and turkey.

Habitats within the Hudson estuary, including mudflats and tidal marshes, support an enormous diversity of resources including waterfowl, fish, and shellfish (NYCDEC 2009). Salt marshes were also an important source of salt hay collected by early Euro-American settlers for animal fodder. More than 200 species of fish are found in the Hudson River and its tributaries including striped bass, largemouth bass, sea sturgeon, bluefish, white perch, shad, and blue crab (Boyle 1979). Historically, the river supported immense populations of herring and sturgeon. Natural resources in the river and estuary were negatively affected by pollution; however, preservation efforts beginning in the late nineteenth century have helped to restore and protect the estuaries natural resources. Today, the Hudson River estuary is reportedly one of the healthiest in the world (NYCDEC 2009).

The large underwater reef on the Jersey side of the Harbor was historically one of the largest oyster beds in the world and was a staple of Native American diet as well as the Dutch and other European groups that followed, until the end of the nineteenth century. The area was called Oyster Bay in the early post-contact period because of the large population of oysters (*Crassostrea virginica*) that grew in the waters of the shallow bay. Hard clams, blue mussel and other mollusks were also likely to be present in the area (Pousson 1986:10). The oyster beds were finally closed in the early twentieth century due to over-harvesting and pollution (Kardas and Larabee 1978).

CHAPTER FOUR

CULTURAL CONTEXT

In order to gain an understanding of the history of human occupation of the Project area it is necessary to have an understanding about the general history, and settlement and subsistence patterns, and other historical developments of the northeast region, with a particular focus on the territory encompassed within the lower Hudson River valley, and on Staten Island and Manhattan in particular. The following review is by no means exhaustive, but provides a framework within which to predict and interpret archaeological resources identified within the Project area. The information for this context has been drawn from the results of professional CRM surveys, pre-contact and post-contact period culture histories, and site-specific histories.

Pre-Contact Period

Most of the pre-contact and contact period sites reported in the vicinity of the study area were noted by early settlers or identified by amateur archaeologists over the course of the last century. While urban development has obscured the archaeological record of the Project area and though few of these sites were clearly mapped and identified, their general locations combined with the fairly large number of sites reported indicates a general level of sensitivity for pre-contact period sites in the area.

Several general surveys for archaeological sites were conducted in the early 1900s in New York (Skinner 1909a, 1909b; Skinner and Schrabisch 1913; Finch 1909; Parker 1920). These surveys included interviews with local collectors at a time when collectors were still active and finding Native American artifacts (Griswold 2002). A number of archaeological sites were reported in shoreline areas in the lower Hudson in New Jersey and New York including a large village site with shell pits and a camp site on Constable Hook; an important Indian village and trading station at Communipaw, campsites along the western shore and near the Bergen Point shoreline in Bayonne, at Greenville Point below Jersey City, and at Paulus Hook in Jersey City.

Several village sites (9), camp sites (2), and cemeteries (2) have also been reported on the northern (Kill Van Kull) and northwestern (Arthur Kill) shorelines of Staten Island, New York from Mariner's Harbor west and south to the mouth of the Fresh Kills (Skinner 1909a; Skinner and Schrabisch 1913). Many sites span the Archaic through the contact periods (Kardas and Larabee 1980) and include a series of village and camp sites from Mariner's Harbor west to the shore of Howland Hook, including the large, multi-component Bowman's Brook Site (Ritchie 1980; Skinner 1909a;Smith 1950), the Goodrich Site (Anderson 1970; Eisenberg 1982; Ottesen and Williams 1969; Skinner 1909a), the Old Place Neck Village Site (Anderson 1964, 1967; Skinner 1909a;Skinner and Schrabisch 1913), the Arlington Place Site, the Arlington Station Site, the Arlington Avenue Site, and Gerties Knoll (Skinner 1909a). Several campsites and a village site with burials (Ascension Church Site) are also reported in the Port Richmond and Harbor Hills (West New Brighton) areas of Staten Island (Skinner 1909a).

Additionally, Finch (1909) and Parker (1920) there are a reported 10 archaeological sites on Manhattan Island (including village sites, shell middens, camp sites, and find spots), though nearly all of the sites were located in the northern part of Manhattan. Several pre-contact sites were also identified in the New York City area during CRM projects conducted in the 1980s (Lenik 1992). These include four sites on Manhattan Island, seven sites on Staten Island, and two sites in the Bronx.

Several Middle Archaic through Woodland Period shell midden sites have been professionally excavated in the project vicinity, including the Kaeser site in the Bronx (Rothschild and Lavin 1977), the Stony Brook and Baxter sites on Long Island (Ritchie 1959; Salwen 1962), the Dogan Point Site near Tarrytown (Claassen 1995), the Sungic Midden Site on Shelter Island (Lightfoot and Cerrato 1988), and a site on Liberty Island (Griswold 1998, 2002). Most Lower Hudson Valley shell middens are comprised primarily of oyster (*Crassostrea virginica*), with lesser amounts of mussel, hard- and soft-shell clam, and bay scallop (Brennan 1981). The Dogan Point Site is one of the more thoroughly excavated Hudson Valley shell midden sites. Site deposits accumulated over the course of 5,000

years, and appears to have been occupied from the late fall to early spring. Analysis of hard-clam shell (*Mercenaria mercenaria)* and at the Sungic Midden site indicates that the site was occupied during most months of the year (Lightfoot and Cerrato 1988).

Post-contact and Woodland period pre-contact shell midden sites have been identified and professionally investigated on both Liberty and Ellis Islands in New York Harbor. The sites on both islands demonstrate the potential for intact pre-contact sites to exist and be evaluated despite extensive development. The shell midden on Liberty Island was first identified in 1985 during excavation of a utility trench. Investigations at the site include a three-day salvage excavation by the NPS in 1985 and intensive excavations by NPS in 1999 (Griswold 2002). The pre-contact midden contained a few ceramic fragments dating to the Middle Woodland through the contact period, a jasper Levanna-type point dating to the Middle Woodland, lithic chipping debris, and a variety of faunal bone (mammal, bird, fish, salamander, and turtle) and shell (Eastern oyster, soft-shell clam, ribbed mussel, and slipper shell). Analysis suggests that the site deposits date to a period when, due to lower sea levels, Liberty and Ellis Islands may have been connected.

Extensive archaeological investigations were conducted in advance of the development of the Museum of Immigration on Ellis Island in the mid- to late 1980s. While summary reports for the archaeological mitigation work have not been completed at this time, preliminary field reports on some mitigation excavations indicate that pre-contact and post-contact period shell midden deposits exist under the basement floor of the Main Immigration Building (Boesch 1987; Pousson 1986). Midden deposits contained a number of native and post-contact period artifacts and features as well as human remains. Preliminary artifact analysis indicates that the site was occupied from the Late Archaic through the contact period.

Most of the sites identified in the project vicinity have not been subject to professional archeological excavation, however, and detailed research information about the sites is lacking (e.g., site size, function, temporal information). It is possible that many, if not most, of these previously reported sites have been disturbed or destroyed through extensive development for railroads, the shipping industry (e.g., dock and wharf expansion along the waterfront, dredging), roads, urban residential communities, and industry. There is the potential for sites to be preserved, though they may be deeply buried under historic fill or other natural deposits (Marshall 1982). Accordingly, there are special challenges to identifying, delineating, or evaluating sites in these contexts.

PaleoIndian Period (12,500–10,000 B.P.)

The earliest evidence for human occupation of the Northeast region dates from the PaleoIndian Period, which is closely associated with the northward retreat of the final Wisconsin glaciers. The retreat of the Wisconsin glacier resulted in the moderation of climatic conditions. By 12,000 B.P., the spruce forest vegetation and glacial lakes of the postglacial environment supported emergent floral and faunal resources, which may have attracted pre-contact groups (Nicholas 1988). Sea levels were much lower during this period, and the study area was located well-inland from the Atlantic coastline.

The PaleoIndian Period is not well understood due to the general paucity of sites dating to this time period. Traditional interpretations of PaleoIndian subsistence patterns include a primary reliance on hunting large game. More recent investigations have determined that a broader subsistence base that incorporated large and small mammals, birds, and plants, is a more likely possibility. In New York, it is thought that these people did exploit a wider array of resources, such as smaller game and seasonal plant foods (Ritchie and Funk 1973), and may have operated within a restricted territory (Eisenberg 1978). Data collected from PaleoIndian sites in the region suggest that high, well-drained areas near streams or wetlands were preferred locations for occupation, though rock shelters near lithic sources and lower river terraces were also subject to occupation and use (Funk 1976; Marshall 1982; Moeller 1980; Ritchie 1980).

Most commonly, PaleoIndian Period sites are typified by the presence of fluted, lanceolate projectile points in an isolated context. Occasionally, large flake scrapers, bifaces, unifaces, and fragments of esquilles and knives are also found (Funk 1978; Ritchie and Funk 1973). These stone tools were often fashioned from non-local cherts originating in eastern New York and jasper from Pennsylvania and New Jersey. Though rare, diagnostic fluted projectile points have been recovered throughout the region from Staten Island, Long Island, and New Jersey (Funk 1978; Gwynne 1982:39–40; Saxon 1973).

A number of PaleoIndian sites are known from the southern portion of Staten Island. The Port Mobil Site on the southwestern shore of Staten Island yielded more than 100 tools that included fluted points, drills, gravers, spokeshaves, knives, scrapers, and cores, indicating a more extensive occupation (Kraft 1977; Ritchie 1980). Additional fluted points and tools were recovered nearby along the tidal beach of the Arthur Kill. Isolated finds of fluted points have also been found on the southwest part of Staten Island (Wagner and Siegel 1996). Fluted points were also recovered from the Cutting Site and at Kreischerville, and lithics thought to be PaleoIndian in age were found at Smoking Point and Charleston beach (Boesch 1994). Other sites in the greater region include an early settlement at the Turkey Swamp Site near Freehold in Monmouth County, the Plange Site in western New Jersey, and the Dutchess Quarry Site in southern New York state (Kraft 1977).

Given that sea level has changed so dramatically over the last 14,000 years, it is likely that many, if not most PaleoIndian Period sites in coastal New Jersey and New York would be submerged under the bay waters or present in what are currently near-coastal wetland areas. Additionally, early occupation sites may be preserved along the elevated postglacial shoreline (Snow 1980).

Archaic Period (10,000–3000 B.P.)

The Archaic Period in the Northeast is characterized by more generalized hunter-gatherer strategies than the PaleoIndian Period. It is subdivided into Early, Middle, and Late periods on the basis of changes in environment, projectile point styles, and settlement patterning (Lavin and Mozzi 1996; McBride 1984; Snow 1980).

Early Archaic Period (10,000–8000 B.P.)

During the Early Archaic Period, it has been estimated that the present coastline extended some 80 miles to the east (Kraft 1977). The Early Archaic was characterized by a gradually warming climate following the cold period associated with the Younger Dryas, and by the end of the period the environment was dominated by a mixed pine-hardwood forest. Megafauna populations were replaced by smaller game such as deer and bear. Seasonally available food resources would have become more predictable and abundant, allowing pre-contact period populations to exploit a wide range of territories.

The lithic technology of the Early Archaic reflects a more diversified subsistence strategy, including beaked unifacial edge tools, cores, flakes, hammerstones, milling slabs, and notched pebble sinkers, indicating an increased utilization of plant and fish resources (Robinson 1992). Early Archaic Period sites are defined by the presence of bifurcate-base (e.g., Kanawha, LeCroy, MacCorckle), Kirk variant and Palmer projectile points, among others. Characteristic of assemblages is the predominance of expedient tools made from local lithic sources.

Settlement strategies during this period remain somewhat speculative, but evidence indicates that a complex multisite settlement system may have been established by this period, with different site locations indicating exploitation of varied resources and environmental settings (Johnson 1993; Ritchie 1984). The nearly exclusive use of local stone for tool production also suggests a more settled lifestyle. Sites tend to be located on tidal inlets, coves, and bays, and on freshwater ponds (Ritchie 1980). Early Archaic finds have been associated with shell middens in the Lower Hudson region (Kraft and Mounier 1982). Populations most likely increased during this period, although Early Archaic sites are poorly represented in the archaeological record of both New York State and New Jersey. This may be a result of low population densities resulting from unfavorable environmental conditions such as rising sea levels and the extinction of large migratory game.

Early Archaic components have been identified from several sites on Staten Island including the Hollowell, Old Place, Charleston Beach, Wards Point, Travis, and Richmond Hill sites (Boesch 1994; Platt 1997). Other possible Early Archaic components in the greater region have been identified on Long Island at Stony Brook, Wading River, and Jamesport sites (Ritchie 1959).

Middle Archaic Period (8000–5000 B.P.)

Middle Archaic Period activity in southern New York State reflects adaptations to more diversified subsistence strategies, particularly along major rivers and streams, in response to changing environments. Pine dominated forest was eventually replaced by mixed hardwoods dominated by oak and hickory as well as mast trees like beech. This

was part of an ideal environment for wild game, birds, and edible roots, berries, and nuts. Middle Archaic groups tended to operate within a system of planned seasonal movement. The types of subsistence activities employed included hunting along with the regular harvesting of anadromous fish and plant resources. Shellfishing stations also begin to appear in the lower Hudson estuary during this period (Brennan 1981).

Typical projectile point types include Neville/Stanly, Stark/Morrow Mountain, Otter Creek, and Guilford varieties (Custer 1996; Snow 1980), as well as points similar to Vosburg and Brewerton types (Ritchie 1979). Ground-stone technology introduced a variety of tool types into the lithic assemblage including net sinkers, plummets, grooved adzes, axes, gouges, and atlatl weights (Dincauze 1976).

Middle Archaic assemblages have been found throughout the region, including on Staten Island, the upper Delaware River valley, the Susquehanna River in New York, and the Maurice River drainage in southern New Jersey (Linck et al. 2009). On Staten Island, a Middle Archaic component has been identified at the Wards Point Site, and possible Middle Archaic components have been identified at Chemical Lane and Harik's Sand Ground. Farther abroad, the Rockelein Site in the Upper Delaware Valley yielded Middle Archaic projectile points from deeply stratified deposits (Kraft and Mournier 1982). The Wading River and Stony Brook sites excavated by William Ritchie in the 1950s also contain evidence of Middle Archaic occupations (Ritchie 1959). The Savich Farm Site in Marlton produced 41 cremation burials and accompanying grave goods.

Late and Transitional Archaic Period (5000–2700 B.P.)

The cultural traditions of the Late Archaic Period (5000–3000 B.P.) throughout the Northeast are better documented and understood than early periods. The period is traditionally considered to be a time of cultural fluorescence, as reflected in burial ceremonialism, population increases, and evidence for the establishment of long-distance exchange networks (Ritchie 1980; Snow 1980).

The Late Archaic Period was marked by a climatic shift to drier and warmer conditions. During this period, oak, pine, and beech reached their full extent, and wetlands became more abundant along river margins. Wetland and estuarine areas appear to have been used extensively based on site distribution. The increase in density of sites and artifacts from this period coincides with this climatic warming (Funk 1972). The archaeological evidence demonstrates an increased use of shellfish, nuts, and plant resources. Perhaps in response to an increasingly resource-rich natural environment, Late Archaic populations expanded and diversified.

The Late Archaic populations that occupied the region utilized a wide variety of riverine and upland habitats. Ritchie (1980) and others have postulated that during the latter portion of the Archaic Period, river valleys provided abundant resource bases for pre-contact populations, who in turn heavily utilized these areas for habitation as well as special purpose activities. This shift from mixed forest uplands to riverine lowlands may help to explain the abundance of sites dating to this period in proximity to the major river drainages of eastern New York. Intensification of coastal-oriented economies is represented by vast shell middens in the lower Hudson Valley as well as the coasts of Long Island, Cape Cod, and Connecticut (Brennan 1974). Sites in general appear to be larger than the preceding periods, and group territories may have become established.

The Late Archaic Period has been divided into three major cultural traditions (Laurentian, Narrow-stemmed, Susquehanna), all of which are represented to some degree at sites in southern New York State. The Laurentian tradition (6000–4200 B.P.) was first identified in New York (Ritchie 1980). The earliest site assigned to this tradition in the Northeast is the Schafer Site, located in the Mohawk Valley of upstate New York. This site yielded cultural deposits radiocarbon dated to 6290 ± 100 B.P. (Wellman 1975). The tradition is characterized by an artifact complex containing wide-bladed points with side or corner notches such as Otter Creek, Vosburg, and a variety of Brewerton subtypes. These points often are manufactured from cherts found in parts of New York and New Jersey.

The Narrow-Stemmed tradition (4300–3500 B.P.), analogous to contracting-stemmed Piedmont tradition points is characterized by small, thick, narrow-bladed, stemmed or notched projectile points such as Sylvan Lake, Wading River, Bare Island, Poplar Island, Lackawaxen and Taconic Stemmed, and Lamoka points. They are usually produced from locally available shale, argillite, quartz, quartzite, and rhyolite. Sites from this tradition also often contain gouges, plummets, scrapers, drills, adzes, paint stones, and pitted stones. Settlement patterns differ from the Laurentian tradition as larger, seasonal camps along with small, temporary sites. The larger camps are thought to be

base camps and often are situated along major rivers. Smaller, more specialized occupations are located in a variety of environmental zones including terrace and upland zones (McBride 1984). The nature and distribution of sites suggest a less-mobile population with communities gathering during summer months and dispersing into smaller groups during the cold weather (McBride 1984; McBride and Soulsby 1989).

The subsequent Transitional Archaic Susquehanna tradition (3800–2700 B.P.) is characterized by broad spear points such as Susquehanna, Snook Kill, Koens-Crispin, Perkiomen. The narrower Orient Fishtail points are present in the latter part of the Transitional Archaic and their use may extend into the subsequent Early Archaic Period. Other Susquehanna assemblage artifacts consist of steatite vessels, ground axes and adzes, wing-shaped atlatl weights, and toward the end of the period, occasional steatite- or grit-tempered ceramics. Another characteristic of the Susquehanna tradition consists of increasingly complex burial ceremonialism the hallmark of which are cremation burials containing "killed" artifacts. The composition and chronological distinction of these assemblages, as well as the variety of settlement types, vary throughout the Northeast. Susquehanna tradition settlement patterns differ with those of the preceding Narrow Stemmed tradition. The pattern is similar to the Laurentian tradition, in that there are more temporary camps and specialized use of the uplands. Evidence from upland sites suggests that temporary occupations were specialized and established near streams and swamps. Less frequent group movements and more specialized procurement strategies are inferred. Communities came together near major rivers during certain parts of the year, possibly coinciding with either burial ceremonies or the harvesting of floodplain plant resources (Pagoulatos 1986).

Sites dating to this time period are abundant in southern New York in general, and have been identified on all of the major islands (Staten, Manhattan, Long, Shelter, and Fishers). Sites with Late or Transitional Archaic components on Staten Island include the Pottery Farm, Bowman's Brook, Smoking Point, Goodrich, Sandy Brook, Wort Farm, Arlington Avenue, Wards Point, Old Place, and Travis sites (Boesch 1994). A number of substantial Late Archaic Period sites have also been more recently investigated the north shore of Long Island, including the Murray Site on Setauket Harbor (Bernstein and Lenardi 1992), and Rudge-Breyer (Gwynne 1982, 1985), Pipestave Hollow (Gramly 1977; Gwynne 1982), Eagles Neck, (Bernstein et al. 1993; Lenardi 1998), and Remsen Hill (Kalin and Lightfoot 1989) on Mount Sinai Harbor.

Sites dating to this period are often very large and contain dense quantities and diverse materials. The Bare Island point, which closely resembles the Small Stemmed type, has been identified as a major component of Late Archaic sites in the vicinity, while the Orient Phase is perhaps the most common component recognized in the Transitional Archaic (Snow 1980). Artifacts and features associated with the Orient Phase include Orient Fishtail projectile points, knives and drills, ground-stone tools and ornaments, soapstone vessels, ceremonial grave goods, and shell middens.

Woodland Period (3000–450 B.P.)

The Woodland Period in the Northeast is characterized by a major shift in subsistence and habitation strategies including the introduction of cultigens (maize, beans, and squash) and the use of ceramic vessels. However, evidence of horticulture has not been clearly documented in the immediate region surrounding the Project area, and it is likely that native peoples would have continued to rely heavily on coastal resources (shellfish and marine species), as well as terrestrial game and gathered foods (Gray and Pape Inc. 2005). Site size and complexity also increased, suggesting increased sedentism and social complexity (Dragoo 1976). The Woodland Period is usually subdivided into Early, Middle, and Late periods on the basis of ceramic types and political and social developments (Lavin and Mozzi 1996; Ritchie 1980; Snow 1980).

Early Woodland Period (3000–1600 B.P.)

Woodland Period settlement patterns and subsistence practices in the lower Hudson region appear to have increasingly shifted to settlement patterns oriented toward riverine, and sheltered bay and estuary locations, both cremation and primary burials, and long-distance trade or exchange networks (Ritchie 1980; Snow 1980). The shift to coastal resources has been observed elsewhere in the greater region and across most of New England (Snow 1980). Changing subsistence systems that include the introduction of horticulture also marks the Woodland Period. Interior hunting, fishing, and gathering of natural food resources appear to have increased within a limited seasonal

exploitation pattern. Settlement became more sedentary, and larger groups of individuals aggregated at preferred coastal/major riverine village sites.

The identification of Early Woodland sites usually relies on the presence of diagnostic stemmed and side-notched Adena, Lagoon, Rossville, and Meadowood projectile points. Tools like net sinkers, bone awls, anvil stones and abraders are also artifacts characteristic of the period. The Early Woodland Period is also marked by the clear emergence of ceramic technology, replacing the soapstone vessels that had been used during the Late/Transitional Archaic periods. These ceramics consist of coarse grit-tempered (and occasionally shell-tempered), conoidal, and cord-wrapped vessels known as Vinette I. In coastal areas, Vinette I pottery has often been associated with Orient Fishtail and Susquehanna broad points. A more sophisticated ceramic type known as Vinette 2 developed slightly later. Artifact assemblages for this period comprise a high percentage of exotic lithic materials and speak to an expansion and elaboration of long-distance trade networks.

Evidence of Early Woodland occupation is fairy widespread, and includes several multicomponent sites on the north shore of Staten Island such as Arlington Avenue, Arlington Place, and Bowman's Brook (Boesch 1994). Elsewhere in the region, Early Woodland Period vessels have been identified at several sites on the north shore of Long Island and near East Hampton (Gray and Pape Inc. 2005; Ritchie 1959). In particular, the Jamesport Site, located on the North Fork of Long Island, identified cord-marked Vinette I style pottery, likely dating to this period (Ritchie 1959).

Middle Woodland Period (1600–1000 B.P.)

The Middle Woodland Period in the Northeast is characterized by increased diversity in ceramic style and form, the use of tropical cultigens (though evidence for this is scarce), and long-distance exchange networks (Dragoo 1976; Snow 1980). Much of our knowledge of this period is extrapolated from work done by Ritchie (1980) in New York State. Ritchie noted an increased use of plant foods such as goosefoot (*Chenopodium sp*.) in the Canoe Phase in New York, which he suggests had a substantial impact upon social and settlement patterns. Ritchie further noted an increase in the frequency and size of storage facilities (Ritchie 1980; Snow 1980). The changes in subsistence strategies led to an increasing sedentism manifested by larger and more diverse sites created through semipermanent village settlement. Year-round access to resources brought about increased settlement in coastal areas and around marshlands (Lavin 1988).

Increased sedentism led to augmented horticulture and harvested nuts, grains, and seeds became more important to the daily diet. The Middle Woodland Period is also documented by an increased diversification in ceramic vessel production as forms began to adapt for increased efficiency in cooking the changing diet (Lavin 1988). Pottery also becomes more stylistically diverse, including grit-tempered coil built vessels with stamped, incised, and dentate decoration of varying quality. Fox Creek stemmed and lanceolate points and Jack's Reef points are widely associated with the Middle Woodland Period in the area.

One Middle Woodland site near the Project area is the shell midden site at Liberty Island that contained ceramic fragments diagnostic of the Middle Woodland, as well as a jasper Levanna-type point (Griswold 2002). Several Middle Woodland Period occupations have also been identified on Staten Island at the Huguenot Site, the Cutting Site, Pottery Farm, Page Avenue North, and at the Van Deventer/Fountain House (Boesch 1994). Further afield, a number of substantial Middle Woodland Period occupations have also been identified on Long Island. These include the Henry Lloyd Manor, a multicomponent shell midden site on the north shore of Long Island, which contains evidence of a broad range of activities (e.g., gathering, hunting, fishing, food processing, and tool manufacture) as well as structures (Merwin and Manfra 2004). The site dates from the Late Archaic to the Late Woodland, with the most intensive occupation during the Middle Woodland Period. The Twin Pond Area 1 Site in Brookhaven appears to have been occupied over a period of 4,000 years, and included Middle to Late Woodland Period occupations.

Late Woodland Period (1000–450 B.P.)

The Late Woodland Period in the Northeast traditionally is characterized by intensification of horticulture; changes in ceramic technology, form, style, and function; and an increase in the use of exotic (non-local) lithic materials. This period is also associated with the emergence of year-round village-type sedentism; settlements adjacent to coasts, broad floodplains, estuaries, and major rivers seem to have been preferred, though upland zones were used by smaller, domestic units and organized task groups. Late Woodland Period artifact assemblages are characterized

by Levanna point forms and finely made collared and collarless vessels with geometric designs, and brushed, stamped, incised, and cord-marked ceramics (Lavin and Mozzi 1996; Ritchie 1980; Snow 1980). Defined territories may have been firmly established by the onset of the Late Woodland. During the later contact period, the area of New Jersey north of the Raritan River was considered the "territory" of Munsee speaking Lenape groups. This territorial division may be reflected in the Late Woodland Period archaeological record by differing ceramic types and burial orientations (Kraft and Mounier 1982).

Settlement patterns in the greater region suggest a trend toward fewer and larger villages near the coast and rivers, reflecting a continued reduction in residential mobility and increased sedentism. It has been hypothesized that these changes can be attributed to the introduction of maize, beans, and squash, but it is unclear how important cultigens were in the aboriginal diet in much of the northeast including the lower Hudson area (Ceci 1980; Chilton 1996; McBride 1984; Ritchie 1980). Village sites are identified along estuaries and along major rivers. Preserved subsistence remains from such occupations have included white-tailed deer, woodchuck, fish, birds, and small mammals. Plant remains include berries, hickory nuts, lambs-quarters, hazelnuts, and acorns. Domesticated plants have included maize, beans, and sunflower (Bendremer and Dewar 1993; McBride 1984). These food remains suggest the exploitation of a wide variety of microenvironments, reflecting spring, summer, and fall occupations.

Late Woodland occupations are found distributed across a range of microenvironments, though floodplain wetlands, coves, tidal marshes, upland streams, and interior wetlands were the most commonly exploited. Villages tended to be situated along major rivers, estuaries, and tidal marshes, while smaller temporary camps were situated along upland streams and inland wetlands. Populations appear to have aggregated in villages during much of the year. Temporary encampments were established on a seasonal basis by smaller domestic units or organized task groups in upland zones. The settlement pattern reflects that of a collecting strategy (Binford 1980; McBride 1984).

Several Late Woodland Period sites have been identified in the vicinity of the study area. The shell midden at van der Kolk on Mount Sinai Harbor on the North Shore of Long Island is perhaps the best studied Late Woodland site in the area (Bernstein et al. 1993; Bernstein et al. 1994). Cultural deposits yielded a large quantity of vertebrate faunal materials and shell in addition to pottery and lithic remains. Shellfish analyses indicate the site was utilized during all seasons of a single year. Two Late Woodland Period sites were noted by Alanson Skinner in 1913, including Bowman's Brook (the type site for the Bowman's Brook phase) on Staten Island and a village on the north shore of Constable Hook in Bayonne New Jersey. Another possible Woodland Period site identified by Skinner in New Jersey may be located on either Caven's Point or Ancoeus Hill (as interpreted by Kardas and Larrabee 1978:20–21).

Contact Period (ca. 1525–1650)

The contact period represents an era of cataclysmic socioeconomic, political, and cultural change in the face of Native American and European interaction. Euro-American utilization of the study area could have begun as early as the sixteenth century, when European explorers reached the eastern coast and began to interact with the Native inhabitants. The earliest accounts date to 1524, when Giovanni da Verrazano, commissioned by King Francis I of France and a silk merchant syndicate, passed through New York Bay in his navigation of the Eastern Seaboard in an attempt to find a passage to the "Indies" (Burrows and Wallace 1999:11). He named the Upper Bay "Santa Margarita" and the surrounding lands Angoulême. Sixteenth century European exploration did not result in trade or extensive contact with the native inhabitants, and though mariners, fisherman, and merchants visited the East Coast sporadically over the next century or so, there was no permanent settlement in the region.

In 1609, Henry Hudson was hired by the Dutch East India Company to locate the elusive Northeast Passage. Although he did not locate the passage, he did travel up the river that bears his name and had several contacts with the Native populations (Brasser 1978). The Dutch began trading with the native groups in the area in 1610. At the time of European contact, native groups were referred to by numerous names, including the Delaware, by European colonists, though they generally referred to themselves as Lenape. The local indigenous peoples spoke a dialect of an Eastern Algonquian language called Munsee (Goddard 1978a; Salwen 1978). The Lenape maintained autonomous, loosely structured bands that resided in small dispersed settlements (Kraft 1975).

Politically, the Munsee-speaking Lenape groups were divided into a number of main groups, who were further divided into numerous smaller political and dialectic subgroups (Ruttenber 1872). Subgroups in the project vicinity

include the Hackensacks in the present Newark and Jersey City areas, Monatons, or Raritans, and Tappans, who traditionally occupied Staten Island; the Nayacks who sold their homeland in Brooklyn and later moved to Staten Island; the Wickquaesgecks or Wiechquaesgeck who occupied upper Manhattan Island; the Reckgawawanck who occupied lower Manhattan Island; and the Canarse who occupied present-day Brooklyn and Queens. The exact territories of these bands are somewhat elusive, due in part to the lack of fixed tribal boundaries (Boesch 1994; Skinner and Schrabisch 1913).

The 1610 Velasco map used the name Manahata to describe the native people occupying both banks of the lower Hudson River (Grumet 1981, 1995). In 1628, Isaak de Rasieres reported the presence of 200–300 "old Manhatasen" men and women in the northern portion of the island, a group later ethnically identified as subgroup of the Wiechquaesgeck (Bolton 1922; Grumet 1981). Although there was a fair amount of trade early on, Hudson's accounts of the Native population in the Hudson Valley region indicate that relations between the two groups were not always peaceful.

Dutch traders benefitted greatly from the fur trade and their prosperity did not go unnoticed. In 1613 or 1614, the English sent a military compliment to expel the Dutch from Manhattan and the Hudson River (PanAmerican Consultants Inc. 2003). Several repeated efforts by both the English and French failed, with the Dutch steadfastly holding their claim to the land. Realizing their tenure was under scrutiny, Dutch colonization was seen as a way to hold onto control. In 1621, the States General of the United Netherlands granted a 21-year charter for the establishment of the Dutch West India Company, with exclusive rights to trade and settlement in what they termed New Netherlands. The West India Company charter allowed qualifying individuals (usually wealthy merchants or company officials) to purchase tracts of land from the Native Americans, and Dutch settlements in Albany and New Amsterdam (New York) became established communities by 1623 (Whitcomb 1904). Trading posts were established and merchants were encouraged to begin long-term trade for furs and animal skins in the new territory. Within 10 years, European competition was so intense that Native inhabitants were offered up to three times the usual trade for a pelt by Dutch traders.

Epidemic disease, competition for trade between Native American groups, and hostilities between Natives and Europeans had substantial impacts almost immediately after the Dutch became a sustained presence in the area. Unlike the Native groups to the north, those along the Lower Hudson lacked the furs necessary to become valuable trading partners with the Dutch. The Dutch policy of supplying the Mahican and Mohawk with firearms while denying the same goods to the groups along the lower Hudson, however, made the Manhattan groups vulnerable to attack. In response to European aggression and increasing intratribal hostilities over trade privileges, palisaded villages began to emerge along the New York coast. A series of major and minor skirmishes among the various competing interests eventually led to local Native Americans suing the Dutch for peace in 1644. Despite this accommodation, friction persisted between the Dutch and Manhattans culminating in two more major armed conflicts over the next 20 years. The incessant violence coupled with "virgin soil" epidemics effectively decimated the Manhattan native groups living in the present New York City area. On the island of Manhattan for example, the once thriving population of its original Lenape, or "Manhatan" inhabitants were reduced to 200–300 individuals by 1628 due to death by disease, or having been driven out by a competing group (Burrows and Wallace 1999:23). The fragmented populations were forced to merge in order to maintain viable communities, many of whom vacated the island to mainland settlements (Grumet 1995).

Unfortunately, most of the records dating to the early contact period are vague and Native settlements and encampments were not clearly mapped or identified, and professionally identified and documented sites are exceedingly rare. One probable Native American habitation site in the area noted by early Europeans was known as *Sapokanickan*. It was situated on the west shoreline of Manhattan in close proximity to the Project area near present-day Gansevoort Street. The site may have been used as a landing area for canoes crossing the Hudson to trade, and a secondary trail led east of the site to the main north-south trail running through the approximate center of Manhattan. This trail likely became the later Old Kill or Great Kill Road, which eventually became present-day Gansevoort Street. Other native village sites noted in early records include *Harsimus* or *Ahasimus* located in New Jersey near the Hudson shore across from the Project area in Manhattan between Hoboken and Paulus Hook; this village reportedly contained a spring and was located on the edge of a salt marsh extending from Communipaw Cove to Harsimus Cove. Nearby, the *Hobokan* or *Hobokan-hackingh* site also in New Jersey near Hudson and 2nd Street in Hoboken was a trading place and trail confluence, and may have also been a source location for Serpentine. There were a number of important settlements on the north shore of Staten Island that were connected by a path that

paralleled the Kill van Kull between West New Brighton and Howlands Hook (Bolton 1922). Contact period components have been identified at a number of sites on Staten Island including Ward's Point, Old Place, Corsons's Brook, Travis, New Springfield, and the Walton-Stillwell House (Boesch 1994).

Post-Contact Period Cultural History

Manhattan

European Colonization and Settlement (ca. 1610–1800)

Beginning with Henry Hudson's "discovery" of the island in 1609, Manhattan and the Harbor Islands attracted acute European interest and profound admiration. Described as a "terrestrial Canaan where the land floweth with milk and honey," (Burrows and Wallace 1999:3), foreign travelers to Manhattan Island described a land of lush and vast meadows, enormous stands of hard- and softwoods, and abundant game. So inexhaustible did these resources initially appear that a Dutch trader was prompted to comment, "There are some persons who imagine that the animals of the country will be destroyed in time, but this is an unnecessary anxiety (Burrows and Wallace 1999:4)

This exuberant praise, however, was not as great an impetus to Dutch colonization of the island as hoped by colonial financiers in Amsterdam. Though trading forts had been established along the river and four houses constructed on Manhattan by 1613 (Morris 1898:54), it wasn't until 1623 with the arrival of 30 Walloon families that settlement on the southern tip of the island of a more permanent nature began (Brodhead 1853:150). The settlement was subsequently dubbed New Amsterdam. This settlement strategy, part of a hastily organized land grab on the part of West India Company in response to French and English claims to the island, effectively marked the beginning of New Netherland (Rink 1986). Under the direction of Peter Minuit, Manhattan was famously "purchased" from the local Lenapes, and soon after boasted 30 log houses, a fort, and a solid stone countinghouse, the last of which spoke volumes about the explicitly commercial orientation of the new colony (Rink 1986:87). It was estimated that there were approximately 200 people at New Amsterdam at this time (Brodhead 1853:159).

The fledgling community comprised a disparate mix of French-speaking Walloons, Dutch-speaking families from Amsterdam, and a loose confederation of young, single merchants concerned solely with profiting from the lucrative fur trade up and down the Hudson. This lack of cultural cohesion and common purpose threatened to undermine the stability of the colony. In response to the situation, the Amsterdam chamber proposed a settlement strategy of patroonships. This system called for the transfer of large portions of New Netherland to wealthy patroons, or patrons, in exchange for a promise on the part of the patron to fund the colonization efforts of at least 50 settlers. Documented early efforts at settlement included land patents granted by patroons to individuals and the establishment of tobacco plantations (Fernow 1883).

Documentation of Dutch activity and settlement in the immediate vicinity of the Manhattan portion of the Project area comes from a land patent record dated to 1629 (Fernow 1883). The record describes a tract of land located near the Native site of Sapokanickan granted to Wouter van Twiller, who had succeeded Minuit as Director General of New Netherland (Fernow 1883:13), though van Twiller does not appear to have arrived until 1633 (Burrows and Wallace 1999:29). The tract, located in what is now Greenwich Village, was bounded to the west by plantations owned by "Jan from Rotterdam" and Edward Fiscock. By 1639, Twiller's land consisted of a palisaded tobacco plantation (Fernow 1883:19), and in 1642, it was leased to Thomas Hall for five years who agreed to clear as much land as possible on the tract and grow tobacco (Fernow 1883:35–36). Another deed dating to 1640 describes another plantation in the vicinity of Sapokanickan with a house granted to Adriaen Pietersen (Fernow 1883:27).

Despite best intentions, the patroon system and poor governance led to rampant speculation and very little in the way of colonial settlement. Van Twiller's inept tenure as Director General had left New Amsterdam in nearly total disrepair and ruinous condition by the time William Keift replaced him in 1638 (Brodhead 1853:276). Keift himself was recklessly cruel and unfair in his treatment of the neighboring Native American groups ultimately resulting in the Dutch-Indian War of 1643–1645 (Brodhead 1853). The war resulted in massive destruction of Dutch colonial settlements throughout the area. The colony at New Amsterdam did not escape unscathed during the hostilities, and by its end the island was nearly depopulated of its settlers (Brodhead 1853:407). Those that remained largely consisted of settlers from other areas seeking refuge at New Amsterdam.

The colony continued to flounder until the firm hand of Petrus Stuyvesant took the administrative reins in 1647. Under Stuyvesant's direction, New Amsterdam underwent a civic and territorial reorganization, beginning with the appointment of three surveyors to establish reliable property lines and lay out a regular and orderly network of streets (Burrows and Wallace 1999). Building, hygienic, and livestock control measures followed soon after, until lower Manhattan began to take on the shape of the orderly, Old World Dutch townships after which it was modeled. By 1660, a survey of the township revealed that there were 350 houses in New Amsterdam (Brodhead 1853:674).

Dutch control of Manhattan had been tenuous from the beginning and, despite Stuyvesant's strong leadership, was made all the more precarious in the face of escalating British aggression. While England and Holland were at peace in 1664, the two countries were engaged in a political battle that extended throughout the Old World and the New. At stake was hegemony over the high seas, a prize that England saw within its grasp and believed was being threatened by Dutch commercial interests (Deak 2000). Monopolistic practices by the Dutch West India Company and its deadly competition with the Royal African Company over slaving rights in West Africa infuriated King Charles II (Rink 1986:262). In an attempt to thwart any further challenges, Charles declared the Dutch to be usurpers in the New World, and ordered four warships across the Atlantic to seize control of Manhattan Island in the summer of 1664 (Deak 2000:13)

The English gambit worked; New Amsterdam was seized without a shot being fired. The ease with which the English overpowered the Dutch colony is attributable to several different factors, not the least of which were poor defenses, a food shortage, and a policy of benign neglect on the part of the governing body in Amsterdam. Stuyvesant, watching his colony about to be unceremoniously wrenched from his grasp, attempted to hold out, proclaiming that "I had much rather be carried out dead!" (Deak 2000:14). The Dutch governor eventually bowed to the greater interests of a peaceful resolution and signed the articles of surrender on August 27, 1664.

Colonel Richard Nichols was installed as the first royal governor of the rechristened New York, followed by Colonel Richard Lovelace. Lovelace's absence from the island in the summer of 1673 allowed the Dutch to briefly reclaim their former colony, only to be restored to English rule nine months later under the control of Major Edmund Andros. By the 1690s, New York was home to approximately 3,000 families:

> *whereof almost one halfe are naturally Dutch a great part English and the rest French . . . few of them intelligent & sincere but the most part ignorant & conceited, fickle & regardless* (Deak 2000:21).

English settlement of Manhattan proceeded at a much faster pace than had similar Dutch efforts, but was marked by rebellion, overcrowding, and the imposition of crippling trade restrictions by an English crown ever watchful of its mercantile interests. In spite of poor trade policy, by the early eighteenth century New York emerged as a major seaport on par with Boston, Philadelphia, and Charleston. That this became possible was due, at least in part, to the actions of Governor Andros. Encouraged by local merchants, Andros required that all import and export goods moved along the Hudson be brought through New York City for preparation and shipping, and made extensive improvements along the waterfront in the 1670s (Burrows and Wallace 1999:85).

Despite some economic ups and downs, the city had by the 1740s a well established genteel class, and summer country houses and estates were established in rural areas on Manhattan and other surrounding lands as refined refuges from the heat, noise and squalor of the city. One such estate that set the trend for other wealthy notables in the area was owned by Sir Peter Warren, and included a comfortable Georgian house that occupied several hundred acres of land in Greenwich which at that time was a mile or so north of the city (Burrows and Wallace 1999:178). One possible estate in the vicinity of the project area lay immediately north of Great Kill Road (now Gansevoort Street) consisting of property with structures and gardens owned by Oliver Delancey and depicted on the 1766–1767 Ratzer map as redrawn by Janvier in 1894 (HCI 1983:221). Delancey's house may also be the Greenwich house built in 1700 that was reportedly located between 12th and 13th streets along the riverbank (HCI 1983:221).

The relationship between the British crown and its fractious colonies was in a long and irreversible decline by the mid-eighteenth century. In 1776, New York somewhat reluctantly agreed to join its colonial counterparts in what would become a prolonged battle for independence from the British crown. Perhaps tipping the balance was a long economic depression in New York that had begun in the early 1760s. Wars waged by Britain against France and Spain and increasing restrictions on colonial trade goods were some of many factors that disrupted the city's

economy. Forced impression of local seamen into the Royal Navy also angered the city's population, and the fortunes of London merchants appeared to rise at the expense of many local merchants (Burrows and Wallace 1999).

New York's seaport made the city a natural target for attack by the British and, therefore, a natural base of operations for American troops. By the beginning of the summer of 1776, more than 10,000 American soldiers were stationed in the city, requisitioning town houses and country estates, ripping down trees and fences to construct barricades, and cramming every piece of open ground with tents, huts, shacks, wagons, and supplies (Burrows and Wallace 1999:229). Shortly thereafter near the end of June, the British fleet landed at Staten Island foreboding the fall of the city.

After a resounding defeat at the Battle of Brooklyn, Washington was forced to abandon and surrender all but the northern portion of Manhattan to General Howe's forces. The American general repositioned his headquarters in Harlem Heights at the Morris-Jumel Mansion on what is now 162nd Street, and watched as the city fell back under British control. Just six days after the reassertion of British authority, a massive fire engulfed the already brutalized city. Believed to have been ignited in a bordello at Whitehall slip on the southern tip of the island, the fire spread rapidly northwest across the most densely populated portion of the city (Cohen and Augustyn 1997:82). Over a quarter of New York was destroyed during the conflagration.

British occupation of New York proved to be a difficult task as squatters camps, food shortages, epidemics, and rampant violence plagued loyalists and rebels alike (Burrows and Wallace 1999:245–261). While New York may have been firmly within royal control during this period, the war raged on throughout the colonies, much to the advantage of the Americans. The war ended with the capitulation of General Cornwallis to combined American and French troops in Yorktown in 1782. Following the evacuation of the last of the British troops by November of 1783, New York returned permanently to American control. The city was subsequently the site of General Washington's inauguration as the first President of the United States in April of 1789.

Serious efforts were underway by the 1790s to develop the city into a large-scale industrial manufacturing center. The New York Manufacturing Society was formed by a group of businessmen in 1789, followed by the organization of the New York Society for the Promotion of Agriculture, Arts, and Manufacturers in 1791 (Burrows and Wallace 1999:306–307). Early manufacturers sponsored by these societies included a textile factory, cotton mills, breweries, iron foundries, and pottery works. Large scale manufacturing at this time was doomed, however, due to Manhattan's lack of water sources needed to power the mills and factories, and the strengths of the shipping industry, which was considered a less risky and increasingly profitable endeavor by investors. From early on, Manhattan's waterfront was the source of its economic power, and it would not be until some 60 years later that large-scale manufactories, powered by steam engines, would make New York a manufacturing center.

As the eighteenth century drew to a close, the Project area vicinity still remained undeveloped consisting of rural farmland. Farmland in the area was owned by then Governor of New York, George Clinton as of 1792. Known as Greenwich Place, the farm was a large tract of property abutting the Hudson River between what it now Gansevoort and West 16th streets and extended as far east as 7th Avenue (NYCLPC 2003:10). After the turn of the century, the land would become the property of John Jacob Astor whose family would continue to have real estate holdings in the area well into the twentieth century.

Industrial and Urban Development Period (1800–1920)

Industrial and urban development in the Manhattan portion of the Project area is defined as the history of waterfront development related to shipping along Manhattan's West Side. New York underwent explosive growth as a commercial port of trade the end of the eighteenth and beginning of the nineteenth century, largely due to American neutrality during the Napoleonic Wars, though this would reverse dramatically with the approach of the War of 1812. By the turn of the century, New York had overtaken Philadelphia as a leading port of entry into the United States and handled nearly one-third of the country's international trade. The main advantage that New York had over other American ports at this time was that the Hudson harbor was deep enough to accommodate the larger, deep-draft vessels capable of carrying bigger cargoes that were increasingly being used by merchants. The value of imported goods, and especially exported goods dramatically rose. Exports through New York, for example, valued at $2.5 million in 1790 grew tenfold to $26 million by 1806 (Burrows and Wallace 1999:334).

The concomitant increase in traffic along the Hudson resulted, for the first time, in substantial commercial development along the west side of Manhattan. Prior to 1840, waterfront development (piers, docks, wharves) had largely been confined to the east side of Manhattan, as the East River provided a better sheltered port. Few docks or piers were present on the west side prior to this time, though at least one early dock was located in the vicinity of the Project area. This dock, located at the foot of Horatio Street then approximately one block east of the present shoreline, was where a mortally wounded Alexander Hamilton landed when brought back across the Hudson after his ill-fated duel with Aaron Burr in 1804 (Burrows and Wallace 1999:331).

The principal early-nineteenth-century waterfront development in the Project area was related to defensive preparations for the War of 1812 whose causal roots were related to the resumption of war between Britain and France in 1803. Desperate for manpower to aid them in their war with the French, and continuing a practice dating to the eighteenth century, the British Royal Navy seized American vessels and forcibly impressed the seamen into service on the premise that those sailors of British origin owed their service and had no right to relinquish their citizenship. Many American sailors were swept up and forced into service as well, and cargo and goods from American vessels were also frequently confiscated. The practice resulted in the Embargo Act, passed by the American Congress in 1808. The Act created an economic crisis in New York as shipping of goods came to an almost complete halt, until it was repealed in 1809. By 1811, war with Great Britain was all but certain and the city completed construction of shoreline defenses. Four forts with batteries were completed, among them Fort Gansevoort built as an extension off the shoreline just north of what was then the foot of Gansevoort Street in the immediate vicinity of the Project area. Fort Gansevoort was also called the "White Fort" because of its white-washed walls (Burrows and Wallace 1999:423). The forts never saw any action and peace was declared in 1815.

Steamboat service, successfully established in the New York area by Robert Fulton in the early nineteenth century, would have a great impact on New York Harbor in general, as well as West Side waterfront development. Steam-powered boats could rapidly transport cargo as well as people, and as they became larger, bigger port facilities were needed. Unlike the East River, the Hudson could better accommodate the larger coastal and transatlantic steamships becoming common by the late 1840s, which spurred West Side waterfront development. Canal boats, were another important vehicle of transport and trade along the Hudson waterfront.

The initial stretch of West Street in the lower West Side had been created on made land off the west shoreline by 1810 providing access to new docking facilities (Burrows and Wallace 1999:339). The area of the West Side in the immediate vicinity of the Project area, however, remained relatively undeveloped, with residential and commercial development predominantly situated south of Houston Street (Burrows and Wallace 1999:387). Waterfront development also lagged behind that of the lower West Side to the south. The 1832 Burr map of the City and County of New York shows that West Street was built as far north as Charles Street by 1832 (Figure 4-1). In the vicinity of the Project area, however, West Street, as well as a portion of Washington Street is depicted as continuing north of Charles offshore as a planned "paper street." The original shoreline in this area was located approximately one block west of Greenwich Street, but by 1851 the area had been filled in to accommodate the construction of Washington and West streets as they appear on the 1852 Dripps map (Figure 4-2). By the 1850s, the western waterfront was crowded with more than 50 piers, wharves, docks and slips extending as far north as 14th Street (Burrows and Wallace 1999:653), including a small pier at the foot of Gansevoort Street (Dripps 1852). The portside facilities became overcrowded with steamboats, ferries, lighters, oysterboats, canal boats, and rail car floats.

Along Horatio and Gansevoort streets, numerous lumber and coal yards were present by the 1850s. Plans were made by the Committee of Wharves and Piers to complete a bulkhead and infill the shoreline area with rubbish and coal ash between Gansevoort and 13th streets by 1851 (HCI 1983:98). Fort Gansevoort was demolished in 1851 when the shoreline was infilled (NYCLPC 2003:7). The Dripps map dating to the following year shows several blocks containing structures constructed on newly made land extending offshore and west of West Street between Gansevoort Street and 20th Street to the north (see Figure 4-2). The map also shows a new offshore bulkhead line extending south of Gansevoort to Hammond Street (now West 11th) west of several still extant piers. Between 1852 and 1856, the area between Gansevoort and West 11th Street that contains the Project area had been filled in one block west of the present day shoreline, as depicted on the 1856 Colton map. The new shoreline street west of West Street was named 13th Avenue.

Figure 4-1. 1832 map of the City and County of New York, with the Project pipeline route in Manhattan (source: Burr 1832).

Figure 4-2. 1852 map of the City of New York, with the Project pipeline route in Manhattan (source: Dripps 1852).

Spurred on by its success as a port of trade, and more importantly by steam power, New York finally established itself as a manufacturing center by the mid-nineteenth century, though the onset of the Civil War would wreak havoc on local manufacturing. The city was flooded by immigrants seeking better fortunes, and who made up the majority of the manufacturing workforce. The immigrants were mainly of Irish, German, Scots or English origin. By 1855, flood of immigrants was so huge that two out of three adults in Manhattan were foreign born (Burrows and Wallace 1999:737).

Industrial developments and commerce were additionally fueled by the establishment of several rail lines in Manhattan. Despite opposition from Hudson River steamboat operators, the Hudson River Railroad, originally chartered in 1847, completed construction of a line in 1851 along the western side of Manhattan establishing a passenger and freight connection to Albany (Burrows and Wallace 1999:655). The rail line was largely constructed by the Irish immigrant workers who had flooded the city. A portion of the line was in service from Canal Street to Poughskeepie by 1849 (HCI 1983:259). The cars were powered by steam engine north of 30th Street, below which passengers had to transfer to horse drawn cars. By 1864, Vanderbilt had obtained the railroad and merged it with the New York Central Railroad in 1869. This ultimately resulted in a shift of the passenger traffic to the Grand Central Terminal completed in 1871 (HCI 1983:279–280).

The Hudson River Railroad was the first to directly serve the waterfront docks along the West Side allowing it to outcompete East Side port facilities. Within five years, the presence of the Hudson line transformed the West Side resulting in the construction of some 200 warehouses built by merchants attracted to the shipping and rail connections (Burrows and Wallace 1999:655). By the end of the 1850s, development in the vicinity of the Project area had a mixed residential and industrial character more common to other areas of Manhattan during earlier decades (NYCLPC 2003:7). The area contained pottery works; coal and lumberyards; and paint, iron and granite works situated among rowhouses and tenement buildings containing street level shops.

In 1854, the Hudson River Railroad had opened a freight depot at Gansevoort and West streets and by the 1860s the area next to the depot attracted vendors from the Washington Market downtown who subsequently set up informal operations (Robins 2002). The downtown West Washington Market burned in 1860 and again in 1867 (NYCLPC 2003:8), events which may have contributed to some vendors moving their operations uptown. The city had been proposing a market on Gansevoort Street since the 1830s, and had actually acquired offshore property from the Astor family in 1852 located off Gansevoort. They planned to fill in the area to create a market district, but no formal market was ever set up (Robins 2002). Rather belatedly in 1880, an official Farmer's Market (later the Gansevoort Market in 1884) was established (NYCLPC 2003:8–9). The market consisted of an open-air produce market on the east side of West Street between Gansevoort and Little West 12th streets (Figure 4-3). The market soon became one of Manhattan's busiest, and by 1889 a second West Washington Market, specializing in dairy, meat and live poultry, was opened on the west side of West Street across from Gansevoort Market. The nearby water and rail facilities were an ideal location for wholesale marketing activity, and the increased traffic to the market area at this time resulted in a need for road improvements, which included the widening of Gansevoort Street.

Manhattan had largely maintained its supremacy as a port of trade by keeping fees at port facilities remarkably cheap during the nineteenth century, but at the cost of keeping those facilities in good repair. By the 1870s, Manhattan's waterfront was in serious decline. The conglomerations of piers, wharves, and docks along the west side, as well as the east side had over the course of the nineteenth century been built or extended piecemeal by private parties without regard to long term planning, and were never properly maintained or regulated. They had been a constant problem for decades as apparent from the numerous complaints and petitions for repairs and extensions from merchants to the Committee of Wharves and Piers (HCI 1983:101–105). Docks loaded with cargo, or even passengers were known to collapse on occasion, and lack of security frequently left goods vulnerable to theft. Dumping of "night soil," refuse and sewage were also a constant problem. It created a squalid and offensive atmosphere along the waterfront, and required constant dredging of berths made increasingly shallow by sewage and other refuse. Shipping began to shift to more modern and secure facilities in Brooklyn and New Jersey.

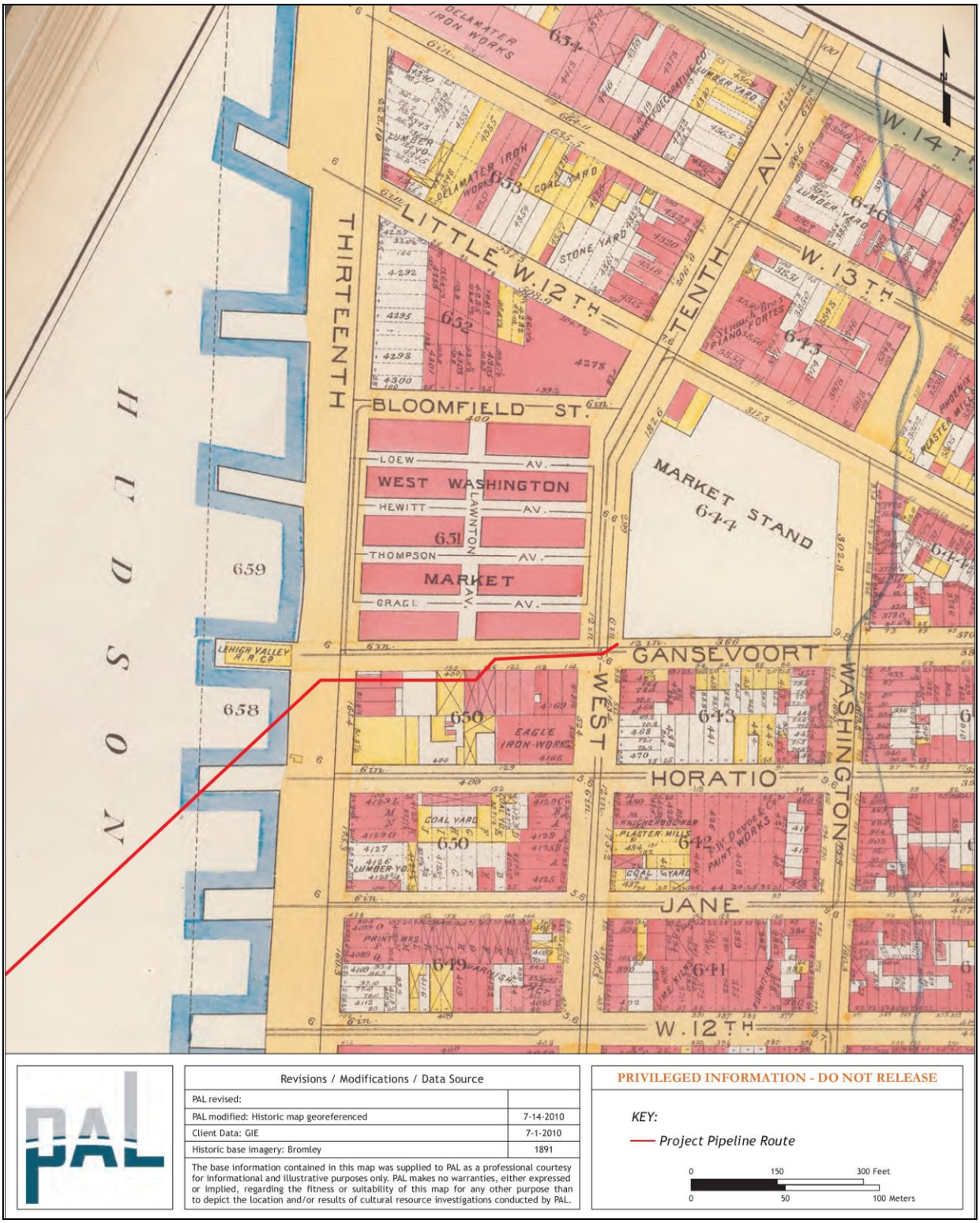

Figure 4-3. 1891 atlas map of the City of New York, with the Project pipeline route in Manhattan (source: Bromley 1891).

In response, the Department of Docks was chartered in 1870 to amend the issue, but faced opposition from wealthy waterfront property owners and transport magnates who wanted to maintain private control of the waterfront facilities. The Department of Docks made efforts to establish a uniform system of piers and bulkhead as well as an attendant waterfront highway that would ring the city (Burrows and Wallace 1999:950). As with earlier proposals by the Committee of Wharves and Piers, and later the New York Pier and Warehouse Company to improve the waterfront, these latest efforts by the Department of Docks to transform the waterfront were generally unsuccessful. However, they did have some success with the creation of a bulkhead. Stretching from Battery Park to West 59th Street, the Hudson River Bulkhead was constructed between 1871 and 1936 (NY SHPO 1997). The finalized uniform bulkhead design had called for cross-braced pilings behind a granite-faced concrete bulkhead wall that was backfilled with earth, coal ash and other debris topped with paving blocks. The pilings were designed to relieve the pressure exerted by landfill onto the wall. Opposition by waterfront property owners and non-compliance meant that construction of the bulkhead was only undertaken on a gradual, piecemeal basis over the next several decades, and as late as 1910 a complete uniform bulkhead had still not been achieved (HCI 1983:270–271), though nearly 80 percent of the present bulkhead consists of quarry-faced granite walls of various designs (NY SHPO 1997). Since 1936, the bulkhead has been updated on numerous occasions and often without regard to uniformity in appearance and use of materials (Empire State Development Corporation 1998). Because of its historical significance related to Manhattan's waterfront development, the Hudson River bulkhead was determined eligible for the National Register in 1997 (NY SHPO 1997).

By the late nineteenth century, the development of refrigeration technology would have a significant impact on the Gansevoort marketing district, fueling the expansion of food-distribution related industry in New York. The Manhattan Refrigerating Company, incorporated in 1894, was a leading pioneer in developing the technology. By 1906, they had established a complex containing a power plant and cold storage warehouses located on the east side of West Street between Horatio and Gansevoort streets, and supplied refrigeration to markets throughout the district via underground pipelines (NYCLPC 2003:12–13).

Other developments in the Project area vicinity at the turn of the century included the removal in 1897 of the manmade land on the west side of West Street between West 11th and Gansevoort streets resulting more or less in the current configuration of the shoreline (HCI 1983:299). Similar shoreline alterations were later made north of the West Washington Market. These areas were removed and deeply dredged to allow construction of long piers able to accommodate the increasingly huge trans-Atlantic steamships. The resulting Gansevoort and Chelsea Piers, constructed between 1897 and 1910, soon became the busiest port facilities in New York and contributed further to the development of wholesale food distribution businesses (NYCLPC 2003:14). Piers 51 at Jane Street and 52 at Gansevoort Street were the initially the berth locations of ships belonging to the Cunard Line Steamship Company (HCI 1983:299). The latter pier was attached to the land mass of the West Washington Market.

Modern Period (1920–Present)

The market-related areas north of Gansevoort had by the 1920s began to transform into what would become known as the Meat Packing District, the southwest end of which abuts the Project area. The Gansevoort Market had substantially declined as an important produce market due to the construction of a pumping station that reduced its size, and the establishment in 1925 of the Bronx Terminal Market. The result was that only 10 percent of the city's produce was handled by the Gansevoort Market by this time (NYCLPC 2003:16). Additionally, two-thirds of the West Washington Market, specializing almost exclusively in meat and live poultry, was taken up by several large meat packers.

The planning, and subsequent construction of rail and automobile transportation improvements served to solidify the importance of the greater marketplace area by increasing property values related to real estate speculation, and physically improving access to the market center that had experienced severe traffic congestion for years. Among these was the construction of an elevated roadway, the Miller Elevated Highway, over West Street between 1929 and 1931, which allowed transport trucks to move freely between the piers and inland warehouses and other businesses without impeding the now overhead automobile traffic. Construction of the highway did result in some displacement of merchants at both the Gansevoort and West Washington markets, and some buildings at the West Washington Market were removed (NYCLPC 2003:17). The Miller Elevated Highway was eventually demolished during the 1980s (NYCLPC 2003:19), following a collapse of a section near Gansevoort Street that closed the road at the end of 1973.

Rail improvements included reconstruction by 1934 of the New York Central Railroad line (formerly the Hudson River Railroad) along West Street as an elevated viaduct known as the High Line south of 35th Street. Though it contributed to continuing development in and around the marketplace, the newly elevated line resulted in the demise of the "West Side Cowboys" who had previously rode on horseback waving a red flag to warn traffic of oncoming trains (Solis 2005). The High Line passed directly through several warehouses along its length, and was in operation until 1980 (Robins 2002).

Meat and poultry packing had become the main commercial activity in the area by World War II. The City had constructed a meat processing plant at Gansevoort Market in 1939, and by 1950 the Gansevoort Market and Meat Center was established at the site of the old Gansevoort produce market further consolidating the area into the Meat Packing District (NYCLPC 2003:17–18). During construction of the Gansevoort Market and Meat Center, the New York Herald Tribune (April 17, 1949) reported that workmen drilling holes for foundation pilings had encountered timbers between eight and 25 feet below the surface, believed to be remnants of Fort Gansevoort (Robins 2002). During the 1950s, the widening of West Street and construction of an incinerator by the Department of Sanitation resulted in the closing and demolition of the West Washington Market (Robins 2002). Despite the removal of the West Washington Market, the Gansevoort Market area in 1959 was described as the largest meat receiving market in the world in a New York Times article about surprise inspections of poultry wholesalers who were short-weighting customers (Alden 1959).

The importance of the Hudson waterfront port facilities began to decline in the 1960s due to changes in shipping, including air freight transport and containerized shipping. The effects of attendant changes in food distribution (e.g., supermarkets, frozen foods, refrigerated trucking) began to be felt in the Meat Packing District (NYCLPC 2003:18). Though still a thriving industry in the 1970s, the character of the area began to change as nightclubs, many catering to the gay community, sprang up in the area. By the 1980s the former Manhattan Refrigerating Company complex between Gansevoort and Horatio streets had been transformed into a luxury apartment building known as the West Coast Apartments.

Other subsequent transformations of the area included the redevelopment of the Hudson waterfront. In 1998, the Hudson River Park Act reserved extensive portions of the West Side waterfront for the creation of a recreational park, portions and elements of which are still undergoing construction (HRP 2010). Stretching 5 miles from Battery Place to 59th Street, the park's first section opened in 1999 at Greenwich Village, and is traversed by the Project area. By 2001, there were an estimated 25–30 meatpacking companies left in the district, a substantial drop from the some 200 present at the peak of the industry (NYCLPC 2003:19–20). Reflecting the historical importance of the marketplace, the area was designated as the Gansevoort Market Historic District in 2003, the southwest boundary of which abuts the Project area.

Staten Island

European Colonization and Settlement (ca. 1610–1800)

The earliest documented presence of Europeans on Staten Island consisted of a Dutch trading post established in 1614 (Morris 1900:35). The first attempt at settlement was made in 1624 by a few Dutch Walloons and their families (Morris 1898:25–26). The attempt was unsuccessful and they retreated to New Amsterdam on present-day Manhattan (Wilson 1893). Then Director General Peter Minuit and five others subsequently purchased Staten Island from local sachems in 1626 (Burrows and Wallace 1999:24). It was later part of a large grant of land made to Michael Pauw extending south from Hoboken and including Staten Island in 1630, though he does not appear to have made any effort to establish a settlement on the island portion of the grant, and later sold his land rights to the West India Company in 1637 (Brodhead 1853; Burrows and Wallace 1999:28; Morris 1898). Six years later, after arranging with then Director General Twiller to establish a colony on Staten Island, it was purchased again in part by David Pietersen de Vries from Native Americans (Brodhead 1853:265). A few settlers were brought by de Vries to the island by the end of 1638 (Morris 1898:28–29). Cabins were built at what later became known as Oude Dorp (or Old Town), and the settlers apparently prospered as tobacco planters until destroyed by Native Americans referred to as the Raritans in 1641. This destruction of the settlement was in retaliation for the murder and torture of Raritans ordered by Kieft who had wrongly assumed they were responsible for stealing pigs from de Vries "bouwerie" or plantation (Brodhead 1853). Kieft was blamed for angering the Raritans, and the incident, known as the "Pig War" set the stage for later widespread hostilities (Burrows and Wallace 1999).

An attempt was made to resettle at Old Town, but it was short lived as new hostilities between the Dutch and Native Americans broke out in 1642 (Morris 1898). The following year saw the start of the first of the Dutch-Indian Wars (1643–1645), which resulted in the widespread destruction and abandonment of Dutch settlements throughout most of New Netherland. After a decade or so of peace, a second war (the "Peach War") broke out between the Dutch and Natives of the area in 1655, and Old Town was destroyed for a third time. No attempt was made to resettle Staten Island following this war until 1658 when a village known as Niuew Dorp (New Town) or Stony Brook was established. Other early settlements included Cucklestown, which later became known as Richmond in 1710 (Morris 1900:439).

One of the few settlements in New Netherland that may have weathered the early hostilities was on Staten Island under the patroonship of Cornelius Melyn, a Dutch merchant (Morris 1898:37). Despite de Vries claims, Melyn had been authorized to take control of all of Staten Island and establish a colony in 1640, though he only brought a handful of settlers. He once again purchased Staten Island from the Native Americans in 1641 and obtained a letter patent (excepting deVries bouwerie), and appointing him patroon of the territory (Brodhead 1853:314; Morris 1898). A decade later he was accused in court documents of smuggling contraband onto Staten Island and of tricking or bribing local Native Americans into trying to kill the then Director of New Netherland, Peter Stuysevant who was widely considered too authoritarian (Fernow 1883:159–161). Despite these and other accusations and a later arrest, Melyn kept the favor of the States General back in Holland and continued to be a thorn in Stuyvesant's side, even going so far as to independently grant land on the island for colonial settlement, and set up his own government and judiciary on Staten Island. Correspondence between Stuysevant and the Directors in Holland dating to 1660 indicate that Melyn had maintained his position as patroon of Staten Island, much to Stuysevant's dismay (Fernow 1883:468). Melyn's patroonship only ended when he opted to sell his holdings to the West India Company in 1661.

Settlers of Staten Island during this period included the Dutch, French Huguenots and a few British colonists. Prior to the construction of the first church at Stony Brook in 1665, worshippers on Staten Island had to content themselves with services provided on a monthly basis by ministers from New Amsterdam. Congregants gathered for services in private homes or barns, or even outdoors (Clute 1877). Many churches for decades after the first ones were built still had their pastors supplied to them from New Jersey, New York, and Long Island. Prior to the Revolutionary War, the area known as Old Place was reportedly where a house along a road (now Washington Avenue) was used for religious services. The house was built around 1680 by John Tunissen, a Dutch settler near the intersection of present day Washington and Western avenues (Payne and Baumgardt 1986:35). When the building became dilapidated, a new place was selected for worship, but due to its inconvenience, the previous building was repaired and religious services resumed at the "Old Place" (Morris 1898:409). The area of Old Place was also reportedly a place of safe retreat for the Native American inhabitants and the location of the last known Indian settlement on the island (Morris 1900:162).

In 1664, Charles II determined to take control of Dutch holdings in the New World granted the territory of New Netherland including Staten Island to his brother James, the Duke of York. Soon after British ships set sail to New Netherland. The Dutch quickly capitulated to the British and land on Staten Island was immediately granted by the new British Governor, Richard Nichols to several of the officers and crew of one of the ships that had set forth to take control of the area from the Dutch (Morris 1898:64). These grantees all returned to England and never attempted to establish settlements. It was just as well, because independent of Nichols, the Duke of York had granted territory west of the Hudson River, including Staten Island to George Carteret and William Berkley. This in fact may be why settlements were not established by Nichols' grantees. Much confusion over the conflicting grants ensued. Ultimately, Carteret made no formal claim for Staten Island, but did accept a conveyance for a tract of land there from Governor Nichols (Morris 1898:136).

Staten Island was once again and for the final time purchased from Native Americans by the British in 1670 under the direction of Governor Lovelace (Morris 1898:30; Wilson 1893). There were around 100 families living on Staten Island by 1676, of predominantly Dutch and French origin. Though there were seven houses at Old Town, most people on Staten Island lived in dispersed farmsteads (Morris 1898).

Richmond County (or "shire"), which contained all of Staten Island, was established in 1683 and the central settlement of Stony Brook became the County seat (Morris 1898:93). By 1688, Staten Island had been divided into the four towns of Westfield, Southfield, Castletown, and Northfield, the latter of which contains the present-day

Project area. The county seat of Richmond was transferred to the village of Richmond in 1729 (Morris 1898). Transportation links at this time consisted of roads that largely followed Native American trails, and ferries connecting Staten Island to New Jersey and New York. For example, the Old Shore Road (present-day Richmond Terrace) laid out ca. 1705 followed the course of a Native trail along the North Shore of Staten Island that ran between Howland Hook and Tompkinsville Landing. Early Euro-American settlers were known to use ferries maintained by Native Americans at various points along the Staten Island shoreline, but the earliest documented Euro-American ferry connecting the island to New York City was present by 1681 (Morris 1900:260). Several other ferry crossings were present along the north shore by the eighteenth century including Decker's, Dacostas' and Hillecker's ferries at and around Port Richmond, and Schuyler's ferry crossing at what is now Howland Hook that connected Staten Island to Elizabethtown. Additionally, important ferry crossings at Tompkinsville and Billop's Ferry to Perth Amboy were located at each end of one of the Staten Island stage routes between New York and Philadelphia during this period. Other stage route connections included the ferry between Bergen Point in New Jersey and Port Richmond established in 1764 and the Blazing Star ferry at Rossville.

The economy of the earliest settlers was largely agricultural, though a tannery and a distillery had been established on the island by the 1640s (Brodhead 1853:313). The distillery was the first in New Netherland established by then Director General William Kieft who no doubt sought to benefit from the lucrative local market for alcohol. At that time one in four houses at New Amsterdam were "grog-shops," or only sold tobacco and beer, and profits from liquor sales for company officials back in the Netherlands were second only to those from the fur trade (Burrows and Wallace 1999:33). Additionally, correspondence between directors in Holland and New Netherland indicate that by the time Peter Stuyvesant was governing New Netherland in 1647, an iron mine had been established somewhere on Staten Island (Fernow 1883:77).

By 1720, a significant portion of commerce in New York City was driven by the sugar trade with the West Indies. Carribean plantations devoted as much land as possible to sugar cane, and thus did not grow much of their own food. This resulted in a substantial increase in commercial farming on Staten Island, and in other rural communities surrounding Manhattan who supplied foodstuffs for the Caribbean market (Burrows and Wallace 1999:122). African slaves were the source of labor that fueled the increasingly commercial farming.

The occupants of Staten Island were divided in their loyalties at the onset of the Revolutionary War (Morris 1898). The divisions fell largely along ethnic lines with English colonists loyal to British rule, while the Dutch and French preferred independence. The British closed or burned all but one English church during the War (Clute 1877), and one could expect these actions did not endear the Dutch and French inhabitants to the loyalist cause. Nevertheless, Staten Island was generally viewed as a bastion of British support by the American Congress. In June 1776, a British fleet of over a hundred vessels containing 9,000 troops led by General Howe landed at Staten Island, as New York and Long Island were heavily fortified by American defenders (Burrows and Wallace 1999:231; Morris 1898:204). The British were reportedly warmly received and they immediately established headquarters at New Dorp, while they waited for reinforcements from General Clifton and England that included Hessian as well as English troops. An additional 9,000 Hessian mercenaries had arrived by August (Burrows and Wallace 1999:234). Defensive redoubts were immediately built by British troops at Holland's (now Howland) Hook near the ferry crossing there. These were the first of many defensive works built by the British along the Staten Island shoreline (Morris 1898:206). Several other fortifications were built during the occupation including one at Old Place.

The large numbers of British regular and Hessian troops occupying Staten Island during the initial period of the War caused the more outspoken proponents of the American opposition to flee the island. The British used Staten Island as a staging area for raiding expeditions into New Jersey and for launching attacks on New York and Long Island. Prior to the fall of New York, General Howe met with a congressional delegation consisting of Benjamin Franklin, John Adams and Edmund Rutledge at Tottenville, Staten Island to persuade the Americans to surrender and revoke the Declaration of Independence in exchange for all being pardoned for taking up arms against the king (Burrows and Wallace 1999:240). The meeting was brief and Howe's terms were briskly refused. Once Manhattan was taken, many of the British troops were removed from Staten Island to maintain their gains while Skinner's Brigade of American Loyalists and a large contingency of Hessian troops remained on the island under the command of General Knyphausen (Morris 1898).

A number of raids were undertaken and attempts made by the Americans to recapture Staten Island across the kills from New Jersey. A series of skirmishes between the Americans and British were known to have occurred at British

fortifications set up at Old Place in 1777 (Payne and Baumgardt 1986:35), and burials of the casualties of these clashes were later discovered in the early twentieth century on the former Reverend James Kinney property along what is now Western Avenue (Skinner 1909a). In all, the raids were largely unsuccessful, though they did manage to continuously harass the British occupiers. American military efforts were more successful elsewhere however, resulting ultimately in the surrender of Cornwallis and end of the war in 1782. By 1783, British troops had departed from New York and Staten Island. However, a number of British and Hessian soldiers, many deserters from the army, remained and settled in Staten Island (Morris 1900:2). By the end of the eighteenth century, the population had grown to more than 4,000 inhabitants (Morris 1898:120).

Industrial and Urban Development Period (1800–1920)

As in earlier times, the predominant economic pursuits on Staten Island were agriculture and oystering. Unlike Manhattan, the economy would not be driven by other large-scale industries until well into the nineteenth century. Flax regained importance as an agricultural crop into the early half of the nineteenth century, and shipbuilding continued to be important. Other early-nineteenth-century industries included various mills, including grist and carding mills. One mill of note was a gristmill constructed at Old Place built at the former location of a small colonial tidal mill (Payne and Baumgardt 1986:135). The mill, or Old Place Mill was constructed in 1803 by John Hillecker, and Native Americans and African slaves were employed to build the mill and work in it. The mill was apparently the site of a dispute between the Native American and slave workers resulting in the use of the mill by the slaves as a "fort" in siege by Native Americans (Morris 1900:163). The ultimate result was the arrest and punishment of all parties in the dispute. By 1870, the mill had been added onto and converted into a mineral paint factory. It subsequently became a feed mill until it fell into disuse and was destroyed by fire in 1898.

Fears of a British landing at Staten Island during the War of 1812 resulted in the repair of remaining Revolutionary War period British forts and the construction of two new stone forts at the Narrows (Morris 1900:31). In spite of these preparations, Staten Island saw very little action during the war, and the construction of forts became a financial embarrassment for the then-governor of New York, Daniel Tompkins.

Significant population growth did not begin until relatively late in the nineteenth century. Then, the establishment of numerous factories and mills fueled the immigration of predominantly Irish immigrants (Morris 1900). One of the larger employers of these immigrants was the Crabtree and Wilkinson silk factory at New Brighton. Other notable nineteenth-century industries included dye works at West New Brighton and Castleton, granite and trap rock quarries near Port Richmond, brick manufacturing at Elm Park, the Consolidated Fire Works Company of America at Graniteville, shipbuilding at Port Richmond, West New Brighton, Tottenville and Mariner's Harbor, the Jewett white lead mills and linseed oil factory at Port Richmond, and various breweries mainly concentrated in Stapleton. The success of breweries was due to Staten Island's reputation for having numerous spring sources of excellent water (Clute 1877:332). Oystering also continued to be an important economic mainstay for Staten Island into the nineteenth century. Ships from Staten Island would transport oysters north from sources as far away as Virginia to the metropolitan market, and seed oysters to planting beds mainly concentrated at Mariner's Harbor (Clute 1877:330).

One dye works, the New York Dyeing and Printing Company, was the largest manufacturer of dyed and printed silk and other goods of its kind in the United States by the 1870s (Clute 1877). Another important manufacturer was the New York Fire-Brick, and Staten Island Clay Retort Works located at Kreischerville, which was founded in 1845 after the discovery of high quality kaolin clay deposits between Tottenville and Rossville (Clute 1877:326) Additionally, the S.S. White Dental Manufacturing Company at Prince's Bay was the first to commercially produce liquid nitrous oxide, and the first linoleum manufacturer in the country, the American Linoleum Manufacturing Company, was established at Linoleumville in the 1870s (Clute 1877; Morris 1900).

Transportation networks expanded on Staten Island after the turn of the century that improved connections between New York and Philadelphia. The Richmond Turnpike was laid out by 1816 which followed the old post and stage route to Philadelphia (Morris 1898:396-397). Other nineteenth-century roadways laid down in the vicinity of the project area included the Port Richmond and Fresh Kills plank roads at Port Richmond, Western Road connecting present-day Washington Avenue and Richmond Terrace, Harbor Road, and Thompson's or South Avenue (Figure 4-4). Despite the construction of plank roadways, roads in general on Staten Island were universally viewed as awful, and no serious efforts were made to improve them until the passage of a "Road Bill" in 1890 and the incorporation

Figure 4-4. 1845 map of New York Bay and Harbor and the environs, with the Project pipeline route in Staten Island (source: Hassler 1845).

of Staten Island into the greater municipality of the City of New York (Morris 1900). It was generally felt that the lack of proper roads had been a serious impediment to Staten Island's fair share of the commercial and industrial development that had been taking place in other neighboring areas during the nineteenth century.

The first steamboat ferry, the "Nautilus" began service between Staten Island and New York City in 1817, and within a decade a second steamboat was in service (Morris 1900:264; Wilson 1893:34). By the 1860s the Huguenot Line was providing ferry service between Manhattan and Mariner's Harbor, and the North Shore Ferry Company had been established. The expansion in transportation and industry in the early half of the nineteenth century resulted in new residential development and even the establishment of new villages, such as that of Tompkinsville in 1815.

The question of whether Staten Island was under the jurisdiction of New Jersey or New York had been a point of contention for over a century. The dispute was finally resolved in 1833 when New York formally obtained rights to Staten Island (Morris 1898:90). Shortly thereafter, the village of Richmond became the social and economic center of the island. In 1896, after several years of formal inquiry, debate, public hearings and a series of votes, Staten Island was consolidated into the greater City of New York (Morris 1900:490).

A village was established at Howland Hook (formerly Holland's Hook) by the early nineteenth century (Morris 1898:409) (Figure 4-5). Howland Hook was likely named for Lieutenant Henry Holland of the Staten Island militia who owned land in this part of Northfield during the early 1700s (Morris 1900:15). In 1833, Sailor's Snug Harbor, the United States first hospital for retired mariners was established along the north shore of Staten Island. Subsequently, numerous sailors retired to and built homes on Staten Island along Richmond Terrace. Other plans for developing the area were made in 1828 to establish a summer resort known as Jacksonville at Howland Hook, but the development never happened due to the financial panic of the 1830s (Morris 1898:409). But the plans generally mirrored the increasing use of Staten Island as a summer getaway by the wealthy.

The presence of railroads transformed or expanded the commercial and residential importance of several communities, including those at Richmond, Tottenville, Rossville, Concord, and Garretsons (Morris 1900) (Figure 4-6). At the prompting of prominent farmers, construction of the first railroad in Staten Island commenced in 1851 connecting Tottenville to Vanderbilt's Landing east of Stapleton (Clute 1877:331; Morris 1900:461). Construction was completed in 1860 and the Staten Island Railroad came under the control of William Vanderbilt. The holdings of the Staten Island Railroad company were later expanded with the acquisition of the East Shore ferries and Jacob Vanderbilt became president of the consolidated company. After a series of ownership changes, the company eventually took the name of Staten Island Railway. In 1863, the Staten Island Shore Railroad proposed the construction of a horse rail line between Fort Wadsworth on the Narrows and Howland Hook. Opposition was fierce resulting in the laying of tracks in the middle of the night. The route was completed as far west as Port Richmond, though cars never ran past West New Brighton (Morris 1900:465). About the same time, similar though unsuccessful efforts were undertaken by a banker to start a railway connecting West New Brighton and Tottenville. Though construction of the railbed started, it was never completed.

Despite the false starts at developing rail lines in previous decades, railways were expanded along the northern and eastern shores of Staten Island in the 1880s and 1890s. These included rail lines operated by the Staten Island Rapid Transit Company, the Richmond County Railroad (later the Midland Railroad), the Midland Railroad Company and New York and Staten Island Electric Railroad. Efforts to consolidate the railways and ferries with connections to Manhattan resulted in the establishment of the Staten Island Rapid Transit Railroad Company in 1884 (Morris 1900:463). The Staten Island Shore Railroad was quickly subsumed by the success of the Rapid Transit Company, and its holdings were eventually taken over by the Staten Island Electric Railroad Company. To accommodate the increase in commercial and passenger traffic, terminal facilities including ferry slips and piers were constructed at St. George on several acres of made land extending beyond the original shoreline. By 1895, trolleys were in service competing with the Rapid Transit Company for passenger traffic, and by 1899, the Baltimore and Ohio (B&O) Railroad Company had bought the Rapid Transit Company (Morris 1900:464). The B&O Railroad had by then already invested heavily in Staten Island railroad interests as witnessed by their financing the construction of a rail bridge across the Arthur Kill at Howland Hook completed in 1884. Rail expansion along the north shore continued in the 1890s with a charter granted to the New York and Staten Island Electric Railroad Company to connect South Beach to Howland Hook via St. George. The result was the expansion of company holdings by acquisition of the

Figure 4-5. 1860 map of the City of New York and Its Environs, with the Project pipeline route in Staten Island (source: H.F. Walling 1860).

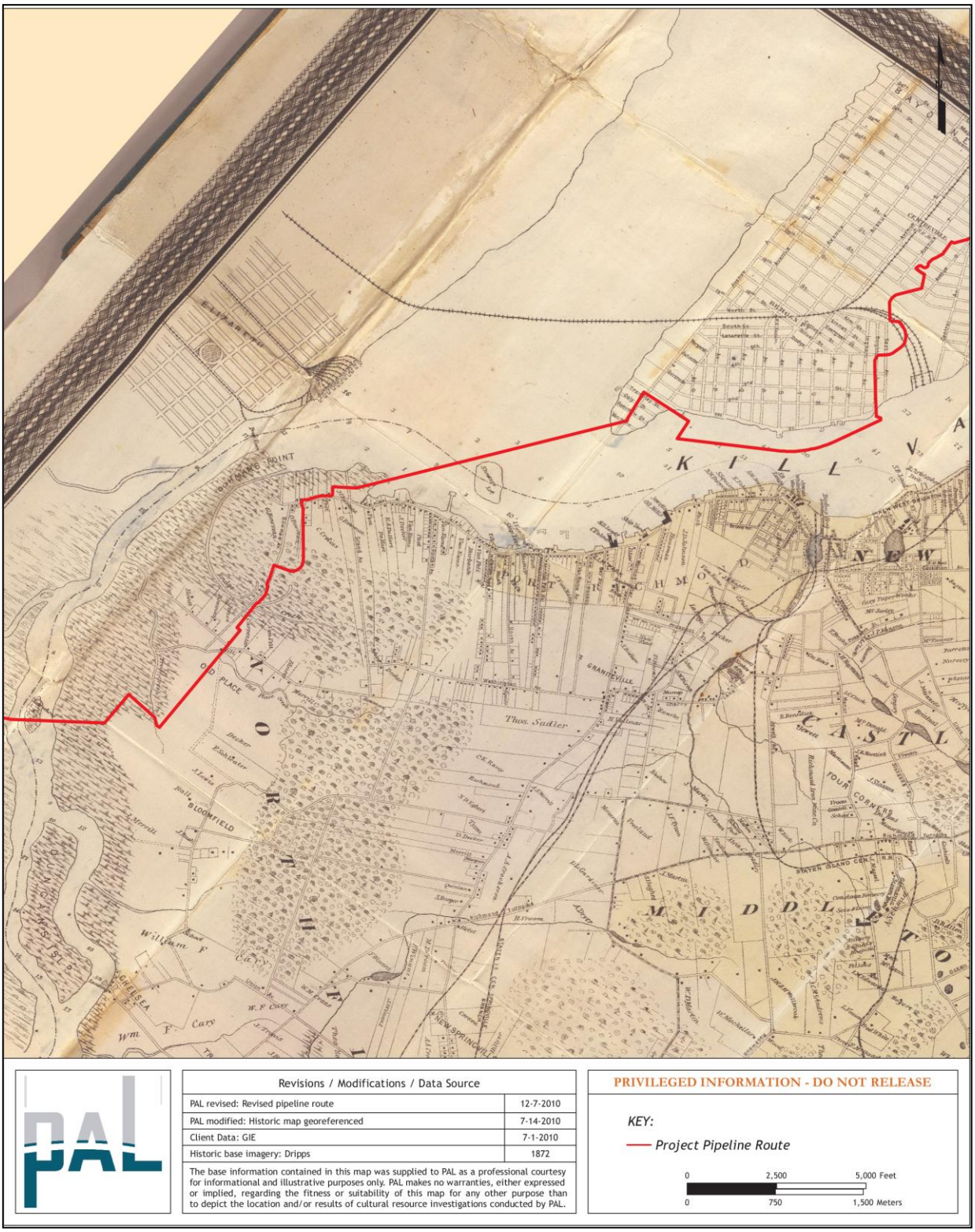

Figure 4-6. 1872 map of Staten Island, with the Project pipeline route in Staten Island (source: Dripps 1872).

Electric Power Company, the Port Richmond Electric Light Company, the old Belt Line Railroad and the reopening the ferry at Howland Hook (Morris 1900:466–467).

Inevitably, railroads brought additional industrial development to Staten Island. The New York Terminal and Transit Company owned large tracts of land at Howland Hook portions of which were bought and developed by the Milliken Bros. Steel Corporation and Proctor and Gamble after the turn of the century (Payne and Baumgardt 1986:27). A steel and rolling mill was constructed by the Milliken Bros. Corporation south of Richmond Terrace in what is now Mariners Marsh Park.

By the end of the nineteenth century, the population of Staten Island was nearly 52,000 people, and improvements in rail and ferry transportation by the end of the century had allowed Staten Island to become a "bedroom" community for New York businessmen (Wilson 1893).

Modern Period (1920–Present)

The introduction of the automobile in particular had a widespread effect on transportation throughout the United States, and Staten Island was no exception. Road networks were extensively improved and expanded during the twentieth century at the expense of railways and ferries in the area as trucks, buses and cars became the predominant means of personal and commercial transport.

One innovative example of a new roadway brought about by the presence of the automobile was the Bayonne Bridge, one of three related bridges planned by the Port Authority of New York (later the Port Authority of New York and New Jersey) to create a circumferential highway system for the greater New York metropolitan region (PANYNJ 2010). Construction of the bridge spanning the Kill Van Kull between Staten Island and Bayonne began in 1928 and was completed ahead of schedule and under budget in 1931. Constructing the bridge created special challenges as the Kill Van Kull is a major shipping channel. The bridge needed to be a continuous arch constructed without temporary supports in the channel, be able to support rail lines, and be elevated 150 feet over the water level to allow clearance for the U.S. Navy's tallest ships of the 1930s. This also required the construction of extensive elevated roadway viaducts at the bridge's landing points. The resulting construction consisted of what would become the world's longest single arch, steel truss bridge for the next 45 years. The two other planned bridges constructed were the Outerbridge Crossing and Goethal's Bridge. The presence of these bridges expanded commercial transportation, attracted industry and spurred the development of bedroom communities on Staten Island whose residents commuted to Manhattan and New Jersey for work.

Staten Island at present is an industrial center for New York City and suburban outlier of Manhattan and New Jersey communities. The area of Staten Island occupied by the Project area currently contains vacant land formerly used as petroleum industry facilities and Port Authority of New York and New Jersey facilities to the west, residential neighborhoods toward the east, and commercial yards and port terminals along the northern shore.

CHAPTER FIVE

RESULTS

This chapter presents the results of the archaeological assessment for the New York portion of the Project APE located within the boroughs of Staten Island and Manhattan. The assessment only includes results for the terrestrial portions of the Project, as the major water crossings (Arthur Kill, Kill Van Kull and Hudson River) traversed by the pipeline route will either not be impacted as they are to be horizontally directionally drilled (HDD), or have been studied separately as a marine archaeological assessment (SEARCH 2010; Appendix E).

The Project APE includes the proposed pipeline trench and associated temporary workspaces, proposed M&R stations, and launcher/receiver facilities. The results discussion is organized by Project mileposts and station numbers, in accordance with the Project plans dated November 2010. The alignment sheets for the route are located in Appendix B.

Previously Recorded Archaeological Sites

A total of 15 pre-contact and 19 post-contact archaeological sites are recorded within one mile of the Project APE in Staten Island and Manhattan. All but four of the post-contact sites are located on Staten Island. The previously recorded pre-contact archaeological sites are summarized in Table 5-1. Recorded post-contact archaeological sites are summarized in Table 5-2. The recorded locations of five of the pre-contact sites and six of the post-contact sites are either traversed by the proposed pipeline route or within 600 feet or less of the route. These recorded archaeological sites are discussed in further detail below.

Pipeline Route

Staten Island, MP 3.52R to 4.92R

STA 192+22.4 to 191+63.2R

This section of the pipeline route begins at the Arthur Kill shoreline (see Appendix B-1), currently tidal marsh surrounded by tall marsh vegetation and a few deciduous trees. Installation of this section of pipeline will be a continuation of the horizontal directional drill (HDD) that crosses the Arthur Kill between Linden, New Jersey and Staten Island. It exits on Staten Island at ca STA 196+75 (MP 3.73) (see Appendix B-1 and Appendix G-1). An existing fenced-in Texas Eastern launcher/receiver and valve facility is present approximately 125 feet south of the proposed centerline, and wooden pilings remains are present along the shoreline. Historically, this segment is within an area of salt marsh created by marine transgression (see Appendix D-1 and D-2). Soils along this portion of the route are mapped as Inwood-Laguardia-Ebbets complex consisting of a mixture of natural soil materials and construction debris (NRCS 2005).

There are no recorded archaeological sites within or in immediate proximity to this part of the Project APE. The closest sites are two pre-contact sites: an unnamed site of indeterminate character (Boesch 1994: A), and the Beulah Point or Bloomfield Watchogue Site (NYSM 7324) that included finds of clay and steatite beads, pottery, a plummet, grooved axes and projectile points (Skinner 1909a:9; see Table 5-1). Both of these sites were located on an area of higher ground known as Bloomfield that is located one-half mile to one mile southeast of the Project route. In terms of post-contact period resources, a previous shoreline investigation identified a waterfront structure consisting of the partially intact remains of a barge mooring rack used by the Gulf Oil Corporation petroleum facility, and concluded that the mooring rack was not eligible to the National Register (Raber et al. 1996a:43). The rack is visible along the pipeline route on the Project alignment sheets (see Appendix B-1).

Table 5-1. Recorded Pre-Contact Archaeological Sites Within 1-mile of the Project Pipeline Route.

Site Name	NY SHPO Site #	Additional Site #	Borough	Project Area Overlapping or Near Sites	Approx. Distance from Pipeline Route	Time Period	Site Type
Arlington Avenue	A085-01-0137	NYSM 728	Staten Island	-	457 m (1,500 ft) SE	Unknown	Camp(s)? Traces of occupation?
Arlington Place Sites	A085-01-0139	NYSM 729	Staten Island	-	610 m (2,000 ft) S	Late Archaic-Late Woodland	Camp
Arlington Station	-	NYSM 730, 4593	Staten Island	-	914 m (3,000 ft) S	Woodland	Shell midden
Bloomfield (Watchogue)	-	NYSM 4596	Staten Island	-	1,524m (5,000 ft) S	Woodland	Camps
Bowman's Brook	-	NYSM 4594, 7321, 8507(?), 4630(?)	Staten Island	ca. STA 259+00 to 292+00	Immediately E and S of APE	Archaic, Late Woodland	Village and burials
Bowman's Brook North	A085-01-2364	-	Staten Island	ca. STA 285+00 to 290+00	Immediately N of APE	Late Archaic, Late Woodland	Probably associated with Bowman`s Brook Site
Gerties Knoll	-	NYSM 731	Staten Island	-	305 m (1,000 ft) S	Transitional Archaic (?)	Unknown
Goodrich Site	-	Boesch 1994: 24; NYSM 732	Staten Island	-	762 m (2,500 ft) E	Early Archaic-Late Archaic	Unknown
Mariners Harbor area	-	Boesch 1994: 105; STD-MH	Staten Island	ca. STA 250+00 to 290+00	0 m (0 ft) APE traverses area	Unknown	Traces of occupation
No name given	-	NYSM 7811	Staten Island		457 m (1,500 ft) SE	Unknown	Camp
No name given	-	NYSM 8505	Staten Island	ca. STA 250+00 to 274+00	0 m (0 ft) APE traverses area	Unknown	Traces of occupation
Old Place	A085-01-0134; A085-01-2366	NYSM 4595; NYSM 7215	Staten Island	ca. STA 244+00 to 251+00	0 m (0 ft) APE traverses area	Early Archaic-Contact	Village/Camps
No name given	-	Boesch 1994: 96	Staten Island	-	610 m (2,000 ft) SE	Unknown	Unknown
North Shore	-	Boesch 1994: I; STD-NS	Staten Island	-	1,210 m (4,000 ft) E	Unknown	Unknown
Beulah Point or Bloomfield/Watchogue	-	Boesch 1994: A; NYSM 7324	Staten Island	-	1,067 m (3,500 ft) SE	Transitional Archaic, Woodland, Contact	Campsites?

Table 5-2. Recorded Post-Contact Archaeological Sites Within 1-mile of the Project Pipeline Route.

Site Name	NY SHPO Site #	Additional Site #	Borough	Project Segment(s) Overlapping or Near Sites	Approx. Distance from Proposed Pipeline Route	Time Period	Site Type
Balanced Floating Dry Dock (KVK 38)	A08501.002825	-	Staten Island	-	1220 m (4,000 ft) E	Late 19th/Early 20th	Shoreline structure
unnamed suction dredge (KVK 36)	A08501.002826	-	Staten Island	-	1220 m (4,000 ft) E	Post-contact	Vessel/Shoreline structure?
Vessel Fish Hawk (KVK 33)	A08501.002827	-	Staten Island	-	1220 m (4,000 ft) E	1949	Underwater vessel
Vessel Paul E. Thurlow (KVK 37)	A08501.002828	-	Staten Island	-	1220 m (4,000 ft) E	1918	Underwater vessel
Composite Vessel (SS16b)	A08501.002829	-	Staten Island	-	457 m (1,500 ft) E	Post-contact	Underwater vessel
Unknown	A08501.002830	-	Staten Island	-	457 m (1,500 ft) W	Post-contact	Underwater vessel
Whalen Trucking Co. (Locus 15 outbuilding)	A085-01-2371	-	Staten Island	-	122 m (400 ft) W	20th century	Outbuilding
Whalen Trucking Co. (Locus 16 1790 Domestic Site)	A085-01-2372	-	Staten Island	-	122 m (400 ft) W	Pre-1800	House site (M.T. Jones House in 1878)
Whalen Trucking Co. (Locus 17 unidentified structure)	A085-01-2373	-	Staten Island	-	122 m (400 ft) W	Pre-1800?	Unidentified structure
Tunissen's 1680 Domestic Structure (Locus 18)	A085-01-2374	-	Staten Island	-	76 m (250 ft) W	ca. 1680	House site
Revolutionary Skirmish and burials; Reverend Kinney Property (Locus 19)	A085-01-2375	NYSM 4595	Staten Island	-	15 m (50 ft) W	ca. 1777	Revolutionary War period battle/skirmish and burials; later period Rev. Kinney house site
Richmond Terrace Historic Archaeological Site (Locus 2)	A085-01-2365	-	Staten Island	-	Immediately N of/adjacent to APE	ca. 1845	House site and well
Whalen Trucking Co. 1790 Domestic Site (Locus 10)	A085-01-2367	-	Staten Island	-	305 m (1,000 ft) W	ca. 1790	House site

Table 5-2. Recorded Post-Contact Archaeological Sites Within 1-mile of the Project Pipeline Route.

Site Name	NY SHPO Site #	Additional Site #	Borough	Project Segment(s) Overlapping or Near Sites	Approx. Distance from Proposed Pipeline Route	Time Period	Site Type
Whalen Trucking Co. unidentified structure (Locus 11)	A085-01-2368	-	Staten Island	-	305 m (1,000 ft) W	ca. 1790 or late 19th/early 20th century?	unidentified structure
Whalen Trucking Co. (1790 Domestic Site - Locus 13)	A085-01-2369	-	Staten Island	-	230 m (750 ft) W	ca. 1790	House site
Sheridan Square Site	A061-01-1273	-	Manhattan	-	823 m (2700 ft) SE	18th and 19th century	Artifacts and features
Site I Washington St. Urban Renewal Project	A061-01-1285	-	Manhattan	-	1610 m (5280 ft) S	ca. 1826	Foundry Site and Historic Landfill
Early 19th Century Suburban Area	A061-01-1286	-	Manhattan	-	549 m (1800 ft) E	early 19th cent.	No information available
City (Bernard M. Baruch College Site B)	A0-61-01.009530	-	Manhattan	-	1610 m (5280 ft) E	19th century	Horse stables

A review of eighteenth- through twentieth-century maps (Beers 1874; Bien and Vermeule 1891; Bromley 1917; McMillen 1933 [1776-1783]) indicates that no historic development pre-dating the mid-twentieth century has occurred in the marshlands associated with the Arthur Kill (see Figures 4-4, 4-5, and 4-6). Some filling of the tidal marsh occurred in the mid-twentieth century (Sanborn 1937). The filling appears to have taken during the creation of a large oil refinery complex under the ownership of the Gulf Oil Corporation. No twentieth-century developments associated with this complex are documented for the Project route (Sanborn 1937, 1950, 1962, 1977, 1981, 1983, 1986, 1987, 1988, 1989, 1990, 1992, 1993, 1994, 1995).

Sources of disturbance include infilling of the tidal marsh. Evidence of subsurface conditions comes from summary files of environmental investigations and remediations for known contaminated sites (TRC 2010-File No. 17). The route traverses a small, southerly projecting portion of a known contaminated site at the former GATX petroleum terminal (formerly the Gulf Oil Corporation). The summary file for this site indicates that historic fill material is present throughout the site area from grade to 5 ft below the surface and overlies a 1 to 5 ft thick layer of meadow mat (TRC 2010-File No. 17). The meadow mat or marsh deposits are underlain by clay, silt, sand, and gravel. Surficial deposits of historic fill materials in the vicinity of the proposed pipeline range between 1 to 2 feet in thickness (TRC 2010-File No. 17). The potential depth of the fill and marsh deposits ranges between 7 and 10 ft. A parcel adjacent to the pipeline route has also undergone remediation activities including excavation and groundwater treatment, although the exact location of the excavated areas is unknown. However, it appears that remedial excavation extended no deeper than the meadow mat layer suggesting that underlying sediments may still be intact (TRC 2010-File No. 17).

The area containing the Project APE has been previously determined to be sensitive for pre-contact cultural resources (Boesch 1994; NY SHPO 2010). The area is considered to have high sensitivity for pre-contact resources that may be present in sediments underlying the fill and marsh deposits at this location. Expected resources could consist of isolated finds or artifact scatters associated with campsites that pre-date marine transgression of the area. This same area is not assessed as having any post-contact period sensitivity because of the presence of extensive marshlands prior to the mid-twentieth-century filling associated with the oil refinery complex.

The HDD across the Arthur Kill will extend between ca. 0 and 160 ft in depth (see Appendix G-1). The portion of the HDD between ca. 196+00 and 191+63.2R that represents the HDD exit point may have vertical impacts on sediments potentially containing pre-contact deposits. The HDD along the remainder of the terrestrial portion of the route between STA 192+22.4 and 196+00 will be of sufficient depth (ca. 40 to 80 ft) that any sediments beneath the fill and marsh deposits potentially containing pre-contact archaeological deposits will not be impacted (see Appendix G-1). Soil borings are recommended between STA 196+00 and 198+00 where the HDD may impact archaeologically sensitive artifact bearing sediments.

The Project area also includes a workspace for pull back heading east of this portion of the pipeline route. Only minimal surface impacts to the filled wetland area containing the pull back area are proposed and no further investigations are recommended (see Appendix B-2 and B-3).

STA 191+63.2R to 211+73.6

Proposed construction along the pipeline route between STA 191+63.2R and 211+73.6 consists of the removal and replacement (take-up/relay) of the existing pipelines with a new 42-inch pipeline (see Appendix B-1, B-4 and B-5). Currently, the route consists of an easement situated within tidal marsh and cleared of tall vegetation. The area was historically tidal marsh prior to 1900 (see Appendix D-1 and D-2). Soils along the route are largely mapped as Ipswich-Pawcatuck-Matanuck mucky peats inundated twice daily at high tide (NRCS 2005).

There are no recorded archaeological sites within or in immediate proximity to the proposed pipeline route, although the area has previously been characterized as sensitive for pre-contact archaeological sites (Boesch 1994; NY SHPO 2010). Two above-noted Beulah Point or Bloomfield Watchogue Site (NYSM 7324; Skinner 1909a:9; see Table 5-1) and unnamed site (Boesch 1994: A) are located approximately one-half mile to the southeast. Review of historic maps shows no historical development along the route pre-dating the early part of the twentieth century (see Figures 4-4, 4-5, and 4-6) (Beers 1874; Bien and Vermeule 1891; Bromley 1917; McMillen 1933 [1776-1783]). Some filling of tidal marsh associated with the Gulf Oil refinery complex had occurred by 1937 (Sanborn) including the construction of the raised dirt road bed (present-day Lambert Avenue) that still parallels the pipeline route between

STA 202+00 and 211+73.6 (see Appendix B-4 and B-5). No twentieth-century developments associated with this complex, however, are documented within the project route (Sanborn 1937, 1950, 1962, 1977, 1981, 1983, 1986, 1987, 1988, 1989, 1990, 1992, 1993, 1994, 1995).

Disturbance along the Project APE consists of the installation of the two existing pipelines, and an existing Texas Eastern valve site located on the west side of the pipeline centerline between STA 201+00 and 202+00 (see Appendix B-1, B-4 and B-5). The route between STA 191+63.2R and 211+73.6 is considered to have high sensitivity for pre-contact resources below tidal marsh deposits, pre-dating marine transgression, and no sensitivity for post-contact resources. However, no impacts to potential archaeological resources is expected to occur since new pipeline in this segment will be placed either in an existing pipeline utility trench, or between two closely spaced or abutting trenches where lines run side-by-side. During a meeting held on February 23, 2010, the New York SHPO expressed an opinion that the take-up/relay portions of the Project would have low archaeological sensitivity, and no further archaeological investigation would be necessary for the take-up/relay portions of the Project that utilize existing pipeline trenches (see Appendix A). Therefore, no further archaeological investigations are recommended.

STA 211+73.6 to 214+92.8

Beginning near the intersection of Lambert and 6th Avenues, newly constructed pipeline will be installed between STA 211+73.6 and 214+92.8 on the south side of Lambert Avenue (see Appendix B-5). Wetland vegetation was observed during the walkover survey, and nineteenth century maps indicate the area consisted historically of tidal marsh (see Appendix D-1 and D-2). Soils in this area are mapped as Ipswich-Pawcatuck-Matanuck mucky peats inundated twice daily at high tide (NRCS 2005).

There are no recorded archaeological sites within or in immediate proximity to this section of the route though the Watchogue Site and another unnamed site are located within approximately one-half mile of this area to the southeast, and the general area has been previously determined sensitive for pre-contact archaeological sites (Boesch 1994; NY SHPO 2010). Historic maps indicate no historical development along the route pre-dating the early part of the twentieth century (see Figures 4-4, 4-5, and 4-6) (Beers 1874; Bien and Vermeule 1891; Bromley 1917; McMillen 1933 [1776-1783]), though filling of tidal marsh associated with the Gulf Oil refinery complex had occurred by 1937 (Sanborn) including the construction of the raised dirt road bed (Lambert Avenue). No twentieth-century developments associated with this complex, however, are documented at this location within the Project route (Sanborn 1937, 1950, 1962, 1977, 1981, 1983, 1986, 1987, 1988, 1989, 1990, 1992, 1993, 1994, 1995).

Disturbance in the Project pipeline route includes the installation of pipelines and likely infilling of the marsh area. The depth of fill is unknown. Below ground utilities consist of a cluster of pipelines crossed by the proposed route between STA 212+00 and 213+00 (see Appendix B-5).

The pipeline route is considered to contain high sensitivity for pre-contact resources located beneath marsh deposits, which could range from isolated finds to artifact scatters associated with campsites predating marine transgression. The route is considered to have no sensitivity for post-contact period resources due to the presence of historically undeveloped marshlands prior to the twentieth century construction of the oil refinery complex.

Soil borings are recommended between STA 211+73.6 and 214+92.8 to determine the presence and depth of ground disturbances or fill, and any sediments potentially containing pre-contact period resources below marsh deposits.

STA 214+92.8 to 250+22.5

Construction of the proposed pipeline along this section consists of a HDD across Old Place Creek (see Appendix B-5, B-8 thru B-10). The HDD begins just south of Lambert Avenue before continuing north across Old Place Creek and affiliated wetlands. North of Old Place Creek, the HDD route continues under Western Avenue, the elevated Goethals Bridge roads (I-278 north and southbound), and Goethals Road North (formerly Washington Avenue) before ending at STA 250+22.5 just north of aboveground facilities for the existing Texas Eastern M&R Station 058. A new launcher/receiver facility is proposed to be built within the fenced-in area at M&R 058 (see Appendix B-10). Current conditions along the route consist of tidal marsh at and south of Old Place Creek with raised dirt roads including Lambert Avenue situated at the south end. The area north of Old Place Creek contains

paved roadways (Goethals Road North and Western Avenue), and a paved and graded dirt and gravel area associated with M&R 058. A building, paved parking area and grassy area associated with the Coca Cola Enterprises property were observed on the west side of Western Avenue. The route traverses what was historically tidal marsh south of Old Place Creek before traversing an area of dry raised land north of the creek (see Appendix D-1 and D-2). Soils along the Project route at and south of Old Place Creek are mapped as Ipswich-Pawcatuck-Matunuck mucky peats, and those north of the creek are mapped as Pavement and Buildings, wet substratum-Laguardia-Ebbets complex (NRCS 2005). The latter soils consist of a mixture of natural soil materials and construction debris over tidal marsh with up to 80 percent pavement and buildings covering the surface.

One recorded pre-contact archaeological site, the Old Place Site (A085-01-0134 and A085-01-2366), is within or adjacent to pipeline route north of Old Place Creek. Initially reported by Skinner (1909a), the Old Place Site has yielded evidence of Archaic, Woodland and Contact period components. Finds from the site include features (fire pits and refuse pits), a variety of diagnostic points (e.g., Stanly/Neville, Snook Kill, Bare Island, Poplar Island, bifurcate, Kirk, Levanna, broad spears), Early and Late Woodland ceramics, and contact period items (brass kettle fragments, brass arrowhead, gun flints, kaolin pipes, pewter ring, lead bullets). One radiocarbon date of 5310 ± 140 years B.C. (uncalib.) from hearth charcoal has been reported from the site (Ritchie and Funk 1971:49). A possible fluted biface resembling a PaleoIndian projectile point was also reportedly recovered from the site (Payne and Baumgardt 1986:II-13). The site has undergone subsequent investigations since Skinner first reported it by both avocational and professional archaeologists in the 1960s and 1980s (HAA 2002; Payne and Baumgardt 1986; Ritchie and Funk 1971).

The exact boundaries of the Old Place Site are uncertain, but it is reportedly located along a large area on a strip of dry land bounded by marsh in the immediate vicinity of Western Avenue between Old Place Creek to the south and the Staten Island rail line to the north. This area overlaps with the northern end of the pipeline HDD section between ca. STA 244+00 and its terminal end at 250+22.5 (see Appendix B-10). Occupational sequences at the site reportedly shift from west to east through time likely reflecting the progress of marine transgression in this area (HAA 1995:13). Despite impacts by historic development and pot-hunting, a previous cultural resource investigation recommended the site as potentially significant (Payne and Baumgardt 1986:III-3). Available documents suggest that finds definitively from the site to date have all been recovered west of Western Avenue, although a recent archaeological survey for the Goethals Bridge Replacement Project found isolated deposits of jasper, chert, argillite chipping debris more than 500 feet to the east along Goethals Bridge Road North and Gulf Avenue which were considered as likely associated with the Old Place Site (The Louis Berger Group 2007:83). In addition, a previous archaeological assessment depicts the bounds of the Old Place Site as extending well east of Western Avenue as indicated by a Skinner map (HAA 1995), and Skinner's artifact collection notes variably refer to finds in the area as being from "Old Place," "Old Place Neck," or "Tunissen's Neck" (Skinner 1898–1909), and the "Neck" landform does continue east of Western Avenue.

Post-contact sites recorded along or in the immediate vicinity of the pipeline route include seven house and outbuilding sites on the west side of Western Avenue identified during the 1986 Howland Hook Marine Terminal survey (Payne and Baumgardt 1986). These sites include several loci consisting of domestic and other associated structures ranging in date from the seventeenth through the twentieth centuries, with the majority dating to the seventeenth and eighteenth centuries (A0815-01-2371, A085-01-2372, A085-01-2373, A085-01-2374, A085-01-2367, A085-01-2368, and A085-01-2369). They are located northwest of the intersection of Western Avenue and Goethals Bridge Road North. The sites were identified through map analysis, and in one case, through visible foundation remnants and subsurface testing (Payne and Baumgardt 1986).

The pre-1800 house sites are indicated on 1870s maps as associated with George Bowman, W.J. Halsey and M.T. Jones (Payne and Baumgardt 1986). Structures of unknown type associated with the houses were also identified, including one dating to the twentieth century (Payne and Baumgardt 1986). All of these latter structures are located on or adjacent to the Coca Cola property some 300 feet west of the pipeline HDD route. All of the residential sites were recommended as potentially significant archaeological resources (Payne and Baumgardt 1986:III-3), which would make them potentially National Register eligible, although the current status of these sites is not known.

Another post-contact site of particular note is Tunissen's 1680 Domestic Structure Site (A085-01-2374) situated along the northwest corner of Western Avenue and what is now Goethals Road North approximately 200 feet west of the Project area according to Payne and Baumgardt's map (1986). This area is documented as being part of a

colonial land patent belonging to John Tunissen, a Dutch settler who settled the area ca. 1680 (Skene 1907). The first structure depicted in this vicinity consists of the Tunissen house on maps dating to the Revolutionary War period, after which numerous farmsteads were present along Old Place Road up to the late nineteenth or early twentieth centuries (see Figures 4-4, 4-5, and 4-6) (Beers 1874; Bien and Vermeule 1891; Bromley 1917; McMillen 1933 [1776-1783]). Present-day Goethals Bridge Road approximates the route of Old Place Road at this location. The Tunissen house was also used as a meetinghouse during the eighteenth and nineteenth centuries and possibly earlier. Like the house sites above, Payne and Baumgardt recommended in their 1986 report that this domestic site is also potentially significant (1986:III-3), which would make it potentially National Register eligible although the current status of the site is not known.

A review of historical maps indicate that no pre-twentieth century improvements were present south of Old Place Creek (Beers 1874; Dripps 1872; Hassler 1845; Walling 1860; USGS 1891). Sanborn maps (1937, 1950, 1962, 1977, 1981, 1983, 1986, 1987, 1988, 1989, 1990, 1992, 1993, 1994, 1995) indicate that the area was owned by Gulf Oil Corporation and had been gridded into "blocks" delineated by roads by 1937. The only twentieth century improvements associated with the Gulf oil refinery complex in proximity to the pipeline HDD route were the construction of a cluster of above ground storage tanks (ASTs) located southeast of the pipeline centerline, the footprint of which are still visible on Project alignment sheets (see Appendix B-8). These ASTs are present on the 1937 and 1950 Sanborns, but are no longer visible on the successive 1962 Sanborn map.

For the portion of the pipeline HDD route north of Old Place Creek, historic maps indicate the presence of nearby structures (see Figure 4-4, 4-5, and 4-6) (Beers 1874; Dripps 1872; Hassler 1845; Walling 1860). The Beers (1874) and Dripps (1872) maps show that the area north of Goethal's Bridge Road was owned by J. Carpenter. A residential structure appears on these maps, but is situated to the east beyond the Project APE. The structure no longer appears on the 1917 Bromley map which indicates that by this time the land was owned by Thos. E. Greacen. A colonial tidal mill was also reportedly constructed in the Project vicinity along Old Place Creek on the south side of Old Place Road. The later Old Place Mill was constructed in 1803 at the site of the former tidal mill. The mill is visible on nineteenth-century maps of Staten Island to the east and outside of the Project pipeline route (see Figures 4-4, 4-5, and 4-6). In 1874 it was being used as a "Flouring Mill" under the operation of J. Carpenter whose residence was on the other side of the road (Beers 1874). The Old Place Mill apparently burned down in 1896 (HAA 1995), although other sources indicate that it burned down in 1898 (Morris 1900). It does not appear on the 1917 (Bromley) atlas map. Other than the construction of the existing natural gas facility (M&R 058) and elevated Goethal's Bridge roadways, there are no documented twentieth-century developments in the vicinity of the pipeline route north of Old Place Creek (Sanborn 1937, 1950, 1962, 1977, 1981, 1983, 1986, 1987, 1988, 1989, 1990, 1992, 1993, 1994, 1995).

Sources of disturbance south of Goethals Bridge Road include likely infilling of the tidal marsh, and artificial channelization in the wetlands along abutting Old Place Creek. Sources of disturbance to the north include the construction of the Goethals Bridge and Western Avenue roadways, and construction and grading associated with the existing Texas Eastern M&R 058 station facilities. In addition a below-ground natural gas line is present along the north side of Western Avenue between STA 243+00 and 244+00 (see Appendix B-9).

Although disturbance has occurred and fill has been deposited along the Project pipeline route, previous subsurface investigations in the vicinity of the pipeline north of Old Place Creek indicate that intact soils are present below fill or disturbed deposits, in some cases within a few feet of the present surface. Test pits from the Goethals Bridge Replacement survey contained what may be intact, medium sandy natural soils below surficial fill deposits at approximately 2 ft below the surface (The Louis Berger Group 2007:69 and Appendix CB). The test pits containing intact soils were located on the north side of Western Avenue just east of the proposed pipeline centerline between STA 244+00 and 245+00 (see Appendix B-10). West of the pipeline route, the Howland Hook Terminal Expansion survey estimated that fill generally did not exceed 3 ft in their study on the west side of Western Avenue (Payne and Baumgardt 1986:III-7). In addition, cores undertaken for geoarchaeological analysis of the Goethals Bridge Replacement Project revealed that sediments representing a former Holocene land surface were also present in the vicinity of the Project area (GRA 1997). Although the boring location map copied from the GRA report was of poor quality, the cores taken closest to the Project area appear to have been placed south of Goethals Bridge Road North west of the pipeline route. These cores revealed 7 to 9 ft of fill overlying a 2-foot thick peat deposit that capped marine sands. The sands represent a former surface available for human occupation. Core analysis additionally revealed that the salt marsh adjacent to the Old Place Creek channel rapidly developed over the past 800 to 1,000

years. Analysis also identified a former stable Holocene land surface dating to ca. 2,500 to 3,000 years ago before becoming inundated by marine transgression, that was subsequently disturbed by infilling, estuarine sedimentation and late Holocene fluvial erosion (GRA 1997).

Previous investigations and assessments have characterized the vicinity as having low to high sensitivity for both pre- and post-contact resources (Boesch 1994; HAA 1995; The Louis Berger Group 2007). Based on the current documentary and cartographic review and the presence of the previously recorded Old Place Site, the area is considered to be highly sensitive for pre-contact resources should intact sediments be present within the Project pipeline route. South of present-day Goethals Bridge Road, expected types of resources could range from isolated finds to campsite remains all predating marine transgression of the area. North of this road expected resource types could consist of components associated with the Old Place Site dating between the Early Archaic and contact periods.

The portion of the pipeline route south of Western Avenue is considered to have low to no sensitivity for post-contact resources in the marshlands, while the portion of the pipeline north of the road is considered moderately sensitive for post-contact resources that could consist of remains associated with the former Old Place Mill or eighteenth- and nineteenth-century home/farmsteads documented along Old Place Road, including the house site and historic property affiliated with John Tunissen.

The majority of the HDD (STA 217+00 to 249+00) will be of sufficient depth (30 to 60 or more ft) that any sediments beneath the fill and marsh deposits that have the potential to contain pre-contact and post-contact period archaeological deposits including recorded sites will not be impacted (see Appendix G-2). However, the entry and exit points of the HDD may impact archaeologically sensitive artifact bearing sediments at shallower depths (see Appendix B-5, B-8 and B-10; Appendix G-2). Therefore, additional investigations in the form of soil borings are recommended from STA 214+92.8 to 217+00 and STA 249+00 to 250+22.5 to determine the presence and depth of ground disturbance, fill, or marsh deposits, and of any sediments potentially containing pre-contact and post-contact period resources within or below these deposits.

No additional disturbance is expected to result from the construction of the proposed launcher/receiver at the M&R 058 station as previous extensive disturbance related to the installation of existing facilities is present. Therefore, no additional archaeological investigations are recommended for the area containing the fenced-in M&R 058 station.

The Project area also includes a workspace for pull back heading south of the southern portion of the pipeline HDD. Only minimal surface impacts to the filled wetland area containing the pull back area are proposed and no further investigations are recommended (see Appendix B-6 and B-7).

STA 250+22.5 to 259+79.9

At its south end, this section of the pipeline route begins within the confines of the northern portion of the existing Texas Eastern M&R 058 and continues north along the east side of Western Avenue (see Appendix B-10 thru B-13). At the south end, the proposed pipeline route traverses the graded gravel and dirt surface on the north side of the existing M&R Station 058 before entering the Bridges Creek wetland restoration area.

The route of Bridge Creek may have been historically altered as there is some evidence of artificial channelization in the wetland (see Appendix B-10). To the north of this wetland area, the route crosses the Staten Island Rail Road raised rail bed and a series of rail spurs before entering and following the route of the paved Western Avenue roadway. A small portion of the line will be bored underneath the rail spurs (see Appendix B-11). The Western Avenue roadway is situated at a slightly higher elevation than the wetlands, and a raised area was observed on the west side of the road just south of Bridge Creek. This raised area may represent part of the original landform. The area south of Bridge Creek historically consisted of dry land abutting tidal marsh to the south and north (see Appendix D-1 and D-2). Soil units in this area are mapped as Ipswich-Pawcatuck-Matunuck mucky peats and the above described Pavement & Buildings, wet substratum-Laguardia-Ebbets complex (NRCS 2005).

The previously described Old Place archaeological site (A085-01-0134 and A085-01-2366) is located at or in the immediate vicinity of the proposed pipeline. The exact boundaries of this large site are uncertain, located between Old Place Creek to the south and the Staten Island Rail Road to the north indicating that the Project route potentially

traverses the site area. In his report on the Old Place Site, Skinner also noted that Euro-American burials had been found near the former residence of the Reverend James Kinney immediately west of Western Avenue (Skinner 1909a:9). A previous cultural resource investigation for the Howland Hook Marine Terminal Expansion indicates the former Kinney residence, dating to 1885, was located on the west side of Western Avenue between the Staten Island Rail Road to the north and the Coca-Cola property to the south (Payne and Baumgardt 1986). This would place the location of the residence and nearby reported Euro-American burials (documented as Site A085-01-2375) in the immediate vicinity of STA 243+00, west of Western Avenue and potentially within 100 to 200 feet of the pipeline centerline.

The vicinity of the Kinney house (no longer standing), was also the location of a series of Revolutionary War period skirmishes in 1777 and a British fortification or picket line. The picket line was located near the "Burnt House" thought to refer to the old John Tunissen House located near the intersection of what is now Western Avenue and Goethals Bridge Road North (Washington Avenue), and earthworks were reportedly constructed on the Kinney property (Payne and Baumgardt 1986:I-35 and III-4). It is believed that the burials on the former Kinney property may represent Hessian casualties from the Revolutionary War skirmish that took place here, though Payne and Baumgardt conclude that Skinner's report implies that there were "non-white" human remains as well (1986:III-3). However, Skinner (1909a:9) does not specifically mention that Native American burials were encountered. Previous test pit excavations undertaken on the former Kinney property revealed fill deposits to 3 ft containing modern refuse and nineteenth- and twentieth-century artifacts possibly associated with occupation of the Kinney House Site (Payne and Baumgardt 1986). No human remains were encountered, but the investigators concluded that human and cultural remains affiliated with the Old Place Site and activity at the Kinney property could be potentially present below the fill deposits (Payne and Baumgardt 1986:II-19). As such, the site was considered potentially significant (Payne and Baumgardt 1986:III-4), which would make it potentially National Register eligible although the current status of the site is not known. Other post-contact sites in the vicinity of the Project pipeline route include the previously discussed and potentially significant eight recorded residential sites identified during the Howland Hook Marine Terminal survey (Payne and Baumgardt 1986).

North of the Staten Island Rail Road line (see Appendix B-11 thru 13), the proposed pipeline overlaps with the Mariner's Harbor site area first reported by Alan Skinner (Boesch 1994: No. 105; STD-MH). The Mariner's Harbor Site is a large area from which artifacts were collected by Skinner (Skinner 1909a), and depicted as a hatched area on his map (Figure 5-1). Regarding this area, Skinner noted "At Mariner's Harbor, beginning about half a mile south of the station and running north to Bowman's Point, in every field are traces of prolonged occupation, fire-cracked stones, flint chips, potsherds and the like" (Skinner 1909a:5). Skinner's map shows the Mariner's Harbor area as generally situated between the Staten Island Rail Road to the south and Shore Road (present-day Richmond Terrace) to the north. The area extends a little west of Western Avenue and east and southeast of South Avenue (see Figure 5-1). Four site concentrations are also depicted on this map including the Bowman's Brook, Gertie's Knoll, Arlington Avenue, and Arlington Station sites.

A review of Skinner's notes cataloging his artifact finds on Staten Island, including those in the Mariner's Harbor area, reveal that numerous artifacts were collected along or in the vicinity of Western Avenue north of the Staten Island Rail Road (Skinner 1898–1909). Finds in this area included a grooved axe, knives of argillite and "flint," a celt, scrapers, fragments of steatite and pottery, a bannerstone, a pewter kettle fragment, jasper and argillite blades, a fragment of a gorget or semi-lunar knife and projectile points of argillite, quartz, and "flint". Some of the finds are suggestive of deposits typically affiliated with the Archaic, Transitional Archaic, Woodland and possible Contact periods. Skinner additionally notes finds of projectile points, including one of argillite, at the "Proctor and Gamble Soap Works" located along Western Avenue (Skinner 1898–1909). These finds may be related to previously recorded Site 8505 (NYSM site files), a pre-contact site located somewhere in the vicinity of Western Avenue and the proposed pipeline, most likely between Richmond Terrace to the north, and the Staten Island Rail Road line to the south along the east side of Western Avenue. No information was available in the site file concerning who found the site or its contents.

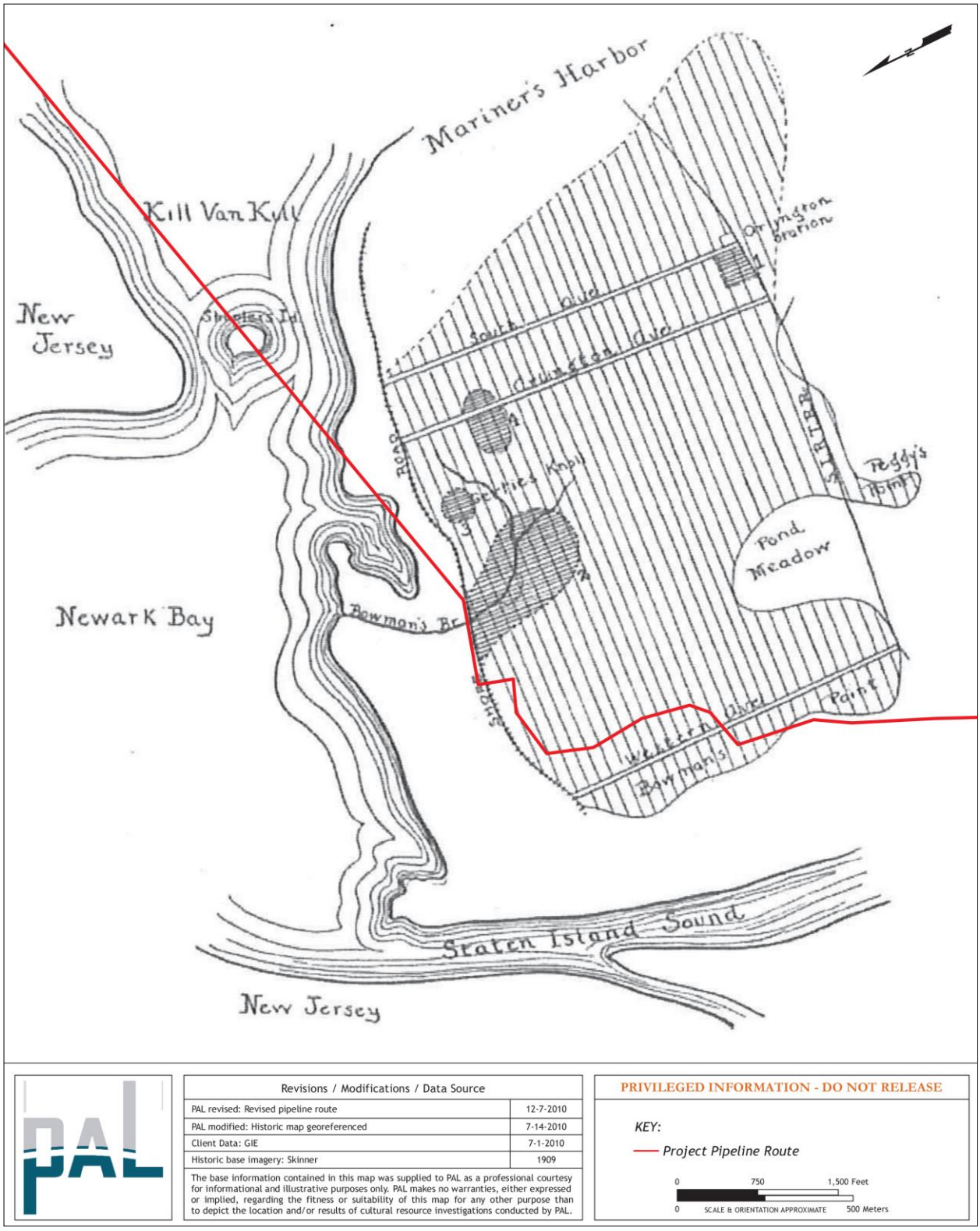

Figure 5-1. 1909 map of archaeological sites identified at Mariner's Harbor, with the location of the Project pipeline route on Staten Island (source: Skinner 1909a).

The pipeline route traverses the area referred to as Old Place which was part of a colonial land patent belonging to John Tunissen during the late seventeenth and early eighteenth centuries (Skene 1907). The first structure in this vicinity was the Tunissen house depicted on maps dating to the Revolutionary War period, after which numerous farmsteads were present along Old Place Road up to the late nineteenth or early twentieth centuries (see Figures 4-4, 4-5, and 4-6). The survey for the Howland Hook Marine Terminal recorded the site of Tunissen's house under or adjacent to Washington Avenue/Goethals Bridge Road North near its intersection with Western Avenue (Payne and Baumgardt 1986; NYSOPRHP No. A085-01-2374). The Western Avenue roadway was present by 1860 (Walling 1860). The pipeline route follows the eastern side of Western Avenue where there was little to no twentieth-century developments, except as discussed below (Sanborn 1937, 1950, 1962, 1977, 1981, 1983, 1986, 1987, 1988, 1989, 1990, 1992, 1993, 1994, 1995).

The major twentieth-century development in proximity to the northern end of this pipeline section, north of the rail line, is associated with the Proctor and Gamble Port Ivory Plant. The portion of the route between the Staten Island Rail Road and STA 259+00 passes along the southernmost limit of the sprawling industrial complex, which extended north from the railroad tracks to Richmond Terrace and west to the Arthur Kill marshlands (Figure 5-2). First opened in 1907, the plant became known for its production of Ivory soap, detergents, Crisco vegetable oil and shortening, as well as later-twentieth-century products including Duncan Hines baking goods, Tide detergent, and orange juice. By the 1920s, the plant occupied both sides of Western Avenue between the Staten Island Rail Road and Richmond Terrace, and included piers along Kill Van Kull. According to a previous cultural resources assessment, the portion of the plant on the west side of Western Avenue including many of the early plant buildings have been determined eligible for listing in the State and National Registers, for its association with American industrial and commercial history (HAA 2002:9). The 1907 Robinson map also indicates that there was a "Milliken Station" along a rail spur north of the Staten Island Rail Road line and in the immediate vicinity of the Project pipeline route. The station is still present on the 1917 Bromley map, but appears to have been torn down by 1937 (Sanborn 1937). By 1962 a manufactory building of the Proctor and Gamble complex for cake mixes was present near the former location of the rail station (Sanborn 1962). This building appears on Sanborn maps as late as 1996, but is no longer present (Sanborn 1962, 1977, 1981, 1983, 1986, 1987, 1988, 1989, 1990, 1992, 1993, 1994, 1995, 1996). However, there are no documented resources associated with the Proctor and Gamble complex within the direct project route alignment (Sanborn 1937, 1950, 1962, 1977, 1981, 1983, 1986, 1987, 1988, 1989, 1990, 1992, 1993, 1994, 1995).

Known or observed sources of disturbance and landscape alterations in this area include grading at the existing Texas Eastern M&R 058, a paved drive just south of the Staten Island Rail Road, construction of the elevated rail bed, graded and paved areas containing rail spurs at the south end of the former Proctor and Gamble complex, the Western Avenue road bed and utility lines below Western Avenue. The existing utilities include a water line and pipelines that are closely paralleled by the proposed pipeline (see Appendix B-11 thru 13). The depth of disturbance from these structures including the underground utilities is unknown, but the pipeline will be installed below the depth of the existing utilities in the roadbed.

The Howland Hook Terminal Expansion survey estimated that fill generally did not exceed 3 ft in the area south of the Staten Island Rail Road on the west side of Western Avenue (Payne and Baumgardt 1986:III-7). Also on the west side of Western Avenue, but on the north side of the railroad, a cross-section profile constructed from soil borings was created for an environmental remediation report for the Port Ivory facility on Port Authority of New York and New Jersey (PANYNJ) property. The cross-section profile, situated 100 to 400 feet west of the Project pipeline route, indicates that red-brown sandy soils are present below approximately 17 to 30 feet of fill deposits (Hatch Mott MacDonald 2008). The sandy soils may represent natural soils protected by a cap of fill.

A previous cultural resources assessment and draft Environmental Impact Statement (EIS) for the Cross Harbor Freight Movement Project concluded that the Arlington Yard area east of Western Avenue was sensitive for pre-contact resources and the Port Ivory area containing the former Proctor and Gamble plant on the west side of Western Avenue was highly sensitive for both pre-contact resources and twentieth-century resources associated with the former Proctor and Gamble plant (NYCEDC 2004; HAA 2002:23–24). This Port Ivory area was also considered to have low to moderate sensitivity for early post-contact period resources (HAA 2002:23–24).

The presence of the recorded Old Place Site and artifact finds along Western Avenue indicate that this section of the route has high sensitivity for pre-contact resources present in intact sediments below deposits of fill or disturbed

soils. Expected pre-contact resource types could consist of campsite or village components potentially dating to the Archaic through contact periods.

The portion of the route located south of the Staten Island Rail Road crossing is considered to have moderate sensitivity for eighteenth- and nineteenth-century resources related to the Revolutionary War period skirmish and burials, and/or the Reverend Kinney property, and low sensitivity for later historic resources. The portion of route north of the rail crossing is considered to have low sensitivity for any significant post-contact period resources.

Soil borings are recommended from STA 250+22.5 to 259+79.9 to determine the presence and depth of ground disturbance, fill, or marsh deposits, and of any sediments potentially containing pre-contact and post-contact period resources within or below these deposits.

Staten Island, MP 4.92Rto 5.80R

STA 259+79.9 to 282+39.2R

This section of the pipeline route heads east from Western Avenue then north passing through Port Authority of NJ and NY property before intersecting the Richmond Terrace road way (see Appendix B-13 thru B-15). The route traverses areas of pavement and dirt, graded graveled areas, and crosses the footprint of an existing building. According to nineteenth-century maps, the route historically lay along dry land abutted by tidal marsh to the west (see Appendix D-1 and D-2). Soils at this location have been mapped as Pavement & Buildings-Windsor-Verrazano complex and Inwood-Laguardia-Ebbets complex (NRCS 2005). The former soil unit consists of a mixture of sandy outwash soils and anthropogenic soils, while the latter unit consists of filled areas containing a mixture of natural soils and construction debris.

The pipeline route at this location traverses the previously described Mariner's Harbor site area (Boesch 1994:No. 105 and STD-MH) and area of pre-contact finds documented by Skinner along Western Avenue and at the former Proctor and Gamble complex, and/or Site 8505 (NYSM Site files; Skinner 1898–1909). In addition, the Bowman's Brook Site (NYSM 4594 and 7321) lies east of the pipeline route within present-day Mariner's Marsh Park. The park formerly contained the site of the Milliken Bros steel factory. Initially identified by Skinner during construction of the Milliken complex south of Richmond Terrace (1909a:6-8), the site contained Archaic and Late Woodland deposits including burials that likely represent a village. Notes from Skinner's artifact catalog dating between 1898 and 1909 and descriptions from his 1909 report indicate that finds from the Bowman's Brook Site included burials, numerous lithics, pottery, clay pipes, charred hickory nuts, items of antler and bone, and fragments of shell, turtle and sting ray spines. In addition, numerous (50 to 100) pit features were observed during factory construction. The site was predominantly occupied during the Late Woodland, but subsequent amateur avocational investigations revealed Archaic components (Ritchie 1980). Amateurs reportedly still find artifactual remains associated with the site (Kardas and Larrabee 1982:1). Skinner indicated that due to construction of the factory, the site as well as the "Indian fields to the north" had been "practically obliterated" (Skinner 1909a:7). Skinner may be referring to the area generally north of present-day Richmond Terrace as the location of the "Indian fields." A subsequent assessment of the site south of Richmond Terrace concluded that isolated pockets of the site may remain, but that massive disturbance related to the Milliken foundry complex had occurred south of the road (Payne and Baumgardt 1986:II-30).

A probable northern extension of Bowman's Brook Site deposits, consists of the more recently identified Bowman's Brook North Site (A085-01-2364). The site was identified during a survey for the Howland Hook Marine Terminal Expansion project, and extends along the north side of Richmond Terrace between Bowman's Brook (DeHart's Creek) to the east and the intersection of Western Avenue and Richmond Terrace to the west (Payne and Baumgardt 1986). This places the site in close proximity to the section of pipeline route closest to Richmond Terrace. Site finds include flakes of quartz, quartzite, jasper and "flint", fire-cracked rock (FCR), an argillite drill tip, a quartzite pebble core, a Late Archaic Bare Island-like stemmed point, an unidentified chert projectile point, and a probable Late Woodland triangle point (Payne and Baumgardt 1986:II-28). All artifacts were recovered from surface or disturbed contexts mixed with nineteenth- and twentieth-century artifacts. Despite the artifacts' recovery from a disturbed context, the site was considered potentially significant on the basis that the finds may be associated with "buried strata below the level of disturbance" (Payne and Baumgardt 1986:III-6).

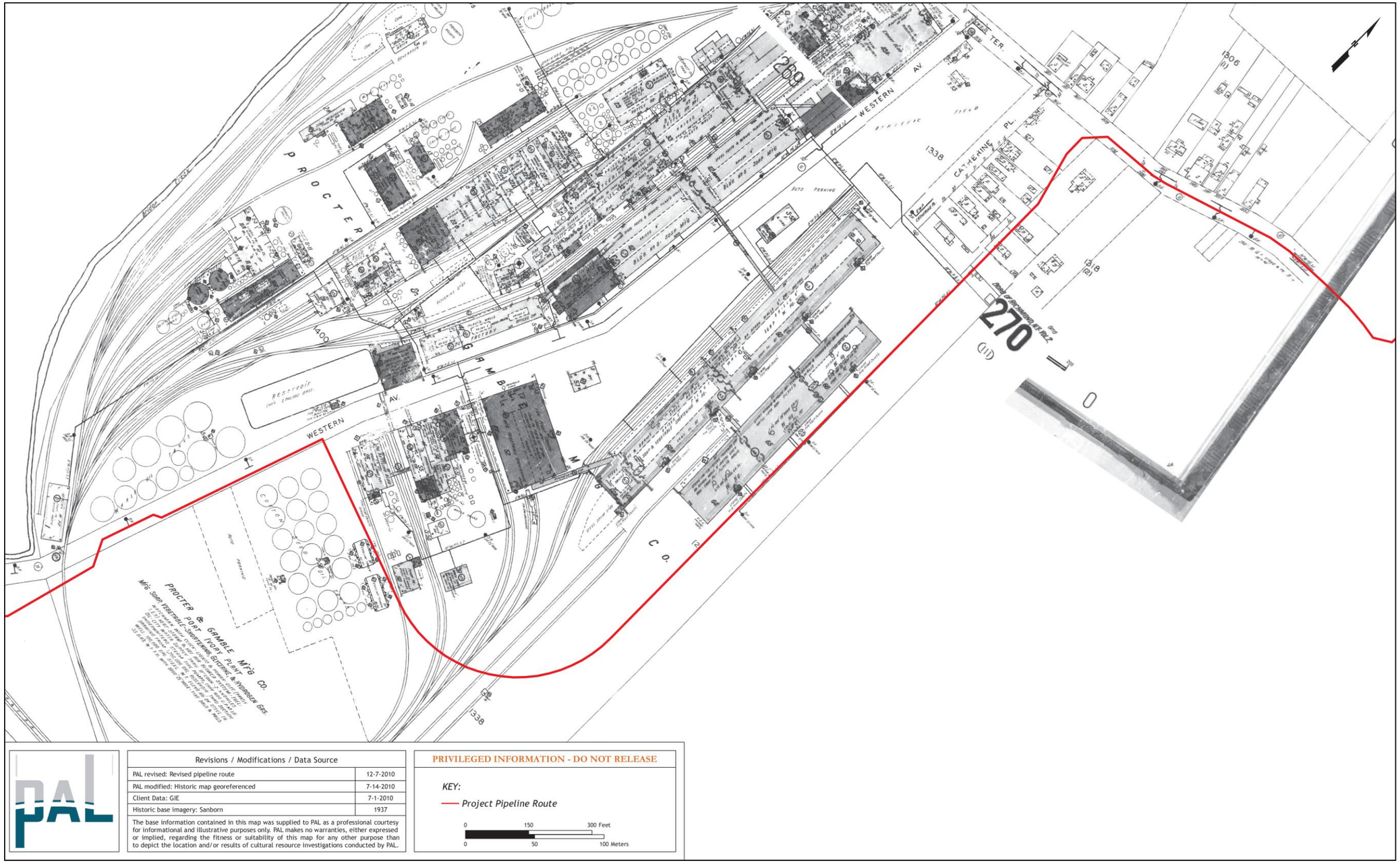

Figure 5-2. 1937 map of Staten Island depicting the Proctor and Gamble Company complex along Western Avenue, with the location of Project pipeline route (source: Sanborn 1937).

A review of eighteenth through twentieth-century maps indicates that prior to the establishment of the Proctor and Gamble Plant along the western side of Western Avenue, the area was undeveloped woodland that by the 1870s became tracts of land owned by G. Bowman, C. Kohler, the Post estate, P.F. Stull and J. Johnson (see Figures 4-4, 4-5, and 4-6) (Beers 1874; Bien and Vermeule 1891; Bromley 1917; Dripps 1872; McMillen 1933 [1776–1783]). No structures or other improvements are depicted on the Bowman, Kohler and Post lots at that time, but the tracts owned by Johnson and Stull were located just south of Richmond Terrace and contained houses (Beers 1874). By 1917, these tracts had been further subdivided and additional homes constructed between Richmond Terrace and Omaha Street in the vicinity of STA 283+00 of the Project route (Bromley 1917). The housing tracts south of Richmond Terrace no longer appear on Sanborn maps after 1950 (Sanborn 1910, 1917, 1937, 1950, 1962). The remaining area to the south was under the ownership of the Howland Hook Imp. Co. (Bromley 1917), but no improvements are depicted along the pipeline route at that time. This area remained undeveloped until the Proctor and Gamble Plant expanded to the eastern side of Western Avenue in the 1920s. By 1937, the Sanborn map indicates that a long, rectangular warehouse associated with a soap and vegetable shortening manufactory was present along the west side of the pipeline centerline (see Figure 5-2). The pipeline route passes through the footprint of the still present building, also used for a warehouse by the company constructed between 1950 and 1962, which adjoins the older building (Sanborn 1950, 1962; see Appendix B-14). Both buildings appear to have been constructed on concrete footings with concrete floors, and no basements.

Sources of disturbance include construction of housing tracts south of Richmond Terrace, and development of the Proctor and Gamble facilities including the buildings adjacent to or within the pipeline route. The depth of disturbance related to these sources is unknown, but may be extensive. However, infilling of the landscape at this location may have preserved intact sediments. Kearns et al. (1991b:1) refer to borings of taken at the Proctor and Gamble Site that revealed around 5 ft of fill overlying deposits of red silt with a trace of clay, sand, and gravel. The location of these borings is unknown, but the sediments underlying the fill may represent natural soils.

A previous cultural resources assessment and draft Environmental Impact Statement (EIS) for the Cross Harbor Freight Movement Project concluded that the Arlington Yard area east of Western Avenue was sensitive for pre-contact resources and the Port Ivory area containing the former Proctor and Gamble plant on the west side of Western Avenue was highly sensitive for both pre-contact resources and twentieth-century resources associated with the former Proctor and Gamble plant (NYCEDC 2004; HAA 2002:23–24). This Port Ivory area was also considered to have low to moderate sensitivity for early post-contact period resources (HAA 2002:23–24).

Based on the presence and proximity of previously identified sites, this portion of the pipeline is considered to have high sensitivity for pre-contact archaeological resources that could be present below deposits of fill or disturbed sediments. The sensitive area includes the building footprint of the ca. 1950s warehouse addition constructed on footings with no basement. Expected resources could range from isolated finds to village/campsite deposits dating from the Archaic through contact periods that may be associated with any one of the previously documented sites in the vicinity.

The portion of the route between STA 259+79.9 and 283+00 is assigned moderate post-contact sensitivity given the presence of documented early-mid-twentieth-century warehouse structures associated with the soap and vegetable shortening manufactory of the former Proctor and Gamble complex. The remaining portion of the route between STA 283+00 and Richmond Terrace is considered to have moderate sensitivity for potential subsurface remains associated with the late nineteenth century housing tracts on the south side of Richmond Terrace.

Soil borings are recommended for the entire length of the pipeline route between STA 259+79.9 and 282+39.2R to determine the presence and depth of ground disturbances, fill or marsh deposits, and of any sediments potentially containing pre-contact period resources below these deposits.

STA 282+39.2R to 290+65.2

This portion of the pipeline route is located entirely within the paved Richmond Terrace roadway along the north side of Mariner's Marsh Park (see Appendix B-15). A vacant area containing grass and trees is located along the north side of this road. Nineteenth-century maps show that the area as dry land abutting tidal marsh and the Kill Van Kull shoreline to the north (see Appendix D-1 and D-2). Soils along Segment 19 have been mapped as the above described Inwood-Laguardia-Ebbets complex (NRCS 2005).

The early-twentieth-century Milliken Brothers iron and steel foundry was located on parcels on both sides of Richmond Terrace adjacent to the Project route. The pipeline route is also at or in immediate proximity to the above described Mariner's Harbor site area, Bowman's Brook (NYSM 4594 and 7321) and Bowman's Brook North (A085-01-2364) sites. The route is located along the northern of the Mariner's Harbor and Bowman's Brook site areas as depicted by Skinner (see Figure 5-1). Finds associated with the Bowman's Brook North Site and Skinner's "Indian fields" to the north of the Bowman's Brook site are located along the north side of the pipeline route (Payne and Baumgardt 1986; Skinner 1909a:7). Skinner indicated that due to construction of the factory, the Bowman's Brook Site as well as the "Indian fields to the north" had been "practically obliterated" (Skinner 1909). A subsequent assessment of the site south of Richmond Terrace concluded that isolated pockets of the site may remain, but that massive disturbance related to the Milliken foundry complex had occurred south of the road (Payne and Baumgardt 1986:II-30).

Human remains were found during the widening of a railroad cut on the Milliken property (Skinner 1898–1909, 1909a). In particular, Skinner's original catalog notes indicate that in April of 1906, he revisited the site saying "Grave #2 exposed by RR cut on preceding Friday. About 25 feet back from Shore Road [now Richmond Terrace] on south side of cut" (Skinner 1898–1909). Skinner also described numerous other burials located along this railroad cut, which are possibly in the vicinity of "Grave #2." The 1910 Sanborn map of the Milliken property shows rail lines running parallel and perpendicular to the Richmond Terrace roadbed as well as crossing the road. Although it is uncertain along which rail line the human remains were located, it may be one of the lines adjacent to or crossing the road (Figure 5-3). Kardas and Larrabee (1982:7) cite a 1926 Skinner report stating that Euro-American burials containing British military buttons and heavy hobnailed shoes had been found by workmen digging a trench on then Downey Ship Building property. Skinner interpreted these as Revolutionary War remains of Hessians. The locations of the graves on the Milliken/Downey property is unknown, but they could be in the vicinity of the Project APE.

The Richmond Terrace Historic Archaeological Site (A085-01-2365) was also identified in the 1986 Payne and Baumgardt report. The site was described in the report as consisting of the buried ruins of a residence predating 1845, and refilled well located on the north side of Richmond Terrace just east of its intersection with Catherine Place (Payne and Baumgardt 1986:II-23). This places the site in proximity to the Project APE. A single test pit, which yielded mainly window glass and no diagnostic artifacts, was placed adjacent to the razed house ruins during the Payne and Baumgardt survey (1986). Despite the lack of diagnostic materials, the site was considered to be potentially significant (Payne and Baumgardt 1986:III-5). Numerous additional slab foundations of earlier nineteenth-century dwellings were also noted along the north side of Richmond Terrace in the vicinity of the Project APE during a previous archaeological assessment of the Newark Bay Site for the New York City Long Range Sludge Management Plan EIS (Kearns et al. 1991a:1). Other potential historic resources noted in the Payne and Baumgardt report and identified from historical maps include the Phillip Post farmstead along the south side of Richmond Terrace in the vicinity of MP 5.5R (see Appendix B-15). According to Payne and Baumgardt (1986:II-30), the Post homestead has been destroyed by a gas pipeline right-of-way (ROW).

Additional historic resources along this section of Richmond Terrace identified during the Howland Hook Terminal survey were the Richmond Terrace Coffee Shop and Richmond Terrace White House, both standing structures located just east of the intersection of Richmond Terrace and Catherine Place at that time. Site descriptions indicate these standing structures were located at the sites of structures that appeared at these same locations on the 1845 (Hassler) map (see Figure 4-4), and the authors imply these sites may have archaeological potential (Payne and Baumgardt 1986:III-5). The standing structures themselves were determined not significant or eligible for listing in the National Register (Payne and Baumgardt 1986:III-7). A separate report also indicated that the Richmond Terrace Coffee House had no historic or architectural significance (Flagg 1991a:6). These structures are no longer standing, but it is not known when they were demolished. The Project pipeline route does not extend onto these documented properties.

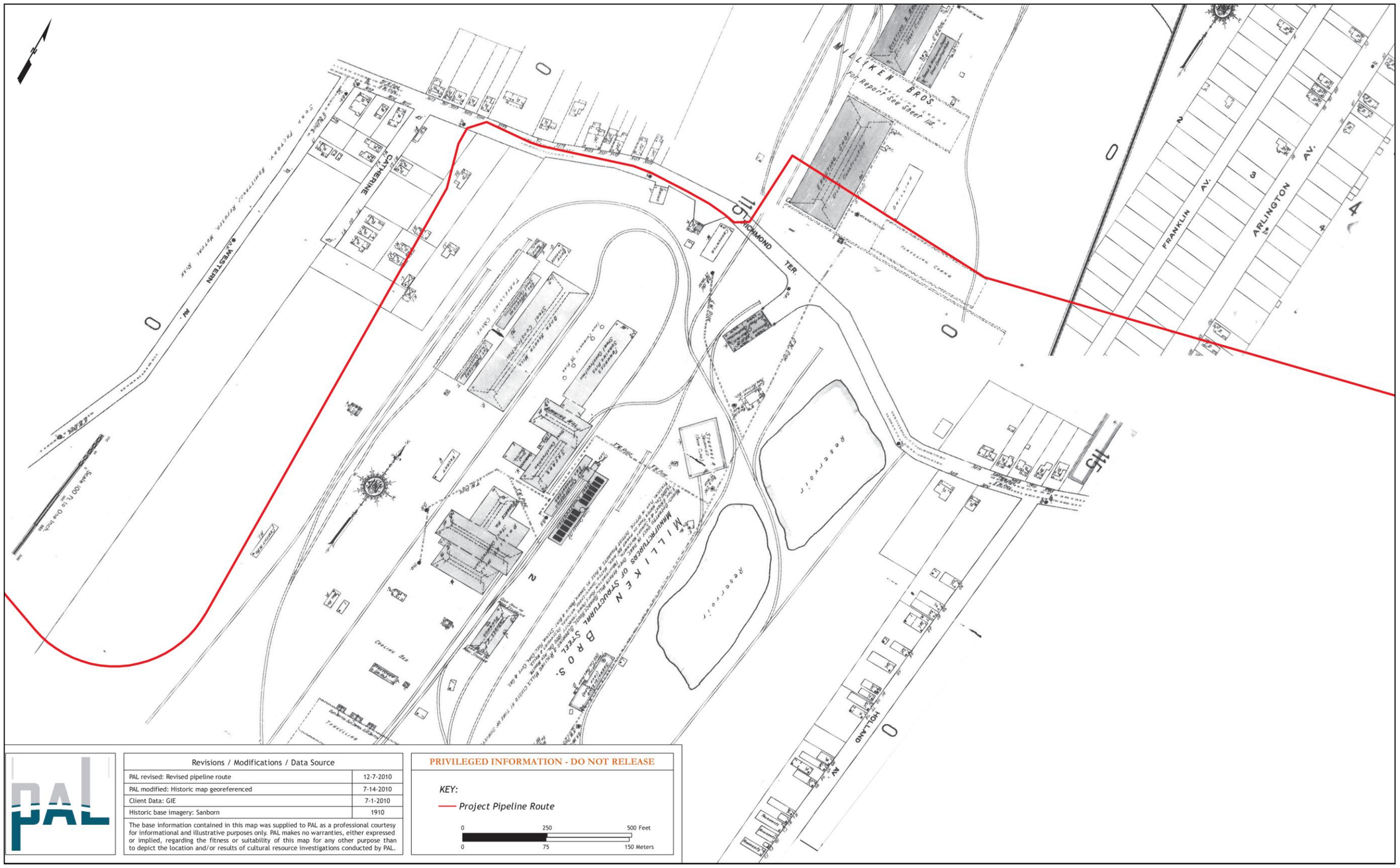

Figure 5-3. 1910 Sanborn insurance map of Staten Island depicting the Milliken Brothers Company property on both sides of Richmond Terrace, with the location of the Project pipeline route (source: Sanborn 1910).

A review of historical maps indicates that in addition to the early Post farmstead, later house structures were present along Richmond Terrace by the mid- to late nineteenth century that may be associated with "Sailor's Row," or residences of retired sailors (see Figures 4-5 and 4-6). The Milliken Bros. Steel Mill complex is depicted along both sides of Richmond Terrace by 1910 (see Figure 5-3). The Downey Ship Building Corporation took over the Milliken complex by 1917, according to the Bromley atlas; however, the Sanborn insurance map of 1917 continued to depict the complex configuration under Milliken Brothers. By 1937 the entire Milliken/Downey property on both sides of Richmond Terrace was vacant land.

Known sources of disturbance along the pipeline route include construction of the Richmond Terrace roadway and sewer lines that run beneath the street on either side of the pipeline centerline. The proposed pipeline will be installed below the depth of the sewer lines. Kearns et al. (1991a:1) refer to borings taken along the Richmond Terrace roadway that revealed between 2 and 7 ft of fill beneath the roadbed overlying deep deposits of either red clay or fine red sand and silt.

The parcels surrounding the route have been previously characterized as sensitive for both pre-contact and eighteenth-and nineteenth-century archaeological resources, as well as twentieth-century industrial remains associated with the former Milliken complex (Boesch 1994; Flagg 1991a, 1991b; Kearns et al. 1991a; Payne and Baumgardt 1986). The Project APE is considered to have high sensitivity for pre-contact resources that could consist of Archaic and Woodland Period remains associated with the Bowman's Brook/Bowman's Brook North sites, including human remains. Although the general area is considered sensitive for eighteenth- and nineteenth-century farmstead or domestic site remains, and sensitive for twentieth-century industrial remains south of Richmond Terrace, the Project APE is contained within the Richmond Terrace roadbed where modern disturbances including utility easements are present. As such, the route is not assessed as being sensitive for post-contact period archaeological resources.

Soil borings are recommended between STA 282+39.2R and 290+65.2 to determine the presence and depth of ground disturbances, fill, or marsh deposits, and of any sediments that have the potential to contain pre-contact period resources below these deposits.

STA 290+65.2 to 303+01.6

This section of the pipeline extends north of Richmond Terrace, and parallels a pipeline ROW to the immediate east before turning east and proceeding into the Kill Van Kull waterway (see Appendix B-15 and B-16). The portion of the route between STA 290+65.2 and 299+89.4 will consist of open cut construction and the remaining portion between STA 299+89.4 and 303+01.6 will consist of a HDD entry point where the route crosses the Kill Van Kull. The HDD portion of this section will extend between ca. 0 and 60 ft below the surface (see Appendix G-3). Current conditions along the route consist of vacant vegetated areas, marshland and the paved, fenced-in property belonging to the New York City Department of Transportation (NYC DOT). Nineteenth century maps indicate the route was historically dry land and tidal marsh along the Kill Van Kull shoreline. Some filling along the shoreline may have occurred by 1891 (see Appendix D-1 and D-2). Soils along the pipeline route have been mapped as Inwood-Laguardia-Ebbets complex consisting of a mixture of natural soil materials and construction debris (NRCS 2005).

Historic maps indicate the presence of numerous mid- to late-nineteenth -century dwellings along the north side of Richmond Terrace likely associated with "Sailor's Row", or the residences of retired sailors (see Figures 4-5 and 4-6). However, the landscape along the pipeline route remained unimproved until the construction of the early-twentieth-century Milliken Bros. iron and steel foundry (Beers 1874; Dripps 1872; Hassler 1845; Sanborn 1910; USGS 1891; Walling 1960). The route traverses the northern parcel of this former complex (see Figure 5-3).

Construction at the Milliken complex began in 1903, but the foundry reportedly failed in 1907. The steel furnaces were shut down, but the fabricating plant portion of the complex remained in operation until 1912 (Flagg 1991a:3). The 1910 Sanborn insurance map depicts a large complex that occupied parcels on both sides of Richmond Terrace, including outdoor traveling cranes that looped close to the Newark Bay (Kill Van Kull) shoreline to the north (see Figure 5-3). The pipeline route passes through the footprint of an erecting shop and a smaller workshop to the east that was present at that time (Sanborn 1910 and 1917; see Figure 5-3). The complex also contained a number of rail lines (spur tracks), two of which crossed Richmond Terrace. This same configuration is depicted on the 1917 Sanborn insurance map; however that same year, the 1917 (Bromley) atlas depicts the entire Milliken complex as

having been taken over by the Downey Ship Building Corporation. According to Kearns et al. (1991a:7), the shipbuilding operation was shut down shortly after World War I and the portion of the complex north of Richmond Terrace was subsequently used, possibly illegally, during the 1950s and 1960s for scrapping and burning of wooden barges (Flagg et al. 1992:2). Historic 1931 and 1954 aerial photographs reveal that the erecting building and a riveting and bolt shop to the north were still present by 1931, but were razed at some point between that year and 1954. The parcel containing the former Milliken/Downey complex was subsequently vacant until construction of the NYC DOT maintenance facility (Sanborn 1988, 1989, 1990, 1992, 1993, 1996).

Previous cultural resource reports note the remains of numerous concrete pedestals associated with the Milliken industrial complex north of Richmond Terrace and a variety of foundations south of the road (Flagg 1991a:4, 1991b). The concrete pedestals north of the road consist of a common foundation type used for large shed-type industrial structures (Flagg 1991:4). The remnants north of Richmond Terrace were not considered to have any historical significance, while the foundations south of the road were considered to have potential historic significance (Flagg 1991a, 1991b).

Pre-contact sites in proximity to the pipeline route include the previously described Bowman's Brook (NYSM 4594 and 7321), Bowman's Brook North (A085-01-2364), and Mariner's Harbor site areas (see Figure 5-1). The above-noted human burials from the Bowman's Brook Site found during rail track construction are most likely located on the south side of Richmond Terrace as this is where Skinner in general conducted his investigations. However, it is possible they were found north of the road in proximity to the pipeline route which is located near rail spurs north of Richmond Terrace (see Figure 5-3). In addition, the Revolutionary War period burials from the former Milliken/Downey complex (Kardas and Larrabee 1982:7, citing Skinner 1926) may be on either side of Richmond Terrace.

Disturbance along the route includes filling of former marsh areas, construction of the Milliken/Downey complex, development of the NYC DOT facility, existing pipeline installation and excavation of former underground storage tanks (USTs). The existing pipeline consists of a below-ground gas or petroleum pipeline paralleled by the proposed pipeline north of Richmond Terrace (see Appendix B-10). Summary files of environmental sites and remediation activities provided to PAL by TRC indicate that USTs were removed from the NYC DOT parcel, but the locations of the excavations is unknown (TRC 2010: File No. 12).

The area containing this section of the pipeline route has been previously characterized as sensitive for pre-contact archaeological resources (Boesch 1994; Kearns et al. 1991a). Based on this and the presence of documented sites in the vicinity, the Project route is considered to have high sensitivity for Archaic and Woodland period materials associated with the Bowman's Brook and Bowman's Brook North sites. The area may also have the potential to contain human remains.

The general area along Richmond Terrace is considered sensitive for pre-twentieth-century farmstead or domestic site remains, and twentieth-century industrial remains south of Richmond Terrace (Flagg 1991a, 1991b; Kearns et al. 1991a; Payne and Baumgardt 1986). However, historic maps do not indicate that any presence of farmstead or domestic structures along the pipeline route itself. Additionally, previous investigations have concluded that industrial remains associated with the portion of the Milliken/Downey complex north of Richmond Terrace do not possess any historical significance (Flagg 1991a, 1991b; Kearns et al. 1991a). Though not considered sensitive for post-contact farmstead, domestic site, or industrial archaeological resources, the portion of the route between STA 290+65.2 and 300+50 may have some potential to contain Revolutionary War period human remains based on the information contained in a 1926 report by Skinner (Kardas and Larrabee 1982:7). This section of pipeline is therefore assessed as having moderate sensitivity for post-contact period burials. The remaining portion of the pipeline route between STA 300+50 and 303+01.6 is assigned low sensitivity for post-contact resources as activity in this area has been limited to infilling of the shoreline.

Soil borings are recommended for the pipeline route between STA 290+65.2 and 303+01.6 to determine the presence and depth of ground disturbances, fill, or marsh deposits, and of any sediments that have the potential to contain archaeological resources below these deposits.

Staten Island, MP 6.06R to 6.5R

STA 332+89.2 to 335+00, Shooter's Island

The terrestrial portion of the pipeline route between MP 6.06R and 6.5R in Staten Island is located between STA 332+89.2 and 335+00 on Shooter's Island (see Appendix B-17 and B-18). The remaining portion of Shooter's Island to the north and east lies within the municipality of Bayonne, New Jersey (see Appendix B-18). The proposed pipeline route traversing Shooter's Island consists of a HDD (see Appendix G-3). Walkover reconnaissance of the island was not feasible at the time of the survey, but recent aerial photographs used for Project alignment sheets indicate that the area currently consists of a vacant vegetated area. According to nineteenth century coastal maps, Shooter's Island was originally a low island of marsh within the Kill Van Kull near its juncture with Newark Bay and the Arthur Kill. Fill had been added by 1891 to approximate its current footprint (see Appendix D-1 and D-2). The Shooter's Island soil unit is mapped as Bigapple-Fortress complex consisting of level to gently sloping areas filled with sandy dredged materials (NRCS 2005).

No previously recorded pre-contact archaeological sites are present on Shooter's Island. One recorded post-contact archaeological site (A08501.002829) consisting of a sunken vessel (SS16b) is located off the eastern shore of the island. Numerous other vessels have been abandoned or dumped around the island during the twentieth century forming several ship graveyards, although many appear to have since been removed. The majority of the vessels consist of scows and barges, although other vessels have been identified such as tugs, a steamer, a lighter, a World War II landing craft, freighters and other harbor utility vessels, as well as marine structures such as floats, bridges and pontoons (Kardas and Larrabee 1985).

A review of historic maps indicates that no extensive improvements were made on the island until the late-nineteenth century (see Figures 4-4, 4-5, 4-6) (Cook et al. 1884; Hassler 1845; Hopkins 1872; USGS 1891; Wadsworth 1855; Walling 1860; Dripps 1872). The 1855 Wadworth U.S. coastal survey map indicates piers were present along the north side of the island and possible structures on the south side. The first historically noted development on the island consisted of a small shipyard built by David Decker in the 1860s (NYC DPR 2001). Remains of this shipyard may have an included a brick structure and drydock that are no longer present (Brouwer 1978).

Shipbuilding was the main industry on the island for the next several decades. Prior to this, Shooter's Island was used as a hunting preserve during the colonial period and for oyster harvesting and a message drop-off point during the Revolutionary War. The late nineteenth century saw the island used by the Shooter's Island Petroleum Refining and Storage Company. Structures possibly associated with the oil refinery and storage firm appear on the southern portion of the island on the 1891 USGS map (see Appendix D-2). The first substantial development, however, consisted of the establishment of Townsend and Downey yacht building company in the early 1900s (Brouwer 1978; Kardas and Larrabee 1985; NYC DPR 2001). In the following year the company completed and launched the *Meteor*, a lavish racing yacht for Kaiser Wilhelm II of Germany (Current History 1902:132; NYC DPR 2010). The company is also known as the builder of the *Atlantic*, a three-masted schooner yacht that still holds the record for a transatlantic crossing under sail (Brouwer 1978).

Townsend and Downey sold their shipyard to Standard Shipbuilding by 1916 or 1917, and moved their operations to Staten Island. Standard Shipbuilding placed fill off the north shore of the island nearly doubling its size (Brouwer 1978). Standard Shipbuilding had thousands of employees who produced steel cargo ships during World War I to meet war time demand, but operations ceased after the war in 1921 (Kardas and Larrabee 1985; NYC DPR 2001; Shipbuildinghistory.com 2010). For the remainder of the twentieth century the island remained vacant, formally becoming a bird sanctuary managed entirely by the State of New York in 1994 (NYC DPR 2001). According to a 1978 cultural resources reconnaissance of Shooters Island (Brouwer 1978), remains of the shipyards including concrete platforms, steel and concrete support pillars, and basements were still present at that time. The reconnaissance report recommended that the shipyard remains should be examined by an industrial archaeologist to determine whether any features merit recording for the Historic American Engineering Record (Brouwer 1978).

Likely sources of disturbance to Shooter's Island include infilling episodes and construction of the oil refinery and shipbuilding facilities. An analysis of cores taken in Newark Bay northeast of Shooters Island indicates that it was not inundated by rising sea levels until ca. 6,000 year ago (GRA 2000). The section of the Project route on

Shooter's Island is therefore considered to have moderate sensitivity for pre-contact resources pre-dating marine transgression to be present below fill and marsh deposits. The pipeline route at this location is also assigned a moderate sensitivity for post-contact resources related to the late-nineteenth and early-twentieth century shipbuilding industries since the exact locations of the shipyard remains reported in 1978 are not known.

However, the HDD proposed for the Shooter's Island portion of the pipeline route will be of sufficient depth (approximately 110 ft below surface) that any potential archaeological deposits will not be impacted (see Appendix G-3). Therefore, no additional archaeological investigations are recommended for the Shooter's Island Project APE between STA 332+89.2 and 335+00.

Manhattan, MP 19.77 to 20.04

STA 1052+42.5 to 1057+94.6

The entire terrestrial Manhattan portion of the Project route is contained within this section. The route runs between the Hudson River to the west and the intersection of Gansevoort Street and West Street (Route 9A) to the east (see Appendix B-19 and B-20). At its eastern terminal end, an underground vault with a 30-inch diameter block valve with blind flange is proposed to accommodate a temporary receiver. Currently, the area consists almost entirely of paved roads, parking, bike path, and walkway areas situated on made land. During the walkover it was noted that relatively intact Belgian block paving is present beneath the asphalt along the south side of the Gansevoort peninsula (Photograph 5-1). Beginning at the southwest corner of the Gansevoort peninsula, the proposed pipeline route extends east within the Gansevoort Street roadbed, then continues east along the south edge of the peninsula, and crosses the Hudson River Greenway and West Street, before terminating on the east side of the 10th Avenue service road extension at its intersection with Gansevoort Street. Historically, this segment was underwater (see Appendix D-1 and D-2). The early historic period shoreline was situated nearly two blocks east of this area between present-day Greenwich and Washington avenues. The segment currently resides on made land. Soils along this segment have been mapped as Pavement & Buildings, wet substratum consisting of fill overlying swamp, tidal marsh or water with more than 80 percent coverage by pavement and buildings (NRCS 2005).

Photograph 5-1. Belgian block pavers visible under asphalt surface of Gansevoort Street at the NY Sanitation Pier/Gansevoort Destructor Plant, view looking west.

The only potential Native American resource in the vicinity is Sapokanickan, a contact period Native American habitation site in Greenwich Village in the vicinity of the former Gansevoort Market noted on early maps and in colonial records (Empire State Development Corporation 1998; Skinner 1909b). Skinner notes that the village may have been occupied up to 1661 and suggests that the early explorer Hudson landed at Sapokanickan and traded with the Native American inhabitants (Skinner 1909b:41–42). It was situated on the original west shoreline outside of and roughly two blocks east of the Project pipeline route near present-day Gansevoort Street.

The other identified potential resources within or immediately adjacent to Segment 74 consist of post-contact resources. Three separate cultural resource studies have been conducted in areas that are in proximity to the Project pipeline route. These include surveys undertaken for the Westside Highway or Westway Project (HCI 1983), the Route 9A Project (HAA 1990), and the Hudson River Park Project (Empire State Development Corporation 1998; Kirkorian et al. 1997). The 1983 Westside Highway Cultural Resource Survey identified four areas along the West Side of Manhattan between Battery Place and West 44th Street as having the potential to contain significant resources (HCI 1983), none of which are within or adjacent to the Project pipeline route.

The HAA 1990 archaeological assessment for the Route 9A Project overlaps the eastern portion of the Project pipeline route from approximately STA 1055+50 to the terminus. The HAA 1990 study identified three areas of historic sensitivity within or immediately adjacent to this area. The locations of "former ca. 1879 pier sheds" along the south edge of the Gansevoort peninsula; an undefined building at the northwest corner of the intersection of present-day West Street and Gansevoort Street; and an early twentieth century former building and a pumphouse associated with the Gansevoort Market (HAA 1990:VIII-2). The lot containing the pumphouse and buildings lies within the boundaries of the Gansevoort Market Historic District located adjacent to and east of the Project pipeline route. The Gansevoort Market area was designated a Historic District in 2003 (NYCLPC 2003). Of these, it appears that the location of the "former ca. 1879 pier sheds" and that of undefined building to the immediate north on either side of Gansevoort Street are within the current Project pipeline route between approximately STA 1055+00 and STA 1057+00. The Final Environmental Impact Statement (FEIS) for the Route 9A Project and associated concurring comments by SHPO indicated that the documented pier sheds were of little value archaeologically as structures of these types leave little or no visible or interpretable archaeological footprint because they functioned as storage areas and were constructed on pier platforms (Empire State Development Corporation 1998; Kirkorian et al. 1997).

An assessment of a portion of the Hudson River Park Project and the 1998 FEIS for that project both identified the Hudson River Bulkhead as a significant historic resource (Empire State Development Corporation 1998; Kirkorian et al. 1997). The Manhattan portion of the Project pipeline route crosses the Hudson River Bulkhead, which has been determined eligible for listing in the National Register (see Appendix C; NY SHPO 1997). The bulkhead was constructed piecemeal between 1871 and 1936 mainly in response to deteriorating waterfront conditions. The majority of the bulkhead constructed prior to 1920 is granite-faced, after which concrete characterized the appearance of bulkhead section (NY SHPO 1997). A small percentage of the remaining bulkhead along the western Manhattan waterfront consists of timber cribbing. The portion of the bulkhead south of Gansevoort Street and adjacent to the Project pipeline route is a masonry bulkhead consisting of a pile-supported granite bulkhead without timber relieving platforms. The masonry bulkhead at this location more specifically consists of a granite-faced wall on mass concrete block, resting in turn on a 2-inch thick concrete bed (NY SHPO 1997:3). This type of masonry bulkhead wall was generally built ca. 1873–1875, although this particular section, one of the largest bulkhead related projects, was likely not constructed until ca. 1894–1902, when made land in this area was removed as part of the Chelsea/Gansevoort Pier Plan (NY SHPO 1997:8).

However, within the Project pipeline route along the south-facing edge of the Gansevoort peninsula and north of Gansevoort Street, the bulkhead is of an atypical material type consisting of collapsed pile-supported platforms and/or rip rap that is not considered significant (NY SHPO 1997:Figure 1). It is this latter type of bulkhead that is intersected by the proposed pipeline route. A masonry bulkhead was never built in this particular area of made land between the Gansevoort and Chelsea Piers (NY SHPO 1997:8). The area of made land comprising the Gansevoort peninsula consisted of solid fill originally retained by a timber-crib bulkhead, and was the location of a Department of Docks work yard, and the later West Washington Market before becoming the site of the present-day Gansevoort Destructor Plant sanitation facility (NY SHPO 1997:8). The area of bulkhead underlying the Project pipeline route along Gansevoort Street and the former pier currently appears to be made of rip rap, a non-significant material type (NY SHPO 1997: Figure 1; Photograph 5-2). Only the northern facing side of the sanitation pier has visible

Photograph 5-2. Riprap portion of the Hudson River Bulkhead along the Project pipeline route

surviving timber bulkhead (Mueser Rutledge 1989a, 1989b; NY SHPO 1997). Extruding up from the sloping rip rap are what appear to be pilings likely associated with former Pier 52 constructed between 1894 and 1902 as part of the Gansevoort Pier Plan (see Photograph 5-2).

The cultural resources survey undertaken for the Hudson River Park Project noted that the Gansevoort peninsula, the site of the 1889 West Washington Market, contained by 1902, 10 red brick buildings that housed live-poultry markets (see Figure 4-3 and 5-4) (Kirkorian et al. 1997:VI-4 and VI-12). The West Washington Market was demolished in 1950 to make way for the sanitation and incinerator facility, although it still appears as such on the 1950 Sanborn insurance map. The Hudson River Park Project cultural resources assessment concluded that the area containing the former market buildings was likely disturbed by installation of the incinerator plant, and that "the associative value of the earlier market structures is questionable given their late date, extensive documentation, and function" (Kirkorian et al. 1997:VII-4). Kirkorian et al. noted that in regards to the Route 9A Project, SHPO concluded that the resource category of markets did not require further consideration due to a lack of archaeological visibility (1997:VII-5).

The current review of nineteenth- and twentieth-century historical maps indicates that the portion of present-day Gansevoort Street containing the Project pipeline route was planned as early as the 1830s, but filling did not begin along the shoreline until sometime in the early 1850s. The 1807 (Bridges), 1832 (Burr), and 1845 (Hassler) maps of New York City all depict the shoreline as being approximately two blocks to the east of the present-day shoreline. By 1852 Gansevoort Street had been extended west to the so-called Thirteenth Avenue (Dripps 1852). Based on the 1852 map the filling of the Manhattan shoreline along the Hudson River in this area was completed by constructing an outer bulkhead and then infilling between the original shoreline and the bulkhead. The 1859 (Perris) map depicts the blocks south of Gansevoort Street between West Street and Thirteenth Avenue as having been completely filled in and built upon by that time. The east side of the lot just south of Gansevoort Street closest to the Project pipeline route contained a lumberyard and small office building situated at the corner of Gansevoort and West Street. The west side of the lot fronting Gansevoort Street contained a "Kindling Wood Yard" with three buildings, two small sheds adjacent to Thirteenth Avenue and a larger wood-frame structure to the east. According to the 1859 Perris map, the area to the north had not been filled by this time, although the unnamed building, noted by HAA in their 1990 study, at the northwest side of the intersection of West and Gansevoort Streets, was also present at that time.

The 1856 (Colton) and 1860 (Walling) maps depict made land in the block areas between West Street and Thirteenth Avenue north and south of Gansevoort Street, although no buildings or other details are shown on either map. The 1879 (Bromley) atlas map depicts a lumberyard and an ironworks on the north side of Gansevoort Street, and a lumberyard to the west and a paint works to the east on the south side of Gansevoort Street. The southern half of the lot to the south contained a tin works to the east and a lumber yard to the west at that same time. The 1880 (Spielman and Brush) map depicts made land in this area, but does not depict any building details. The 1891 (Bromley) map depicts much expansion of buildings in the same block between West Street and Thirteenth Avenue south of Gansevoort Street (see Figure 4-3). The northern half of the block contained brick and wood-frame buildings in the former lumberyard and paint works lots. The southern half of the block contained the brick building complex occupied by the Eagle Iron Works (former Tin Works in 1879) and other unnamed wood-frame buildings (former Lumber Yard in 1879). The riverfront to the west of Thirteenth Avenue contained a number of piers that extended westward from all of the cross streets. The pipeline route passes just south of the pier occupied by the LeHigh Valley Railroad Company at that time. The 1895 Sanborn insurance map of the river waterfront in Manhattan depicts a scaled-back building configuration in this same block. The ironworks was still present in the southeast corner, but some of the buildings are indicated as vacant. The area to the west is identified as a "Wagon Yard" with only a few small structures remaining. The lots to the north appear to contain a mix of dwellings, stables, and commercial buildings.

By the time of the 1899 (Bromley) atlas map, the made land south of Gansevoort Street and west of West Street had been removed as part of the city's Chelsea – Gansevoort Pier Plan for the lower half of Manhattan. This plan, issued in 1871 by the newly formed Department of Docks, called for the razing of buildings on 23 city blocks and the excavations of the blocks themselves back into deep water. The redevelopment efforts of this river area included the construction of 21 new piers to be built on the Hudson between West 11th and West 23rd streets. The excavations were carried out in the 1890s, except for the ca. 1850 landfill between Gansevoort and Bloomfield streets, on which the West Washington Market opened in 1889 (Howe 2007). Gansevoort Street was still present after the landfill excavations, but more than half of the block to the south had been dredged back to shoreline and reconfigured into piers and bulkheads running parallel and perpendicular to West Street (Figure 5-4). The five Gansevoort Piers, as they were known, were opened to the Cunard, White Star, and Leyland lines for their passenger trade in 1902. The luxury steamship companies at these piers became clientele for the Gansevoort area ship provisioners and hotel suppliers (Howe 2007). The piers closest to the Project pipeline route along Gansevoort Street and to the south off Horatio Street (later known as Piers 51 and 52) were occupied by the Cunard Steamship Line. As part of the shoreline redevelopment in this area, West Street was widened to more than double its original width. All of the earlier commercial and industrial structures that were present in the blocks west of West Street from as early as 1859 were demolished.

The Project pipeline route traverses the early-twentieth-century Cunard steamship line pier (Pier 52), which contained a long, rectangular multi-story brick building, then follows east along Gansevoort Street, and terminates in the widened West Street (see Figure 5-4). The 1904 Sanborn insurance map depicts the "Cunard Line Steamship Co. Freight and Passenger Pier" that bordered Gansevoort Street to the north. The pier, building, and West Street configuration remained the same throughout the first half of the twentieth century, although the pier changed ownership by different shipping companies throughout this period (Bromley 1911, 1916, 1920, 1930; Sanborn 1921, 1950).

By 1969 the freight pier (Pier 52) had been shortened to approximately half of its original length and the earlier multi-story brick building was gone. The other shipping piers to the south remained unchanged. The area to the north of Gansevoort Street had been reconfigured and infilled to create the City of NY Sanitation Pier, aka Gansevoort Peninsula. The project area and peninsula to the north has remained relatively unchanged in terms of landform since that time, except for the addition of Miller (Hudson River) Highway and Marginal Street from parts of West Street in the 1970s and 1980s (Sanborn 1975, 1979, 1980, 1983, 1985, 1987, 1988, 1993, 1994). Today, these roadbeds are collectively part of the modern West Street/Route 9A highway and the parallel Hudson River Greenway that runs along the shoreline for pedestrian access only as part of the Hudson River Park. During the walkover survey, wooden pilings were observed in the rip rap along the southwest edge of Gansevoort peninsula near the proposed pipeline route crossing (see Photograph 5-2). These pilings likely represent the remains of Pier 52.

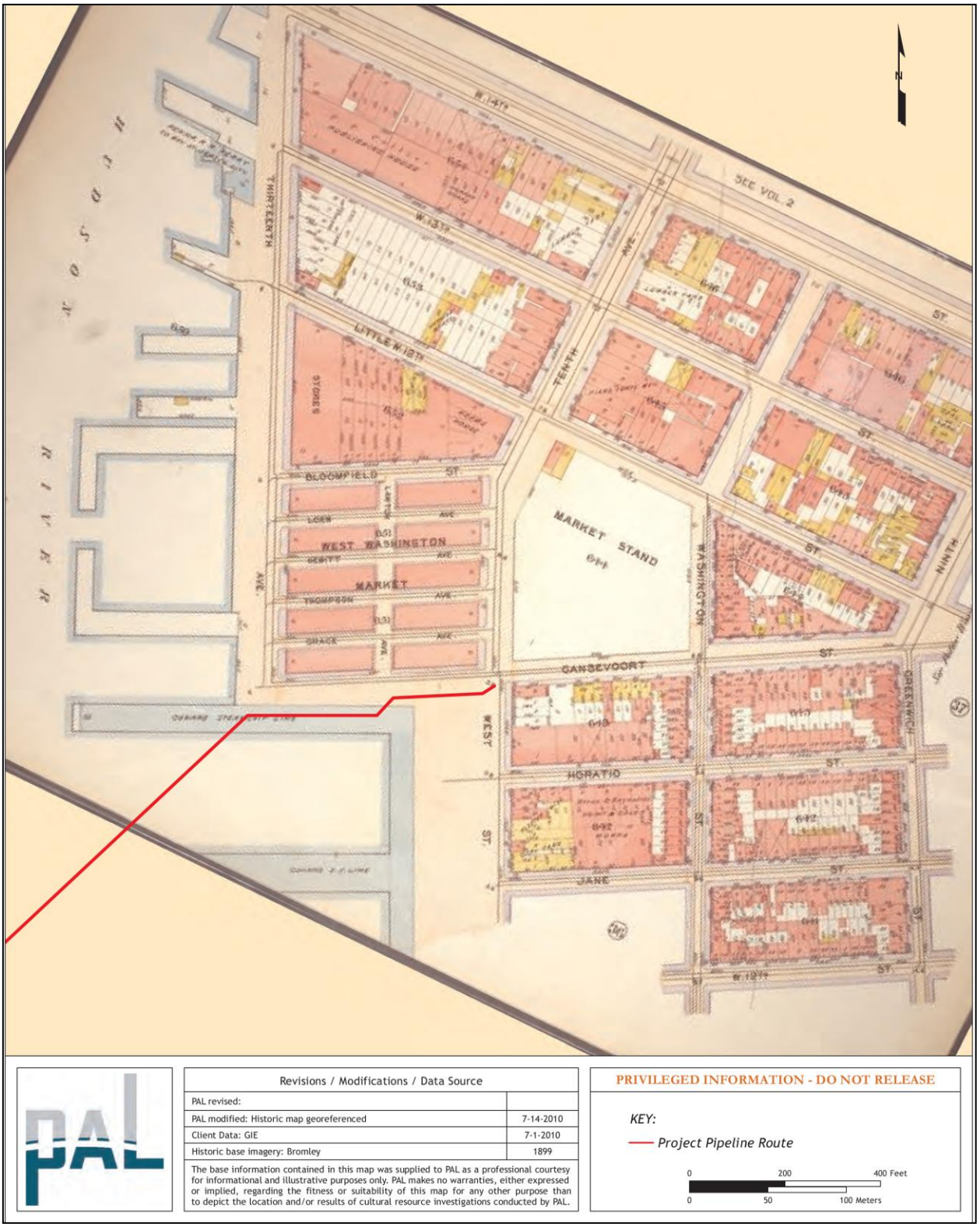

Figure 5-4. 1899 atlas map of the City of New York, Borough of Manhattan, with the location of the Project pipeline route (source: Bromley 1899).

Early-nineteenth-century maps of Manhattan also indicate that Fort Gansevoort, built for the War of 1812, was constructed on made land located to the northeast of the terminus of the pipeline route. Historical maps indicate that it lay within the area bounded today by Gansevoort, West, Little West 12th, and Washington Streets. Additionally, workmen drilling holes for foundation pilings during construction of the Gansevoort Market and Meat Center (located on the lot northeast of STA 1057+94.6) reportedly encountered timbers between eight and 25 feet below the surface, believed to be remnants of Fort Gansevoort (Robins 2002). These remains could also have been associated with the original vertical pilings for the bulkhead used to construct the land on which the fort was erected.

Sources of landfill for the Project vicinity in the 1800s could have included natural sediments from former shorefront bluffs, residential debris, garbage collected on piers and wharves, and coal ash and rubbish. Citing Buttenweiser's 1987 *Manhattan Water Bound*, the Route 9A archaeological assessment noted that a pier used as a garbage dumping board was present at Gansevoort Street in 1844, that sediment from bluffs leveled to make land for development and the associated debris was deposited into the river in the vicinity of the current Project area, and that the area between West 12th and Gansevoort streets was partially filled with the remains of former notable family estates (HAA 1990:VI-4). The Westside Highway cultural resources study noted that a Committee on Wharves and Piers resolution called for coal ash and rubbish to be used as fill for what is now the Gansevoort peninsula area (HCI 1983:98). Fill comprising the present-day Gansevoort peninsula dates to the 1850s and 1860s. According to the Perris 1859 map, the area north of Gansevoort Street was still open water along the Hudson River shoreline at that time. The Project pipeline route traverses fill to the south of Gansevoort Street that was placed sometime between 1852 and 1859, according to the Dripps and Perris maps. The filled land in the Project pipeline route contained various commercial and industrial buildings from the 1850s through the 1890s when the area was excavated to create the shipping piers south of Gansevoort Street. The documented mid- to late-nineteenth-century buildings were part of the maritime and building trades that filled the wide-open spaces of the new blocks created by landfilling the river west of West Street to extend the Gansevoort waterfront. These trades included lumber, coal, and stone yards, plaster works, white lead refiners, foundries, turpentine distilleries, and iron foundries (Howe 2007).

Remains of shoreline structures such as piers, old bulkheads and retaining structures were reportedly encountered on a frequent basis during construction of the Miller elevated highway in the 1930s (HAA 1990:VI-10). As summarized in the Hudson River Park FEIS and cultural resources assessment for the portion of that project between West Houston and little West 12th Street, the FEIS for the Route 9A Project concluded, and SHPO concurred, that piers would make little contribution to the archaeological record as they were rebuilt on a continuous basis and reflect technology at the end of their use rather than that used when they were originally constructed (Empire State Development Corporation 1998 7-16; Kirkorian et al 1997:VII-1). Other SHPO comments regarding the Route 9A Project also indicated that landfill and retaining devices such as old bulkheads predating the present Hudson River bulkhead would have limited research potential as 1) landfill episodes along the West side of Manhattan have been well-documented and landfill remains lack integrity and contextual association, and 2) retaining devices were continuously rebuilt so that remains would represent rebuilding episodes rather than their original form (Empire State Development Corporation 1998:7-16; Kirkorian et al. 1997:VII-4).

Known disturbance and development in the Project vicinity is related to the creation of made land, building construction, building demolition and the excavation of the landfill, construction of the present West Street roadway as well as the previous construction of the Hudson River Rail Road, High Line and Miller Elevated Highway, and construction of the Department of Sanitation incinerator and Hudson River Park. There was no specific available information about existing utilities in this area, but numerous underground utilities are expected to be present in the area given the presence of manhole covers, street lights and fire hydrants along West Street. Additionally, elements of the late-nineteenth-century underground refrigeration piping associated with the Manhattan Refrigerating Company may be present under West and Gansevoort streets, and 10th Avenue.

The removal of made land and dredging at this location down to a depth of 40 feet (Kirkorian et al. 1997:VI-7) likely impacted the southern edge of the modern sanitation pier along the Project pipeline route (see Appendix B-19 and B-20). Post-contact resources consisting of rubble from the demolition of piers and buildings, docks, and old bulkhead or retaining structures and dredging of the made land are likely to be present in the fill areas along the southern portion of the sanitation pier. Furthermore, the construction of the elevated Miller Highway also likely caused substantial disturbance in the immediate Project vicinity as it included sinking 4 to 5 foot wide cast-iron

cassions 40 to 48 feet deep along the present route of West Street (HAA 1990:VI-10). Belowground remnants of these cassions could also be present.

In summary, the Project pipeline route in Manhattan traverses made land that served for the extension of Gansevoort Street and adjacent commercial and industrial lots in the second half of the nineteenth century (ca. 1850s to ca. 1890s). The documented structures on the lots to the south of Gansevoort Street were situated on made land that was excavated in the 1890s, except for the very northern limits along the south side of Gansevoort Street. This area was converted into a freight and passenger pier continuously used and built upon in the first half of the twentieth century, and then following 1950 it was absorbed into the present-day New York City sanitation pier on the Gansevoort peninsula. The remaining portion of the Project pipeline route was reconfigured into the present day highway roadbeds and belowground support infrastructure just west of and parallel to West Street. Given the nature and extent of modern period disturbances in the former block west of West Street and south of Gansevoort Street, which included repeated filling, construction, demolition, and excavation/dredging episodes, it is not considered likely that any intact, articulated buried nineteenth-century streetscapes, buildings, or other features have survived in the Project pipeline route. The documented location of Fort Gansevoort is situated to the north outside of the Project pipeline route, so there are no potential impacts to any remains that may be present belowground in this general area.

In regards to pre-contact period resources, a cartographic shoreline reconstruction was created for the Westside Highway Project cultural resources study based on soil boring data (HCI 1983). The shoreline reconstruction map indicates that the depth of the former surface available for human occupation ranged between 40 and 100 feet below the present sea level, and the configuration of the contour lines indicates that this area was steeply sloped (HCI 1983:Figure 4). The contour map also indicated that the Gansevoort Street area containing the present Project pipeline route was last available for human occupation prior to ca. 7,200 years before being completely inundated by the Hudson River, although the steep slope was not likely to have been attractive to inhabitants. On this basis alone, the route is considered to have very low pre-contact sensitivity, and proposed pipeline construction impacts are not expected to exceed 20 feet.

Based on the above summarized information, the pipeline route is considered to have no to low sensitivity for both pre-contact and post-contact period resources. No further archaeological investigations or soil borings are recommended between STA 1052+42.5 and 1057+94.6.

Access Roads and Pipe Yards

There are three temporary access roads (TAR-4, TAR-5, TAR-19), all in Staten Island, which will be used for the proposed pipeline route (see Figure 1-3). All of the access roads are located along existing gravel or asphalt surfaces that will not require any upgrades. Due to the nature of the proposed Project activities at these existing paved and graveled surfaces, no further archaeological investigations are recommended for the proposed access roads.

There are three proposed pipe yards and contractor ware yards (Yards 6, 7, and 10), all in Staten Island, which will be used for the Project (see Figure 1-3). All of the proposed pipe yards for the Project are also located in existing paved or graveled parking/industrial areas. No excavation activities will be required for the proposed pipe yard areas. Due to the nature of the proposed Project activities at these existing paved and graveled surfaces, no further archaeological investigations are recommended for the proposed pipe yards.

Upstream Facilities

Ramapo M&R Station

Review of files maintained at PAL and the New York SHPO indicate that the location of the Algonquin Ramapo M&R Station (see Figures 1-12 and 1-13) is within an area surveyed by PAL in 2006 as part of the Algonquin Ramapo Expansion Project (FERC Docket #CP06-78-000 and #NE07; OPRHP #07PR03680; and PAL #1827). The results of the survey are presented in the report entitled, *Phase IA/IB Cultural Resources Survey, Algonquin Gas Transmission, LLC, Ramapo Expansion Project, Rockland and Putnam Counties, New York* (Macpherson et al. 2006). Additionally, one of the proposed temporary access road to the Ramapo M&R Station was originally

surveyed for the Millennium Pipeline Project, and cultural resources approval was obtained by PAL for the Algonquin Ramapo Expansion Project as TAR-0.11 (Figure 5-5).

Results of the 2006 PAL survey indicate that the proposed construction impact areas, temporary workspace, and proposed temporary access road adjacent to the existing Ramapo M&R Station exhibit low sensitivity for containing significant archaeological resources. No further archaeological survey was recommended and the NY SHPO concurred that the then proposed Project would have no effect on historic properties (see Appendix A). No further survey for the Ramapo M&R Station workspace and existing permanent access road and one of the proposed temporary access roads is recommended as part of the NJ-NY Project.

An alternate temporary access road is proposed for the Ramapo M&R Station to be used during construction and that road has not yet been surveyed for cultural resources. Design of this alternate access road remains under development and PAL will survey it for potentially significant archaeological recourses once its design is finalized by Spectra Energy.

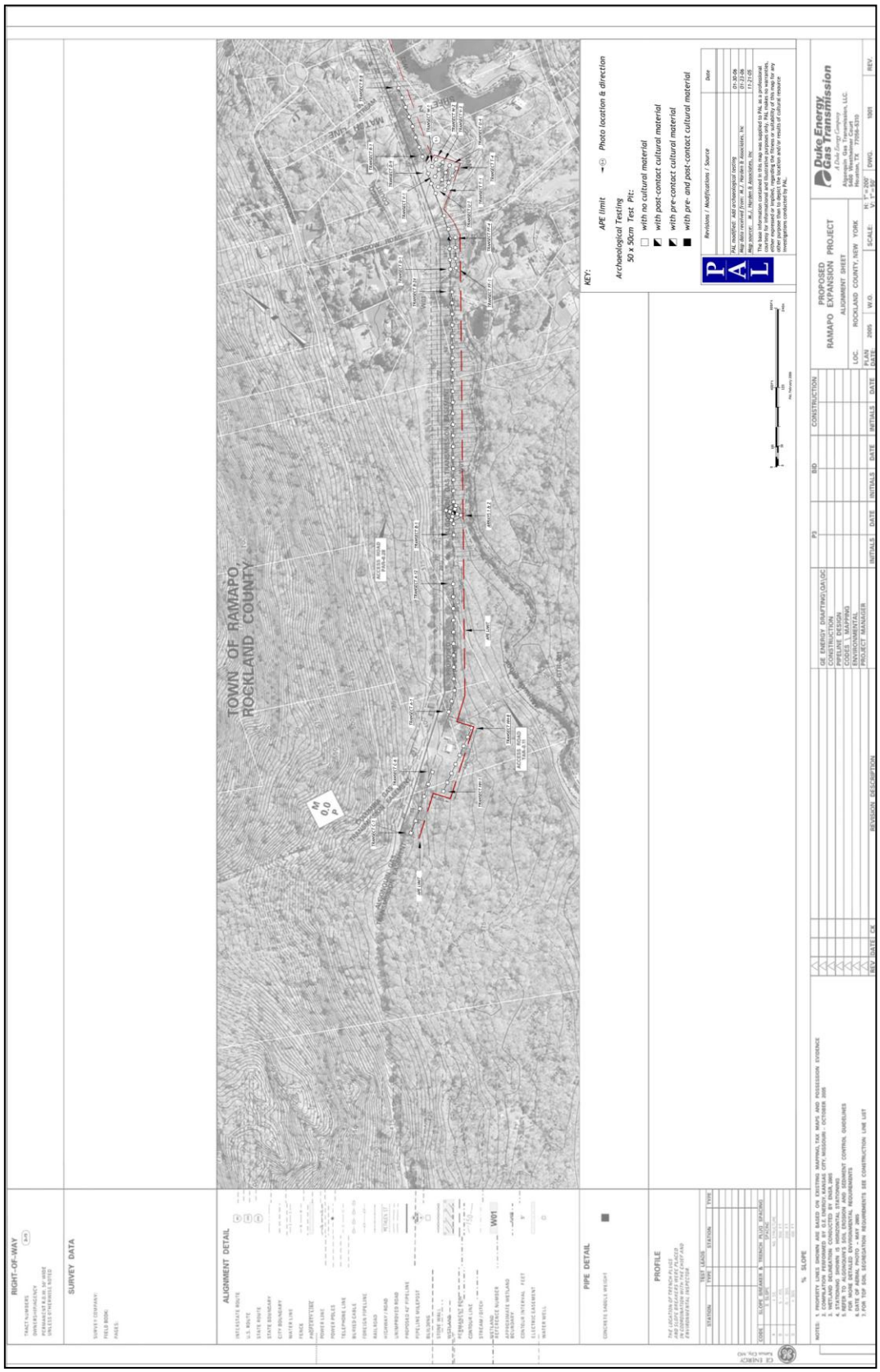

Figure 5-5. Location of archaeological identification subsurface testing for the Algonquin Gas Transmission, LLC Ramapo Expansion Project (FERC Docket #CP06-78-000 and #NE07; OPRHP #07PR03680) in the immediate vicinity of the proposed impact areas and temporary access road (TAR-0.11 for the Ramapo Expansion Project) as part of the NJ-NY Project at the Ramapo M&R Station.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

Archival research and a walkover survey were conducted as part of the archaeological overview survey of the Project APE in New York. The information obtained during the survey indicates that the New York portion of the Project contains sensitivity for human occupation that dates to the pre-contact, contact, and post-contact periods. However, because of the complex urban setting of the Project, the presence and integrity of any archaeological deposits will be largely dependent on the degree of modern ground disturbances, depth of fill, and presence of buried landscapes suitable for pre-contact period occupations.

Pipeline Route

Recorded pre-contact archaeological sites within one mile of Project APE in New York range in date from the Early Archaic through the contact periods, and types of sites include traces of occupation, shell middens, camp sites, village sites, and burials. The vast majority of these sites are situated on dry ground overlooking the shoreline, tidal marsh, or streams. Many of the recorded pre-contact sites are on Staten Island and were reported during the early part of this century in an American Museum of Natural History Publication (Skinner 1909a). Given that the New York Project APE occurs in a broader shoreline or near-shore settings, as well as near streams and tidal marshes, any area spared from severe ground disturbances by historic and modern period developments has the potential to contain pre-contact archaeological resources. Most of the pipeline route in Staten Island is assigned high sensitivity for pre-contact period archaeological resources based on the review of known site locations and sensitivity factors for site locations.

The recorded post-contact archaeological sites within 1 mile of the Project APE on Staten Island consist of domestic farmstead or residential sites, commercial and industrial complexes, underwater vessels, and shoreline structures. Many of the homestead or residential sites date to the seventeenth and eighteenth century, with a few dating to the nineteenth century. The commercial and industrial complexes date to the late nineteenth and twentieth centuries. The shoreline and offshore resources (vessels, shoreline structures) mainly date to the twentieth century. Recorded sites in Manhattan are of a more urban character including a foundry site and historic landfill. The Manhattan sites mainly date to the nineteenth century. The review of historical maps indicates that the Staten Island portion of the Project primarily traverses existing roads that date back to at least the early nineteenth century, or areas of tidal marsh. The portion of the route at Old Place on Staten Island is assigned moderate sensitivity for potentially significant archaeological deposits. The sensitive resource areas are related to documented early/mid-nineteenth-century and possibly eighteenth-century residential settlements (Old Place). This resource type has the potential to inform on important research themes related to historic Euro-American settlement patterns and land uses in the Staten Island section of New York City.

The archaeological sensitivity and recommendations for the pipeline route in the New York portion of the NJ-NY Project are summarized in Table 6-1. No further archaeological investigations are recommended for those sections of the pipeline in Staten Island and Shooters Island where there will be no impacts to potentially sensitive archaeological strata. No further investigation are recommended for the portion of the route in Manhattan because it is assigned a very low potential for the presence of significant archaeological deposits. Soil borings are recommended for the remaining areas in Staten Island in order to determine the presence and depth of ground disturbances, fill or marsh deposits, and of any sediments that having the potential to contain pre-contact, and in one location (Old Place), post-contact period resources, below these deposits.

Table 6-1. Summary of Archaeological Sensitivity and Recommendations in New York.

Municipality	Mile Post (MP) Location	STA No. Location	Appendix B Sheet No.	Pre-contact Sensitivity	Post-contact Sensitivity	Recommendations
Staten Island	MP 3.52R to 4.92R	STA 192+22.4 to 196+00	1	High	Low	No expected impacts from HDD. No further archaeological investigation.
		STA 196+00 to 191+63.2R	1	High	Low	Area of expected HDD impacts. Soil borings between STA 196+00 and 191+63.2R
		STA 191+63.2R to 211+73.6	1, 4-5	Low	Low	Area of take-up/relay. No further archaeological investigations.
		STA 211+73.6 to 214+92.8	5	High	Low	Soil borings between 211+73.6 and 214+92.8.
		STA 214+92.8 to 217+00	5, 8	High	Low	Area of expected HDD impacts. Soil borings between STA 214+92.8 and 217+00.
		STA 217+00 to 244+00	8-9	High	Low	No expected impacts from HDD. No further archaeological investigation.
		STA 244+00 to 249+00	10	High	Moderate	No expected impacts from HDD. No further archaeological investigation.
		STA 249+00 to 250+22.5	10	High	Moderate	Area of expected HDD impacts. Soil borings between 249+00 and 250+22.5.
		STA 250+22.5 to 250+00R	10-11	High	Moderate	Soil borings between STA 250+22.5 and 250+00R.
		STA 250+00R to 259+79.9	11-13	High	Low	Soil borings between STA 250+00R and 259+79.9.
	MP 4.92R to 5.80R	STA 259+79.9 to 283+00	13-14	High	Moderate	Soil borings between STA 259+79.9 and 283+00.
		STA 283+00 to 282+39.2R	14-15	High	Moderate	Soil borings between STA 283+00 and 282+39.2R.
		STA 282+39.2R to 290+65.2	15	High	Low	Soil borings between STA 282+39.2R and 290+65.2.
		STA 290+65.2 to 303+01.6	15-16	High	Moderate	Soil borings between STA 290+65.2 and 303+01.6.
Staten Island (Shooter's Island)	MP 6.06R to 6.5R	STA 332+89.2 and 335+00	17-18	Moderate	Moderate	No expected impacts from HDD. No further archaeological investigation.
Manhattan	MP 19.93 to 20.04	STA 1052+42.5 to 1057+94.6	19-20	Low	Low	No further archaeological investigations.

In those areas recommended to undergo a soil boring program, the borings will be placed at approximately 200-foot intervals along the Project route, as agreed upon during consultation with the NY SHPO (see Appendix A). Identifying areas of disturbance and characterizing/dating the fill deposits through a soil boring program will be crucial in determining whether or not an archaeologically sensitive segment of the Project pipeline route will require additional archaeological investigations, including but not limited to, hand and/or machine-assisted subsurface investigations for pre-contact and/or post-contact period resources. The proposed soil boring program is presented in Appendix F.

Access Roads and Pipe Yards

All of the proposed access roads for the proposed pipeline route are located along existing gravel or asphalt surfaces that will not require any upgrades (Table 6-2). Due to the nature of the proposed Project activities at these existing paved and graveled surfaces, no further archaeological investigations are recommended for the proposed access roads.

Table 6-2. Proposed Temporary and Permanent Access Roads for the New York Portion of the NJ-NY Expansion Project.

Access Road #	Municipality, State	Approx. MP	Use (Permanent or Temporary)	Existing Road Surface	Upgrade Requirements/ Comments	Approx. Length (feet)	Cultural Resources Recommendation
TAR-4	Staten Island, NY	3.5	Temporary	Gravel	None	+/- 6,400	No Survey
TAR-5	Staten Island, NY	3.8	Temporary	Gravel	None	+/- 8,800	No Survey
TAR-19	Staten Island, NY	5.6R	Temporary	Dirt	None	+/- 320	No Survey

Additionally, all of the proposed pipe yards for the Project are also located in existing paved or graveled parking/industrial areas (Table 6-3). No excavation activities will be required for the proposed pipe yard areas. Due to the nature of the proposed Project activities at these existing paved and graveled surfaces, no further archaeological investigations are recommended for the proposed pipe yards.

Table 6-3. Proposed Pipe Yards and Contractor Ware Yards for the New York Portion of the NJ-NY Expansion Project.

Yard	Municipality, State	Size (acres)	Cultural Resources Recommendation
Yard 6	Staten Island, NY	6.47	No Survey
Yard 7	Staten Island, NY	6.85	No Survey
Yard 10	Staten Island, NY	1.42	No Survey
Total		**14.74**	

Upstream Facilities

Ramapo M&R Station

The Ramapo M&R Station was subjected to previous archaeological investigations as part of the *Phase IA/IB Cultural Resources Survey, Algonquin Gas Transmission, LLC, Ramapo Expansion Project, Rockland and Putnam Counties, New York* (Macpherson et al. 2006). Additionally, one the proposed temporary access roads to the Ramapo M&R Station was originally surveyed for the Millennium Pipeline Project, and cultural resources approval was obtained by PAL for the Algonquin Ramapo Expansion Project as TAR-0.11. Results of the survey indicate that

the proposed construction impact areas, temporary workspace, and proposed temporary access road adjacent to the existing Ramapo M&R Station exhibit low sensitivity for containing significant archaeological resources. No further archaeological survey was recommended and the NY SHPO concurred that the then proposed Project would have no effect on historic properties (see Appendix A). No further survey for the Ramapo M&R Station workspace and existing permanent access road and one of the proposed temporary access roads is recommended as part of the NJ-NY Project (Table 6-4).

An alternate temporary access road is proposed for the Ramapo M&R Station to be used during construction and that road has not been surveyed for cultural resources. Design of this alternative access road remains under development and PAL will survey it for potentially significant archaeological resources once its design is finalized by Spectra Energy.

Table 6-4. Proposed Upstream Facility - Ramapo M&R Station for the New York Portion of the NY-NY Expansion Project.

Access Road #	Municipality, State	Approx. MP	Use (Permanent or Temporary)	Existing Road Surface	Upgrade Requirements/ Comments	Approx. Length (feet)	Cultural Resources Recommendation
NEW ABOVEGROUND FACILITIES a/							
Algonquin							
Ramapo M&R Station, NY							
TAR		N/A	Temporary	Existing pipeline right-of-way	Will require gravel, flumes for any streams and mats for any wetland, plus a temporary bridge over the Mahwah River.	+/-1,450	Previously surveyed by PAL (Macpherson et al. 2006)
Alternate TAR		N/A	Temporary	Existing pipeline right-of-way for approximately 1,800 ft and 2,200 ft cross-country	Will require gravel along existing right-of-way, tree clearing and grading for cross country sections, and new asphalt road.	+/-4,000	Archaeological identification survey recommended for cross-country portion of alternate TAR. No further survey for alternate TAR along existing pipeline right-of-way.

Note: This table does not include access roads for the existing compressor stations because there will be no upgrades or modifications to these access roads.

N/A = Not applicable. TBD = To be determined.

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APPENDIX A

PROJECT CORRESPONDENCE

PROJECT CORRESPONDENCE INCLUDED IN REPORTS SUBMITTED TO SHPO, NATIVE AMERICAN GROUPS, AND OTHER CONSULTING PARTIES.

FOR FERC VERSION OF REPORT, PLEASE REFER TO APPENDIX 4A OF RESOURCE REPORT 4

APPENDIX B

PROJECT ALIGNMENT SHEETS WITH ARCHAEOLOGICAL SENSITIVITY AND PROPOSED SOIL BORING LOCATIONS

RIGHT-OF-WAY

TRACT NUMBERS | RODDAGE | CROSSING | WORKSPACE

(18-21.15) ARTHUR KILL, NJ

(18-22) 380 DEVELOPMENT, LLC.

(18-22.1) 380 DEVELOPMENT, LLC.

SURVEY DATA

SURVEY COMPANY:
FIELD BOOK:
PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

PROPOSED PIPELINE
PRE-FERC (A7) ALIGNMENT
EXIST. P/L w/OWNER NAME
PIPELINE TO BE REMOVED/ABANDONED
TEMP. WORKSPACE
PROPOSED PERMANENT EASEMENT
EXISTING EASEMENT
ADD. TEMP. WORKSPACE
YARD LOCATION
℄ WATERS OF THE U.S.
DELINEATED WATERS OF THE U.S.
APPROXIMATE WATERS OF THE U.S. BOUNDARIES
EDGE OF PAVEMENT
PERMANENT ACCESS ROAD (PAR)
TEMPORARY ACCESS ROAD (TAR)
CONTOUR MAJOR (EVERY 10')
CONTOUR AT +2 ELEV.
CONTOUR MINOR (EVERY 2')
TREE / BRUSH LINE
JERSEY BARRIER
PIPELINE MILEPOST
PROPERTY LINE
VERIFIED STORM DRAIN
UNCONFIRMED STORM DRAIN
VERIFIED UNDG. ELEC. CABLE
UNCONFIRMED UNDG. ELEC. CABLE
VERIFIED NAT. GAS LINE
UNCONFIRMED NAT. GAS LINE
VERIFIED SANITARY SEWER
UNCONFIRMED SANITARY SEWER
VERIFIED WATER LINE
UNCONFIRMED WATER LINE
VERIFIED STEAM LINE
UNCONFIRMED STEAM LINE
VERIFIED TELEPHONE CABLE
UNCONFIRMED TELEPHONE CABLE
VERIFIED UNDG. COM. CABLE
UNCONFIRMED UNDG. COM. CABLE
ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
LIGHT POLE | UTILITY POLE
GAS VALVE | WATER VALVE
FIRE HYDRANT | TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

ARTHUR KILL — ARTHUR KILL — 622.4'

SI-W1A — SI-W1A — 52.7'

SI-W1A — SI-W1A — 241.0'

SITE SPECIFIC E & S: 6, 6

GENERAL E & S FIGURES: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix B-1

Archaeological Sensitivity

High

Moderate

Low

FOR ARTHUR KILL HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1010

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

REV	DRN	DATE	DESCRIPTION
	DLF	11/8/2010	CHANGE TITLE BLOCK FROM 30" TO 42" PIPELINE
	DLF	10/28/2010	ADDED E&S DATA, VARIATION #39 & WORKSPACE

DWG. NO. | DESCRIPTION — REFERENCE DRAWINGS

REVISIONS

ITEM NO. | DESCRIPTION | LN. FT. — MATERIALS

DRAWN BY: DLF
DRN. DATE: 06/12/2010
CHECKED BY: JRL
CHK. DATE: 11/01/2010

ENGINEERING APPROVALS: BID | CONSTRUCTION

TITLE | SIGNATURE | DATE | SIGNATURE | DATE

NJ-NY EXPANSION PROJECT
PROPOSED 42" PIPELINE
STA. 186+00.0 TO STA. 192+00.0
ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1015 | REV. A10

C:\temp\AcPublish_2548\LD-A-1009 thru LD-A-1020.DWG Plotted on: Nov 10, 2010 - 3:05pm by dforbus

Appendix B-1. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

(18-22.1)
380 DEVELOPMENT, LLC

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR) PAR 0.00
- TEMPORARY ACCESS ROAD (TAR) TAR 0.00
- CONTOUR MAJOR (EVERY 10') +2
- CONTOUR AT +2 ELEV.
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST
- PROPERTY LINE
- VERIFIED STORM DRAIN
- UNCONFIRMED STORM DRAIN
- VERIFIED UNDG. ELEC. CABLE
- UNCONFIRMED UNDG. ELEC. CABLE
- VERIFIED NAT. GAS LINE
- UNCONFIRMED NAT. GAS LINE
- VERIFIED SANITARY SEWER
- UNCONFIRMED SANITARY SEWER
- VERIFIED WATER LINE
- UNCONFIRMED WATER LINE
- VERIFIED STEAM LINE
- UNCONFIRMED STEAM LINE
- VERIFIED TELEPHONE CABLE
- UNCONFIRMED TELEPHONE CABLE
- VERIFIED UNDG. COM. CABLE
- UNCONFIRMED UNDG. COM. CABLE
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE
- UTILITY POLE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

FOR ARTHUR KILL HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1010

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project
NJ-NY Expansion

Date
December 3, 2010

Appendix B-2

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
LD-A-1015	ALIGNMENT SHEET	6	DLF	11/01/2010	ADDED VARIATION #39 & REVISED WORKSPACE			
		5			DRAWING NUMBER CHANGE 1014A TO 1015A			
		4	DLF	8/16/2010	ADDED CONTOURS			
		3						
		2						
		1						
REFERENCE DRAWINGS		REVISIONS				MATERIALS		

ENGINEERING APPROVALS

	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 42" PIPELINE
PULL BACK WORKSPACE
SUPPLEMENTAL ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1015A | REV. A10

Appendix B-2. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

(12-22.1)

380 DEVELOPMENT CORP.

41.16 RODS

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

PROPOSED PIPELINE
PRE-FERC (A7) ALIGNMENT
EXIST. P/L w/OWNER NAME — COMPANY —
PIPELINE TO BE REMOVED/ABANDONED
TEMP. WORKSPACE
PROPOSED PERMANENT EASEMENT
EXISTING EASEMENT — EXMT —
ADD. TEMP. WORKSPACE
YARD LOCATION
℄ WATERS OF THE U.S.
DELINEATED WATERS OF THE U.S.
APPROXIMATE WATERS OF THE U.S. BOUNDARIES
EDGE OF PAVEMENT
PERMANENT ACCESS ROAD (PAR) — PAR 0.00 —
TEMPORARY ACCESS ROAD (TAR) — TAR 0.00 —
CONTOUR MAJOR (EVERY 10') — 42 —
CONTOUR AT +2 ELEV.
CONTOUR MINOR (EVERY 2')
TREE / BRUSH LINE
JERSEY BARRIER
PIPELINE MILEPOST XXX.XX

PROPERTY LINE — E — E —
VERIFIED STORM DRAIN — D — D —
UNCONFIRMED STORM DRAIN — D — UNC —
VERIFIED UNDG. ELEC. CABLE — E —
UNCONFIRMED UNDG. ELEC. CABLE — UE — UNC —
VERIFIED NAT. GAS LINE — G —
UNCONFIRMED NAT. GAS LINE — G — UNC —
VERIFIED SANITARY SEWER — S —
UNCONFIRMED SANITARY SEWER — S — UNC —
VERIFIED WATER LINE — W —
UNCONFIRMED WATER LINE — W — UNC —
VERIFIED STEAM LINE — STM —
UNCONFIRMED STEAM LINE — STM — UNC —
VERIFIED TELEPHONE CABLE — T —
UNCONFIRMED TELEPHONE CABLE — T — UNC —
VERIFIED UNDG. COM. CABLE — UCOM —
UNCONFIRMED UNDG. COM. CABLE — UE — UNC —
ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES

LIGHT POLE — UTILITY POLE
GAS VALVE — WATER VALVE
FIRE HYDRANT — TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG ▲

SLOPE BREAKER & TRENCH PLUG SPACING		
CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 – 15%	300 FT
C	15 – 30%	200 FT
D	> 30%	100 FT

% SLOPE

FOR ARTHUR KILL HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1010

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix B-3

Archaeological Sensitivity

High

Moderate

Low

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
		3	DLF	11/012010	ADDED VARIATION #39 & REVISED WORKSPACE			
					DRAWING NUMBER CHANGE 1014B TO 1015B			
LD-A-1015	ALIGNMENT SHEET	4	DLF	8/16/2010	ADDED CONTOURS			
REFERENCE DRAWINGS		REVISIONS				MATERIALS		

ENGINEERING APPROVALS

	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 42" PIPELINE
PULL BACK WORKSPACE
SUPPLEMENTAL ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1015B | REV. A10

Appendix B-3. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

192+00.0

(R-22.1)
300 DEVELOPMENT, LLC.
60.00 RODS

201+61.3

(R-22.18)
FIFTH STREET - LAMBERT AVE.
6.39 RODS

203+00.0

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR)
- TEMPORARY ACCESS ROAD (TAR)
- CONTOUR MAJOR (EVERY 10')
- CONTOUR AT +2 ELEV.
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST
- PROPERTY LINE
- VERIFIED STORM DRAIN
- UNCONFIRMED STORM DRAIN
- VERIFIED UNDG. ELEC. CABLE
- UNCONFIRMED UNDG. ELEC. CABLE
- VERIFIED NAT. GAS LINE
- UNCONFIRMED NAT. GAS LINE
- VERIFIED SANITARY SEWER
- UNCONFIRMED SANITARY SEWER
- VERIFIED WATER LINE
- UNCONFIRMED WATER LINE
- VERIFIED STEAM LINE
- UNCONFIRMED STEAM LINE
- VERIFIED TELEPHONE CABLE
- UNCONFIRMED TELEPHONE CABLE
- VERIFIED UNDG. COM. CABLE
- UNCONFIRMED UNDG. COM. CABLE
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE
- UTILITY POLE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project	NJ-NY Expansion
Date	December 3, 2010
	Appendix B-4

PAL

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

REV	DRN	DATE	DESCRIPTION
2	DLF	11/8/2010	CHANGE TITLE BLOCK FROM 30" TO 42" PIPELINE
1	DLF	10/28/2010	ADDED E&S DATA & VARIATION #21

REFERENCE DRAWINGS — DWG. NO. | DESCRIPTION

REVISIONS

MATERIALS — ITEM NO. | DESCRIPTION | LN. FT.

ENGINEERING APPROVALS

	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 42" PIPELINE
STA. 192+00.0 TO STA. 203+00.0
ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1016 | REV. A10

Appendix B-4. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS
RODDAGE

FIFTH STREET - LAMBERT AVE.

380 DEVELOPMENT, LLC.

SURVEY DATA

SURVEY COMPANY:
FIELD BOOK:
PAGES:

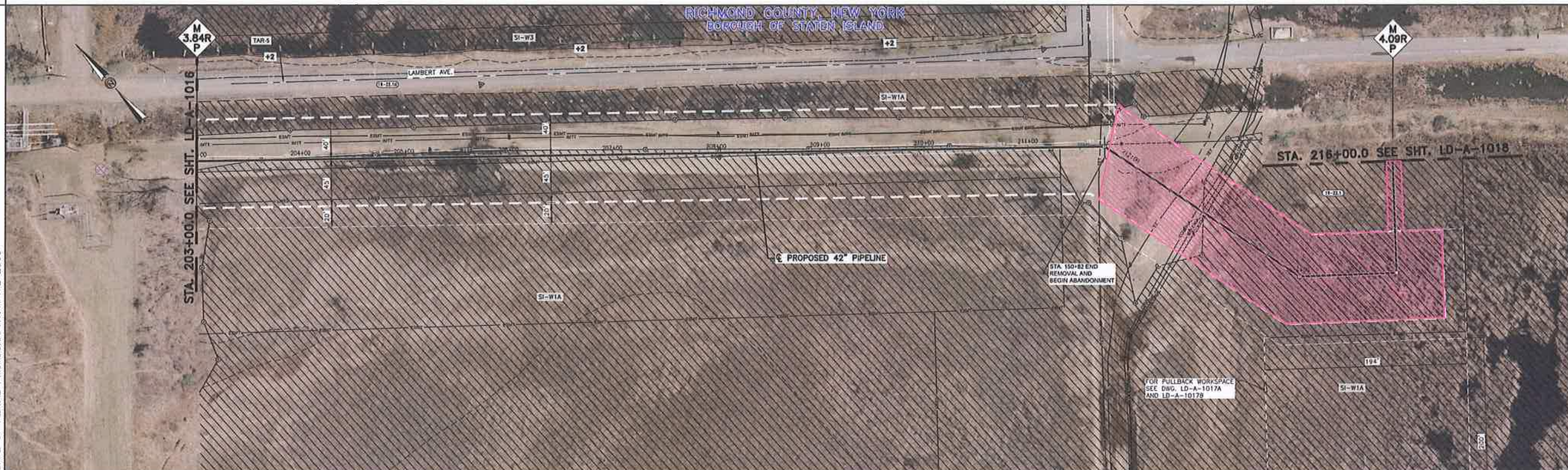
CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

PROPOSED PIPELINE
PRE-FERC (A7) ALIGNMENT
EXIST. P/L w/OWNER NAME
PIPELINE TO BE REMOVED/ABANDONED
TEMP. WORKSPACE
PROPOSED PERMANENT EASEMENT
EXISTING EASEMENT
ADD. TEMP. WORKSPACE
YARD LOCATION
℄ WATERS OF THE U.S.
DELINEATED WATERS OF THE U.S.
APPROXIMATE WATERS OF THE U.S. BOUNDARIES
EDGE OF PAVEMENT
PERMANENT ACCESS ROAD (PAR)
TEMPORARY ACCESS ROAD (TAR)
CONTOUR MAJOR (EVERY 10')
CONTOUR AT +2 ELEV.
CONTOUR MINOR (EVERY 2')
TREE / BRUSH LINE
JERSEY BARRIER
PIPELINE MILEPOST
PROPERTY LINE
VERIFIED STORM DRAIN
UNCONFIRMED STORM DRAIN
VERIFIED UNDG. ELEC. CABLE
UNCONFIRMED UNDG. ELEC. CABLE
VERIFIED NAT. GAS LINE
UNCONFIRMED NAT. GAS LINE
VERIFIED SANITARY SEWER
UNCONFIRMED SANITARY SEWER
VERIFIED WATER LINE
UNCONFIRMED WATER LINE
VERIFIED STEAM LINE
UNCONFIRMED STEAM LINE
VERIFIED TELEPHONE CABLE
UNCONFIRMED TELEPHONE CABLE
VERIFIED UNDG. COM. CABLE
UNCONFIRMED UNDG. COM. CABLE
ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
LIGHT POLE / UTILITY POLE
GAS VALVE / WATER VALVE
FIRE HYDRANT / TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009



ENVIRONMENTAL DATA

SI-W1A
SI-W1A
616.01'

SI-W1A
SI-W1A
312.17'

SITE SPECIFIC E & S: 6 | 6

GENERAL E & S FIGURES: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

The base information contained in this map was supplied to PAL as a professional courtesy for informational and illustrative purposes only. PAL makes no warranties, either expressed or implied, regarding the fitness or suitability of this map for any other purpose than to depict the location and/or results of cultural resource investigations conducted by PAL.

Project: NJ-NY Expansion
Date: December 3, 2010
Appendix B-5

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

FOR 380 GOETHELS BRIDGE HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1020

PRIVILEGED INFORMATION - DO NOT RELEASE

REV	DRN	DATE	DESCRIPTION
	DLF	10/08/2010	CHANGE TITLE BLOCK FROM 30" TO 42" PIPELINE
	DLF	10/28/2010	ADDED E&E DATA & VARIATION #21

DWG. NO. | DESCRIPTION — REFERENCE DRAWINGS
REVISIONS
ITEM NO. | DESCRIPTION | LN. FT. — MATERIALS

DRAWN BY: DLF
DRN. DATE: 06/12/2010
CHECKED BY: JRL
CHK. DATE: 11/01/2010

ENGINEERING APPROVALS: BID | CONSTRUCTION
TITLE | SIGNATURE | DATE | SIGNATURE | DATE

NJ-NY EXPANSION PROJECT
PROPOSED 42" PIPELINE
STA. 203+00.0 TO STA. 216+00.0
ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1017 | REV. A10

Appendix B-5. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

(18-32)
360 DEVELOPMENT, LLC

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

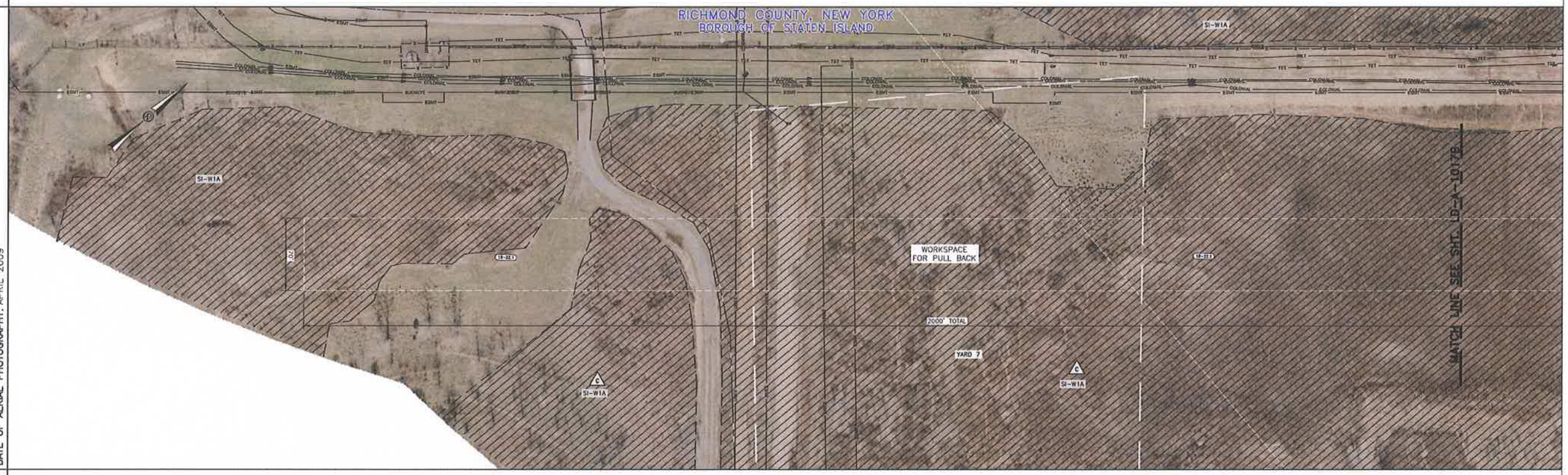
CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME — COMPANY
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT — ESMT
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR) — PAR 0.00
- TEMPORARY ACCESS ROAD (TAR) — TAR 0.00
- CONTOUR MAJOR (EVERY 10') — +2
- CONTOUR AT +2 ELEV.
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST — XYZ+XX
- PROPERTY LINE — P
- VERIFIED STORM DRAIN — D
- UNCONFIRMED STORM DRAIN — D UNC
- VERIFIED UNDG. ELEC. CABLE — E
- UNCONFIRMED UNDG. ELEC. CABLE — UE UNC
- VERIFIED NAT. GAS LINE — G
- UNCONFIRMED NAT. GAS LINE — G UNC
- VERIFIED SANITARY SEWER — S
- UNCONFIRMED SANITARY SEWER — S UNC
- VERIFIED WATER LINE — W
- UNCONFIRMED WATER LINE — W UNC
- VERIFIED STEAM LINE — STM
- UNCONFIRMED STEAM LINE — STM UNC
- VERIFIED TELEPHONE CABLE — T
- UNCONFIRMED TELEPHONE CABLE — T UNC
- VERIFIED UNDG. COM. CABLE — UCOM
- UNCONFIRMED UNDG. COM. CABLE — UC UNC
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE
- UTILITY POLE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009



ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

- FLUME PIPE AS REQUIRED
- SLOPE BREAKERS/ARROW INDICATES DIRECTION
- TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 – 15%	300 FT
C	15 – 30%	200 FT
D	> 30%	100 FT

% SLOPE

FOR 380 GOETHELS BRIDGE HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1020

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix B-6

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
		3	DLF	11/17/2010	ADDED WETLAND			
		2	DLF	11/01/2010	ADDED VARIATION #21 & CHANGED DWG. NO.			
					DRAWING NUMBER CHANGE 1016A TO 1017A			
LD-A-1017	ALIGNMENT SHEET	1	DLF	8/16/2010	ADDED CONTOURS			
REFERENCE DRAWINGS		REVISIONS				MATERIALS		

ENGINEERING APPROVALS				
	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 42" PIPELINE
PULL BACK WORKSPACE
SUPPLEMENTAL ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: | DWG. LD-A-1017A | REV. A10

Appendix B-6. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

CR-22

380 DEVELOPMENT, LLC

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME — COMPANY
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT — ESMT
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR) — PAR 0.00
- TEMPORARY ACCESS ROAD (TAR) — TAR 0.00
- CONTOUR MAJOR (EVERY 10') — +2
- CONTOUR AT +2 ELEV.
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST — MILE POST
- PROPERTY LINE — P
- VERIFIED STORM DRAIN — D
- UNCONFIRMED STORM DRAIN — D — UNC
- VERIFIED UNDG. ELEC. CABLE — E
- UNCONFIRMED UNDG. ELEC. CABLE — UE — UNC
- VERIFIED NAT. GAS LINE — F
- UNCONFIRMED NAT. GAS LINE — G — UNC
- VERIFIED SANITARY SEWER — S
- UNCONFIRMED SANITARY SEWER — S — UNC
- VERIFIED WATER LINE — W
- UNCONFIRMED WATER LINE — W — UNC
- VERIFIED STEAM LINE — STM
- UNCONFIRMED STEAM LINE — STM — UNC
- VERIFIED TELEPHONE CABLE — T
- UNCONFIRMED TELEPHONE CABLE — T — UNC
- VERIFIED UNDG. COM. CABLE — UCOM
- UNCONFIRMED UNDG. COM. CABLE — UC — UNC
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE
- UTILITY POLE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

- FLUME PIPE AS REQUIRED
- SLOPE BREAKERS/ARROW INDICATES DIRECTION
- TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 – 15%	300 FT
C	15 – 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix B-7

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

FOR 380 GOETHELS BRIDGE HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1020

0 50 100 150 300ft

0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION
LD-A-1017	ALIGNMENT SHEET

REFERENCE DRAWINGS

REV	DRN	DATE	DESCRIPTION
B	DLF	11/01/2010	ADDED VARIATION #21 & CHANGED DWG. NO.
			DRAWING NUMBER CHANGE 1016B TO 1017B
A	DLF	8/16/2010	ADDED CONTOURS

REVISIONS

ITEM NO.	DESCRIPTION	LN. FT.

MATERIALS

	ENGINEERING APPROVALS			
	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 42" PIPELINE
PULL BACK WORKSPACE
SUPPLEMENTAL ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy

Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: | DWG. LD-A-1017B | REV. A10

Appendix B-7. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

WORKSPACE

CROSSING

(R-22.1) 380 DEVELOPMENT, LLC. 1.46 RODS

(R-22.1H) FIFTH STREET – LAMBERT AVE. 7.89 RODS

(R-22) 380 DEVELOPMENT, LLC. 78.93 RODS

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

216+91.0 APPROX. WETLAND BOUNDARY

217+24.4 APPROX. WETLAND BOUNDARY

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME — COMPANY —
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT — ESMT —
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR) — PAR 0.00
- TEMPORARY ACCESS ROAD (TAR) — TAR 0.00
- CONTOUR MAJOR (EVERY 10') — 42 —
- CONTOUR AT +2 ELEV. — 42 —
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST — MP XX.XX
- PROPERTY LINE — E — E —
- VERIFIED STORM DRAIN — D — D —
- UNCONFIRMED STORM DRAIN — D — UNC —
- VERIFIED UNDG. ELEC. CABLE — E —
- UNCONFIRMED UNDG. ELEC. CABLE — UE — UNC —
- VERIFIED NAT. GAS LINE — G —
- UNCONFIRMED NAT. GAS LINE — G — UNC —
- VERIFIED SANITARY SEWER — S —
- UNCONFIRMED SANITARY SEWER — S — UNC —
- VERIFIED WATER LINE — W —
- UNCONFIRMED WATER LINE — W — UNC —
- VERIFIED STEAM LINE — STM —
- UNCONFIRMED STEAM LINE — STM — UNC —
- VERIFIED TELEPHONE CABLE — T —
- UNCONFIRMED TELEPHONE CABLE — T — UNC —
- VERIFIED UNDG. COM. CABLE — UCOM —
- UNCONFIRMED UNDG. COM. CABLE — UC — UNC —
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES

LIGHT POLE — UTILITY POLE

GAS VALVE — WATER VALVE

FIRE HYDRANT — TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

SI-W1A	SI-W1A	SI-W2	SI-W2
216+00.0	90.95'	216+81.2	217+24.4
			1275.61'

SITE SPECIFIC E & S: 6 | 6

GENERAL E & S FIGURES: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

- FLUME PIPE AS REQUIRED
- SLOPE BREAKERS/ARROW INDICATES DIRECTION
- TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 – 15%	300 FT
C	15 – 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix B-8

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

B FOR 380 GOETHELS BRIDGE HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1020

0 50 100 150 300ft

0 30 60 90m

B PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
REFERENCE DRAWINGS		REVISIONS				MATERIALS		
		4						
		3						
		2						
		B	DLF	11/10/2010	ADDED HDD REFERENCE NOTE, REVISED			
		1			ABANDON/REMOVAL & LINE SIZE IN TITLE BLOCK			
		A	DLF	10/28/2010	ADDED E&S DATA & VARIATION #21			

ENGINEERING APPROVALS

DRAWN BY: DLF

DRN. DATE: 06/12/2010

CHECKED BY: JRL

CHK. DATE: 11/01/2010

TITLE	BID SIGNATURE	BID DATE	CONSTRUCTION SIGNATURE	CONSTRUCTION DATE

NJ-NY EXPANSION PROJECT
PROPOSED 42" PIPELINE
STA. 216+00.0 TO STA. 230+00.0
ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1018 | REV. A10

C:\temp\AcPublish_2548\LD-A-1009 thru LD-A-1020.DWG Plotted on: Nov 10, 2010 – 3:06pm by dforbus

Appendix B-8. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

TRACT NUMBERS
RODDAGE

SURVEY DATA
SURVEY COMPANY:
FIELD BOOK:
PAGES:

CLASS LOCATION

PIPE MATERIAL

ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

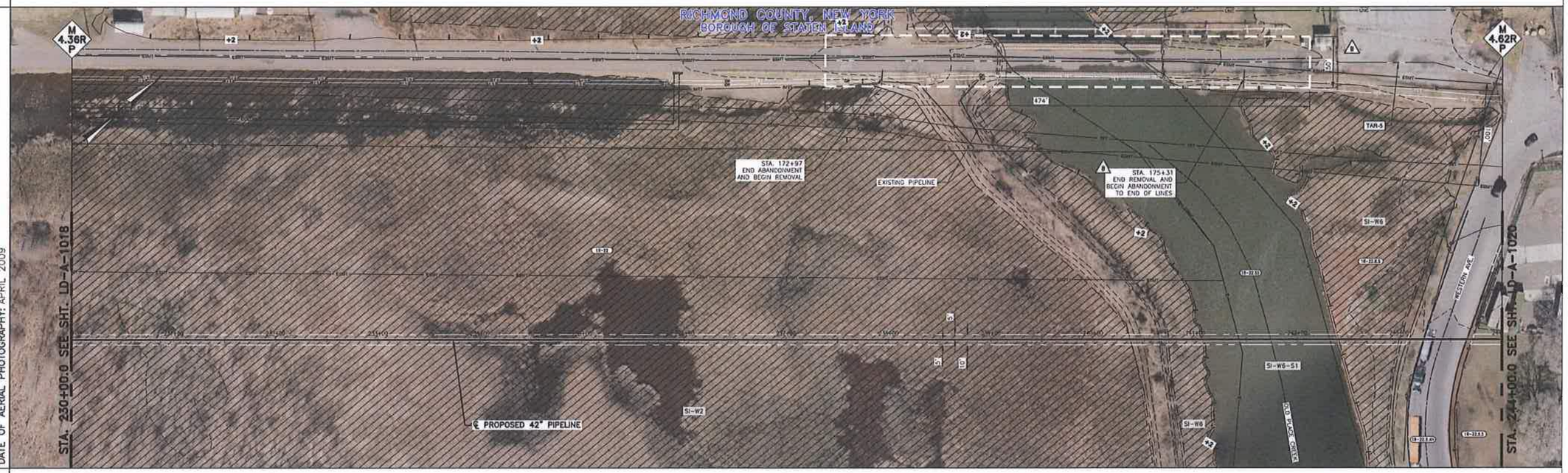
CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 – 15%	300 FT
C	15 – 30%	200 FT
D	> 30%	100 FT

% SLOPE

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR)
- TEMPORARY ACCESS ROAD (TAR)
- CONTOUR MAJOR (EVERY 10')
- CONTOUR AT +2 ELEV.
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST
- PROPERTY LINE
- VERIFIED STORM DRAIN
- UNCONFIRMED STORM DRAIN
- VERIFIED UNDG. ELEC. CABLE
- UNCONFIRMED UNDG. ELEC. CABLE
- VERIFIED NAT. GAS LINE
- UNCONFIRMED NAT. GAS LINE
- VERIFIED SANITARY SEWER
- UNCONFIRMED SANITARY SEWER
- VERIFIED WATER LINE
- UNCONFIRMED WATER LINE
- VERIFIED STEAM LINE
- UNCONFIRMED STEAM LINE
- VERIFIED TELEPHONE CABLE
- UNCONFIRMED TELEPHONE CABLE
- VERIFIED UNDG. COM. CABLE
- UNCONFIRMED UNDG. COM. CABLE
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE
- UTILITY POLE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009



ENVIRONMENTAL DATA

230+00.0	SI-W2		LEVEE	240+24.5	SI-W6	SI-W6-S1	240+71.3	SI-W6	
	SI-W2			240+71.3	SI-W6	OLD PLACE CREEK	241+06.4	SI-W6	
	1034.46'				34.93'	131.22'	242+38.2	62.12'	245+00.3

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion
Date: December 3, 2010
Appendix B-9

PAL

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

⚠6 FOR 380 GOETHELS BRIDGE HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1020

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
REFERENCE DRAWINGS		REVISIONS				MATERIALS		
		⚠4	DLF	11/10/2010	ADDED HDD REFERENCE NOTE, REVISED			
		⚠3			ABANDON/REMOVAL & LINE SIZE IN TITLE BLOCK			
		⚠2	DLF	10/28/2010	ADDED E&S DATA & VARIATION #21			

	ENGINEERING APPROVALS			
	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ–NY EXPANSION PROJECT
PROPOSED 42" PIPELINE
STA. 230+00.0 TO STA. 244+00.0
ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD–A–1019 | REV. A10

C:\Work\1430\LD-A-1009 thru LD-A-1020.DWG Plotted on: Nov 18, 2010 – 12:24pm by dforbus

Appendix B-9. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

(IR-22.8.S)	(IR-22.9.SH)	(IR-22.9.JH)	(RCH-1)	(RCH-1)	(RCH-2)	(RCH-2S)
DEPT OF REAL ESTATE - CITY OF NEW YORK 3.98 RODS	NYS DOT 10.19 RODS	GOETHALS ROAD NORTH 3.85 RODS	TEXAS EASTERN TRANSMISSION CORP. 12.54 RODS	TEXAS EASTERN TRANSMISSION CORP. 37.00 RODS	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION 28.47 RODS	BRIDGE CREEK
244+00.0	244+51.1	244+19.3	245+07.6	245+86.5	247+80.2	245+50.0

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME — COMPANY —
- PIPELINE TO BE REMOVED/ABANDONED — PR —
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT — E OUT —
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR) — PAR 0.00 —
- TEMPORARY ACCESS ROAD (TAR) — TAR 0.00 —
- CONTOUR MAJOR (EVERY 10') — +2 —
- CONTOUR AT +2 ELEV.
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST — XX.XP —
- PROPERTY LINE — P —
- VERIFIED STORM DRAIN — D —
- UNCONFIRMED STORM DRAIN — D — UNC —
- VERIFIED UNDG. ELEC. CABLE — E —
- UNCONFIRMED UNDG. ELEC. CABLE — UE — UNC —
- VERIFIED NAT. GAS LINE — G —
- UNCONFIRMED NAT. GAS LINE — G — UNC —
- VERIFIED SANITARY SEWER — S —
- UNCONFIRMED SANITARY SEWER — S — UNC —
- VERIFIED WATER LINE — W —
- UNCONFIRMED WATER LINE — W — UNC —
- VERIFIED STEAM LINE — STM —
- UNCONFIRMED STEAM LINE — STM — UNC —
- VERIFIED TELEPHONE CABLE — T —
- UNCONFIRMED TELEPHONE CABLE — T — UNC —
- VERIFIED UNDG. COM. CABLE — UCOM —
- UNCONFIRMED UNDG. COM. CABLE — UC — UNC —
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES

LIGHT POLE · UTILITY POLE · GAS VALVE · WATER VALVE · FIRE HYDRANT · TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

FOR 380 GEOTHELS BRIDGE HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1020

241+27.6		242+42.7	242+57.8		244+43.3	244+72.4	245+50.0
SI-W7	SI-W7		SI-W7	SI-W7	SI-W7-S1	SI-W7	
	115.1'			185.5'	BRIDGE CREEK 29.1'	77.6'	

SITE SPECIFIC E & S

6 6 6

GENERAL E & S FIGURES

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED Ⓕ

SLOPE BREAKERS/ARROW INDICATES DIRECTION Ⓓ

TRENCH PLUG ▲

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

The base information contained in this map was supplied to PAL as a professional courtesy for informational and illustrative purposes only. PAL makes no warranties, either expressed or implied, regarding the fitness or suitability of this map for any other purpose than to depict the location and/or results of cultural resource investigations conducted by PAL.

Project: NJ-NY Expansion

Date: December 3, 2010

Appendix B-10

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

0 50 100 150 300ft

0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
REFERENCE DRAWINGS		REVISIONS				MATERIALS		
		4						
		3						
		2	DLF	10/8/2010	CHANGED TITLE BLOCK FROM 30" TO 30" & 42" PIPELINE			
		1	DLF	10/28/2010	ADDED E&S DATA & VARIATION #21			

ENGINEERING APPROVALS

DRAWN BY: DLF

DRN. DATE: 06/12/2010

CHECKED BY: JRL

CHK. DATE: 11/01/2010

TITLE	BID SIGNATURE	BID DATE	CONSTRUCTION SIGNATURE	CONSTRUCTION DATE

NJ-NY EXPANSION PROJECT
PROPOSED 42" & 30" PIPELINE
STA. 244+00.0 TO STA. 245+50.0
ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1020 | REV. A10

C:\Temp\AcPublish_2548\LD-A-1009 thru LD-A-1020.DWG Plotted on: Nov 10, 2010 - 3:07pm by dforbus

Appendix B-10. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS
RODDAGE

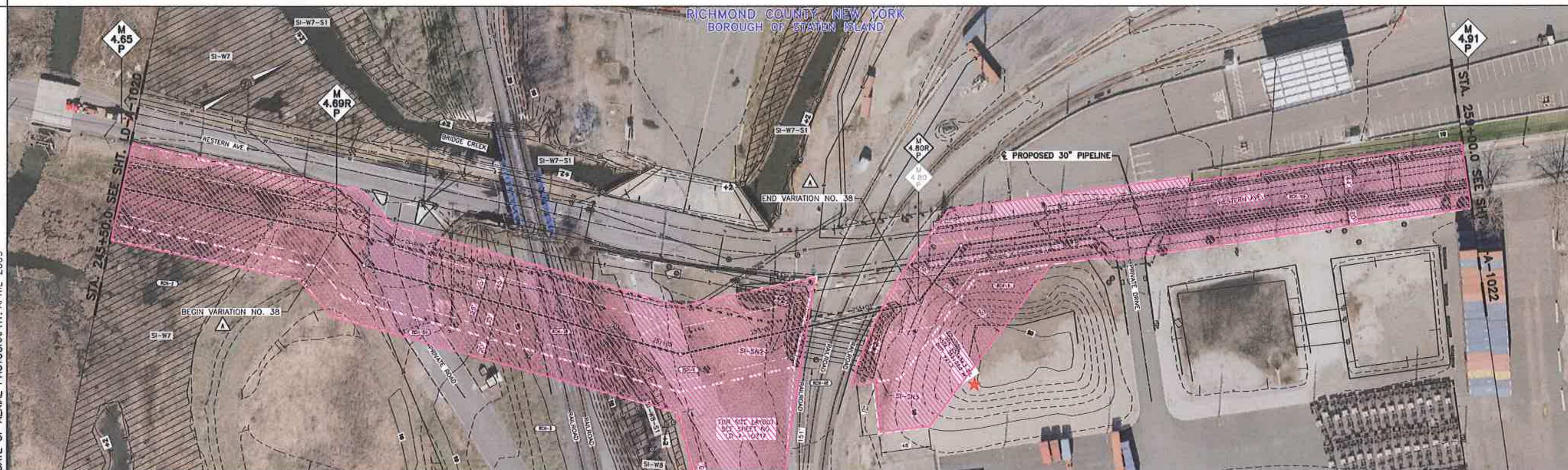
SURVEY DATA

SURVEY COMPANY:
FIELD BOOK:
PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL



DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

The base information contained in this map was supplied to PAL as a professional courtesy for informational and illustrative purposes only. PAL makes no warranties, either expressed or implied, regarding the fitness or suitability of this map for any other purpose than to depict the location and/or results of cultural resource investigations conducted by PAL.

Project
NJ-NY Expansion

Date
December 3, 2010

Appendix B-11

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION
LD-A-1021A	SUPPLEMENTAL ALIGNMENT SHEET		DLF	10/28/2010	ADDED E&S DATA AND VARIATION #38

REFERENCE DRAWINGS — REVISIONS — MATERIALS (ITEM NO., DESCRIPTION, LN. FT.)

DRAWN BY: DLF
DRN. DATE: 06/12/2010
CHECKED BY: JRL
CHK. DATE: 11/01/2010

ENGINEERING APPROVALS: BID / CONSTRUCTION — TITLE, SIGNATURE, DATE

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
STA. 245+50.0 TO STA. 259+00.0
ALIGNMENT SHEET

LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1021 | REV. A10

Appendix B-11. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

RCH-2 — NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION — 14.66 RODS

RCH-3A — PRIVATE ROAD

RCH-3 — PORT AUTHORITY OF NY AND NJ — 14.13 RODS

RCH-3B — RAILROAD

RCH-4 — PORT AUTHORITY OF NY AND NJ — 12.91 RODS

RCH-4B — RAILROAD — 5.38 RODS

RCH-4 — PORT AUTHORITY OF NY AND NJ — 3.93 RODS

RCH-4A — WESTERN AVE. — 32.32 RODS

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME — COMPANY
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE — TWS
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT — EXMT
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR) — PAR 0.00
- TEMPORARY ACCESS ROAD (TAR) — TAR 0.00
- CONTOUR MAJOR (EVERY 10') — +2
- CONTOUR AT +2 ELEV.
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST — MILEPOST
- PROPERTY LINE — E
- VERIFIED STORM DRAIN — D
- UNCONFIRMED STORM DRAIN — D UNC
- VERIFIED UNDG. ELEC. CABLE — E
- UNCONFIRMED UNDG. ELEC. CABLE — UE UNC
- VERIFIED NAT. GAS LINE — P
- UNCONFIRMED NAT. GAS LINE — G UNC
- VERIFIED SANITARY SEWER — S
- UNCONFIRMED SANITARY SEWER — S UNC
- VERIFIED WATER LINE — W
- UNCONFIRMED WATER LINE — W UNC
- VERIFIED STEAM LINE — STM
- UNCONFIRMED STEAM LINE — STM UNC
- VERIFIED TELEPHONE CABLE — T
- UNCONFIRMED TELEPHONE CABLE — T UNC
- VERIFIED UNDG. COM. CABLE — UCOM
- UNCONFIRMED UNDG. COM. CABLE — UE UNC
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE
- UTILITY POLE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- TREE

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix B-12

PAL

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

RICHMOND COUNTY, NEW YORK
BOROUGH OF STATEN ISLAND

M 4.65 P

M 4.69R P

M 4.80R P

M 4.91 P

SI-W7-S1

SI-W7

BRIDGE CREEK

WESTERN AVE

STA. 245+50.0 SEE SHT. LD-A-1020

STA. 259+00.0 SEE SHT. LD-A-1022

℄ PROPOSED 30" PIPELINE

BEGIN VARIATION NO. 38

END VARIATION NO. 38

PRIVATE ROAD

ENVIRONMENTAL DATA

SI-W7 — SI-W7 — 150.7'

SI-W8-S1 — UNNAMED CREEK — 19.5'

SI-SN2 — SI-SN2 — 5.5'

SI-SN3 — SI-SN3 — 13.9'

0 50 100 150 300ft

0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
REFERENCE DRAWINGS		REVISIONS				MATERIALS		
LD-A-1021	ALIGNMENT SHEET	1	DLF	11/05/2010	ADDED E&S DATA AND VARIATION #38			

ENGINEERING APPROVALS

	TITLE	SIGNATURE	DATE	SIGNATURE	DATE
DRAWN BY: DLF					
DRN. DATE: 11/05/2010					
CHECKED BY: JRL					
CHK. DATE: 11/06/2010					

BID — CONSTRUCTION

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
STA. 245+50.0 TO STA. 259+00.0
SUPPLEMENTAL ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy

Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1021A | REV. A10

C:\Work\1430\LD-A-1021A.dwg Plotted on: Nov 07, 2010 - 8:09pm by dforbus

IC.

Appendix B-12. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS
RODDAGE

CROSSING
WORKSPACE

WESTERN AVE.

PORT AUTHORITY OF NY AND NJ

SURVEY DATA

SURVEY COMPANY:
FIELD BOOK:
PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

PROPOSED PIPELINE
PRE-FERC (A7) ALIGNMENT
EXIST. P/L w/OWNER NAME
PIPELINE TO BE REMOVED/ABANDONED
TEMP. WORKSPACE
PROPOSED PERMANENT EASEMENT
EXISTING EASEMENT
ADD. TEMP. WORKSPACE
YARD LOCATION
℄ WATERS OF THE U.S.
DELINEATED WATERS OF THE U.S.
APPROXIMATE WATERS OF THE U.S. BOUNDARIES
EDGE OF PAVEMENT
PERMANENT ACCESS ROAD (PAR)
TEMPORARY ACCESS ROAD (TAR)
CONTOUR MAJOR (EVERY 10')
CONTOUR AT +2 ELEV.
CONTOUR MINOR (EVERY 2')
TREE / BRUSH LINE
JERSEY BARRIER
PIPELINE MILEPOST
PROPERTY LINE
VERIFIED STORM DRAIN
UNCONFIRMED STORM DRAIN
VERIFIED UNDG. ELEC. CABLE
UNCONFIRMED UNDG. ELEC. CABLE
VERIFIED NAT. GAS LINE
UNCONFIRMED NAT. GAS LINE
VERIFIED SANITARY SEWER
UNCONFIRMED SANITARY SEWER
VERIFIED WATER LINE
UNCONFIRMED WATER LINE
VERIFIED STEAM LINE
UNCONFIRMED STEAM LINE
VERIFIED TELEPHONE CABLE
UNCONFIRMED TELEPHONE CABLE
VERIFIED UNDG. COM. CABLE
UNCONFIRMED UNDG. COM. CABLE
ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
LIGHT POLE — UTILITY POLE
GAS VALVE — WATER VALVE
FIRE HYDRANT — TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

The base information contained in this map was supplied to PAL as a professional courtesy for informational and illustrative purposes only. PAL makes no warranties, either expressed or implied, regarding the fitness or suitability of this map for any other purpose than to depict the location and/or results of cultural resource investigations conducted by PAL.

Project
NJ-NY Expansion

Date
December 3, 2010

Appendix B-13

PAL

Archaeological Sensitivity

High

Moderate

Low

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
			DLF	10/28/2010	ADDED E&S DATA & VARIATION #30			
REFERENCE DRAWINGS		REVISIONS				MATERIALS		

ENGINEERING APPROVALS

TITLE	BID SIGNATURE	DATE	CONSTRUCTION SIGNATURE	DATE
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
STA. 259+00.0 TO STA. 270+50.0
ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1022 | REV. A10

C:\Work\1430\LD-A-1021 thru LD-A-1027.dwg Plotted on: Nov 05, 2010 - 5:15pm by dforbus

Appendix B-13. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY	
TRACT NUMBERS	
RODDAGE	
WORKSPACE	CROSSING

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

PROPOSED PIPELINE
PRE-FERC (A7) ALIGNMENT
EXIST. P/L w/OWNER NAME
PIPELINE TO BE REMOVED/ABANDONED
TEMP. WORKSPACE
PROPOSED PERMANENT EASEMENT
EXISTING EASEMENT
ADD. TEMP. WORKSPACE
YARD LOCATION
℄ WATERS OF THE U.S.
DELINEATED WATERS OF THE U.S.
APPROXIMATE WATERS OF THE U.S. BOUNDARIES
EDGE OF PAVEMENT
PERMANENT ACCESS ROAD (PAR) — PAR 0.00
TEMPORARY ACCESS ROAD (TAR) — TAR 0.00
CONTOUR MAJOR (EVERY 10')
CONTOUR AT +2 ELEV. — +2
CONTOUR MINOR (EVERY 2')
TREE / BRUSH LINE
JERSEY BARRIER
PIPELINE MILEPOST
PROPERTY LINE
VERIFIED STORM DRAIN
UNCONFIRMED STORM DRAIN
VERIFIED UNDG. ELEC. CABLE
UNCONFIRMED UNDG. ELEC. CABLE
VERIFIED NAT. GAS LINE
UNCONFIRMED NAT. GAS LINE
VERIFIED SANITARY SEWER
UNCONFIRMED SANITARY SEWER
VERIFIED WATER LINE
UNCONFIRMED WATER LINE
VERIFIED STEAM LINE
UNCONFIRMED STEAM LINE
VERIFIED TELEPHONE CABLE
UNCONFIRMED TELEPHONE CABLE
VERIFIED UNDG. COM. CABLE
UNCONFIRMED UNDG. COM. CABLE
ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
LIGHT POLE — UTILITY POLE
GAS VALVE — WATER VALVE
FIRE HYDRANT — TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES — 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING		
CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

The base information contained in this map was supplied to PAL as a professional courtesy for informational and illustrative purposes only. PAL makes no warranties, either expressed or implied, regarding the fitness or suitability of this map for any other purpose than to depict the location and/or results of cultural resource investigations conducted by PAL.

Project: NJ-NY Expansion

Date: December 3, 2010

Appendix B-14

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

Scale: 0, 50, 100, 150, 300ft / 0, 30, 60, 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
			DLF	10/28/2010	ADDED E&S DATA & VARIATION #30			
REFERENCE DRAWINGS		REVISIONS				MATERIALS		

	ENGINEERING APPROVALS			
	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
STA. 270+50.0 TO STA. 285+00.0
ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1023 | REV. A10

C:\Work\1430\LD-A-1021 thru LD-A-1027.dwg Plotted on: Nov 05, 2010 - 5:15pm by dforbus

Appendix B-14. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

(RCH-A) PORT AUTHORITY OF NY AND NJ 9.94 RODS

(RCH-SH) RICHMOND TERRACE 52.58 RODS

(RCH-B) OCAS 7.88 RODS

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

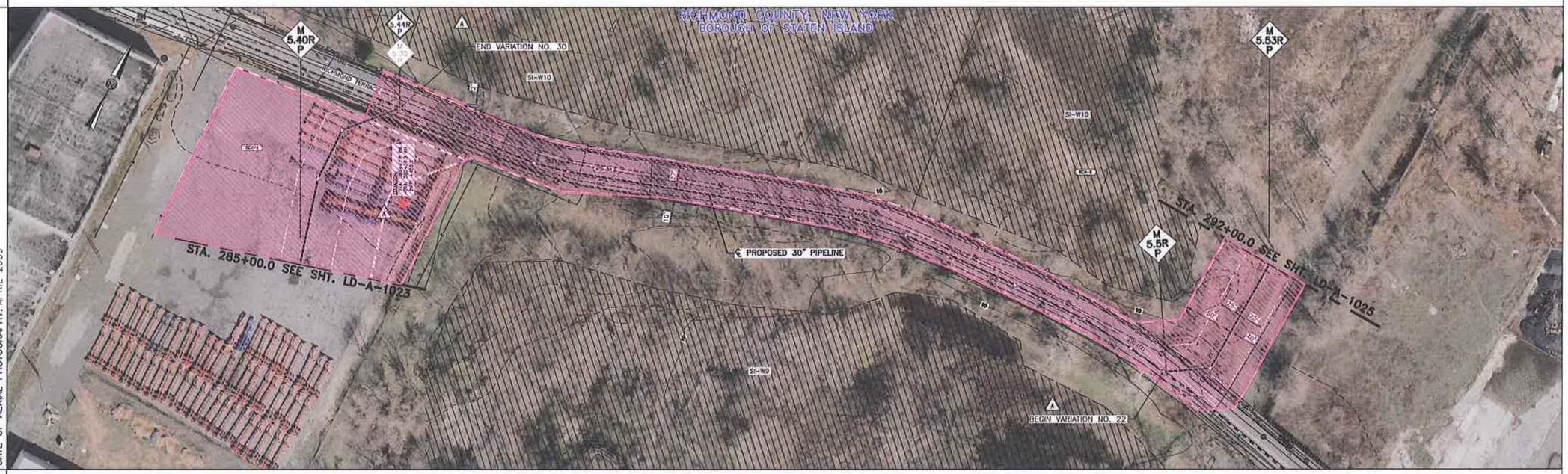
CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

PROPOSED PIPELINE
PRE-FERC (A7) ALIGNMENT
EXIST. P/L w/OWNER NAME
PIPELINE TO BE REMOVED/ABANDONED
TEMP. WORKSPACE
PROPOSED PERMANENT EASEMENT
EXISTING EASEMENT
ADD. TEMP. WORKSPACE
YARD LOCATION
℄ WATERS OF THE U.S.
DELINEATED WATERS OF THE U.S.
APPROXIMATE WATERS OF THE U.S. BOUNDARIES
EDGE OF PAVEMENT
PERMANENT ACCESS ROAD (PAR)
TEMPORARY ACCESS ROAD (TAR)
CONTOUR MAJOR (EVERY 10')
CONTOUR AT +2 ELEV.
CONTOUR MINOR (EVERY 2')
TREE / BRUSH LINE
JERSEY BARRIER
PIPELINE MILEPOST
PROPERTY LINE
VERIFIED STORM DRAIN
UNCONFIRMED STORM DRAIN
VERIFIED UNDG. ELEC. CABLE
UNCONFIRMED UNDG. ELEC. CABLE
VERIFIED NAT. GAS LINE
UNCONFIRMED NAT. GAS LINE
VERIFIED SANITARY SEWER
UNCONFIRMED SANITARY SEWER
VERIFIED WATER LINE
UNCONFIRMED WATER LINE
VERIFIED STEAM LINE
UNCONFIRMED STEAM LINE
VERIFIED TELEPHONE CABLE
UNCONFIRMED TELEPHONE CABLE
VERIFIED UNDG. COM. CABLE
UNCONFIRMED UNDG. COM. CABLE
ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
LIGHT POLE
UTILITY POLE
GAS VALVE
WATER VALVE
FIRE HYDRANT
TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009



ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix B-15

Archaeological Sensitivity

High

Moderate

Low

0 50 100 150 300ft

0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
4	DLF	10/28/2010	ADDED E&S DATA & VARITAIONS #30 & #22			

DWG. NO. | DESCRIPTION — REFERENCE DRAWINGS — REVISIONS — MATERIALS

ENGINEERING APPROVALS

DRAWN BY: DLF
DRN. DATE: 06/12/2010
CHECKED BY: JRL
CHK. DATE: 11/01/2010

BID | CONSTRUCTION

TITLE | SIGNATURE | DATE | SIGNATURE | DATE

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
STA. 285+00.0 TO STA. 292+00.0
ALIGNMENT SHEET
LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1024 | REV. A10

C:\Work\1430\LD-A-1021 thru LD-A-1027.dwg Plotted on: Nov 05, 2010 - 5:16pm by dfarbus

16 of

Appendix B-15. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

PROPOSED PIPELINE
PRE-FERC (A7) ALIGNMENT
EXIST. P/L w/OWNER NAME
PIPELINE TO BE REMOVED/ABANDONED
TEMP. WORKSPACE
PROPOSED PERMANENT EASEMENT
EXISTING EASEMENT
ADD. TEMP. WORKSPACE
YARD LOCATION
℄ WATERS OF THE U.S.
DELINEATED WATERS OF THE U.S.
APPROXIMATE WATERS OF THE U.S. BOUNDARIES
EDGE OF PAVEMENT
PERMANENT ACCESS ROAD (PAR)
TEMPORARY ACCESS ROAD (TAR)
CONTOUR MAJOR (EVERY 10')
CONTOUR AT +2 ELEV.
CONTOUR MINOR (EVERY 2')
TREE / BRUSH LINE
JERSEY BARRIER
PIPELINE MILEPOST
PROPERTY LINE
VERIFIED STORM DRAIN
UNCONFIRMED STORM DRAIN
VERIFIED UNDG. ELEC. CABLE
UNCONFIRMED UNDG. ELEC. CABLE
VERIFIED NAT. GAS LINE
UNCONFIRMED NAT. GAS LINE
VERIFIED SANITARY SEWER
UNCONFIRMED SANITARY SEWER
VERIFIED WATER LINE
UNCONFIRMED WATER LINE
VERIFIED STEAM LINE
UNCONFIRMED STEAM LINE
VERIFIED TELEPHONE CABLE
UNCONFIRMED TELEPHONE CABLE
VERIFIED UNDG. COM. CABLE
UNCONFIRMED UNDG. COM. CABLE
ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
LIGHT POLE — UTILITY POLE
GAS VALVE — WATER VALVE
FIRE HYDRANT — TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

SI-W10	KILL VAN KULL
158.2'	298.4'

SITE SPECIFIC E & S

GENERAL E & S FIGURES

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

FOR KILL VAN KULL HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1030

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

FLUME PIPE AS REQUIRED

SLOPE BREAKERS/ARROW INDICATES DIRECTION

TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project
NJ-NY Expansion

Date
December 3, 2010

Appendix B-16

PAL

Archaeological Sensitivity

High

Moderate

Low

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
			DLF	10/28/2010	ADDED E&S DATA & VARIATION #22			
REFERENCE DRAWINGS		REVISIONS				MATERIALS		

	ENGINEERING APPROVALS			
	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
STA. 292+00.0 TO STA. 306+00.0
ALIGNMENT SHEET

LOC. RICHMOND COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1025 | REV. A10

C:\Work\1430\LD-A-1021 thru LD-A-1027.dwg Plotted on: Nov 07, 2010 - 2:31pm by dforbus

Appendix B-16. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY

TRACT NUMBERS

RODDAGE

CROSSING

WORKSPACE

320+69.0

RCH-7.3S
MARINERS HARBOR MARINE CORP.
10.24 RODS

321+69.0

RCH-12S
KILL VAN KULL
64.72 RODS

332+36.6

RCH-12.1
NYC PARKS & RECREATION
8.89 RODS

334+00.0

SURVEY DATA

SURVEY COMPANY:

FIELD BOOK:

PAGES:

332+83.2 EDGE OF WATER

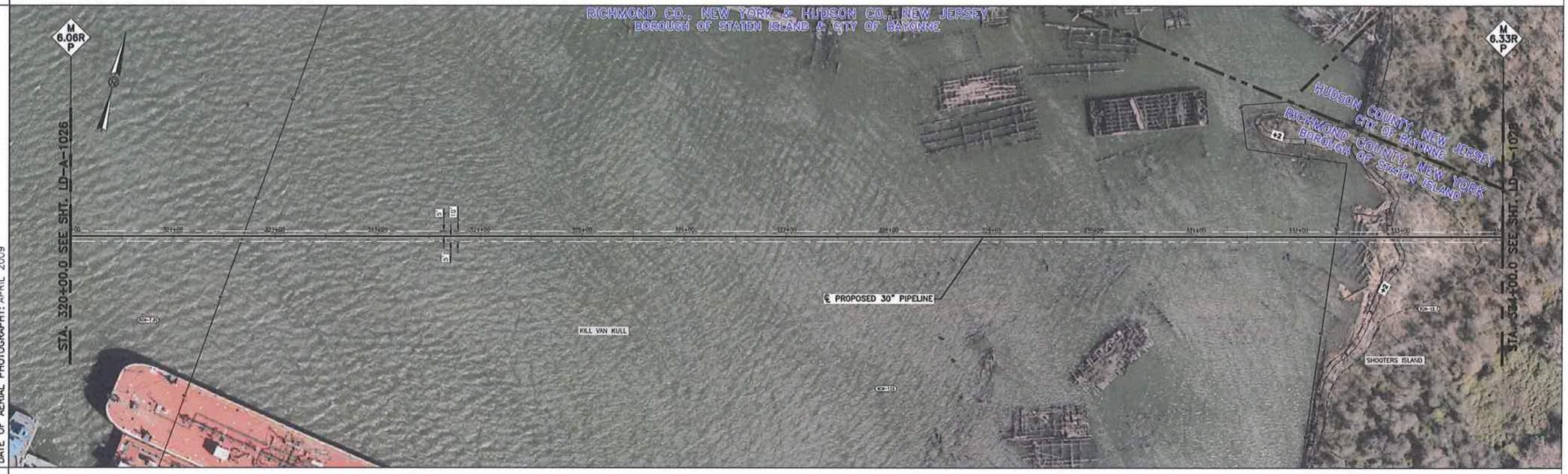
CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME — COMPANY —
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT — ESMT —
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR) — PAR 0.00
- TEMPORARY ACCESS ROAD (TAR) — TAR 0.00
- CONTOUR MAJOR (EVERY 10') — 10 —
- CONTOUR AT +2 ELEV. — +2 —
- CONTOUR MINOR (EVERY 2') — 2 —
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST — M 6.06R P
- PROPERTY LINE — P —
- VERIFIED STORM DRAIN — D —
- UNCONFIRMED STORM DRAIN — D — UNC —
- VERIFIED UNDG. ELEC. CABLE — E —
- UNCONFIRMED UNDG. ELEC. CABLE — UE — UNC —
- VERIFIED NAT. GAS LINE — # —
- UNCONFIRMED NAT. GAS LINE — D — UNC —
- VERIFIED SANITARY SEWER — S —
- UNCONFIRMED SANITARY SEWER — S — UNC —
- VERIFIED WATER LINE — W —
- UNCONFIRMED WATER LINE — W — UNC —
- VERIFIED STEAM LINE — STM —
- UNCONFIRMED STEAM LINE — STM — UNC —
- VERIFIED TELEPHONE CABLE — T —
- UNCONFIRMED TELEPHONE CABLE — T — UNC —
- VERIFIED UNDG. COM. CABLE — UCOM —
- UNCONFIRMED UNDG. COM. CABLE — UC — UNC —
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE
- UTILITY POLE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009



ENVIRONMENTAL DATA

320+00.0

KILL VAN KULL

KILL VAN KULL

1269.3'

332+83.2

SITE SPECIFIC E & S

GENERAL E & S FIGURES

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

- FLUME PIPE AS REQUIRED
- SLOPE BREAKERS/ARROW INDICATES DIRECTION
- TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project	
NJ-NY Expansion	PAL
Date	
December 3, 2010	
Appendix B-17	

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

⚠8 FOR KILL VAN KULL HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1030

0 50 100 150 300ft

0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
REFERENCE DRAWINGS		REVISIONS				MATERIALS		
		8	DLF	11/10/2010	ADDED HDD REFERENCE NOTE			
		7	DLF	10/28/2010	ADDED E&S DATA & VARIATION #22			

ENGINEERING APPROVALS				
	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
STA. 320+00.0 TO STA. 334+00.0
ALIGNMENT SHEET
LOC. RICHMOND CO., NEW YORK & HUDSON CO., NEW JERSEY

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1027 | REV. A10

IGF

C:\temp\AcPublish_3800\LD-A-1021 thru LD-A-1027.dwg Plotted on: Nov 10, 2010 - 9:51am by dferbius

Appendix B-17. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY
TRACT NUMBERS
RODDAGE
CROSSING
WORKSPACE

334+00.0 | HCH-12.1 HYC PARKS & RECREATION 0.81 ACRES | 335+15.8 | HUD-1 CITY OF BAYONNE 31.08 ACRES | 342+26.8 | HUD-1S KILL VAN KULL, NJ 49.86 ACRES | 348+00.0

SURVEY DATA
SURVEY COMPANY:
FIELD BOOK:
PAGES:

340+32.5 EDGE OF WATER

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME — COMPANY —
- PIPELINE TO BE REMOVED/ABANDONED — TBR —
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT — EXIST —
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR) — PAR 0.00
- TEMPORARY ACCESS ROAD (TAR) — TAR 0.00
- CONTOUR MAJOR (EVERY 10') — +2 —
- CONTOUR AT +2 ELEV.
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST — STA 42
- PROPERTY LINE — E — E —
- VERIFIED STORM DRAIN — D — D —
- UNCONFIRMED STORM DRAIN — D — UNC —
- VERIFIED UNDG. ELEC. CABLE — E —
- UNCONFIRMED UNDG. ELEC. CABLE — UE — UNC —
- VERIFIED NAT. GAS LINE — G —
- UNCONFIRMED NAT. GAS LINE — G — UNC —
- VERIFIED SANITARY SEWER — S —
- UNCONFIRMED SANITARY SEWER — S — UNC —
- VERIFIED WATER LINE — W —
- UNCONFIRMED WATER LINE — W — UNC —
- VERIFIED STEAM LINE — STM —
- UNCONFIRMED STEAM LINE — STM — UNC —
- VERIFIED TELEPHONE CABLE — T —
- UNCONFIRMED TELEPHONE CABLE — T — UNC —
- VERIFIED UNDG. COM. CABLE — UCOM —
- UNCONFIRMED UNDG. COM. CABLE — UE — UNC —
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE — UTILITY POLE
- GAS VALVE — WATER VALVE
- FIRE HYDRANT — TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

KILL VAN KULL
KILL VAN KULL
767.5'
340+32.5 | 348+00.0

SITE SPECIFIC E & S

GENERAL E & S FIGURES

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

- FLUME PIPE AS REQUIRED (F)
- SLOPE BREAKERS/ARROW INDICATES DIRECTION (D)
- TRENCH PLUG ▲

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

FOR KILL VAN KULL HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1030 (3)

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion
Date: December 3, 2010
Appendix B-18

PAL

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
REFERENCE DRAWINGS		REVISIONS				MATERIALS		
		4						
		3						
		2						
		1	DLF	11/10/2010	ADDED HDD REFERENCE NOTE			
		0	DLF	10/28/2010	ADDED E&S DATA & VARIATION #22			

ENGINEERING APPROVALS

	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
STA. 334+00.0 TO STA. 348+00.0
ALIGNMENT SHEET
LOC. BOROUGH OF STATEN ISLAND & CITY OF BAYONNE

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1028 | REV. A10

C:\Work\1430\LD-A-1028 thru LD-A-1039.dwg Plotted on: Nov 10, 2010 - 10:56am by dforbus

Appendix B-18. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY
TRACT NUMBERS
RODDAGE
CROSSING
WORKSPACE

SURVEY DATA
SURVEY COMPANY:
FIELD BOOK:
PAGES:

CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR)
- TEMPORARY ACCESS ROAD (TAR)
- CONTOUR MAJOR (EVERY 10')
- CONTOUR AT +2 ELEV.
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST
- PROPERTY LINE
- VERIFIED STORM DRAIN
- UNCONFIRMED STORM DRAIN
- VERIFIED UNDG. ELEC. CABLE
- UNCONFIRMED UNDG. ELEC. CABLE
- VERIFIED NAT. GAS LINE
- UNCONFIRMED NAT. GAS LINE
- VERIFIED SANITARY SEWER
- UNCONFIRMED SANITARY SEWER
- VERIFIED WATER LINE
- UNCONFIRMED WATER LINE
- VERIFIED STEAM LINE
- UNCONFIRMED STEAM LINE
- VERIFIED TELEPHONE CABLE
- UNCONFIRMED TELEPHONE CABLE
- VERIFIED UNDG. COM. CABLE
- UNCONFIRMED UNDG. COM. CABLE
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE
- UTILITY POLE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009

ENVIRONMENTAL DATA

HUDSON RIVER
HUDSON RIVER
842.5'

SITE SPECIFIC E & S

GENERAL E & S FIGURES

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

- FLUME PIPE AS REQUIRED (F)
- SLOPE BREAKERS/ARROW INDICATES DIRECTION (D)
- TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 - 15%	300 FT
C	15 - 30%	200 FT
D	> 30%	100 FT

% SLOPE

FOR HUDSON RIVER HDD DETAIL DESIGN, REFER TO DWG. NO. LD-H-1080 (6)

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

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Project: NJ-NY Expansion
Date: December 3, 2010
Appendix B-19

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	DESCRIPTION	REV	DRN	DATE	DESCRIPTION	ITEM NO.	DESCRIPTION	LN. FT.
REFERENCE DRAWINGS		REVISIONS				MATERIALS		
LD-A-1085A	SUPPLEMENTAL ALIGNMENT SHEET	3	DLF	8/16/2010	ADDED CONTOURS, UTILITIES & SURVEY DATA			
		2	DLF	10/28/2010	ADDED E&S DATA & REVISED TRACT DATA			
		1	DLF	11/10/2010	ADDED HDD REFERENCE NOTE			

ENGINEERING APPROVALS

	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 11/01/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
STA. 1044+00.0 TO STA. 1057+94.6
ALIGNMENT SHEET
LOC. NEW YORK COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1085 | REV. A10

C:\temp\ePublish_129\LD-A-1083 thru LD-A-1085.dwg Plotted on: Nov 10, 2010 - 2:47pm by dfarbus

Appendix B-19. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

RIGHT-OF-WAY
TRACT NUMBERS
RODDAGE
CROSSING
WORKSPACE

(NYC-1S) HUDSON RIVER (STATE OF NEW YORK) 1052+82.8
(NYC-2) NY SANITATION / HUDSON RIVER PARK TRUST, LLC. 51.51 RODS
(NYC-3) HUDSON RIVER PARK TRUST, LLC 3.42 RODS 1055+91.1 1057+47.5
(NYC-4A) NY STATE DOT 6.25 RODS
(NYC-5A) NYC DOT 3.69 RODS 1072+50.6 1073+44.6

SURVEY DATA

SURVEY COMPANY:
FIELD BOOK:
PAGES:

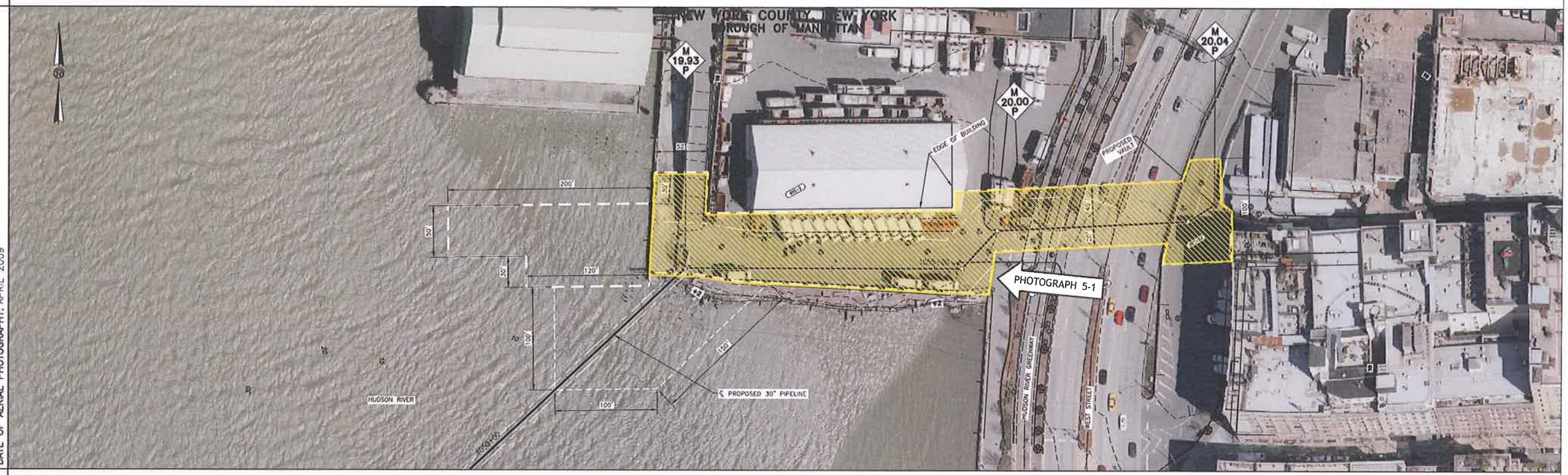
CLASS LOCATION

PIPE MATERIAL

ALIGNMENT DETAIL

- PROPOSED PIPELINE
- PRE-FERC (A7) ALIGNMENT
- EXIST. P/L w/OWNER NAME — COMPANY —
- PIPELINE TO BE REMOVED/ABANDONED
- TEMP. WORKSPACE
- PROPOSED PERMANENT EASEMENT
- EXISTING EASEMENT — ESMT —
- ADD. TEMP. WORKSPACE
- YARD LOCATION
- ℄ WATERS OF THE U.S.
- DELINEATED WATERS OF THE U.S.
- APPROXIMATE WATERS OF THE U.S. BOUNDARIES
- EDGE OF PAVEMENT
- PERMANENT ACCESS ROAD (PAR) — PAR D.OO
- TEMPORARY ACCESS ROAD (TAR) — TAR D.OO
- CONTOUR MAJOR (EVERY 10') — 10 —
- CONTOUR AT +2 ELEV. — +2 —
- CONTOUR MINOR (EVERY 2')
- TREE / BRUSH LINE
- JERSEY BARRIER
- PIPELINE MILEPOST — M 19.93 P
- PROPERTY LINE — P —
- VERIFIED STORM DRAIN — D —
- UNCONFIRMED STORM DRAIN — D — UNC —
- VERIFIED UNDG. ELEC. CABLE — E —
- UNCONFIRMED UNDG. ELEC. CABLE — UE — UNC —
- VERIFIED NAT. GAS LINE — G —
- UNCONFIRMED NAT. GAS LINE — G — UNC —
- VERIFIED SANITARY SEWER — S —
- UNCONFIRMED SANITARY SEWER — S — UNC —
- VERIFIED WATER LINE — W —
- UNCONFIRMED WATER LINE — W — UNC —
- VERIFIED STEAM LINE — STM —
- UNCONFIRMED STEAM LINE — STM — UNC —
- VERIFIED TELEPHONE CABLE — T —
- UNCONFIRMED TELEPHONE CABLE — T — UNC —
- VERIFIED UNDG. COM. CABLE — UCOM —
- UNCONFIRMED UNDG. COM. CABLE — UE — UNC —
- ELEC., WATER, SAN. SEWER, GAS, TELE. & STORM DRAIN MANHOLES
- LIGHT POLE
- UTILITY POLE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- TREE

DATE OF AERIAL PHOTOGRAPHY: APRIL 2009



ENVIRONMENTAL DATA

SITE SPECIFIC E & S

GENERAL E & S FIGURES

△ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

PROFILE

THE LOCATION OF TRENCH PLUGS AND SLOPE BREAKERS ARE INTENDED TO BE USED AS A GUIDELINE ONLY. EXACT LOCATION TO BE DETERMINED IN THE FIELD AS DIRECTED BY THE CHIEF INSPECTOR.

- FLUME PIPE AS REQUIRED
- SLOPE BREAKERS/ARROW INDICATES DIRECTION
- TRENCH PLUG

SLOPE BREAKER & TRENCH PLUG SPACING

CODE	% SLOPE	SPACING
A	< 5%	NO STRUCTURE
B	5 – 15%	300 FT
C	15 – 30%	200 FT
D	> 30%	100 FT

% SLOPE

FOR HUDSON RIVER HDD DETAIL DESIGN, REFER TO SHEET NO. LD-A-1080

Source/Revision/Issue	Date
PAL revised	12-03-10
Map data received from: Spectra Energy	11-24-10
PAL modified: Indicate above ground resources	07-20-10
Map data received from: Spectra Energy	07-02-10

The base information contained in this map was supplied to PAL as a professional courtesy for informational and illustrative purposes only. PAL makes no warranties, either expressed or implied, regarding the fitness or suitability of this map for any other purpose than to depict the location and/or results of cultural resource investigations conducted by PAL.

PHOTOGRAPH # *Photograph angles and designations*

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

0 50 100 150 300ft
0 30 60 90m

PRIVILEGED INFORMATION - DO NOT RELEASE

Project: NJ-NY Expansion
Date: December 3, 2010
Appendix B-20

PAL

REV	DRN	DATE	DESCRIPTION
2	DLF	10/28/2010	ADDED E&S DATA & ADDED TRACT DATA
			RENAMES SHEET LD-A-1084A TO LD-A-1085A
1	DLF	8/16/2010	ADDED CONTOURS

REFERENCE DRAWINGS: LD-A-1085 ALIGNMENT SHEET
REVISIONS: DWG. NO. | DESCRIPTION | REV | DRN | DATE | DESCRIPTION
MATERIALS: ITEM NO. | DESCRIPTION | LN. FT.

ENGINEERING APPROVALS

	BID		CONSTRUCTION	
DRAWN BY: DLF				
DRN. DATE: 06/12/2010				
CHECKED BY: JRL				
CHK. DATE: 10/15/2010				
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

NJ-NY EXPANSION PROJECT
PROPOSED 30" PIPELINE
CONSTRUCTION WORKSPACE
SUPPLEMENTAL ALIGNMENT SHEET
LOC. NEW YORK COUNTY, NEW YORK

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. 076115750 | SCALE: 1"=50' | DWG. LD-A-1085A | REV. A10

Appendix B-20. NJ-NY Expansion Project alignment sheets showing archaeological sensitivity.

APPENDIX C

NYC HUDSON RIVER BULKHEAD – NYSHPO RESOURCE EVALUATION

OFFICE OF PARKS · RECREATION · HISTORIC PRESERVATION
NEW YORK STATE
Bernadette Castro
Commissioner

New York State Office of Parks, Recreation and Historic Preservation
Historic Preservation Field Services Bureau
Peebles Island, PO Box 189, Waterford, New York 12188-0189 518-237-8643

RESOURCE EVALUATION **DATE:** 3/31/97 **STAFF:** Peter Shaver

PROPERTY: NYC Hudson River Bulkhead **MCD:** Manhattan
ADDRESS: Battery Place to West 59th Street **COUNTY:** New York
PROJECT REF: 97PR0483 **USN:** 06101.009182

I. ___ Property is individually listed on SR/NR:
name of listing: _____
___ Property is a contributing component of a SR/NR district:
name of district: _____

II. _X_ Property meets eligibility criteria.
___ Property contributes to a district which appears to meet eligibility criteria. **Pre SRB:**___ **Post SRB:**___ _____ SRB date

Criteria for Inclusion in the National Register:
A. _X_ Associated with events that have made a significant contribution to the broad patterns of our history;
B.___ Associated with the lives of persons significant in our past;
C. _X_ Embodies the distinctive characteristics of a type, period or method of construction; or represents the work of a master; or possesses high artistic values; or represents a significant and distinguishable entity whose components may lack individual distinction;
D. _X_ Have yielded, or may be likely to yield information important in prehistory or history.

III.___ Property does not meet eligibility criteria.

STATEMENT OF SIGNIFICANCE:

Based on the extensive information prepared by Raber Associates and Allee King Rosen & Fleming, it is the opinion of the State Historic Preservation Office that the Hudson River bulkhead from Battery Place to West 59th Street is eligible for listing on the State and National Registers of Historic Places. Constructed between 1871 and 1936, mostly of masonry faced with granite blocks, the bulkhead meets Criterion A for its importance in the development of the New York City waterfront. It also meets Criterion C as a monumental architectural and engineering achievement in the city. It may also meet Criterion B for its association with General Geroge B. McClellan, who was responsible for the planning and design of the bulkhead, and Criterion D for the potenital of buried and underwater portions of the bulkhead to provide information about historic engineering methods. Despite the loss of integrity of setting of the buried sections of the bulkhead between Battery Place and Chambers Street and the loss of integrity of materials and design of some sections, the majority of the bulkhead retains a high degree of integrity of location, design, materials, workmanship, feeling, and association.

BUILDING-STRUCTURE INVENTORY FORM

NYS OFFICE OF PARKS, RECREATION
& HISTORIC PRESERVATION
DIVISION FOR HISTORIC PRESERVATION
(518) 474-0479

FOR OFFICE USE ONLY	
UNIQUE SITE NO.	06101.009182
QUAD	
SERIES	
NEG. NO.	

YOUR NAME: Michael S. Raber DATE: February 20, 1997

YOUR ADDRESS: 81 Dayton Road
So. Glastonbury, CT 06073
TELEPHONE: (860) 633-9026

ORGANIZATION (if any): Raber Associates and Allee King Rosen & Fleming, Inc.
for the Hudson River Park Conservancy (HRPC)

* *

IDENTIFICATION

1. BUILDING NAME(S): New York City's Hudson River Bulkhead from Battery Place to West 59th St.*
2. COUNTY: New York TOWN/CITY: New York VILLAGE:
3. STREET LOCATION: Battery Place to 59th Street
4. OWNERSHIP: a. public ☒ b. private ☐
5. PRESENT OWNER: New York City/New York State Department of Transportation ADDRESS:
6. USE: Original Commercial Waterfront Wharfage Present: Commercial, Municipal Services, Recreation
7. ACCESSIBILITY TO PUBLIC: Exterior visible from public road: Yes ☒ No ☐
   Interior accessible: Explain No; Structurally Inaccessible.

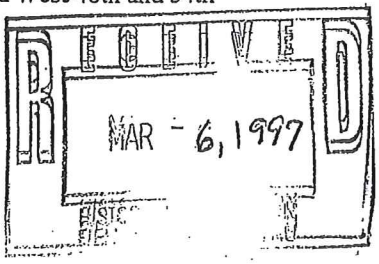
DESCRIPTION

8. BUILDING MATERIAL: a. clapboard ☐ b. stone ☐ c. brick ☐ d. board and batten ☐ e. cobblestone ☐ f. shingles ☐ g. stucco ☐ other: Varied, including wood, granite, pre-cast concrete, mass concrete, cobbles, riprap, demolition debris, and ashes.
9. STRUCTURAL SYSTEM: (if known)
   a. wood frame with interlocking joints ☐
   b. wood frame with light members ☐
   c. masonry load bearing walls ☐
   d. metal (explain) ☐
   e. other ☒ *See attached page.*
10. CONDITION: a. excellent ☐ b. good ☒ c. fair ☒ d. deteriorated ☐
    See attached page.
11. INTEGRITY: a. original site ☒ b. moved ☐ if so, when?
    c. list major alterations and dates if known:
    See attached page.

12. PHOTO: *See attached Photos 1-11.*

13. MAP: *See attached figure.*

* Two areas along this stretch of the waterfront are outside the planning jurisdiction of the Hudson River Park Conservancy (HRPC). These are between West 35th and 38th Streets and West 48th and 54th Streets.



14. THREATS TO BUILDING: a. none known ☐ b. zoning ☐ c. roads ☐
d. developers ☐ e. deterioration ☒
f. other:

15. RELATED OUTBUILDINGS AND PROPERTY:
a. barn ☐ b. carriage house ☐ c. garage ☐
d. privy ☐ e. shed ☐ f. greenhouse ☐
g. shop ☐ h. gardens ☐
i. landscape features: ☐
j. other: ☒ These include piers in various states of preservation and use; one railroad transfer bridge; and wooden platforms supporting public access, heliport, ferry, sports, and restaurant facilities.
Of these structures, Pier 57, the piersheds at Piers 60 and 61, and the Baltimore & Ohio Railroad Transfer Bridge at 26th Street have been determined eligible for the State and National Registers of Historic Places.

16. SURROUNDINGS OF THE BUILDING (check more than one if necessary):
a. open land ☐ b. woodland ☐
c. scattered buildings ☐
d. densely built-up ☐ e. commercial ☒
f. industrial ☒ g. residential ☐
h. other:

17. INTERRELATIONSHIP OF BUILDING AND SURROUNDINGS:
(Indicate if building or structure is in an historic district)
Most bulkheads were originally visible from the water only between piers, whose decks rested on lowered bulkhead faces. Piersheds, bulkhead sheds, and headhouses covered bulkhead tops in these areas. Except for areas around Gansevoort Street and between West 35th and 37th Streets (the latter outside HRPC's planning jurisdiction), masonry bulkheads were continuous along most of the location in question.

18. OTHER NOTABLE FEATURES OF BUILDING AND SITE (including interior features if known):
At the three sites built to accommodate passenger ship terminals, bulkhead construction involved extensive upland excavation behind long coffer dam systems. These terminals were built between West 11th and Gansevoort Streets (Gansevoort Piers), Little West 12th and West 23rd Streets (Chelsea Piers), and West 44th and 52nd Streets. See Item 20 below.

SIGNIFICANCE

19. DATE OF INITIAL CONSTRUCTION: 1871 - ca. 1960

ARCHITECT:

BUILDER: New York City Department of Docks and successor agencies

20. HISTORICAL AND ARCHITECTURAL IMPORTANCE:
See attached page.

21. SOURCES
See attached page.

22. THEME:

9. STRUCTURAL SYSTEM

Viewed from the water, there are three major kinds of Hudson River bulkheads retaining the landfilled waterfront south of West 59th Street: quarry-faced ashlar granite walls, pre-cast or cast-in-place concrete walls, and timber cribwork. The masonry bulkheads are much more varied in their foundation systems, and reflect all the evolutionary stages of about 50 years of Department of Docks design work. Masonry wall foundations reflect bottom conditions, the need for pile footings, and the use of pile-supported relieving platforms behind the walls to reduce live load pressure and lateral thrusts.

Masonry Bulkhead

There is no standard typology for the masonry bulkheads. Figures 1-6 show the distribution and typical design of different bulkhead types, based on a classification scheme that attempts to show the full range of design variations. Other classifications have also been used (e.g., Hoag 1906; Mueser Rutledge Consulting Engineers 1997). The classifications used here, and the respective percentages of all the masonry bulkheads built from Battery Place to West 59th Street*, are:

Type I. GRANITE OR CONCRETE BULKHEAD ON FIRM OR ROCK BOTTOMS (See Figure 2)

Type I was typically built on firm bottoms less than 40 feet below mean high water. Type I totals about 18.6 percent of the masonry bulkheads.

IA Granite blocks on riprap, built at the Battery in 1871 as the first Department of Docks bulkhead—comprises about 2 percent of the masonry bulkheads.

IB Granite wall supported by one to three pre-cast concrete blocks and bagged concrete, built ca. 1872-1920 at Cedar Street and between 52nd and 59th Streets—comprises about 7 percent of the masonry bulkheads.

IC Concrete wall built ca. 1915-1936 between 44th and 52nd Streets—comprises about 9.5 percent of the masonry bulkheads.

Type II. PILE-SUPPORTED GRANITE BULKHEAD WITHOUT TIMBER RELIEVING PLATFORMS

(See Figure 3)

Type II was usually built on soft or deep mud bottoms 40-170 feet below mean high water. Type II totals about 23.1 percent of the masonry bulkheads

IIA Granite wall on mass concrete block, resting on a 2-inch-thick concrete bed, built ca. 1873-1875 in several sections between Murray and Horatio Streets—comprises about 19.8 percent of the masonry bulkheads. Some sections of this type were replaced by Types IIIB and IV.

IIB Granite wall on concrete block resting on a 2-timber-thick grillage, with inclined bracing piles, built ca. 1875 at Morton Street to Christopher Street—comprises about 2 percent of the masonry bulkheads.

IIC Granite wall on pre-cast concrete block, with mass concrete backing and inclined bracing piles—comprises about 1.3 percent of the masonry bulkheads. In this case, built ca. 1900 at Rector Street, the mass concrete backing served as an alternative to a Type IIIC timber-relieving platform.

Type III. PILE-SUPPORTED GRANITE BULKHEAD WITH TIMBER RELIEVING PLATFORMS

(See Figure 4)

Type III was built on soft or deep mud bottoms 40-170 feet below mean high water. The relieving platforms were encased in fill or cut off from open water. Type III totaled about 49.1 percent of the masonry bulkheads.

IIIA A modified form of Type IIA, built ca. 1874 at Canal Street—comprises about 1.9 percent of masonry bulkheads.

IIIB Granite wall on narrow concrete block, with inclined bracing piles taking lateral thrusts to below base block, and timber binding frame around piles; built 1876-1898 in many areas between Warren and 38th Streets—comprises about 21.5 percent of the masonry bulkheads.

* Percentages given in this form are based on the entire bulkhead from Battery Place to West 59th Street, including sections of the wall—between West 35and 38th Streets, and West 48th and 54th Streets—that are outside HRPC's planning jurisdiction.

9. STRUCTURAL SYSTEM (CONTINUED)

IIIC Granite wall on wider concrete blocks, similar to Type IIIB without binding frame, built ca. 1899-1915 in many areas between Carlisle and 44th Streets—comprises about 25.6 percent of masonry bulkheads.

Type IV. CONCRETE BULKHEAD WITH TIMBER RELIEVING PLATFORM
(See Figure 5)
Type IV generally replaced Type IIIC, with relieving platforms exposed to open water. This type was built in many areas ca. 1920-1960 for replacement of some older types, and as new construction. Type IV totaled about 8.8 percent of the masonry bulkheads.

From Battery Place to West 59th Street, the granite walls comprise approximately 81.3 percent of all the masonry bulkheads built in this area, and 77.9 percent of all masonry and timber bulkheads. In most cases, the granite walls rest on large pre-cast concrete blocks weighing 25-70 tons. The derrick-installed base blocks typically extend from about 2.5 feet below mean low water to 16-40 feet. Regardless of foundation, all the granite walls, except the very earliest (see Figure 2, Type IA), were backed by mass concrete and originally included four courses of granite blocks laid as alternating headers and stretchers to an elevation of about 9.4 feet above mean low water. These blocks were typically 4 feet long and 2 feet wide, with the lowest course 4 feet high and the others about 1.75 feet high. Additional courses were sometimes added as bulkheads settled.

Above the facing blocks, a coping of 8-foot-long, 3-foot-thick granite blocks rose about 2.5 feet to street level. Twelve-inch-square timber backing logs, bolted to the coping, rose above street level in most areas not covered by piersheds, bulkhead sheds, or other structures. The backing logs helped prevent wheeled vehicles from rolling over the top of the bulkhead into the river (see Photo 8 and Figures 2, Type IB; 3, Types IIB and IIC; and 4, Types IIIB and IIIC). Original or later variations in granite-face construction included round and rectangular openings for stream, sewer, or drainage outfalls (see Photos 3 and 5).

The concrete-face bulkheads total about 18.3 percent of the masonry walls (18.1 percent of the total masonry and timber bulkhead), and consist of sections resting on rock (see Figure 2, Type IC) and sections resting on relieving platforms (see Figure 5, Type IV).

Timber Bulkhead

Timber cribwork totals about 4 percent of all the current bulkheads south of West 59th Street, and is found at Little West 12th Street (built ca. 1870-1905) and outside HRPC's planning jurisdiction between West 35th and 37th Streets (built ca. 1885-1890) (see Figure 6: Type V and Atypical Significant Type 2). Typically, timber bulkheads from this era consist primarily of vertically layered timber cells, floated into place and sunk with rock and earth fill, which often reached 20-25 feet below mean low water and extended about 10 feet above this elevation. In section, cribs below mean low water typically extended to widths of 20 to 25 feet, sometimes tapering on the exterior or both faces as they rose. Above mean low water, crib widths in section narrowed to about 15 feet. Square timbers—spiked or bolted together in a smooth, continuous face and fitted onto notched cribwork logs—formed the outer face of the bulkhead above mean low water in most cases.

10. CONDITION

A thorough investigation of the condition of the bulkhead has been conducted for the Hudson River Park Conservancy (HRPC) by the firm of Mueser Rutledge Consulting Engineers in the fall-winter of 1996-1997. As part of this study, Mueser Rutledge reviewed previous inspection reports, including a study the firm prepared in 1989 for the New York State Department of Transportation as part of the Route 9A Reconstruction project; conducted inspections of the bulkhead from both land and water (during mid- and low-tide conditions); conducted limited diver inspections; took core samples of timber piles at relieving platforms to investigate the existence and extent of marine borer damage; and identified areas requiring repair, remediation, or new construction and developed concepts for basic repair types. The following excerpt is from Mueser Rutledge's Final *Hudson River Park Project Bulkhead Condition Review* report:

> In general, the visible portions of the bulkhead are in fair to good condition. At some locations, the granite capstone has been replaced with cast-in-place concrete. Timber backing logs (curbs) along the top of the bulkhead and fendering piles, where installed, are typically in a deteriorated condition. Facing stones and capstones are missing in various sections along the bulkhead specifically at junctions with former piers. Mortar between stone facing blocks in the splash zone is typically weathered and often has been eroded away. Over much of the alignment, the stone facing blocks are chipped, eroded at the edges and portions of block are missing. This 'worn' condition is generally not considered to be a structural defect, but unless replaced, missing blocks could lead to structural degradation and loss of fill inboard. Although a number of blocks contain spalls that vary in degree, this condition, while not aesthetically pleasing, should not be viewed as a structural insufficiency. Other visible masonry and concrete elements are generally in good condition.
>
> In the northern vicinity of the site, the bulkhead contains approximately one thousand feet of low-water relieving platforms over water where the timber piles that support the concrete bulkhead wall are visible above the mudline. Typically, the concrete bulkhead wall in this area contains spalls and cracks. Many of the outfalls which penetrate the bulkhead in this area are in poor condition. The timber piles, pile caps and decking in this area exhibit signs of marine borer infestation. At several locations, gaps between the piles and pile caps exist (non-bearing). Gaps of approximately one inch width between the timber deck plans exist at several locations. No fill loss through these gaps was observed at the time of the inspection.
>
> At isolated locations throughout the park alignment, the surface inboard of the bulkhead generally contains small sinkholes and depressions. Although a fair amount of the surface immediately adjacent to the bulkhead has recently been repaved, the surface elevation generally varies. A significant amount of grade variation is due to the installation of multiple asphalt pavement overlays over time in adjacent areas.

11. INTEGRITY

As described above in response to Item 9, "Structural System," and Item 10, "Condition," when viewed from the water, there are three main types of Hudson River bulkhead: 1) quarry-faced ashlar granite walls constructed between ca. 1871 and 1920, which comprise nearly 78 percent of all the bulkhead between Battery Park City and West 59th Street; 2) concrete face bulkhead constructed between ca. 1920 and 1970, which comprises approximately 18 percent of the bulkhead between Battery Place and West 59th Street; and 3) timber cribwork built ca. 1870 to 1905, which comprises roughly 4 percent of all current bulkhead between Battery Place and West 59th Street. Thus, the appearance of the bulkhead is not consistent for its entire length, but rather contains a mix of materials.

In addition to the type of replacement of bulkheads of earlier design with later designs at the same locations, there have been two other major changes to the bulkhead that have affected its integrity. First, intact sections south of Harrison Street were buried ca. 1970 behind fill used to create Battery Park City. Second, since World War II, the uppermost elements of bulkhead wall and coping have frequently been altered. Modifications include vertical additions of granite block facing to address bulkhead settlement, and use of several kinds of concrete infill to replace granite coping blocks or areas formerly occupied by pier decks. These modifications were made by various agencies and tenants, often without any attempt to create a uniform appearance. The dates of these modifications are incompletely documented. In several locations, new railings or other edge treatments, have been mounted in the bulkhead. These include the new steel railings installed ca. 1994-96 along the western edge of the interim public safety zone (bikeway/walkway) on New York State Department of Transportation property between Battery Park City and 29th Street.

Other alterations reflecting lack of maintenance include loss of timber backing logs and coping blocks, weathering or wear damage to wall facing blocks, and recent marine borer damage to exposed timber-relieving platforms and piles. Changes made to bulkhead tops, and weathering or wear damage have generally not threatened the structural integrity of visible bulkhead components. Aside from the marine borer damage, foundations of the granite- or concrete-faced walls are evidently in good condition. Cribwork foundation conditions are not known.

20. HISTORICAL AND ARCHITECTURAL IMPORTANCE

Summary

Between 1871 and 1936, the City of New York built more than 5 miles of bulkhead along the Hudson River, extending in an almost unbroken line from the Battery to the south end of the New York Central Railroad's terminal at West 59th Street. The vast majority of this construction consisted of masonry walls on a variety of foundation systems, with quarry-faced ashlar granite block forming the visible face along nearly 80 percent of the armored frontage (see Photo 1). Masonry bulkhead construction was the "... most expensive and most important class of... permanent [waterfront] improvement" undertaken by the City (Hoag 1906: 107), during a long campaign to maintain New York's status as the premier American port. The carefully built granite walls created a consistent surface to waterfront sections seen by many thousands of transatlantic passengers, reinforcing an aura of commercial prominence. The City rarely made such investment in waterfront sections not used for shipping. North of 59th Street on the Hudson River, the only comparable construction was about 1,100 feet of masonry bulkhead built ca. 1902-1908 in an area used for the 130th Street ferry.

The City's waterfront redevelopment program was significant as the first and largest of its kind in the United States, and included construction of individual piers and four complete Hudson River terminals for transatlantic passenger traffic. With the disappearance of virtually all the original superstructures, the well-preserved bulkheads remain the principal artifacts of an unprecedented public effort that helped sustain Manhattan's maritime prominence until the era of airplane travel, containerized shipping, and interstate trucking after ca. 1960. The bulkhead line reflects large upland excavations at three of the passenger terminals, built between 1897 and 1936 in a race to accommodate ever-longer steamship liners within federally controlled pierhead limits. In addition to their importance in the history of urban planning and international commerce, the varied masonry bulkhead sections reflect evolving marine substructure design, including significant and influential innovations made by municipal engineers. The last general bulkhead form, including concrete facing on a low-water relieving platform (see Figure 5), became a standard for new or replaced pile-supported bulkheads after ca. 1920. Since World War II, a variety of repairs have been made by different agencies and tenants to the uppermost components of the granite walls, often without any attempt to create a uniform appearance.

Older timber bulkhead designs, built by the City or several railroads in areas not used for transatlantic shipping, may include significant but deeply buried, undocumented historic engineering information at cribwork bottoms. This information is probably at least 20-25 feet below mean low water.

Urban and Commercial Redevelopment Context

The City's waterfront redevelopment began in response to decades of deterioration, congestion, and siltation. Although privately owned, antebellum wharves and piers were too encumbered by municipal controls and often-corrupt bureaucracy to warrant investment. Accumulating sewage amidst rotting solid-fill wooden piers threatened public health as well as commerce. New York State's reorganization of the City's charter in 1870, a reaction to widespread public concerns, included creation of a Department of Docks to redevelop Manhattan's waterfront on the Hudson and East Rivers. The State deeded all previously ungranted underwater shoreline property to the City, and the Department was authorized to acquire, rebuild, and regulate existing commercial waterfront. Under the Department's first Engineer-in-Chief, Gen. George B. McClellan, a plan emerged in 1871 that in general form was followed until the last major Hudson River terminal was finished in 1936. Noting that the port's narrow tidal range did not require the enclosed tidal basins seen in Great Britain, McClellan proposed new bulkheads sufficiently outshore of existing waterfronts to create a 250-foot-wide marginal street, from which 60- to 100-foot-wide piers with cargo sheds would project 400-500 feet around 150- to 200-foot-wide slips. As property was acquired and as commerce warranted, the City built the bulkheads, built or rebuilt pier substructures, and leased redeveloped areas to private companies who were usually responsible for piershed and headhouse construction.

When McClellan's plan appeared, regional water pollution had already decimated the marine borers that destroyed wooden structures, allowing for open-pile wooden-pier construction. Open-pile piers had better tidal flow, less siltation, and greater flexibility in ship-versus-pier encounters than the more solid structures built earlier. In contrast to the piers, the bulkhead proposed by McClellan was all masonry above footings or piles. McClellan remains best known for his over-cautious command of Civil War armies, but he was by training and experience an excellent engineer. Before the war, he made surveys for various railroad and military installations, and served as chief engineer or president of several railroads. The need for very substantial footings in railroad construction may account in part for McClellan's emphasis

on bulkheads intended for unusual permanence. Origins of the Department's earliest bulkhead designs remain under-documented. McClellan was in Europe from late 1864 until 1868, and he may have seen designs for British bulkheads that resemble those built by New York City (cf. Bray and Tatham 1992). The choice of a quarry-faced bulkhead with concrete foundations likely reflects a widespread desire among New York's commercial leaders for a waterfront with the imposing character of European ports, commensurate with the City's growing international stature. McClellan ignored most recommendations for waterfront plans offered during public hearings, but it is probably no coincidence that many of these ideas included masonry bulkheads, piers, piersheds, and warehouses. Concrete above low water was not then regarded as sufficiently durable "...for a work of such monumental character" (Greene 1917: 62).

Surviving bulkheads from the 1870's include a number of sections south of Gansevoort Street, including the earliest Department project, built at the Battery in 1871 (see Figure 2: Type IA). Until ca. 1880, the pace of municipal waterfront redevelopment was slowed by depressed economic conditions following the Panic of 1873, limits on allowable annual bonding for property acquisition, and initial problems with soft-bottom bulkhead designs. As these economic conditions and engineering solutions improved, construction accelerated. By ca. 1905, the Department had built about 3.7 miles of Hudson River masonry bulkhead, most of it after 1880 (Hoag 1906: 120; Buttenweiser 1987: 83). The largest projects in this period were the liner terminals built in the Gansevoort (1897-98) and Chelsea (1902-08) sections, both of which involved upland excavation.

The section between these terminals was one of only two south of West 59th Street in which masonry bulkheads were not built. At Gansevoort Street, solid fill originally retained by timber-crib bulkheads served as a Department of Docks work yard, and was later redeveloped by the City as the second West Washington or Gansevoort Market in 1889. During part of the 20th century, the market site served as a garbage-processing facility, a use that continues today. Surviving cribwork along the north face of this site is partially visible, and has been classified as Type V in Figures 1 and 6 (Mueser Rutledge Consulting Engineers, 1997). Within HRPC's planning jurisdiction, an atypical waterfront section remains between West 34th and 35th Streets, where the shore consists of a low-rubble slope. It appears that no bulkhead of any kind was built along the current bulkhead line (see Photo 7).*

The remainder of the waterfront discussed here was used by cargo and passenger shipping firms, with the largest City projects after 1910 at the terminals between West 44th and 52nd Streets (1915-1936)** and West 55th and 57th Streets (1915-1917). Despite the effort to keep up with docking requirements of larger ships, some terminals proved not quite long enough as new vessels were built. Two curved indentations—9 and 40 feet deep, respectively—were made in the bulkheads at West 10th and 57th Streets to accommodate the bows of such ships.

Historic Engineering Context

The granite-faced masonry bulkheads built by the City until ca. 1920 were unique within the Port of New York. No commercial bulkheads in the region were ever finished in such a deliberately monumental manner. The City bulkheads were also perhaps the earliest American examples of granite seawalls placed on concrete bases, breaking a long tradition of bulkhead foundations made of various timber cribwork designs. Earlier stone-faced walls found in some New England ports appear to be on variants of crib foundations, or rest directly on shallow surfaces with timber reinforcing around the faces (Greene, 1917; Heintzelman, 1986). The Department of Docks made especially notable progress in the problem of supporting the bulkhead on soft-bottom or deep-mud conditions. After about 6 years of trial and error, including removal of some early bulkhead sections, the Department under Engineer-in-Chief George S. Greene, Jr. developed a remarkably successful design involving perhaps the earliest use of a relieving platform in the Port of New York (see Figure 4, Type IIIB). Although some sections of this type sank as much as 4 feet, no vertical deflection exceeding 6 inches was ever noted. Described as "[o]ne of the most remarkable...bulkhead walls" as late as World War I (Greene 1917: 88), the early relieving platform type used from 1876 to 1898 was praised in more detail by an 1895 Board of Consulting Engineers:

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* Outside of HRPC's planning jurisdiction, there is an atypical cribwork section between West 35th and 37th Street. In this location, cribwork conditions and extent have been obscured by pile-supported platforms built outshore on deposits of riprap (Mueser Rutledge Consulting Engineers, 1997).

** The section of this terminal between West 48th and 52nd Streets is outside HRPC's planning jurisdiction.

20. HISTORICAL AND ARCHITECTURAL IMPORTANCE (CONTINUED)

> To float a wall in mud when that wall must also take a horizontal thrust is a problem which can only be solved by care and experience, no formulas or mathematical rules being available. The wall, as now built, is a satisfactory solution of the problem. Your Board believes it to be a unique construction, one which is worthy of the most careful study, and deserves the strongest commendations...this wall...is remarkable for its originality and the excellence of its results (quoted in Hoag 1906: 117).

This design was modified slightly in 1899 with a wider concrete base block, which reduced timber and labor costs by eliminating the diver-installed timber binding frame used around the piles of the 1876 design. The surviving Hudson River bulkheads include examples of virtually all the granite-faced designs ever used by the Department, including those which led to the adoption of the most successful relieving-platform models (see Figure 3, Types IIA and IIB; Figure 4, Type IIIA).

The Department's designs probably influenced the early-20th-century adoption of relieving-platform construction for solid-fill structures by a number of railroads using the port. In these private designs, reinforced-concrete walls were supported on concrete and timber platforms set on timber piles cut off below mean low water. By ca. 1920, the Department eliminated its use of granite facing and began to use a similar design, with platforms set just above low water. This was the only type of municipal masonry bulkhead that left timber elements exposed to open water. Although not a problem when first built prior to ca. 1960, this design is now the most vulnerable to attacks by marine borers, which have reappeared in the port with the improvement of water quality since ca. 1980.

From ca. 1920 to 1960, concrete facing on a low-water relieving platform became a standard for new or replaced pile-supported bulkheads. Unlike the granite walls, which were dressed in an ashlar finish and divided into blocks, the concrete walls have a plain smooth finish and are monolithic. Approximately 18 percent of the bulkhead, scattered throughout the length of the waterfront, is of this design (see Figures 1 and 5). Since World War II, numerous other repairs have also been made, largely in an uncoordinated manner, to the bulkhead. The most common repair has been replacement of missing or damaged granite capstones with concrete that is cast in place (see Photos 2 and 5).

In addition to the masonry bulkheads, the Hudson River waterfront south of West 59th Street includes two sections of timber-crib bulkheads, noted above. The most exposed timber bulkhead is at Little West 12th Street (on the north side of the Gansevoort peninsula), and a buried section apparently survives outside of HRPC's planning jurisdiction from West 35th Street to 37th Street. Both timber bulkheads appear to be late-19th-century examples of what was, by then, a well-established and relatively standardized means of construction. When timber was relatively inexpensive, cribwork was a cheap form of bulkhead requiring only hand tools after any dredging phases. Disappearance of marine borers from the harbor beginning about 1850 made most bulkhead components permanent. Periodic replacement of all components subject to decay above mean low water complicates any identification of extant cribwork bulkheads with particular decades, and minimizes the significance of these upper elements. Cribwork bottoms are the least documented and probably most varied elements in timber bulkheads throughout the port, however, and tend to remain well-preserved under water. The bottoms of the Hudson River examples, buried at least 20 feet underwater, could include important information on once-widespread vernacular engineering practice.

National Register Criteria of Significance

As discussed under "Condition" (Item 10) and "Integrity" (Item 11), the masonry bulkheads are in fair to good condition. Beyond integrity, National Register eligibility is based on meeting at least one of four criteria of significance, summarized as follows:

A. Association with important historic events or activities;
B. Association with important persons;
C. Distinctive design or physical characteristics, including representation of a significant entity whose individual components may lack distinction; and
D. Potential to provide important information about prehistory or history.

The masonry bulkheads appear to meet at least Criteria A-C, and possibly Criterion D. The central place of the bulkheads in more than 60 years of City waterfront development, the considerable engineering and architectural investment made in bulkhead construction, and the influential role played by some bulkhead types in regional waterfront engineering, all appear to satisfy Criterion A. The central role of George B. McClellan (1829-1885) in initial bulkhead planning

and design appears to satisfy Criterion B. McClellan was one of President Lincoln's most important generals early in the Civil War, and was also an unsuccessful candidate for the American presidency in 1864. Criterion C is met by the presence not only of distinctive, influential engineering designs, but of the full range of bulkhead types built by the Department throughout the period of New York City's direct involvement in Hudson River waterfront development.

Even the latest type (see Figure 5: Type IV), similar to relieving-platform designs used elsewhere in the ports of New York and other cities, remains significant as part of the Department's long sequence of bulkhead designs. The masonry bulkhead appear well-documented in surviving drawings, descriptions of construction methods (e.g., Greene 1917: 88-94), and possibly in surviving original specifications. It is possible, however, that the surviving structures include undocumented details reflecting minor adaptations to bottom or other site conditions. Such undocumented details in the masonry or timber bulkheads could meet Criterion D.

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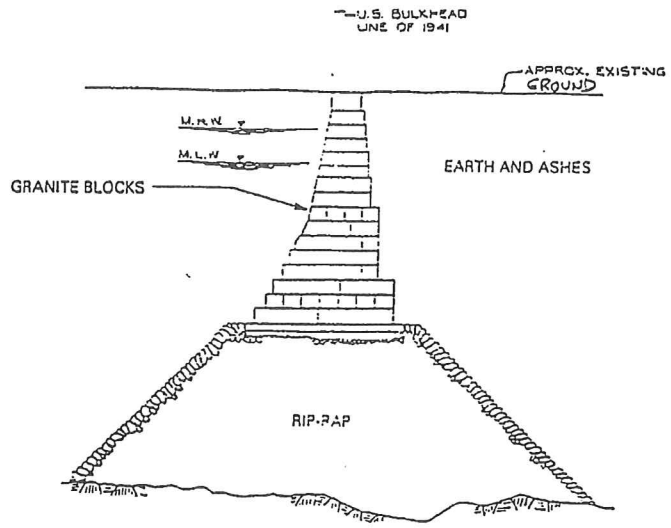
Figure 2

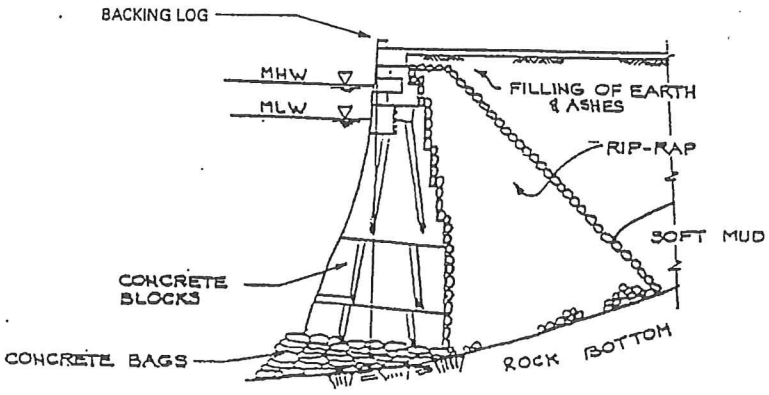
Bulkhead Type I Sections

Type I: Granite or Concrete Bulkhead on Firm or Rock Bottom



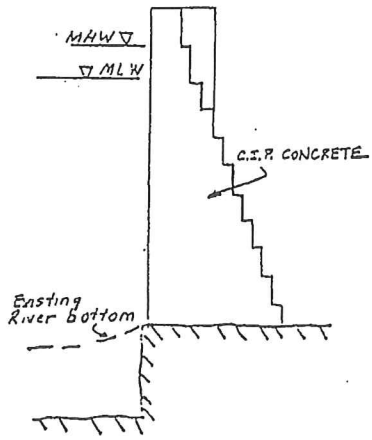
TYPE I-A

Granite blocks on rip-rap. Built in 1871 at Battery as first Department of Docks bulkhead.



TYPE I-B

Granite wall supported by 1-3 pre-cast concrete blocks and concrete base. Built c. 1872-1920 at Cedar Street and between 52nd-59th Streets. (Portion between 48th-54th Streets outside HRPC's planning jurisdiction.)



TYPE I-C

Concrete wall. Built c. 1915-1936 between 44th-52nd Streets.

0 25 FEET

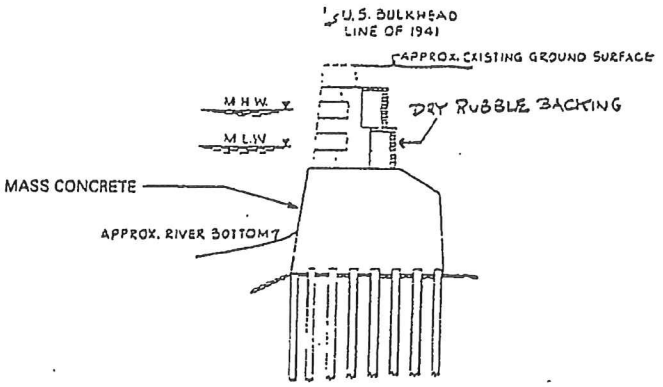
SCALE

Note: Type I was typically built on firm bottoms less than 40 feet below mean high water.
Source: Mueser Rutledge Consulting Engineers.

Figure 3

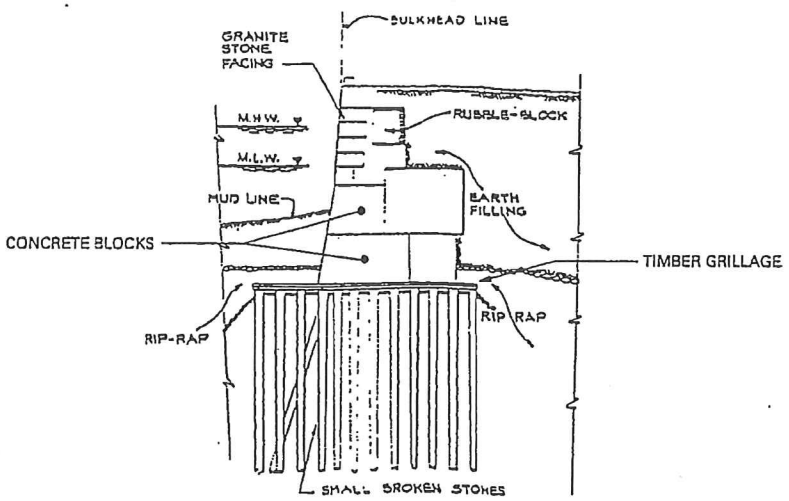
Bulkhead Type II Sections

Type II: Pile-Supported Granite Bulkhead Without Timber Relieving Platforms



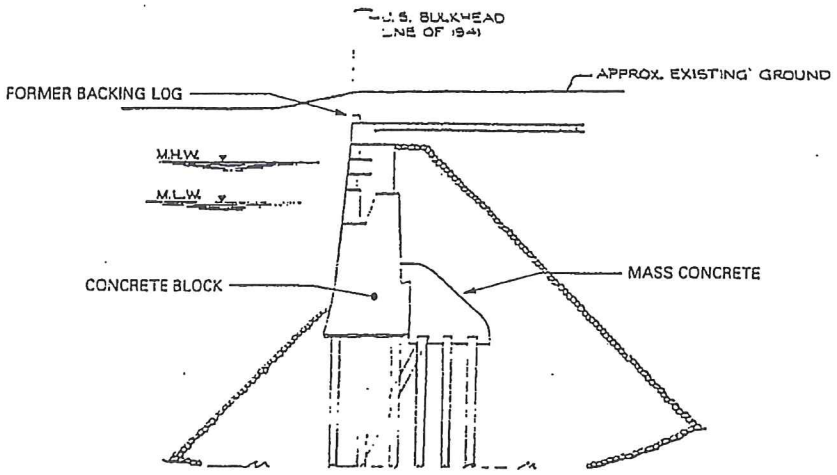
TYPE II-A

Granite wall on mass concrete block, resting on 2-inch thick concrete bed. Built c. 1873-1875 in several sections between Murray and Horatio Streets; some sections replaced by Types III-B and IV.



TYPE II-B

Granite wall on concrete block on 2-timber-thick grillage, with inclined bracing piles. Built c. 1875 at Morton and Christopher Streets.



TYPE II-C

Granite wall on pre-cast concrete block, with mass concrete backing and inclined bracing. An alternative to Type III-C timber-relieving platform. Built c. 1900 at Rector Street.

0 25 FEET

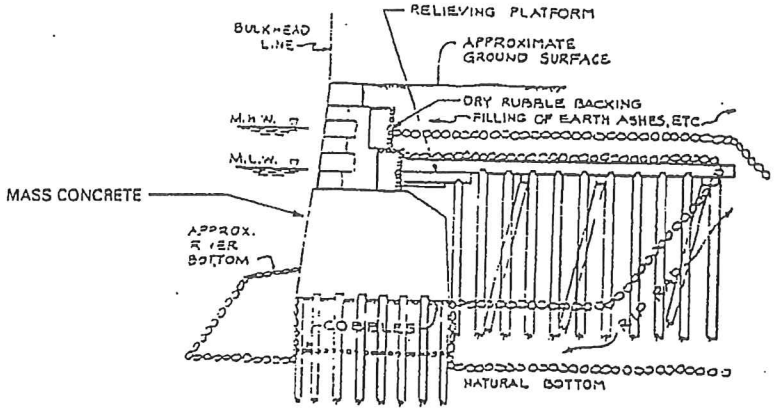
SCALE

Note: Type I I was usually built on soft or deep mud bottoms 40-170 feet below mean high water.
Source: Mueser Rutledge Consulting Engineers.

Figure 4

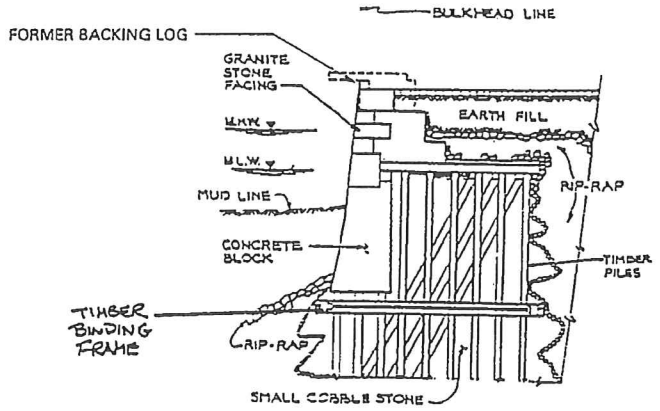
Bulkhead Type III Sections

Type III: Pile-Supported Granite Bulkhead With Timber Relieving Platforms



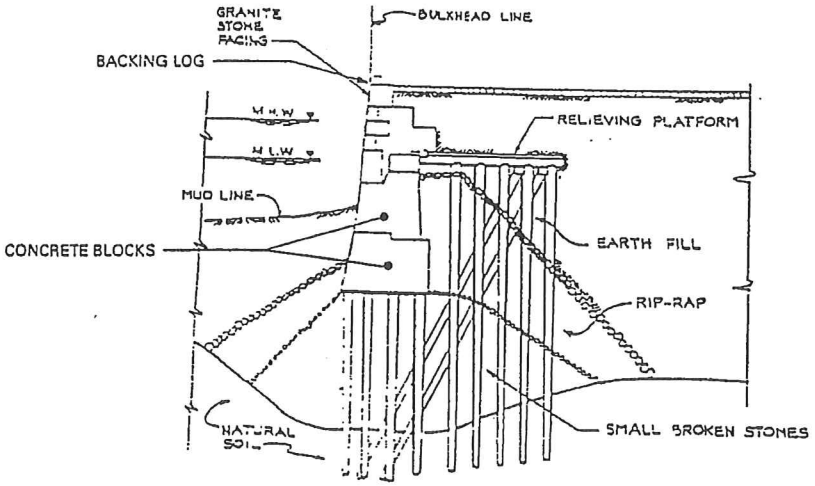
TYPE III-A

Modified form of Type II-A. Built c. 1874 at Canal Street.



TYPE III-B

Granite wall on narrow concrete block, with inclined bracing piles taking lateral thrusts to below base block, and timber binding frame around piles. Built 1876-1898 in many areas between Warren and 38th Streets.



TYPE III-C

Granite wall on wider concrete blocks, similar to Type III-B without binding frame. Built c. 1899-1915 in many areas between Carlisle and 44th Streets.

0 25 FEET

SCALE

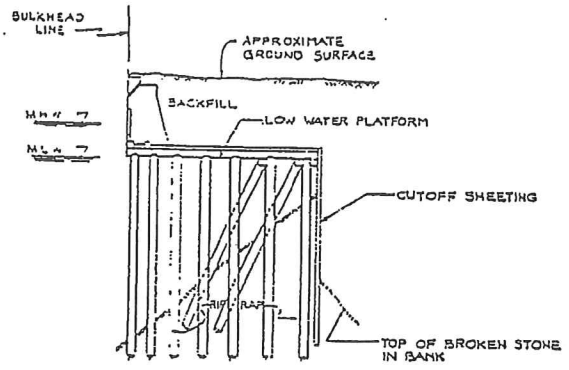
Note: Type III was built on soft or deep mud 40-170 feet below mean high water. The relieving platforms were encased in fill or cut off from open water.

Source: Mueser Rutledge Consulting Engineers.

Figure 5

Bulkhead Type IV Section

Type IV: Concrete Bulkhead With Timber or Concrete Relieving Platforms



TYPE IV

Concrete bulkhead with timber or concrete relieving platforms on piles. Built c. 1920-1960 in many areas, as replacement of some older bulkhead types and as new construction.

0 25 FEET

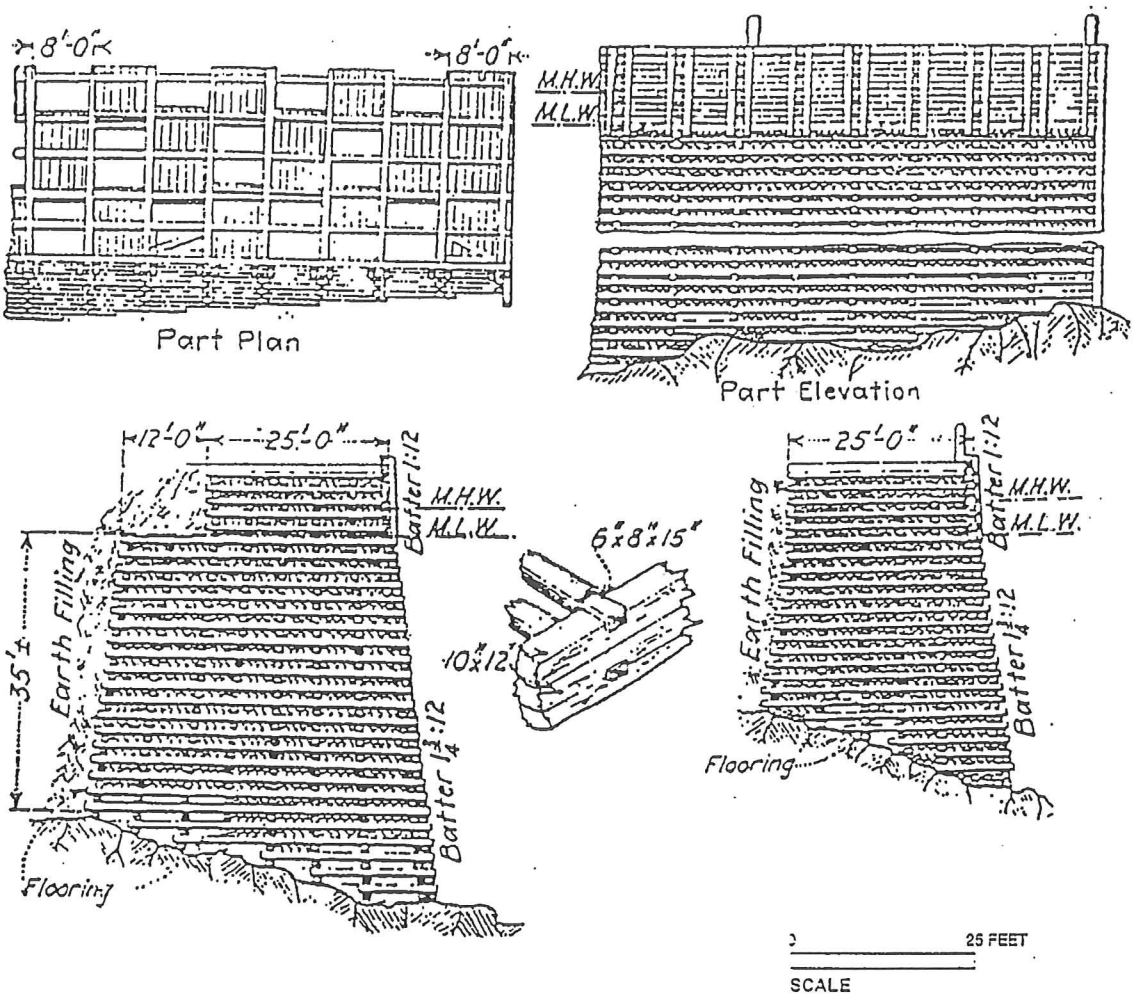
SCALE

Note: Type IV generally replaced Type III-C, with relieving platforms exposed to open water.
Source: Mueser Rutledge Consulting Engineers.

Figure 6

Bulkhead Type V Sections and Other Views

Type V: Timber Crib Bulkhead



TYPE V

Layered, rock- and earth-filled timber cells, with outer face of squared timbers above mean low water.

Note: This is a typical design and does not reflect possible crib-bottom variations adopted to specific bottom conditions. On the Manhattan waterfront south of West 59th Street, the only remaining cribwork bulkhead along the water is a late 19th century example at Little West 12th Street. There is also a cribwork bulkhead, built c. 1885-1890, buried near the water between West 35th and West 37th Streets, in an area outside HRPC's planning jurisdiction.

Source: Carleton Green. Wharves and Piers, 1917, pg. 53.

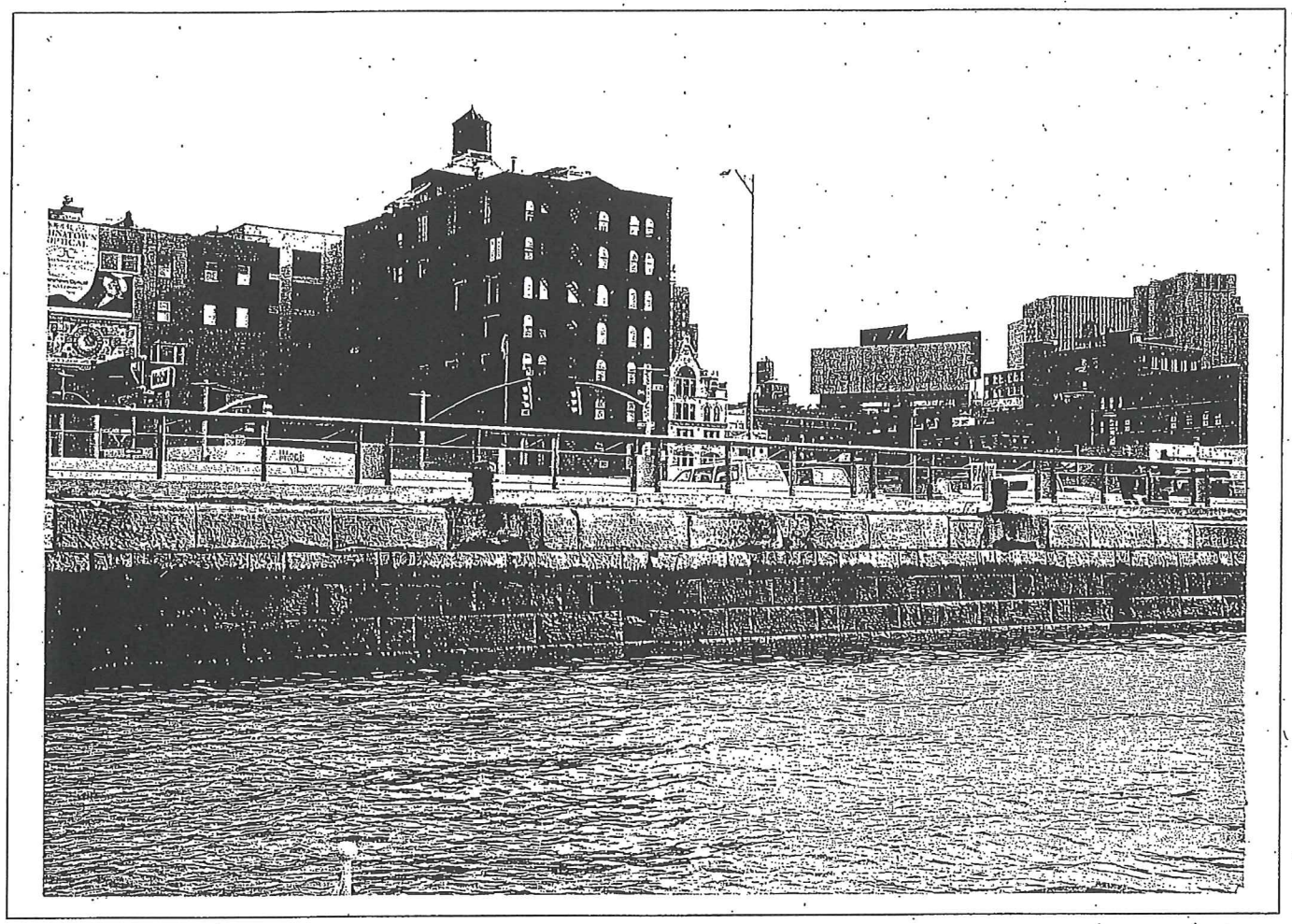


Photo 1

View southeast of granite bulkhead at approximately Canal Street (just north of Pier 32) showing new railing mounted in bulkhead along western edge of interim public safety zone (bikeway/walkway)

Type II.A

December 1996

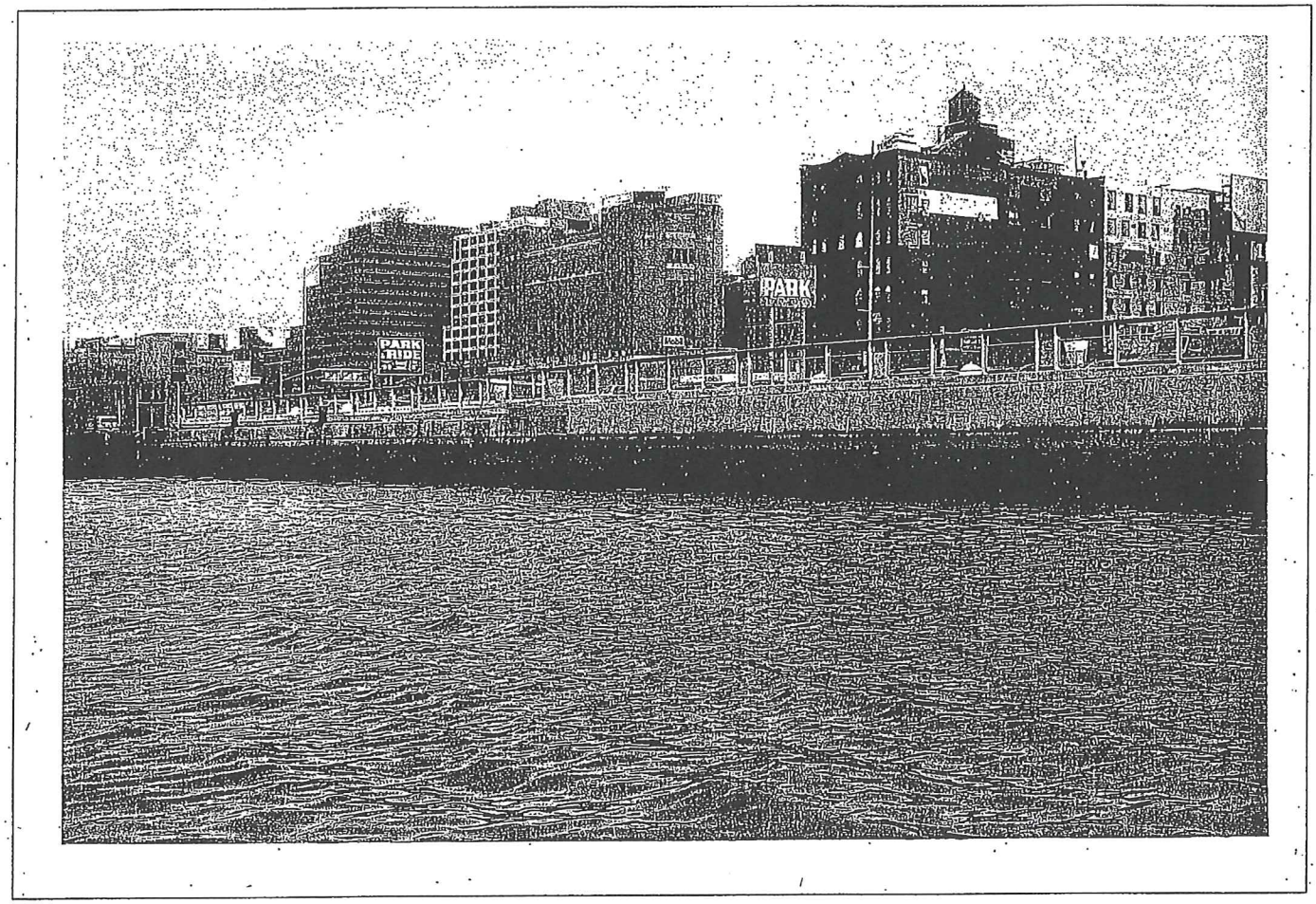


Photo 2

View northeast of granite bulkhead at Watts Street, with varied concrete and granite coping treatments and new railing

Type II.A

December 1996

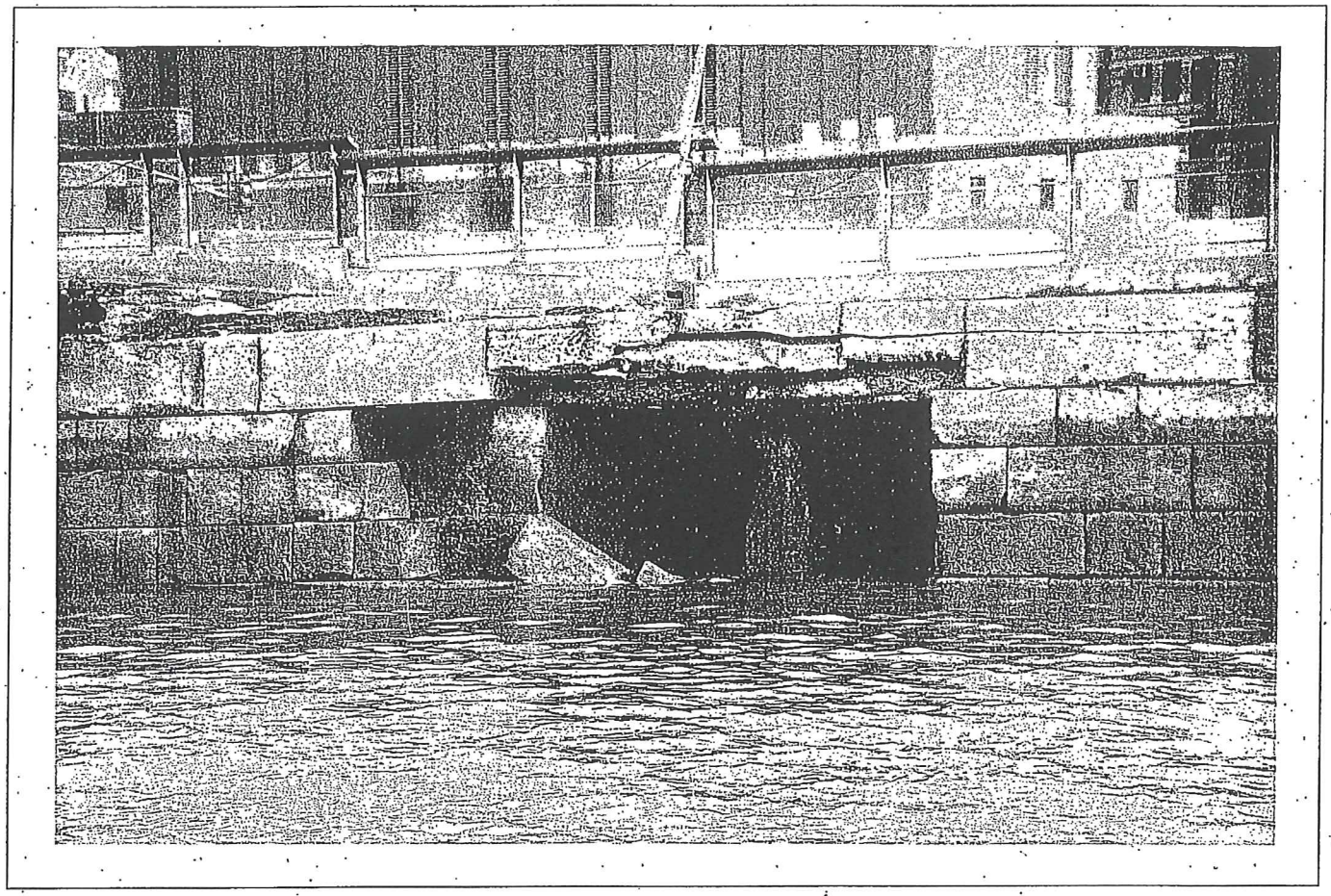


Photo 3

View east of granite bulkhead near Canal Street at stream outfall, with original coping blocks, partially collapsed facing, exposed interior facing, and new railing

Type III.A

December 1996

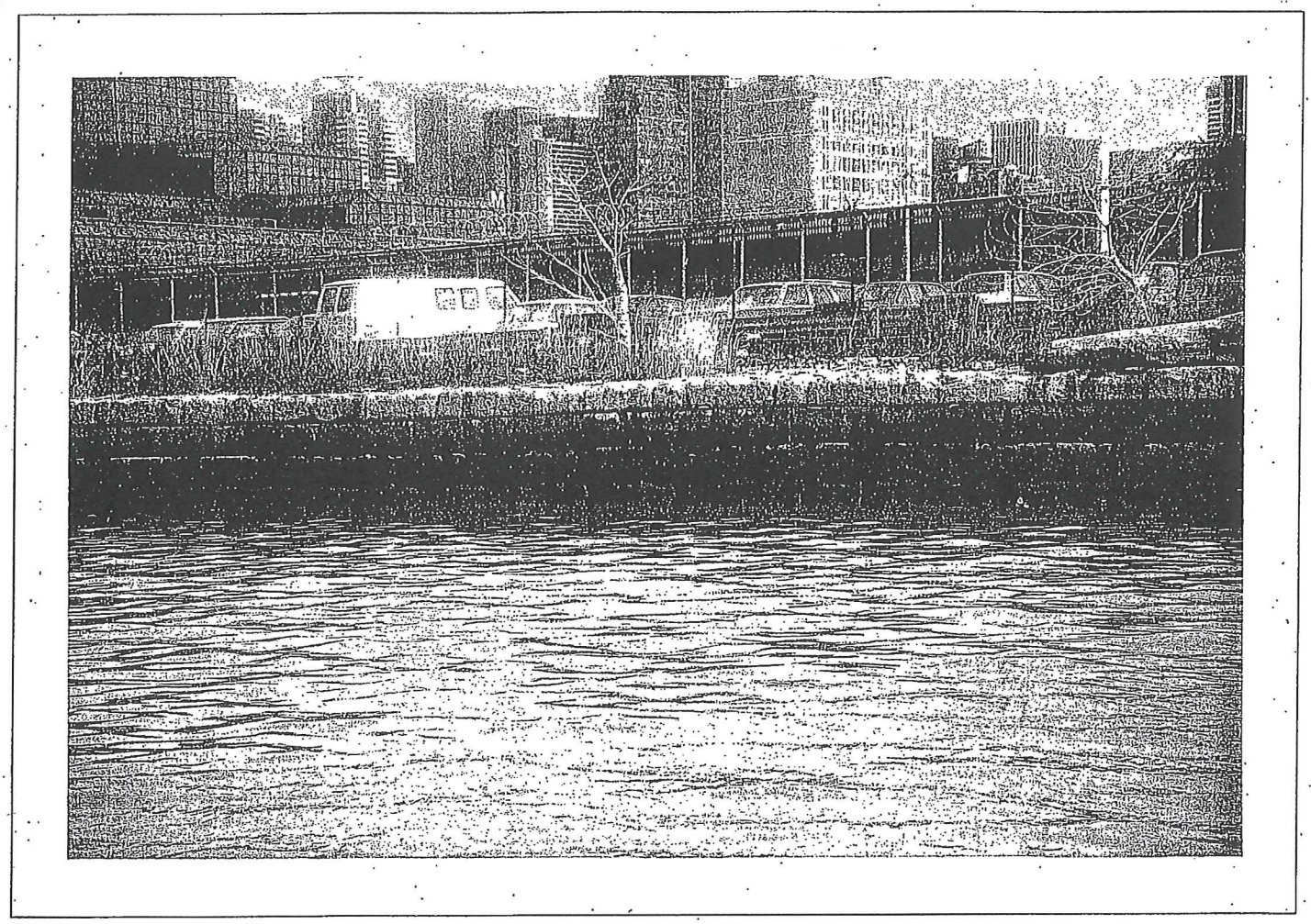


Photo 4

View east of granite bulkhead at 30th Street, with eroded original face and missing coping blocks

Type III.B

December 1996

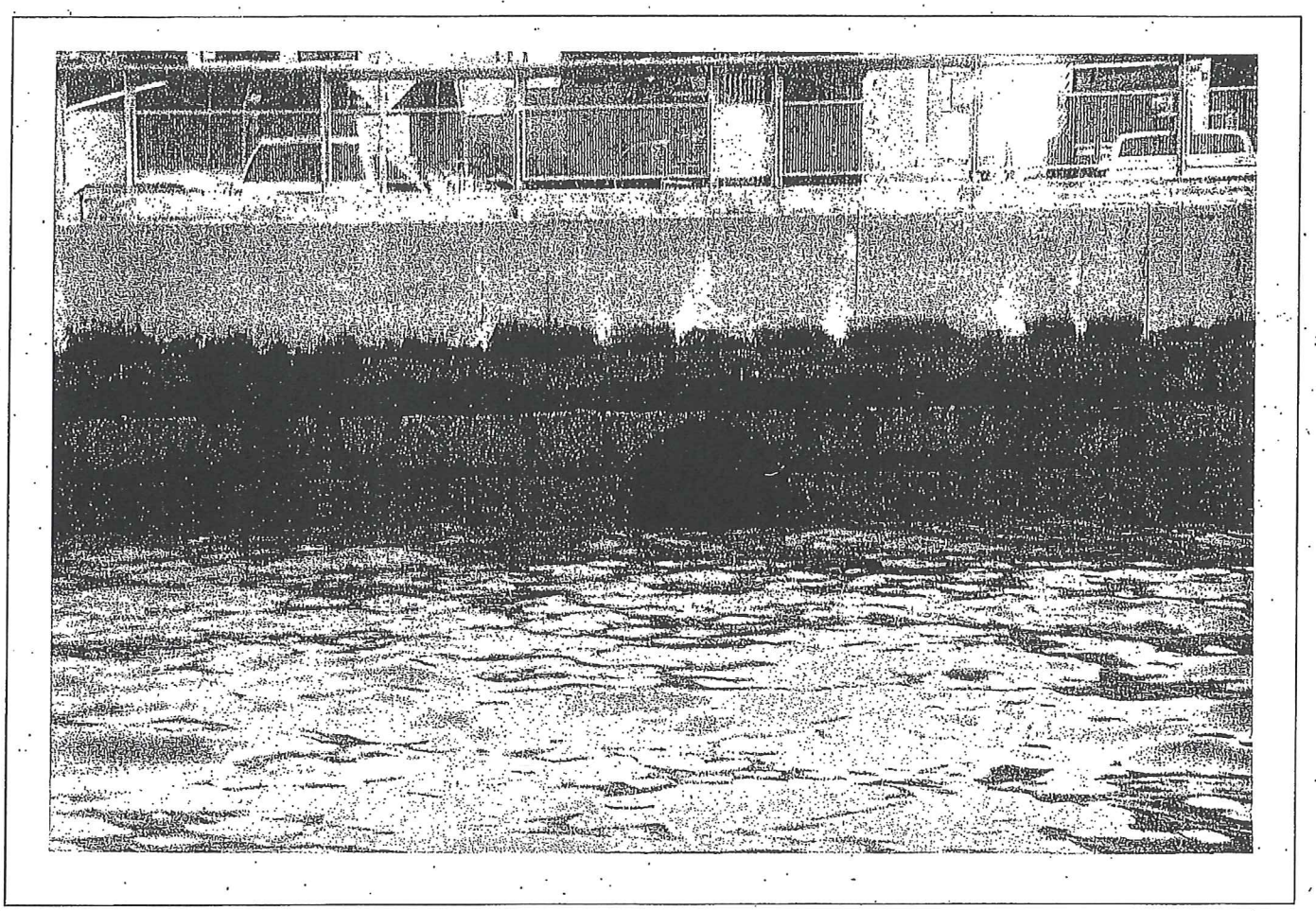


Photo 5

View east of granite bulkhead at Vestry Street with outfall, concrete replacement coping, and new railing

Type II.A

December 1996

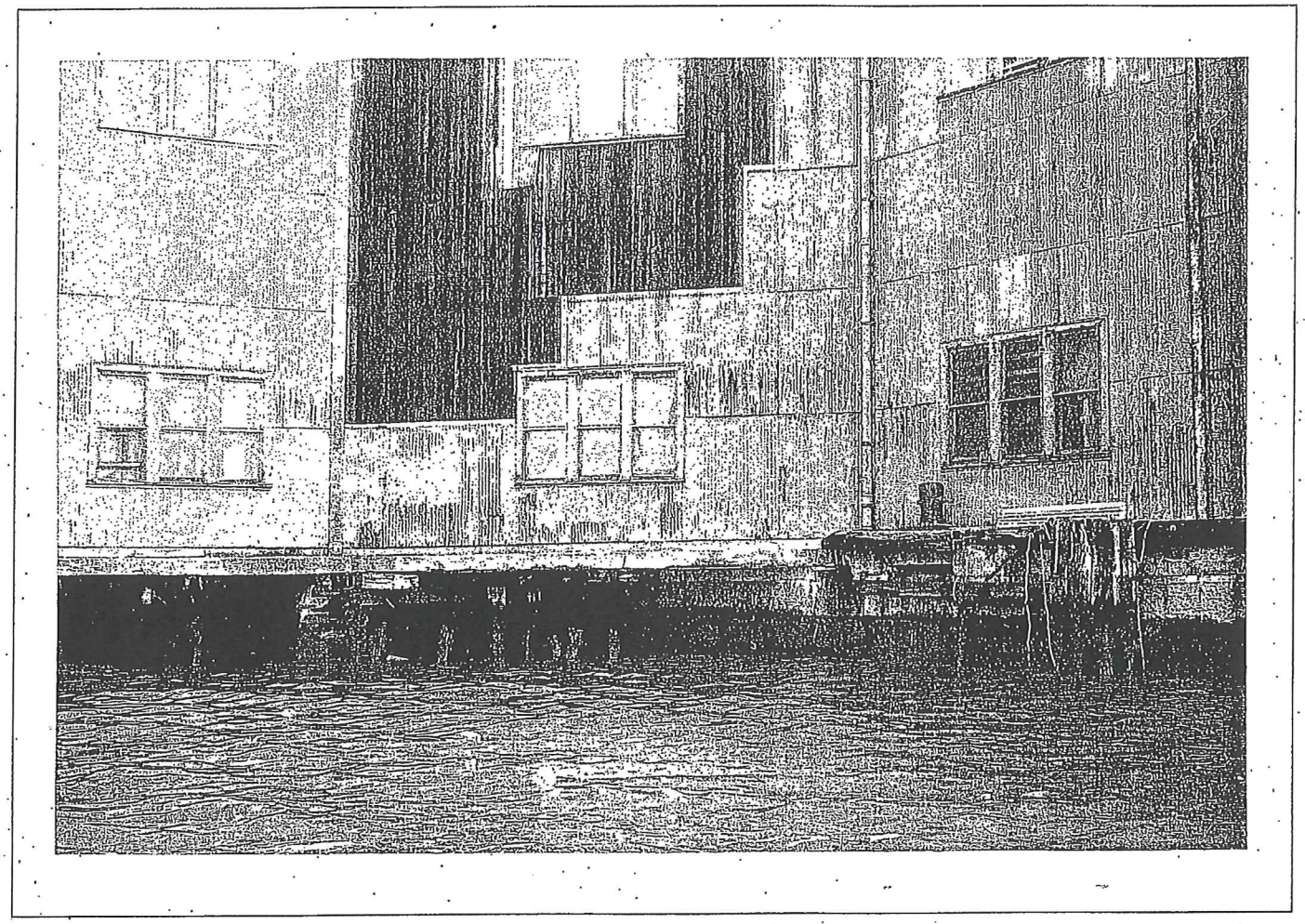


Photo 6

View north of granite bulkhead under Pier 64 at 24th Street, with pier deck set into bulkhead face

Type III.B

December 1996

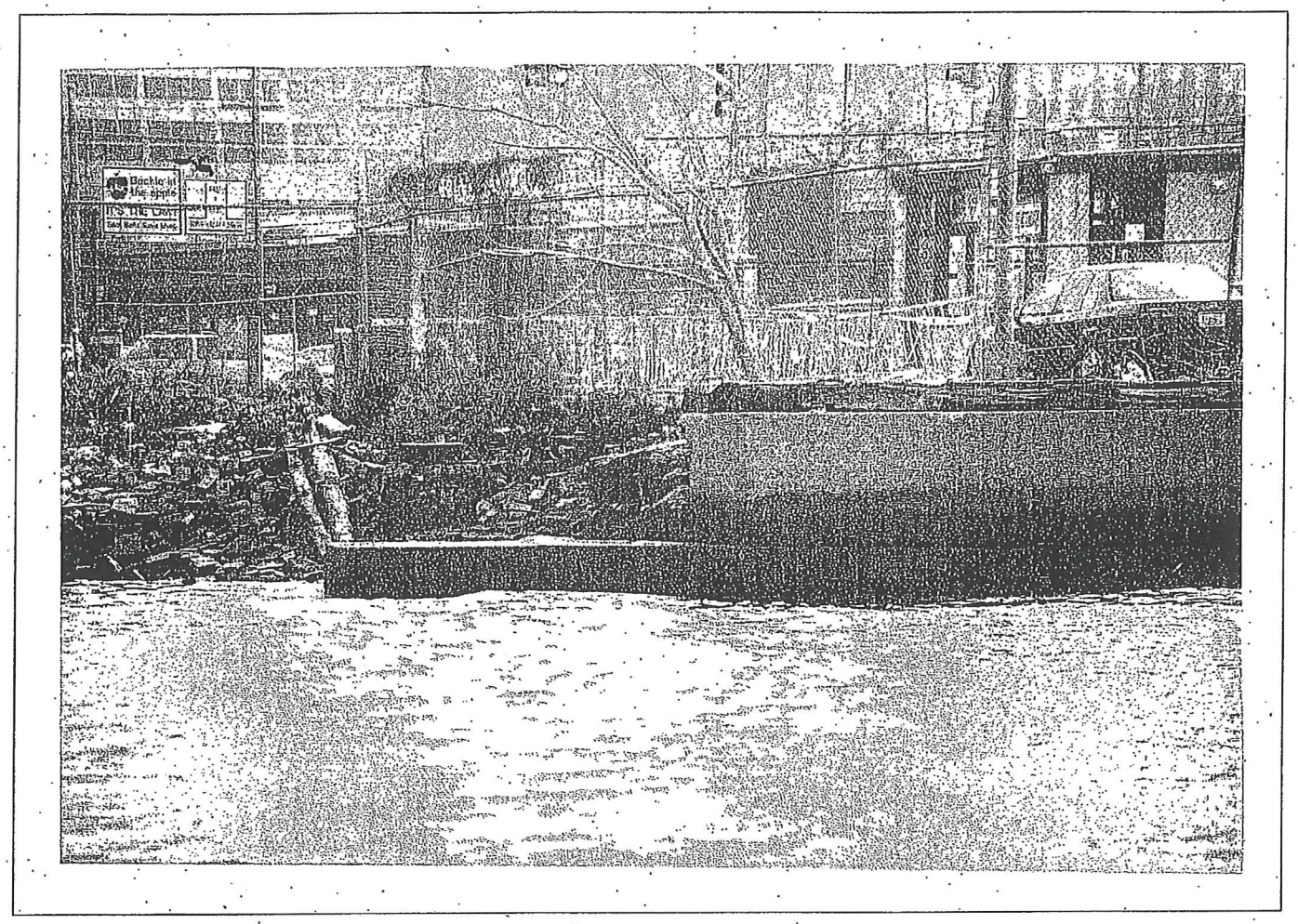


Photo 7

View east of shore section without bulkhead, south of Pier 76 between 34th and 35th Streets

Atypical not significant - Type 1

December 1996

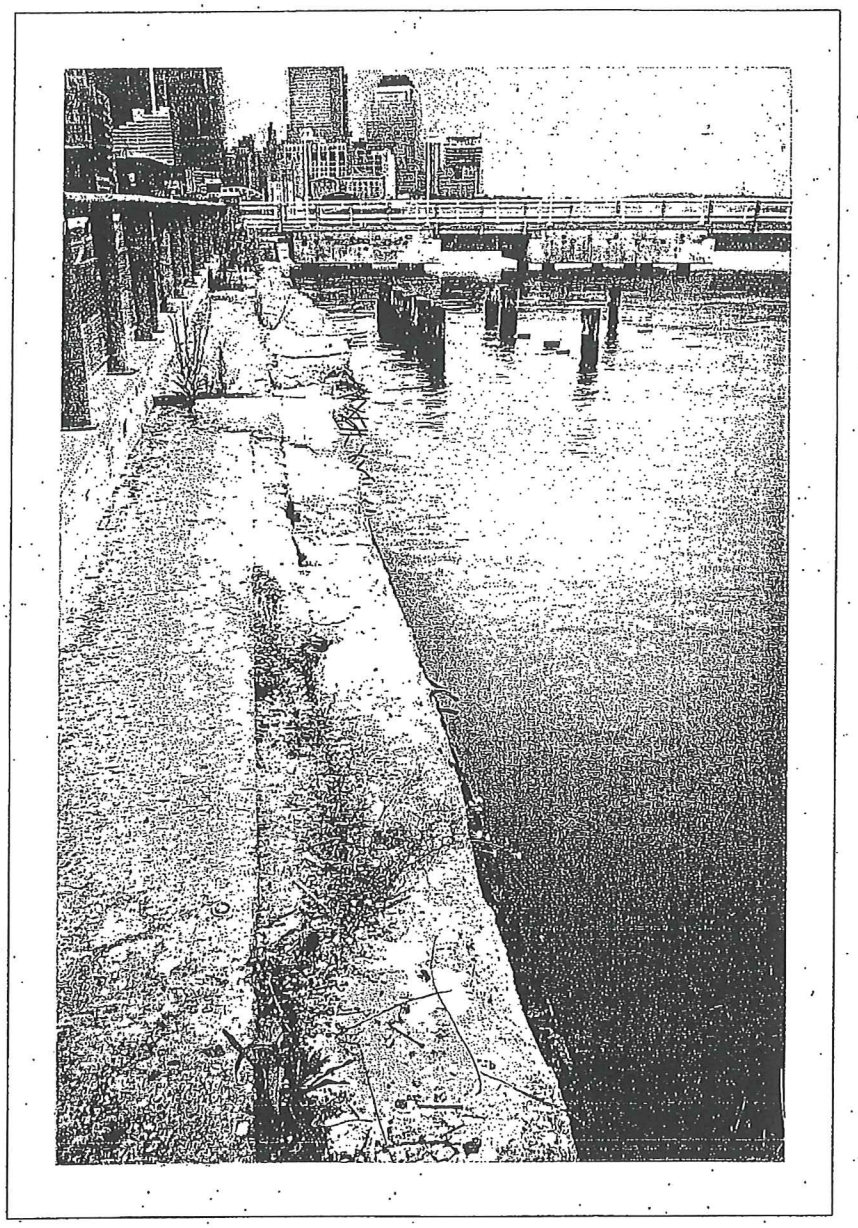


Photo 8

Top of bulkhead looking south from location of Pier 34 (above the Holland Tunnel). Granite capstone has been replaced by concrete edge; edge is irregular, cracked and reinforcing rods are exposed. Note introduction of new railing.

Type II.A

September 1996

Source: Mueser Rutledge Consulting Engineers

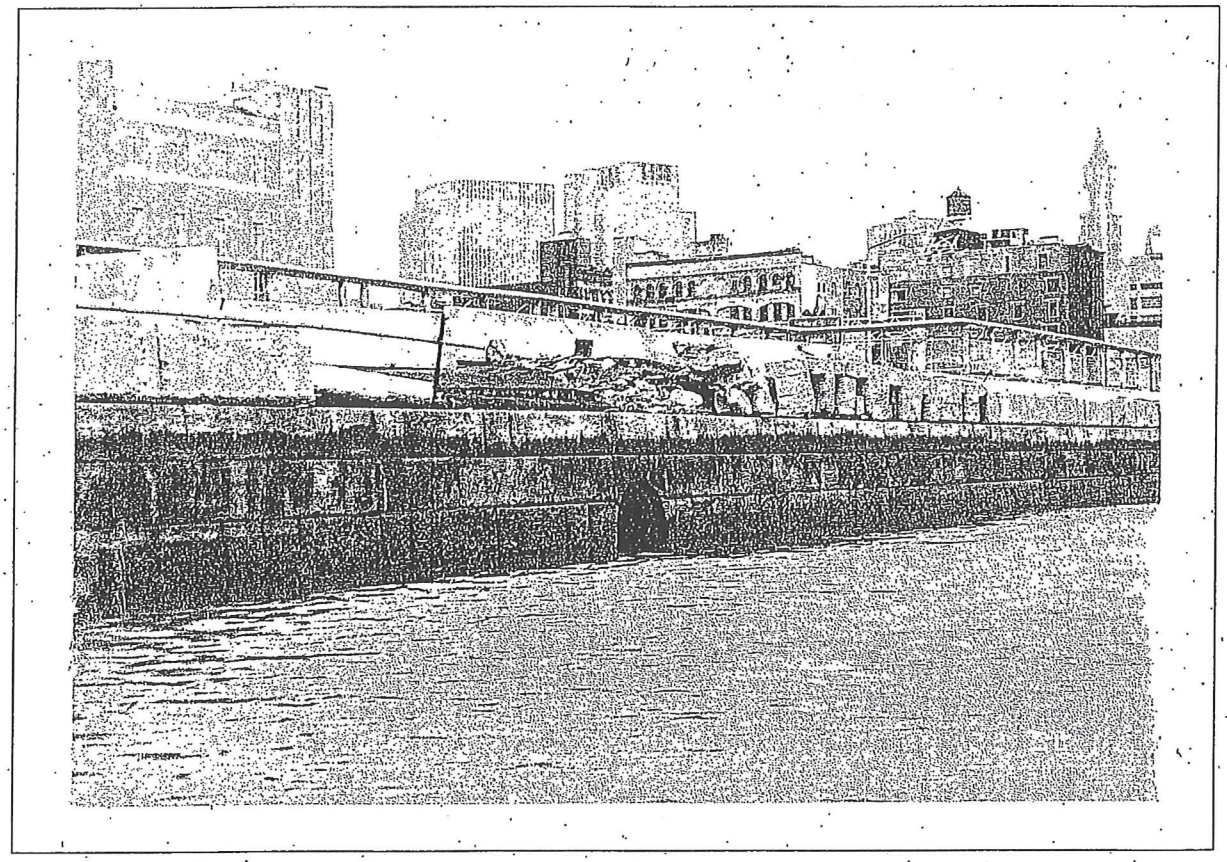


Photo 9

View south at granite bulkhead at approximately Van Dam Street. Note portion of capstone is missing and has been partially replaced by concrete block.

Type II.A

September 1996

Source: Mueser Rutledge Consulting Engineers

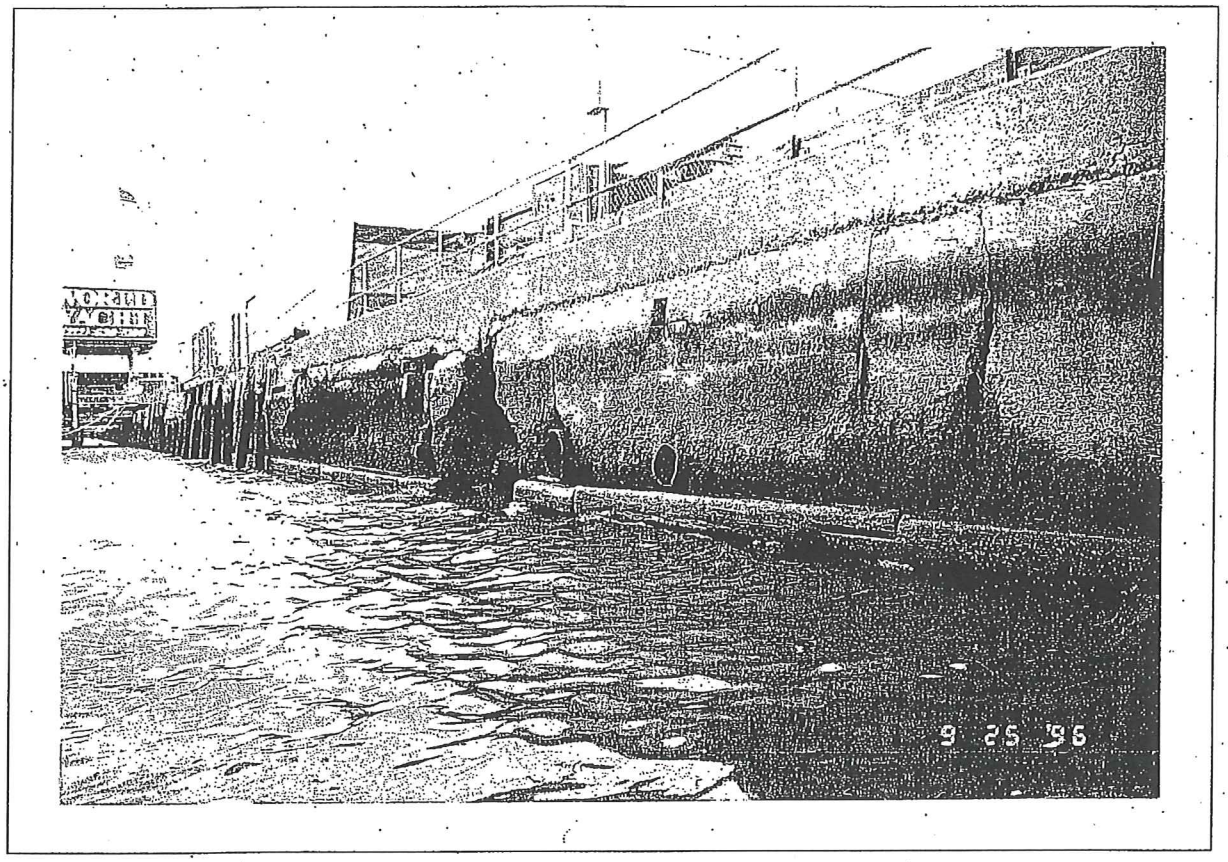


Photo 10

View of concrete bulkhead looking north from approximately West 40th Street. Bulkhead is in fair to poor condition at this location; erosion and spalling is evident, as are remains of timber fender system.

Type IV

September 1996

Source: Mueser Rutledge Consulting Engineers

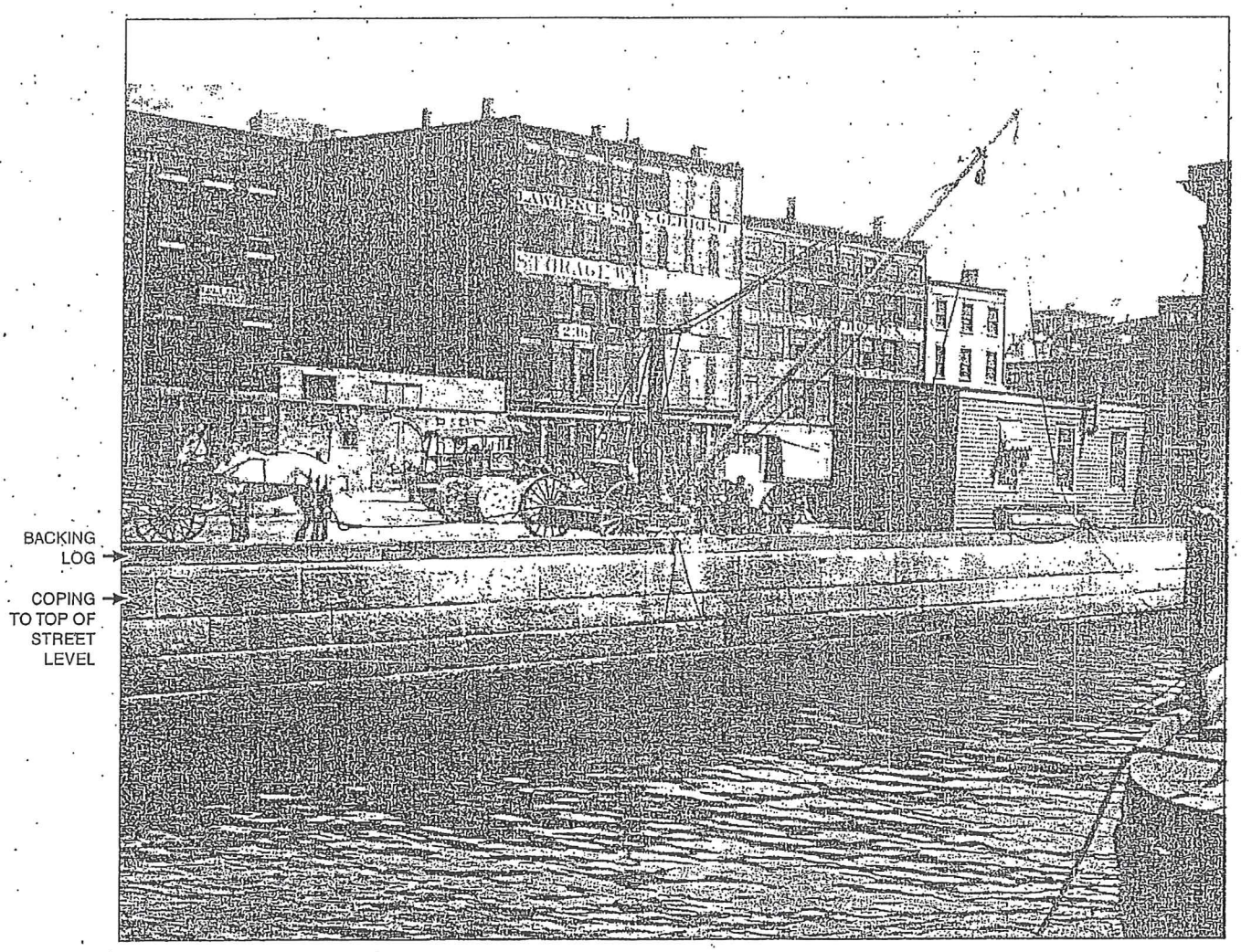
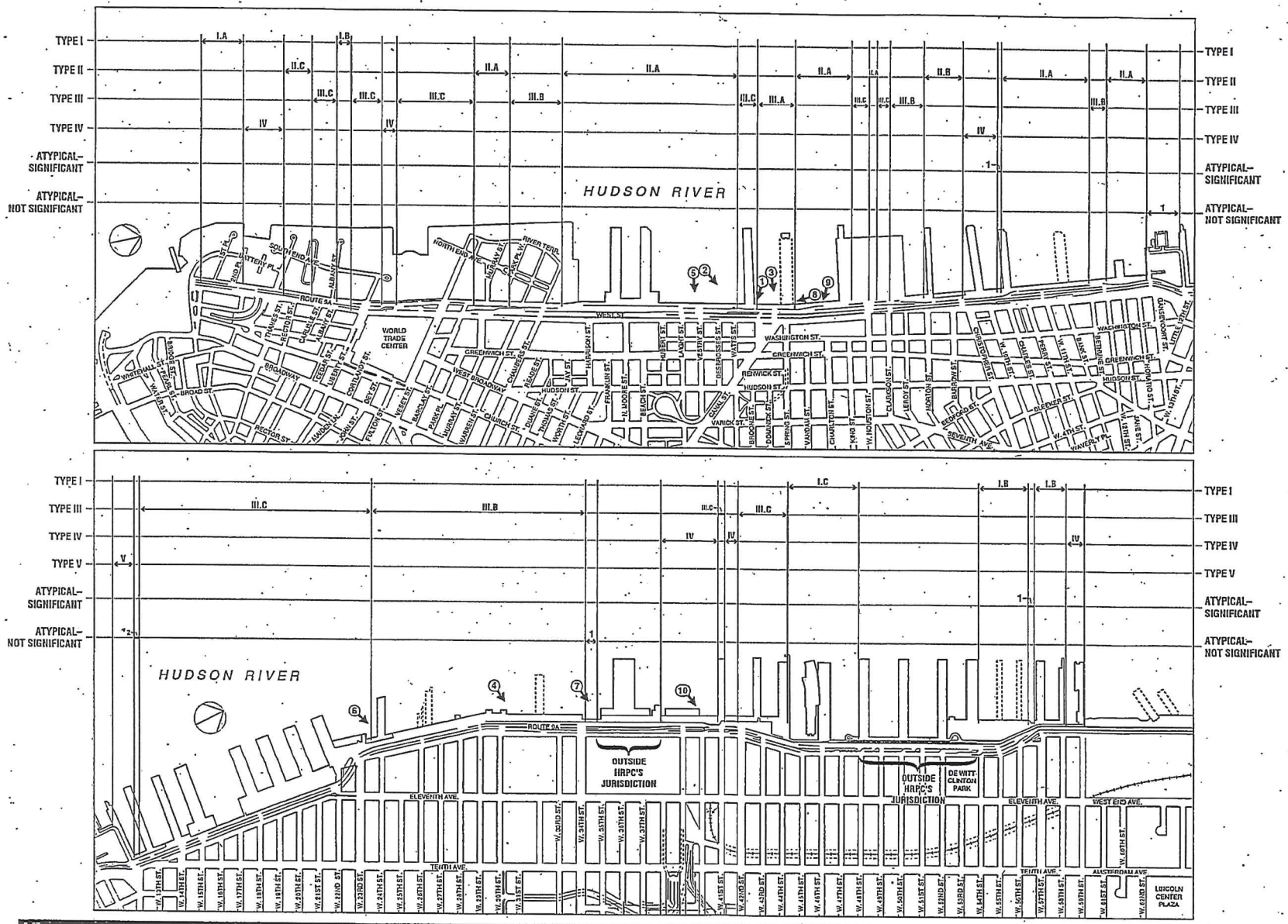


Photo 11

View of granite bulkhead.
Undated historic photograph, location unknown.
Collection of South Street Seaport Museum

Bulkhead Types and Key to Photographs

Figure 1



LEGEND

Significant Types

- I Granite or concrete walls without piles, on rock or firm bottoms (see Figure 2)
- II Granite walls with piles, no timber relieving platforms, usually on soft or deep mud bottoms (see Figure 3)
- III Granite walls with piles and buried timber relieving platforms, on soft or deep mud bottoms (see Figure 4)
- IV Concrete walls on piles with exposed timber or concrete relieving platforms (see Figure 5)
- V Timber cribwork (see Figure 6)
- Atypical 1 Curved-plan indentations for ships' bows

Atypical Non-significant Types

1. Collapsed pile-supported platforms and/or rip-rap
2. Narrow pile-supported building foundation
3. Riprap shoreline
4. Pile-supported platform in rip-rap, fronting cribwork

Key to Photographs

① Photo Number and Location from which Photograph was Taken

Source: Mueser Rutledge Consulting Engineers

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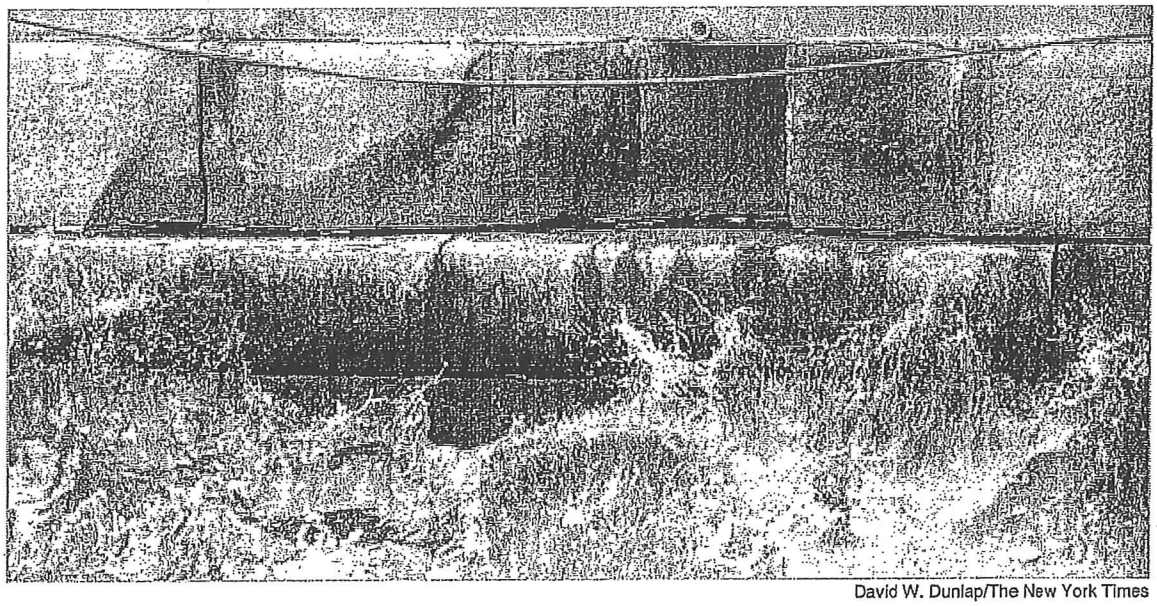
The New York Times

N.Y. / Region

N.Y. / Region

Exposing the Wall Between the River and New York City



David W. Dunlap/The New York Times

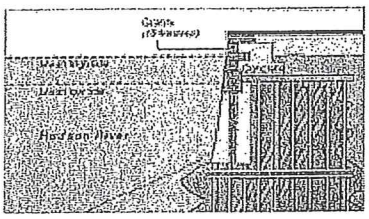
Parts of the river wall are visible north of Chambers Street, but the excavation at the trade center will show it at greater depth.

By DAVID W. DUNLAP
Published: May 25, 2008

To the builders of the 21st-century World Trade Center it is both an obstacle and an engineering marvel of 19th-century New York: the massive granite river wall that opened Manhattan's edges to a world of seagoing commerce.

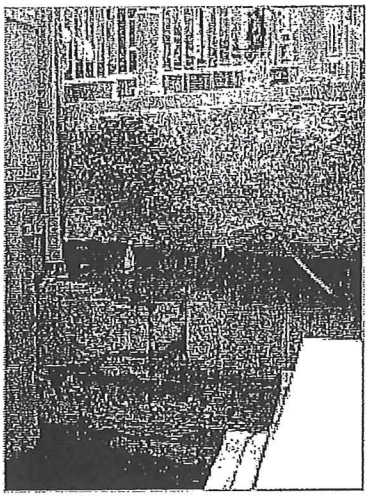
Multimedia

The river wall near the trade center was long ago cut off from the Hudson River by the landfill on which Battery Park City stands. But the wall's granite and concrete blocks are very much in place under the western edge of West Street and have posed an engineering and archaeological



Graphic

A 19th Century River Wall Unearthed



Port Authority of New York and New Jersey

Newly exposed granite blocks from the historic river wall that lies just west of the World Trade Center site.

challenge to the Port Authority of New York and New Jersey.

That is because part of the river wall must be removed to allow construction of an underground passageway between the new World Trade Center and the World Financial Center in Battery Park City. But at the same time, by agreement with state preservation officials, the river wall must also be treated as the historical resource it is. The New York State Office of Historic Preservation has deemed it eligible for the National Register of Historic Places.

As a result, archaeologists will be given the chance to monitor, inspect and document the river wall as it is being dismantled. And for a week or two early next year, before it is removed, the section of wall will be visible from the Winter Garden, its rough-hewn but handsomely coursed granite blocks exposed to a depth of perhaps 15 feet below street level.

The top of the wall, which runs from the Battery to 59th Street, can currently be seen from many places along the shoreline. Just walk out on a pier and look back. But the chance to see a whole section of the wall — dry — will be exceptional.

"The beauty of it is that they're going to be able to view an entire length," said Clarelle DeGraffe, the project manager for the Port Authority. "About 80 feet of granite wall section will be exposed. It's awesome."

Awesome, but little known.

By restraining the land mass behind it, a bulkhead allows large vessels to dock at the island's edge, rather than at the end of piers or wharves hundreds of feet off shore.

The depth and sturdiness of the shoreline is taken for granted now, but in 1873, the waterfront was so dilapidated and unnavigable as to "awake the amazement and indeed scorn of the foreigner," The New York Times said. "What is wanted is a broad thoroughfare clear round the City, stone-faced, with all necessary piers, solid and imperishable."

The river wall, formally known as the Hudson River bulkhead, was built under an improvement plan proposed in 1870 by Gen. George B. McClellan, the chief engineer of

the city's Department of Docks, who was far better known as a Union leader during the Civil War and Abraham Lincoln's Democratic challenger for the presidency in 1864.

McClellan's plan was "as ambitious, in its way, as the Brooklyn Bridge" and "the greatest public-works project of its period," Phillip Lopate wrote in "Waterfront: A Journey Around Manhattan."

It took six decades to complete.

According to an archaeological report prepared in 2006 by the Louis Berger Group, the bulkhead nearest the trade center was built with granite blocks atop concrete blocks atop vertical piles and lateral braces. The method suggests it was installed between 1899 and 1915.

But only physical inspection can determine the dimensions of the wall for certain, and only exploration can uncover artifacts behind the bulkhead or evidence of an earlier river wall or piers. Among materials that might be found, the Berger report said, are "historic ceramics, curved glass (bottle, table and furniture glass), pipes, small finds/architectural, bone, floral, shell and aboriginal (prehistoric)."

Ultimately, demolition of part of the river wall is needed to permit a clear path under West Street between the trade center and Battery Park City. One day, a commuter getting off the subway along William Street will be able to walk underground as far as the World Financial Center.

To prevent flooding during construction — the water table is only about 10 feet below street level — the passageway under West Street will be built in three phases, with barrier walls between each segment. It is the second barrier wall that will displace the bulkhead.

"No matter what, we've got a dam between us and the river," said Raymond E. Sandiford, chief geotechnical engineer at the Port Authority.

While Mr. Sandiford's enthusiasm is obvious for the passageway project, so is his admiration for the engineering feats of an earlier age. He noted that a preliminary excavation had disclosed the possibility of coming across timber structures from the early 19th century that were used in cribworks that functioned like a bulkhead.

"We may be uncovering even more of the historic waterfront," Mr. Sandiford said, sounding hopeful that he would.

More Articles in New York Region »

APPENDIX D

HISTORIC ENVIRONMENTAL CONDITIONS MAPS

Revisions / Modifications / Data Source	
PAL revised: Revised pipeline route	12-7-2010
PAL modified: Historic map georeferenced	7-14-2010
Client Data: GIE	7-1-2010
Historic base imagery: Hassler	1845

The base information contained in this map was supplied to PAL as a professional courtesy for informational and illustrative purposes only. PAL makes no warranties, either expressed or implied, regarding the fitness or suitability of this map for any other purpose than to depict the location and/or results of cultural resource investigations conducted by PAL.

PRIVILEGED INFORMATION - DO NOT RELEASE

KEY:

Project Pipeline Route

0 2,500 5,000 Feet

0 750 1,500 Meters

Appendix D-1. 1845 map of New York Bay and Harbor and the environs, with the Project pipeline route in New York and New Jersey.

PAL

Revisions / Modifications / Data Source	
PAL revised: Revised pipeline route	12-7-2010
PAL modified: Historic map georeferenced	7-14-2010
Client Data: GIE	7-1-2010
Historic base imagery: USGS	1891

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PRIVILEGED INFORMATION - DO NOT RELEASE

KEY:

Project Pipeline Route

0 2,500 5,000 Feet

0 750 1,500 Meters

Appendix D-2. 1891 USGS topographical quadrangle, Staten Island, New York, with the Project pipeline route in New York and New Jersey.

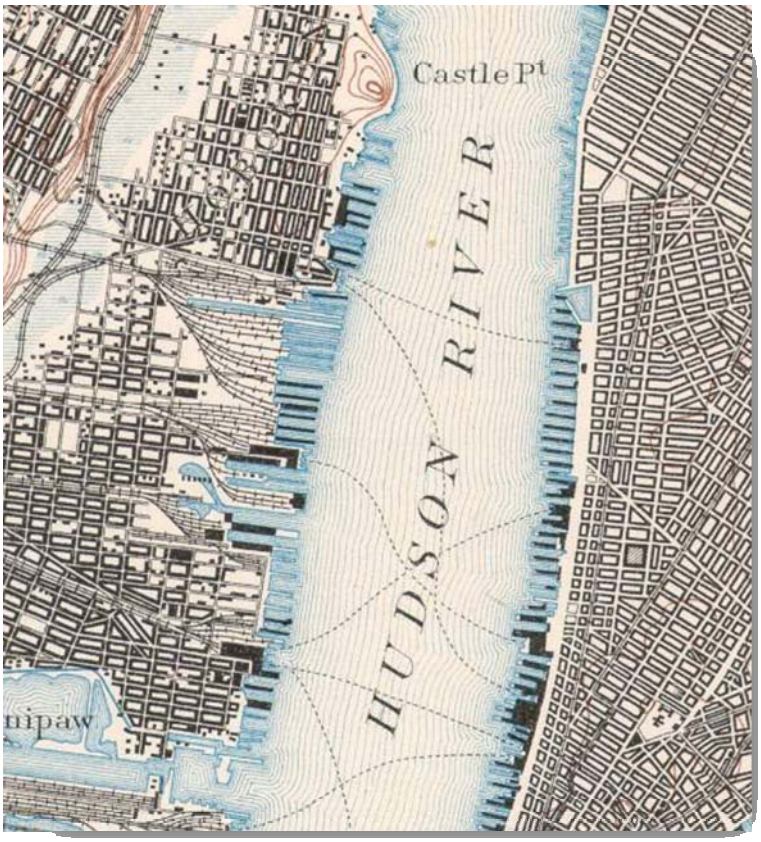
APPENDIX E

MARINE ARCHAEOLOGICAL ASSESSMENT

Summary Report
Marine Archaeological Sensitivity Assessment: Contact/Post-Contact Period Archaeological Resources

New Jersey-New York Expansion Project
Jersey City, New Jersey to Manhattan, New York

August 2010



Prepared for:
The Public Archaeology Laboratory, Inc. (PAL)
210 Lonsdale Avenue
Pawtucket, Rhode Island 02860

Prepared by:
Southeastern Archaeological Research, Inc.
(SEARCH)
315 NW 138th Terrace
Newberry, Florida 32669

INTRODUCTION

This Summary Report presents the results of a marine archaeological sensitivity assessment conducted for contact/post-contact period archaeological resources by Southeastern Archaeological Research, Inc. (SEARCH) for The Public Archaeology Laboratory (PAL) in anticipation of permitting requirements from the New Jersey and New York State Historic Preservation offices. The New Jersey-New York Expansion project crosses the Hudson River (Figure 1). The first of the two locations under study within this corridor is on the western shore of the Hudson River, immediately off the coast of Jersey City, New Jersey. The second location is on the eastern shore of the Hudson River, immediately off the coast of Manhattan, New York.

Marine Archaeological Sensitivity Assessment

To assist PAL, a marine archaeological sensitivity assessment was performed for the two offshore project areas. The purpose of this sensitivity assessment was to

- Document the locations and types of any previously identified State and/or National Register-listed or –eligible archaeological properties;
- Document the results of previous archaeological investigations conducted in the vicinity of the two project areas;
- Review historic maps and nautical charts; and
- Assess the probability of submerged archaeological sites in both project areas

SENSITIVITY ASSESSMENT METHODOLOGY

Research

Research conducted for this study consisted of a review of the following:

- Historic United States Army Corps of Engineer (USACE) reports from the LEXIS-NEXIS Congressional records database
- Historic newspaper articles on the development of Chelsea Piers from the ProQuest Historical Newspapers database
- The National Oceanic and Atmospheric Administration's Automated Wreck and Obstruction Information System (NOAA-AWOIS)
- Historic maps and charts from the Office of Coast Survey Historical Map & Chart Project (NOAA database)
- Library of Congress Map Collections homepage

- Secondary sources including Army Corps histories and local history

- Available site data from the New Jersey Historic Preservation Office and the New York State Historic Preservation Office

RESULTS

The two project areas have experienced rather intensive development since the early nineteenth century. The 1836 "Topographical Map of the City and County of New York" is one of the earliest maps of detail for the two areas (Figure 2). This map depicts the New Jersey project area as open water or perhaps marshland. The vague outline of city blocks indicates that the area was under proposal for reclamation and development. The bold north-south line that extends southward from Hoboken represents the proposed limit of the outward development of Jersey City. Directly to the north of the project area was a ferry dock (Colton & Company 1836). Across the river, the New York project area is similarly depicted as either open water or marshland. Nearby to the immediate south and also to the west, the outline of a "Proposed Pier and Basin" is depicted.

Urban growth along the west bank of the Hudson River began in earnest during the 1830s and 1840s when an expansion of transportation links with New York City was established (Whitcomb 1904). A series of railroads established terminals along the Hudson shoreline with ferry links to Manhattan. These terminals provided the impetus for substantial and enduring industrial, commercial, and residential growth in the Jersey City communities of Paulus Hook, Communipaw, and Bayonne. By 1845, the population of Jersey City was 4,000 (Trust Company of New Jersey 1921).

The Delaware, Lackawanna & Western (DL&W) began leasing railroads in Jersey City in the 1860s. Not long after their presence was made, the company sponsored the digging of a slip or canal adjacent to one of its spurs that led to the Hudson River. Completed in 1870, the slip (known alternatively as the Hoboken Terminal Long Slip) played an important role in facilitating the transfer of freight from vessels on the river to railroad cars on shore (Drobbin & Associates 2000). By 1875, harbor-side terminals in Jersey City were handling 90 percent of all rail freight exports passing through New York Harbor, and by the end of the century, Jersey City's population had increased to 180,000 (Rutsch et al. 1978:84). Rail development in particular also led to the construction of terminals along the marshy areas of the Jersey City shoreline. This development required these lands to be filled.

By the closing decade of the nineteenth century, the two project areas had experienced development as is indicated in the 1891 Staten Island topographic map (Figure 3). Piers had been built in numerous locations to the north and south of the New Jersey area. There appears to be a pier inside the eastern extent of the project area although there are no remains visible in the present-day aerial (Figure 1).

The New York project area also was developed by 1891. The eastern half of the project area had been reclaimed for urban development. Also, there were piers that extended from the new shoreline. None appear to have been in the project area (Figure 3).

While these developments were taking place along the shoreline, the USACE began dredging the channel of the Hudson River between Jersey City and Manhattan. This work began no later than 1877, and would continue on a regular basis well into the twentieth century (*New York Times* 8 January 1952; USACE 1877). Another ongoing project in this same period was the construction of the Hudson River Bulkhead on the New York side of the river. Stretching from Battery Park to West 59th Street, the bulkhead was constructed between 1871 and 1936. Masonry and granite were the principal building materials for this costly and important project which the city of New York funded in order to improve the functionality of its waterfront. Since 1936, the bulkhead has been updated on numerous occasions and often without regard to uniformity in appearance and use of materials. A portion of this National Register-eligible bulkhead is located adjacent to the New York project area (Empire State Development Corporation 1998).

Into the early twentieth century, the eastern portion of the New Jersey project area remained the site of a pier. However, the New York project area drastically changed (Figure 4). The change had begun in 1897 when the federal government approved the so-called Chelsea Improvement which was intended to modernize the port facilities located along the Hudson River between 12th Street West to 42nd Street in Manhattan. The development, like the bulkhead, was a municipal endeavor. At the time the Chelsea Improvement was proposed, this long stretch of waterfront was occupied by decrepit piers, the 14th Street ferry terminal, and city blocks. The New York project area was included in the latter. The Chelsea Improvement took years to complete, but when it was finished around 1910, the complex consisted of nine piers and adjacent facilities that greatly improved access for the large ships of the era (*Architects and Builders Magazine* 1910). The city blocks that formed the eastern portion of the New York project area were purposely excavated as part of the large development and soon became open water, as is visible on the 1931 nautical chart (Figure 4) and also in the present day (Figure 1).

An attempt was made to reconcile the information obtained from historic maps and charts with known archaeological site information and surveys and also with the NOAA-AWOIS database of shipwrecks. The limited remote availability of site file and survey data for both New Jersey and New York constrained this analysis. For New Jersey, the NJ-Geo Web mapping system (http://www.state.nj.us/dep/gis/geowebsplash.htm) provides the location and some brief information on historic structure sites in the vicinity, but no piers are shown in the area. Information on archaeological sites—submerged as well as terrestrial—must be obtained at their office; therefore, it is unknown if the remnants of the pier have been recorded. The NOAA-AWOIS database contained no information on shipwrecks in the New Jersey project area.

Similar to New Jersey, the New York State Preservation Historical Information Network Exchange (SPHINX) (http://nysparks.state.ny.us/shpo/online-tools/) provides only limited data on archaeological sites. The mapping system highlights so-called "Archaeological Sensitive Areas," but the sites that are pertinent to these designations are available only by visiting their office or by submitting a formal request for research that can take up to a month to process. It should be noted, however, that the New York project area does not fall within any of these

Archaeological Sensitive Areas. As was the case with New Jersey, the NOAA-AWOIS database contained no information on shipwrecks in the New York project area.

Based on the analysis presented in this report, a remote sensing survey is not recommended for either the New Jersey or the New York project areas of the New Jersey-New York Expansion project. Both areas have been extensively altered since the late nineteenth and early twentieth centuries via manmade improvement projects to the shoreline of the Hudson River. Given the intensive history of development in the New York project area—which, over time, has gone from open water to city block and back to open water—the potential of submerged archaeological sites is considered low. The Hudson River Bulkhead, although it is considered potentially eligible due to its role in Manhattan history, has been extensively altered over the last century without regard to uniformity in appearance (Empire State Development Corporation 1998). A marine archaeological survey likely would not result in new information on the bulkhead and therefore it is not recommended.

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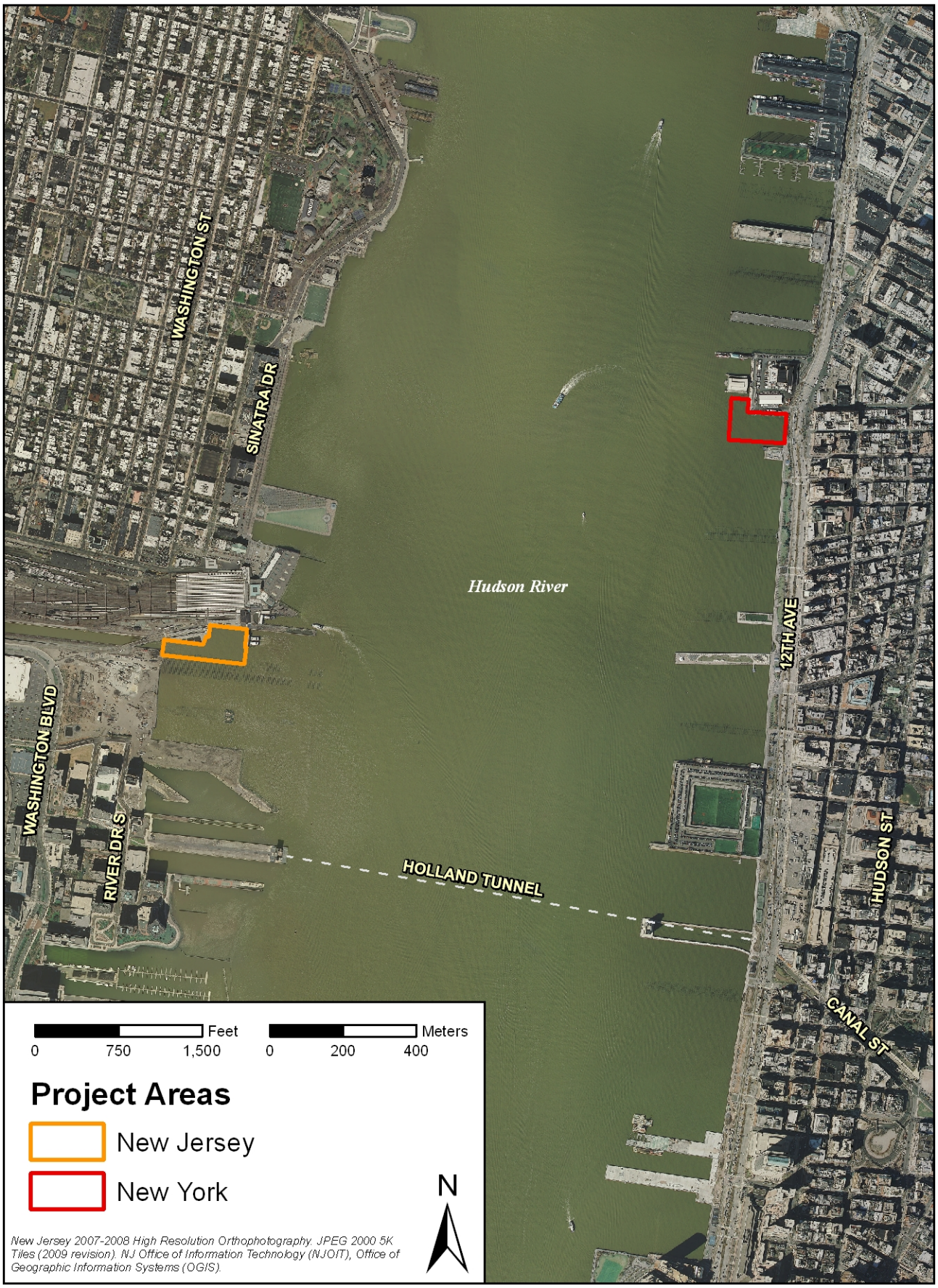

Figure 1. Present-day aerial photograph showing the two study areas.

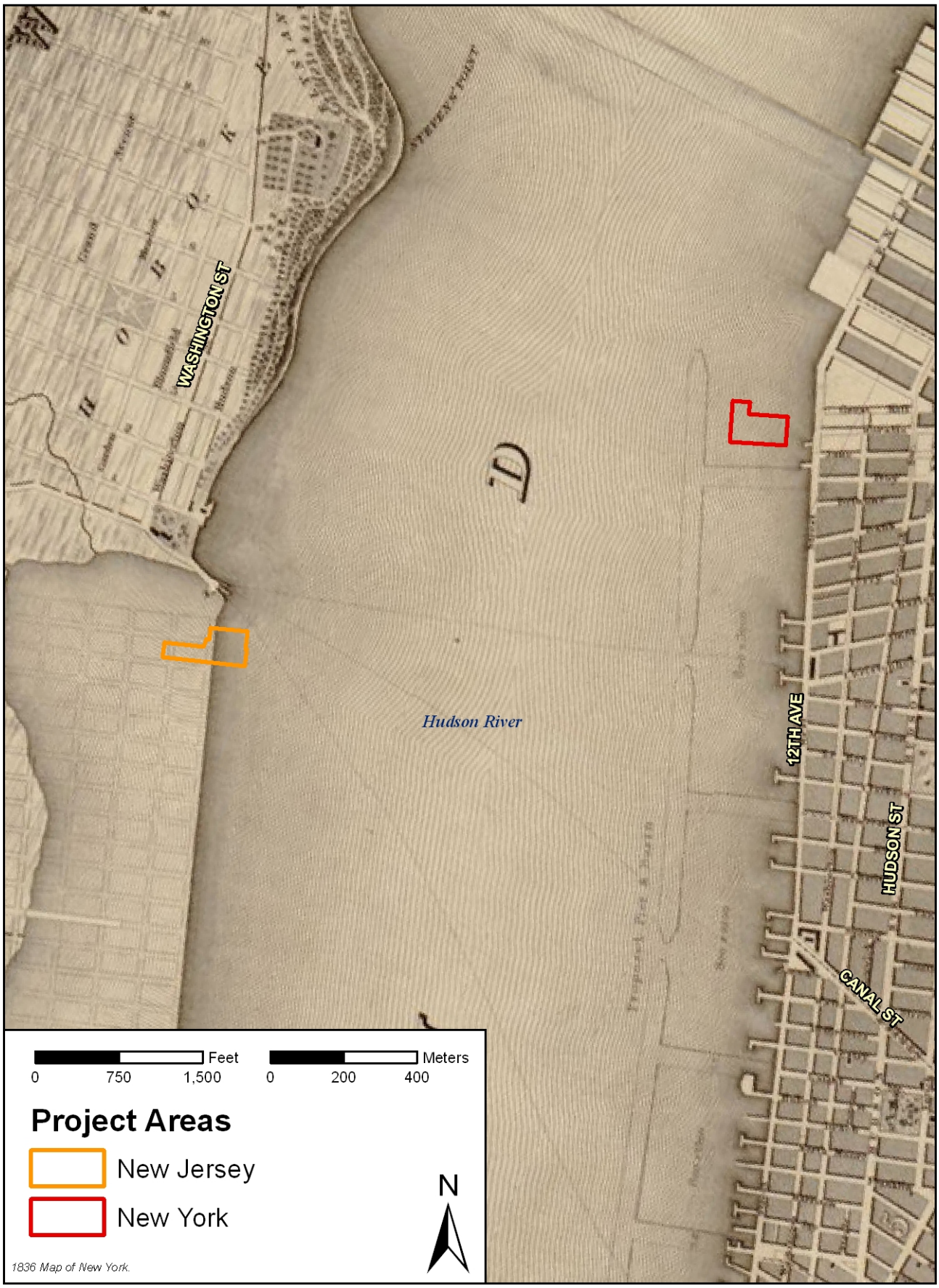

Figure 2. 1836 map showing the two study areas.

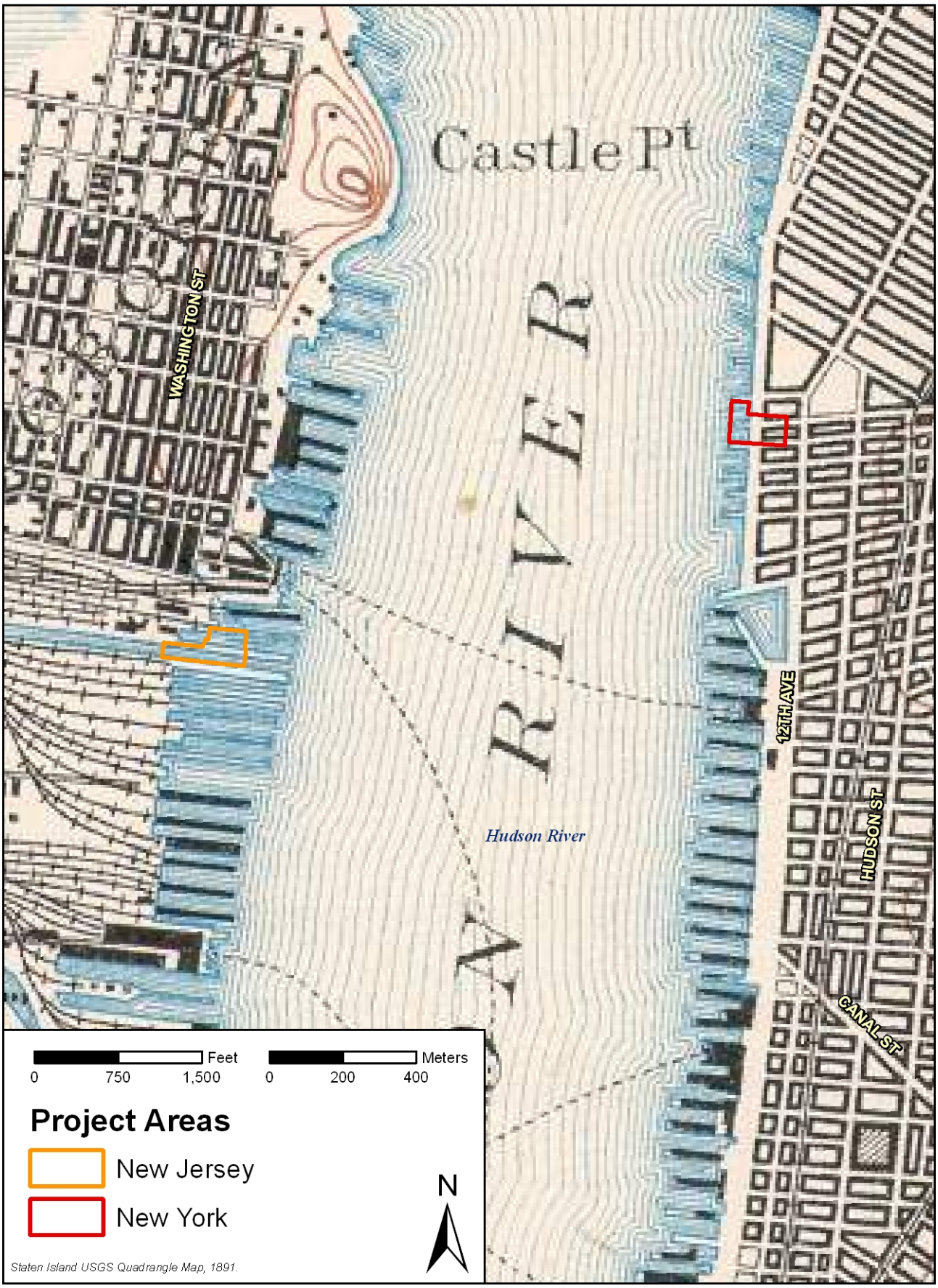

Figure 3. 1891 Staten Island quadrangle showing the two study areas.

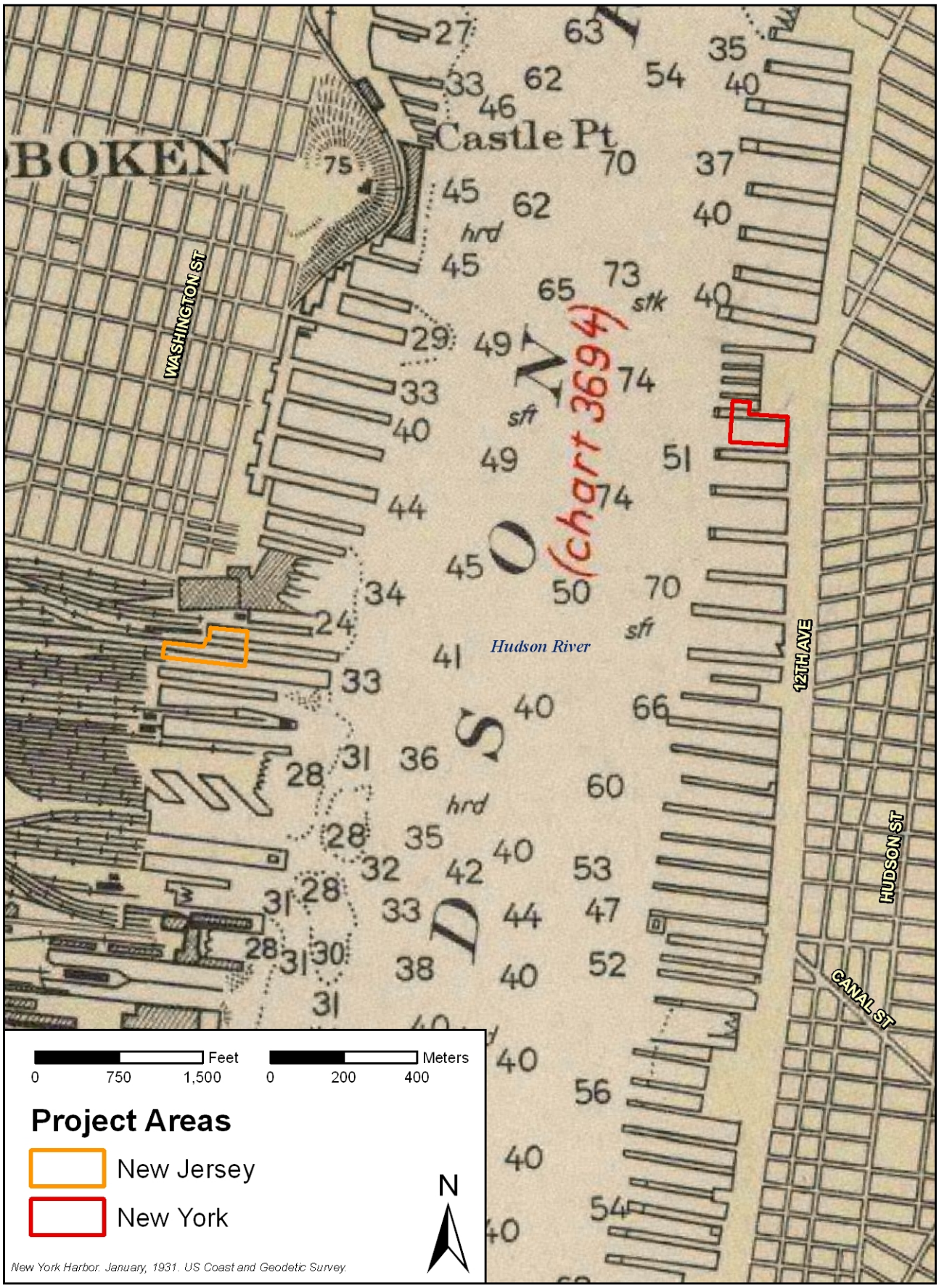

Figure 4. 1931 nautical chart of the Hudson River.

Summary Table of Previously Identified Offshore Resources within Proximity to the Pipeline Route.

Water Crossing	Map Reference	Map Sheet	Resource/Site	Proximity to APE	Comments	Significance	References
Arthur Kill	A	E-1	S18/S18A/S19A	Within study corridor	Gulfport barge mooring rack - timber pile/deck shoreline structure.	Not eligible	Raber 1996a
Kill Van Kull	B	E-2	Shooters Island SS16b (NY SHPO Site No. A08501.002829)	ca. 500 ft south	Composite-built tugboat.	Eligible, appears to have been removed	Panamerican 2007, 2008
Kill Van Kull	C	E-2	Ship graveyard off west shore of Shooters Island.	Within study corridor	This vessel cluster represents one of two remaining ship graveyards left in the New York Harbor area. Cluster originally contained 60 or more vessels and hulks that include scows, drydocks, and unidentifiable hulks.	Eligible	Kardas and Larrabee 1980, 1985; Brouwer 1978; Brighton 1997
Kill Van Kull	D	E-2	KVK Cluster 8	Within study corridor	Includes vessels, a steel railroad car float and barges.	Not significant	Panamerican 1996, 1999
Kill Van Kull	E	E-2	KVK Cluster 9 (Includes vessel nos. 105, 112, 113, 119, 120, 121)	Within study corridor	Contains ca. 40 vessels including covered barges [no. 121], derrick lighters [nos. 113, 120], steam pile driver [no. 112], trap rock scows, coastwise hold barges, work barges [no. 105], concrete plant barge [no. 119]), and carfloats.	Cluster not significant, but individual vessels significant (nos. 105, 113, 120).	Panamerican 1996, 1999
Kill Van Kull	F	E-2	S182/184 (Brewer Dry Dock Pier)	ca. 250 ft south	Fill and timber pile/deck pier used as repair yard for motor boats.	Not significant	Raber et al. 1996b
Kill Van Kull	G	E-2	S188 (M&P Marine/Ecklof Marine Corp. Pier 9)	ca. 250 ft south	Timber pile, wood and concrete-decked pier used to moor floating equipment.	Not significant	Raber et al. 1996b
Kill Van Kull	H	E-2	S192 (Spearin, Preston & Burrows wharf)	ca. 250 ft south	Timber sheet pile wharf used to moor floating equipment.	Not significant	Raber et al. 1996b
Kill Van Kull	I	E-2	S193 (Spearin, Preston & Burrows dolphins)	Within study corridor	Line of timber dolphins used to moor floating equipment.	Not significant	Raber et al. 1996b
Kill Van Kull	J	E-2	S194 (possible Spearin, Preston & Burrows pilings)	ca. 250 ft north	Piles.	Not significant	Raber et al. 1996b

Water Crossing	Map Reference	Map Sheet	Resource/Site	Proximity to APE	Comments	Significance	References
Kill Van Kull	K	E-2	S197/197/202 (Spearin, Preston & Burrows Staten Island Mooring)	Within study corridor	Line of timber dolphins used to moor floating equipment.	Not significant	Raber et al. 1996b
Kill Van Kull	L	E-2	S199 (Mariner's Harbor Yacht Club bulkhead	ca. 100 ft south	Wooden sand barge used as bulkhead,	Not significant	Raber et al. 1996b
Kill Van Kull	M	E-2	S204 (Mariner's Harbor Yacht Club piles)	Within study corridor	Piles.	Not significant	Raber et al. 1996b
Kill Van Kull	N	E-2	Vessel nos. 149, 151, 152	Possibly within study corridor.	Wooden offshore tugs. Location estimated. Described as "near Milliken/ Downey Shipyard".	Vessel 149 significant. Vessels 151, 152 not significant	Panamerican 1996
Kill Van Kull	O	E-2	Vessel no. 37	ca. 250-300 ft	Covered barge. Part of ship graveyard off west side of Shooters Island (see above).	Eligible. One of a selection of vessels in the ship graveyard that has undergone HABS/HAER level recordation per 1985 MOA.	Kardas and Larrabee 1985; Brighton 1997

* Note: No previously identified offshore marine resources were present in the New York reach of the Hudson River crossing.

Table of Cultural Resource Management Reports Reviewed for the NY Offshore Portion of the NJ-NY Expansion Project.

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LPC 783	Panamerican Consultants 1996	Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach; Arthur Kill, New Jersey Reach; and Kill Van Kull, New York Reach.
LPC 802	Raber et al. 1996a	Reconnaissance Cultural Resources Investigations, Arthur Kill, New York Reach, Richmond County, New York, New York Harbor Collection and Removal of Drift Project, U.S. Army Corps of Engineers, New York District.

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-	Kardas and Larrabee 1985b	Arthur Kill Channel, Howland Hook Marine Terminal Study, Appendix 5: Cultural Resources Study.
-	Brouwer 1978	Appendix I: Report of a Preliminary Reconnaissance of Cultural Resources on Shooter's Island, in New York Harbor. (In Kardas and Larrabee 1980).
-	La Porta et al. 1999	A Geomorphologiacl and Archaeological Analysis of Potential Dredged Material Management Alternative Sites in the new York Harbor-Apex Region.
-	GRA 1999	Geomorphological and Archaeological Study of New York and New Jersey Harbor Navigation Channels.
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1986 *Howland Hook Marine Terminal Expansion Cultural Resources Reconnaissance.* Prepared by MAAR Associates, Inc., Newark, DE. Prepared for International Technologies, Edison, NJ.

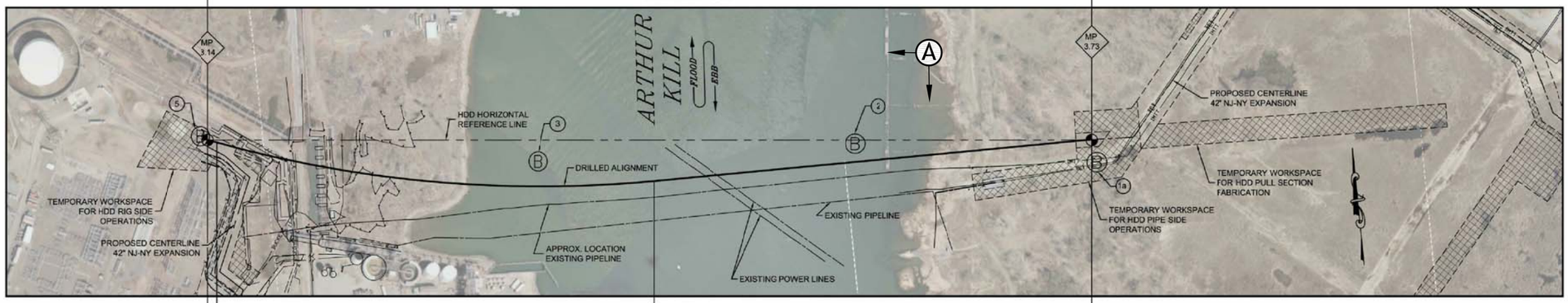
Raber, Michael S., Thomas R. Flagg, Gerald Weinstein, Ernest Weigand, and Norman Brouwer

1996a *Reconnaissance Cultural Resource Investigations, Arthur Kill New York Reach, Richmond County, New York, New York Harbor Collection and Removal of Drift Project, U.S. Army Corps of Engineers, New York District.* Prepared for Frederick R. Harris, Inc., New York, NY. Submitted by Raber Associates, Glastonbury, CT.

Raber, Michael S., Thomas R. Flagg, Gerald Weinstein, and Ernest Weigand

1996b *Reconnaissance Cultural Resource Investigations, Kill Van Kull, New York Reach, Richmond County New York, New York Harbor Collection and Removal of Drift Project, U.S. Army Corps of Engineers, New York District.* Prepared by Raber Associates., South Glastonbury, CT. Prepared for Fredrick R. Harris, Inc., New York, NY.

Wagner, Daniel Ph.D., and Peter E. Siegel, Ph.D.
1996 *A Geomorphological and Archeological Analysis of the Arthur Kill-Howland Hook Marine Terminal Channel, Richmond County, New York and Union County, New Jersey*. Prepared by John Milner Associates, West Chester, PA. Prepared for The Greeley-Polhemus Group, West Chester, PA. and The U.S. Army Corps of Engineers, New York District, New York, NY.



PLAN

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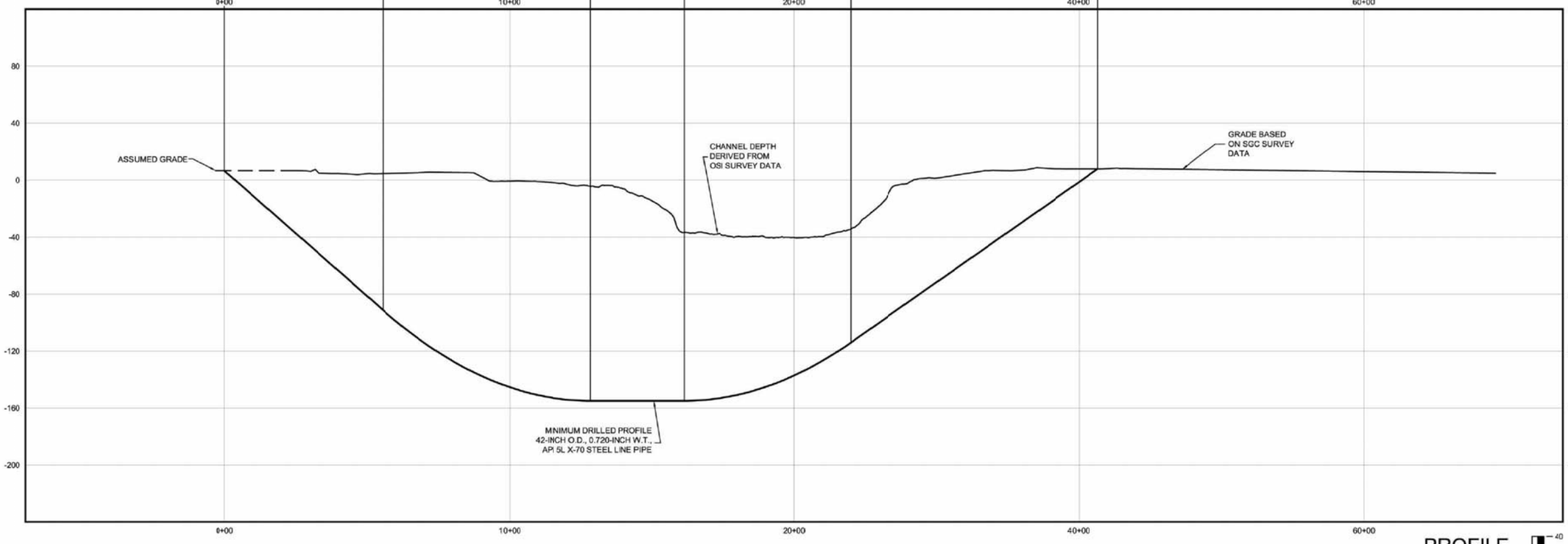


GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

SURVEY NOTES

1. ALL TOPOGRAPHIC LAND SURVEY DATA WAS PROVIDED BY SGC ENGINEERING.

2. RIVER BOTTOM DEPTHS WERE DERIVED FROM A HYDROGRAPHIC SURVEY PERFORMED BY OCEAN SURVEYS INC DATED OCTOBER 06, 2010.

3. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO, UTM ZONE 18, NAD83.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO HDD HORIZONTAL REFERENCE LINE LOCATED IN THE PLAN VIEW.

2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PIPE.

GEOTECHNICAL LEGEND

Ⓑ BORING LOCATION

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT UTILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

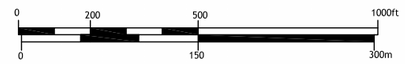
1. ELEVATION - PLUS 0 FEET, MINUS 20 FEET.
2. ALIGNMENT - PLUS OR MINUS 10 FEET.
3. ENTRY POINT - AT THE STAKED LOCATION.
4. EXIT POINT - PLUS OR MINUS 5 FEET IN ALIGNMENT, PLUS 25 FEET AND MINUS 0 FEET IN LENGTH.
5. CURVE RADIUS - NO LESS THAN 2,100 FEET.

PROTECTION OF UNDERGROUND FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS:

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

PROFILE



Source/Revision/Issue	Date
PAL modified	12-03-10
Map data received from: Spectra Energy	11-24-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix E-1

Ⓐ *Resource location and map reference number(see table)*

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	REFERENCE DWG.	REV	DSN	CK	DESCRIPTION
		1	CLC	KMN	ISSUED FOR FERC APPROVAL (11-22-10)

John Deering Hair
Professional Engineer
New Jersey Lic.# 24GE04547300
New York Lic.# 080869
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

ENGINEERING APPROVALS					
	PRELIMINARY		CONSTRUCTION		
DRAWN BY:					
PROJECT MANAGER	JMS	08/09			
DESIGN ENGINEER	CLC	08/09			
DESIGN CHECKER	KMN	11/04			
TITLE	SIGNATURE	DATE	SIGNATURE	DATE	

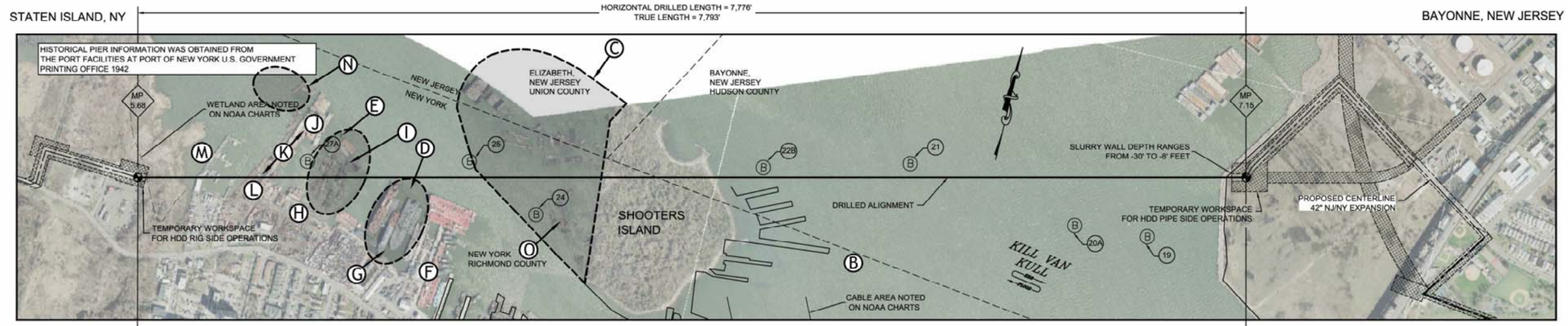
PLAN AND PROFILE WORKSHEET
42-INCH ARTHUR KILL CROSSING BY HDD
SPECTRA NJ-NY EXPANSION PROJECT

LOC. UNION CNTY., NJ & RICHMOND CNTY NY

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. | DWG. LD-H-1010 | REV. 1

Appendix E-1. NJ-NY Expansion Project, Marine Archaeological Assessment (SEARCH 2010) and previously identified resources .



PLAN

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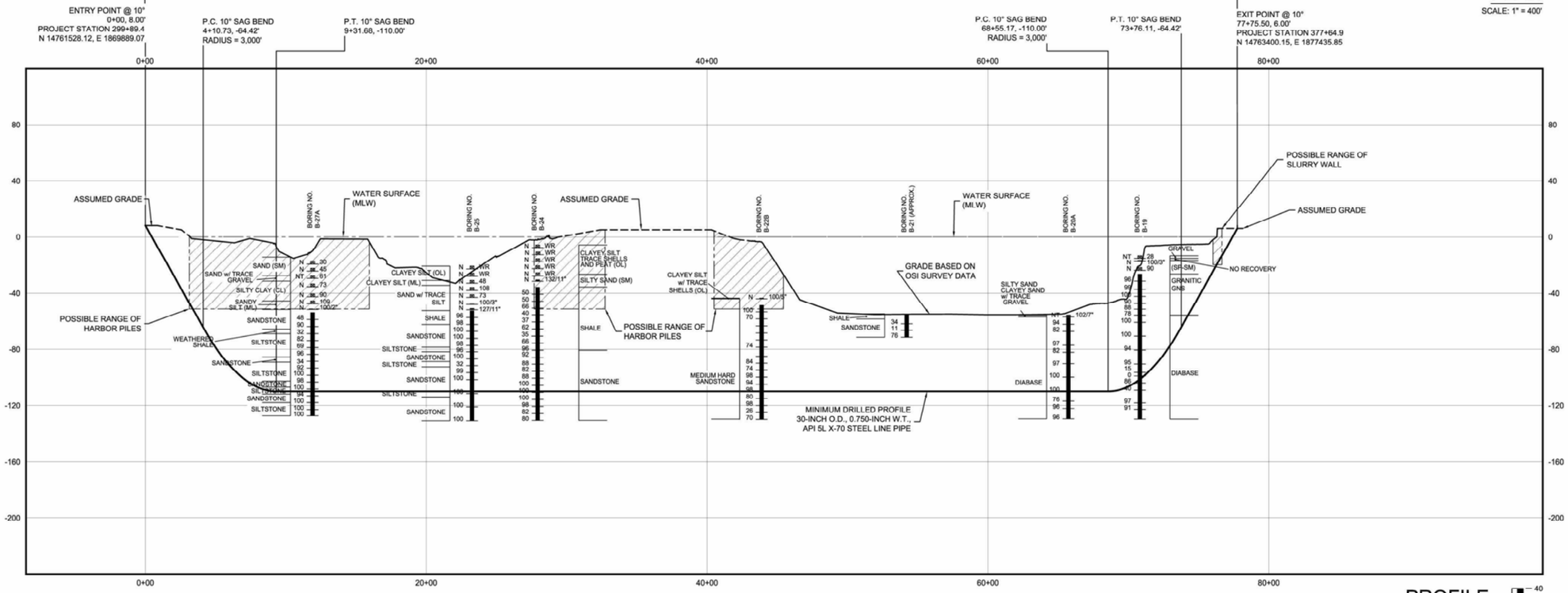
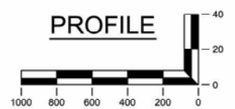


PROFILE



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

TOPOGRAPHIC SURVEY NOTES

1. ALL TOPOGRAPHIC LAND SURVEY DATA WAS PROVIDED BY SGC ENGINEERING.

2. RIVER BOTTOM DEPTHS WERE DERIVED FROM A HYDROGRAPHIC SURVEY PERFORMED BY OCEAN SURVEYS INC DATED OCTOBER 06, 2010.

2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO, UTM ZONE 18, NAD83.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.

2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PIPE.

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 / 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
53 / 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY MUESER RUTLEDGE CONSULTING ENGINEERS, NEW YORK CITY, NEW YORK. REFER TO THE PROJECT GEOTECHNICAL REPORT DATED FOR ADDITIONAL INFORMATION.

2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TESTS WERE PERFORMED.

3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGEMENT IN INTERPRETING THIS DATA.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT UTILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ELEVATION - PLUS 0 FEET, MINUS 20 FEET.

2. ALIGNMENT - PLUS OR MINUS 20 FEET.

3. ENTRY POINT - AT THE STAKED LOCATION.

4. EXIT POINT - PLUS OR MINUS 20 FEET IN ALIGNMENT, PLUS 100 FEET AND MINUS 0 FEET IN LENGTH.

5. CURVE RADIUS - NO LESS THAN 1500 FEET.

PROTECTION OF UNDERGROUND FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS:

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.

2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.

3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

Source/Revision/Issue	Date
PAL modified	12-03-10
Map data received from: Spectra Energy	11-24-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix E-2

Ⓐ Resource location and map reference number(see table)

0 400 800 1200 1600 2000ft
0 300 600m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	REFERENCE DWG.	REV	DSN	CK	DESCRIPTION
		1	CLC	KMN	ISSUED FOR FERC APPROVAL (11-22-10)

John Deering Hair
Professional Engineer
New Jersey Lic # 24GE04547500
New York Lic # 080869
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

ENGINEERING APPROVALS				
DRAWN BY:	PRELIMINARY		CONSTRUCTION	
PROJECT MANAGER	JMS	11/10		
DESIGN ENGINEER	CLC	11/10		
DESIGN CHECKER	KMN	11/10		
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

PLAN AND PROFILE WORKSHEET 30-INCH KILL VAN KULL CROSSING BY HDD SPECTRA NJ-NY EXPANSION PROJECT

LOC. HUDSON CNTY., NJ & RICHMOND CNTY NY

YEAR: 2010 | W.O. | DWG. LD-H-1030 | REV. 1

Spectra Energy

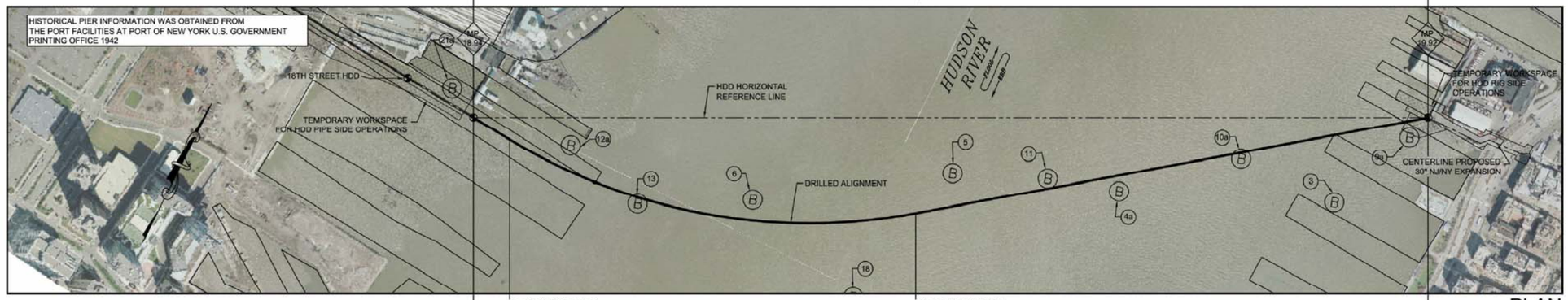
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

Appendix E-2. NJ-NY Expansion Project, Marine Archaeological Assessment (SEARCH 2010) and previously identified resources .

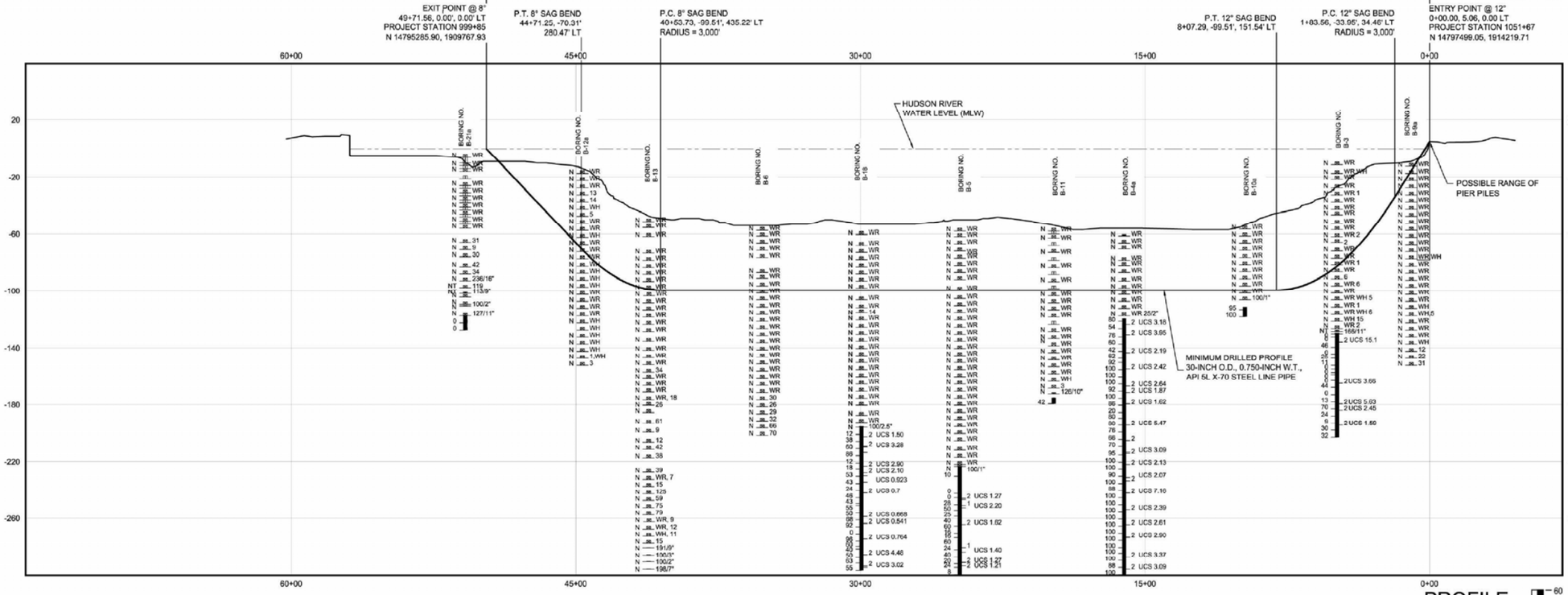
JERSEY CITY, NEW JERSEY

HORIZONTAL REFERENCE LENGTH = 4,791'
HORIZONTAL PLAN LENGTH = 5,134'
TRUE LENGTH = 5,149'

MANHATTAN, NEW YORK



PLAN
SCALE: 1" = 300'



PROFILE
SCALE: 1" = 300'

Ⓐ *Resource location and map reference number(see table)*

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

SURVEY NOTES

1. ALL TOPOGRAPHIC LAND SURVEY DATA WAS PROVIDED BY SGC ENGINEERING.
2. RIVER BOTTOM DEPTHS WERE DERIVED FROM A HYDROGRAPHIC SURVEY PERFORMED BY OCEAN SURVEYS INC DATED AUGUST 09, 2010.
3. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO, UTM ZONE 18, NAD83.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO HDD HORIZONTAL REFERENCE LINE LOCATED IN THE PLAN VIEW.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PIPE.

GEOTECHNICAL LEGEND

Ⓑ BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

SHELBY TUBE OR PUSH SAMPLE

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (KSI)
53 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY MUESER RUTLEDGE CONSULTING ENGINEERS, NEW YORK CITY, NEW YORK. REFER TO THE PROJECT GEOTECHNICAL REPORT DATED 01-OCT-10 FOR ADDITIONAL INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TESTS WERE PERFORMED.
3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGEMENT IN INTERPRETING THIS DATA.

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2. ALIGNMENT - PLUS OR MINUS 20 FEET.
3. ENTRY POINT - AT THE STAKED LOCATION.
4. EXIT POINT - PLUS OR MINUS 5 FEET IN ALIGNMENT, PLUS 50 FEET AND MINUS 0 FEET IN LENGTH.
5. CURVE RADIUS - NO LESS THAN 1,500 FEET.

PROTECTION OF UNDERGROUND FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS:

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2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

Source/Revision/Issue	Date
PAL modified	12-03-10
Map data received from: Spectra Energy	11-24-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix E-3

0 300 600 1200ft
0 150 300m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	REFERENCE DWG.	REV	DSN	CK	DESCRIPTION
		1	CLC	---	ISSUED FOR FERC APPROVAL (11/22)

John Deering Hair
Professional Engineer
New Jersey Lic.# 24GE04547500
New York Lic.# 080859
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

ENGINEERING APPROVALS	PRELIMINARY		CONSTRUCTION	
DRAWN BY:				
PROJECT MANAGER	JMS	11/10		
DESIGN ENGINEER	CLC	11/10		
DESIGN CHECKER	CLC, KMN	11/10		
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

PLAN AND PROFILE WORKSHEET
30-INCH HUDSON RIVER CROSSING BY HDD
SPECTRA - NJ-NY EXPANSION PROJECT

LOC. HUDSON CNTY., NJ., AND NEW YORK CNTY., NY.

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

YEAR: 2010 | W.O. | DWG. LD-H-1080 | REV. 1

Appendix E-3. NJ-NY Expansion Project, Marine Archaeological Assessment (SEARCH 2010) and previously identified resources .

APPENDIX F

SOIL BORINGS PROPOSAL – GRA 2010

Recommendations for Geoarchaeological Assessment
NJ-NY Expansion Project for Spectra Energy and PAL
New Jersey and New York

By J. Schuldenrein
Geoarcheology Research Associates
July 16, 2010

General Scope of Work

Geoarcheology Research Associates (GRA) is proposing to undertake a geoarcheological assessment for The Public Archaeology Laboratory, Inc. (PAL) for the above referenced project. This effort is based both on the results of an archaeological overview survey conducted by PAL and also on a preliminary assessment of the project terrain and substrate by GRA. The objective of the proposed field work and analysis is an evaluation of the preserved archaeological site potential for buried surfaces, from the present surface to a depth of approximately 20 feet in areas of identified low, moderate, and high sensitivity as described by PAL in the archaeological overview reports prepared for the Project. The sensitive areas are depicted in relation to the proposed gas pipeline route that runs across segments of northern New Jersey, Staten Island (NY), and Manhattan (NY).

Buried pre-contact archaeological site potential is considered high to moderate because of the association of the subsurface with the estuarine and/or interior margins of the Hudson River and feeder drainages. GRA's previous studies of the area indicate that the estuary may be separated from Pleistocene lake deposits by a sequence of fluvial and marsh sediments. The stratigraphy is consistent with Late Quaternary models for the landscape history of Manhattan and the emergence of human populations in the area. In this connection systematic subsurface testing can form the basis for refining the potential for pre-contact period sites as identified in the PAL archaeological inventory survey reports. This potential is linked to the preservation of paleo-environments that emerged over the past 15,000 years from the earliest prehistoric through Euro-american contact and subsequent historic periods.

The work to be undertaken takes into account the proposed impact to the substrate by Spectra Energy. This Scope of Work (SOW) proposes a strategy that will include the following field and analysis stages depending on findings:

- Assessment of sediment stratigraphy from 142 borings (82 in New Jersey and 60 in New York);
- Coring of continuous columns to depths of approximately 20 ft or the vertical extent of project impact;
- Characterization of sediment composition from cores focusing on fill depths and composition and contact with pristine buried surfaces indicative of buried historic and prehistoric site potential;
- Systemic assessment of buried archaeological potential through resolution of anthropogenic sediment types, native soils, riverine, and marsh edge deposits;
- Detailed analysis of aboriginal (pre-contact) sediments that includes sedimentological, geochemical, biotic, and microfossil studies;
- Correlation of fill sequences with PAL's identified areas of historic impacts to native terrain;
- General mapping of fill depths, characterization of age and type of fill distribution (no detailed laboratory analysis);
- Dating of organic materials and buried surfaces;
- Synthetic report stressing buried site potential and paleoenvironmental reconstruction.

Methods and Procedures

Initial work will consist of a review of the PAL archaeological overview survey reports, including the compilation of extant documentary data related to pre-contact and post-contact period site potential within the Project pipeline route, and relevant examination of background maps, including most recent digital imagery and available surface geology projections. These document the pre- to early industrial topography and land use histories of the project area. Additional records will be utilized to establish the subsurface stratigraphies and the sedimentary contexts disclosed in a variety of

engineering and geotechnical boring logs. The field phase will concentrate on a series of 142 borings that will be excavated using a geoprobe that will recover continuous to near continuous sediment columns.

The geoprobe forms the centerpiece of the field effort. It is a coring device that utilizes a hydraulic system to penetrate the subsurface, to extract continuous subsurface stratigraphic columns, and to collect soil and sediment samples (Figures 1 and 2). The core samples are 2-3" diameter and are retrieved in 3-4' sections. As noted, the core depths for the NJ-NY Expansion project are on the order of 20 feet. Samples are recovered in plastic sleeves, are sealed immediately upon retrieval, and are then transported to the GRA laboratory facilities for more detailed analyses. All field-sampling holes are filled and sealed upon the completion of the probing operation. The type of geoprobe device to be used is dependent on the needs of the field work. For the NJ-NY Expansion project we anticipate using either a small unit attached to a basic utility vehicle (like a mule or side-by-side) with a 6-8' high boom, or a stand-alone, track-driven vehicle with a 8-10' boom (see Figures 1 and 2). Selection of the machine is dependent on field conditions and access. The geoprobe is typically transported from site to site on a trailer but it can also be driven along the project line over short distances, depending on the sampling interval. Archeologists, as well as an environmental monitor and land agent, will be on site during the collection of samples. Documentation of buried utilities is conducted before any boring.

At the laboratory facility tubes are sliced open and examined to assess the potential for buried surfaces, which include the presence of artifacts or cultural features. Any artifacts recovered in the coring are either returned to the landowner or curated with the state, depending on contractual agreements.

Figure 1. Example of smaller geoprobe mounted on a wheeled mule.


Figure 2. Example of the larger track-driven geoprobe.

GRA personnel will be on-site to collect recovery tubes and samples and to document sequences. 2-3″ diameter cores are preferable to assure maximum stratigraphic continuity and to facilitate maximum recovery of complete sediment columns that are necessary for comprehensive description. Appropriate and detailed HAZMAT procedures will be taken in consultation with Spectra/PAL personnel since contamination potential is a possibility along several key segments of the project line. A formal Safety Plan will be developed prior to project field work.

GRA will describe the soil and sedimentological characteristics of the strata contained in the sections using standardized terminology (USDA 1994; ISC 1990). Field and baseline laboratory work will be performed by the GRA team of geoarchaeologists, all of whom have extensive experience in the northern New Jersey and New York City area. Scheduling will be co-ordinated with PAL and Spectra personnel. It is assumed that at least one PAL representative will be with the GRA team over much of the probing work.

Following procurement and recovery of sediment columns, sample tubes will be taken to GRA's facility for more detailed description. Columns designated for paleoenvironmental and site formation reconstruction work in archaeologically sensitive areas identified by PAL will be collected from the intact columns and packaged for specific analyses as appropriate and per the guidelines of this Scope. These analyses may include:

- Grain size analysis to establish depositional sources and to support any visual evidence of buried (weathered) soils linked to occupation;
- Micromorphology to identify macro-fossils in the matrix and to test for evidence of a buried soil and/or occupation surface;
- Pollen analysis to establish vegetation changes along the estuarine margins;
- Microfossil and malacological (shell) analysis to establish the transition from terrigenous to brackish and estuarine conditions;
- Radiocarbon and shell dating to establish an absolute chronology

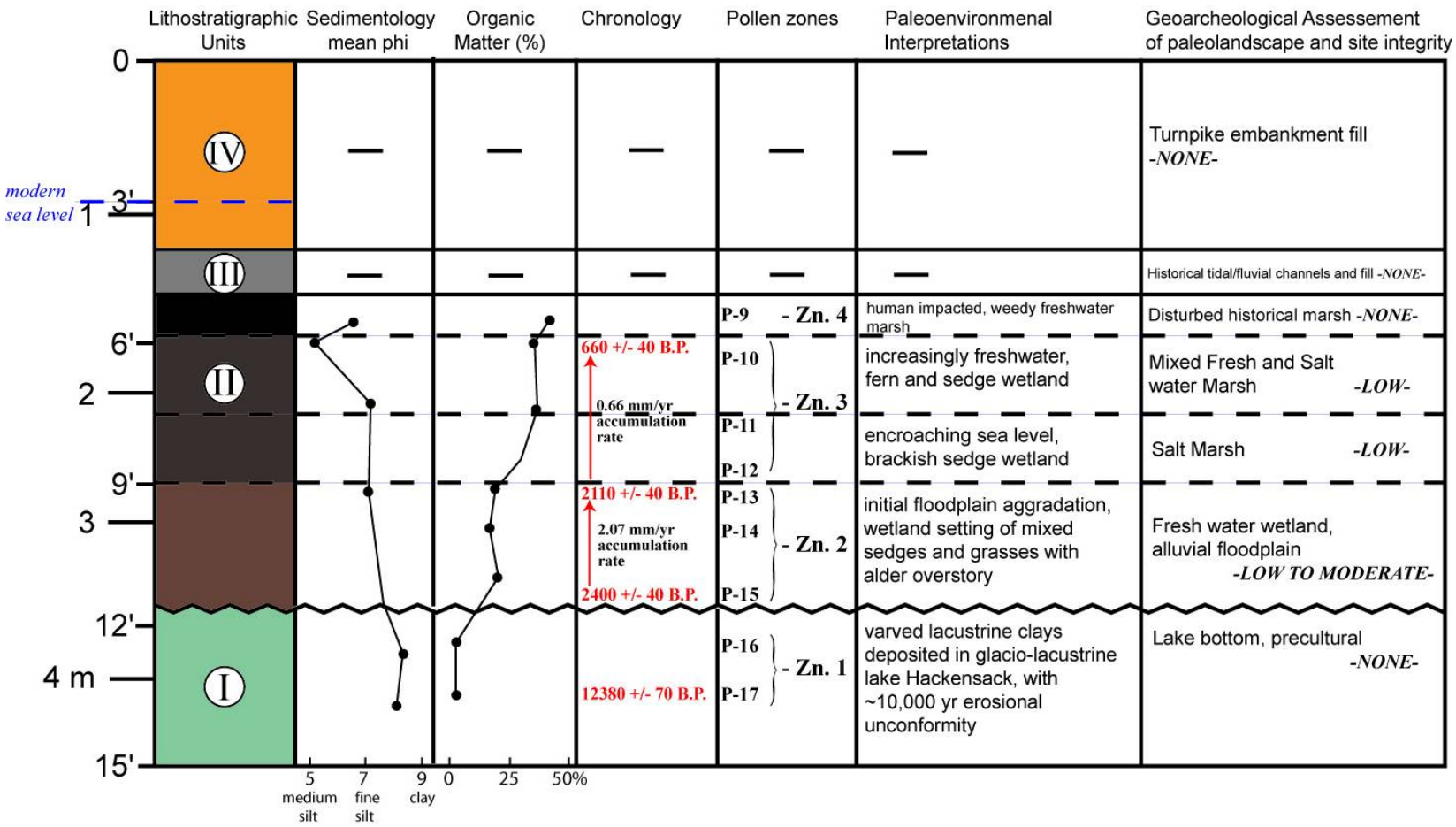
Results of the specialized studies will be synthesized into a comprehensive report that will streamline the paleoenvironmental interpretations to the project area and structure a topo-stratigraphic model that identifies the age and extent of any buried stable or occupation surfaces. Site formation studies will also form a key component of the effort. It will be necessary to document and date the ages and composition of filling events that altered the changing landscapes of post-aboriginal occupation. A report will

be generated that will identify the composite stratigraphy and the sequence of buried intact surfaces. An example of a core-based assessment of archaeological sensitivity linked to a reconstruction of buried surfaces is presented as Figure 3. This type of profile has been successfully used for regulatory review.

Ultimately we will correlate the results of the geoarchaeological sensitivity with the pre-contact and post-contact period sensitivity assessment for the Project pipeline route identified by PAL in the archaeological overview reports. The report will include detailed profiles and a generalized site formation model. Graphics work will be integrated, as necessary, into GIS format.

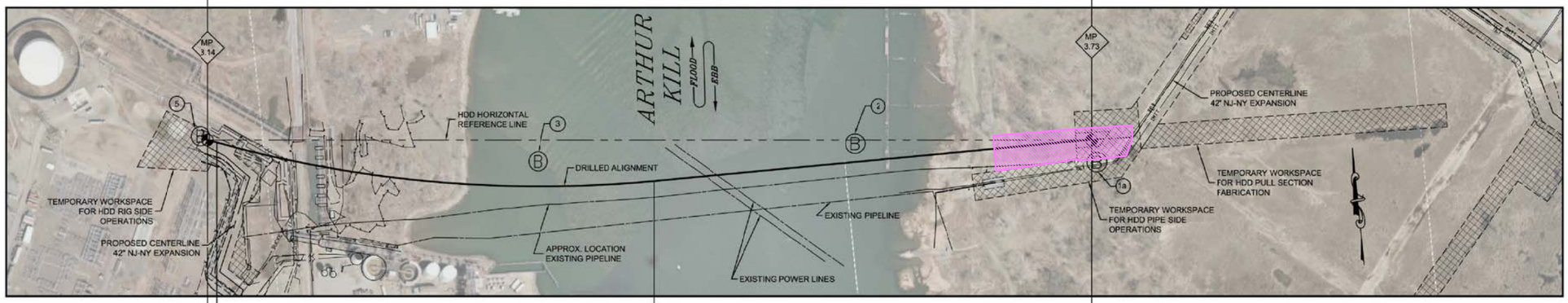
The report will be submitted in a technical format compatible with platforms required by PAL. The document will be camera ready and will serve as a stand-alone product.

Figure 3. Example of a site formation reconstruction. Taken from GRA project in Hackensack Meadowlands, NJ (north of Newark). The Figure provides an example site expectation model we can build from cores when we integrate special studies (radiocarbon dating, pollen studies, and sedimentology) with deep testing.



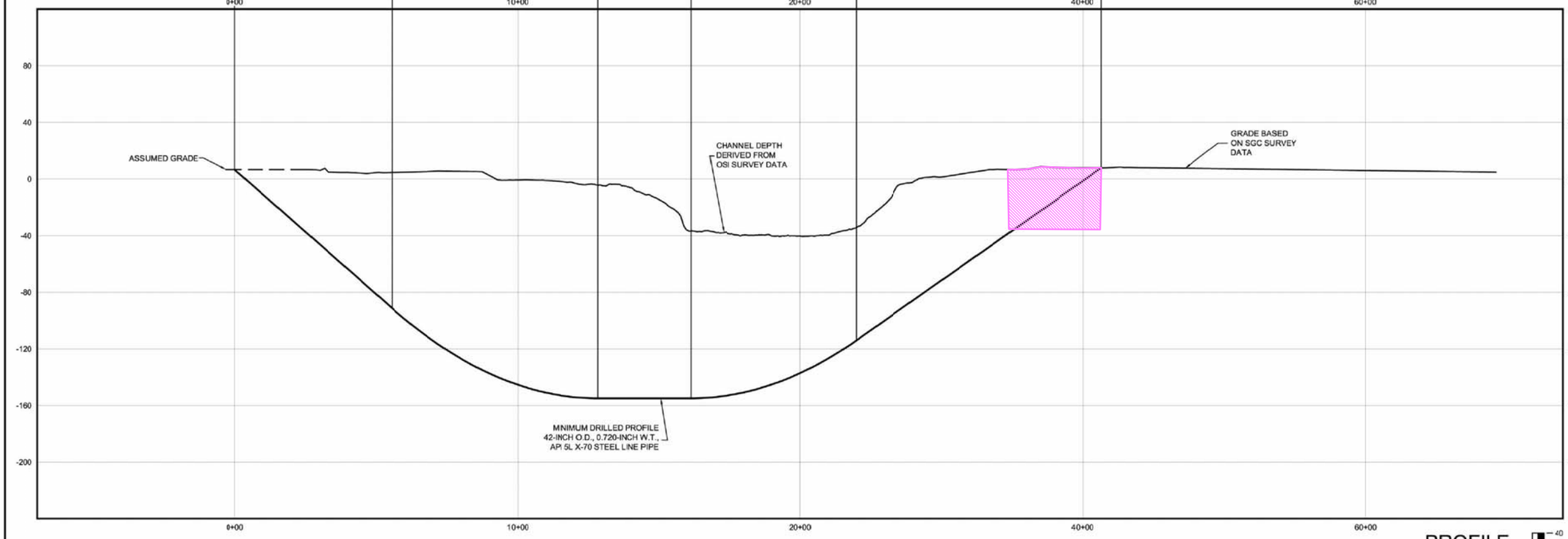
APPENDIX G

HDD PLANS AND PROFILE DRAWINGS WITH ARCHAEOLOGICAL SENSITIVITY



PLAN

SCALE: 1" = 20'



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

SURVEY NOTES

1. ALL TOPOGRAPHIC LAND SURVEY DATA WAS PROVIDED BY SGC ENGINEERING.

2. RIVER BOTTOM DEPTHS WERE DERIVED FROM A HYDROGRAPHIC SURVEY PERFORMED BY OCEAN SURVEYS INC DATED OCTOBER 06, 2010.

3. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO, UTM ZONE 18, NAD83.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO HDD HORIZONTAL REFERENCE LINE LOCATED IN THE PLAN VIEW.

2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PIPE.

GEOTECHNICAL LEGEND

Ⓑ BORING LOCATION

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT UTILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ELEVATION - PLUS 0 FEET, MINUS 20 FEET.

2. ALIGNMENT - PLUS OR MINUS 10 FEET.

3. ENTRY POINT - AT THE STAKED LOCATION.

4. EXIT POINT - PLUS OR MINUS 5 FEET IN ALIGNMENT, PLUS 25 FEET AND MINUS 0 FEET IN LENGTH.

5. CURVE RADIUS - NO LESS THAN 2,100 FEET.

PROTECTION OF UNDERGROUND FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS:

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.

2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.

3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

Source/Revision/Issue	Date
PAL modified	12-03-10
Map data received from: Spectra Energy	11-24-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix G-1

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

PROFILE

400 200 50 0 — 40 20 0

0 200 500 1000ft

0 150 300m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	REFERENCE DWG.	REV	CLC	DSN	CK	DESCRIPTION
		1				ISSUED FOR FERC APPROVAL (11-22-10)

John Deering Hair
Professional Engineer
New Jersey Lic. # 24GE04547300
New York Lic. # 080869
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

ENGINEERING APPROVALS					
	PRELIMINARY		CONSTRUCTION		
DRAWN BY:					
PROJECT MANAGER	JMS	08/09			
DESIGN ENGINEER	CLC	08/09			
DESIGN CHECKER	KMN	11/04			
TITLE	SIGNATURE	DATE	SIGNATURE	DATE	

PLAN AND PROFILE WORKSHEET
42-INCH ARTHUR KILL CROSSING BY HDD
SPECTRA NJ-NY EXPANSION PROJECT

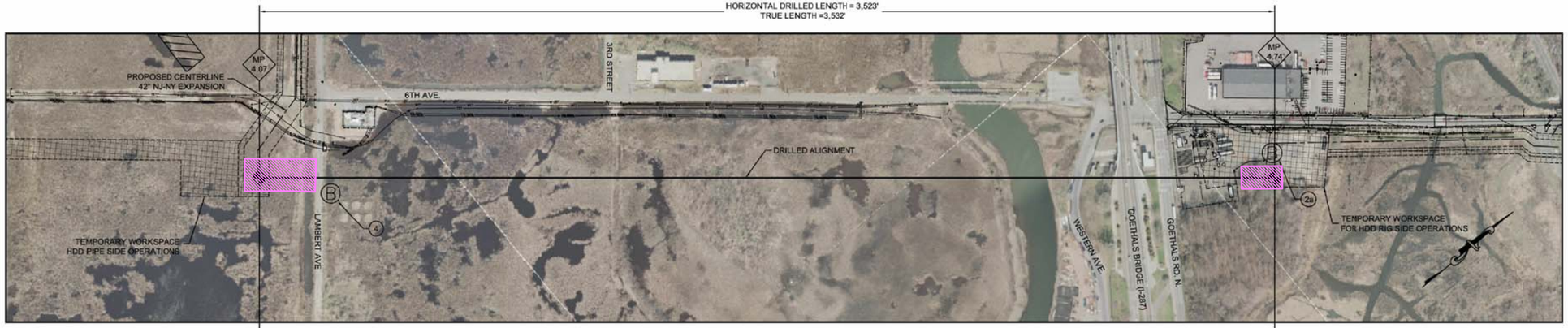
LOC. UNION CNTY., NJ & RICHMOND CNTY NY

Spectra Energy

Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

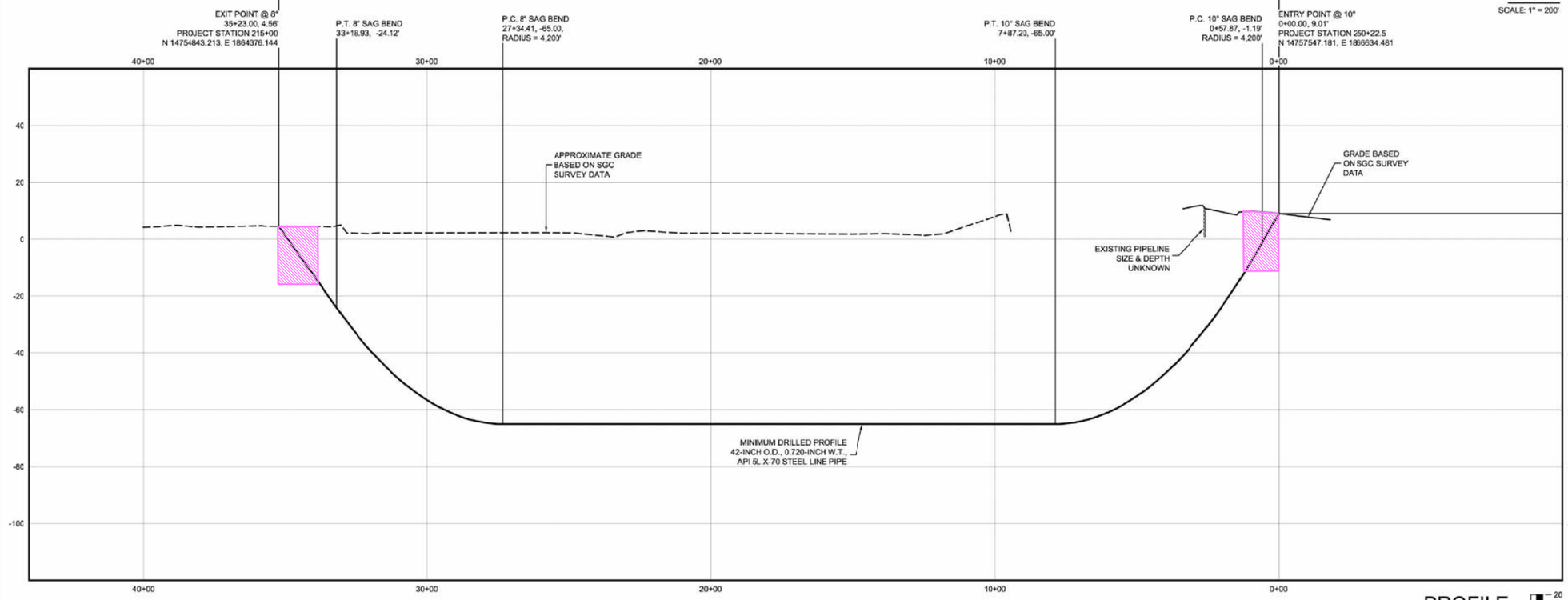
YEAR: 2010 | W.O. | DWG. LD-H-1010 | REV. 1

Appendix G-1. NJ-NY Expansion Project HDD plan and profile drawings with archaeological sensitivity, 42-inch Arthur Kill HDD.



PLAN

SCALE: 1" = 200'



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

SURVEY NOTES

1. ALL TOPOGRAPHIC LAND SURVEY DATA WAS PROVIDED BY SGC ENGINEERING.

2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO, UTM ZONE 18, NAD83.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.

2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PIPE.

GEOTECHNICAL LEGEND

B BORING LOCATION

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY MUESER RUTLEDGE CONSULTING ENGINEERS, NEW YORK CITY, NEW YORK. REFER TO THE PROJECT GEOTECHNICAL REPORT DATED FOR ADDITIONAL INFORMATION.

2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TESTS WERE PERFORMED.

3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGEMENT IN INTERPRETING THIS DATA.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT UTILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ELEVATION - PLUS 10 FEET, MINUS 20 FEET.

2. ALIGNMENT - PLUS OR MINUS 10 FEET.

3. ENTRY POINT - AT THE STAKED LOCATION.

4. EXIT POINT - PLUS OR MINUS 5 FEET IN ALIGNMENT, PLUS 25 FEET AND MINUS 0 FEET IN LENGTH.

5. CURVE RADIUS - NO LESS THAN 2,100 FEET.

PROTECTION OF UNDERGROUND FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS:

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.

2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.

3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

Source/Revision/Issue	Date
PAL modified	12-03-10
Map data received from: Spectra Energy	11-24-10

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Project
NJ-NY Expansion

Date
December 3, 2010

Appendix G-2

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

PROFILE

20
10
0
400 200 100 0

0 200 500 1000ft
0 150 300m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	REFERENCE DWG.	REV	DSN	CK	DESCRIPTION
		1	CLC	KMN	ISSUED FOR FERC APPROVAL (11-22-10)

John Deering Hair
Professional Engineer
New Jersey Lic.# 24GE04547500
New York Lic.# 080869
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

ENGINEERING APPROVALS				
DRAWN BY:	PRELIMINARY		CONSTRUCTION	
PROJECT MANAGER	JMS	11/10		
DESIGN ENGINEER	BKB	11/10		
DESIGN CHECKER	KMN	11/10		
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

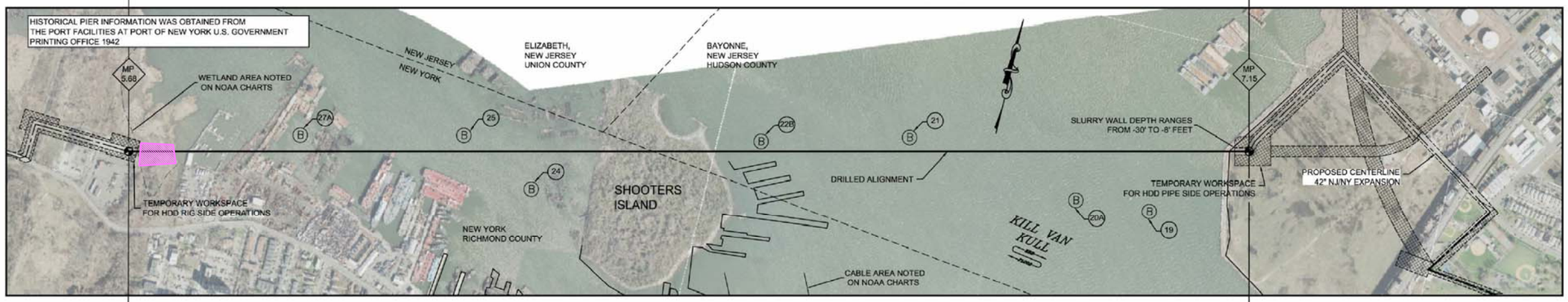
PLAN AND PROFILE WORKSHEET
42-INCH 380 GOETHALS BRIDGE CROSSING BY HDD
SPECTRA NJ-NY EXPANSION PROJECT

LOC. RICHMOND COUNTY, NEW YORK

YEAR: 2010 | W.O. | DWG. LD-H-1020 | REV. 1

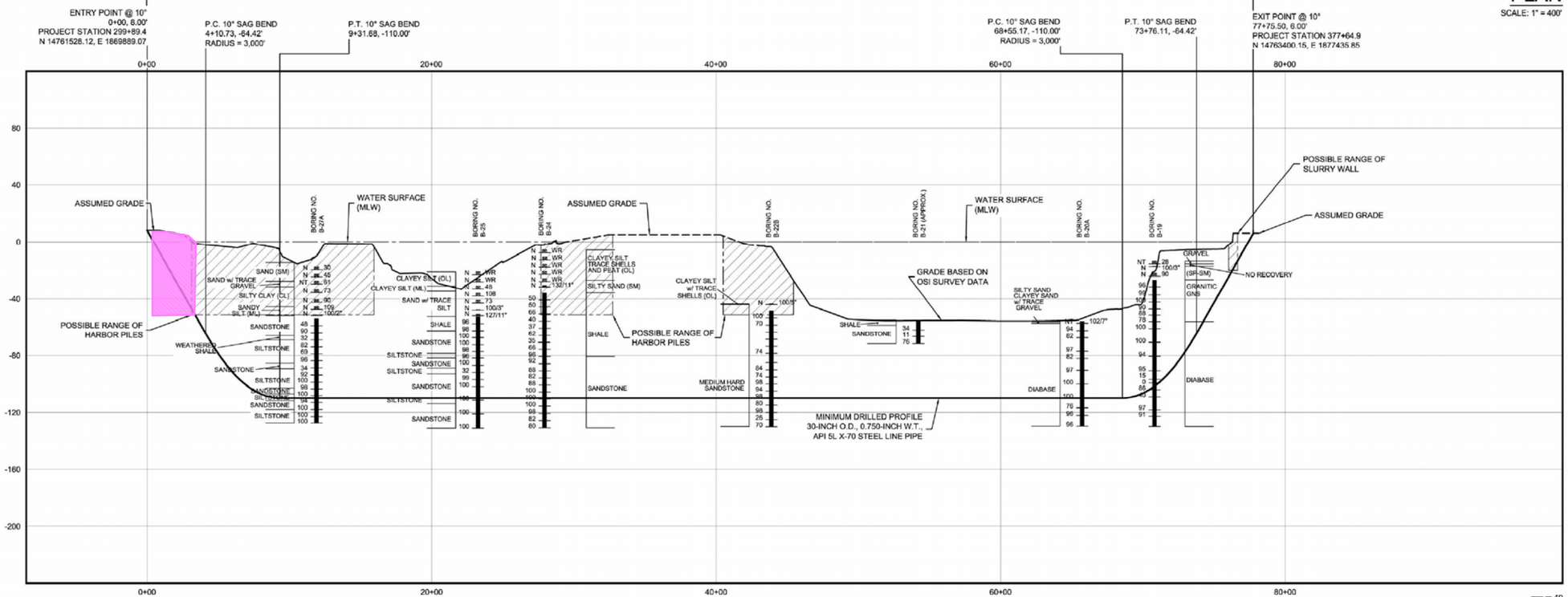
Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713/ 627-5400

Appendix G-2. NJ-NY Expansion Project HDD plan and profile drawings with archaeological sensitivity, 42-inch Goethals Bridge HDD.



PLAN

SCALE: 1" = 400'



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

TOPOGRAPHIC SURVEY NOTES

1. ALL TOPOGRAPHIC LAND SURVEY DATA WAS PROVIDED BY SGC ENGINEERING.

2. RIVER BOTTOM DEPTHS WERE DERIVED FROM A HYDROGRAPHIC SURVEY PERFORMED BY OCEAN SURVEYS INC DATED OCTOBER 06, 2010.

2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO, UTM ZONE 18, NAD83.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.

2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PIPE.

GEOTECHNICAL LEGEND

(B) BORING LOCATION

SPLIT SPOON SAMPLE

53 / 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
53 / 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY MUESER RUTLEDGE CONSULTING ENGINEERS, NEW YORK CITY, NEW YORK. REFER TO THE PROJECT GEOTECHNICAL REPORT DATED FOR ADDITIONAL INFORMATION.

2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TESTS WERE PERFORMED.

3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGEMENT IN INTERPRETING THIS DATA.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT UTILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ELEVATION - PLUS 0 FEET, MINUS 20 FEET.

2. ALIGNMENT - PLUS OR MINUS 20 FEET.

3. ENTRY POINT - AT THE STAKED LOCATION.

4. EXIT POINT - PLUS OR MINUS 20 FEET IN ALIGNMENT, PLUS 100 FEET AND MINUS 0 FEET IN LENGTH.

5. CURVE RADIUS - NO LESS THAN 1500 FEET.

PROTECTION OF UNDERGROUND FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS:

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.

2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.

3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

Source/Revision/Issue	Date
PAL modified	12-03-10
Map data received from: Spectra Energy	11-24-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix G-3

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

PROFILE

1000 800 600 400 200 0 — 40 20 0

0 400 800 1200 1600 2000ft
0 300 600m

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	REFERENCE DWG.	REV	DSN	CK	DESCRIPTION
		1	CLC	KMN	ISSUED FOR FERC APPROVAL (11-22-10)

John Deering Hair
Professional Engineer
New Jersey Lic # 24GE04547500
New York Lic # 080969
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

ENGINEERING APPROVALS				
DRAWN BY:	PRELIMINARY		CONSTRUCTION	
PROJECT MANAGER	JMS	11/10		
DESIGN ENGINEER	CLC	11/10		
DESIGN CHECKER	KMN	11/10		
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

PLAN AND PROFILE WORKSHEET
30-INCH KILL VAN KULL CROSSING BY HDD
SPECTRA NJ-NY EXPANSION PROJECT

LOC. HUDSON CNTY., NJ & RICHMOND CNTY NY

YEAR: 2010 | W.O. | DWG. LD-H-1030 | REV. 1

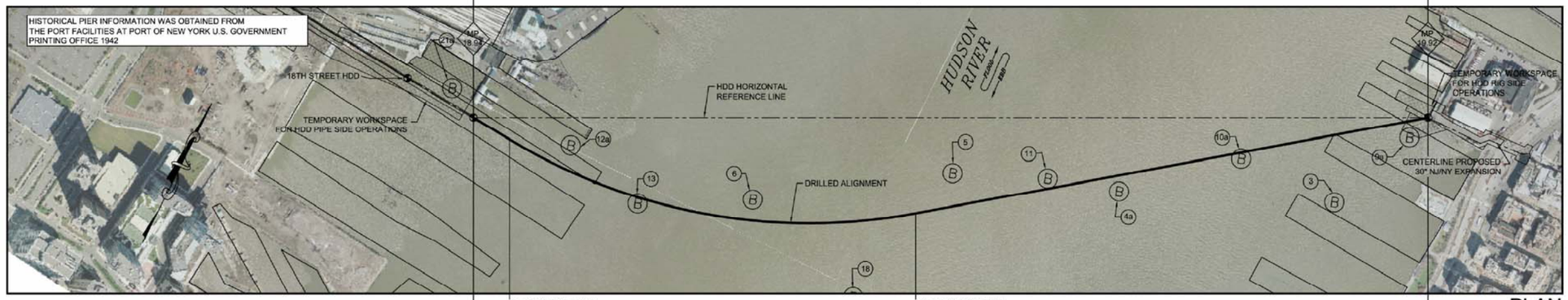
Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

Appendix G-3. NJ-NY Expansion Project HDD plan and profile drawings with archaeological sensitivity, 30-inch Kill Van Kull HDD.

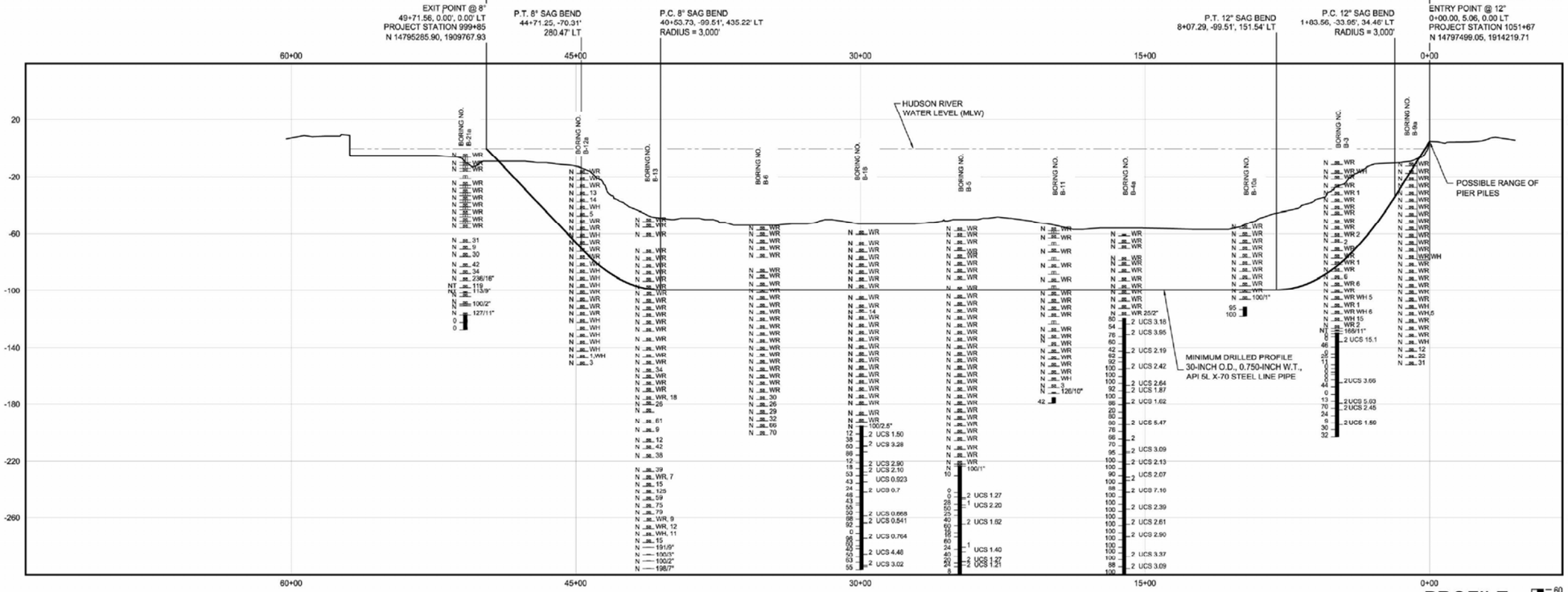
JERSEY CITY, NEW JERSEY

HORIZONTAL REFERENCE LENGTH = 4,791'
HORIZONTAL PLAN LENGTH = 5,134'
TRUE LENGTH = 5,149'

MANHATTAN, NEW YORK



PLAN
SCALE: 1" = 300'



PROFILE
SCALE: 1" = 300'

Archaeological Sensitivity

- *High*
- *Moderate*
- *Low*

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

SURVEY NOTES

1. ALL TOPOGRAPHIC LAND SURVEY DATA WAS PROVIDED BY SGC ENGINEERING.
2. RIVER BOTTOM DEPTHS WERE DERIVED FROM A HYDROGRAPHIC SURVEY PERFORMED BY OCEAN SURVEYS INC DATED AUGUST 09, 2010.
3. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO, UTM ZONE 18, NAD83.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO HDD HORIZONTAL REFERENCE LINE LOCATED IN THE PLAN VIEW.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PIPE.

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

SHELBY TUBE OR PUSH SAMPLE

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (KSI)
53 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY MUESER RUTLEDGE CONSULTING ENGINEERS, NEW YORK CITY, NEW YORK. REFER TO THE PROJECT GEOTECHNICAL REPORT DATED 01-OCT-10 FOR ADDITIONAL INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SPLIT SPOON SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TESTS WERE PERFORMED.
3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGEMENT IN INTERPRETING THIS DATA.

PILOT HOLE TOLERANCES

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1. ELEVATION - PLUS 0 FEET, MINUS 20 FEET.
2. ALIGNMENT - PLUS OR MINUS 20 FEET.
3. ENTRY POINT - AT THE STAKED LOCATION.
4. EXIT POINT - PLUS OR MINUS 5 FEET IN ALIGNMENT, PLUS 50 FEET AND MINUS 0 FEET IN LENGTH.
5. CURVE RADIUS - NO LESS THAN 1,500 FEET.

PROTECTION OF UNDERGROUND FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS:

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

0 300 600 1200ft
0 150 300m

Source/Revision/Issue	Date
PAL modified	12-03-10
Map data received from: Spectra Energy	11-24-10

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Project: NJ-NY Expansion

Date: December 3, 2010

Appendix G-4

PRIVILEGED INFORMATION - DO NOT RELEASE

DWG. NO.	REFERENCE DWG.	REV	DSN	CK	DESCRIPTION
		1	CLC	---	ISSUED FOR FERC APPROVAL (11/22)

John Deering Hair
Professional Engineer
New Jersey Lic. # 24GE04547500
New York Lic. # 080859
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

ENGINEERING APPROVALS	PRELIMINARY		CONSTRUCTION	
DRAWN BY:				
PROJECT MANAGER	JMS	11/10		
DESIGN ENGINEER	CLC	11/10		
DESIGN CHECKER	CLC, KMN	11/10		
TITLE	SIGNATURE	DATE	SIGNATURE	DATE

PLAN AND PROFILE WORKSHEET
30-INCH HUDSON RIVER CROSSING BY HDD
SPECTRA - NJ-NY EXPANSION PROJECT

LOC. HUDSON CNTY., NJ., AND NEW YORK CNTY., NY.

YEAR: 2010 | W.O. | DWG. LD-H-1080 | REV. 1

Spectra Energy
Texas Eastern Transmission, LP
5400 Westheimer Ct. Houston, TX 77056-5310 713 / 627-5400

Appendix G-4. NJ-NY Expansion Project HDD plan and profile drawings with archaeological sensitivity, 30-inch Hudson River HDD.