WESTSIDE HIGHWAY CULTURAL RESOURCE SURVEY ARCHEOLOGICAL WORK PROGRAM:

CULTURAL RESOURCES RESEARCH
(Contract No. D-202836)

by

HISTORIC CONSERVATION AND INTERPRETATION, INC.
Box 111, RD 3, Newton, New Jersey 07860

for

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SEPTEMBER 1983

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THE STUDY AREA

The construction of the Westway Project involves a study area that extends along the West Side of Manhattan from Battery Place in the south northward to W. 44th Street. It includes West Street throughout this length, as well as (a) portions of lands presently inundated by the Hudson River between the bulkhead line (west side of West Street) and the U.S. pier line, approximately between Jay Street in the south and W. 37th Street in the north, and (b) four interchange areas extending eastward from West Street at (1) Battery Place, (2) Canal Street, (3) 14th Street, and (4) Midtown (see map of study area, Figure 1).

DESCRIPTION OF THE SURVEY

One of the components of the supplemental environmental impact statement currently under preparation for the design and construction of the Westway Project by the Federal Highway Administration (FHWA) is the cultural resource survey. Portions of this work have already been accomplished by others. For example, the survey work on all above-ground architectural properties was performed by the New York State Department of Transportation (NYSDOT) and Systems Designs Concepts, Inc. (SYDEC) of Washington, D.C. In addition, archeological research on the MaBSTOA Garage site was conducted by the NYSDOT and SYDEC in the Midtown Interchange area.

The Westside Highway Cultural Resource Survey Archeological Work Program--i.e., research on potential archeological (below-ground) cultural resources--was undertaken by Historic Conservation and Interpretation, Inc. (HCI) of Newton, New Jersey under contract No. D202836 to the NYSDOT. With the exception of an accelerated effort to complete a portion of the survey undertaken on an emergency basis in December of 1981 and January through March of 1982,* the survey was conducted from June of 1982 to June of 1983, when the first draft of the final report (in two parts) had been submitted.

The purpose of this Stage IA-level survey, which consisted of documentary research only (i.e., archeological excavations were neither proposed nor made), was to locate and identify potentially significant prehistoric and historic period archeological cultural resources that were likely to exist within the project area.

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*This accelerated effort was performed on the prototype fill area, an offshore area bounded on the north by pier 52, on the east by the bulkhead line, on the south by pier 45, and on the west by a line 160 feet east of the pier line (i.e., roughly piers 45-52 between W. 10th and Gansevoort).

To accomplish this end, four research tasks were proposed and carried out:

1. Review of the history and all previous studies of the project area;

2. Correlation of the paleoecological research data supplied by the subconsultants;

3. Documentation of prior disturbance within the project area; and

4. Data analysis and report preparation.

Task 1 included a review of all the previous cultural resource work undertaken for the project area as well as the customary literature and document research. The HCI research team consulted the site files of the City, State, and National Registers, as well as the files of various city, state, and federal agencies, public and private libraries, museums, historical societies, and other appropriate archives and data repositories. Also consulted were persons knowledgeable in the areas of prehistory and local history, as well as individuals familiar with New York City's below-ground matrix.

Task 3, the documentation of prior disturbance within the project area, was in many respects an extension of Task 1. In areas in which potentially significant cultural resources were likely to exist, all previously recorded ground disturbances--e.g., as a result of construction, grading, the placement of underground facilities, etc.--were researched in order to determine what impact such activities may have had on the cultural resources that were suspected of existing. Data were gathered from water, sewer, road, and utility departments and companies, as well as from Chancery Records. Deed and tax records were also researched on specific potentially significant sites.

Task 2--called "correlation of the paleoecological research"--was designed to determine what areas within the Westway Project study area were suitable for human occupation during the prehistoric era. Part of this task was the gathering and evaluation of extant research data--e.g., site reports, historical references to Manhattan's prehistory, etc. The remainder of the proposed work was the correlation of these known prehistoric archeological data with the results of the analyses performed by HCI's subconsultants on some 30 samples from the many test borings already made for engineering purposes by the Westway staff. These samples were examined for the information they could yield pertaining to the project area's changing sea level and shoreline environments and to the nature of its late and postglacial paleoenvironments. They were also subjected to flotation studies performed at Columbia University. Data resulting from these investigations contributed to the reconstruction of prehistoric shorelines in the project area and to the formulation of a predictive model for areas most likelt to have contained prehistoric human habitation.

All data collected on the study area were analyzed toward the following goals:

1. To determine the location within the study area of sites likely to contain significant cultural resources; and
2. To determine which of the potentially significant sites identified in (1) would be disturbed or destroyed by the proposed design/construction activities for the Westway Project.

In achieving the second goal, the proposed construction/design plans were, of course, taken into consideration. Figure 2 illustrates the types of physical treatment that the study area is slated to receive during the building of the highway:

- A Areas to be excavated (approx. to -35')
- AA Areas to be excavated (approx. to -25')
- B Areas to be dredged (-5 to -15')
- C Areas to be filled by dredge spoil
- D Areas in which piles will be driven
- E Areas in which foundations for ramps and above-ground structures will be placed
- F Areas in which road surfaces will be reconstructed
- G Areas in which present tunnels will be protected by deep pile-driven bridges

RESEARCH FINDINGS

This analysis has resulted in the identification of four areas within the study area--labeled Areas 1-4 in Figure 3--in which research has indicated that one or more sites likely to be significant may be located, and where the proposed construction activities have been assessed as likely to damage or destroy the remains of these potentially significant sites:

<u>Area 1.</u> The potential aboriginal site area offshore below (south of) Canal Street, where the proposed construction activities will be dredging, filling, and pile driving.

<u>Area 2.</u> The lower West Street area, where historic shoreline facilities, land-building remains, and possible abandoned vessels would be impacted by the proposed excavations to -25 feet.

Area 3. The Canal Street Interchange area, containing a number of potential sites, including potential aboriginal sites, early nineteenth-century backyards, a colonial period farmstead, a city park-turned freight station, and an area of early docks, a drainage canal, and shoreline building activities. Pilings will be driven throughout.

Area 4. A single factory site on the north side of 31st Street between 9th and 10th avenues, where piles will be driven through the remains of a mid-nineteenth-century paperhanging factory.

The recommendations for assessing the presence of potentially significant cultural resources in these areas is archeological testing in Areas 2-4 and the taking of additional boring samples for archeological analysis in Area 1.

I. INTRODUCTION

The construction of the Westway Project involves a study area that extends along the West Side of Manhattan from Battery Place in the south northward to W. 44th Street. It includes West Street throughout this length, as well as (1) portions of presently inundated lands (approximately between Jay Street in the south and W. 37th Street in the north) between the bulkhead line (west side of West Street) and the U.S. pier line, and (2) four interchange areas extending eastward from West Street at (1) Battery Place, (2) Canal Street, (3) 14th Street, and (4) Midtown (see Figure 1).

One of the components of the supplemental environmental impact statement currently under preparation for the design and construction of the Westway Project by the Federal Highway Administration (FHWA) is the cultural resource survey. Portions of this work have already been accomplished by others. For example, the survey work on all above-ground architectural properties was performed by the New York State Department of Transportation (NYSDOT) and Systems Design Concepts, Inc. (SYDEC) of Washington, D.C. In addition, archeological research on the MaBSTOA Garage site was conducted by the NYSDOT and SYDEC in the Midtown Interchange area.

The Westside Highway Cultural Resource Survey Archeological Work Program--i.e., research on potential archeological (below-ground) cultural resources--was undertaken by Historic Conservation and Interpretation, Inc. (hereafter HCI) of Newton, New Jersey under Contract No. D-202836 to the NYSDOT. With the exception of an accelerated effort to complete a portion of the survey undertaken on an emergency basis in December of 1981 and January through March of 1982,* the survey was conducted from June of 1982 to June of 1983. The purpose of this Stage IA-level survey, which consisted of documentary research only (i.e., archeological excavations were neither proposed nor made), was to locate and identify potentially significant prehistoric and historic period archeological cultural resources that are likely to exist within the project area. To accomplish this end, four research tasks were proposed and carried out:

1. Review of the history and all previous studies of the project area;
2. Correlation of the paleoecological research data supplied by the subconsultants;
3. Documentation of prior disturbance within the project area; and
4. Data Analysis and report preparation.

Task 1 included a review of all the previous cultural resource work undertaken for the project area as well as the customary literature and document research. The HCI research team consulted the site

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files of the City, State, and National registers, as well as the files of various city, state, and federal agencies, public and private libraries, museums, historical societies, and other appropriate archives. Also consulted were persons knowledgeable in the areas of prehistory and local history, as well as individuals familiar with New York City's complex below-ground matrix. The participation of several members of the research team, in fact, was solicited because of their acknowledged expertise in the history and/or urban archeology of Manhattan. (See APPENDIX I: DESCRIPTION OF PROJECT PERSONNEL RESPONSIBILITIES AND RESEARCH EFFORTS for a complete listing.)

Task 3, the documentation of prior disturbance within the project area, could be said to be an extension of Task 1. In areas in which potentially significant cultural resources were likely to exist, all previously recorded ground disturbances--e.g., as a result of construction, grading, the placement of underground facilities, etc.--were researched in order to determine what impact such activities may have had on the cultural resources that were suspected of existing. Data were gathered from water, sewer, road, and utility departments and companies, as well as from Chancery Court records. Deed and tax records were also researched on specific potentially significant sites.

Task 2--called "correlation of the paleoecological research"--was designed to determine what areas within the Westway Project study area were suitable for human habitation during the prehistoric era. Part of this task was the gathering and evaluation of extant research data--e.g., site reports, historical references to Manhattan's prehistory, etc. The remainder of the proposed work was the correlation of these known prehistoric archeological data with the results of the analyses performed by subconsultants on some 30 samples from the many test borings already made for engineering purposes for the project by the firm of Mueser, Rutledge, Johnston and DeSimone. These samples were examined for the information they could yield pertaining to the project area's changing sea level and shoreline environments and to the nature of its late and postglacial paleoenvironments. They were also subjected to flotation studies performed at Columbia University. Data resulting from these investigations contributed to the reconstruction of prehistoric shorelines in the project area and to the formulation of a predictive model for areas most likely to have contained prehistoric human habitation.

The results of Task 4, data analysis and report preparation, as well as those of Tasks 1 through 3, are found in the following pages of the final report. The following short summary of research results is presented so that the reader will be properly oriented to the data presentation.

All data collected on the study area have been analyzed toward the following goals:

1. To determine the location within the study area of sites likely to contain significant cultural resources; and
2. To determine which of the potentially significant sites identified in (1) will be disturbed or destroyed by the proposed construction activities for the Westside Highway.

In making recommendations for further cultural resource research, the proposed construction and/or design plans for the Westway Project were, of course, taken into consideration. Figure 2, presented in three sheets owing to space limitations--Figures 2.1, 2.2, and 2.3--illustrates the types of physical treatment that the study area is slated to receive during the building of the highway. The proposed construction/design activities are identified in Figure 2 as follows:

A	Areas to be excavated (approximately to -35')
AA	Areas to be excavated (approximately to -25')
B	Areas to be dredged (-5' to -15')
C	Areas to be filled by dredge spoil
D	Areas in which piles will be driven
E	Areas in which foundations for ramps and above-ground structures will be placed
F	Areas in which road surfaces will be reconstructed
G	Areas in which present tunnels will be protected by deep pile-driven bridges

This analysis has resulted in the identification of four areas within the study area--labeled Areas 1-4 in Figure 3--in which one or more sites likely to be significant have been indicated, and where the proposed construction activities have been assessed as likely to damage or destroy the remains of these potentially significant sites:

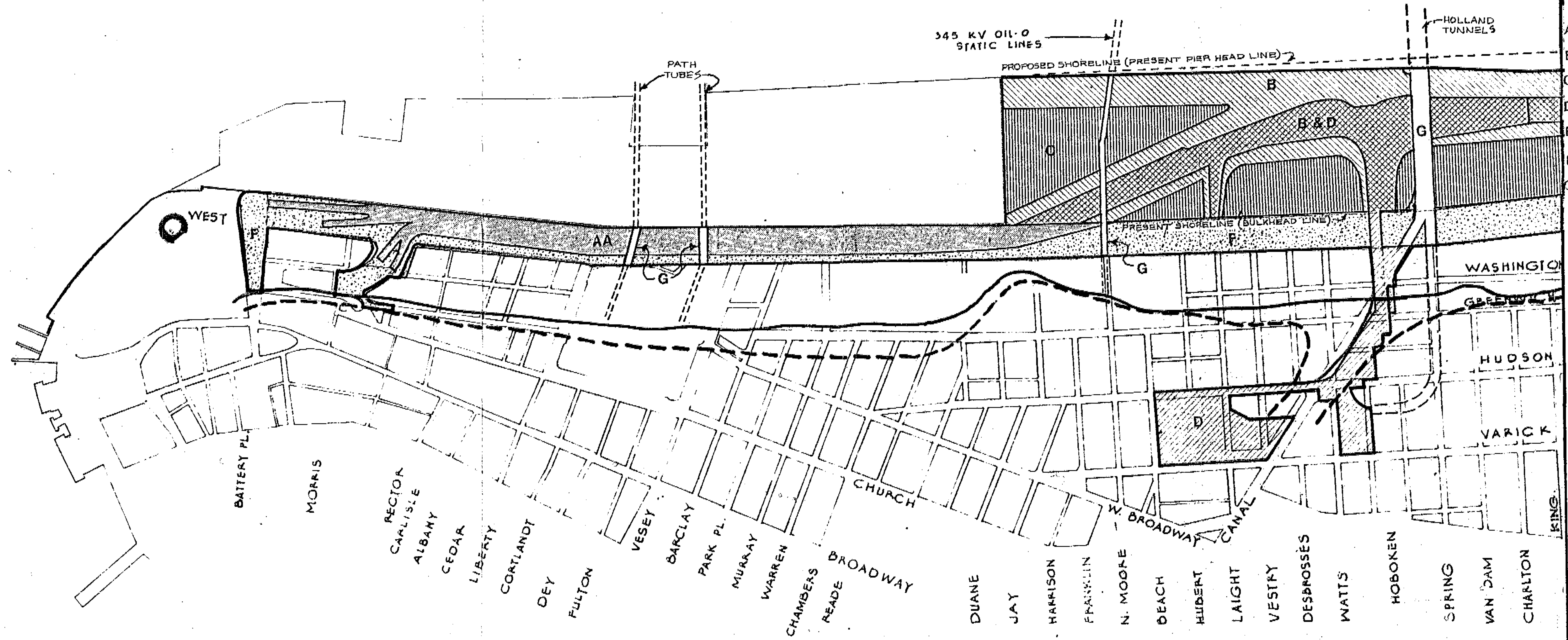
1. The potential aboriginal site area offshore below (south of) Canal Street, where the proposed construction activities will be dredging, filling, and pile driving.

2. The lower West Street area, where historic shoreline facilities, land-building remains, and possible abandoned vessels will be impacted by proposed excavations to a depth of 25 feet.

3. The Canal Street Interchange area, containing a number of potential sites, including potential aboriginal sites, early nineteenth-century backyards, a colonial period farmstead, a city park-turned freight station, and an area of early docks, a drainage canal, and shoreline building activities. Pilings will be driven throughout.

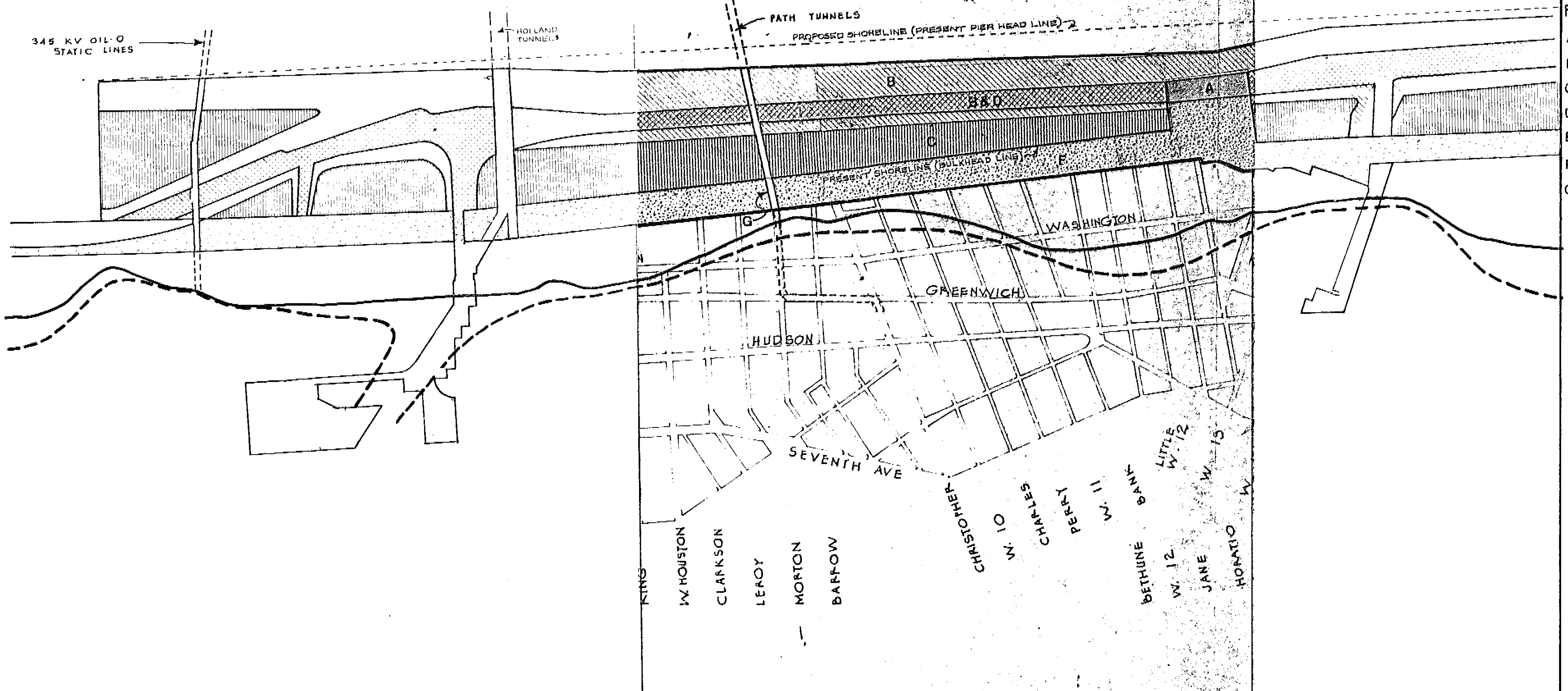
4. A single factory site on the north side of 31st Street between 9th and 10th avenues, where the remains of a mid-nineteenth-century paperhanging factory will have piles driven through it.

The recommendations for assessing the presence of potentially significant cultural resources in these areas is testing in Areas 2-4 and taking additional boring samples for archeological analysis in Area 1.



CULTURAL RESOURCE SURVEY,
PROPOSED WESTWAY PROJECT:
AREAS AND TYPES OF IMPACT,
LOWER MANHATTAN PORTION
OF PROJECT AREA

FIGURE 2.1



PROPOSED CONSTRUCTION ACTIVITY

A — AREAS TO BE EXCAVATED (APPROX. -35')

B — AREAS TO BE DREDGED (5' - 15' DEPTHS)

C — AREAS TO BE FILLED BY DREDGE SPOIL

D — AREAS IN WHICH PILES WILL BE DRIVEN

E — AREAS IN WHICH FOUNDATIONS FOR RAMPS & ABOVE GROUND STRUCTURES WILL BE PLACED

F — AREAS IN WHICH ROAD SURFACES WILL BE RECONSTRUCTED

G — TUNNEL PROTECTION

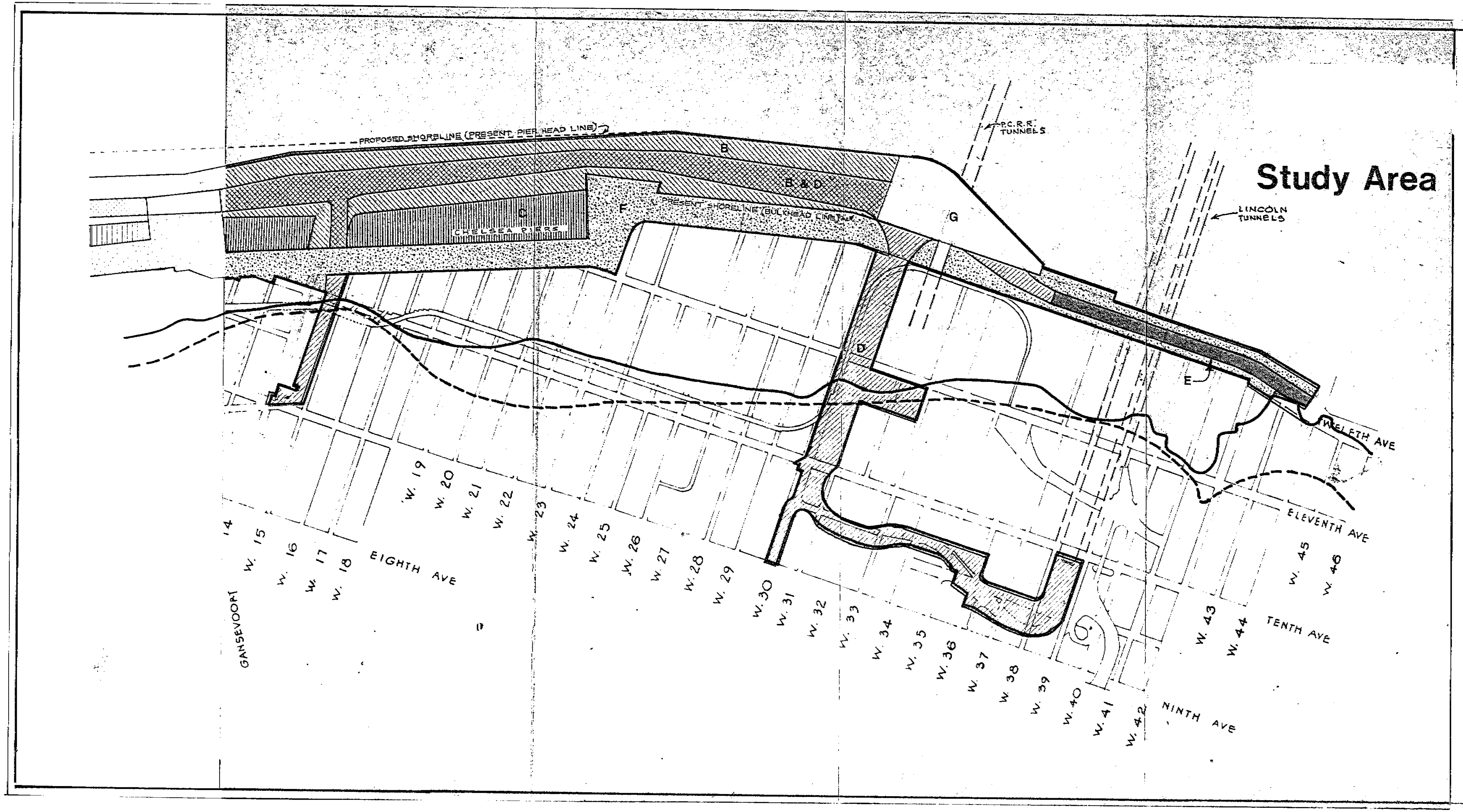
APPROXIMATE SHORELINE IN COLONIAL DAYS, BASED ON VARIOUS DOCUMENTARY SOURCES. (INCLUDING RATZER 1776)

1873 HIGH WATER MARK TAKEN FROM MAP MADE UNDER DIRECTION OF DEPARTMENT OF DOCKS, PREPARED BY LOCKWOOD KESSLER AND BARTLETT, INC., 1978.

CULTURAL RESOURCE SURVEY, PROPOSED WESTWAY PROJECT: AREAS AND TYPES OF IMPACT, GREENWICH VILLAGE PORTION OF PROJECT AREA

BASED ON COMMUNITY PLANNING MAPS PREPARED FOR 1973 WESTWAY PROJECT LANDMARKS REPORT (UPDATED THROUGH 2/81)
REVISED 2/83 PROJECT AREA.
" 4/83 " "

FIGURE 22



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- —— 1873 HIGH WATER MARK TAKEN FROM MAP MADE UNDER DIRECTION OF DEPARTMENT OF DOCKS, PREPARED BY LOCKWOOD KESSLER AND BARTLETT INC., 1978.

CULTURAL RESOURCE SURVEY,
PROPOSED WESTWAY PROJECT:
AREAS AND TYPES OF IMPACT,
CHELSEA AND CLINTON
PORTIONS OF PROJECT AREA

BASED ON COMMUNITY PLANNING MAPS PREPARED FOR 1973 WESTWAY PROJECT LANDMARKS REPORT (UPDATED THROUGH 2/81)
REVISED 2/83 STUDY AREA.
" 4/83 " "

FIGURE 2.3

Study Area Schematic
of Potentially
Significant Resources
CULTURAL RESOURCES SURVEY
HISTORIC CONSERVATION & INTERPRETATION, INC. NEWTON, NEW JERSEY
ONE INCH EQUALS APPROX. 650 FEET
Area 1
ABORIGINAL REMAINS
Area 2
DOWNTOWN WEST STREET DOCKS
Area 3
CANAL STREET SITES
Area 4
WHITING PAPER-HANGING FACTORY SITE
LISPENARD HOUSE
SAINT JOHNS PARK TERMINAL
HOBOKEN STREET
PREVIOUSLY UNDEVELOPED PLOTS
WASHINGTON
GREENWICH
HUDSON
VARICK
SEVENTH AVE
EIGHTH AVE
NINTH AVE
TENTH AVE
ELEVENTH AVE
TWELFTH AVE
CHURCH
W. BROADWAY
CANAL
BROADWAY
FIGURE 3

II. DOCUMENTARY RESEARCH

A. INTRODUCTION

Inasmuch as the cultural resources are discussed in chronological order in the following report--i.e., from the prehistoric era through the various periods in the historic era--it is appropriate that the descriptive evaluations of the paleoenvironment begin the manuscript. Owing to the highly technical nature of the two evaluations made by the subconsultant, however, they have been placed in a technical appendix, and Section B (following) contains only a synopsis of their contents. The reader should consult APPENDIX II: PALEOENVIRONMENT OF THE STUDY AREA, for the two research reports in their entirety: (1) *Changing Sea Level and Shoreline* and (2) Paleoecological Investigations.

Section C, entitled CULTURE HISTORY, begins with the presentation of the research on the prehistoric cultural period. Data on the historic cultural period are then presented in the following order: an overview of the evolution of the project area's waterfront, 1800-1860; the project area in the Colonial/Federal era; and the project area in the industrial era.

B. PALEOENVIRONMENT OF THE STUDY AREA

1. Introduction

The primary purpose of the paleoecological research undertaken as part of the cultural resource survey for the Westway Project was to help determine what portions of the project area were suitable for human habitation during the prehistoric era, based on available documentation and soil samples. Thirty samples from the test borings already made for engineering purposes for the four-mile long Westway Project were examined and analyzed by the paleoecologists. Tests performed on these samples yielded information on sea level change, salinity, sedimentation, and the flora and fauna of the study area throughout the periods of man's habitation there.

This environmental information was then analyzed by the archeologists to formulate an estuarial history of the project area which would help determine those areas most likely to have hosted human habitation. The archeologists brought to this analysis, of course, their accumulated knowledge and experience--both documentary and infield--of prehistoric settlement patterns in the area. The overall result of this research process was the development of a predictive model to illustrate the study area's potential sensitivity to cultural resources.

Museums and other collectors of aboriginal cultural material made very rich finds and artifact recoveries in the early twentieth century in New York City. Today on Manhattan Island, some of these archeological sites have survived in a preserved state, either covered with fill or within undeveloped land. These known sites are recognized as city landmarks and are being preserved for careful study in the future. They represent a unique opportunity to discover that period of man's activity which went unrecorded but which represents the first chapter in the culture history of the area.

Recent studies done as part of cultural resource projects similar to the present research have had the opportunity to work with new materials, as scientists from other disciplines have developed techniques for accurately dating and retrieving knowledge of the ecology of the environments known to have been used by these prehistoric first New Yorkers. Archeologists have also added to this record. Recent studies performed along the Bronx, Brooklyn, and New Jersey shorelines have yielded concrete evidence regarding the filling and development of the harborside as well as the conditions of the underlying habitation of the preindustrial society.

Historic Conservation and Interpretation, Inc. is presently undertaking several cultural research projects in the New York coastal area where soil borings made for engineering purposes are being used in archeological analysis. (The techniques employed and the potential results of these projects are reviewed and analyzed, in comparison to the Westway Project area, in the Conclusions and Recommendations section of this report.) In conjunction with others, we are currently addressing one problem especially--that of obtaining samples and data specificially designed to answer archeological research needs. Hopefully, some new techniques of sampling will soon be used that will make the process more effective.

The environment that was examined for the Westway Project by paleoecologists and prehistorians was, of course, difficult to research because it is covered. Analysis was further complicated because during the prehistoric era since the last ice age (15,000 to 30,000 years ago) the study area has also been increasingly inundated by rising sea water. Ever since the era of the first historic settlement, sea level has been rising at approximately 1 foot per 100 years.

Very briefly, the shoreline strata remains have been found to be deposits of organic peat materials, which grew on the river's bank. Carbon-14 dating of these peats has identified the period during which each of these bogs was alive and growing. Further chemical analysis and analysis of the fossil animal record within the samples have established the nature of the river insofar as salinity is concerned. The evaluation of salinity was considered essential to this research because if a sea level change occurred (and it was known that it had), it could have affected the river's fresh and salt water balance. Since it has been shown that the nature of man's environment--e.g., marine vs. estuarine vs. freshwater--greatly affected where and how he lived, it was assumed that knowledge of the paleoenvironment could not help but to shed light on prehistoric man's cultural patterns.

From these data, we have reconstructed several prehistoric shorelines on our map of the study area. We have been able to date these prehistoric shorelines accurately and to tell a great deal about the changes that went on between them. These data have illuminated the nature of the paleoenvironment--hence the use of the term "paleo-ecological studies" for this portion of the research.

The paleoecological research was performed in two parts (the following Sections 2 and 3, respectively): a study of changing sea level and shoreline; and investigations of the study area's paleoecology. The highly technical nature of this work has dictated its placement in APPENDIX II of this report. What follows, here, then, is a precis of the technical data and research findings, edited for the lay reader.

2. Changing Sea Level and Shoreline

a. *PROJECT DESCRIPTION*

The work on the Westway Project performed at Queens College Radiocarbon Laboratory had two phases: (1) an analysis of the sea level record of the past 12,000 years in the vicinity of the proposed project; and (2) an examination of the environmental conditions as reflected in the chemistry of the cores.

The first phase of this work was designed to yield an accurate picture of the location of shorelines for the area of the lower West Side of Manhattan for the time since the end of the Pleistocene Epoch. Specifying the position of the shorelines at any particular time is essential for evaluating the possibility of the presence of archeological sites. Radiocarbon analyses were performed on 30 samples of organic matter--chosen on the basis of their likelihood of being sea level indicators--selected from several hundred samples obtained from the core sample collection taken for the Westway Project.

The second phase was a direct attempt to locate strata of potential archeological significance by the chemical record contained in the core sediments. It is to be expected that certain chemical elements--e.g., phosphorus--might be artificially concentrated owing to human activity. The chemical analysis was geared to studying the samples most likely to contain anthrosols--sediments that have been deposited or disturbed by man.

b. SEA LEVEL AND SHORELINE POSITION

The analyses of sea level resulted in the plotting of a sea level curve for the project area (see APPENDIX II, Figure A1). The sea level curve reflects three processes which controlled the formation and accumulation of organic sediments within the Hudson estuary: (1) the rise in postglacial sea level; (2) equilibrium adjustments following the retreat of the last glacial ice; and (3) subsidence of the land. Subsidence of land in the area has been relatively constant since the end of the last glaciation. Sea level rise has occurred in three distinct periods during that time: sea level rose rapidly in a period before 13,000 BP to about 11,000 BP; very little sea level rise occurred between 11,000 and 8,000 BP; and a second period of rapid rise took place from about 8,000 to 6,000 BP.

These periods of rapid sea level rise should be expected to be advantageous for the preservation of occupational sites. The first period, until about 11,000 BP, occurred before man was likely to have entered the area in any numbers (Haynes 1977). The second, from about 8,000 to 6,000 BP, is a more favorable time for possible human occupation to have taken place.

A shoreline position map has been drawn on the assumption that the top of the glacial gravel/sand surface as interpreted by the Westway Project's engineers (see Meuser, Rutledge, Johnston and DeSimone's Project Soils Reports) is the same as that surface onto which rising sea level deposited the first layers of organic-rich sediment at or near mean high water (see Figure A2, APPENDIX II).

The topography of this surface is generally highest in the southern portion of the study area near Canal Street and lowest at the northern end near the Amtrak tunnel. In the southern section, an island or peninsula existed a short distance offshore. Not inundated until about 7,500 BP, before that time it was separated from the mainland of Manhattan by a valley, which may have carried the stream at Canal Street north for some distance approximately along the Westway Project centerline.

A "delta"-like feature exists at Canal Street, which may have been used by the Canal Street stream. This feature, extending about 500 m west into the Hudson from the present shoreline, was above sea level until approximately 6,500 BP. It was a relatively gently sloping hill, perhaps containing patches of marsh. The shallow valley extending northward from this "delta" was probably marshy for several hundred years, until the island/peninsula was overrun by rising sea level (about 7,500 BP).

c. CHEMICAL ANALYSES

The chemical analyses performed in this study have been done for survey purposes; therefore, they were designed not so much to give a detailed picture of an occupational area as to identify which areas might be productive for future investigation. Thus, only anomalies in the concentration of some elements were sought, anomalies which might possibly be related to human occupation, such as those for phosphorus, potassium, calcium, and iron.

Phosphorus has been the most often-used element for the detection of human-deposited or -disturbed sediments. This element is present in soils in several forms, both organic and inorganic (Eidt 1977). One sample, taken just north of Laight Street, contained a slightly elevated phosphorus content. Similar positive phosphorus anomalies are absent from other samples north or south of the Laight Street vicinity.

The variability in all other chemical elements seems to be related to two simple causes--changes in the content of shell fragments and changes in salinity. Some shell concentrations are probably related to natural changes in environmental conditions; whether others are the result of human activity should be evaluated only in light of other evidence in this report.

Diatom assemblages were examined for two samples, both of which appeared superficially to be the best candidates for containing ancient sediments. The diatom assemblage turned out not to be significantly different from that of any other taken from estuarine core-bottom samples--i.e., it was indicative of brackish or marine conditions with only a normal mixture of freshwater forms.

d. CONCLUSIONS

The portion of the study area north of approximately Gansevoort Street was inundated by rising sea level at least as early as 13,000 BP. The prospect of archeological remains below any historical fill or natural estuarine deposits in this area is slim. South of Gansevoort Street, the archeological prospects appear brighter. A long valley strikes north-south throughout this southern portion of the study area. It may have carried a freshwater stream and was dry land until about 9,000 BP. An accessible island of indeterminate size just offshore and probable marshes with shellfish resources provided other conditions favorable to habitation. The island/peninsula was near-shore dry land at about the same time (10,000 - 6,000 BP) that midden sites were being occupied only tens of kilometers north near Ossining, New York.

An examination of the Project Soils Report as well as the results of the chemical analyses presented herein*for some of the core samples clearly shows that the area south of Laight Street was considerably modified by artificial fill right down to nearly the level of the glacial gravels. Although the layer sampled for chemical analysis in this area might actually represent valid ancient sediments, artificial fill appears to have extensively modified sediments above the glacial gravels. It seems likely that the area between Laight Street and the north PATH Tubes may have been occupied by aboriginal Americans but may not have been extensively modified by modern man.

*For these data, see APPENDIX II.

3. Paleoecological Investigations

a. PURPOSE AND SCOPE

The purpose of this study was to extend our knowledge of the postglacial marine occupation of the lower Hudson Valley in order to determine those events that led to the development of the present estuary. The methodology selected to accomplish this goal was the analysis of the presence of foraminifera in selected Westway Project boring samples. Foraminifera are single-celled microscopic shelled animals which form an integral part of the group of organisms that live in or near the bottom of the water portions of most estuaries. They have thus been found to be accurate indicators of sea level. In addition, they are normally found in sufficient numbers to allow their use in stratigraphic and paleoecologic studies. (Shells of larger organisms, such as clams and snails, are often broken or destroyed by the coring devices used in such work.)

b. SITE SELECTION, LOCATION, AND DESCRIPTION

The cores chosen for this study were selected from the hundreds obtained for the design of the proposed Westway Project. The following criteria were used to make this determination:

1. The cores contained the longest possible length to bedrock to insure the oldest and most complete sediment, stratigraphic, and paleoecological record.
2. The core sites were as far beyond the pier and/or bulkhead line as possible to insure that dredging, filling, or other human activities had not disturbed the sediments deposited in the estuary.

3. The driller's record for the cores did not indicate disturbed or other man-derived materials.

Ten sites were initially selected and the cores from seven were examined. Only four cores contained foraminiferal material suitable for this study (see APPENDIX II for complete data).

All cores generally displayed a stratigraphic sequence, above bedrock, consisting of a basal coarse sand or gravel overlaid by varying thicknesses and sequences of gray clayey silt with traces of fine sand, which, in turn, were overlaid by gray organic silty clay. The uppermost portion of each core was comprised of black organic silty clay. This last material is presently being deposited in the estuary.

The Hudson River in the project area should be correctly described as a partially stratified estuary. Chute *et al.*(1975) reports that the salinity found in the study area vicinity is partially mixed during the fall, winter, and spring, and displays a distinct two-layered structure during summer months. A northward progression of high salinity during the low flow periods of summer was noted by Rachlin *et al.* (1975).

c. METHODS OF STUDY

All samples available from the four cores studied were examined for their foraminiferal content. Approximately 100 g of material was removed from each core sample and chemically treated to allow the material to be separated into its various components. Wet sieving, hot air drying, and flotation completed the separation process. When sufficient numbers permitted, up to 500 foraminifera were counted per sample. In all instances, the foraminifera were identified and their relative abundance determined. Foraminiferal distribution diagrams were constructed for each core (see APPENDIX II, Figures A5-A8). Using the species found and the number of foraminifera in each sample, we determined the salinity conditions at the time of deposition of each sample horizon. This information (presented in APPENDIX II, Figure A9) indicates whether conditions were less saline (fresher) or more saline (marine) than today.

d. RESULTS

Research results showed that the foraminiferal species contained in the four samples represent those presently thriving in the study area as well as those not indigenous to the present estuary. The foraminifera found in the cores can be grouped into three assemblages, as follows: the *Elphidium* assemblage; the *Ammonia/Elphidium* assemblage; and the *Virgulina/Elphidium* assemblage. *Elphidium clavatum* is the dominant foraminifera in all assemblages, comprising at least 60% of the number of individuals present in most samples. The other species listed (see APPENDIX II), although not found in comparable percentages, are indicative of specific environmental conditions of importance.

e. DISCUSSION

The three foraminiferal assemblages identified from the core samples are similar to those found in modern estuarine, coastal, and shelf environments. The *Elphidium* and *Ammonia/Elphidium* assemblages are currently found in the waters of the Hudson Estuary and adjoining New York Bay. The *Virgulina/Elphidium* assemblage is characteristic of the waters of the Atlantic continental shelf off the northeastern United States, including the New York Bight, Block Island Sound, Buzzards Bay, and eastern Long Island Sound. Because each of these assemblages is characteristic of given salinities and water temperatures, we can make present-day evaluations of the study area's paleoenvironment from their presence, absence, or relative abundance.

The earliest occurrence of estuarine conditions at each core site is marked by the first appearance of foraminifera. Cores TT380, RR102, and WT515, which have the longest sediment record, show the earliest signs of saline conditions at about 11,000-12,000 years BP. The first occurrence of foraminifera in these cores is made at slightly shallower depths from the most southerly, TT380, to the most northerly, WT515 (see APPENDIX II, Figure A9). Weiss (1974) also reports the first occurrence of foraminifera at two additional lower Hudson Estuary sites. The first is reported at the Holland Tunnel site, which shows the first sign of saline conditions and foraminifera at about 12,000 BP, and the second is at W. 50th St. at 10,500 BP. Thus, a northward progression of salinity and estuarine conditions, with higher than present salinity, occurred as early as 12,000 years BP and continued to about 10,000 BP. At the lower Hudson Estuary core sites, these conditions are noted primarily by the presence of the *Virgulina/Elphidium* and *Ammonia/Elphidium* assemblages. Occasional reductions in salinity during this period are marked by the occurrence of the *Elphidium* assemblage.

Between 10,000 and 8,000 years BP, a reduction in salinity is noticeable. It is also evident by the presence of the *Elphidium* assemblage and a marked reduction in the number of foraminifera present in each sample. This event correlates with a reduction in the rate of rise of sea level. At about 8,000 BP, sea level again began to rise rapidly. The foraminiferal assemblages show a concurrent increase in salinity, with the return of the *Virgulina/Elphidium* and *Ammonia/ Elphidium* assemblages. This rate of rise was maintained until about 6,000 BP, when the present rate of rise was established.

The first appearance of foraminifera at the site of core VT255 occurred at about 7,000 to 8,000 years ago. This date corresponds to the second period of rapid rise of sea level and correlates to the high salinity conditions observed in the upper parts of cores TT380, RR102, and WT515. The organic silty clays containing foraminifera are found directly above basal coarse sands. It is therefore highly likely that an unconformable boundary marks the initial inundation of this area by estuarine conditions. Weiss (1974) reports similar events in the Hudson Valley in the vicinity of Tarrytown and Ossining. This event probably marks that point in time when the present extent of the estuary, as well as the present near salinity conditions, were established. Topographic data also indicate that the Westside Highway project area south of the VT255 site was exposed and subjected to possible subaerial conditions prior to 7,000-8,000 BP. It is thus very possible that during the early stages of marine transgression and estuarine development, the course of the Hudson Estuary in the vicinity of lower Manhattan was west of its present position. Therefore, the estuary as recognized today obtained its maximum extent about 7,000 years ago.

C. CULTURE HISTORY

1. Prehistoric Cultural Period

a. INTRODUCTION

The following general discussion of prehistoric human occupation provides a basis on which to anticipate the kinds of cultural properties that may be found in the study area. It summarizes available knowledge about the ways in which prehistoric peoples lived in the northeastern United States in general and in coastal New York in particular, and it applies this information to projections of potential site locations within the study area.

By correlating environment and cultural behavior in the study area, this discussion attempts to reconstruct past environments. It also considers the archeological potential of the study area with regard to prehistoric cultural resources. The previous absence of systematic field investigations has produced difficulties in identifying the study area's extant prehistoric resources. Therefore, this discussion evaluates the probable attractiveness of the study area for prehistoric peoples and locates areas where prehistoric peoples were likely to have lived and worked.

Consideration of prehistoric occupation of Manhattan requires reconstruction of the area's paleoecology. Palynologists and geologists have demonstrated that the climate and land surfaces of the shoreline areas have changed radically through time. Recession of the Wisconsin glaciation in northeastern North America dramatically affected local environments. As the glacier receded, soon after 15,000 B.P. (Ogden 1977), sea level began to rise. The change in sea level affected shorelines both on the seacoast and along the shore of the Hudson River. Rising sea level in turn caused river and sea waters to inundate the land surfaces such that some land surfaces that were available for human occupation and utilization during prehistoric times presently lie underwater. Thus, much evidence of prehistoric human land use in the study area probably has been drowned by the Hudson River. For archeology in the study area, this situation implies that the reconstruction of former shorelines is critical to understanding prehistoric occupation. Reconstructing the shorelines would allow comparison of their present and prehistoric topographic features. Areas of likely prehistoric occupation, as well as other areas not likely to have been of interest to prehistoric populations, can then be noted.

The following discussion outlines prehistoric settlement pattern information; describes the methods used to reconstruct Hudson River shorelines in the study area; describes the reconstructed shorelines extant at various points in time during the period of potential prehistoric occupation; projects possible habitation areas along the reconstructed shorelines; and describes supplemental information provided from examination of soil samples from borings collected in the study area. The conclusions drawn have been summarized.

b. REVIEW OF AREA'S PREHISTORY AND PALEOECOLOGY

Human populations have occupied the Hudson Valley for at least 11,000 years (Eisenberg 1978). Scientists rely on the archeological record for information about prehistoric human populations, who left no written records about their cultures. Written observations about indigenous Native American populations were not recorded until about the seventeenth century when Europeans began to interact with these local groups.

Archeological evidence documents various technological changes and environmental shifts. Cultural changes have been traced based on recognized differences in artifactual forms and the locations of prehistoric sites. Three periods of prehistoric human occupation typify the culture historical sequence of northeastern North America: Paleo-Indian, Archaic, and Woodland. Each period implies particular technologies, lifestyles, time periods, and environmental contexts.

1) Paleo-Indian Period

The Paleo-Indian Period represents the earliest archeological evidence of human occupation in North America and ranges in age between 11,000 and 9,000 B.P. Fluted bifacially worked lanceolate projectile points and unifacially flaked stone tools typify the period.

A few archeologists interpret initial human occupation in northeastern North America to have taken place earlier than 11,000 B.P. Adovasio *et al.* (1977) extend the Paleo-Indian Period back to 17,000 B.P. based on dates derived from Stratum

IIa of the Meadowcroft Rockshelter, Washington County, Pennsylvania. At this site level, charcoal was associated with nondiagnostic flaked stone artifacts in features interpreted as firepits. Dincauze (1981) summarized two main criticisms of Adovasio's interpretations: (1) the emphasis on the early radiocarbon dates, whereas the stratigraphic, floral, faunal, and artifactual data do not support a pre-Holocene age determination (Haynes 1980); and (2) the potential contamination of the charcoal samples by introduced organics in Strata IIa and I (Haynes 1980). Furthermore, the dates from these lower strata are unique with respect to established northeastern North American culture history (Willey 1966; Jennings 1974; Ritchie 1969; Funk 1978). Evidence suggests that the dates at Meadowcroft are not typical for the Northeast and are therefore not pertinent to consideration of the study area's prehistory.

Since Paleo-Indian sites are sparse, we infer local Paleo-Indian lifeways from sites in other northeastern areas. The archeological literature reports five recorded Paleo-Indian sites in New York in the Hudson Valley, in addition to numerous fluted points found on the ground's surface throughout the valley: West Athens Hill and Kings Road in Greene County; Twin Fields in Ulster County; Dutchess Quarry Cave in Orange County; and Port Mobil in Richmond County (Funk 1976; Kraft 1977; Eisenberg 1978). Although these sites may not be statistically representative of Paleo-Indian sites in the Hudson Valley, they suggest a light population density during Paleo-Indian times. Areas surrounding the Hudson Valley in New Jersey and Long Island corroborate this conclusion (Saxon 1973; Marshall 1981).

Pollen records show that at 11,000 B.P. coniferous forest dominated by spruce with substantial amounts of pine characterized the northeastern United States' environment. Southeastern New York and Long Island supported mixed coniferous hardwood forests. At about 10,000 B.P. climate became colder and more moist, and forests included increasing percentages of spruce. By 9,000 B.P. white pine replaced spruce as the dominant tree species, thus indicating warmer, drier conditions. Parklands and meadows existed in addition to forests (Salwen 1975: 43).

Sea level in the Paleo-Indian Period was approximately 80 feet below the present level (see Table 1). Consequently, the Atlantic coastline extended about 20 to 30 miles south and east of its present position (Salwen 1975: 43). Therefore, some of the land surfaces available for Paleo-Indian occupation on the Atlantic coast and in the lower Hudson River Valley are presently underwater.

Paleo-Indians supported themselves through hunting and foraging subsistence strategies. Their pattern of settlement was mobile, and their social system was probably based on band organization with flexible community residence. Band movement facilitated the exploitation of a wide variety of resources within a number of locally available microhabitats (Eisenberg 1978; Marshall 1981). Gardner (1977: 261) describes Paleo-Indians in the Shenandoah Valley as "selectively mobile within

TABLE 1. SEA LEVEL CURVE*

Feet Below Datum (Approximately Below Present Sea Level)	Radiocarbon Years Before Present
-100	12,500 - 12,000
-90	12,000 - 11,000
-80	11,000 - 10,000
-70	10,000 - 8,000
-60	8,000 - 7,500
-50	7,500 - 7,200
-40	7,200 - 6,500
-30	6,500 - 5,000
-20	5,000 - 4,600
-10	4,600 - 2,000
0	2,000 - Present

*Developed from the radiocarbon analysis of samples from Westside Highway borings, performed by Richard Pardi, Queens College Radiocarbon Laboratory, Flushing, New York.

a prescribed territory with eventual return to a prescribed base camp."

A pattern of Paleo-Indian site location emerges based on the analysis of recorded sites. Paleo-Indian sites tend to occur on landforms which rise above most of the local terrain (Barber 1979). Ritchie and Funk (1973) recognize the elevated river terraces of major river valleys as the key routes of movement used by Paleo-Indians entering new territories. Eisenberg (1978) notes three site locations: (1) lowland waterside camps near coniferous swamps and near larger rivers; (2) upland bluff camps in areas where deciduous trees dominated; and (3) ridge-top camps, also where deciduous trees dominated. A relationship between lithic resource locations and Paleo-Indian site distributions has been demonstrated by Gardner in the Shenandoah Valley, Virginia (Gardner 1977). In eastern Pennsylvania, Paleo-Indian occupants of the Shawnee Minisink site left evidence of fishing activities, thus indicating that archeologists have overemphasized hunting strategies while losing sight of a probably more typical pattern which included a range of subsistence activities (Marshall 1981).

After about 9,000 B.P., the Paleo-Indian way of life ended in the Hudson Valley. The archeological record yields sites with new kinds of tools represented at locations which suggest a more specific resource focus for the site occupants. In the Southeast, the archeological record demonstrates a continuity between Paleo-Indian and succeeding Early Archaic traditions (Coe 1964; Broyles 1971; Gardner 1974, 1977). In the Northeast it seems that Early

Archaic technology was introduced from areas to the south. The supposed hiatus in northeastern human occupation which archeologists once hypothesized as following the Paleo-Indian period is no longer supported by the archeological evidence (Dincauze 1976; Starbuck and Bolian 1980; McNett *et al.* 1977), although the data indicate that population densities during the Early Archaic Period remained somewhat sparse.

2) Archaic Period

Technological innovations, including new stone spear point forms with bifurcated bases, mark the beginning of the Early Archaic cultural period dated between 9,000 and 7,000 B.P. First recognized at sites in North Carolina (Coe 1964) and West Virginia (Broyles 1971), investigators have found similar Early Archaic cultural materials north of the study area in the Hudson Valley (Brennan 1977), on Staten Island (Ritchie and Funk 1971), in the Delaware Valley (Dumont and Dumont 1979; Kraft 1975; McNett *et al.* 1977), and in New England (Dincauze 1976; Starbuck and Bolian 1980). Early Archaic people participated in a mobile lifestyle based on hunting, fishing, and gathering. Population densities were low.

After 9,000 B.P., at the beginning of the Archaic Period, pollen sequences indicate the presence of forests of largely white or red pine with significant amounts of both birch and oak. Decreasing amounts of nonarboreal pollen suggest a more closed forest than had previously existed (Salwen 1975).

Sea level at this time was about 70 feet below the present level (see Table 1). New York Harbor and Long Island Sound were considerably smaller than they are today, and Staten Island was part of the mainland (Salwen 1975). Therefore, some of the land area that was available for occupation by Early Archaic peoples along the Atlantic coast and in the Hudson Valley study area is now underwater.

The Middle Archaic Period spans approximately from 6,500 to 5,500 B.P. Sites such as Sylvan Lake Rockshelter, Dutchess County, New York (Funk 1965); Harry's Farm (Kraft 1975) and the Rocklein site (Dumont and Dumont 1979) in the Upper Delaware Valley; and oyster shell heap sites in the Lower Hudson Valley north of the study area as reported by Brennan (1977), indicate that Middle Archaic people exploited more diversified ecological zones than did people of earlier periods. Associated tool assemblages indicate similarities with sequences established in the Southeast and demonstrate new technological innovations, including atlatl weights and grooved axes (Dincauze 1976).

By about 5,000 and 4,000 B.P., hardwood forests, particularly oak, replaced some of the pine forests. Climatic shifts appear to have included a succession of warm-moist, warm-dry, and, finally, cooler-moister conditions (Salwen 1975).

Between 6,000 and 4,000 B.P., sea level stood at about 20 to 30 feet below present level (see Table 1). Salwen notes that the salinity of the Hudson Estuary as far north as Bear Mountain Bridge was greater then than today (Salwen 1975). Thus, as did people of earlier periods, Middle Archaic peoples had access to presently drowned land surfaces.

A large number of sites represent the Late Archaic Period, which spanned approximately 5,500 to 3,000 B.P. Archeologists interpret an increased population density, greater diversification in site location, and broader resource exploitation. Numerous projectile point types suggest at least two cultural traditions simultaneously extant in the Northeast: (1) a small-stemmed tradition, representing coastal plain and piedmont adaptation (Kinsey *et al.* 1972; Ritchie 1969; Brennan 1977; Byers 1959); and (2) points characterized as Laurentian, a more inland-oriented tradition (Ritchie 1969).

Late Archaic people used local lithic sources for tool manufacture and also participated in long-distance trade to acquire additional materials. Late Archaic subsistence strategies incorporated seasonal scheduling of site relocations to take advantage of the seasonal availability of favored food sources, including interior and coastal resources (Braun 1974). Artifact distributions suggest regional cultural adaptations by groups within circumscribed areas. New tool forms associated with the Late Archaic Period include bola stones for hunting birds; harpoons; netsinkers; and fishspears for procuring riverine resources; millingstones, mullers, mortars, and pestles for processing collected nuts, berries, fruits, and legumes; and chipped and polished adzes, celts, choppers, and axes for woodworking tasks. Late Archaic sites are often larger than sites in earlier periods, and they were occasionally reoccupied.

From c. 3,000 B.P., prehistoric peoples have essentially had access to the modern-day coastline. Sea level has risen only a couple of feet since that time (see Table 1). Climatic conditions then were essentially similar to those of the present time.

The end of the Archaic Period in the Northeast is represented by projectile point forms characterized as broadspears. Subcategorized into several point types, broadspear sites are often riverine. Flat-bottomed steatite bowls have been associated with the broadspear tradition. Considering that these vessels were heavy and the soapstone from which they were manufactured was brought into the area from either eastern Pennsylvania or central Connecticut, Witthoft interprets that canoe travel was an important cultural innovation during this period (Witthoft 1953).

3) Woodland Period

The earliest appearance of clay vessels at about 3,000 B.P. marks the beginning of the Woodland Period. Fragile and not easily transportable, ceramics have been interpreted as indicative of a sedentary or semisedentary settlement pattern associated with the cultivation of plants (Salwen 1975). However, the Early Woodland cultural pattern resembles the Late Archaic pattern of seasonal shifts in residence within restricted territories. Movements were scheduled to allow access to seasonally available plant and animal resources.

The pattern of mobility and temporary site occupation may have extended throughout the Woodland Period in coastal New York, whereas in central New York large permanent villages typified Late

Woodland settlement (Ritchie 1969; Ritchie and Funk 1973). The degree of reliance on food production and the existence of large, permanent villages in coastal New York is open to question (Ceci 1979-80; 1982). One point of view is represented by Carlyle Shreeve Smith (1950), who, in analyzing the distribution of ceramics in coastal New York, describes the Clason's Point Focus of the East River Aspect as distributed over the western portion of Long Island, northern Staten Island, probably all of Manhattan Island, and the mainland area between the Hudson and Housatonic rivers at least as far as Hudson Highlands. He describes most of the Clason Point sites as "village sites situated near tidal inlets on the second rise of ground above water" (Smith 1950: 120). Windsor Aspect sites, which preceded Clason Point culture, are "village sites" found on the margins of bays and tidal streams (Smith 1950: 130).

Smith's "village sites" are characterized by shell midden deposits mixed with artifacts, including potsherds, stone tools, fire-cracked rock, charcoal, and animal bones. These sites do not necessarily represent permanent occupations but could represent just one component of a settlement pattern that brought Woodland peoples into several ecozones affording exploitation of a variety of resources, some available in different seasons (Salwen 1970).

c. ARCHEOLOGICAL SITES IN THE STUDY AREA

There are no recorded sites specifically in the study area. However, Skinner speculates on the probability that

> ... all along the shore, wherever one of the many springs or small brooks, shown on old maps, emptied into the Hudson or East River, there were small, temporary Indian camps. It is likely that these camps were used only in summer while the primitive occupants of Manhattan retreated to the more protected part of the Island, as at Inwood and Cold Spring, during the winter. Or it may be possible that, as Ruttenber states, the villages on Manhattan Island were only occupied when the Indians were on hunting and fishing excursions, while their permanent villages were on the mainland. Bolton however says their principal settlement was in Manhattan Island. (Skinner 1961: 52)

Shell midden sites have been reported along coastal New York including New York Harbor by Kaeser (1964), Lopez and Wisiniewski (1971), and Rothschild and Lavin (1977), to name a few. Many sites may have been either destroyed by land development activities or inundated by rising water levels (Salwen 1968; Powell 1965; Bourn 1972; Glynn 1953).

Several sites have been recorded on Manhattan Island (Parker 1922; Skinner 1909A, 1909B, 1961; Finch 1909; Bolton 1909). In the vicinity of the study area is one site reported by Skinner (1961: 630) as Site 9, a village site on a small lake near Canal Street. It was called Shell Point owing to the large deposits of shells. Skinner discusses this site in greater length, as follows:

> ... Mrs. Lamb says that the Dutch found a large shellheap on the west shore of Fresh Water Pond, a small pond, mostly swamp, which was bounded by the present Bowery, Elm, Canal, and Pearl Streets, and which they named from this circumstance Kalch-Hook. In course of time, this was abbreviated to Kalch or Collect and was applied to the pond itself. This shell-heap must have been the accumulation of quite a village, for Mrs. Jno. K. VanRensselaer speaks of a castle called Catiemuts overlooking a small pond near Canal Street, and says that the neighborhood was called Shell Point. (Skinner 1961: 51)

Nineteenth-century maps show a stream flowing into the Hudson River near present-day Canal Street, and it is possible that this whole area near the stream may have archeological potential. Marsh areas surrounding the stream would have been attractive hunting areas for prehistoric populations.

Skinner also notes another site near the former location of the Gansevoort Market (1961: 51). His informant, Janvier, said that there was an Indian settlement there as recently as 1661 at Sappokanican, near the Gansevoort Market. Skinner writes,

> The Indian village probably was near the site of the present Gansevoort Market; but the name seems to have been applied to the whole region lying between the North River and the stream called the Manetta Water or Bestavaar's Kill. (Skinner 1961: 52)

The area today is known as Greenwich Village.

When the Dutch, and then the English settled on Manhattan Island in the seventeenth century, they did so on lands that were originally the territory of Algonkian-speaking natives. Bolton (1920) notes that in Manhattan lived the Reckgawawanc, a local group of the Unami Delaware. However, Grumet disagrees and believes that the occupants of Manhattan were the Canarsie and the Wiechquaesgeck (1981). The prehistoric period essentially ended in the seventeenth century when Europeans began to take over Native American territories, disrupt traditional cultural practices of the Native Americans, and began to record their observations about these local populations.

Therefore, although no sites have been previously recorded as located within the study area, there is certainly potential there for the existence of yet undiscovered prehistoric cultural resources.

d. RECONSTRUCTION AND ANALYSIS OF DROWNED SHORELINES

This section addresses the reconstruction of Hudson River shoreline environments in the proposed Westway Project area. The reconstruction provides a basis for determining those areas considered the most likely places on Manhattan Island to have been selected by prehistoric populations prior to European contact.

Geologists have demonstrated that the gradual rise of sea level after the recession of the Wisconsin glaciation in northeastern North America dramatically affected local environments (Fairbridge 1977; Salwen 1965; see Pardi's work, this report, APPENDIX II, Section 2). In the study area specifically, the greatest impact of sea level rise affected the riverine shorelines. After 12,000 B.P., rising sea levels caused river waters to inundate land surfaces which were once available to prehistoric populations for use. Thus, areas presently under the river may potentially contain prehistoric cultural resources.

Evaluation of the proposed project's impact on archeological resources thus requires consideration of some of the inundated portions of Manhattan's former shorelines which may contain drowned sites. Such analyses provide a basis for reconstructing topographic and environmental features of extinct shorelines, which, in turn, provide a basis for highlighting areas most likely to have archeological potential.

As previously mentioned, at the time of the arrival of Europeans to the New World, the entire project area, except the interchange areas, was below water. However, because sea levels during most of the period of prehistoric habitation of coastal New York were substantially lower than at present, or at the time of initial European settlement, prehistoric sites could have been located within the project area and could have gone unreported by the settlers because of their previous inundation by the rising sea levels.

The first step in the assessment of the possibility of drowned prehistoric sites being located within the project area involved the determination of the location of the most likely areas for prehistoric habitation. This determination necessitated the reconstruction of the pre-inundation landforms and a comparison of these landforms with the characteristics of known site areas discussed previously.

Reconstruction of the shorelines was based on data from hundreds of soil borings made in the project area for engineering purposes from as long ago as the early 1900's and as recently as 1982. Available for use were the boring logs and centerline stratigraphic profiles and contour maps drawn by Westway Project staff.

The profiles and log descriptions of borings south of Charles Street--in areas of open water or landfill, including the present location of West Street--show a stratum of organic gray silt up to 90 feet thick overlying various sand strata. Those borings not taken in areas of open water show deposits of historic period landfill overlying the silts. The gray silt stratum represents deposits of river silt which have accumulated since the inundation of the land surface. The underlying sand represents glacial outwash deposited by the retreating Wisconsin glacier prior to the earliest human occupation of the area. It is at the interface between the glacial sands and the overlying river silts that prehistoric habitation would have taken place. Any soil accumulation which could have occurred between the deposition of the glacial sands and the inundation of the land would have amounted to a relatively small part of the stratigraphic column and would not be indicated separately in the boring logs from the underlying sands.

North of Charles Street, the profiles indicate a stratum of inorganic silts between the organic silt deposits and the surface of the glacial sands or bedrock. In this area, the contours indicate the presence of a deep "canyon" prior to the inundation of the land surface. It was originally thought that this stratum represented lacustrine deposits from Glacial Lake Hudson. Dr. Dennis Weiss (personal communication), of the City College of New York, interprets the difference in the organic content of the two strata as the result of the differences in the pollen deposited in various periods subsequent to the inundation by rising sea levels. He suggests that both deposits represent river silts.

The surface of the glacial sand deposits, as indicated in the boring records, is assumed to represent the surface on which any human occupation would have taken place. In actuality, a relatively thin deposit of topsoil, which would probably not be shown in boring logs, may have accumulated above the glacial sands, prior to inundation. Therefore, the depth of the surface of the glacial sands below present sea level approximates closely the amount of sea level rise since the land was last available for human habitation. Geologists have constructed curves, based on radiocarbon-dated peat samples from these inundated land surfaces, which indicate the rate of sea level rise. Richard Pardi of Queens College has developed sea level curves for the study area (see Table 1). As shown in Table 1, sea level rose progressively from about 13,000 to 10,000 B.P. The rate of sea level rise slowed between 10,000 to 8,000 B.P. Concordantly shoreline features along the Hudson River would have been relatively stable for several thousands of years. After about 8,000 B.P. to about 6,000 B.P., the rate of sea level rise increased. Consequently, the shoreline features were somewhat less stable than previously. After about 6,000 B.P., the rate of sea level rise leveled off again to a more gradual pattern, by which it continues to rise today.

Westway Project staff have constructed contour maps (APPENDIX III) showing the surface of the glacial sands presently under the Hudson River. In those areas where glacial sand did not accumulate above bedrock, it was assumed for this analysis that bedrock surface represents the pre-inundation land surface. Each contour line representing the level of the glacial sands approximates the shoreline as it existed at a particular time during the prehistoric period. The elevation of each contour indicates its depth below current sea level and thus could be correlated with Pardi's sea level curves to determine at what time period it would have represented the shoreline. Consideration of these contours provided a basis for the identification of topographic features favorable for human habitation and provided a basis upon which to study the changing nature of the shoreline through time. Figure A10 (18 foldouts in APPENDIX III) illustrates the contours of the surface of the glacial sands as interpolated by Mueser, Rutledge, Johnston and DeSimone, based on the engineering borings. Contours from -10 to -90 feet are shown because these contours fall within the time frame of consideration of prehistoric human habitation.

Areas considered likely loci of habitation for prehistoric populations would have provided access to one or more of the following: potable water; estuary and marsh environments providing habitats for shellfish, fish, and waterfowl; shelter from inclement weather and high water conditions (except for temporary hunting camps); areas where land animals could be hunted or trapped; areas having good landings for canoes; and, to a lesser extent in this coastal zone, land suitable for agriculture, where corn, beans, and squash may have been grown by Late Woodland groups.

In the project area, prehistoric coastal sites should be found on higher ground near coves or bays and near stream intersections with those coves or bays. The higher ground provided shelter. The streams' potable water would have attracted animal as well as human populations. The coves and bays provided good habitats for fish and waterfowl and often contained marshy habitats where shellfish could be collected and where migratory birds and small mammals might feed.

The data offered by the contour drawings allowed the identification of areas of high ground, coves, bays, and other topographic features which may have proved attractive for prehistoric settlement. The presence of peat at the interface between the glacial sands and the river bottom silts indicated in the boring logs was interpreted as an indication of once-extant marshes in the project area. The presence of peat indicates areas in which the inundation of the land took place gradually enough for vegetation to take hold in the water-deposited silt, leading to marshy conditions.

The location of stream beds flowing into the Hudson River was difficult to reconstruct based on the data from the borings. The distance between borings and the small size of the streams did not allow such fine-tuned topographic reconstruction. Such information was partially available from historic period maps. These maps show a stream known first as Bestaever's Rivulet and later as Minetta Brook, which entered the Hudson several blocks north of the present location of Canal Street. In addition, a marsh located in the Canal Street area carried the runoff from a freshwater pond, the Collect Pond, near the present location of City Hall. At times of lower sea level, both Minetta Brook and the wetlands in the Canal Street area probably extended further westward to intersect the shoreline of the Hudson.

Based on consideration of the pre-inundation landforms, the presence of peat, and the locations of streams, 21 areas have been denoted as shoreline features of possible significance for prehistoric human settlement (see Figures 4 and A10). Table 2 summarizes the changes in the shorelines for the entire project area. Table 3 describes those shoreline features interpreted as possibly significant for prehistoric human settlement (see Section h).

e. DESCRIPTION OF PROJECTED HABITATION AREAS

This section focuses on those locales within the project area considered as most attractive for prehistoric human settlement. The reader should consult Tables 2-3 (Section h) and Figures 4 and A10 (see APPENDIX III) throughout the following discussion.

The shoreline analysis indicates the area from south of the line of Harrison Street to approximately the line of Desbrosses Street as a prime location for prehistoric occupation in relation to the stated settlement criteria. As early as 10,500 B.P., about -80 feet below present sea level, this area contained a headland which was surrounded by water on three sides, with a narrower "neck" projecting west of the project area (Area 12, Figures 4 and A10). The presence of peat in the boring logs suggest that this headland was surrounded by a marshy area, an area possibly attractive to

FIGURE 6. Portion of the 1826 Prior-Dunning map showing the lower West Side of Manhattan. Note that West Street does not exist between Marketfield and Cedar streets, in contradistinction to the Bridges 1811 map (Figure 5), which is more correctly termed a plan than a map.

Study Area Schematic of Reconstructed Shorelines Based on Soil Data in Boring Logs

SEA LEVEL CURVE*

FEET BELOW PRESENT SEA LEVEL	RADIOCARBON YEARS BP
-100	12,500-12,000
-90	12,000-11,000
-80	11,000-10,000
-70	10,000- 8,000
-60	8,000- 7,500
-50	7,500- 7,200
-40	7,200- 6,500
-30	6,500- 5,000
-20	5,000- 4,600
-10	4,600- 2,000
0	2,000- PRESENT

*ADAPTED FROM TABLE 1.

KEY

ARCHEOLOGIST'S EXTRAPOLATION OF CONTOUR LINES

MAP REFERENCE AREAS

CULTURAL RESOURCES SURVEY

HISTORIC CONSERVATION & INTERPRETATION, INC. NEWTON, NEW JERSEY

FIGURE 4

prehistoric people. At this time, the highest ground on the headland was represented by Map Reference Areas 19 and 8. At approximately 7,700 B.P., about -60 feet below present sea level, the headland still existed although the rising sea level reduced its boundaries and inundated the projecting neck. The southeastern part of the headland was penetrated by a cove by this time (Map Reference Area 16), and peat was still indicated in some locales, suggesting the continued presence of marshland. Another cove may have penetrated the land in the northeastern portion of this area (Map Reference Area 17). The northern boundary of the headland may have been at Vestry Street. The highest ground in the area remained that indicated by Map Reference Areas 19 and 8.

By approximately 7,000 B.P., about -50 feet, the former higher ground on the above-discussed headland became an island with a shallow bay to the east and some marshland. Map Reference Area 8 was the highest land in the area. Map Reference Areas 7 and 9 were headlands delimiting the bay.

By approximately 6,500 B.P., about -40 feet, the only portion remaining above the water would have been two small islands (Map Reference Area 8). By 6,000 B.P., about -30 feet, these islands would have been inundated.

Borings indicate the presence of peat north of Map Reference Area 19 in the vicinity of the Holland Tunnel. In historic times an inland marsh existed in the vicinity of Canal Street, and this wetland area drained the Collect Pond near the present location of City Hall. It is possible that at times of lower sea level, this marshy area extended to the west. This freshwater wetlands area--which may have been only several hundred feet north of the headland/island--would have increased the variety of resources available to occupants of the headland/island (Map Reference Area 19) and would have increased its attractiveness for aboriginal occupation.

At approximately 6,500 B.P., from -30 feet to -40 feet, the data indicate the likelihood that a bay existed approximately between Carlisle Street and the southern PATH Tubes. The headlands of the bay, Map Reference Areas 2 and 4, are only partially within the project area. In addition, the southernmost headlands contained a knoll (Map Reference Area 3). This high ground may have been attractive to aboriginal occupants. At the mouth of this bay were located a series of slightly elevated land surfaces (Map Reference Area 5), which may have been attractive areas for the collection of resources but were not likely places for occupation.

Between Vesey and Murray streets, the irregular shoreline contained several coves and headlands. At approximately 7,000 B.P., about -40 feet, two coves, Map Reference Area 18, were present in an area extending from south of Barclay Street to Park Place. One boring suggests the presence of marsh in at least a portion of this area.

At 6,000 B.P., about -30 feet, a cove was present at Vesey Street (Map Reference Area 6). In the vicinity of Murray Street was located a small headland and cove, with high ground on the headland (Map Reference Area 10).

North of Canal Street, there are significantly fewer topographic features in the project area that demonstrate the settlement criteria previously discussed in relation to prehistoric human settlement.

f. ANALYSIS OF AVAILABLE CORE SAMPLES

Soil samples from borings taken in the Westway project area for engineering purposes have been stored by Mueser, Rutledge, Johnston and DeSimone. As a supplement to the reconstruction of prehistoric shorelines, selected samples were examined to explore whether or not any indications of prehistoric occupation might be present. Although borings have been used for purposes of archeological investigation (e.g., Pickman 1980), archeological sampling procedures differ from those used in taking samples for engineering purposes. The procedures used to obtain soil samples from the engineering borings from the study area suggest that any results obtained should not be considered as conclusive.

Soil samples had been taken for engineering purposes from each boring, using an approximately 2-foot long sampler. These samples were not taken continuously from within the stratigraphic column but only at every several feet. Only a portion of soil from each sample was retained, and, in most cases there was no indication on the associated labels of the retained sample's provenience from within the 2-foot section.

As noted earlier, the critical area of archeological concern would occur at the interface between the glacial sand and the ground surface on which any prehistoric occupation would have occurred. The sampling procedures used for the engineering analysis could easily miss this limited but critical zone. An added problem is the small sample obtained with the 2-inch outer diameter split-spoon sampler. These factors limited the chances of the critical former land surface zone, or any associated archeological materials, being included in the retained soil sample. However, if the sample taken happened to be from an area on which organic midden deposits were located on a former ground surface, evidence of its presence should be detectable in the sample.

Sixty-two (62) soil samples were examined, chosen from 42 borings located within areas discussed previously as likely areas for prehistoric habitation (Table 4). Samples from each selected boring were chosen based on their proximity to the glacial sand-river silt interface. The selected soil samples were examined to determine the presence of cultural materials. Also noted were the soil type. Table 4 lists the selected examined borings and indicates for each the map reference area, the boring number, the sample number, the depth below present sea level, a description, and associated finds. There were no core samples available for areas 1, 3-6, and 10. (See Section h for Table 4.)

The soil sample descriptions indicate that in most cases the soil sampled represented either the glacially deposited sands or the river bottom silts. The critical interface was apparently not represented in most of the samples. The presence of bone, wood, coal, and other fragments in samples taken near the base of the cores suggests the possibility that their presence was caused by "migration" of these materials from higher levels of the silt, where they may have been deposited during the historic period. It is, however, more likely that these materials were carried downward during the sampling process.

Of the 62 samples examined, soil from 5 samples suggested that they may have come from a ground surface underlying the river silts. These samples were distinguished by their darker, less clayey and more organic appearance. Furthermore, the presence of shell fragments in four of these samples suggests that these deposits may be of archeological interest, although no other cultural materials were observed. Four of these five samples derived from Map Reference Area 19, which was considered to be the most likely area for prehistoric occupation.

These five distinctive samples were submitted to closer examination, with an additional six samples chosen from the glacial sand and river silt strata as control samples for comparison. The samples were floated to detect the presence of seeds, charcoal, and other materials. APPENDIX IV, FLOTATION OF SELECTED SOIL SAMPLES, describes the processing of these samples and the analytical results.

The flotation process separated seeds, bone, and charcoal fragments from four of the five samples believed to represent prehistoric land surfaces. In addition, these samples contained some tiny fragments of quartz. Fragments of this size have been associated with toolmaking activities, but in this context we were unable to determine whether these chips were produced by natural or cultural processes. Sample 5 from core HV36 contained neither seeds nor bone fragments. Notably, this sample was smaller than the others inasmuch as a large portion of it had been previously removed for analysis by Pardi. Flotation of the river silt and glacial sand deposits, the control samples, did not yield seeds, bone, or charcoal.

Pardi had previously extracted soil from two of the samples from the suspected prehistoric ground surface and subjected these, as well as other soil samples, to chemical analysis (see APPENDIX II, Section 2). Although the results of his analyses were inconclusive, it is interesting that sample HV36 had by far the highest concentration of phosphorus of the ten samples he tested. The sample tested from HV35, an adjacent boring to HV36, yielded a much lower phosphorus level. Phosphorus has been found to be a sensitive indicator of human occupation.

Two factors cast serious doubt on the significance of these analyses. First, except for the smaller sample from HV36, all the possible ground surface samples contained fragments of coal. Only one of the control samples also contained coal fragments. This suggests the possibility that the other material recovered from these samples originated in the overlying silt and had been pushed into the lower context as a result of the techniques used to collect the samples. Observation of the soil coloration noted in the flotation results (APPENDIX IV) suggests that after drying, the differences between the sample groups were not as distinct as were noted during the initial observations (see Tables A6 and A7 in APPENDIX IV).

Therefore, the examination of the available soil samples provides no conclusive evidence for the existence of undisturbed prehistoric land surfaces under the Hudson River silts or of associated archeological sites. However, this analysis does not rule out the possible presence of such sites or land surfaces.

g. *CONCLUSIONS*

Reconstruction of the prehistoric shorelines and comparison of the topographical characteristics with prehistoric settlement pattern models indicate several areas which may have been attractive to prehistoric human populations as loci for occupation and resource exploitation. In particular, this analysis identified the area approximately between Harrison and Desbrosses streets in the project area [Map Reference Area 19 in Figures 4 and A10 (APPENDIX III), and Area 1 in Figure 3] as the most likely area of prehistoric occupation. The analysis also identified the area surrounding the historic period wetlands near Canal Street, and a nearby freshwater stream, as potentially attractive to prehistoric people.

TABLE 2. CHANGES IN SHORELINE RELATIVE TO SEA LEVEL

Ft. Below Present Sea Level	Approx. Time Period (B.P.)	Area Described	Shoreline Description*
		BATTERY PLACE NORTH TO PARK PLACE	
-10 -20	5,000 B.P. to present	Battery Pl. N to Park Pl.	Drowned land surface, unavailable for occupation.
-30	6,500-5,000	Battery Pl. N to Morris St.	Rather straight shoreline with few distinguishing features.
		N of Morris St. to Joseph Ward St.	Shoreline become sinuous, moves eastward, possibly forming edge of a cove.
		Rector St.	Spit of land with coves to the N and S.
		Carlisle St.	Area (3) located at center of small peninsula which juts into water; possible knoll in the center.
-40	7,200-6,500	Battery Place N to Morris St.	Slightly sinuous shoreline, narrow cove just north of Battery Pl. Area (1) is a small pond just S of a knoll at Morris St.
		Rector St.	Cove.

*Numbers in parentheses refer to locations on Figures 4 and A10.

Ft. Below Present Sea Level	Approx. Time Period (B.P.)	Area Described	Shoreline Description
-40	7,200-6,500	Carlisle St. N to Albany St.	Area (2) is a cove between the shoreline and an island, which is (5). Shoreline extends sinuously eastward. Island extends from Albany St. N to World Trade Center.
		Cedar St.	Several small islands indicated between shoreline and larger island (5). Possible bay extends from Cedar St. to just N of World Trade Center and PATH Tubes.
		PATH Tubes to Vesey St.	Irregular shoreline extends westward into water forming spit of land at northern end of a bay (4).
		Vesey St.	Cove (6).
		Barclay St. to Park Pl.	Cove.
-50	7,500-7,200	Vesey St.	Southern margin of a bay or cove.
		Vesey St. to Park Pl.	Shoreline interrupted by 2 small coves (18).

Ft. Below Present Sea Level	Approx. Time Period (B.P.)	Area Described	Shoreline Description
		PARK PLACE NORTH TO CANAL STREET	
-30	6,500-5,000	Murray St.	Small spit of land extends out into bay or river (10).
		Warren St.	Northern margin of bay. Shoreline continues slightly irregularly north to N. Moore St., where it dips sharply eastward.
		Vestry St.	-30' shoreline appears again in study area as the northern margin of a bay.
		Canal St.	Shoreline shifts eastward. Possible outlet of river or bay.
-40	7,200-6,500	Park Pl. N to Moore St.	Shoreline runs northward slightly irregularly to N. Moore St., where it dips sharply eastward and forms the southern margin of a bay (7).
		Vestry St.	Northern margin of a bay.
		Canal St.	Small cove near a marsh (20).
-50	7,500-7,200	Park Pl.	Northern margin of a cove or small bay.
		Park Pl No. to N. Moore St.	Shoreline runs slightly irregularly northward to N. Moore St., where it dips sharply eastward. Southern margin of bay formed. Possibly a steep slope to water (7).

Ft. Below Present Sea Level	Approx. Time Period (B.P.)	Area Described	Shoreline Description
-50	7,500-7,200	Harrison St. N to Vestry St.	50' contour outlines margin of an island (19) in a bay. Several small knolls (8) appear on island.
		Vestry St. to Desbrosses St.	Land juts out into water.
		Desbrosses St.	Northern margin of bay (9). Sloped drop to water separating shore and island (19).
		Desbrosses St. N to Canal St.	Shoreline relatively straight. Possible marsh in area of Canal St.
-60	8,000-7,500	Murray St. to Chambers St.	Relatively straight shoreline extends N to Chambers St.
		Chambers St. N to Harrison St.	Lagoon or cove (16).
		Harrison St. N to Laight St.	Slightly irregular shoreline extends north to Laight St., where it sharply dips eastward forming the southern margin of a cove (17).
		Beach St.	Small lagoon, possibly near a marsh (14).
		Vestry St. to Desbrosses St.	Land juts out into water.
		Desbrosses St. N to Canal St.	Irregular shoreline extends northward.

Ft. Below Present Sea Level	Approx. Time Period (B.P.)	Area Described	Shoreline Description
-70	10,000-8,000	Warren St. N to Harrison St.	Southern and eastern margin of a lagoon. At Harrison St., a narrow neck of land (12) runs between two bays.
		Beach St.	Small cove indicated in large bay.
		North Moore St. N beyond Canal St.	Extensive bay.
		Hubert St. N to Vandam St.	Large island (15) west of bay.
		CANAL STREET NORTH TO 23 STREET	
-30	6,500-5,000	Canal St. N to Morton St.	Possible bay east of project area.
		Morton St. N to Gansevoort St.	-30' contour east of project area.
		Gansevoort St. N to 15 St.	Relatively straight shoreline.
		15 St.	Southern margin of a bay.
		15 St. N	-30' contour east of project area.
-40	7,200-6,500	Canal St. N to Morton St.	Possible bay.
		Morton St. N to 11 St.	Relatively straight shoreline.
		11 St. N to Gansevoort St.	South and north shores of bay.
		Gansevoort St. N to 17 St.	Relatively straight shoreline.

Ft. Below Present Sea Level	Approx. Time Period (B.P.)	Area Described	Shoreline Description
-40	7,200-6,500	17 St.	Southern shoreline of bay.
		17 St. N	-40' contour east of project area.
-50	7,500-7,200	Canal St. N to Morton St.	Bay.
		Morton St. N to 11 St.	Relatively straight shoreline.
		11 St. N to Gansevoort St.	Bay.
		Gansevoort St. N to 17 St.	Relatively straight shoreline.
		17 St. N	-50' contour runs east of project area.
-60	8,000-7,500	Canal St. N to Bank St.	Slightly undulating shoreline.
		Bank St.	Steep hill at southern margin of bay.
		Bank St. N to Gansevoort St.	A shallow bay.
		Gansevoort St. N to 18 St.	Relatively straight shoreline.
		18 St.	Southern margin of bay.
		N of 18 St.	-60' contour runs east of project area.

Ft. Below Present Sea Level	Approx. Time Period (B.P.)	Area Described	Shoreline Description
-70	10,000-8,000	Canal St. N to Charlton St.	Irregular shoreline of an island.
		Canal St. N to Bank St.	Slightly undulating shoreline.
		Bank St.	Steep hill at southern margin of bay.
		Bank St. N to Gansevoort St.	A shallow bay.
		Gansevoort St. N to 23 St.	Gently undulating shoreline.
		N of 23 St.	-70' contour line east of project area.
-80	11,000-10,000	Clarkson St.	-80' contour extends east to west at Clarkson St. and extends northward from Clarkson, forming the shore area around a lake. Peat noted near (11) in the boring logs suggests a marsh in this area.
		Clarkson St. N to Bank St.	Gently undulating shoreline.
		Bank St.	Steep bank. Southern shore of shallow bay.
		Bank St. N to Gansevoort St.	Shallow bay.
		Gansevoort St. N to 23 St.	Gently undulating shoreline.
		N of 23 St.	-80' contour runs east of project area.

Ft. Below Present Sea Level	Approx. Time Period (B.P.)	Area Described	Shoreline Description
-90	12,000-11,000	10 St.	-90' contour runs east and west and then northward to 23 St., forming the shore area around a lake.
		N of 23 St.	-90' contour runs east of project area.
-100	12,500-12,000	Charles St.	-100' contour runs east and west and then northward to 23 St., forming the shore area around a lake.
		N of 23 St.	-100' contour runs east of project area.
		23 STREET NORTH TO 39 STREET	
-100	12,500-12,000	33 St. N to 37 St.	-100' contour in project area forms a slightly irregular shoreline. Most of this area would have been inundated during periods of earliest human occupation.

TABLE 3. SHORELINE FEATURES OF POSSIBLE SIGNIFICANCE FOR PREHISTORIC HUMAN SETTLEMENT

Map Ref. Area	Location	Sea Level Below Datum (Ft.)	Topographic Description
1	W of Morris St.	-40	Small hill next to depression, possibly a pond. The hill is about 100' long and the hilltop is about 150' from the river edge.
		-30	Hill becomes a small island about 20 ' above the water.
2	Carlisle St.	-40	Southern headland of a bay near a hill.
3	Carlisle St.	-40	Top of a hill about 33' above the shore and about 250' east of the river.
		-30	A peninsula with a cove to the south.
4	Just N of World Trade Center	-40	Easternmost head of a bay, only several feet above water level.
		-30	Inundated by river.
5	Just N of World Trade Center	-40	Islands at mouth of bay.
		-30	Islands inundated by river.
6	W of Vesey St.	-40	Small cove about 125' from east to west and about 350' from north to south.
7	Vesey St. N to Harrison St.	-40	Irregular shoreline, possibly southern headland of a bay. The shoreline dips eastward east of the project area.
8	W of Beach and Hubert Sts.	-40	Two small islands in the river.

Map Ref. Area	Location	Sea Level Below Datum (Ft.)	Topographic Description
9	At Desbrosses St.	-40	Northern headlands of a bay.
7 N to 9		-30	Bay still extant.
10	Just S of Murray St.	-30	Headlands of a bay.
11	Clarkson St.	-80	Peat noted in borings at 80', shoreline's southern extent.
No #	N of W.10 St.	-80	80' contour is part of steep slope to river leading to a marsh.
12	W of Harrison St.	-70	Narrow neck located in western portion of the proposed fill area. Two coves come into neck of land.
13	W of Beach St.	-70	Small cove at Pier 26. Peat noted in cores north of cove.
14	500' N of Beach St.	-70	Shoreline dips eastward between Hubert and Laight Sts. Peat noted along northern coast.
15	Hubert St.	-70	Island's southern end at Hubert St. It extends northward to approx. 650-800' N of Holland Tunnel. Island is at western limit of project area.
15A	100' N of Holland Tunnel	-70	Cove going into island. Marsh development indicated by peat in Holland Tunnel area. At Canal St., area slopes up to 40' contour at about 40% slope. East of Map Reference Area 11, peat is also indicated at 70' contour indicating a continuation of marsh development.
No #	N of W. 10 St	-70	70' contour is part of steep slope.
16	W of Harrison St.	-60	Lagoon or cove area.
17	Vestry St. at Holland Tunnel	-60	Possible narrow cove. Peat comes up to 60' contour.

Map Ref. Area	Location	Sea Level Below Datum (Ft.)	Topographic Description
18 18A	S of Barclay St. and between Barclay and Park Pl.	-50	Two small coves.
19	In bay bounded by Map Ref. Areas 7 to the south and 9 to the north.	-50	Large island in bay. Area 8 is a high spot on the island. Whether peat exists is indeterminable at this time.
20	Canal St.	-40	Cove near a marsh at Canal St. Interchange.
21	W. 20 St N to W. 30's		Possibly the former area of extinct Glacial Lake Hudson.
No #	S of W. 10 St	-90	Areas in project area were all dry land.
No #	W. 10 St. N to W. 20 St.	-90	Slope from 30 to 90' contours is steep, approximately 13% slope at 15 St. Interchange and about 75% slope at Bank St. Top of the slope at 15 St. may be affected by the project. The top of the slope at Bank St. will not be affected.

TABLE 4. SELECTED EXAMINED CORE SAMPLES

Map Ref. Area	Boring No.	Sample No.	Depth (ft.)*	Description	Associated Finds
2	BH16	9	41-43	Dark gray clayey silt	Fine shell fragments; large bone fragments
2	BH16	10	44-45.3	Yellow-tan sand	Shell fragments, rocks, bone
2	BH26	13	38.5-40.5	Gray clayey silt mixed with yellow sand	Shell fragments in the silt; oyster shell
2	BH26	14	48-49.9	Bag 1: Yellow-tan sand with mica chunks Bag 2: Red micaceous sand	
7	HV29	7	29.5-31.5	Bag 1: Gray clay Bag 2: Dark brown silt	Shale, possibly coal, shell fragments
7	HV29	8	34-36	Light brown sandy silt	Many pebbles, a few shell fragments
8	HV36	5+	36-38	Bag 1: Dried clay with yellow mottling +Bag 2: Dark brown loam (topsoil?)	Some charcoal
9	VT260	6	40-42	Gray clayey silt (river bottom silt)	Some shell fragments (sparse)
9	VT260	7	45-47	Gray sandy silt mixed with micaceous sand	Some sand

*Below present sea level.
+Indicates samples used in flotation analysis.

Map Ref. Area	Boring No.	Sample No.	Depth (ft.)*	Description	Associated Finds
11	NPT103	14	75-77	Gray silty clay	
11	NPT112	11	80-82	Gray silty clay surrounding dark brown sandy silt in a dried lump	
11	NPT112	12	85-86.5	Pinkish-tan coarse sand with pebbles	
South of 11	NPT119	12D	59-61	Dark brown silty sand	Some shell fragments
South of 11	NPT119	13	64-66	Gray silty clay	Moderate to heavy shell inclusions (clam and oyster)
12	HV12	2	35-37	Bag 1: dark gray clay Bag 2: dark gray clayey silt	Possible shell fragments Gray rock
12	HV16	9	64-66	Light gray clayey silt	Fine shell fragments
12	HV6	2	37-39	Bag 1: gray clay Bag 2: gray clay	
12	HV6	3	40-42	Rock (bedrock)	
13	HV50	5	72.5-73.5	Brown silty sand with mica	Clam shell fragments
14	HV53	9°	64.5-66.5	Dark gray clay	Wood fragments (dressed wood)
14	HV19U	15	66-68	Dark gray silty clay	Shell fragments, a few pebbles
14	HV19U	16	69-71	Gray micaceous silt with sand	Clam shell fragments, rock, chunk of wood
15	VT218	15D	67-69	Gray clayey silt	Sparse shell fragments, brick chip, 2 fragments white porcelain (modern bathroom tile)

°Indicates samples examined microscopically.

Map Ref. Area	Boring No.	Sample No.	Depth (ft.)*	Description	Associated Finds
15	VT218	17	72-74	Gray clayey sand	Many pebbles
16	HV54	6	41-42	Silty clay with sand	Root fibers
16	HV54	7	45-47	Dark brown silty sand	Crushed shell
16	HV55	10+	44-46	Dark brown sandy loam (topsoil?)	Quartz pebbles, a few shell fragments, wood fragments
16	HV55	11	46-48	Dark gray coarse sand mixed with some silt	
17	HV49	12	60-62	Dark gray clay	
17	HV49	13	65-67	Reddish brown micaceous sand mixed with tan brown finer sand	
17	HV43	13	60-62	Bag 1: gray clay Bag 2: gray clay	
17	HV43	14	66-68	Yellow sand with several small rocks	
17	HV43	15	70-72	Reddish-brown micaceous sand (fine to medium)	
18	BH30	10	50-52	Light gray silty clay	A few shell fragments
18	BH30	11	57-59	Yellowish-tan sand, rock fragments, and pebbles	

+Indicates samples used in flotation analysis.

Map Ref. Area	Boring No.	Sample No.	Depth (ft.)*	Description	Associated Finds
19	HV26	5 (top)	40-42	Light gray silt, rock fragments, and pebbles	
19	HV26	5D	40-42	Red micaceous sandy silt (river bottom silt)	
19	HV27	6	36-38	Red micaceous sand with sandy silt, some rock, and pebbles	Possible shell fragments
19	HV31U	6	32-34	Bag 1: gray clay Bag 2: clayey silt	 Wood, pebbles, coal, shell fragments
19	HV31U	8	37-39	Gray clayey silt	Charcoal, snail shell, coal, wood, brick chips
19	HV31U	9	40-42	Silty clay	Wood, slag, cinder
19	HV33	7	Label has question mark +7	Mixed deposit	Safety glass, 20th-century ceramics
19	HV33	8	Not indicated	Possibly a disturbed sample, topsoil with sand	Glass, coal
19	HV37	6+	39-41	Gray-brown clayey silt	Broken mussel shell throughout; other kinds of shell
19	HV37	7°	44-46	Tan sand	
19	HV34U	9	43.5-45.5	Light brown sand	Sandstone, quartzite, shell
19	HV35	7+°	44-46	°Bag 1: dark gray silty clay +Bag 2: dark brown silt possibly topsoil or a midden	Shell fragments (mussel) Rock fragments

+Indicates samples used in flotation analysis.
°Indicates samples examined microscopically.

Map Ref. Area	Boring No.	Sample No.	Depth (ft.)*	Description	Associated Finds
19	HV38	6	36-38	Red micaceous sand with rocks	Shell fragments
19	HV39	4+°	35-37	+Bag 1: dark brown sandy loam, possibly topsoil °Bag 2: reddish coarse micaceous sand	Crushed shell fragments
19	HV40	8 (bottom)	42.5-44.5	Yellowish-tan sand, pebbles	A few tiny whole shells; shell fragments
19	TF40	13	75-77	Dark gray silty clay	Oyster shell fragments
19	HV42	6	35.5-37.5	Dark gray silty clay	Dressed wood
19	HV42	7	40.5-42.5	Dark gray clayey silt	Shredded wood, rock fragments, many small shell fragments
19	HV43	7	44-46	Sand, rocks	A few shell fragments
20	VT220	6D+	30-30.5	Brown coarse sand with mica	Wood fragments and possible brick chips
20	VT220	7D	35-37	Dark brown coarse micaceous sand mixed with dark brown sandy silt (more loamy than river bottom silt); possible topsoil component in this sample	Possible brick chips, dressed wood, coal
20	VT221	7D	35-37	Bag 1: gray clayey silt Bag 2: clayey silt with sand	Sparse shell fragments Sparse shell fragments (at least 1 2" oyster shell fragment)

+Indicates samples used in flotation analysis.
°Indicates samples examined microscopically.

Map Ref. Area	Boring No.	Sample No.	Depth (ft.)*	Description	Associated Finds
21	WT502	14D	76-78	Gray clayey silt	
21	WT502	15D°	81-83	Gray clayey silt (missed the glacial sand-river silt interface)	Sparse shell fragments
21	WT512A	22D	82-84	Gray clayey silt	Few shell fragments
21	TT318	21	87-89	Gray silt	
21	TT357	15	85-87	Dark gray clayey silt	Some shell fragments
21	TT357	16	90-92	Silt mixed with fine sand	A few pieces of shell

°Indicates samples examined microscopically.

2. Historic Cultural Period: Overview of the Evolution of the Project Area's Waterfront, 1800 to 1860

a. INTRODUCTION

The present Westside Highway project is a continuation of a long chapter in New York history relating to the more effective use and development of the Hudson River waterfront, especially that area below 42nd Street. This history, although it has its roots in the eighteenth, and even in the seventeenth centuries, does not really begin until after 1800, a time when several important and concurrent events took place. In 1807 came the invention of Robert Fulton's steamboat. The period 1815-25 saw the end of the War of 1812 and the completion of the Erie Canal, as well as the start of the modern period of immigration, industrialization, and urbanization. Later, between 1820 and 1860, many more major changes occurred, turning a rather backward, underdeveloped waterfront--especially when it was compared to the East River side--into an important marine terminus for the entire city. The ways in which these events took place are complex, and rarely, if ever, have they been recounted. This report, then, is an attempt to relate and assess that story.

Several generalizations can be made. Essentially, the expansion of the waterfront was in response to immediate needs. If conditions became too crowded at one pier, for example, then either the existing structure would be extended or an entirely new one would be built at the foot of a nearby street. If a pier or basin became too obstructed with siltage or debris, then a decision was made as to whether to fill in the area behind a new bulkhead, to dredge and deepen the pier or basin in question, to limit traffic to specific merchants, or to build a new pier or basin beyond high water. In very few instances were any attempts made to view the entire problem, find common faults, perceive future difficulties, or, in general, plan for long-range solutions to present or future contingencies. The waterfront was constantly involved with *ad hoc* temporary construction. Planning has rarely been descriptive of city history--certainly a true statement when applied to the waterfront.

This area was also the scene of bitter conflict between merchants, landowners, and trademen--all vying for increasingly limited space and opportunity. Into this intricate pattern were woven the ambitions of wharf builders as well as workingmen of various persuasions, all looking for their part of the pier. Also involved were the visionaries, inventors, owners of bathing establishments--all seeking room in ever-constricting space.

Lastly, this story is also that of the steamboat, the dramatic impact of which on the waterfront caused the passing of the Age of Sail and led directly to the emergence of modern New York--a city built of iron and steel, not wood and shingle.

Author's Note: The data in this section have been presented and discussed in alphabetical order--e.g., Albany Street Basin, Canal Street Basin, Christopher Street Basin, etc. Numbered piers and wharves consistently followed each alphabetical listing per topic. It was felt that this system allowed for a greater degree of rapid identification than a chronological presentation would have afforded.

b. *MAPS OF THE WEST SIDE WATERFRONT, 1800-1860*

Maps are, of course, an important source of information in studying history, archeology, or any related discipline. For this survey of the Westside Highway project area waterfront they are an indispensable asset. It is possible, through the use of maps, not only to plot the growth and development of the West Side on an almost yearly basis, but also to learn details of size, shape, number, and property ownership relating to piers, wharves, and bulkheads. Available maps of New York pertinent to this study are not only large in number but also accurate and detailed. The well-known Dripps *Map of the City of New-York Extending Northward to Fiftieth Street* (1852) and the less well-known, but equally accurate, Prior-Dunning map entitled *Plan of the City of New-York* (1826) are good examples of the care and artistry of the mapmaker. The Ewen waterfront maps of 1827-30 are classic examples of city-sponsored surveys. Like the Dripps and Prior-Dunning maps, they are not only tributes to the draftman's pen but also examples of works of art--beautiful in content and execution.

However, care should be taken in reading all these documents. Sometimes they are idealized versions of what was true, as in the *Map of the City of New-York and Island of Manhattan as laid out by the Commissioners appointed by the Legislature April 3, 1807* (which is generally known as "the 1807 Commissioner's map" but which will be referenced herein as Bridges 1811, after William Bridges, City Surveyor, and the year of its publication). Often they are plans rather than maps. Care should be taken regarding scale, size, and dating. For example, the Lawrence map of 1834 is really a copy of the Prior-Dunning map of 1826.

The so-called 1807 Commissioners' map (Bridges 1811) is as much a plan as a map. This statement is particularly true in regard to the West Side waterfront. The map shows West Street as an almost completed thoroughfare, straight and regular from the Battery (then Marketfield Street) to Charles Street in Greenwich Village except for interruptions at the Dey Street Slip and at the Canal Street, Duane Street, and Albany basins (see Figure 5). However, this depiction is far from correct: as late as 1826, West Street did not exist between Marketfield and Cedar streets, although in the plan major structures are clearly visible there, including the unimproved shoreline north of Charles Street (see Figure 6).

The Daniel Ewen waterfront maps on file at the Bureau of Topography can be considered both as manuscript maps and as plans. Updated periodically by changes made directly on the maps, they include such data as lot dimensions and ownership, dates of land grants, and outlines of dwellings and other structures; they also show planned landfilling and pier construction. Like the later nineteenth-century Sanborn Insurance Company maps, the Ewen maps were color-coded to convey additional information, a system which increases their value as research tools but makes them difficult to reproduce, either photographically or Xerographically, in a black-and-white typed final report format. The level of accuracy of the Ewen maps in general is reported to be excellent (Hershkowitz 1982: personal communication).

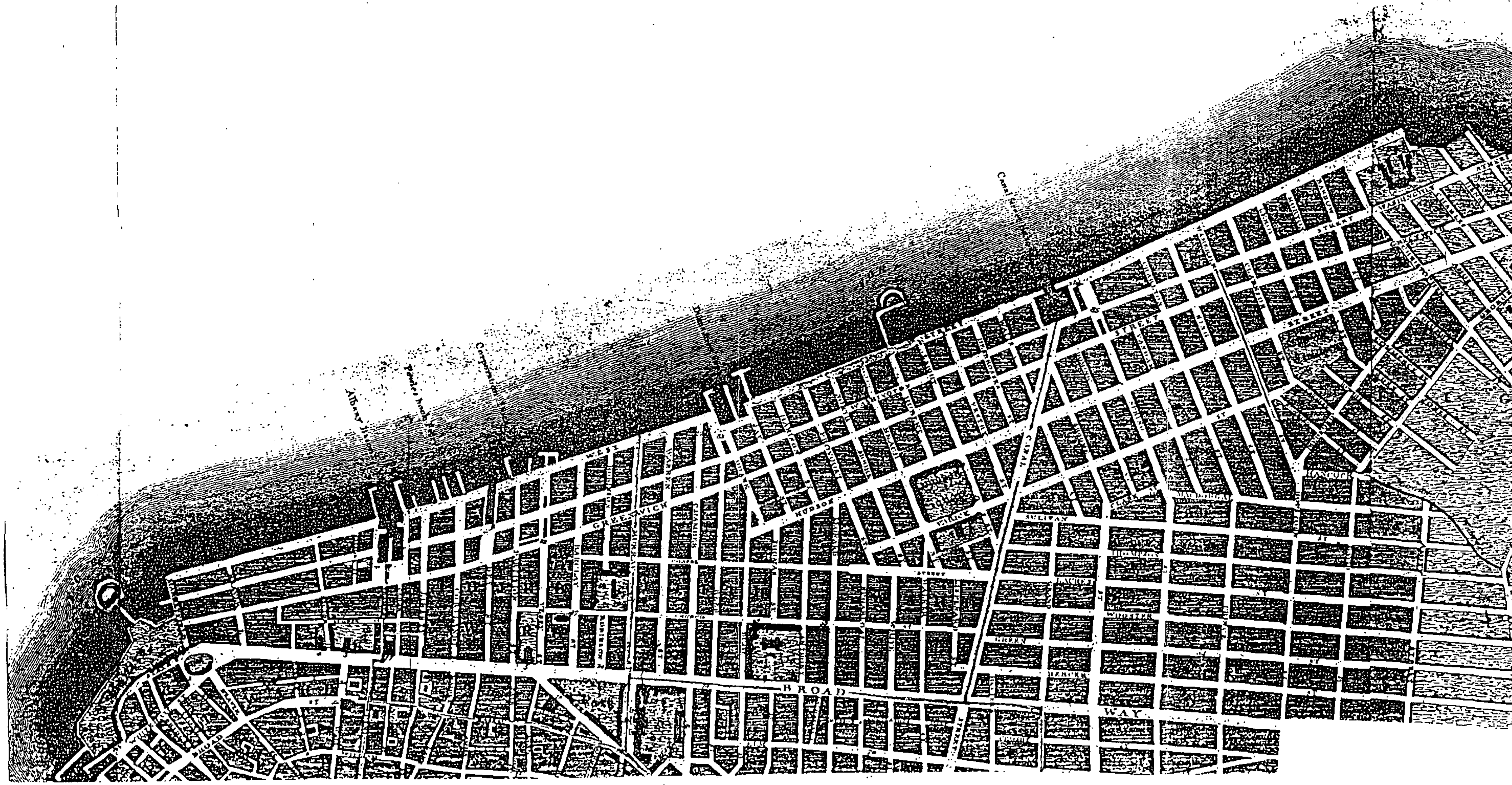


FIGURE 5. Portion of the so-called 1807 Commissioners' map (published in 1811), which is more a plan than a rendering of reality--e.g., as late as 1826, West Street did not exist between Marketfield and Cedar streets (compare with Figure 6, the accurate Prior-Dunning map of 1826).

Comparison of the almost identical 1826 Prior-Dunning map and the 1827-30 Ewen waterfront maps with the 1807 Commissioners' map (Bridges 1811) reveals a rapid growth in waterfront development following the War of 1812. The Commissioner's map shows no piers extant between Marketfield Street and the Albany Basin (see Figure 5). For the same extent of shoreline, the 1827-30 Ewen maps (Figures 7 - 9) and the 1826 Prior-Dunning map (Figure 6), show, with a few exceptions (e.g., at Rector Street), similar configurations, with slight differences (e.g., length of piers) most likely the result of drafting errors in the Prior-Dunning map (Hershkowitz 1983: personal communication). The Ewen maps show the piers in a shaded outline to distinguish the extant shore from future planned waterfront development; the piers are neither numbered nor labeled. The Prior-Dunning map does not label the piers by their 1826 numbers but by their names (see Figure 6):

Prior-Dunning Map Labels	*1826 Pier Numbers*
Arden	2
White	3
White	4
Schermerhorn	5
Edgar	6
Arden	7
Hermit	8
Rector	9
Schermerhorn	10
Castle	11
Lawrence	12
Albany Basin	13

An obvious feature of the period between 1826 (the Prior-Dunning map) and 1839 (the J. H. Colton and Company's *Topographical*

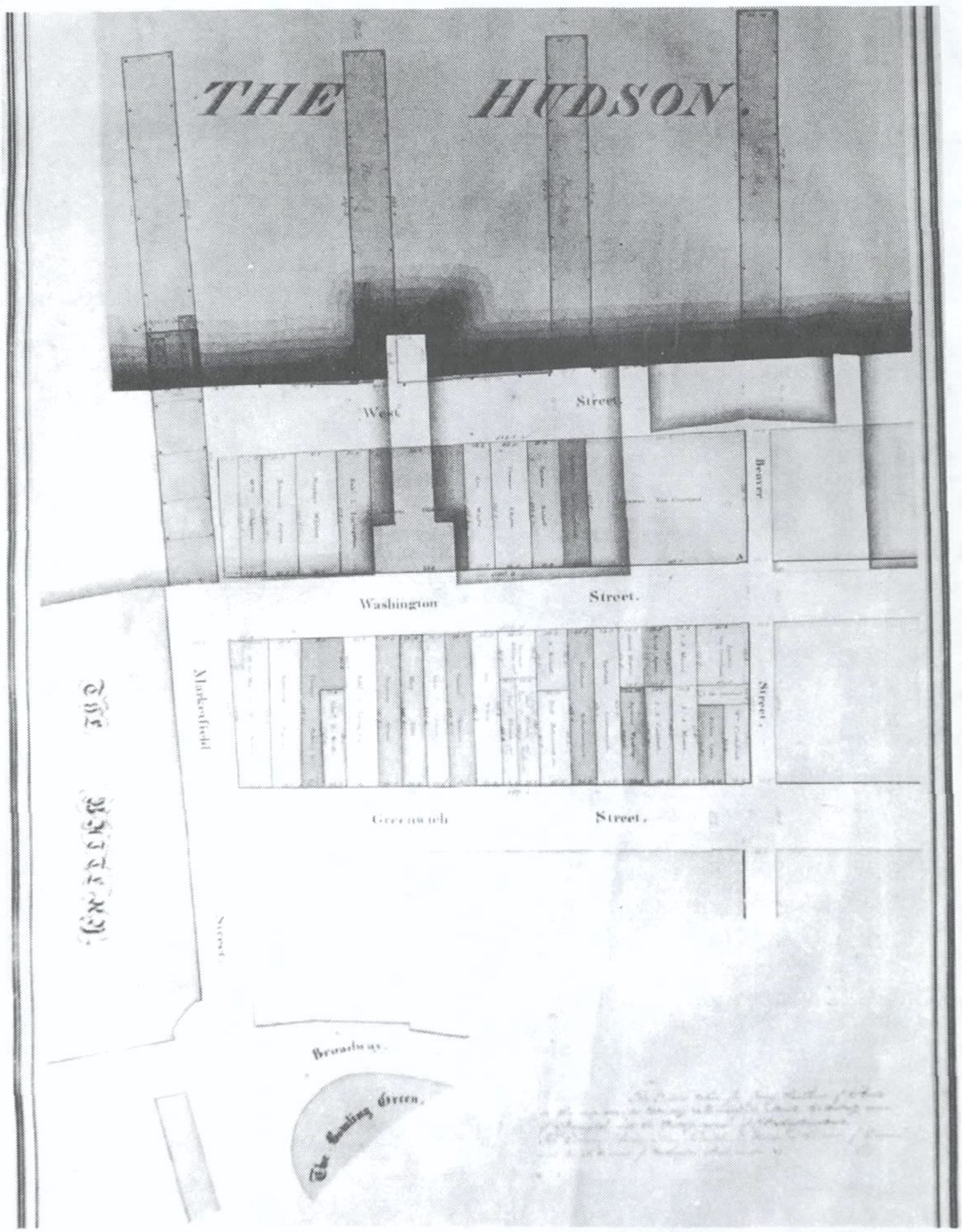


FIGURE 7. Plate 2 of the 1827-30 Ewen waterfront map series showing, from left to right, piers 2-4 [labeled "Arden" (No. 2) and "White" (Nos. 3 and 4) on the 1826 Prior-Dunning map, Figure 6]. The lower shaded line represents the shoreline at this time; lots and piers west of this line exist in plan only.

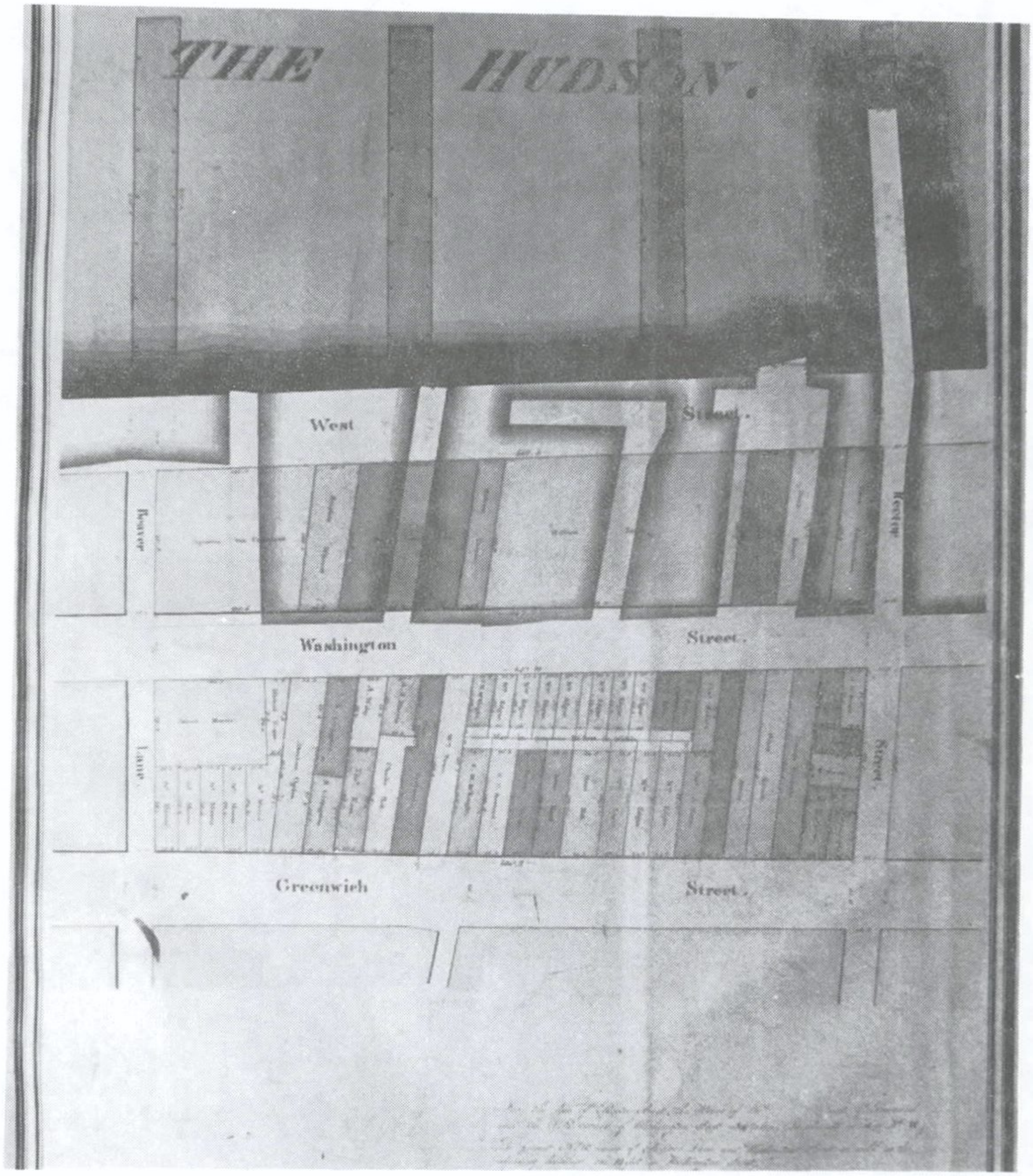


FIGURE 8. Plate 3 of the 1827-30 Ewen waterfront map series showing, from left to right, piers 4-6, 7/8, and 9 (labeled "White," "Schermerhorn," Edgar," "Arden"/"Hermit," and "Rector" on the 1826 Prior-Dunning map, Figure 6). Piers 7 and 8 on the Prior-Dunning map ("Arden" and "Hermit") appear to have been consolidated into one structure on the Ewen map. As in Figure 7, the extant shore is outlined by shading--i.e., West Street has not yet been built.

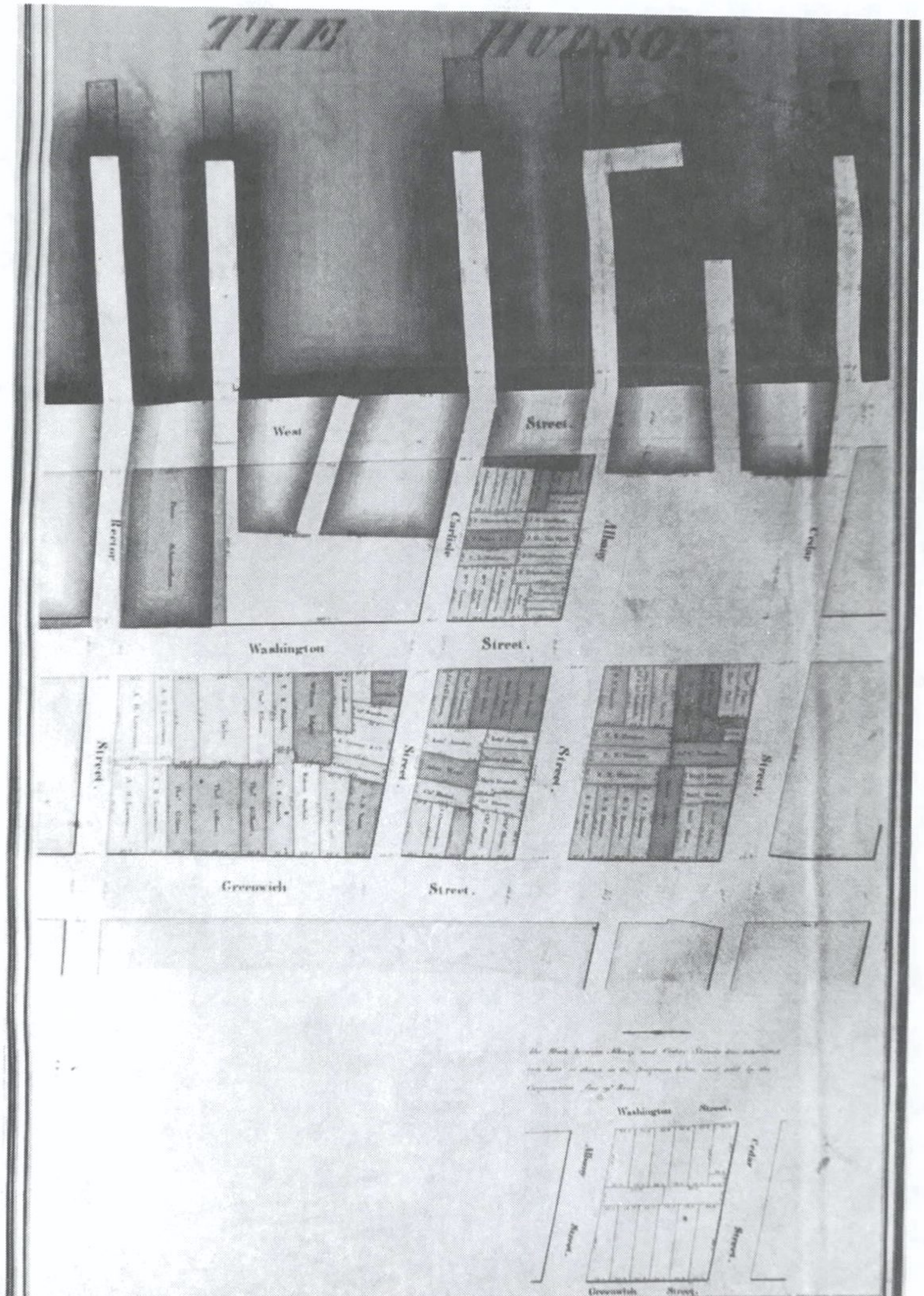


FIGURE 9. Plate 4 of the 1827-30 Ewen waterfront map series showing, from left to right, the shoreline (shaded) between Rector and Cedar streets (West Street does not yet exist south of Cedar Street). Piers 9 through 13 are shown south of the Albany Basin (compare with Figure 6).

Map of the City and County of New-York and the Adjacent Country; see Figure 10) is the addition of new piers generally north of Jay Street in today's Greenwich Village. The indented slips and basins below Cedar Street still remain. They are not shown on Burr's *Map of the City of New York* of 1834 (Figure 11), but they do appear on the Lawrence map of that year (which is, however, a copy of the earlier Prior-Dunning map of 1826) and on the Colton map of 1839. Therefore, it would appear that the Burr map is an idealized version of the waterfront.

Comparison of the 1826 Prior-Dunning map (Figure 6) with the Colton map of 1839 (Figure 10) reveals a new waterfront rapidly taking shape. A new pier has been built off Battery Place (then a new street below Marketfield Street). The Fulton-Vesey complex that made up the Corporation Docks has been filled in and straightened. A T-shaped pier is located off Warren Street. A basin change occurs in the area of Greenwich Village north of Jay Street. New piers include those off Harrison, Franklin, North Moore, Beach, Vestry, Watts, Charlton, King, Clarkson, Charles, and Amos streets. These piers were built between Spring, Canal, and Hoboken streets. Almost all piers were by this time T- or L-shaped. The "Red Fort," or North Battery, is still shown on the map of 1839.

1820's↓

1830's

The outstanding changes during the 1840-50 period--the era of the greatest and most rapid growth--are the elimination of basins and slips, making West Street a continuous regular street from Battery Place to beyond the elbow at the joining of Gansevoort Street with Tenth Avenue, and the addition of new piers at Ganse-

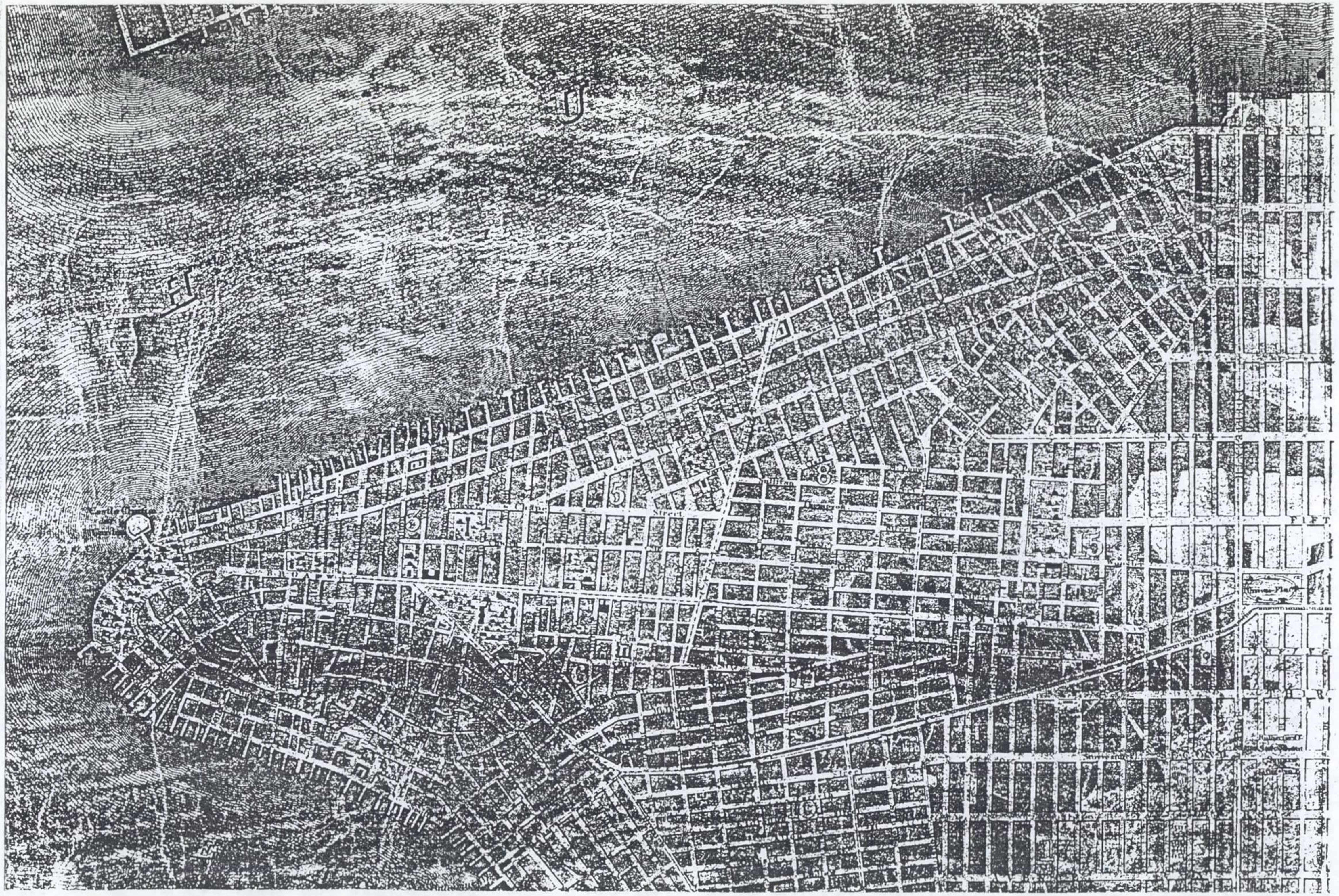


FIGURE 10. Portion of Colton's 1839 *Topographical Map of the City and County of New-York and the Adjacent Country*, showing shoreline development by that date.

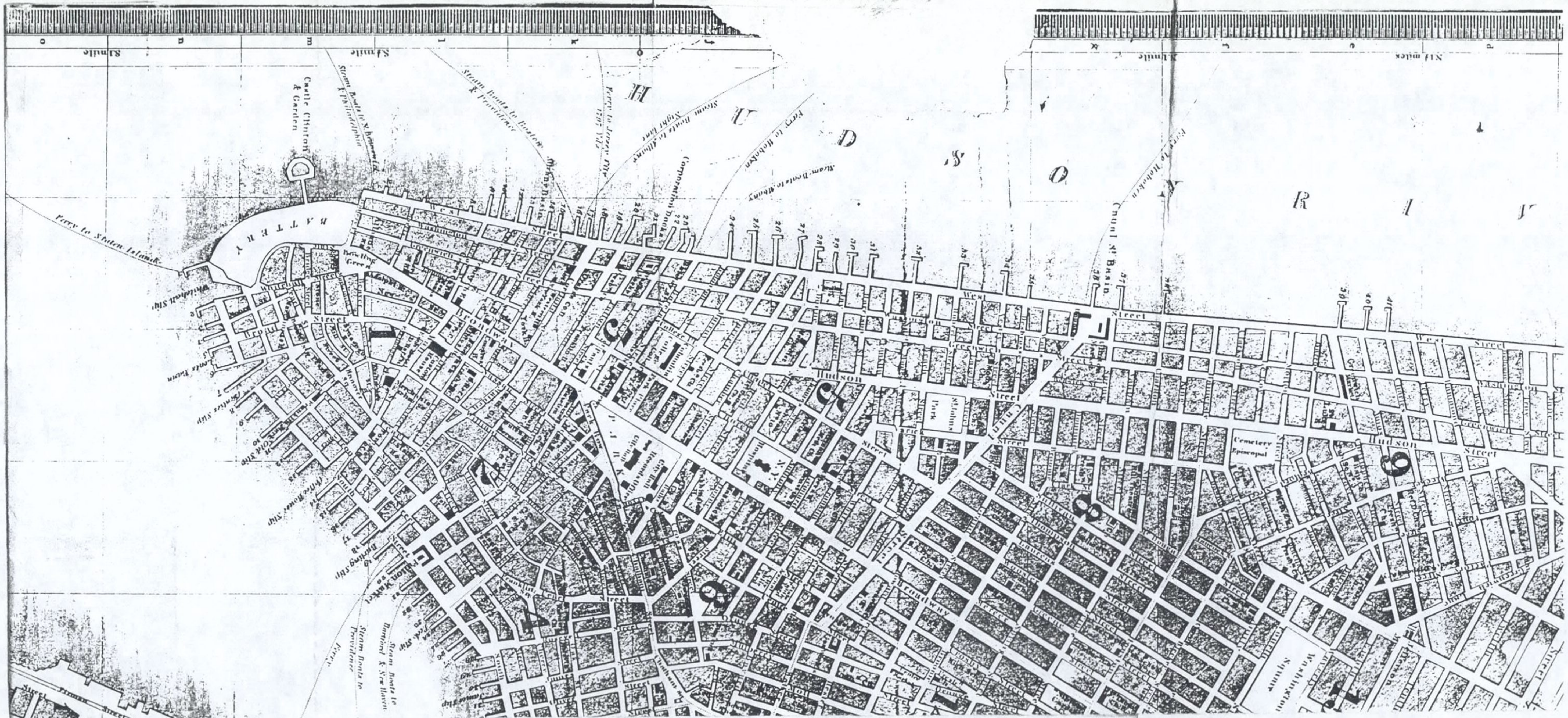


FIGURE 11. Portion of 1834 *Map of the City of New York* (Burr 1834), showing lower West Side waterfront development at that date, although it appears that some features are planned rather than actual (compare with the more reliable, and later, 1839 Colton map, Figure 10).

voort Street (pier 52), just below West 12th Street (pier 53), at Jane Street (pier 5), and at Hammond Street (pier 50), all in Greenwich Village. The area from Battery Place to Cedar Street has been filled in to West Street, and new piers (1-24) have been constructed. It would seem that the Corporation Docks between Fulton and Vesey streets (piers 21-23) have been lengthened, and the Fulton Street pier has a pronounced "N" shape.

A glance at Kemble's 1844 map entitled *City of New York* (Figure 12) reveals that a pier exists at the foot of almost every street on the Hudson River shore---a remarkable change from the waterfront shown on earlier maps. Another look shows the rapid increase in the use of the piers by ferryboats. New England steamboats, from Newport, Boston, and Providence, used pier 1 off Battery Place; the Camden, Amboy and Philadelphia Railroad Company used pier 2; and the Le Havre Packets used pier 7, just below Rector Street. Ferries to and from New Jersey docked at a number of other piers.

In 1851 and 1852, probably the two best commercial maps depicting pre-Civil War New York were published: the Perris and Hutchinson *Map of the City of New-York* (1851) and Dripp's *Map of the City of New-York Extending Northward to Fiftieth Street* (1852). The Perris and Hutchinson map used a scale of 1:5,200, whereas the justly famous Dripps map used a scale of 1:3,600. (The large scale prevents their being included herein in their entirety; portions have been reproduced, as needed.) These large charts give astonishing closeup details. Although both maps are very similar, the

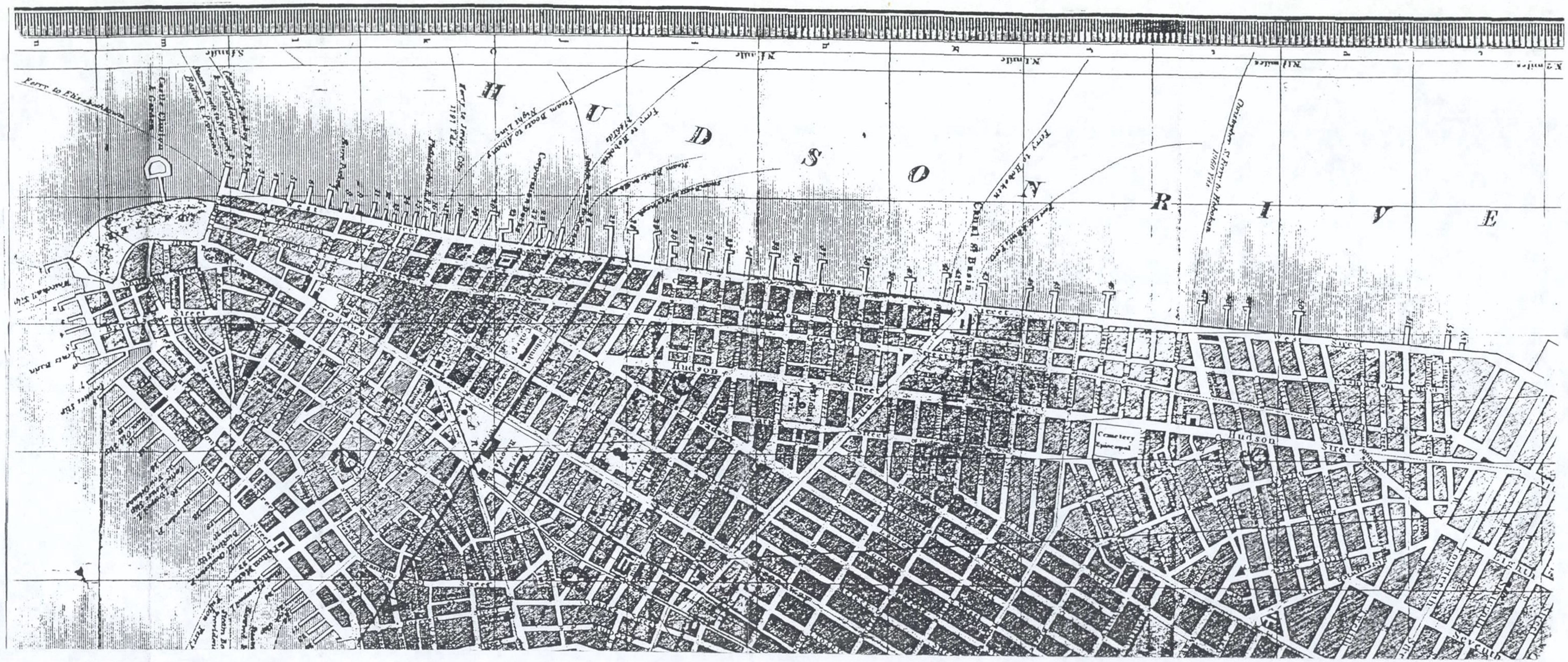


FIGURE 12. Portion of W. Kemble's 1844 map entitled *City of New York,* showing West Side waterfront at that time.

Dripps map contains more elaborate descriptions of the use of piers. It also provides, for the first time, details regarding street numbering of houses, and it indicates the location, by name, of various businesses and industries--e.g., iron forges, lumberyards, etc. Certainly, by 1850-51, the West Side of Manhattan is as fully developed as the East Side, and more than a rival for that earlier-settled region.

A study of both maps reveals a number of other developments (see Figures 13 and 14). New piers have been constructed just off Battery Place and below pier 1--the terminals of the ferry to New Brighton, Staten Island. Pier 1 now houses the Camden and Amboy Railroad, and pier 2 contains the U.S. Line to Boston and the steamboats *Empire City* and *Crescent City* for Havana and Chagres. Pier 3 is the terminus for the Boston & Fall River Line as well as for the steamships *Washington* and *Hermann* for Bremen and Southampton.

The steamships *Georgia*, *Ohio*, and *Falcon* sail for Havana and Chagres from Pier 30 off Chambers Street. The Collins Line sails for Liverpool using pier 41 (Canal Street). Ferries to New Jersey, Philadelphia, Boston, Nashua, Lowell, Lawrence, and Albany use piers 12, 14, 17, 18, 24, 25, etc. The Lackawanna Coal Company uses pier 38, the site of the old North Battery. The Kingston and Roundout Pier is at number 33, also used by the Delaware and Hudson Canal Line. The Erie Railroad uses pier 31. The Hoboken Ferry uses a specially constructed pier at number 25. Almost all the piers have been lengthened, many with T's, L's, or cross members.

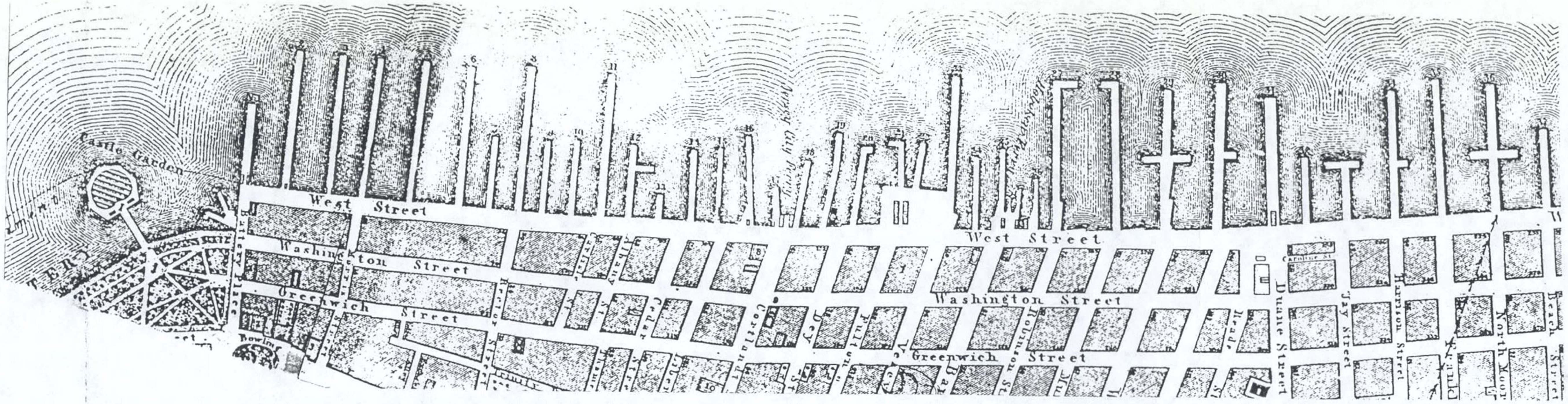
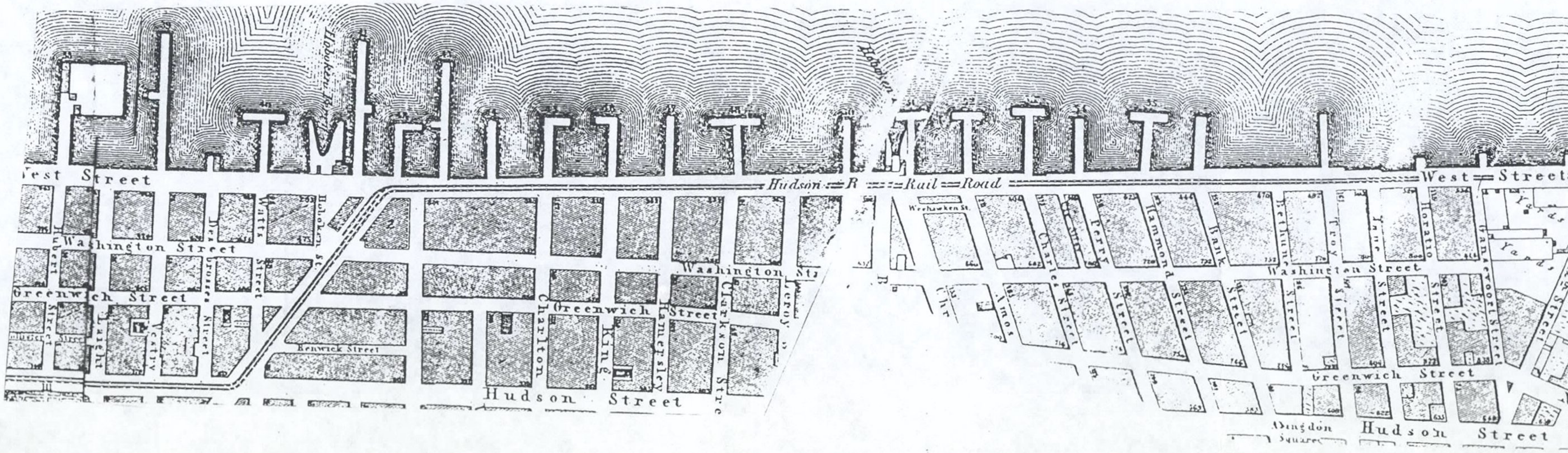


FIGURE 13. Lower West Side waterfront in 1851 on Perris and Hutchinson's *Map of the City of New-York.*



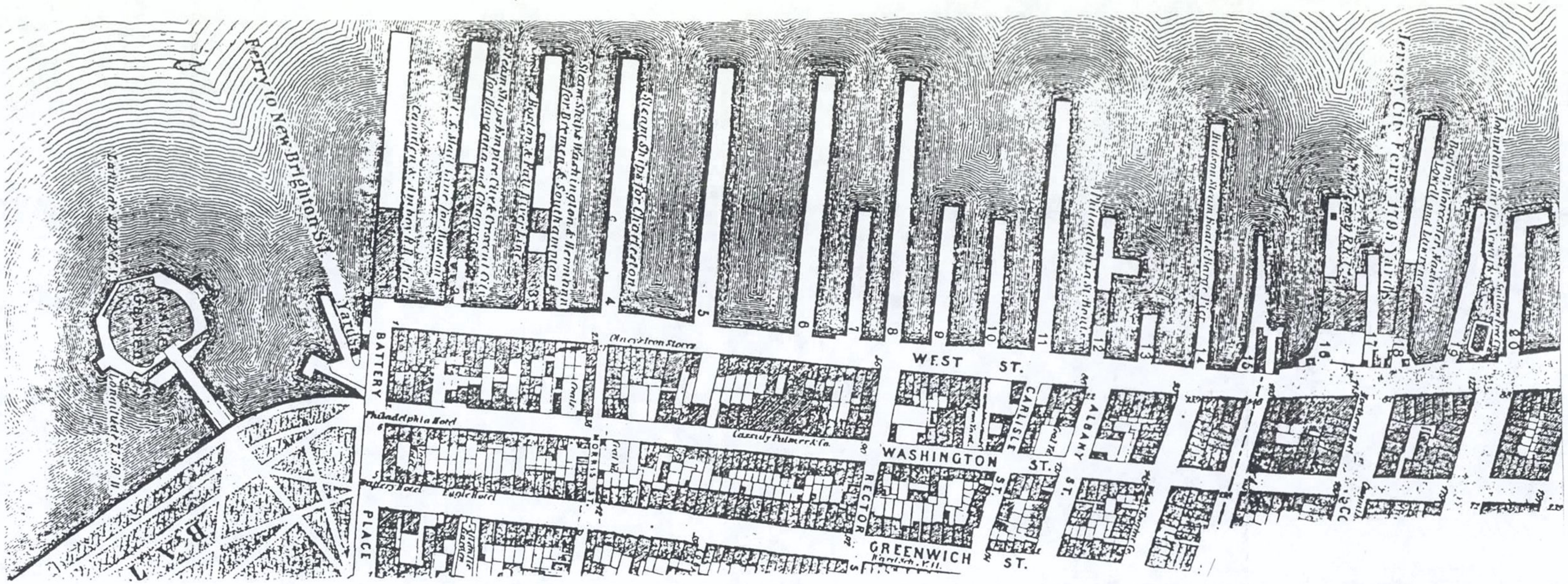
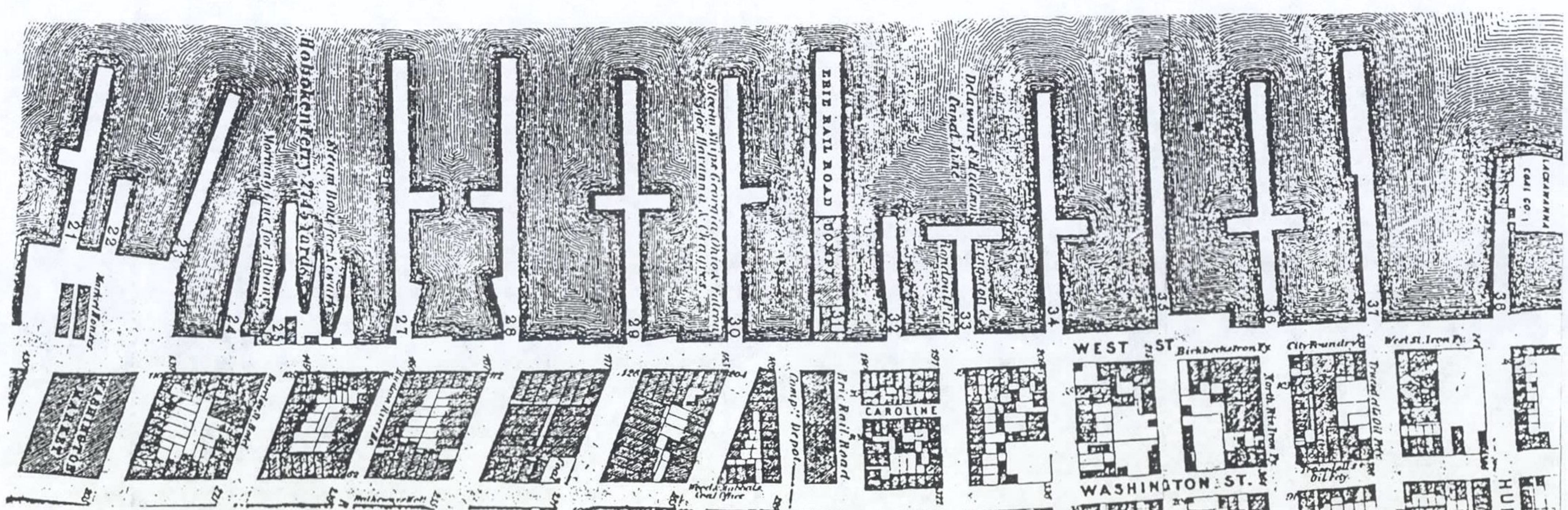


FIGURE 14. Portion of Dripps' 1852 *Map of the City of New-York Extending Northward to Fiftieth Street,* showing waterfront development as of that date. Piers 1 through 20 appear above and 21 through 38 below. Piers 39 through 48 and 49 through 57 appear on the following page, top and bottom (respectively).



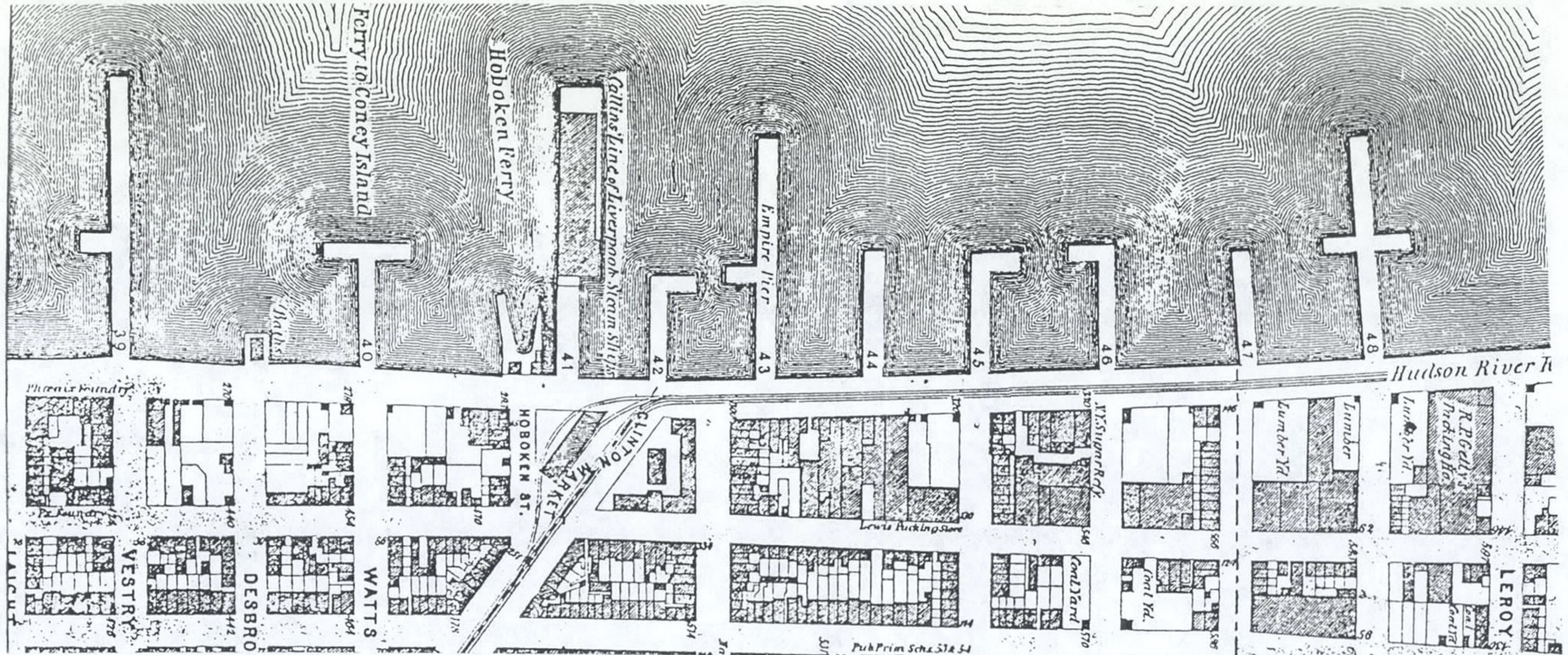


FIGURE 14 (cont.)

By 1852, then, there existed 57 numbered piers, and almost every street had a pier at its foot. The Dripps and Perris and Hutchinson maps are remarkable testimony to the tremendous growth of the port area in the years between 1840 and 1850 and to the triumph of those whose innumerable petitions led to waterfront construction.

Bacon's 1856 *Barnitz Pier Map of the City of New-York* (scale 1:5,800), although not quite the equal in detail of the Dripps map, nevertheless remains one of the series of great nineteenth-century maps of New York City (see Figure 15). It documents changes from the aforementioned maps of 1851-52. The unnumbered pier (New Brighton Pier) is gone and the area has been filled in. The Jersey City Ferry line piers off Cortlandt Street have been lengthened and widened. The same is true for the docks forming the area before the Washington Market (between Dey and Vesey street, piers 20-23). Only Bethune Street in Greenwich Village does not have a pier. New docks have been built at LeRoy and Bank streets. Landfill has been extended from West Street at Troy Street to the extension of Eleventh Avenue. A new basin thus has been formed, or is being prepared to be formed, between Troy and Bank streets.

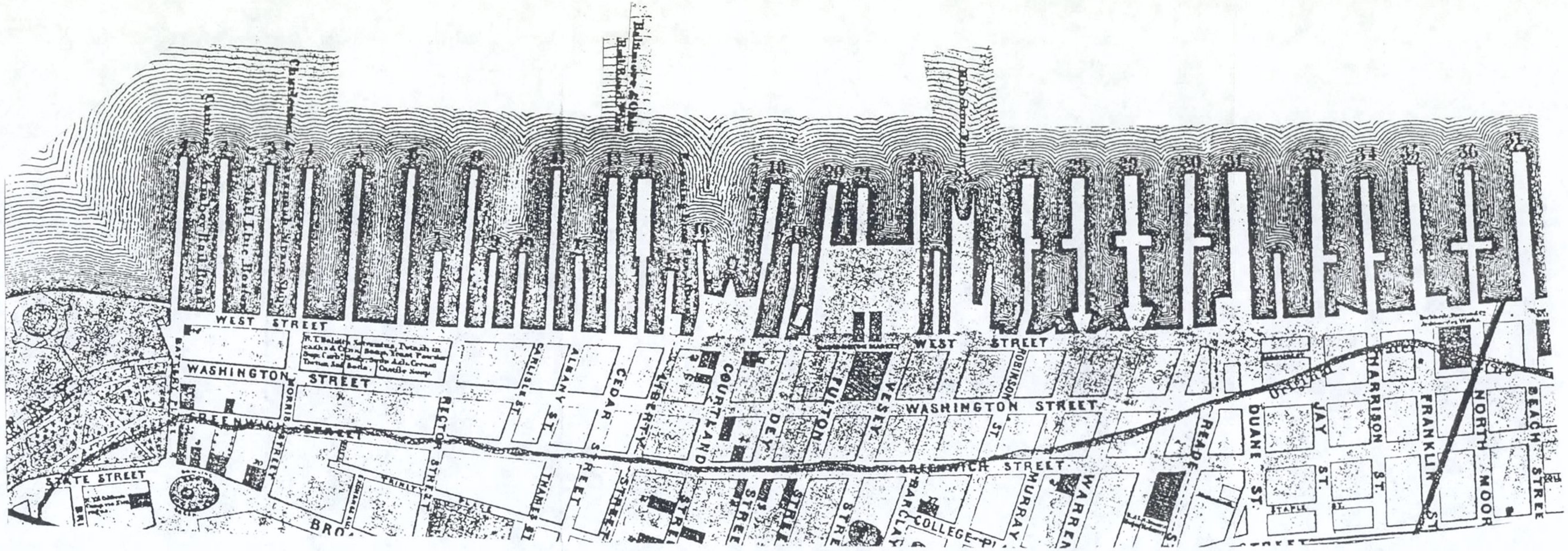
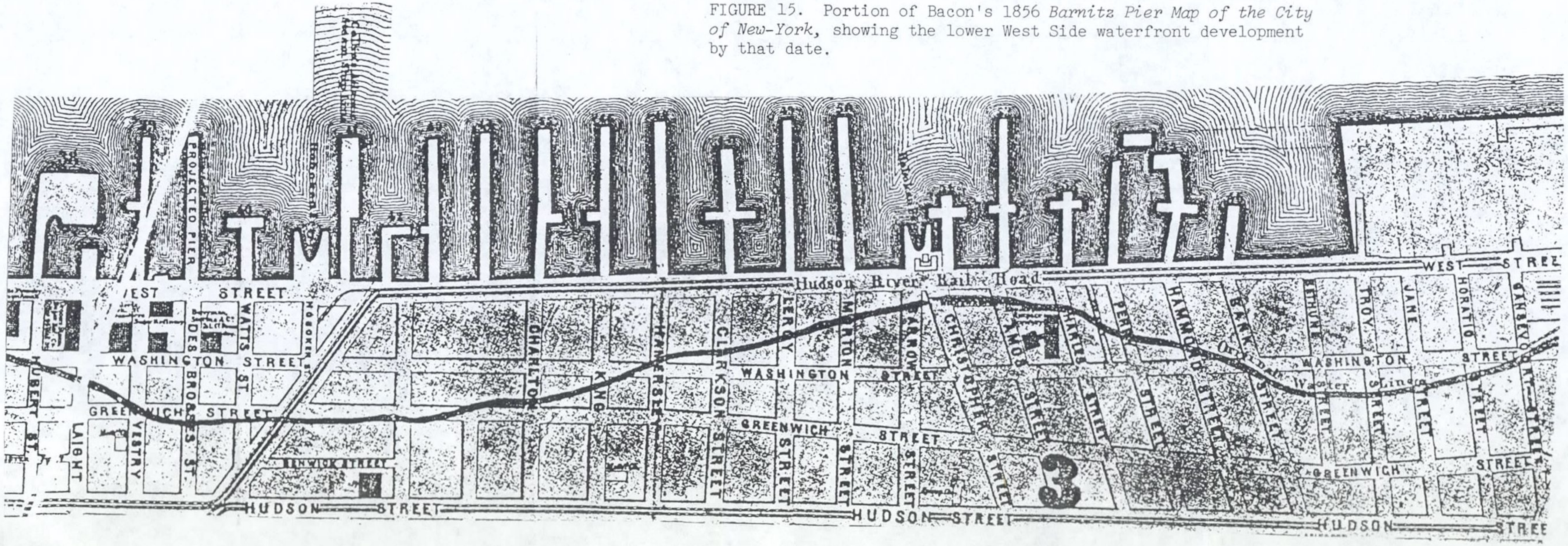


FIGURE 15. Portion of Bacon's 1856 *Barnitz Pier Map of the City of New-York*, showing the lower West Side waterfront development by that date.



c. *LANDFILL*

Given its shortcomings in geography--the West Side of New York is hindered by high bluffs fronting the river and unprotected from often blustery northwest winds sweeping down from the Hudson Highlands--comparatively little was done to develop Manhattan's Hudson shore during the eighteenth century. In March 1701, the Common Council appointed a committee to provide for convenient streets, wharves, and slips to be constructed on land between high water and low water on the Hudson River--basically to accommodate the petitions of several individual proprietors who owned land along the river. The result was some improvement of the lower parts of Greenwich Street, this principally by the extension of title to land 200 feet beyond high water (MCC 1675-1776: II, 138-39).*

In 1730, the Montgomerie Charter officially extended the shoreline of the City 400 feet from the low water line into the Hudson and East rivers. For the Hudson, the grant ran from the Bestaver's Killitie or riverlet, which emptied into the Hudson at present Charlton Street, to the tip of the island at Fort George, site of the present Customs House. A series of private grants were made by the city between 1739 and 1770 from Marketfield Street to the Albany Basin between Albany and Cedar streets, none of which extended beyond the 400-foot low water mark of the Montgomerie Charter (MCC 1675-1776: III, 89-90, 93; IV, 167-68).

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*Throughout the manuscript, the abbreviation "MCC 1675-1776" will denote *Common Council Minutes of New York City, 1675-1776*, edited by H.L. Osgood (New York, 1905), and "MCC 1784-1831" will denote *Common Council Minutes of New York City, 1784-1831*, edited by A.E. Peterson (New York, 1917).

By the time of the Revolution, Greenwich Street had been opened to the southern edge of Oliver Delancey's farm in Greenwich Village at present-day 14th Street. The lower end of the street from Partition Street (present-day Fulton Street) to Little Stone Street (today's Thames Street) contained several wharves, including those of the Rhinelander family, the Powles Hook Ferry at Cortlandt Street, the Albany Basin, the Corporation Dock at Partition Street, the Duane Street Basin, and the Canal Street Basin. For the most part, however, the river was largely untouched (see Figure 16, Ratzer map of 1766-67, for details).

During the Revolution and just prior to the British occupation of New York City in September 1776, several fortifications were erected by American forces. Southwest of Trinity Church on the high river bank were located the Oyster Battery and McDougal's Battery. Just west of Greenwich Street between Reade and Duane streets, quite near the water, was the Jersey Battery. In front of the "Brew-House," located on Greenwich Street between Franklin and North Moore streets, was a circular structure called the Grenadier's Battery. From here a line of breastworks extended along the river to Hubert Street. Another similar line then extended to Desbrosses Street.

This may be an impt area to test

The process of filling in the waterfront to provide room for sheltering piers was often slow and tedious. By the end of the War of 1812, however, this process was spurred on by new technology and pressure for additional space. Basically, the landfilling process resulted from the rising value of surrounding real estate,

FIGURE 16. Bernard Ratzer's *Plan of the City of New York,* depicting lower Manhattan c. 1766-67 (the document was published in London in 1776).

which itself depended on increased traffic and business. As use expanded, great pressure was put on existing pier and wharf resources, thus causing the extention of extant structures or the building of new ones. Bulkheads were placed, usually by owners of waterfront property, between adjacent piers, and the space behind them was filled in, thereby enlarging and straightening West Street, the exterior nineteenth-century street, and, in the process, raising the value of these and adjoining properties. A large share of the cost for waterfront construction was the concern of private enterprise, but where the city owned property along the waterfront its development was paid for by municipal authorities.

The Common Council in 1795 and 1796, expressing fear that indiscriminate water lot grants could prevent the drainage of water from the interior streets into the river, passed an ordinance beyond which no grants ought to be made and no buildings erected. In 1798 this outer road was officially called West Street, but it was also known as the Seventy-foot Street. City officials expected an improvement in public health and increased safety to ships as a result of the ordinance, which also provided that piers could be constructed but only in such a way as to allow for ebb and flow to carry away all dirt and impurities (MCC 1784-1831: II, 214-15, 420-21: III, 397-98).

d. NEW AND REPAIRED BULKHEADS

The story of the process of applying for permission to build bulkheads--the costs involved, the purposes of, as well as any number of difficulties arising over, construction--is a complex one but one that is very much a part of the history of the Hudson River waterfront. In October 1818, the Committee on Wharves and Piers of the Common Council (an appointed committee hereafter referred to as CWP), after having conferred on a Council resolution on the expediency of continuing West Street from Charlton Street to the north side of the pier at the foot of Spring Street, resolved that the Street Commissioner should notify proprietors of affected properties to have a bulkhead completed by July 1, 1819. There was no demurrer on the part of the proprietors (CWP Dec. 1, 1819).

In 1847, proprietors of the piers and waterfront land between Battery Place and Carlisle streets--piers 2, 4, 5, 6, 8, 10, and 11--were instructed to construct a bulkhead some 100 feet from the edge of West Street and then extend the various piers up to 600 feet from the bulkhead. The job was to be completed by September 1, 1848 (CWP Nov. 8, 1847). In 1850 the CWP supported a Council resolution to build a bulkhead along the westerly line of 13th Avenue from 13th Street to the southerly line of Gansevoort Street and from 13th Avenue along Gansevoort Street to West Street. An earlier resolution involving almost the same area had been passed in 1837. It was expected that the cost to the city of the completed bulkhead would be $55,000 and the filling in would be completed in three to five years using coal ashes and rubbish as principal fill. When finished the property would be the equal of 112 lots of 25 x 100 feet and would be worth about $300,000. Work on the bulkhead was to start on or before August 1, 1850 and be completed May 1, 1851 (CWP July 8, 1850).

Piers 20 to 23 from Dey to Vesey streets, directly opposite the Washington Market, received the attention of the city in 1852 when it was resolved that a new bulkhead was to be built in the North River from the northerly end of the "L" on pier 20 in line with the outer end of pier 23--about 306 feet in length. Work would be under the direction of the Street Commissioner (CWP Sept. 15, 1851). The CWP was aware that public convenience and facilities would be greatly promoted by the enlargement of the vacant ground between the market and the river. William Mengies, the owner of water lots lying between 44th and 46th streets and 11th and 13th avenues, was allowed to improve his property for business purposes by building a bulkhead on the westerly line of 13th Avenue and filling in behind it (CWP Dec. 19, 1853). The CWP also found in favor of a petition by Edmund Griffin allowing him to construct, because of the greater increase of commerce and the need for greater facilities, a bulkhead on the extreme line of the city from the center of Troy Street to the southerly line of Hammond Street. The work was to be completed December 1, 1853 (CWP Apr. 22, 1853). Three years later, owners of the bulkhead between Beach and Hubert streets were permitted to bridge and pile out a space of 18 feet beyond the bulkhead, 112 feet long, beginning at the north side of pier 37 (CWP Mar. 10, 1856). John M. Dodd and Alex M. Ross, owners of waterfront property between 26th and 27th streets, sought and were given permission to construct a bulkhead, the outward part to be 778 feet west of the west line of 11th Avenue on 26th Street and 843 feet from the west line of 11th Avenue on 17th Street. They were to fill in all underwater land with "sound and wholesome" earth at their own expense (CWP Dec. 19, 1859).

All the foregoing were examples of new bulkhead construction, but frequently repair was also attended to. In 1850 new backing pieces were placed in bulkheads between Duane Street and 13th Street, and the bulkhead was built to the height of 5 feet above high water. All such work was to be paid by the involved proprietors (CWP Mar. 18, 1850).

In 1821, a violent storm tore up a good deal of the waterfront. The bulkheads on Washington and Marketfield streets were washed away, and streets were rendered unpassable. A petition to the Council signed by William Gibbons, of *Gibbons v. Ogden* fame, asked that Marketfield Street be filled up to the western line of Washington Street and that the bulkhead at the Battery be united to the western line of Washington Street, thus creating a permanent durable barrier. In this case repair led to new construction. Repairs were also required for bulkheads between Charles and Amos streets and Hammond and Perry streets, among others (CWP Feb. 25, 1839).

Not all work went smoothly. William Rhinelander in 1814 objected to paying his proportion of expenses incurred in repairing the bulkhead at the intersection of Jay and West streets. He was subsequently directed to pay $762 as his share (CWP Mar. 28, 1814). Construction of the bulkhead ordered to be built in 1817 between Warren and Chambers streets was delayed at the request of the executors of the will of Peter P. Van Zandt in order not to inconvenience various tenants (CWP Mar. 13, 1817). In 1845 the bulkhead in the process of construction on Vesey Street posed problems for its builders, Henry Dubois and Issac Hendrick, when the city ordered certain changes. They asked for and received additional sums to conform to those changes (CWP July 21, 1845).

e. REPAIR, EXTENSION, AND BUILDING OF PIERS AND WHARVES

1) Repair

If anything can be said to typify the city's nineteenth-century waterfront it would be its almost constant need of repair, ranging from surface mending, to extension, to almost complete overhaul. In some sections, especially in basins such as the one at Canal Street, filth, debris, and pervading stench literally drove business away. All in all, the poor, run-down condition of piers and wharves was an offense to the senses and a barrier to trade and commerce. Still, no overall plan to solve problems was ever adopted. At best, all such problems were attended to sporadically as the need arose.

Typically, in an early survey of the condition of piers in 1821, it was found that from the Spring Street Basin to the Battery, all the piers and wharves, with but two or three exceptions, were in a "most destroyed" situation. Among the damage cited was that the bridge at Canal Street was out of order, the middle pier at Vesey Street needed "great repairs," the pier at the north side of the Albany Basin was "very bad," and the wharf at the foot of Dey Street was "quite bad." Although this report did follow the great storm of 1821, such assessments were common (CWP Sept. 10, 1821).

As a result of such conditions, the city suffered revenue loss and business generally declined. City officials were asked to follow the example of Boston or Philadelphia and pay greater attention to the waterfront. In terms of overall planning and supervision, this advise was rarely followed. Merchants would cheerfully have paid higher wharfage rates provided they could have had clean facilities as well, eliminating the necessity, as so often happened, of selling goods soiled as a result of poor waterfront maintenance (CWP Apr. 17, 1845).

2) Extension

The need to extend piers continually was also perennial. The filling in and widening of West Street, an ongoing and gradual process as previously described, reduced the length of piers and wharves at a time when, with the advent of steamboat and Erie Canal traffic, longer piers were needed. From 1815 to 1860, the City Council was regularly requested to extend almost all piers and wharves. In 1825, Hannah Murray, owner of the north dock of the Albany Basin (foot of Cedar Street), asked to build a 40-foot extension with an "L" at the end of the dock. In 1842, various merchants--including Suydam, Reed & Co., grocers at 107-108 West Street; and Crooke, Fowks, grocers at 104 West Street--petitioned for the extension of several piers between Albany and Liberty streets, which they deemed absolutely necessary because of increased traffic from several towns on the Hudson that "have been in the habit of landing at those piers" (CWP Apr. 17, 1825; Jan. 4, 1842).

In 1824, a considerable group of merchants, about 70 in number--including William Rhinelander; George Ireland, builder, 219

Duane Street; and Stuart F. Randolph, 546 Greenwich Street--asked that the pier then being constructed at the foot of Charles Street be made the same length as the one being built at Murray Street fronting property owned by the Rhinelander family. It was suggested that the Chambers Street pier should have a "T" at its end, thus affording "complete protection" from west and northwesterly winds. Such an abutment made repairs owing to ice damage less frequent. Any expenses to the city because of this added construction would be more than repaid by added business (CWP Aug. 30, 1824).

The piers fronting on the Washington Market (i.e., Fulton to Dey streets) received considerable attention because of the importance of that facility. In 1822, city officials were informed by another large group of merchants--including Philip Hone, soon to be Mayor of New York, and Isaac Amerman, flour dealer--that there was a "great want of room for market boats," so much so that "upwards of 1800 dollars (in several years past) has been paid for the use of Fulton's Long wharf, by the Dutchess County wharfs alone ...." Petitioners asked as a minimum that the middle pier of the basin be extended to its mouth, which was done (CWP June 10, 1822).

Similar petitions had been presented for pier after pier. The Vesey Street pier was extended 400 feet (CWP June 27, 1814). The Fulton Street pier at the north side of Washington Market was extended to the permanent line of the Hudson River in consequence of filling in Varick's Basin at the foot of Dey Street (CWP Dec. 4, 1817). A similar petition was filed in 1828 (CWP Sept. 19, 1828), and the pier at Liberty Street was similarly extended in 1825 (CWP May 9, 1825).

Still another large group of merchants--including flour trader Eli Hart, who had a large warehouse in Washington Street; Henry Van Fleet, grocer at 163 West Street; and Justus E. Earle & Co., grocers, 127 West Street--wrote a lengthy petition to the city again pointing out in 1841 the dilapidated and crowded conditions of the Dey and Fulton street piers and the fact that ordinary tides were damaging large portions of stored goods. They asked that the piers be raised and bridged to accommodate the "numerous class of people concerned in its accomplishment" (CWP Dec. 24, 1841). A similar petition was issued in 1845 (CWP Feb. 9, 1845).

Eli Hart's own dock near the foot of Dey Street (pier 19) was allowed an extension of 120 feet (CWP Aug. 8, 1841). The repair of the Fulton wharf, known also as Fulton's Long Wharf, just above Cortlandt Street (possibly the departure site of the first steamboat voyage of 1807), the property of the heirs of the "late Robert Fulton," was ordered attended to in order to make a "safe landing place in future." Some 20 sloop captains or owners signed the petition, including Robert L. Crooke, sloop *General Jackson*, Red Hook; Charles Brooke, sloop *Harper*, Red Hook; I. M. Nelson, sloop *America*, "Pokeepsie"; Joseph Harris, sloop *Dutchess*, Poughkeepsie; and Eugene Pierce, sloop *William*, Wappingers Creek. The list represents a cross section of Hudson River traffic and demonstrates its relation to the growth of New York City (CWP Jan. 17, 1820).

Property owners and merchants around the Franklin Street pier asked that the pier be extended 300 feet, which would "give water of sufficient depth for ship or other large vessels which pay the most wharfage" (CWP Aug. 1847). In 1846, city officials were asked to plan ahead by the petitioner William C. Rhinelander, Executor of the Rhinelander estate, and extend Harrison Street to 280 feet, instead of 200 feet as had been requested a year earlier, since in a short time "West Street will require that thoroughfare to be widened to 150 feet" (CWP May 15, 1845; Jan. 26, 1846).

The numbered piers received similar attention. Pier 10 (foot of Albany Street) needed new sheathing because its surface was "so much loose and decayed" (CWP May 26, 1845). In 1818, pier 11 was extended to the same length as pier 12 (CWP May 4, 1818). Piers 30 and 31 were extended in 1861. Pier 36 was straightened in 1860, as was pier 40 in 1858, pier 43 (the Empire Pier) in 1850, and pier 47 in 1854 (CWP Oct. 31, 1861; July 6, 1860; Sept. 24, 1838; July 3, 1850; Nov. 21, 1854).

3) Steamboats

Steamboats had a special role to play in the repair and extension of piers. Piers in the Washington Market vicinity were especially sensitive to changes brought by steam. In a petition of 1845, merchants of the area--including Justus E. Earle & Co.; Ashbel Denison & Co., grocer 170 West Street; Nelson Wells & Co., fish, 81 Dey Street; John Vandeventer & Co., paints, 74 Dey Street; and others--noted that a great amount of the produce for the city's citizens was carried in vessels and steamboats, which, although they increased in size, found no corresponding increase in the size of the wharves at which they docked. With new bulkheads across the basin formed between Vesey and Fulton streets (the Corporation Docks), it was even more imperative that the piers be extended (CWP May 21, 1845).

A similar message is found in the petition of property holders in the 8th, 9th, 15th, and 16th wards, the "upper part of the City." Increased traffic in the area, which taxed the only available dock at Hammond Street to the limit, "... not only causes delay often times to the steamboats but confusion among the passengers. Then three or four boats are waiting to land at the same time ...." The petitioners included John Douglass, 317 West Street; Joshua Burnham, 7219 Greenwich Street; and John W. Christie, 720 Greenwich Street. They asked for a 40-foot extension of the "T" at the foot of Amos Street by a "Pile Rock," the "front to be for a steamboat landing, which can be built at a small expense and it is central, it being formerly the Steamboat landing for a number of years,-----saving time and expense to the Traveling Public residing in the upper part of the City" (CWP July 6, 1847; see also Apr. 26, 1850). Attorney Cambridge Livingston, 17 Wall Street, and Robert W. Stevens, 53 West Street, among others, also asked in 1845 that the extension of the north side of the Barclay Street wharf 100 feet into the river be altered in such a way as not to interfere with the public's use of steamboats landing at the wharf. They wanted the extension constructed at a different angle, and they provided a necessary working diagram (CWP Mar. 24, 1845). An effort in the same year to extend Rodgers Wharf, lying between Barclay and Vesey streets, caused opposition among 80 merchants, including Stephen R. Row, 176 Broadway, and Henry W. King, grocery stores agent, 151 Fulton Street, who complained that it would reduce clearance between wharves to about 93 feet and it would be impossible for such steamboats as the *Empire* to get into the Barclay Street wharf when the adjacent wharf was occupied. The proposed extension would inconvenience the "many hundreds both of citizens and strangers" who daily use the facility and would cause larger steamboats to seek other and more convenient piers. A rough diagram was included. The extension was defeated (CWP Mar. 24, 1845).

In 1844 the petition of A. Vansantvoord, secretary of the *Peoples Line* of steamboats, asked and was granted the extension of the pier between Courtland and Liberty streets in order to facilitate the landing of passengers and to afford them better protection in bad weather (CWP Dec. 16, 1844). Cornelius Vanderbilt, the famed Commodore, asked that his 40-foot pier just south of pier 1 at the Battery be widened and extended 150 feet (CWP Sept. 13, 1852). This pier, not as long as adjoining pier 1, appears on the 1852 Dripps and Perris & Hutchinson maps but has disappeared in the 1856 Bernitz map (see Figures 22-24). In 1837, Robert L. Stevens, owner of pier 2, which he leased to the Philadelphia Railroad Company, asked that his wharf be lengthened 50 feet to accommodate the railroad's steamboat line (CWP Dec. 11, 1837). H. B. Cromwell and Company, owners of the steamship line which carried their name and proud owners of the steamships *Mount Vernon* and *Monticello*, which plied between New York and Washington, asked permission in 1859 to widen Pier 9 and its bulkhead and to put a "suitable shed" on the pier to protect their property from rain. The request was approved (CWP Nov. 29, 1859).

4) Requests to Build

The same reasons that led to requests to extend and widen piers also applied to the building of new structures, with some differences. Building was a more expensive proposition than extension, and reasons given generally had to be of more pressing urgency. However, like the story relating to extension, that of new building is an integral part of the history of the waterfront.

As early as 1817, the need to have a middle pier in the Albany Basin (with outer piers at Cedar and Albany streets) was obvious to many, including some 20 boatmen who were exposed, as were their vessels, to the ever-present northwesterly winds. Among the signers of various petitions were four members of the Martling family--David, Abraham, Edward, and Samuel. It is possible Abraham was the famous innkeeper who in the first decade of the century was associated with the anti-Clinton wing of the Democratic Party.

They sought expansion of facilities to accommodate increasing trade and to shield passengers and freight from the great dangers caused by the "high swell which rolls through its wide mouth into the said Basin whenever the wind blows from the Northwest ...." The boatmen were joined by an important group of merchants and traders including attorney Samuel N. Judah; P. G. Arcularius & Co., grocers, 133 Washington Street; and John Van Nostrand & Co., grocers, 135 Washington Street. The petitioners made a special point to emphasize that when the "great storehouse of the Western country is unlocked ..." (i.e., by the completion of the Erie Canal) the prosperity of the city would greatly benefit, provided it was prepared for such trade increase. A second merchants' petition supporting that of 1823 was filed in 1824. By 1826 the middle pier was in operation (CWP 1817; 1823; Jan. 26, 1824; Apr. 13, 1824).

Another large group of citizens, from Greenwich Village in the vicinity of Bank Street--including Frederick S. Byrd, whiting, 102 Bank Street, and James Berdan, baker, 48 Washington Street--petitioned for a pier at the foot of Bank Street because there was no pier in that part of the city at which a large vessel could discharge or receive cargo. This plea was approved in April of 1846 (CWP July 27, 1846).

Property owners on and about Barclay Street petitioned to build a pier at that street. However, despite a lack of funds on the part of the city, an agreement was reached among the proprietors--including Joshua Jones and Philip Hone, lessee of the Hoboken Ferry--to extend the Vesey Street pier by providing an "L" at its end and to build the Barclay Street pier 290 feet into the river. The costs were to be borne by the city, the proprietors, and Philip Hone. The Vesey Street extension and the Barclay Street pier (just above Vesey Street) were to be finished by 1826 (CWP June 14, 1819).

In February 1811, Jacob Halsey informed the city that his contract to construct a pier at the foot of Canal Street had been completed three weeks before, "except the graveling in front of two of the blocks, and a few loads of stone are wanting at the extremity of the dock." This delay was due in part to ice in the river. His petition "respectfully" asked for the third installment of $2,328 on his contract (CWP Feb. 11, 1811). The Canal Street pier became the center of a great deal of business activity. In 1835 it was leased in part to the Hoboken Ferry Company, which asked for permission to build a roofed platform for the convenience and safety of its many passengers, who until then had been compelled to stand in the street without shelter and in danger of being run over by carts. Permission was granted (CWP June 3, 1835).

The construction of the Chambers Street pier was the result of two 1822 petitions drawn up by many important merchants--including Selah Strong, the first City Comptroller; George Ireland, builder, 219 Duane Street; and some 60 others--seeking to accommodate the needs of the people of the area, especially those using the crowded facilities of the Duane Street Basin (CWP May 21, 1822). In 1837 another group of citizens and businessmen residing mostly along West Street pointed out to the City Council the pressing need for a 400-foot pier to be built between Spring and Charlton streets. The extreme width of the basin between the two streets, which offered little protection to sloops using the facilities, drove away a good deal of trade from the early Clinton Market and caused serious loss to persons doing business in the neighborhood (CWP 1837).

In 1829 other residents of Greenwich Village noted the lack of piers servicing their waterfront--in fact, only one pier was in operation, and it was occupied by hay boats. They asked for and finally received approval for construction of a pier near Christopher

Street (pier 32) (CWP Mar. 27, 1829). In 1849 a Council resolution was adopted to build a pier 200 feet north of Gansevoort Street. Street Commissioner John T. Dodge amended the process in 1850 by building the pier directly at the foot of Gansevoort Street and extending the pier at Bank Street (CWP Feb. 11, 1850).

The lack of a pier at Hammersley Street was brought to the attention of the city in 1854. It was also pointed out that an existing bulkhead was too shallow to afford protection to vessels from prevailing storms from the northwest. The nearest piers, one at Clarkson Street and the other at King Street, were too distant to serve the neighborhood conveniently. In 1829 a group consisting mainly of tradesmen and merchants mentioned to the city officials that a "large proportion of the stone and greater proportion of the wood used in the upper part of the City is landed between the State Prison and Hammond Street and yet there is but one basin above Charlton Street which is used exclusively for Hay Vessels." They thus proposed the building of a pier at the foot of Hammond Street (CWP Jan. 20, 1829). It was not until 1845 that such a pier was in place.

Also in 1829, a number of interested persons--including James Lowerre, inspector of beef and pork at Canal Street, corner of Washington Street; Henry Spafford, boatman, 80 Water Street; and Edwin Wells, grocer, West Street--petitioned for a pier at King Street which would be of greater convenience than an existing wharf, and which would increase the value of "publick" ground on King Street as well as serve as a growing investment (CWP 1829). As in so many other cases, inhabitants of the area of Harrison, Provost (present-day Franklin), and North Moore streets asked for the protection which a pier could afford to vessels delivering "lumber, fuel, etc." The CWP in 1831 recommended that such action be taken by constructing 250-foot long piers from the foot of the respective streets. In addition, other advocates of the North Moore Pier--including Amos Corning, city surveyor, 427 Greenwich Street, and Underhill and Ferris of the marble yard at the corner of Greenwich Street--stressed the need for construction, inasmuch as the "waterfront from the foot of Jay Street to the Bridge at the North Battery - is central and important, but without a pier or anything to defend a vessel from the weather ...." They also asked for a "T" or "L" to be built at the end of the structure (CWP 1831).

In 1821 a group of sloop owners and captains, some 60 in number--such as, Stephen Bloomer, sloop *Hornet*; Charles Isham, sloop *Herald*; Abraham Martling, sloop *Julia*; and S. M. Nelson, sloop *Othello* (the list is a good representation of the famed Hudson River sloops, not too many of which have been so nicely catalogued) --asked that either a public basin or additional pier be erected between Murray and Warren streets in order to relieve some of the overcrowding in the Washington Market area. That petition was supported by another of William Rhinelander, who in 1824 asked to be allowed to construct a pier at the foot of Murray Street similar to the one at Robinson Street, which piers were to be his property. Again, the main purpose was better accommodation (CWP Dec. 10, 1821; Apr. 12, 1824).

Abraham Acker, 16 Hammersly Street, in a petition of 1844, asked to have the city construct a pier at the foot of Perry Street. It was favorably received and acted on, although petitions of 1825 and 1836, again with a large number of signatures, to build Perry Street and Hammond Street piers, which would be "useful for building, fuel, etc." since a good part of the year vessels "cannot lay with safety at the State Prison Dock ...," were not acted upon (CWP Feb. 25, 1825; Feb. 27, 1826; Nov. 25, 1844).

As in so many other instances relating to the lack of piers, Spring Street petitioners were heard from in 1817. Then, at least 100 citizens--including Caleb Bruch, grocer, 62 North Moore Street; James Lowerre, a petitioner of the King Street pier; Dilbert Chichester, 523 Greenwich Street; and John Towt, attorney, 16 James Street--noted the need to build a pier inasmuch as there was no basin north of Jay Street and the one at the foot of Canal Street was too shallow at low water. Even at high tide it could accommodate only two vessels--thus the need for the Spring Street pier (CWP 1817). A problem with water depth was also cited as a reason to build a pier at Troy Street. Among the many signatures were those of George and Garret Green, lumber dealers, whose large business was situated at the corner of West and Horatio streets. In support of the petition, the CWP noticed the need for piers to accommodate the ever-increasing landing of lumber, brick, granite, and other building materials. The lumber dealers had considerable clout (CWP Jan. 13, 1840).

Of the most interesting of the pleas to construct piers are those relating to the Vesey, Dey, and Fulton street complex--i.e., the Corporation Dock--serving Washington Market. The request to form a "capacious" basin between the mentioned streets was first made in 1815. It summed up many of the reasons for waterfront development and noted that "internal navigation supplying alike the conveniences and necessities of this growing metropolis is considered as a source of wealth and is deserving the highest consideration [as in] the true interest of the Community" (CWP July 31, 1815).

Although the CWP realized the importance of the request, nothing was done because of cost, previous commitments, and the scarcity of workmen and materials. However, the need did not go away, and in 1817 an impressive group of merchants and landowners--among them Joseph Ireland, grocer, 82 Dey Street; Salisbury & Graham, merchants, 177 Washington Street; and Haines & Hunter, 70 Partition (Fulton) Street--repeated demands, asking for haste inasmuch as the "vessels of our customers would be in a deplorable situation next Fall in inclement weather." Speed was asked for in construction (CWP 1817), and similar haste was called for in 1819 (CWP Feb. 26, 1819; Jan. 25, 1819). Late in that year, John Anderson was contracted to build the Vesey Street pier. One of the blocks used in building the pier turned over. The Committee charged that the event resulted from Anderson's carelessness in throwing in stones at the time of sinking, and it refused to allot more money to the contractor (CWP Sept. 4, 1820).

The desire for a basin between Warren and Murray streets was owing to the crowded conditions at the wharves at the Washington and Duane markets. Such construction would be of benefit to the "mercantile and commercial interest of the west side of the City generally, as well as to those who are concerned in real estate in the immediate neighborhood. The very bleak and exposed situation of the north side of the City calls loudly for basins and piers.... It is in the recollection of many of your petitioners that fifteen or twenty years ago this part of the City afforded better accommodations for shipping and river craft and was in greater commercial prosperity than at present" (CWP 1821). This petition of 1821 was signed by another large and impressive group, including Stephen O. Beekman; Philip Hone; Daniel Bush, accountant, 109 Duane Street; Stuart F. Randolph, grocer, 253 Greenwich Street; and William Ballantine, grocer, 200 Washington Street. By 1825, the Murray Street pier was 315 feet long. The one being constructed at Chambers Street was to be of similar length. What was wanted was for the pier at Warren Street to provide two large basins 200 feet in width between Chambers and Murray and between Murray and Warren streets. The signers of this petition included William Rhinelander; Qaing & Randolph, merchants, 254 Washington Street; and John B. Ebbets, grocer, 204 Washington Street.

Pier 1, at the foot of West Street and the Battery, was on the water lot of William Gibbons, one-half of the *Gibbons v. Ogden* steamboat monopoly case. Gibbons petitioned early in 1821 and was granted construction privilege in September of that year. The space between piers 6 and 7 was alloted in 1845, when Stephen Whitney, owner of the water lot, received permission to build a new pier to "keep pace with the constant increase in shipping" on the North River. In the course of the grant, it was commented that narrow piers offered greater protection from high winds than did wide ones.

The 17th Street pier resulted from the need to land large quantities of iron, coal, grain, and building materials. A pier large enough to accommodate two ships on either side was asked for. Again, a large number of merchants and tradesmen signed, including Jacob Sharp, builder and entrepreneur. The date of the request was 1852.

One of the more well-known names connected with waterfront development was the poet-writer-landlord Clement C. Moore. In March of 1853 he informed the city that he had "lately" caused bulkheads to be built from 19th to 20th streets and from 20th to 21st streets, thus making a continuous line from 18th to 24th streets. These bulkheads fronted his extensive property holdings. Since vessels unloading and trading at the bulkheads had no protection from storms, he asked to be allowed to build at his own expense for "his own benefit" three piers between 19th and 20th streets, between 21st and 22nd streets, and between 23rd and 24th streets. Each pier was to be 40 feet wide and 300 feet long. They were to be built on an "outward block of fifty feet square at the base and forty feet square at the top filled with stone in the usual manner ...." Moore included a sketch of this proposal. Although the petition was approved by the CWP, the piers themselves were never constructed. It would seem that Moore's "A night before Christmas ..." was more successful (CWP Apr. 15, 1853).

It was suggested that the 28th Street pier should be 550 feet long and 40 feet wide, corresponding in size to the pier at 30th Street. The need for a new pier reflected an increase in business in the neighborhood as well as the fact that the 26th Street pier was being used for street manure. Among the signers of the petition were R. W. Forbes, lumber, West 29th Street and 11th Avenue; C. C. Dole and W. E. Demarest, at the same address; Lewis Calwell, foundry, West 27th Street; Danker & Van Siclin, merchants, West 27th Street; and a number of lumber mill and stone mill operators. The industrial character of the area is evident (CWP Mar. 14, 1855).

The 37th Street pier was petitioned for in 1853, again to meet the needs of the business community of that vicinity. Among the signers was A. Terrell & Co., New York Moulding Planing Mill, 37th Street near 8th Avenue.

The 47th Street pier has illustrious petitioners. In 1831, David Hosack and Thomas A. Emmet, two of the city's most noted doctors, joined with others to remind the city officials that 42nd Street was about to be opened from 3rd Avenue to Bloomingdale Road and that the inhabitants of the 12th Ward needed a pier to reduce the expense of providing fuel and necessities from the lower end of the city. They asked for a pier at 42nd Street and that 42nd Street be opened from the river to 10th Avenue. They also asked that 42nd Street be "worked" to the river. A second petition was written in 1852.

In 1863, petitioners asked for a pier at the foot of 49th Street because the extreme length of the 47th Street pier exposed its users to storms and tides, which also placed it constantly in repair. In addition, the pier was a "monopoly" for storers of bricks and sand. The signers included James Carmichael, Malt House, 49th Street; Matthew Allen, brewer, 49th Street and 11th Avenue; and P. Danvers, forge, 53rd Street.

The 51st Street bulkhead was asked for in 1853 on the petition of Charles T. Shelton. The 52nd Street pier was the request of John Hamilton of 52nd Street between 11 and 12th avenues, and of William Connor.

Owners and occupants of property around 55th Street--M. Hooper Mott, watches, 7 Nassau Street; Mott Bros., watches, 7 Nassau Street; and others--asked that a dock be built at the front of their street to permit ordinary coasting vessels to unload. In 1853 Bradish Johnson, merchant at 168 W. 16th Street, was given permission to "dock out" in front of his property on the North River between 57th and 58th streets, 250 feet west of the westerly line of 12th Avenue.

Part of the process of pier building related to the granting of contracts to the builders. The aforementioned John Anderson was one of the earliest of such contractors. In the mid-nineteenth century, Jacob Sharp, friend of politicians and a voice of authority in New York, was one of the most successful. Some claimed his authority was used or obtained by corruption. Among the contracts Sharp received as low bidder were the following: pier 79 (1860); repairing (twice) pier 47 (1860); rebuilding pier 48 (1860); building an addition to 40th Street pier (1852); rebuilding, extending pier at foot of 40th Street (1859); repair pier, foot of 13th Street (1858); extending pier 51 (1858) (CWP Oct. 8, 1858; July 24, 1860; June 1, 1860; June 11, 1860; May 31, 1859; Nov. 13, 1858).

5) Rentals

Given the obvious scarcity of wharfage, the struggle among users for available space was often very bitter and involved all manner of pressure to obtain rental along the waterfront. As with the building of piers, rentals followed the northward march of the developing city. One of the causes for added friction regarding rentals was the rapidly expanding use of steamboats, which strained docking facilities and caused sailboat owners considerable worry. An example of this concern was a petition in April of 1825, by a large number of merchants, grocers, and the like (the names are very similar to those attached to petitions for building and expanding piers--i.e., A & B Stagg, 185 Washington Street; P. G. Arcularius, grocer, 133 Washington Street; John Van Nostrand, grocer, 135 Washington Street) protesting the rental to steamboats of part of the Albany Basin (between Cedar and Albany streets), since it would "greatly interfere with the regular North River trade and injure many of your petitioners." The petition asked that everyone be treated equally, but that if preference were to be shown, let it be given to "long standing" users. "Steamboats," the petitioners went on, "not only occupy the wharf with wood, but also require much more room than the sloops" (CWP Apr. 25, 1825). Obviously, West Side merchants had not yet considered the benefits of steam. The petition was not accepted by the Committee, for in May 1825 it resolved to allow William C. Redfield, steamboat factor, 82 Courtlandt Street, the right to have exclusive use of the pier on the north side of the basin for his "steamboats Commerce and Swiftsure, tug boats, Lady Clinton and Car of Comfort in common with other vessels that are under one hundred tons" (CWP May 7, 1825).

Steamboats also figure in disputes with hay boats. In 1835 a group of interested parties--including Townsend Harris, later the first American ambassador to Japan; and builder James G. Wells; together with some 30 others--complained that the hay boats assigned to the Amos Street pier should be given use of another dock because they were a nuisance to steamboats using the same pier to load and unload passengers as well as a fire hazard. The Committee ordered Joseph Crowell, lessee of the hay scales, to move to the head of the pier at Charles Street (CWP Sept. 14, 1835).

Struggles also occurred between steamboat lines. In 1840 the Committee ordered that the south side of the pier at the foot of Battery Place be leased for a year to the Elizabethport and New York Ferry Company (that location was subsequently used for several years by that company). The lease of the Boston and Providence Line, which had shared the pier with the Elizabethport and New York Ferry Company, was ended, since a bulkhead was being built across the slip on the north side of the pier (CWP July 1, 1840).

John C. and E. A. Stevens, lessees of the private pier at the foot of Barclay street and owners of the Hoboken Ferry, asked for exclusive use of the pier in order to widen the platform by some 65 feet so that their buildings and offices could be set back some 70 feet from the street. The request was approved by the Committee, which took notice of the crowded condition of West Street and the pier around the Washington Market. The existing ferry float rack was removed to the outer end of the pier (CWP Dec. 30, 1851).

At the request of the owners of the steamboat *Frank*, and the owners of the freight barges *Pratt*, *Rip Van Winkle*, *Wave*, and *Star*, all of Catskill, New York, as well of several other owners and occupants of the slip between Cedar and Liberty streets (piers 14 and 15), the Committee took notice that the vessels mentioned were part of a regular line between New York and Catskill that transported produce and passengers, thus providing a trade of very important character to the city. Realizing that the line therefore deserved a fixed location, the Committee assigned the Liberty Street pier in 1842 to the firms of Penfield, Day & Co., of Catskill, and to Crooke Forbes & Co., grocers, 104 West Street, at the corner of Liberty Street (CWP June 8, 1842).

When in 1844 two claimants of seemingly equal merit appeared before the Committee, both asking rental of the north side of the Cedar Street pier, the Committee carefully weighed the testimony of several merchants on the part of each rival. They were the proprietors of the Hudson Tow Boat line, owners of the steamboat

Fairfield and several barges, and the previous users of the pier, owners of the steamboat *Westchester* and the sloops *Othello* and *Perserverance.* The Comittee solved the problem by granting the pier for a year to the Hudson Tow Company, but granting as well a berth to the *Westchester* on opposite days from that used by the *Fairfield.* Rental for the total pier was $1,200, payable quarterly (CWP Apr. 15, 1844; Mar. 11, 1844).

Five steamboat captains--H. B. Murray of the *Norfolk,* Martin Bartholmew of the *R. L. Stevens*, H. Tuthill of the *Union,* Jonathan Slidell of the *Telegraph* and Daniel Drew of the *Oseola,* the last best known as a financier and stock manipulator--noted the crowded conditions of the waterfront and asked the City Council to set aside the entire Charles Street pier for the exclusive use of market and passage steamboats. Approval was given. As with hay boats, sailing vessels were being crowded out of the rental market, which for Charles Street was, by 1841, $2,150 per year (CWP Mar. 25, 1839).

The earliest reference to steamboats and the North River piers occurs in 1814 when Ann Smyth, executrix of the estate of Jacob Witkin, asked city officials to be allowed to rent the pier at the foot of Courtland Street, which was then occupied by the Jersey Steam Boat Company. The result of this request is not evident (CWP Jan. 24, 1814).

In 1825, John R. Livingston told an interesting story regarding questionable practices in city docks. Livingston owned the steamboat *Olive Branch*, which, because of the gale of 1821 that destroyed the Marketfield Street pier, had rented the Courtland Street pier for $450 per annum. Sometime in late 1824 or early 1825, the Troy Steam Boat Company, paying more than double the rental, had been given exclusive use of the pier, although the *Olive Branch* had been using the pier for three and one-half years. Livingston angrily complained "that your petitioner submitted to this act of injustice at the hands of a monied aristocracy ... consoling himself with the reflection that although the company could obstruct the slip (no matter how illegally) and prevent his boat entering therein, yet as your Honorable Body is the owner of one-half of the north side of said slip (the south pier of the Powlas Hook ferry) that his boat could stop at the bulkhead of the said pier and take in her passengers on the days of her sailing and pay to the proper claimant the per diem dockage." However, the steamboat company had blocked up the bulkhead with laborers and three or four tiers of cord wood. At different times a chain was put across the slip. Appeals to the harbor master were to no avail. Orders to remove the obstacles by the Street Comissioner also had no effect. In his fight with the "monied aristocracy," a favorite Jacksonian term, this irate citizen asked city officials to order that the obstruction of the entire pier for "mere gratification of passion or ill will" be so far cleared as to allow passengers to go aboard vessels laying at the foot of the Courtlandt Street wharf. It was so ordered (CWP Apr. 11, 1825).

In the same vein and at the same time, 1825, Jacob Corlies asked exclusive rental of the lower half of the Dey Street pier for the steamboat *Franklin*, which ran between New York and Poughkeepsie. Here, the city refused the request, arguing that the pier, so near the Washington Market, was in constant use for market boats and other vessels carrying wood and other merchandise to the city (CWP Apr. 11, 1825). In 1831, a petition on the part of the Troy & New York Steam Boat Company requesting a lease for part of the Dey Street pier was also politely refused, as it would drive away the business of sloops and coasters and, in return, would do nothing to compensate for the loss of that trade. The decision favored doing what was most beneficial to the city and its interests; therefore, the connection with the country was important, but at this moment in time traditional traffic assumed priority (CWP Apr. 23, 1832).

The lease of the Duane Street dock also is of interest. James B. Vanderhovel led 20 hay dealers in a complaint to the city that lack of available dock facilities harmed their businesses. They asked for additional accommodations, including the entire Duane Street pier and all of pier 29 (they had previously occupied the north side of the pier). They were given rental to the Duane Street slip (CWP May 22, 1820). In regard to the hay business, Garrit Walgrove was in 1817 given the right to put his hay scales at the Albany Basin; the scales had been previously located at Whitehall Street on the East River (CWP Oct. 28, 1917).

In 1839, the petition of the New York Urate and Poudotte Company to rent the facility at Duane Street for the steamboat *Providence* in order to dispose of waste matter from sinks and privies in the city was granted. It was reasoned that the nuisance, dangerous to health, would be lessened by the company (CWP June 17, 1839). The history of this company is not known but it must have been a short one, for in 1844 the Erie Railroad was given right to the exclusive use of the Duane Street pier for railroad steamboats and barges. Horatio Allen, President of the Erie, indicated that the pier was central to the company's depot, was the most northerly of all steamboat piers in the city, and was used to bring produce from Rockland and Orange counties (CWP May 24, June 24, 1844).

The east side of Fulton slip, previously Fulton's Long Wharf, just north of Cortlandt Street, was leased to Elihu S. Bunker in 1821 for use of the steamboat *Enterprise*. The city agreed to the confirmation (CWP Sept. 3, 1821).

Steamboat expansion and Hudson River traffic merged in the 1846 petition of a group of merchants and property and steamboat owners around Hammond Street to have the city grant exclusive rights to the pier to the steamboats plying between New York, Westchester, and Rockland counties. Individuals such as Daniel Drew; Horatio Mott, shipbuilder, 313 West Street; and Joseph Hammond, butcher, 364 West Street, stressed the importance of such traffic to the "thousands" of passengers crowding the wharf yearly. The petition was granted (CWP Jan. 14, 1846).

The rental question was, of course, most intense in the lower parts of the city, especially around the Washington Market area. In 1826, two groups met in combat over the rental of the Murray Street pier. One faction, led by William C. Rhinelander, asked that the pier be appropriated for the exclusive use of the Poughkeepsie & Fishkill Steam Boat Line. The other group was headed by Jonathan T. Odell and seven others engaged in freighting between the city and Tarrytown, Sing Sing, Peekskill, Cortlandtown, and Dobbs Ferry using "sloops and other craft not using steam"--the steamboat controversy again. The decision this time was in favor of the steamboats; steamboats experienced great inconvenience and damage caused by sloops carrying bricks; the crowded condition of piers like Cedar Street caused as much as two days' delay to steamboats; the depth of water at Murray Street was 15 feet, sufficeint for the steamboats, whereas other piers were in shallower water; and, lastly, the Odell group generally used the Duane and Franklin Street piers and had not applied to the owners of these piers for rental privileges. Thus, the nod went to the steamboats. A considerable group of merchants and property owners around Murray Street supported the Rhinelander petition (CWP Oct. 5, 1836).

In 1839, the Poughkeepsie company was replaced by a group of individual steamboat and barge owners. Cary Wilkinson & Co., owner of the barge *Clinton*, and James Lockwood, owner of the barge *Columbia* and the steamboats *Emerald* and *Robert O. Stevens*, which were used to tow the barges from Poughkeepsie, New Hamburgh, and Milton, New York, asked for exclusive use of the Murray Street pier. William C. Rhinelander, proprietor of the wharf, signed the petition, which was granted for the period between May 1840 and May 1842 (CWP May 10, 1838; Apr. 18, 1840). This arrangement was subsequently extended to at least 1848 (CWP July 1848; Feb. 1846; Mar. 13, 1847). Each request for an extension was accompanied by lists of merchants and shipowners.

The influence and development of steamboat traffic can also be seen in the Robinson Street pier request. In 1825, when William Rhinelander asked for exclusive use of the north side of the Robinson pier for steamboats, his petition was turned down because it interfered with the "laws of the state for the laying of ships and vessels at the wharves of this city" (CWP Apr. 11, 1825). But by 1846 a similar and "annual" petition of Samuel Schuyler and Abraham Hitchcock, owners of the steamboats *Belle* and *Express*, to use the south side of the Robinson Street pier for exclusive use in running passengers and freight between Albany and New York was granted to "promote public convenience." William C. Rhinelander, proprietor of the pier, supported the petition (CWP Feb. 15, 1845; Apr. 13, 1846).

A group of storekeepers, cartmen, and boatmen were given exclusive right to the Vesey Street pier, thus preventing "speculators" from vending "fruit, etc." at the pier and crowding out those having business interests of a more legitimate kind (CWP Oct. 24, 1839).

Public convenience was also chiefly considered when in 1839 Houston & Johnson & Co. engaged in the Newburgh trade with their towboat *Union* and the sloop *John Beveridge* at the Warren Street pier (CWP Mar. 18, 1839). Earlier, in 1837, T. Powell & Co., B. Carpenter & Co., D. Cranford & Co., and Oakley Davis & Co., all of Newburgh and owners of the steamboats *Washington, Superior, Highlander,* and *James Madison,* which were used to convey produce of a "large surrounding country," asked and received rental at Warren Street. Crowded conditions and public convenience were again cited (CWP 1837).

As for numbered piers, number 1 was leased for a year in 1818 to Noah Brown and Daniel D. Tompkins, former governor of New York, for $206 (CWP June 6, 1818). Pier 2 was granted for three years to the Camden and Amboy Railroad and Transportation Company. The president of the company was Robert L. Stevens, who also ran steamboats between the city and South Amboy (CWP Aug. 26, 1844). In 1842, the New London and Norwich Steamboat Company was given lease to pier 4, having earlier occupied pier 1, but they were priced out by the New Jersey Steam Navigation Company (CWP Apr. 2, 1842).

In 1825, Mowatt Brothers & Co., owning a steamboat and six freighters and engaged in the Albany trade, were given the basin in the north side of pier 6 for two years (CWP Mar. 21, 1825). Owners of the steamboats *Santa Claus* (used to transfer James Monroe's body to Virginia), *Arrow, Argo,* and *Buffalo* received exclusive use of the slip between piers 21 and 22 for one year (CWP 1845). The north side of pier 24 was assigned for a year in 1838 to owners of the steamboat *Warren,* which plied between the city and Haverstraw. This petition, signed by a number of land-owners and residents, refers to the pier as Roger's Dock (CWP Aug. 12, 1838). Owners of the steamboat *Maria,* a market boat running between New York City and Washington, New Jersey three times a week, was given a permanent berth in the south side of pier 24 in 1838 (CWP Nov. 26, 1838).

Captains Smith and Marselles of the steamboats *Orange* and *Rockland* were given a two-year lease to the north side of pier 33 "being the first pier above Spring Street." Their trade was between Nyack, Haverstraw, and New York (CWP Apr. 22, 1836). In 1853 George C. Bryne, lessee of piers 33 and 34, received exclusive use of the piers for the steamers *Black Warrior, Cahawba, Columbia, South America, America, Thomas E. Hulse*, and *George Washington*, as well as for several barges (CWP Dec. 27, 1853).

In this brief account of the renting of wharves, it is obvious that there existed considerable struggle for space between merchants and owners of wind and steam vessels. In the process, the names of the individuals involved-- long forgotten and mostly overlooked by history-- have once again surfaced.

f. BETWEEN THE PIERS: SEWERS, EXCAVATION, AND DREDGING

A continual problem affecting use of piers was the frequent need to deepen individual wharves. As vessels were enlarged or as siltage accumulated, the depth of the water adjacent to a pier became increasingly a matter of concern. How to solve such a problem, outside of lengthening piers, led to a number of suggestions, one of which was dredging, accomplished by a "mud machine." Another was to extend sewer lines further into the Hudson. Examples here cited give some account of the problem and methods of solution. They also provide information as to clearances and general waterfront conditions.

In 1855, the Canal Street pier was deepened to 10 feet at low water. It had been only 3 feet at low water (CWP July 26, 1855). In reporting on the Charles and Hammond Street piers in 1847, the Street Commissioner found that at low water there was not 3½ feet between the two street piers, with the bulkhead being entirely exposed. The depth of the piers at the foot of Perry Street was gradually increased to 5 feet. City officials agreed to excavate the Charles-Hammond Street Basin to 5 feet at low water, increasing depth to 8 feet at the Perry Street pier. A request for excavation to 12 feet was rejected as being "unnecessary." It was estimated it would cost $1,500 for each 3 feet of excavation.

In 1825, the accumulation of mud and dirt at Clarkson Street was called to the notice of the Committee. The foot of Clarkson Street was the point at which the "great sewer which drains a portion of the City of nearly five hundred acres of surface empties into the river. This sewer was constructed fourteen years [ago and] since that period has constantly been depositing, in the river at its mouth, the offscourgings of all the streets which communicated with it" (CWP 1825). This condition reduced the depth of the water so that at low tide the bulkhead was bare. It also almost ended any commercial traffic at Clarkson Street. The Committee recommended that the sewer be extended 250 feet into the Hudson, similarly to what had been done at Canal Street. At the same time it was voted that a pier be built at Clarkson Street extending 250 feet into the river with a "T" 75 feet on each side similar to the one at Canal Street.

In 1844, a number of boatmen and others doing business at the Christopher and Amos Street Basin petitioned for the excavation of the slip, which, in common with other West Side docks, drew 3 feet of water at low tide. The city was informed that owing to the press of trade some vessels had to lay off the piers two or three days waiting for the proper place and tide "at the great annoyance of the *Steam Boats* which are daily landing there." Among the petitioners were Captains William Weirnel, sloop *Clermont*; John Ostrander, sloop *Sevant*; John Boucher, sloop *Drew*; and Elizer Sage, sloop *Calhune* (CWP July 29, 1844). In 1858 attention turned to the Franklin Street pier, which could not be used by shipping at "ordinary low water," and where the "effluvia" arising from the exposed river bottom was "very unpleasant and injurious to the health of the City." It was a condition that needed correction before the "approaching warm weather sets in." This petition was submitted by officials of the Catskill Steam Transportation Company (CWP Mar. 26, 1858).

The condition of the long pier at the foot of Hoboken Street and that of the pier at Canal Street fronting the Clinton Market was drawn to the attention of the city in 1848. As a result of sewer discharge from Canal Street (a situation relieved when the sewer was extended 300 feet further into the river) and the wash of the street, the slip between the two streets had filled up enough to slow traffic in the area. It was suggested that the slip be excavated 8 feet below water. Four hundred dollars was funded for the job (CWP 1848).

Also in 1848, users of the Jay Street slip found that canal boats of 50 tons ran aground at low tide. It was therefore agreed that the slip should be excavated to 8 feet at low water. Others urged that such excavation also be done at the Harrison Street slip. Both petitioners were approved (CWP June 12, 1848).

In 1835, the CWP approved excavation to a depth of 8 feet for the slip between Robinson and Warren streets. By 1836 the basin between Hoboken and Watts streets was so full of mud that vessels could only land at high tide. The city acted quickly and ordered the mud, which at "low water is very offensive to passengers," to be removed as quickly as possible (CWP Sept. 19, 1836).

By 1852, the slips on either side of pier 40, Watts Street, were ordered dug out so as to provide 10 feet at low water (CWP May 19, 1852). Also in that year, the slip between piers 12 and 14 was ordered excavated to 14 feet at low tide (CWP May 17, 1852), and the slip between King and Charlton streets was excavated to 6 feet below low water (CWP Mar. 31, 1852). In 1853, the slip between piers 31 and 32 was ordered excavated to 10 feet below low water to 300 feet beyond the bulkhead line (CWP Oct. 28, 1853). In 1855 a number of interested parties around piers 35 and 37 asked that the slip be excavated to "a sufficient depth of water for navigation of such vessels as frequent those slips for business purposes" (CWP Apr. 2, 1855). In the same year the slip between piers 45 and 47 was excavated to 10 feet below low water (CWP Apr. 26, 1855).

One of the chief concerns over dock conditions related to the noxious odors frequently emitted from sewerage-, silt-, and debris-filled waterfront sites. This problem, in turn, raised questions as to the danger of disease, which threatened not only immediate neighborhoods but also, indeed, the entire city. Thus, the deepening of piers was also related to the solution of the problems caused by dirt and disease--e.g., Canal Street, which although not a heavily trafficked area had a special problem inasmuch as a major sewer emptied its contents there. Attempts to solve these concerns came early. In 1813, one John Arthur built a "Flatt" 50 feet long and 30 feet wide with sides almost 5 feet high and offered it for sale to the city, "her shape and size being near that of that used to clean out the slips in the City of New York." The offer seems not to have been accepted. The barge was to have been used as part of a "dredging" or "mud machine," which, commented one observer in 1824, was "in constant use in this city." The comment was made by John Eveleth, who offered the city a recently completed "mud machine" plus two scows, which he said could send out twelve or thirteen scow loads per day, much beyond the capacity of the "dredging machine" then in operation. City officials felt that the device then in use was of sufficient merit and rejected Eveleth's offer (CWP Apr. 26, 1813; Oct. 25, 1824).

The optimism of the officials was not shared by a large number of inhabitants of the Canal Street area. Individuals such as Nathaniel Janis, shipmaster, 303 Hudson Street, and William McLean, Jr., carpenter, 194 Varrick Street, protested the existence of filth and rubbish at the foot of Canal Street and the mouth of the Canal Street sewer, which "produces the offensive smell that can [hardly] be imagined. We beg that your honorable body will cause the nuisance to be removed by the Mud Machine before the dog days set in" (CWP June 30, 1827). One wonders what the smell must have been like during the "dog days." At the same time the petitioner noticed that the Spring Street Basin had become so filled that it was impossible to remove any vessel except at high tide, and he asked that the "Mud Machine" be used to clear out the site (CWP Noah Brown n.d.).

The problem persisted until 1847, and to an even greater degree. In a petition of that year signed again by almost 100 businessmen and tradesmen (including Anthony P. Halsey, cashier of the Bank of New York, who lived at 16 Dey Street, and Charles Olmsted, grocer, 301 Spring Street), city officials were advised that the many years of great nuisance at the mouth of the Canal Street sewer had been further aggravated by the more recent introduction of sinks and waterclosets into the drain. The petitioners asked for an extension of the sewer 300 feet into the Hudson so that the river could carry off the "offensive matter" which is now "constantly floating on the surface of the water in its [sewer] vicinity, thereby causing an offensive smell, and as has been stated by physicians, endangering thereby, public health. They [the petitioners] would further represent that it prevents market boats, as well as others, from frequenting said slips and wharves, as it is almost impossible for the crews of vessels to remain at night, on account of the atmosphere. Also discolors and destroys the paint on vessels lying in the same waters. Also impregnating the water to such an extent as to cause the fish kept in cases for the supply of the Clinton Market, to be entirely unfit for consumption thereby causing a great injury to said market, depreciating its value to an enormous extent as well as inflicting injury on the whole vicinity." The CWP asked that the city build and extend the Canal Street sewer by 300 feet long and 40 feet wide. The amount of $13,000 was to be spent on construction (CWP Mar. 29, 1847).

The complaints about conditions at the Canal Street Basin brought a quick response from the CWP. They found that the "wash and filth from the gas works and distilleries discharged at the bases emits at all times and particularly at low water a smell the most noisome and offensive and being in the vicinity of a public ferry and in the vicinity of one of your largest public markets" making it imperative to construct a pier and sewer line 250 feet into the Hudson. However, a stone pier was rejected in favor of one of timber, which "will last until some future day, when it will be found necessary to extend the limits of your City by another street exterior to West Street." A diagram,probably drawn by the builder Noah Brown, was attached (CWP Noah Brown n.d.).

Another nuisance had been noted earlier at the Canal Street pier. In 1812 attention was called to a "certain vessel called the Sally almost 35 tons Berthen," which for almost a year had laid sunk on the north side of the Canal Street Basin. Her anchors, cables, and sails had been stripped away, and no owner had been found. Removal of the sunken derelict was called for (CWP Aug. 17, 1812), but it is not known whether it was carried out. Still another nuisance was created at Canal Street when in October 1853, a barge containing 60 tons of coal was hauled to the Canal Street pier, then used by the New York and Liverpool U. S. Mail Steamship Company, where during the night it was filled with water and sunk. A floating derrick raised the barge and the coal was sold by the city. The Company and the city shared the costs of the salvage operation (CWP Sept. 23, 1854).

In 1826 some 30 masters of Hudson River vessels--among them John Wiltse, sloop *Belvedere*, Fishkill; John V.R. Ten Brock, sloop *Milan*, Rhinebeck; Stephen A. Sherwood, sloop *Mars*, Hyde Park; Francis Bogardus, sloop *Counsellor*, Poughkeepsie; and Captain Samuel Wiswall, steamboat *Richmond*--asked for the removal of "a block part of an old pier (belonging as they are informed to Mr. John Murray) partially covered with water which is very dangerous to their vessels" using the Albany Basin at Cedar Street (CWP May 12, 1826).

In the next year, the masters of coasting vessels using the wharf at the foot of Chambers Street notified the city that they were very much "incommoded" by a vessel which had sunk alongside the pier. They asked for its removal (CWP Dec. 1, 1847). A sunken sloop was also reported lying at pier 43. It was ordered raised in 1855 (CWP Apr. 4, 1857).

The health and filth issue was raised again on other piers. In 1856, 9th Ward Health Warden James Demarest informed City Inspector George W. Norton that so much "night soil" had been dumped from the end of the pier at Clarkson Street that it was barely covered even at high tide. He remarked that if it was "suffered to remain during the heat of the summer it would ... be detrimental to the health of the whole neighborhood." Demarest recommended that the dumping be moved to Hammersly Pier, inasmuch as it was some 150 feet longer than the pier at Clarkson Street and would thus allow the filth to be carried away more readily (CWP 1856).

Interestingly, the Clarkson Street sewer probably lost West Street a chance to have one of its very few shipyards. In 1819 Samuel and Joseph Webb informed the city that they had purchased a water grant at Clarkson Street at a cost of $13,000 to construct a shipyard. The filling-in of ground cost them an additional $6,000, carried out under the supposition that the permanent sewer would be at Hammersly Street, where the "Drain or outlet of water now is and that wherever its mouth is it will shoal the water around it." The drain had been there for 15 years and would remain. Their petition came to nothing, as did the shipyard as well (CWP Sept. 13, 1826; MCC 1784-1831: XV, 230).

An obstruction, an overturned block, at the Duane Street Basin, in the opinion of the aforementioned dock builder John Anderson, would require construction on top of the obstacle so as to make a "solid surface of 30 feet by 40 ft. with a base of 55 ft. by part 40 & partly 40 feet." Anderson asked $3,970 for the job, to which the CWP agreed, to end the "dangerous" condition at the basin (CWP May 13, 1811). Then in 1826 some 20 petitioners complained of the conduct of the officer whose duty it was to repair the two lower bridges of the middle Duane Basin, but who had done nothing to relieve the "Dangerous and impassable state of the bridges" (CWP Mar. 26, 1826).

In 1831, inhabitants in the vicinity of Duane and Reid streets asked that the manure boats be prevented from depositing their cargo in the area because these "deposits destroy the comfort and respite of the neighborhood," a neighborhood where "great and expensive improvements both public and private" have been made (CWP 1831).

In 1848 a number of boatmen--William Hillyer, Garret H. Van Cleff, and others--found that the slip at the foot of Hubert Street needed to be "cleared out" so that "boatmen can load street manure without injury to their vessels." They said nothing of smell (CWP Mar. 13, 1848). Unlike the Clarkson Street people, they did not find "night soil" too offensive--money could be made from it.

However, to a large and indignant group of Watts Street residents, the practice of dumping street manure off the pier had caused suffering to their businesses and danger to the health of their families. Thousands of loads of manure had damaged the basin and made it so shallow that vessels had difficulty in approaching the bulkhead. The CWP found that the "bulkhead at what is usually called the Red Fort and is distant but three streets from Watts Street will afford sufficient facility for the shipping of the manure gathered in this district of the City." The petitioners asked for the repair of the pier and the street (CWP July 9, 1857).

g. *OTHER PRESSURES*

While the manure boats annoyed the Duane Street people, to a large number of tradesmen (some 50), including the noted flour merchant Eli Hart, the real nuisance was made by oyster boats, which were crowding the traditional market boats out of the Fulton-Dey street piers. This situation was in consequence of the city's pulling up the slip in front of the Washington Market in 1844, forcing oyster boats from their usual place of business to the piers of Fulton and Dey streets, to the great injury of some 40 sloop owners who had traditionally used those piers. The Common Council was asked to remove the oystermen, thereby performing an act of justice. The CWP did not support the petition (CWP May 21, 1845).

Another factor complicating use of the piers was related to the lumber trade. The expanded use of wood for steamboats and building added to the strain of finding space on the waterfront. For example, in 1826 a group of the principal lumber dealers in the city--David Brown, George Lovett, Thorn & Williams, etc.--objected to a proposal that would have prohibited lumber rafts from lying below 20th Street. The dealers found that such an ordinance would raise their costs and cause considerable danger to the rafts. They asked for denial of the prohibition, and they seem to have been successful. Lumber rafts apparently disappeared not by law but by convenience (CWP Sept. 13, 1826).

h. *LIGHTING*

Another aspect of the conditions on the piers which led to attempts to alleviate any related problems was the concern over adequate lighting. Although illumination seems to have been of no major interest--perhaps most business was transacted during the day--it does warrant some attention.

John C. and Robert L. Stevens, owners of the North River Line and lessees of the wharves at the foot of Barclay Street on the "north and south sides" of the Hoboken Ferry, called attention to the "numerous dangers & losses that are constantly occurring to the passengers in steamboats arising from the confusion and crowded state of the pier from which all the different lines (comprising ten larger boats) depart and come to." The Stevens's asked to be allowed at their own expense to have fixtures placed on spikes at different places on the dock, not only to reduce confusion but also to protect the safety and property of passengers who are "now obliged to run the gauntlet through a crowd of thieves and vagabonds that collect with a view to plunder on the narrow and confined wharf at which we now land." This petition gives us a rare view of early nineteenth-century social conditions on the Hudson River docks (CWP 1829).

In 1831 a group of merchants proposed that to prevent the "many fatal accidents that are almost daily occurring from the exposed state of our wharves and slips, to the unwary foot passengers in their vicinity during the darkness of night" it would be a good idea to differentiate between lamps on the wharves and those in other parts of the city, "to have different colored glasses substituted and that at the corners of the head of every slip lamps with red colored glass be placed and that at the corners of all the bulkheads ... blue glass emitting a more distinct light than the ordinary lamps." They also suggested that the "string pieces" at the head of all slips be elevated two feet to act as a barrier on approaching the same" (CWP 1831).

In 1854 Henry Wray, a manufacturer of lamps and reflectors, proposed putting a lamp of his manufacture at the foot of Murray Street to provide light for two blocks and the whole length of the pier. The petition was granted. Its effect is not known (CWP Feb. 16, 1854).

i. THE BATTERY

If any area of the city concerned those individuals who were anxious to preserve the pristine beauty of a particular site, it was the Battery. Incursions of private interests threatening to exploit this open space were almost always repulsed, and throughout the history of the Battery to the present time it has remained essentially untouched by commercial enterprise.

For example, in 1817, when Frederick DePeyster attempted to expand his water grant which would encroach on the Battery, the CWP refused his request and pointedly noted the "lively interest that our citizens take in preserving the Battery grounds free from any obstructions that would impair the beautiful prospects up and down the Hudson" (CWP Dec. 22, 1817). The DePeyster water grant was returned to the city. In 1836 officers of the Battery Association, a group engaged in boating, sometimes transferring passengers from vessels in harbor to their dock just below pier 1, asked to be allowed to erect a pier between Castle Garden and pier 1 (CWP

May 16, 1856). This request seems not to have been granted. The group probably continued to use a small dock just adjacent to pier 1, inasmuch as this structure appears on maps of the period.

In 1825, Dr. Jacob Rabineau, at the "solicitations of a number of respectable citizens in the lower part of the City," informed the city that he decided to build a "new and elegant Salt Water Floating Bath" located at the Battery between Castle Garden and Marketfield Street. Rabineau pointed to the healthful quality of salt baths and their usefulness to citizens. However, city officials felt that the location would endanger the "wall of the Battery and likewise incommode the inhabitants using that promenade," and refused the request (CWP Apr. 11 and 25, 1825). In the same year, 1825, William Pitts; Erastus Farnum, who had a salt water bath in Boston; and Elijah Boardman, proprietor of the American Hotel, sought to build a bath on the waterfront. They also pointed to the healthful benefits of such an establishment. This request probably was opposed by Rabineau, who, in fact, had a bath at the foot of Warren Street, having "erected a bridge pier further out" in order to obtain "pure and clear water" (CWP Apr. 25, 1825; Oct. 21, 1825). The Farnum bath seems not to have been built.

Seemingly by 1826, however, Rabineau's Battery request had, in fact, been granted, since the bath, reached by a foot bridge from the Battery, it was argued, would not do any damage to the "wall" (Johnston and Lightfoot 1980: 12). Rabineau was soon succeeded by Isaac Hall, who ran the establishment for many years until 1857, when he noted that the location was "nearly ruined for bathing purposes" and asked for a 10-year lease on the east end of the enlargement adjoining the Staten Island pier at the foot of Whitehall Street. However, some 80 petitioners joined Hall and supported the continuance of the Rabineau Bath at the Battery. By the 1870's, two baths were located at the Battery. In 1915, six free floating baths were opened by the city.

j. *WIDENING OF WEST STREET*

As with the process of building, repairing, or maintaining piers and wharves, public pressure, which generally took the form of petitions to the Common Council, was the method by which such improvements--including the widening of West Street--were accomplished. Little by way of any comprehensive program or planning in regard to the waterfront was instituted by the city. As previously observed, approaches to problem solving were always pragmatic and of the moment, and little regard was given to long-range objectives.

Other illustrations of this conclusion are the petitions regarding the widening of West Street. Figure 5, the 1807 Commissioners' map (1811), indicates that the Hudson River waterfront, including a widened, unindented West Street, was to be included in the plan; however, this map is an idealized version of reality. Subsequent maps--e.g., the Ewen maps (Figures 7 - 9)--show exactly how West Street appeared at these different times: a street completed in parts and indented by basins. Pictures of West Street prior to the Civil War show a traffic-laden, dirty, dusty thoroughfare, where passage was almost an adventure (Johnson and Lightfoot

1980: *passim*). West Street was, in fact, built in bits and pieces, straightened as demands for a wider street increased.

For example, in March 1825, in response to a petition from John Van Nostrand; P. G. Arcularius & Co., grocers, 133 Washington Street; and others, the CWP granted that "West Street be made from Hubert Street to Canal Street" (CWP Mar. 28, 1825). In the same year, some 30 merchants--including Daniel Demaray, grocer, 360 Washington Street; Platt Brush, grocer, corner of West and Robinson streets; and Stephen Rich, grocer, 226 Washington Street--requested that West Street be completed between the Albany Basin and the State Prison, including the filling of the Duane Street Slip. Since many of the slips were under lease, the CWP felt it advisable that this request should be postponed until proper arrangements could be made (CWP Sept. 23, 1825).

k. PLANS BY PRIVATE ENTERPRISE RELATING TO THE NORTH RIVER WHARVES

The many problems that impeded the development of the waterfront were the concern, especially in the early mid-nineteenth century, of many of the city's citizens. The city itself seemed at times prepared to provide leadership. At different times private companies were formed to provide plans calling for comprehensive solutions; sometimes the two sides joined forces.

Among the earliest attempts by the city to provide a long-range plan to overcome the many impediments on the waterfront came in 1836, when a report written by the CWP backed the construction of a Great Pier in the North River. The report came in response to a large public meeting held in City Hall May 5, 1836, which supported the construction of such a pier. Participants included some of the city's leading merchants: Jonathan Goodhue, Jacob Lorilard, and Stephen Whitney. Mayor Aaron Clark in July 1836 specifically empowered the CWP to make a full investigation and report on the subject. Earlier in 1832, a survey, basically of East River piers, noted problems of lack of space, the choking of basins and piers by mud and debris, and "a fact of great notoriety that piers and wharves as now constructed of timber, are temporary and generally endure from fourteen to seventeen years, *before they are destroyed* by worms," (Doc. 80 1836: 423).* In 1836 these words applied to the North River piers.

The need for a permanent and safe harbor on the West Side had received the attention of the Board of Assistant Aldermen a year earlier, when it proposed for the first time that a stone pier or breakwater be built at a sufficient distance from the present piers and slips, to form a large and commodious basin in order to meet the need for accommodations [which] are daily becoming less adequate to the wants of our business community ..." (Doc. 80 1836: 424).

Members of the CWP were asked to look into costs, procedures (i.e., whether the city or a private company should be used), and feasibility. The lengthy report, submitted in December 1836, is, in part, a history of docks and piers built by ancient communities and the "modern" wharfage in cities in the United States and in London. The report stressed the economic value of shipping in New York. For

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***New York City Aldermanic Documents*, Document 80, is abbreviated "Doc. 80" herein.

example, in 1832 over $100,000,000 worth of goods were brought into the United States with more than half--$53,000,000--coming through New York. The importance to the city of revenue raised through taxes and rents on commercial interests was also stressed. Of the more than $1,000,000 received by the city in taxes in 1836, almost $54,000 came from wharves and piers (Doc. 80 1836: 431-34). The importance to the city of the harbor and the North River by way of trade, commerce, and revenue was repeated once again.

It was noted that the "waters of the North River are deep, wide and extensive" but have been avoided by vessels because of the "extreme cold, the ice, the bleak winds and driving tempest that frequently beat upon that shore in winter and the squalls and rough weather to which that part of our island is every year subject, and frequently even in summer" (Doc. 80 1836: 431-34). Yet the "Great Pier" should form a safe harbor for the ever-increasing tide of commerce and "defend our shipping piers damaged by ice and storm; no renewal of or cleaning and few repairs would ever be required; the general health will be promoted" (Doc. 80 1836: 455). The proposed pier would raise the value "at this time" of every lot west of Broadway by $5,000, which, in total, would mean $29,000,000 added to property value in the city. In addition, some revenue and increased trade, lessening of filth and disease along the docks, and better North River facilities would bring more immigrants into the "City of Refuge," who would also, while seeking "safety and repose," bring their much-needed labor (Doc. 80 1836: 475).

The report pointed to the support of such noted merchants as John J. Astor, and mentioned that the towboat system introduced in 1825 opened trade to boats of 50 tons in the lakes and rivers of New York. It also pointed to an "exhaustible" supply of gray granite "lately" discovered in the "Highlands" which could be used in building the city and the pier (Doc. 80 1836: 483). It was hoped that part of the money needed for the pier would come from the "surplus revenue of the Union" (Doc. 80 1836: 417). A pier 5,550 feet long, 67 feet high, and 160 feet wide at the top would cost some $3.4 million (Doc. 80 1836: 491).

The pier, to be placed some 800 to 1,000 feet beyond West Street piers, would be constructed of granite and cement, would involve the use of coffer dams, and could be connected by wharves or ridges each 250 feet wide. Plans were made for rapid unloading of ships as well as for storage room. This much-heralded plan was never built (Doc. 80 1836: 442-43).

In 1865 another plan, less ambitious in nature but also aimed at solving the wharfage problem in the Hudson and East rivers, was the creation of the New York Pier and Warehouse Company, incorporated in 1864. Each new warehouse, five stories high and provided with hoistways and elevators, was to be erected on piers with iron tubular columns filled with concrete or masonry, each 2½ to 6 feet in diameter. The plan was designed to solve the need for space, to increase demands for facilities, to help remove sewer and surface drainage, to prevent smuggling and plundering, and to prevent extensive conflagrations. As another argument, it was suggested that such new structures would keep the harbor and river frontage from being erased by constant landfill. It would preserve the environment (New York Chamber of Commerce 1866: 11-13). Like the plan for the "Great Pier," nothing was done to implement the designs. The city rarely accepted long-range solutions to immediate problems.

l. *CONCLUDING REMARKS*

This survey of the development of the West Side of New York during the period 1800-1860, a period which coincided with the initial impact of the Industrial Revolution, is an account of the various social, political, and economic forces behind the continuous development of the Hudson River waterfront. Interwoven in the preceding discussion were conflicting interests that often precipitated physical change--e.g., differences between lumber dealers and hay factors, sewer scavengers and brick dealers, and steamboat owners and Hudson River sloop proprietors. Within these conflicts lies the ever-present human issue of personal ambition and political motivation versus the interest of the city in general. It is, overall, a story of the city--one rarely told but one deserving of considerable attention.

A great deal of the story of the waterfront deals directly with transportation systems and construction to accommodate them. Section II, C, 4, a--Development of Waterfront Transport Facilities--picks up the threads of discussion dropped here in 1860 and discusses the West Side development to the present. The West Side's industrial and commerical development in the industrial era are also discussed in Section II, C, 4. Some summary and repetition--mostly for clarity and reader reorientation--have been unavoidable.

3. Historic Cultural Period: The Project Area in the Colonial/Federal Era

a. INTRODUCTION

The extent to which archeological resources dating to the Colonial and Federal periods could be present within various portions of the project area is affected by the historical pattern of New York City's growth. From its beginnings on lower Manhattan, the city expanded northward on the island and outward on landfill. Until the nineteenth century, the bulk of the city's population was concentrated well below Wall Street. The nonfilled area north of the city proper was rural, occupied by farms and country estates.

The following description of what possible archeological resources from the Colonial and Federal eras might remain within the Westway Project study area is presented geographically. Four subareas have been identified for the purposes of the present discussion: (1) West Street; (2) the Canal Street Interchange Area; (3) the Fourteenth Street Interchange Area; and (4) the Thirtieth Street Interchange Area (see Figures 1,-3). The first describes the possibility of resources being present in the bed of West Street (or to the west), the eastern boundary for most of the project route. The next three subareas are the loci of interchanges--i.e., where the project comes further inland or eastward, often to original land remaining from Manhattan's pre-filled contours.

In fact there are four such interchange areas. Excluded from the following account is the southernmost interchange at Battery Place (see Figures 1, 3). Although this last is a highly sensitive area because it falls within the original settlement of New Amsterdam--and, in fact, coincides with the probable area of the first Dutch fort--the actual project corridor does not appear to affect Manhattan's original land surface (see following discussion). The processes of subsequent landfilling and shoreline development are documented in Sections II, C, 2 and II, C, 4, a of this report.

b. WEST STREET

The practice of landfilling in Manhattan may have begun as early as the late seventeenth century. Egbert L. Viele's *Original Topography of Manhattan Island* (1859), which superimposes the Hudson River's original, prelandfilled shoreline onto the mid-nineteenth-century street grid, seems to indicate that the prelandfilled shoreline did not reach as far west as present-day West Street (see Figure 17). Stokes' landmark map, on the other hand, shows two places where the original shoreline may have reached the east side of present-day West Street. He shows a point of shoreline between Harrison and Jay streets which he identifies as the site of the house of Roelof and Annetje Jans and the Rhinelander Dock. A second broader point of shoreline in this era occurs between Christopher and Perry streets, an area Stokes identifies as "the Market Place" (Stokes 1922: 175). However, other maps at the Manhattan Bureau of Topography indicate that the shoreline was indeed located just east of West Street (see Figure 18) and thus outside of the project

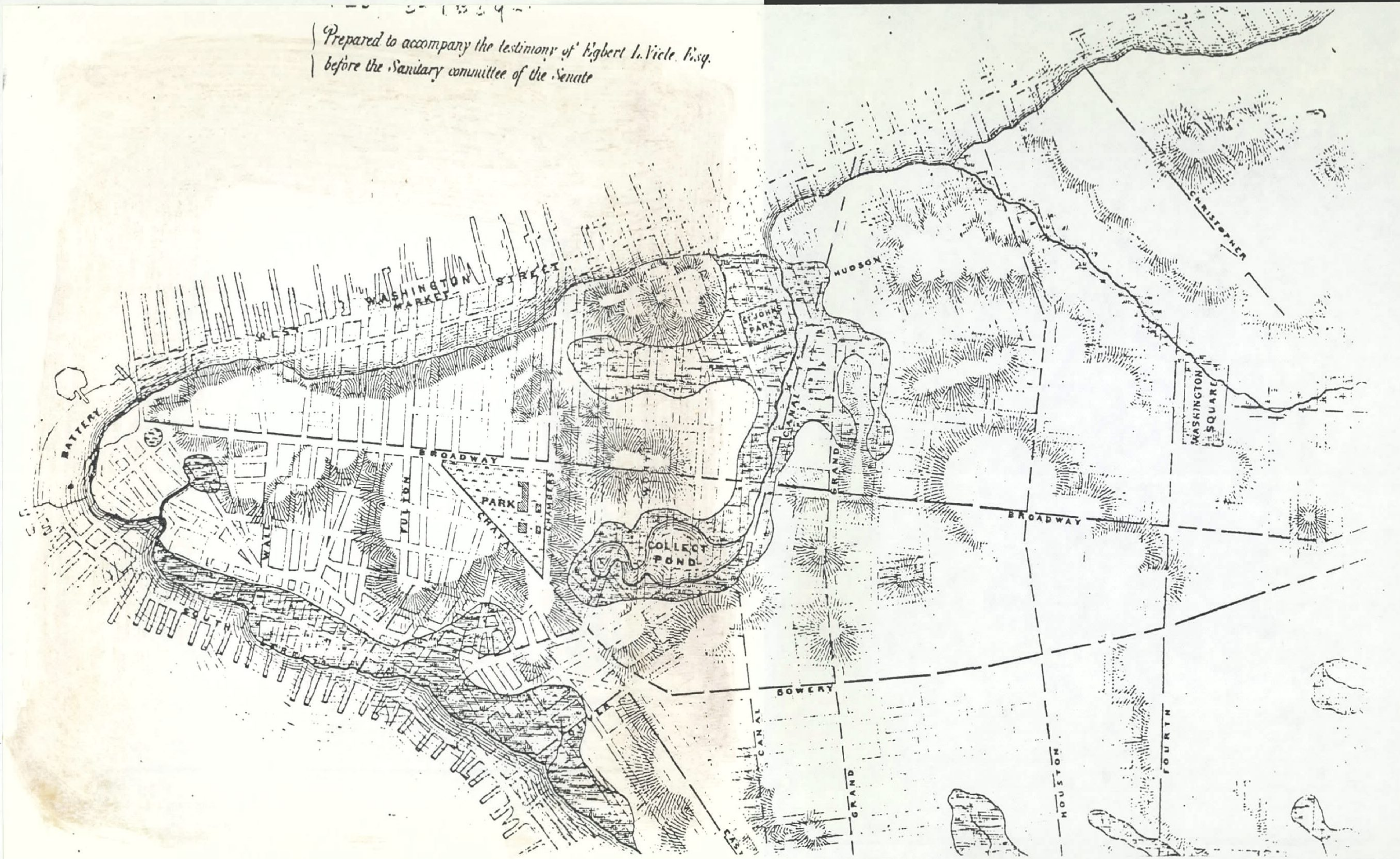

FIGURE 17. Portion of Viele's 1859 *Original Topography of Manhattan Island.* This document indicates that the original (prelandfilled) shoreline did not extend westward as far as West Street. At Christopher Street, the shoreline was located just east of West Street.

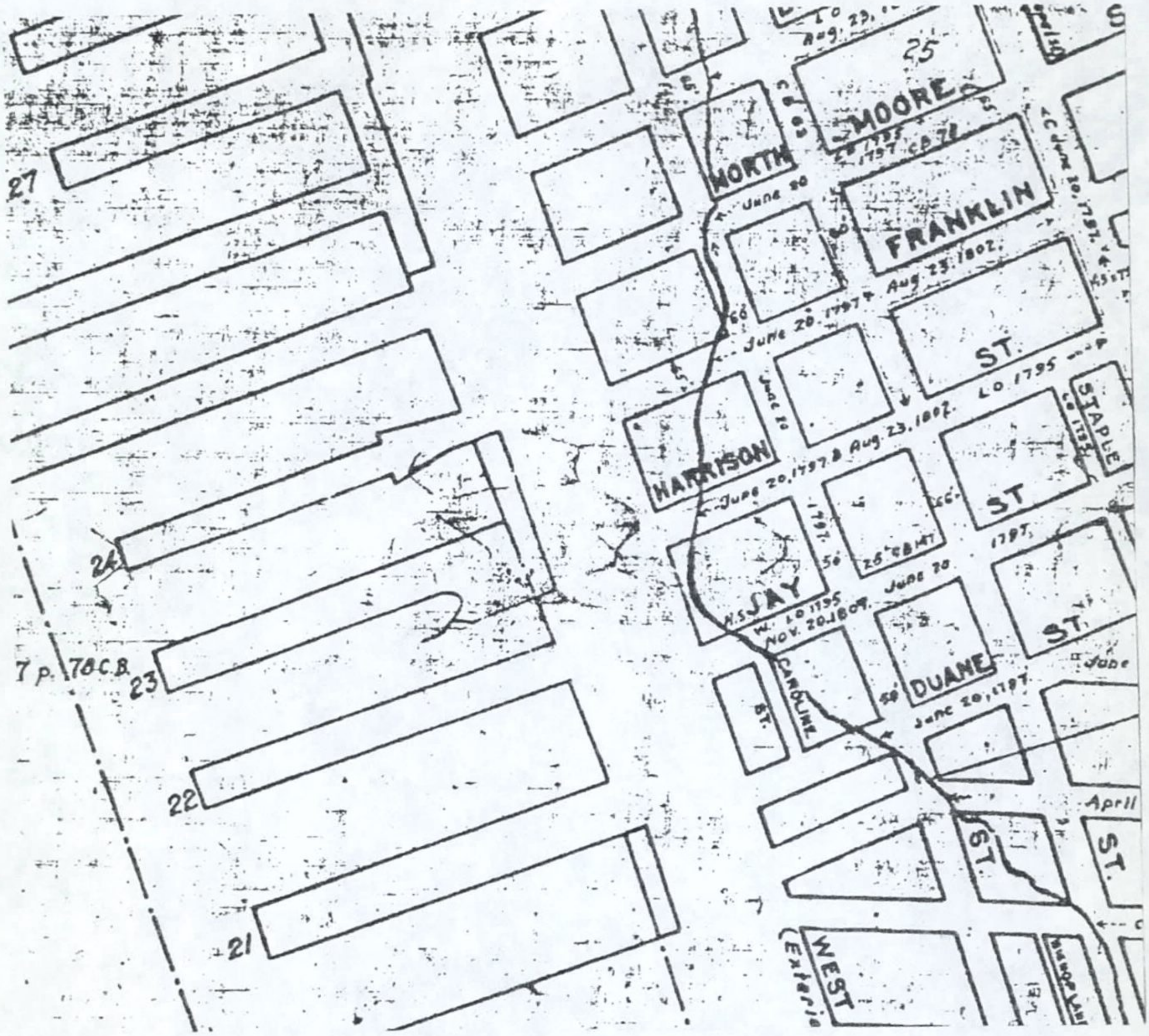

FIGURE 18. Portion of a topographical map showing the original shoreline of the Hudson River on the lower West Side (Source: Subsurface Office, Manhattan Bureau of Topography; scale: 1" = 300'). In the Harrison/Jay Street area, the shore almost reaches, but falls short of, the east side of West Street (eastern boundary of the project area).

area. Figures 2.1-2.3 include the prelandfilled shoreline in relation to the project area, approximated from these and other data sources. Therefore, except for constructions extending into the river (a topic discussed in Section II, C, 2, which precedes, and Section II, C, 4, a, which follows), there appears to be very little possibility that Colonial/Federal period cultural resources could exist in the portion of the project area within West Street, depending, of course, on the date on which the land was created by landfilling and West Street was constructed.

Johnston notes that at the time of the Revolution, Greenwich Street ran along the shoreline (1971: 31). None of the eighteenth-century maps examined shows West Street in existence for any part of its length at that time (see Figures 16, 19, and 20).

The first mention of West Street in the documentary record seems to have been c. 1795-98. The Common Council in 1795 and 1796, expressing fear that indiscriminate water lot grants could prevent the drainage of water from the interior streets into the river, passed an ordinance creating a limit (road) beyond which no grants ought to be made and no buildings erected (MCC 1784-1831: II, 214-15). In 1798 this outer road was officially called West Street, and no buildings were allowed to be constructed within it to prevent fire (Feb. 1798, MCC 1784-1831: II, 420-21). It was also known as the "Seventy-foot Street" (Mar. 21, 1803, in MCC 1784-1831: III, 397-98). In October 1804, the distance from Washington to West Streets was increased to 200 from 160 feet (MCC 1784-1831: III, 612).

FIGURE 19. John Montresor's 1775 *A Plan of the City of New-York & its Environs*. As in the 1766-67 Ratzer map (Figure 16), Greenwich Street is still the city's westernmost (shoreline) thoroughfare.

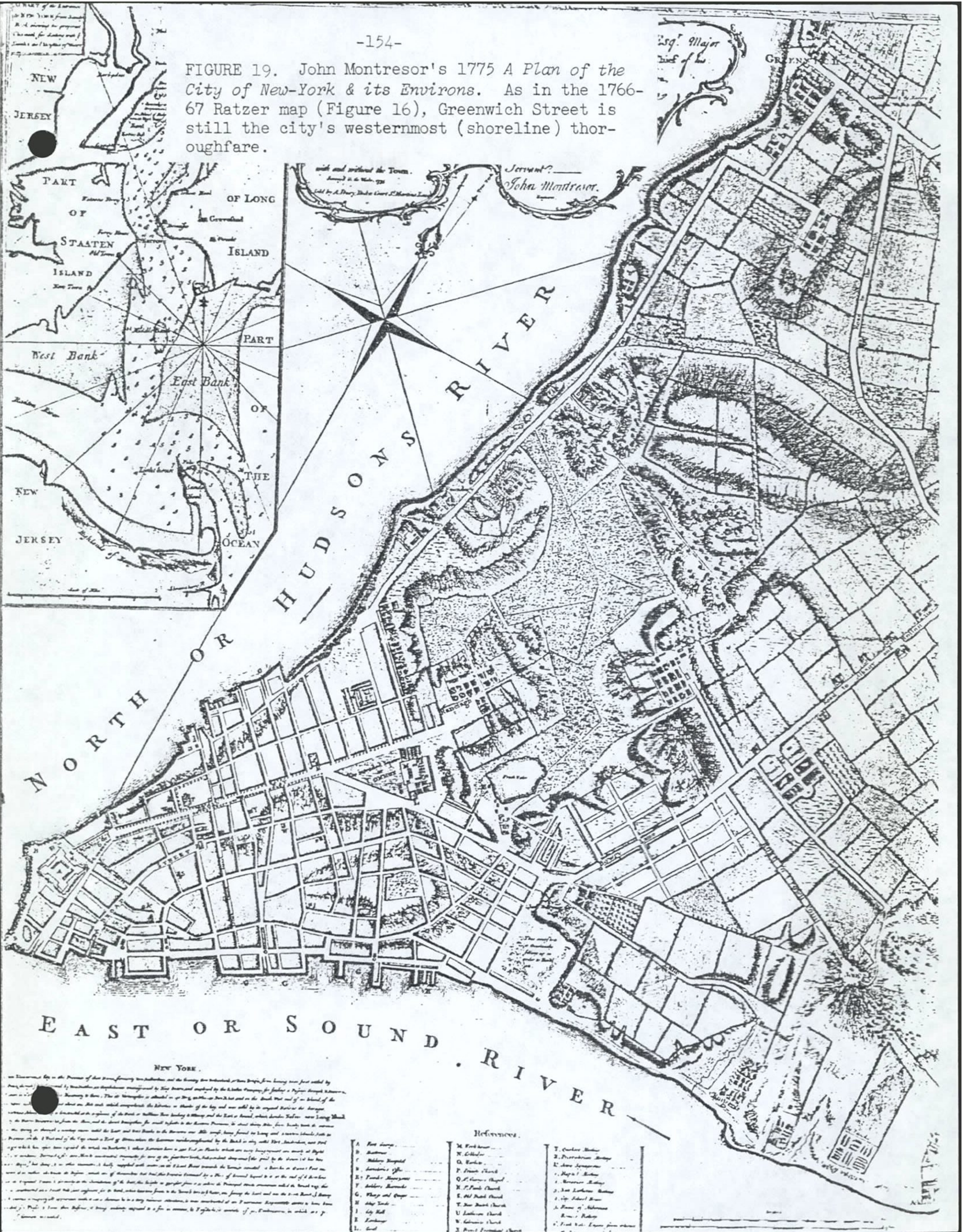

FIGURE 20. By the date of B. Taylor and J. Roberts' *A New & Accurate Plan of the City of New York* (1797), portions of Washington Street had been created on landfill. West Street is still not in evidence.

Maps of this period show conflicting data. The 1803 Goerck-Mangin *Plan of the City of New York* (Janvier 1894: opp. 55) shows the planned route of West Street west of the existing land for most of its length, indicating that it had not then been constructed (see Figure 21). Nor do the Longworth maps, dated 1804 and 1808, show any part of West Street in existence (see Figures 22 and 23). At this time, however, these maps show that the area between Warren and Harrison streets, identified as Rhinelander's Shipyards (Figure 21), had been filled in westward close to the line of West Street. The Commissioners' map of 1811 (see Figure 5) shows West Street in existence as far north as Charles Street; however, as Stokes and others point out, this map shows a proposed plan for the city rather than streets as they were actually constructed (Stokes 1915: 456; Hershkowitz 1982: personal communication).

The 1817 Poppleton *Plan of the City of New York* shows West Street in dotted lines for most of its length, indicating its planned route (see Figure 24). Only short stretches of the route are shown by solid lines, indicating land which apparently had already been filled in. These include the blocks between Cedar and Liberty streets, Liberty and Cortlandt streets, Jay and (slightly north of) Harrison streets, North Moore and Beach streets, Leroy and Morton streets, and Christopher and Charles streets. A portion of the space between Charlton and Clarkson streets had also apparently been filled in by 1817.

FIGURE 21. Goerck-Mangin 1803 *Plan of the City of New York* (as redrawn for Janvier 1894: opp. 50) shows West Street as it was planned, not as it existed, at that time.

FIGURE 22. Longworth's 1804 *Plan of the City of New York.*

FIGURE 23. Longworth's 1808 *Plan of the City of New York.*

FIGURE 24. Thomas Poppleton's 1817 *Plan of the City of New York.*

In 1818 the Council approved a resolution that "West Street be extended across Spring Street Slip" (Stokes 1926: 1675). In March of 1825 the Common Council passed an ordinance for"making West Street and filling lots adjoining thereto from Cedar Street to Dey Street and from Hubert Street to Canal Street"(MCC 1784-1831: XIV, 415). In April 1828, the Council also adopted a resolution "that West Street be continued by the adjoining owners from its present termination at Hammond Street to its intersection with a line drawn through the middle of Jane Street (MCC 1784-1831: XVII, 110).

An apparent gap in the extent of West Street, "a principal channel of communication for the very extensive trade of the west part of the city," was ordered closed in November 1828, when the Council required "West Street to be extended across the Slip at Washington Market between Fulton and Vesey Streets" (MCC 1784-1831: XVII, 110; Stokes 1926: 1679). In January 1830 another gap in lower Manhattan was closed when the State Legislature provided "for laying out West St. from Albany Basin [at Cedar St.] to Battery Place ... parallel with Washington St." (Stokes 1926: 1689).

West Street was extended from Jane Street to the Great Kill Road (now Little West 12th Street) in or shortly after 1831. In that year, "the proprietor [late William Bayard] of the grounds fronting the Hudson River and lying between Jane Street and the Kill Road [was permitted] to take out Grants for the water lots in front of the grounds to the permanent line...." This property, then underwater, had been claimed by the United States (MCC 1784-1831: XIX, 473).

Thus, except for a few blocks which were filled sometime before 1817, West Street from the Battery to Little West 12th Street was filled and constructed between 1817 and 1831. Cultural resources which date earlier would only exist within the portion of the project area along West Street if they had been built as extensions into the river and then buried during the landfilling.

1) The North Battery

One such resource may be the North Battery, which was also known as the Red Fort owing to the color of the stone used to construct it (Haswell 1897: 21). The fort was built as a result of the events preceding the War of 1812. The site of the fort was approved by the Common Council in 1807, lying "between the south line of Hubert Street and the north line of Laight Street, west of a line to be extended parallel to the permanent line as established by the Corporation [of the City of New York], two hundred feet west of said permanent line, and from thence to extend into the North River so far as the lands underwater of the Corporation extend" (Stokes 1926: 1473). The actual construction of the fort took place between this date and 1810, at which time a report to the Governor noted that "the battery at Laight and Hubert Street is ready to receive its guns, and is capable of mounting 16 guns of the heaviest metal" (Stokes 1926: 1515). Neither the 1804 nor the 1808 Longworth map shows the fort (Figures 22-23), whereas it does appear on the 1817 Poppleton map (Figure 24), an observation that supports the 1810 construction date. The Battery was described in a report to Congress as "a semi-circular work of stone, having a stone magazine, and a furnace for heating shot" (Stokes: 1926: 1538).

Since the "permanent line" referred to in the Common Council description is the established limit, or West Street (although the street itself had not yet been constructed), the fort would have stood some 200 feet west of the present location of West Street. The 1817 map shows the fort itself as extending from approximately 235 to 350 feet west of the western edge of West Street on an alignment extending from Hubert Street on the south to about 50 to 75 feet south of Laight Street. According to this map, Hubert Street appears to be extended on fill to approximately the middle of the future location of West Street, with a bridge from this point to the fort. According to Haswell the solid stone fort "stood some two hundred feet out in the river, approached by a bridge"(1897: 21). Figure 25, an 1837-30 Ewen map, clearly shows the North Battery at that date. The only remains of this fortification which may remain on the present river bottom would be foundations and rubble from the destruction of the fort itself.

In 1823, the city received permission to use the bridge leading to the fort as a "public landing place for vessels bringing country produce to the city" (Stokes 1926: 1634). In 1831 the entire North Battery was delivered to the city by the Federal Government (Stokes 1926: 1700), and in March 1832, the City Comptroller's office put the structure up for auction with the following notice:

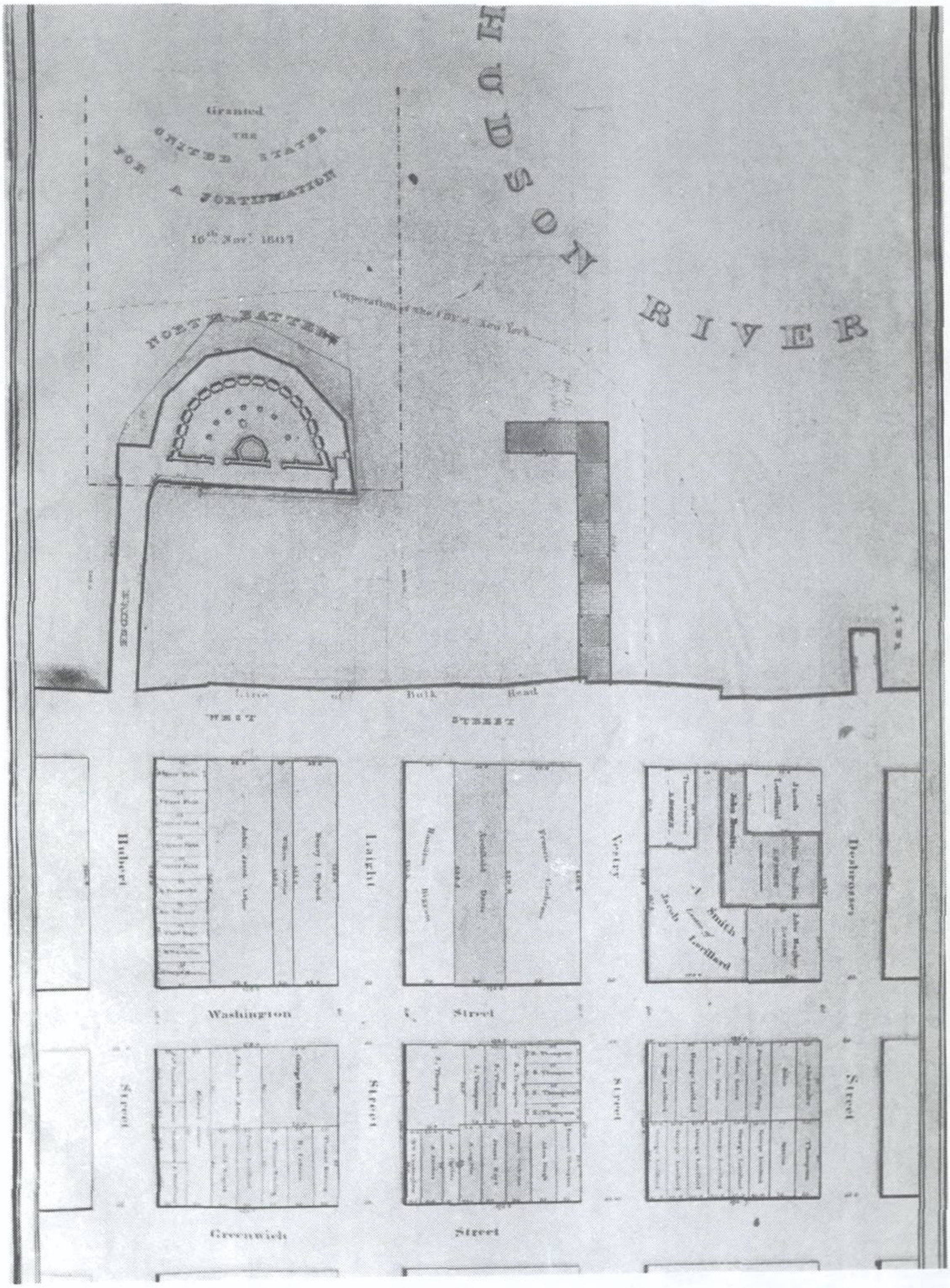

FIGURE 25. Plate of 1827-30 Ewen waterfront map series showing the shoreline between Hubert and Desbrosses streets. The North Battery appears at the foot of Hubert Street and dry land has been extended westward to the west side of West Street.

> The Building at the foot of HUBERT-ST. known as the *North Battery*, will be sold at Public Auction on the premises, on
>
> *Thursday, 15th March, inst.*
> AT 12 O'CLOCK.
>
> A large portion of the stone is of even surface, fit for immediate use, and most of the remainder can be prepared for use with little delay and at small expense; for the convenience of purchasers, the building will be marked off and sold in small sections, and the parties allowed until the 1st day of May next to move the materials off the site. (Comptroller's Records 1832)

From this notice, it would seem that the city intended to remove the fort down to its pier level.

Stokes writes that in 1848 the "North Battery [which, if the auction achieved its desired end, should have been dismantled by May 1, 1832] and pier at the foot of Hubert St. [were] granted to the Commissioners of Emigration for the landing of Immigrants" (Stokes 1926: 1810). Such a use (as an immigrant station) was odd, and perhaps did not actually occur, when one realizes that the area of the "Red Fort," or what was left of it, was at that time used for the dumping of "Sewer Stuff" taken from several sewers from around the city by "Rubbish Boats." Aaron Noyes, the "Inspector of Manure" at the fort, acknowledged receipt there of 308 loads of the sewerage over a four-month period in 1848. The two uses ascribed to this pier in 1848 would not seem to be compatible. In any case, the pier was leased to the Delaware and Hudson Canal Company in 1849 (Stokes 1926: 1813; see Figure 26).

NEW YORK, 30 Oct 1848

THIS IS TO CERTIFY, that I have ~~this day placed on board~~ Received on board of the Rubbish Boats at the Red Fort since the ~~Captain~~ 10th of August last

Three Hundred & Eight loads of ~~Manure~~. Sewer Stuff from Sewers in Grand St Canal St & Chamber Street

To Octr 16. 92 Loads
30. 216
308

Aaron Noyes Inspector of Manure. at the Red Fort

FIGURE 26. Receipt for 308 loads of "Sewer Stuff" delivered to rubbish boats at the Red Fort over the period of August 10 to October 30, 1848 (Comptroller's Records 1848).

2) The 1745 Block House

In approximately 1745 a block house, or battery, of twenty guns was constructed on the Hudson River shore in preparation for an expected French and Indian invasion. Based on the 1757 Holland survey, Stokes places this structure at the approximate location of Harrison and West streets (Stokes 1922: 589; 1927: 279). Prior to the landfilling noted previously, the shoreline jutted out slightly to the west at this location. However, according to the eighteenth-century maps (which show the Harrison estate, brewery, and foundry or furnace at this location--see Figures 16 and 19), the shoreline--and therefore the site of this fortification--was slightly east of today's West Street.

3) Docks and Basins

The other type of cultural resource dating from the Colonial/Federal period which may be present under West Street consists of the waterfront structures--wharves, piers, docks, etc.--which may have been covered over when West Street was filled. Examination of maps dated to 1797 (Figure 20), 1804 (Figure 22), 1808 (Figure 23), and 1817 (Figure 24) suggest that most of the docks predating 1817 can be placed in two groups. The first includes docks which extended from the shoreline prior to the filling of West Street but ended short of the projected line of that street. These were extended when West Street was built, but no remains of the earlier docks would exist beneath West Street. The second group consists of docks built between 1808 and 1817, which crossed the line of West Street. When West Street was constructed, remains of these waterfront facilities could have been preserved beneath the street.

This second category includes a group of seven docks between Battery Place and Rector Street, the extended Albany Basin between Thames and Cedar streets, and the extended Corporation Docks at Fulton and Vesey streets (the Albany Basin and Corporation Docks existed before 1808 but were extended to intersect the line of West Street between 1808 and 1817). Other docks in this category were located at Barclay, Robinson, Duane, and Desbrosses streets.

The basin at the foot of Canal Street was also constructed during this period. The *Minutes of the Common Council* contains references to it as early as 1803 (MCC Vol. 3: 247), although Stokes dates its construction c. 1810 (Stokes 1918: 983-91; 1926: 1523). It appears on the 1817 Poppleton map (Figure 24) but not on the 1808 Longworth map. The ends of the two docks enclosing the basin--the southern one on a line with Broome Street (later to become Hoboken Street) and the northern one just south of Spring Street--intersected the line of West Street. The location of the southern dock would be affected by the construction of the Canal Street Interchange. (See also Section 3, c, 3, which follows.)

Map analysis also indicates that the ends of a few docks extant before 1808 may have intersected the future route of West Street. Included are the Albany Basin, at Thames and Cedar streets, shown on both the 1797 and 1804 maps; Dean's Dock at Murray Street, on the 1804 but not the 1797 map; and an area indicated on the 1804 and 1808 maps as Rhinelander's Shipyards, between Warren and Harrison streets. The 1803 Goerck-Mangin plan shows Rhinelander's Shipyards and a dock at Cortlandt Street (labeled as the Ferry to Paulus Hook) as intersecting the planned route of West Street. Rhinelander's Shipyards are *not* shown on the 1797 map, but an apparently filled area between Warren and Chambers street is shown as Tenbrook's Dock and an area between Harrison and Jay streets appears as Rhinelander's Dock. Portions of these areas may have reached the line of West Street.*

c. *CANAL STREET INTERCHANGE AREA*

The land to be affected by the Canal Street Interchange was included within the bounds of a grant of 62 acres obtained by Roelof Jans (or Jansen) in 1636. Upon his death, his widow, Annetje, married the pastor (Domine) Everadus. Her heirs subsequently sold the tract to Colonel Francis Lovelace, the English Governor, and it became known first as the Duke's farm and later as the King's or Queen's farm. In 1703 it became the property of Trinity Church. The tract extended along the river from the approximate location of what is now Warren Street northward to Christopher Street (Booth 1859: 75-76; Lamb 1877: I, 79; Hemstreet 1899: 59-60). According to Janvier, Roelof Jansen "probably erected a small farmhouse upon a low hill near the river shore at about the present Jay Street" (Janvier 1894: 14). Stokes (1918) places the house in the block now bounded by Harrison, Jay, Washington, and West streets--an area where the original shoreline protruded westward close to the line of West Street. This structure may be the one numbered 21 on the 1639 Manatus map and identified as the bouwery of the Senikant (Stokes 1922: 146). The boundaries of Trinity Church Farm encompassed a large portion of the marsh which extended from the Collect Pond, located east of Broadway near the site of the present City Hall (see Figure 17),

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*See Section II, C, 4,a for a discussion of the evolution of the West Side waterfront, illustrated with interpretive maps.

northwestward to the Hudson River, with a branch of the marsh extending southward east of Varick Street to the southern extent of the farm.

1) Rutgers Ditch and Bridge

In the early eighteenth century, Anthony Rutgers leased a section of the Trinty Church Farm which included the present Canal Street Interchange area. About 1730 Rutgers proposed that in return for a grant to the swampland he would clear and drain it (Janvier 1894; Hemstreet 1899). This proposal was accepted, and the straight lines representing the Rutgers ditch are shown running through the marsh area on all maps of the period (see Figures 16, 19-23). The area was filled in and Canal Street constructed early in the nineteenth century. According to Stokes, Rutgers probably constructed the bridge which carried the road to Greenwich (later Greenwich Street) over the swamp and ditch (Stokes 1915: 926; 1922: 530). The bridge was rebuilt of stone in 1786. Any remnants of this bridge which may still exist beneath the later landfill could be affected by the proposed construction procedure, which is the driving of piles. However, the exact location of this bridge is not known.

2) Construction of Canal Street

From the early Colonial period, the marshy area which became known as Lispenard's Meadows was viewed as a health hazard. According to Stokes, when Rutgers requested permission to build his ditch, he described this area as

> ..."filled constantly with standing water" for which "there was no natural vent and being covered with bushes and small trees," was "by the stagnation and rottenness of it ... become exceedingly dangerous and of fatal consequence to all the inhabitants of the north part of this City bordering near the same, they being subject to very many deceases [*sic*] and distempers, which by all Physicians and by long experience are imputed to those unwholesome vapours occasioned thereby ...." (Stokes 1918: 560)

At the end of the eighteenth century this problem remained unsolved. In 1798 the city's Health Commissioners informed the Common Council that "the swamp or meadow between the Fresh Water Pond [i.e., the Collect Pond] and Hudson River is overflowed with standing water, and requires immediate measures for draining it." Among several schemes proposed for accomplishing this feat was to lay out a broad street, 100 feet wide, with a brick or stone canal or "tunnel" in its center to carry off the water and with shade trees on both banks of the stream (Stokes 1918: 561; Leonard 1910: 322-23). The street is pictured in a sketch shown by Lamb (1877: II, opp. 567). The route of Canal Street was surveyed in 1803 and a list of owners of land required for the street was drawn up in 1805. However, work on Canal Street did not begin until later. Canal Street is not shown on the 1808 Longworth map (Figure 23). A description of the city in 1808 and 1809 written in 1864 by John Randel, who had surveyed the city, mentions a ditch cut through Lispenard's Meadows (Stokes 1926: 1,480) but makes no mention of Canal Street.

"An open ditch or canal eight feet wide" may have been constructed along a portion of the Canal Street route as early as 1811

(Stokes 1915: 397); however, in 1813 the problem of standing water in Lispenard's Meadows apparently still existed (Stokes 1918: 562).

By August of 1819 the open ditch was finally converted into a covered sewer (Stokes 1918: 562). It is not clear which of several plans for the construction of an eliptical sewer was adopted. One of the plans, designed in 1813 by Robert Fulton, Eli Whitney, and Thomas Poppleton, called for it to be 16 feet in horizontal diameter and 8 feet deep, with the bottom of the tunnel on a level with the low-water mark at the Hudson River and 3 feet above the low-water mark at Broadway (Stokes 1918: 562). It was not adopted. Apparently the filling of the land for Canal Street was not completed until shortly before the covered sewer was constructed, since it was only in 1817 that the Common Council passed an ordinance to fill in Lispenard's Meadows (Stokes 1926: 1,592).

Records of soil borings conducted in 1980 were located in the Map Room of the New York Public Library. Five borings were taken on Watts Street between West and Canal streets and on Canal Street between Watts and Hudson streets. These indicate the presence of from 9 to 22.5 feet of fill beneath the surface of the street as it existed at that time. These records provide no indication as to whether the fill contained cultural materials.

3) The Canal Street Basin-Hoboken Street Area

Historical activity in the general area of the Canal Street Basin (later Hoboken Street and today part of Canal Street) occurred quite early, inasmuch as the freshwater marsh known as Lispenard's Meadow provided a convenient anchorage on the otherwise inhospitable West Side shoreline. With the controlling of the meadows' freshwater stream by Henry Rutgers via the ditch system visible on the 1776 Ratzer map (see Figure 16), and with the construction of a causeway and bridge across the meadows near the shoreline, the road northward along the shore, today's Greenwich Street, was opened. (On the Ratzer map, which although it was published in 1776 depicts lower Manhattan c. 1766-77, this site is located in the vicinity of the word "Greenwich," which labels the road along the west shore.)

After the end of the Revolution, as stream vessels began to appear on the river, a succession of basins, piers, and slips was built at this location. As the meadows were filled in, the stream was placed in the center of Canal Street. However, it did not run directly down Canal Street to West Street but rather veered off to the south of the west end of Canal Street, where it was eventually covered with a tunnel and extended out into the river as it became a sewer (see Figure 27).

As mentioned previously, the Canal Street Basin was built sometime between 1803 and 1810; it appears on Poppleton's 1817 *Plan of the City of New York* (see Figure 24). Figure 27, a plate in the 1827-30 Ewen waterfront map series, shows that the Canal Street Basin had been filled in by that time, transforming it into an inboard street rather than part of the shore. The Hoboken Ferry had been established at the foot of this street by that time--hence its appellation "Hoboken Street."

Hoboken Street is well represented on mid-nineteenth-century historic maps. The Dripps map of 1852 (Figure 28) shows the Hudson River Rail Line turning from West Street eastward into Canal Street, passing around the Clinton Market, which was serviced by the railroad.

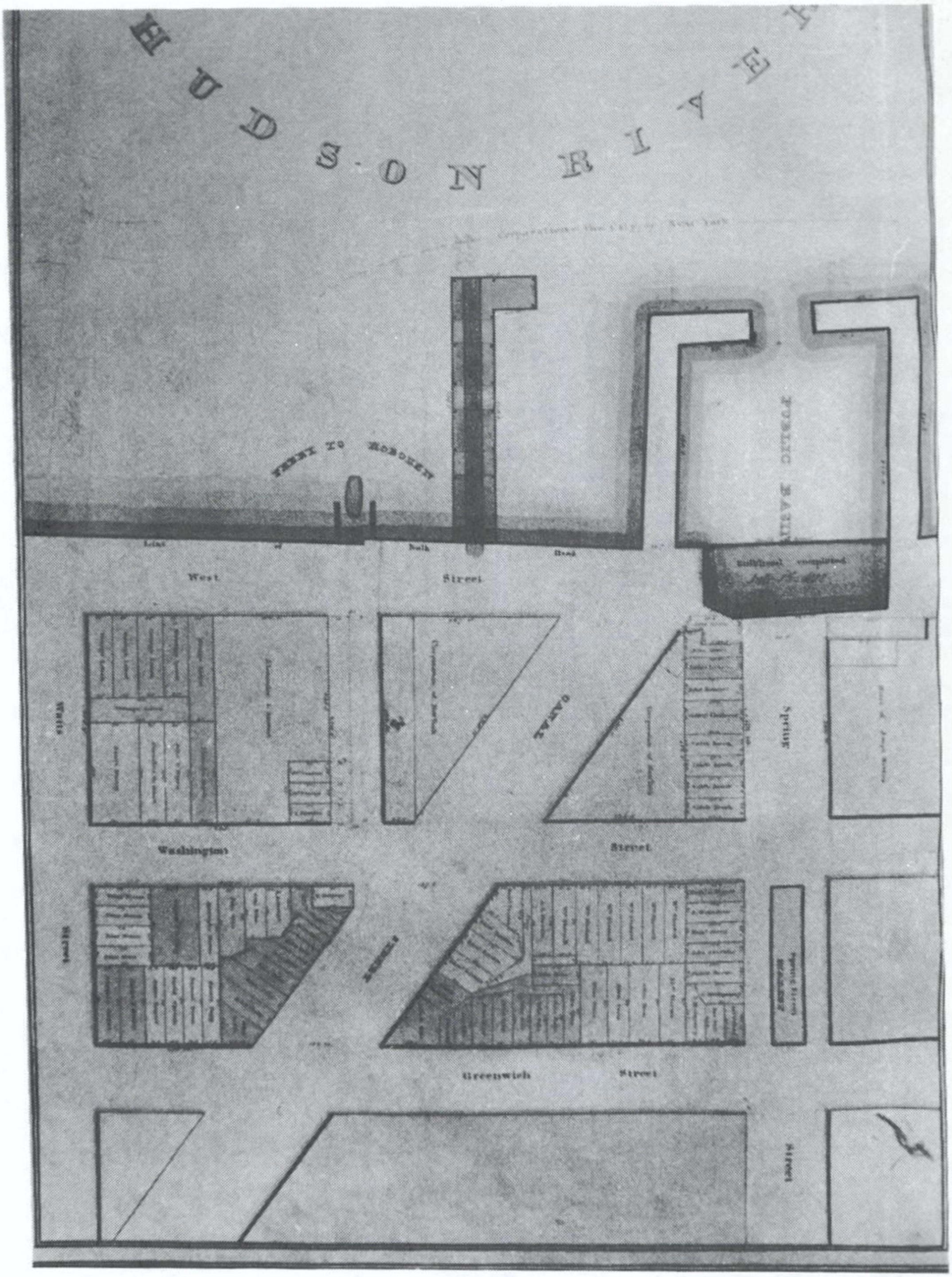


FIGURE 27. Plate from Ewen's 1827-30 waterfront map series showing the Hoboken Street (unlabeled, between Watts and Canal streets) area at that time. Note the Canal Street sewer just north of the Hoboken Ferry slip.

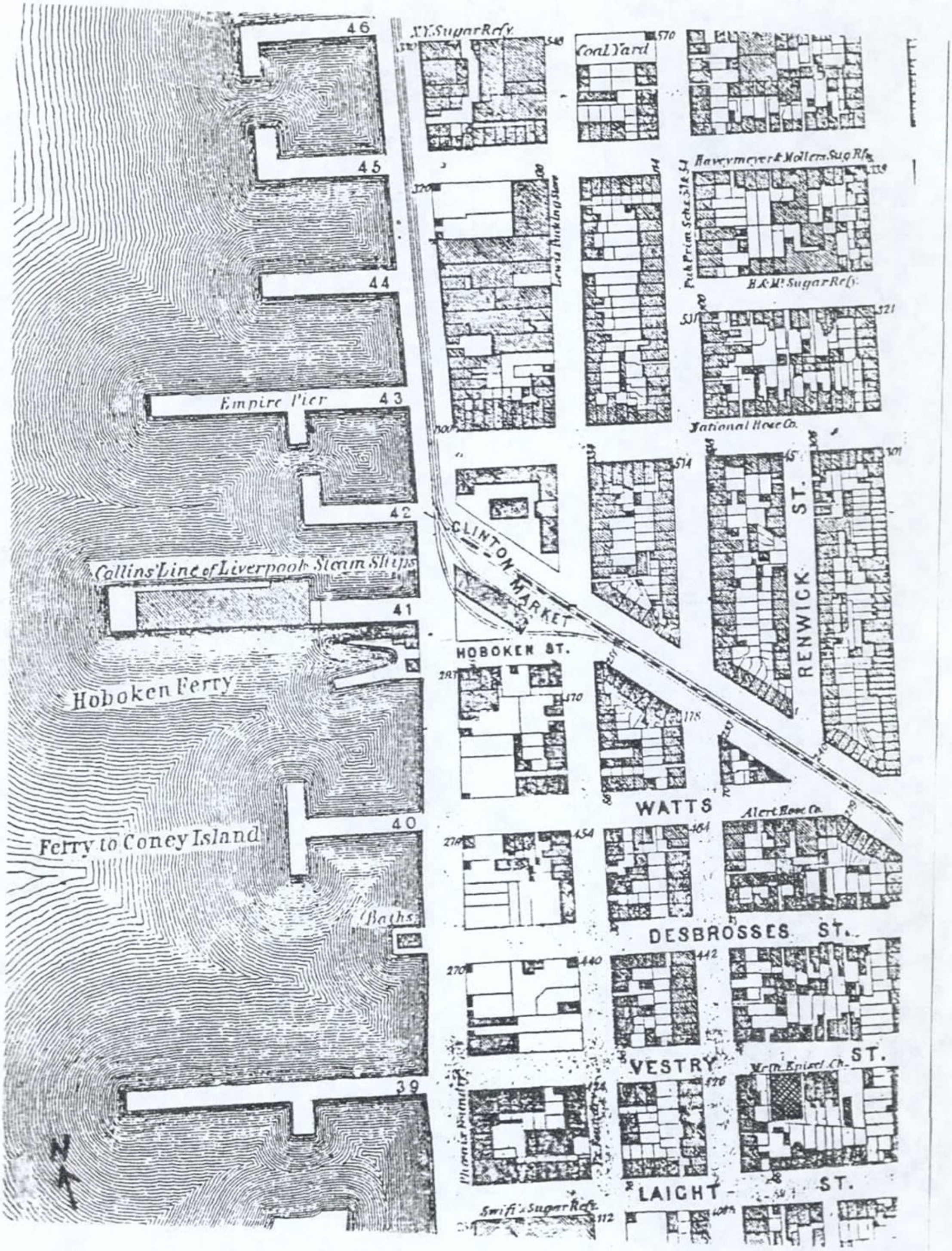


FIGURE 28. Dripps map of 1852 showing the West Side of Manhattan at that time. Note Hoboken Street is clearly marked, bounded on the north by Clinton Market buildings. The Hudson River Railroad line turns from West Street onto Canal Street and passes around the market.

The Hoboken Ferry slip and pier had been built by then, as had a pier at the site of the Canal Street sewer shown in Figure 27. By 1852 this pier is labeled "41" and the "Collins' Line of Liverpool Steam Ships" (see Figure 28). Figure 29, the Perris map of 1854, shows the properties on the south side of Hoboken Street--e.g., the Collins Hotel--as well as the absence of that part of the Clinton Market that had bounded Hoboken Street on the north. By 1857, the Hoboken Ferry pier and slip have been enlarged and attached to pier 41 [*Maps Copied from the Atlas of the Harbor Commissioners* (Kurth and Rosa 1857)].

By 1894 (see Figure 30), the city atlas map shows a park located on the site of the Clinton Market buildings formerly situated on the north side of Hoboken Street.* A Bromley city atlas shows the site in 1916 (see Figure 31). Hoboken Street and the park to its north are still extant. The rail line is shown totally within Canal Street.

In the twentieth century, the area just north of Hoboken Street, in Canal Street proper, was greatly disturbed when the entrance to the southern tube of the Holland Tunnel was constructed. The railroad had by that time been removed, as had been all traces of the Clinton Market and the Hoboken Canal Street Park. Today, a broad entrance from West Street into the west end of Canal Street is all that remains of Hoboken Street on the ground's surface. (See Figure 32.)

4) The Lispenard Estate

In 1741, shortly after Anthony Rutger's ditch and bridge were constructed, his daughter Alice married Leonard Lispenard. Lispenard thus came into possession of the marshy area, which came to be known as Lispenard's Meadows, and the adjacent uplands

*Although these data pertain to Hoboken Street after the Colonial/Federal era, they have been included here for the sake of continuity.

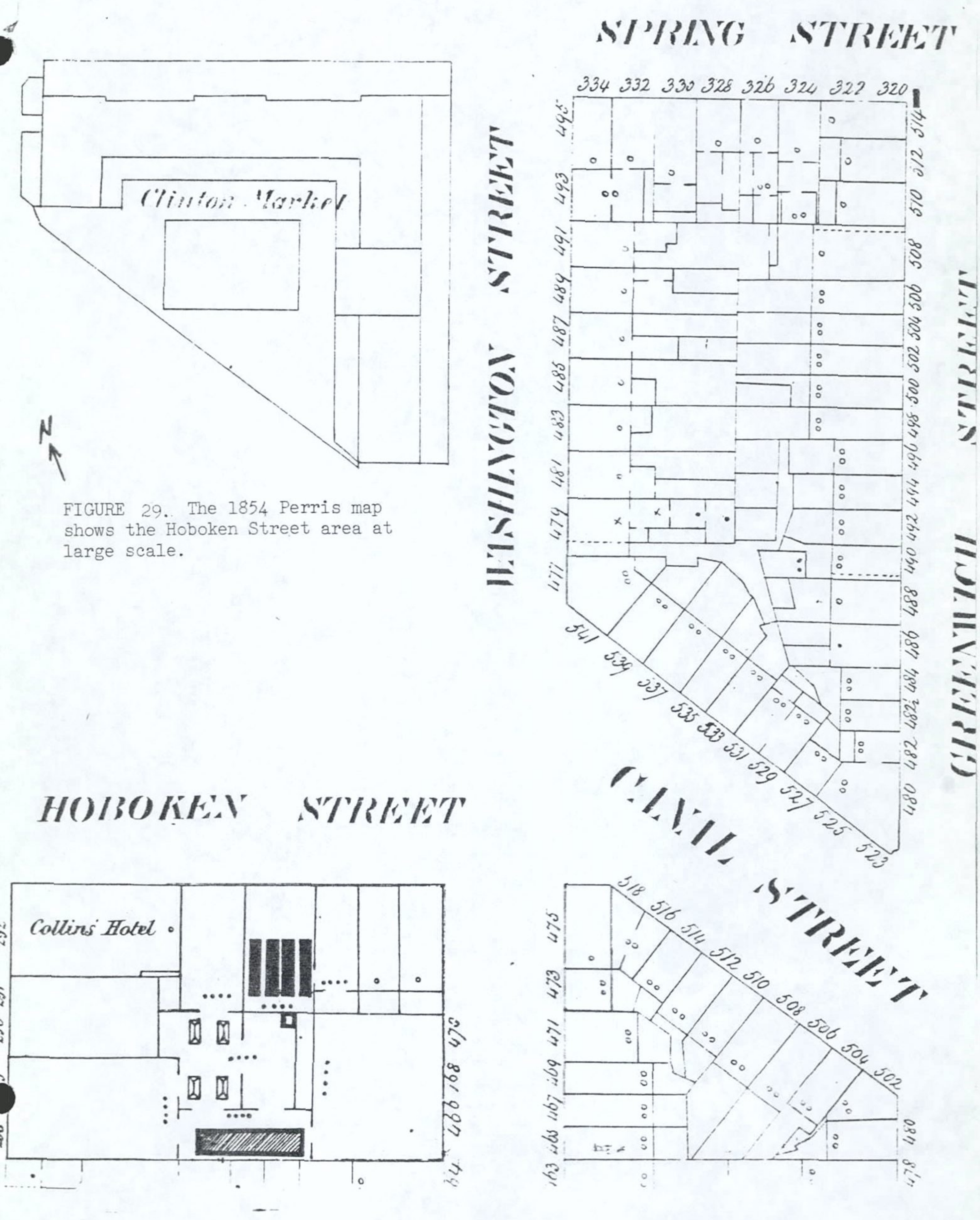


FIGURE 29. The 1854 Perris map shows the Hoboken Street area at large scale.

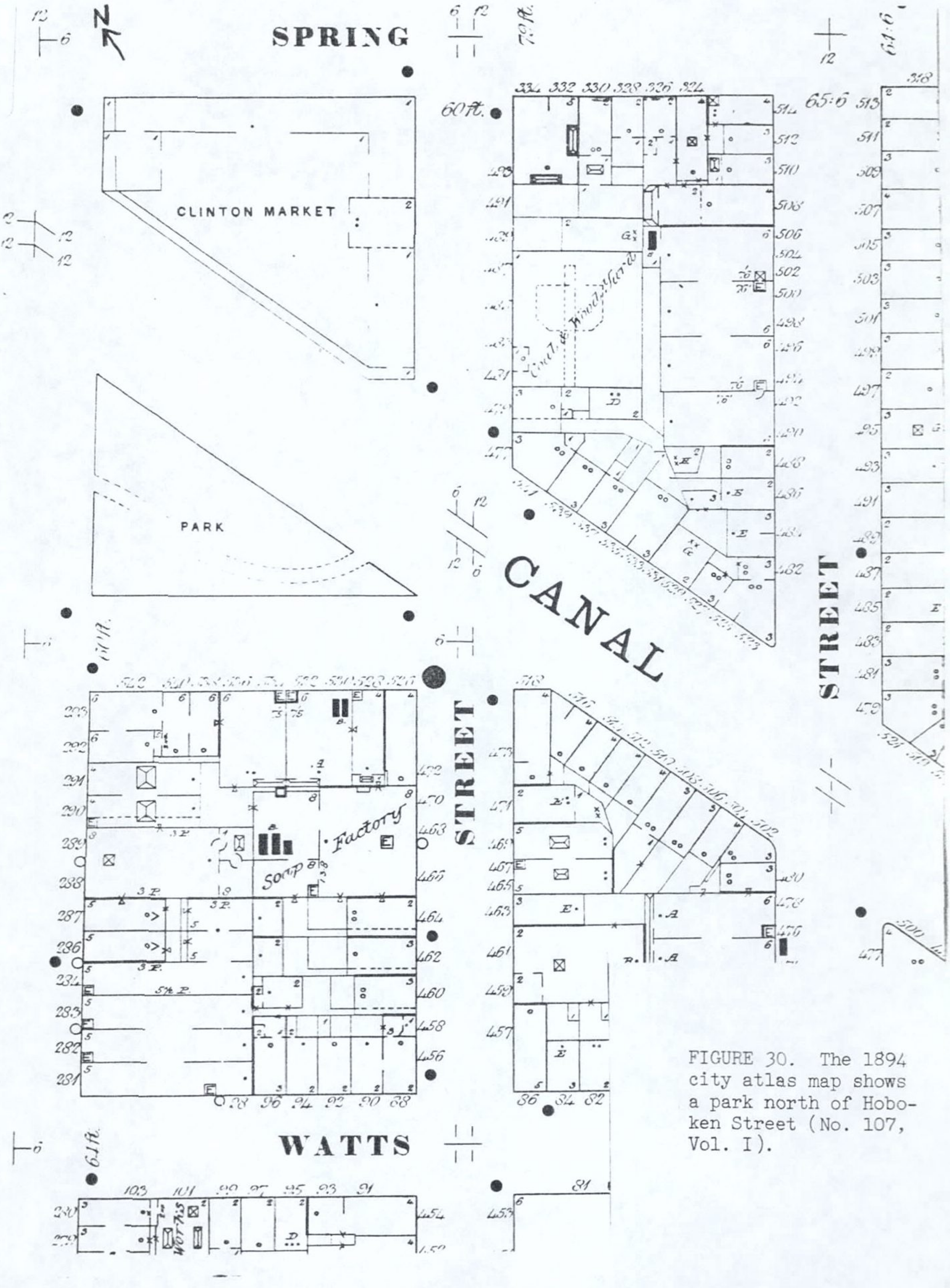


FIGURE 30. The 1894 city atlas map shows a park north of Hoboken Street (No. 107, Vol. I).

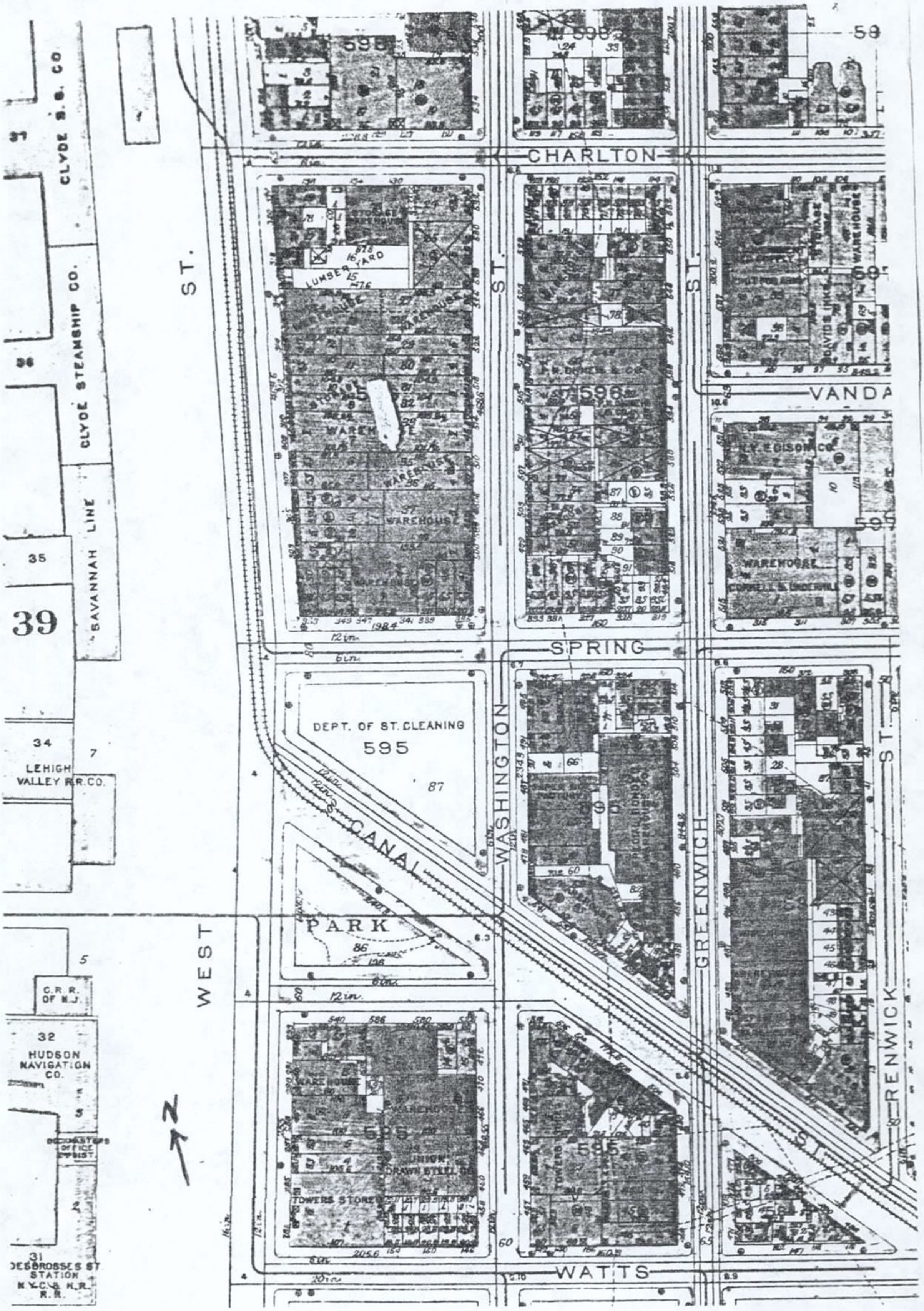


FIGURE 31. Bromley's 1916 map showing the Hoboken Street site. The rail line is now entirely within Canal Street.

WEST SIDE HIGHWAY
INTERSTATE ROUTE CONNECTION 518

AREA 3

DRAWING No.	DATE	SCALE	SHEET No.

FIGURE 32. Map showing HCI's Area 3 (compare with Figure 3), the Canal Street Interchange Area. Densely screened areas indicate land that has undergone relatively little disturbance in the historic period. The vertical-line screen indicates areas which were open, previously undisturbed spaces in the mid-1850s but which were subsequently built upon.

FIGURE 33. Portion of Hills 1782 map entitled *The City of New-York* showing the area of Lispenard's Meadows. Leonard Lispenard's house is indicated by the arrow. The obvious military fortifications are understandable inasmuch as the document was drawn during the Revolutionary War.

[Janvier 1894; Hemstreet 1899; American Scenic and Historic Preservation Society (hereafter ASHPS) 1914; Darling 1893]. Lispenard was the grandson of Anthony Lispenard, Sr., a brewer who came to New York City in 1684. In 1765 Lispenard served on a committee appointed to oppose the Stamp Act, and in 1775 he was a member of the New York Provincial Congress (Booth 1859; ASHPS 1914). He also served as a city alderman in 1758 (Lamb 1877: I, 673).

Leonard Lispenard's house was erected in 1749. When George Washington was traveling from Philadelphia to Cambridge to assume command of the American Army, he spent the night of June 25, 1775 in this house (Brown 1916; ASHPS 1914). The Lispenard house and associated buildings are shown on a number of late eighteenth-century maps, including the Ratzer map (c. 1766-67, Figure 16), the Montresor map (1775, Figure 19) the Hills map (1785, Figure 33), and the Taylor-Roberts plan (1797, Figure 20).

Lamb describes the Lispenard House as occupying an "eminence" above the surrounding lower land (1877: I, 569). The maps indicate that the house was, in fact, located on higher ground, with the lower-lying marshy ground to the north and west. The house

> ... stood amid extensive cultivated grounds on a hill which sloped on the west to Hudson River and on the north to the Canal Street Valley and on the east to the Meadows ... the grounds were a rectangular tract of about eight acres lying in the approximate area bounded by the present Canal, Varick, Laight and Hudson Streets. (ASHPS 1914: 258-59)

Lispenard also operated a brewery on this property:

> The brewery stood on the south side of Watts St., mostly south of the southerly line of the Street but partly lapping over into the street, its western corner being about 100 feet east of the easterly line of Greenwich St. (ASHPS 1914)

The Ratzer map, published in 1776 but drawn a decade earlier, shows the formal layout of the Lispenard estate (labeled "Leo Lispenard") as well as the meadows on the estate's east and north sides (see Figure 16). The 1797 Taylor-Roberts plan shows the Lispenard house in relation to the proposed street grid, placing it approximately on a line with Desbrosses Street and west of Hudson Street (see Figure 20).

Both Lamb (1877: II, 565) and Stokes (1926: Plate 90) reproduce a late eighteenth-century sketch of Lispenard's Meadows by Alexander Anderson. The sketch shows a house and barn to the south of a frozen-over area of Lispenard's Meadows, which is being utilized by ice skaters. The Hudson River appears in the background, and another house is located on higher ground north of the frozen pond. The ASHPS publication (1914: 259) describes the sketch as being drawn in 1785 and as showing the hill on which the Lispenard residence was situated, with the Lispenard brewery at the foot of the hill.

According to Stokes (1918: 950), Lispenard's house was located "in the bed of Hudson St." on the south line of Desbrosses Street. In the early twentieth century, a tablet was affixed to 198 Hudson Street to indicate that the house of Leonard Lispenard had stood opposite it (Brown 1916). Stokes (1918: 950) notes that the house was removed or demolished c. 1813. The ASHPS publication describes the house as standing

> ... in what is now Hudson Street, nearer to the east than to the west side, opposite numbers 194, 196, and 198 Hudson Street. The southern line of Desbrosses Street projected eastward would pass through the site. (ASHPS 1914: 259)

These addresses no longer exist, having been replaced by 200 Hudson Street, a large twentieth-century commercial building.

The location of the Lispenard House as given in Stokes and ASHPS is taken from an 1811 map of the Lispenard property (Filed Map #162; see Figure 34) in the Office of the Register of the City of New York. Although Leonard Lispenard, builder of the house, had died in 1790 (*New York Journal and Weekly Register* 1790), the property had remained in the possession of the Lispenard family. Inasmuch as the location of the house is of particular interest for present purposes, the 1811 map was examined in some detail. It shows the position of the Lispenard House within the present location of Hudson Street, with its northeast corner approximately 5 feet from the building line on the east side of Hudson Street. The house is oriented such that its northeastern facade is aligned approximately parallel to Canal Street. An eastward extension of the building line on the southern side of Desbrosses Street would pass through the northeastern corner of the structure. Today, a substantial portion of the house would be located beneath the Hudson Street sidewalk, with the remainder under the street itself (see Figure 34, A).

Two additional structures are shown in the southeastern portion of the block bounded by Canal, Hudson, and Vestry streets. These are possibly outbuildings. The structure previously identified as a brewery is located, as previously described, on the south side of Watts Street. Another house, not mentioned by other sources, is shown on the east side of Greenwich Street between Watts and Desbrosses streets. Approximately half of this structure is shown west of the building line--i.e., within

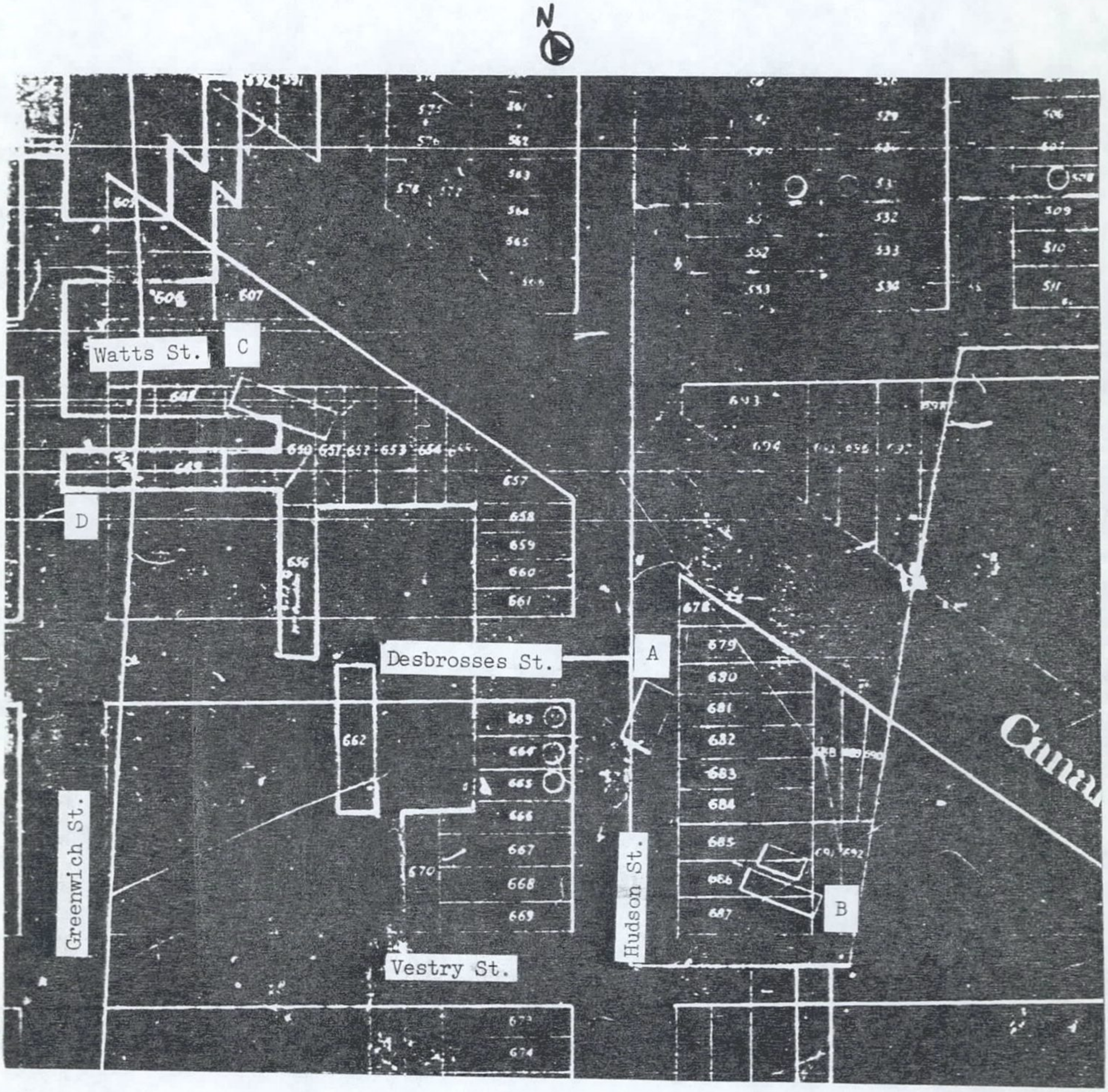


FIGURE 34. Copy of a photostat of Filed Map #162 dated 1811, on which we have affixed the following labels: (A) Lispenard's House; (B) probable Lispenard Estate outbuildings; (C) Lispenard's brewery; and (D) possible contemporary structure marked "House" that extends into Greenwich Street. Street names have also been included to assist in orientation. Of these buildings, only the Lispenard House is within the project area.

the sidewalk and pavement area of Greenwich Street (Figure 34, D). The only one of these structures lying within the path of proposed construction/design activities is the Lispenard House, located in Hudson Street (see Figure 32).

Darling (1893) disagrees with the previously referenced sources as to the location of the Lispenard House. He maintains that the crest of the hill was situated at the junction of Hudson and Desbrosses streets but that the house itself was located on the Greenwich Road. This reference could be to the house shown on Greenwich Street on the 1811 map.

The most likely interpretation of the evidence, however, is that the location of the original Lispenard House was at Hudson and Desbrosses streets, as is indicated by most sources, including the eighteenth-century maps. The Greenwich Street house was therefore built later, perhaps by Leonard Lispenard's grandson, who was also named Leonard. (See also Figure 35.)

5) Structures North of Canal Street

The 1811 map of the Lispenard estate does not show any structures north of Canal Street. However, there is evidence that structures stood in this area prior to this date. The Ratzer map (1766-67, Figure 16) shows at least two structures on the north side of Lispenard's Meadows, between 150 and 200 feet east of the Greenwich Road (near the location of present Renwick Street) and one structure west of the Road to Greenwich, located in the approximately 250-foot wide strip between the road and the shoreline. Structures are also shown in these areas on the 1775 Montresor map (Figure 19). The 1782 Hills map (Figure 33) shows the two structures east of the Greenwich Road, accompanied by a third smaller structure, perhaps an

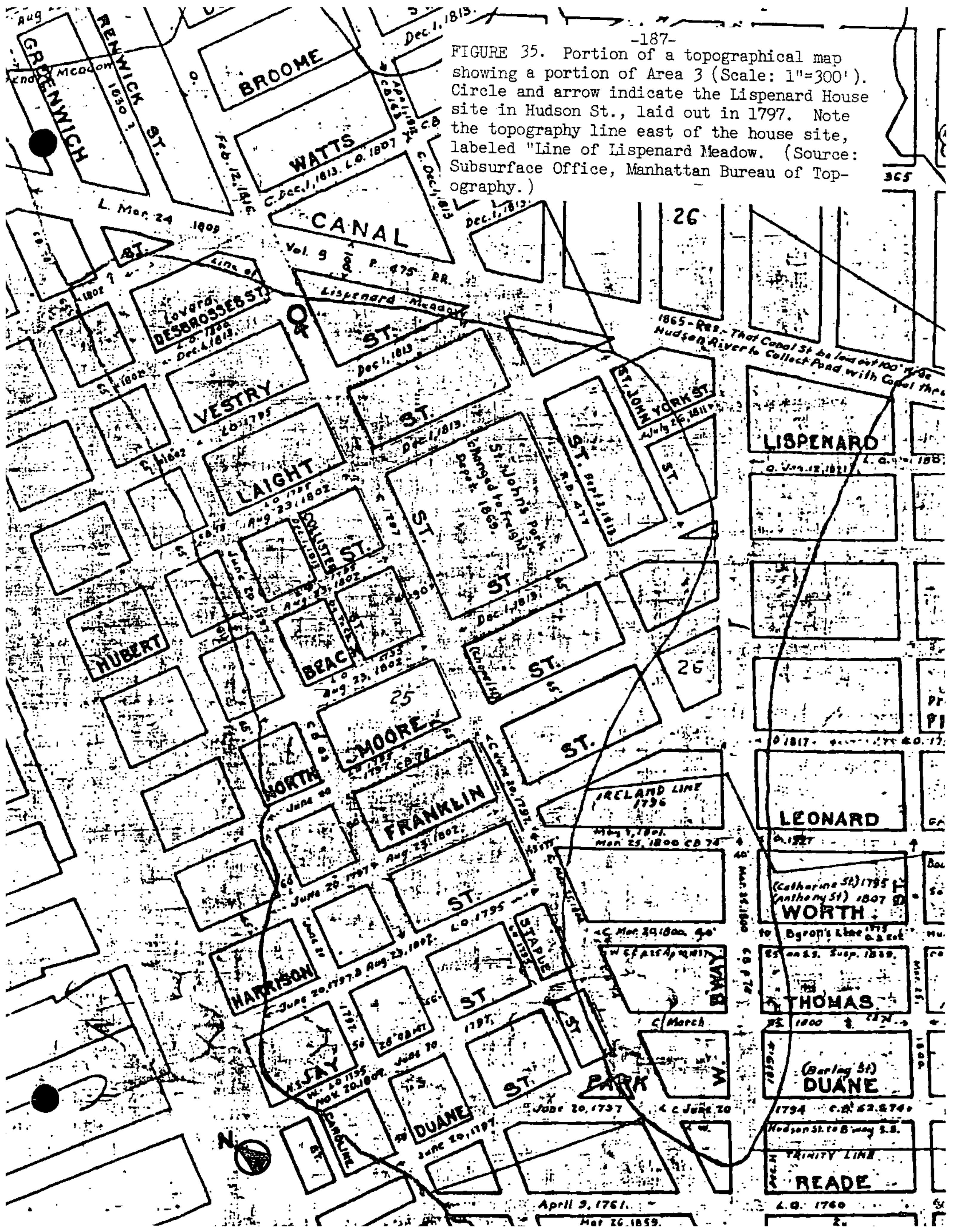


FIGURE 35. Portion of a topographical map showing a portion of Area 3 (Scale: 1"=300'). Circle and arrow indicate the Lispenard House site in Hudson St., laid out in 1797. Note the topography line east of the house site, labeled "Line of Lispenard Meadow. (Source: Subsurface Office, Manhattan Bureau of Topography.)

outbuilding. The structure west of the road is not shown; however, this map shows a Revolutionary War earthwork situated west of the Road to Greenwich in the same area. As previously noted, the Anderson sketch shows a house located north of the meadows. The 1811 map indicates that these buildings would have been located on land belonging to the Lispenard family.

During the laying out of Canal Street, the Common Council discussed payments to landowners whose land would be taken for the street. In 1808, all the land east of Greenwich Street which would eventually become Canal Street was owned by the heirs of Anthony Lispenard (sons of the first Leonard Lispenard) and Trinity Church (MCC 1784-1831: V, 6). However, several lots fronting Greenwich Street had been leased from Lispenard. Edward Ball leased a lot on the east side of Greenwich Street; Canal Street later cut a triangular piece from the rear of this lot. James Nelson leased a lot on the east side of Greenwich Street adjacent to Ball's lot; Canal Street later "cut off about one half of it in a diagonal manner." This ground "included a wooden stable." Consideration of the present geometry of Canal and Greenwich streets indicates that the Nelson lot would have been located to the north of Ball's lot. William Tait owned a smith's shop on ground leased from the Lispenards on the east side of Greenwich Street immediately north of Nelson's lot; "Canal Street runs diagonally through the center of the shop." Both Nelson and Tait asked permission from the Council to move the above-mentioned structures.

It is difficult to assess, with any great accuracy, the location of the structures north of Canal Street shown on the previously cited eighteenth-century maps with respect to the planned route of construction. This assessment depends on the location of Canal Street in relation to the area of lower-lying, marshy ground known as Lispenard's Meadows. The 1859 Viele topographical map (Figure 17) is almost certainly incorrect in both the extent and location of the meadows in the vicinity of Greenwich Street. If accurate, this map would place the Lispenard house and brewery in the middle of the meadows. It shows the width of the meadows at Greenwich Street as approximately 550 feet. The more accurate Ratzer map shows the meadows as being approximately 250 feet wide at this location. (See also Figure 35.)

According to Stokes, "Canal Street, east of Broadway to Collect Street, was laid out on the line of this old ditch [Rutger's ditch], but west of Broadway the new street ran in a straight line south of the ditch, which curved northward, joining it again at the outlet on the North River" (Stokes 1918: 560). Canal Street, therefore, may have intersected some of the drier land to the south of the marshes. The description of the properties to be taken for Canal Street in 1808 suggests that the street was not designed to run through the marsh in the vicinity of Greenwich Street.

The area to be affected by construction extends approximately 100 feet north of Canal Street at Greenwich Street and more than 200 feet north of Canal Street at Renwick Street (see Figures 1, 3, 32). Canal Street is approximately 80 feet wide and the area of marsh was 250 feet wide. If a portion of Canal Street intersected the dry ground south of the marshes, it is possible that the area to be affected by the project extends far enough north to impact the area of dry ground which existed north of the marsh. Therefore, it is possible that some of the area in which structures were known to exist during the eighteenth century would be affected by the proposed project (the construction activity for this area is the driving of piles--see Figure 2.1).

North of Canal Street, at the southwest corner of Spring and Hudson streets, a tavern known as Brannan's Gardens was established c. 1765. The tavern was known as New York Gardens in 1795 and as Washington Gardens or Tyler's Gardens in the 1830's. It was still standing as late as 1862 (Stokes 1918; Hemstreet 1899: 101; Janvier 1894: 214-15). This site is about 400 feet north of the planned construction area.

6) Hudson Square Area (Block 221)

The block bounded by Varick, Laight, Beach, and Hudson streets (referred to as Block 221 herein to eliminate repetition of street names) was formerly known as Hudson Square or St. John's Park (see Figures 3 and 32). When the expansion of the city was planned at the end of the eighteenth and the beginning of the nineteenth centuries, this land was reserved for a park. It is so shown on the Taylor-Roberts plan of 1797 (see Figure 20, where "Hudson Square" appears to have been planted with an ellipsis of trees between Vestry and Moore streets) and the Goerck-Mangin plan of 1803 (see Figure 21, where the formal ellipsis is shown between Moore and Laight streets and between Hudson and Varick streets). This land was not owned by the Lispenard family at this time but by the Corporation of Trinity Church (Stokes 1915: 397). The Common Council ordered the park area fenced and "ornamented by trees" in 1804, and the streets bordering the park were officially ceded to the city by Trinity Church in 1805 (Stokes 1915: 397; 1918: 608). Haswell (1897: 243) notes that the first fence around the park was wooden. It was replaced with an iron fence sometime before 1829 (Stokes 1918: 608). In 1823, Trinity Church resolved to keep the square as a park, without any buildings, and it was described as "one of the finest, if not the finest in the city." The lessees of the lots facing the square were responsible for its maintenance, and Hudson Square was regarded as one of the most fashionable places in which to live in New York City (Stokes 1918: 609). Janvier (1894: 220) notes the "wide-fronted houses" which faced the square in the early nineteenth century. Residents included John Ericsson, builder of the *Monitor*.

Husdon Square remained a park until 1867. At this time the land was sold to the Hudson River Railroad, which erected a freight depot on the block (Stokes 1918: 609). Many of the houses fronting the square became lodging-houses in the latter part of the nineteenth century after the construction first of the Hudson River freight line and then of the freight depot changed the character of the neighborhood (Janvier 1894). The 1907 E. Belcher Hyde Atlas shows this three-story building still standing. Railroad tracks entered the building from Hudson Street. The structure had an open courtyard in its center. See a discussion of this use in Section II,C,4,a,5),c),(2),(a), entitled St. John's Freight Terminal.

a) ST. JOHN'S CHURCH

Saint John's Church, or Chapel, was built in the Federal style of architecture on the east side of Varick Street east of Hudson square, which subsequently also became known as St. John's Park (see Figure 36). Started in 1803 and finished in 1807, it was still standing in 1917. When Varick Street was widened in the second decade of the twentieth century, an arrangement was reached whereby the chapel porch was to remain projecting into the street protecting the sidewalk beneath it (Stokes 1915: 397; 1918: 608).

b) LAIGHT STREET PRESBYTERIAN (BAPTIST) CHURCH

Another church, the Laight Street Presbyterian Church, was erected on the northwest corner of Laight and Varick streets in 1825. It was sold to a Baptist congregation in 1842 (Stokes 1918). The church is shown on the 1851 Perris and Hutchinson map and the 1852 Dripps Map (see Figure 37).

c) RELATIONSHIP TO PROJECT AREA

Hudson Square, the site of the Laight Street Presbyterian Church, and the sites of some of the houses which fronted Hudson Square on Laight Street would be affected by the proposed construction. The site of St. John's Chapel lies outside the project area.

7) Early Nineteenth-Century Residential Construction

a) BACKGROUND: PARTITION OF THE LISPENARD ESTATE

At the beginning of the period in question, most of the land was owned by the Lispenard estate. To understand the sub-

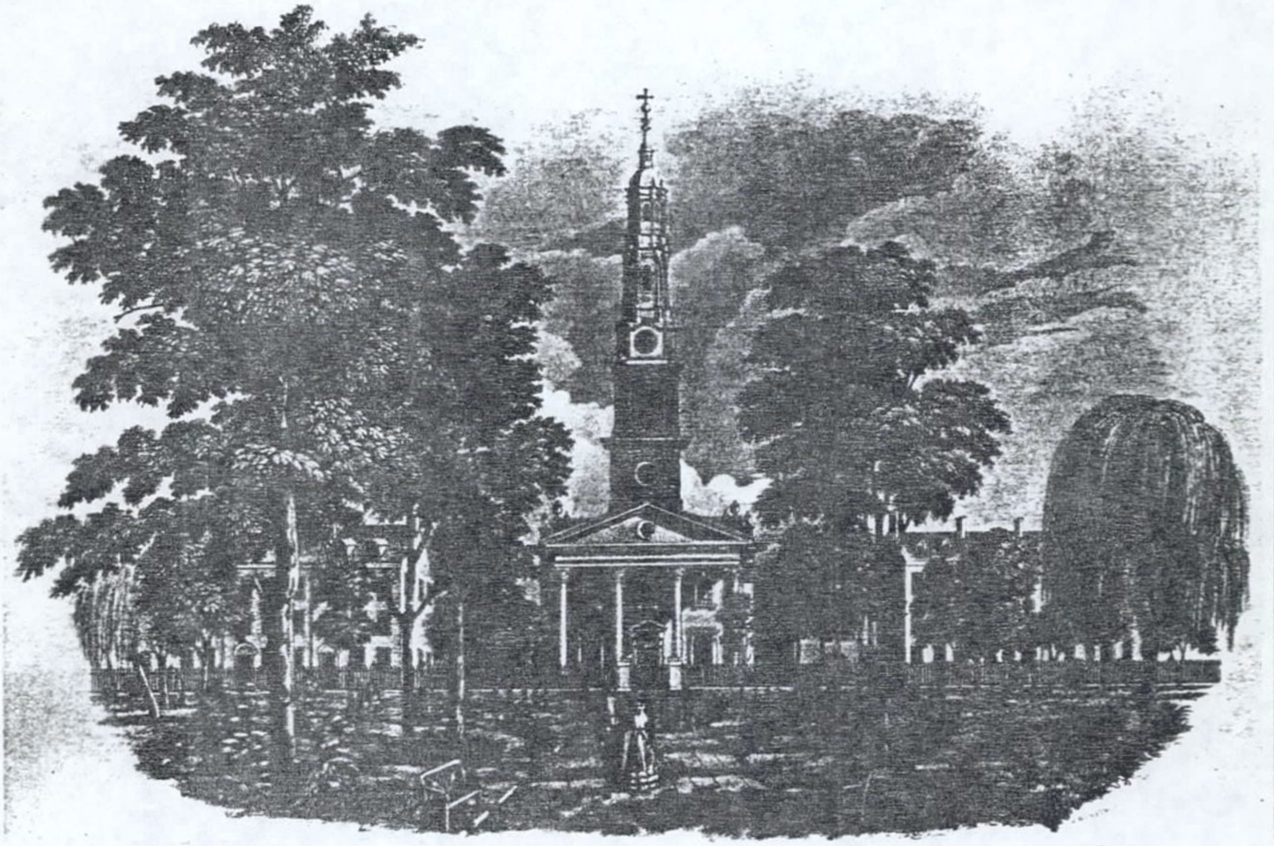
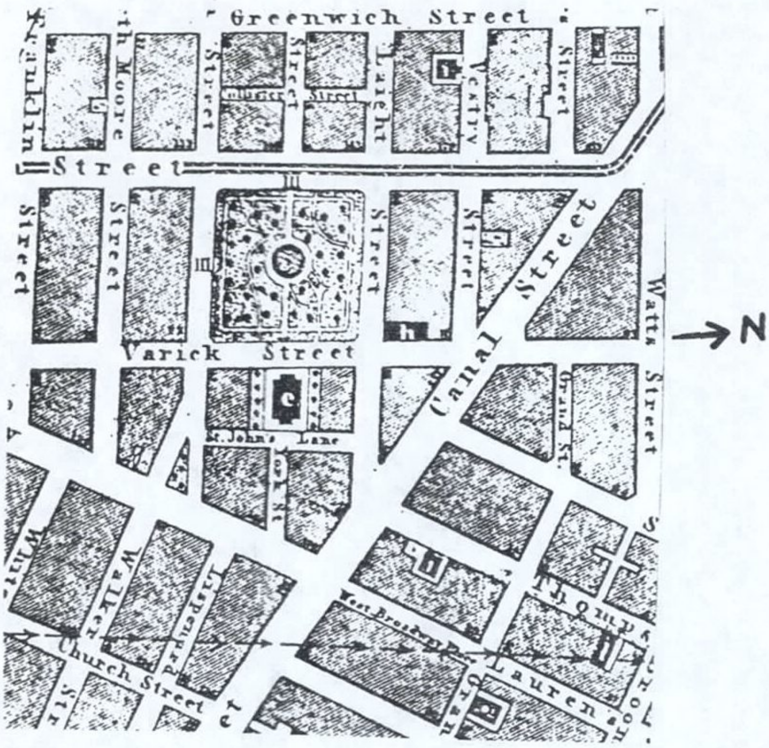


FIGURE 36. Drawing of St. John's Episcopal Chapel on the east side of Hudson's Square or Hudson's Park (later St. John's Park), which is visible in the foreground. The chapel and buildings flanking it were built in the Federal style of architecture (Lockwood 1972: 41).



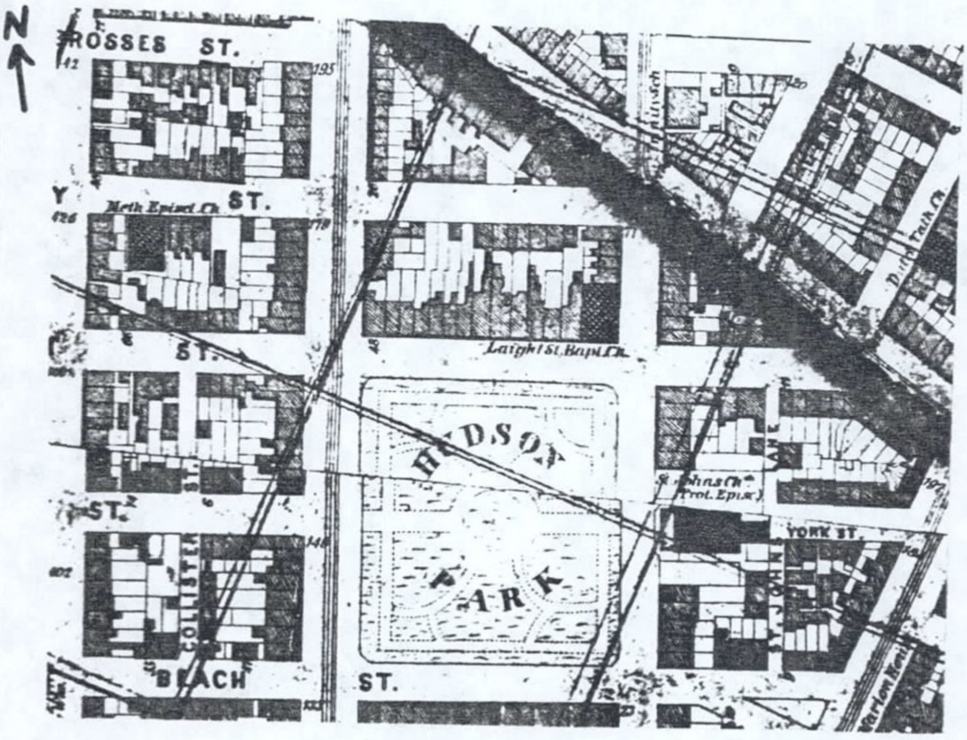


FIGURE 37. *Above:* Portion of 1851 Perris and Hutchinson map showing the Laight Street Presbyterian Church on the northern side of Hudson Square (northwest corner of Laight and Varick streets, labeled "h"). *Below:* Portion of 1852 Dripps map showing the Laight Street Baptist Church on Hudson Square at that date.

sequent land transactions it is useful first to examine the history of land ownership after the death of Leonard Lispenard, who built the first structures in the area, as discussed previously.

Leonard Lispenard died in 1790, leaving his entire estate to his son, Anthony (Pelletreau 1905). Darling (1893) notes that Anthony was the "proprietor of extensive breweries and mills on the Greenwich Road near the foot of Canal Street." It is not certain whether these are the same structures shown on the 1811 map of the Lispenard estate. Anthony had six children, and on his death in 1806, he bequeathed his estate to two of his sons, Anthony and Leonard, a daughter, Alice, and his granddaughter, Sarah Bache, daughter of Helen Roosevelt Lispenard (*The True Issue or Brief Thoughts on the Lispenard Estate* 1836). In the 1790's, Leonard Lispenard together with his father and/or his brother, Anthony, continued the brewery business. In 1802, however, he formed a partnership with Bernard Hart. They were auctioneers and "did a general commission business" (Scoville 1870: 124-25).

In 1808, Alice Lispenard sold her share of the estate to her sister, Sarah Lispenard Stewart (*The True Issue* ... 1836). In the same year (*Stewart and Lispenard Family Genealogy* n.d.) the younger Anthony Lispenard died and his share of the estate was divided among Leonard Lispenard, Sarah Lispenard Stewart, and Sarah Bache, who at this time held the estate in common (*The True Issue* ... 1836). At that time Sarah Bache was a minor, and her guardian was Alexander Stewart, her uncle and husband of Sarah Lispenard Stewart. Alexander Stewart was also then the active manager of the Lispenard estate (MCC 1784-1831: V, 6).

In 1810 and 1811, the estate was partitioned between Leonard Lispenard, Sarah Stewart, and Sarah Bache, at which time the previously discussed map of the Lispenard property was drawn (see Figure 34). The partition was confirmed by the parties in 1815, and in the same year Sarah Bache and her husband Richard Montgomery Livingston sold their share in the estate to Leonard Lispenard and Sarah Lispenard Stewart. Leonard disposed of his share of the estate before his death in 1817 (*The True Issue* ... 1836).

b) TAX AND LAND RECORD RESEARCH

(1) Introduction

Few pre-1850 maps of the Canal Street Interchange area show details of type and number of structures built. Therefore, to determine the history of construction on this land in the early nineteenth century, researchers consulted deeds and filed maps in the office of the New York City Register as well as tax records located in the New York City Municipal Archives. This research indicates that the first construction on Laight Street, facing Hudson Square, occurred during the first decade of the nineteenth century. From 1810 to 1820, structures began to be erected in the project area on the north side of Canal Street in the blocks bounded by Washington and Greenwich, Renwick and Hudson, and Hudson and Varick streets. However, most of the construction occurred during the 1820's, and by 1830 every lot within the project area contained structures. Apparently most of the Laight Street structures were built by their owners as residences for themselves or their families. However, many of the buildings on the blocks north of Canal Street were built as commercial ventures, and were thus presumably rented to tenants. A detailed history of construction within each block follows.

(2) Laight-Hudson-Vestry-Varick Street Block (Block 220)

Block 220 is bounded by Laight, Hudson, Vestry, and Varick streets and is only partly included in the project area (see Figures 3 and 32). The land within the project area on this block was apparently not included in the division of the Lispenard estate, inasmuch as Anthony Lispenard and his wife Sarah transferred this property to Thomas Miller and Stephen Baker in 1804 (New York County Deeds, Liber 77: 261). Miller and Baker apparently had purchased this property for speculation, for by 1808 the land had been subdivided into lots numbered 49 through 58, as shown on the filed map included as Figure 38. (Note: Figure 38 shows these lots in 1824.) The four westernmost lots on this block (45-48) were not included in this transaction and are also not within the boundaries of the present project area. Portions of lots 49 through 52 and all land within lots 53 through 58 are included within the present study area. Dix (1950) lists the proprietors of the various lots within the project area in 1808 as follows:

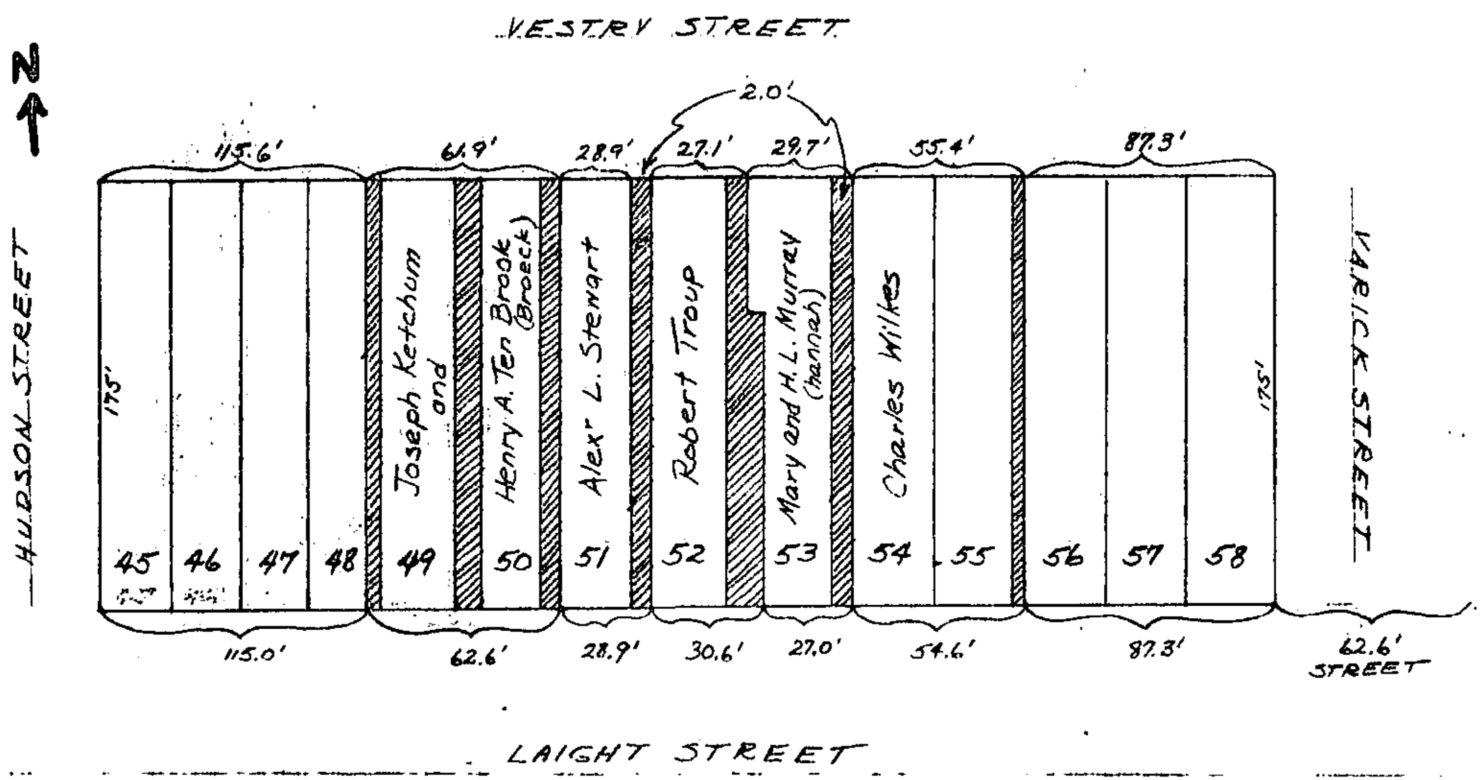


FIGURE 38. Tracing of an 1824 deed map for Block 220 (New York County Deeds, Liber 188: 329).

Lot No.	Proprietor
49,50,51	Leonard Lispenard
52	Dr. William Moore
53,56	John R. Murray
54	Charles Wilkes
55	Andrew Ogden
57,58	John B. Church

All these lots ran through the block from Laight to Varick streets. The subdivision of this land may have occurred immediately after the purchase by Miller and Baker, inasmuch as Moore is placed on lot 52 in 1806 and John R. Murray on lot 53 in 1805 (New York County Deeds, Liber 22: 406).

Leonard Lispenard's purchase of lots 49 through 51 was apparently part of his overall real estate investments. In 1805 (New York County Deeds, Liber 106), Lispenard had obtained 99-year leases from Trinity Church to lots 45 through 48 (not in the project area); thus, with the three lots purchased from Miller and Baker, Leonard Lispenard owned the western portion of the block prior to 1810. The 1810 tax records show that Lispenard had apparently transferred lot 51 to his brother-in-law, Alexander Stewart, by this date. Although Lispenard still owned lots 49 through 50 in 1810, he may have disposed of them by 1811, since they are not included on the map of the Lispenard property dated that year whereas lots 45 through 48 are shown on that map.

According to the tax records, the first houses within the project area on this block were built prior to 1810. The Murray family had apparently acquired the lot formerly owned by Ogden by this date, thus owning three lots in the project area. Two of the three lots contained houses in 1810.

The lots and their owners in 1824 are shown on the deed map in Figure 38. By that date, 49 and 50, which had been owned by Leonard Lispenard in 1810, were in the possession of Joseph Ketchum and Henry A. ten Broeck. In 1825, Ketchum and ten Broeck transferred lot 50 to Hannah Murray. The deed specifies that any structure erected on this lot may share a "party wall with Alexander L. Stewart from an agreement made by the former owner Late Robert Fulton and Leonard Lispenard" (New York County Deeds, Liber 192: 370). This reference indicates that Robert Fulton, presumably the steamboat inventor, owned this lot between 1810, when it was owned by Lispenard, and 1819, when he died. In 1825 it was owned by Ketchum and ten Broeck. The 1823 and 1824 tax lists indicate the "estate of R. Fulton" as owning two lots on the block, presumably lots 49 and 50. No structures are indicated on these lots. The deed just referenced also indicates that Stewart had constructed a house on lot 51 at some time prior to 1825. Lot 51 is apparently the one taxed to Charles A. Dale in the 1823 and 1824 tax records. A house is incidated as standing on this lot in both years.

Tax records indicate that Charles Wilkes was in the process of constructing a house on his lot (lot 54) in 1824. By that date, Wilkes also owned lot 55, and the records suggest that a second house was built there. Tax records also indicate that a house had been constructed before 1823 on the property owned by Robert Troup (lot 52). This lot is the same one owned by Dr. Moore in 1808.

The description of the properties in 1824 in the land records indicates that alleyways several feet wide existed between the properties. The owners of the land east of Wilkes lots are not shown in Figure 38. Lot 56 would have contained one of the houses built by the Murray family in the first decade of the nineteenth century. The two corner lots at the intersection of Laight and Varick streets would have been the site of the Laight Street Presbyterian Church, which was built in 1825, as mentioned previously.

Properties on block 220 in 1830 are shown on a deed map included herein as Figure 39 (New York County Deeds, Liber 262: 194). The block is still made up of 14 lots (not numbered in Figure 39), but comparison of this map with the 1824 deed map of the same block (Figure 38) reveals that lot sizes have changed. The tax records for 1830 indicate that each lot contained a house at this time. The two corner lots (57 and 58; see Figure 38) would have been the property of the Laight Street Church and consequently were not taxed. Presumably, each house on the block fronted Laight Street and Hudson Square and had a yard area on the Vestry Street side. The Church lots encompassed only the Laight Street portion of the property bordering Varick Street. The Vestry Street protion of this property (i.e., the southwest corner of Vestry and Varick streets) may have been the site of a stable indicated as owned by Robert Jones in the 1834-1835 tax records.

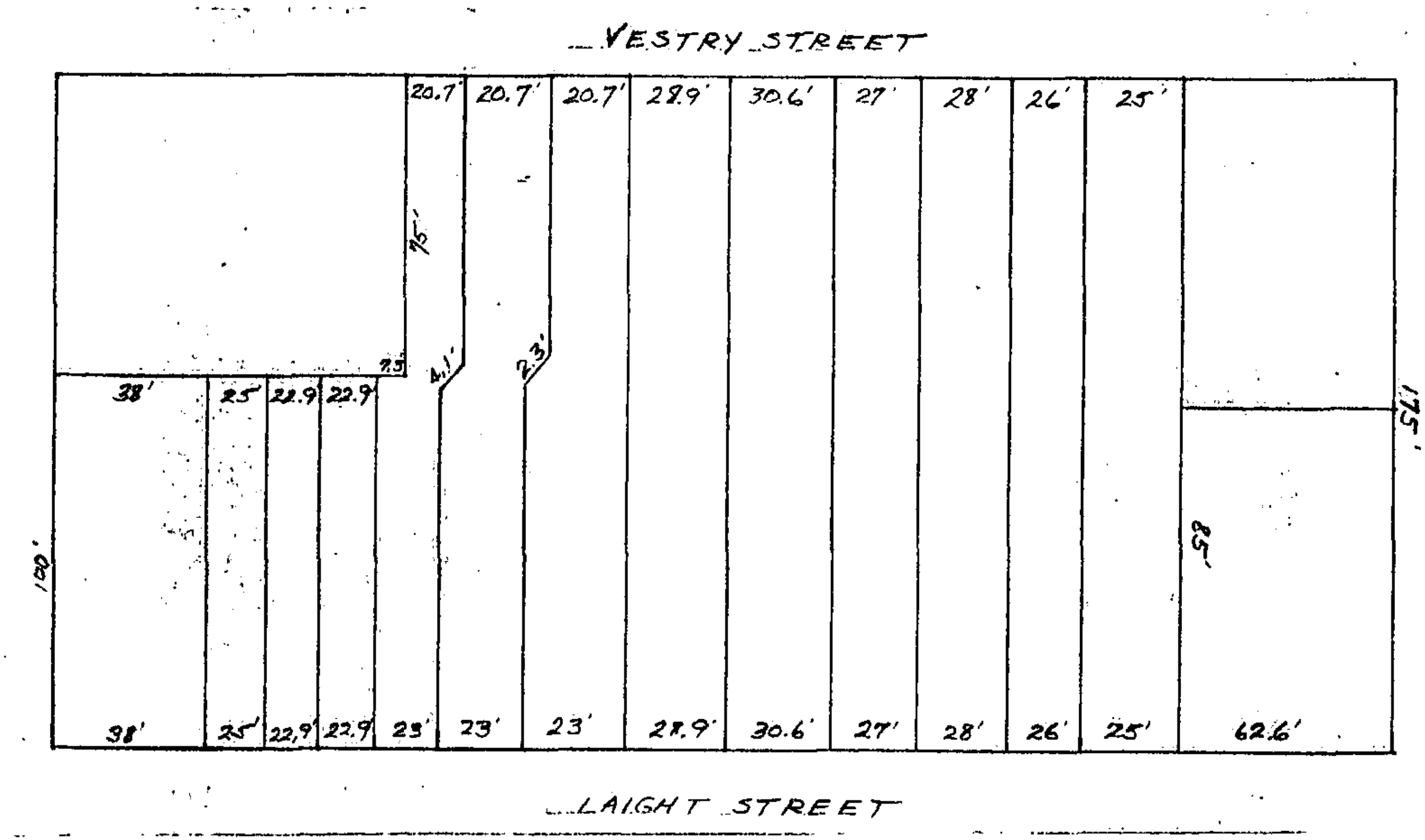


Figure 39. Tracing of a deed map of block 220 dated May 12, 1830 (New York County Deeds, Liber 262: 194).

The following list summarizes the dates of construction of the first structure built on each of the lots within the project area:

Lot No.	Date
49	1825-30
50	1825-30
51	1810-23
52	1810-23
53	Before 1810
54	1825-30
55	1825-30
56	Before 1810
57, 58	c. 1825 (Laight Street Church)

(3) Greenwich-Canal-Washington-Spring Street Block (Block 595)

Block 595 is bounded by Greenwich, Canal, Washington, and Spring streets. Only the triangular-shaped southern end of the block is included in the project area (see Figures 3 and 32). After partitioning of the Lispenard estate was confirmed by agreement in 1815, all the property within the project area in block 595 was in the hands of Alexander L. Stewart and his wife, Sarah Lispenard Stewart.

According to the tax records, Stewart had constructed a house on this block by 1818 on the west side of Greenwich Street near the corner of Canal Street. A second house had been built by 1820. A deed dated October 20, 1820 (New York County Deeds, Liber 148: 277) indicates that Stewart and his wife leased "2 lots with buildings and party walls" to John George Rohr. The map attached to this deed (Figure 40) shows this property extending northward 59.3 feet along Greenwich Street and 66 feet

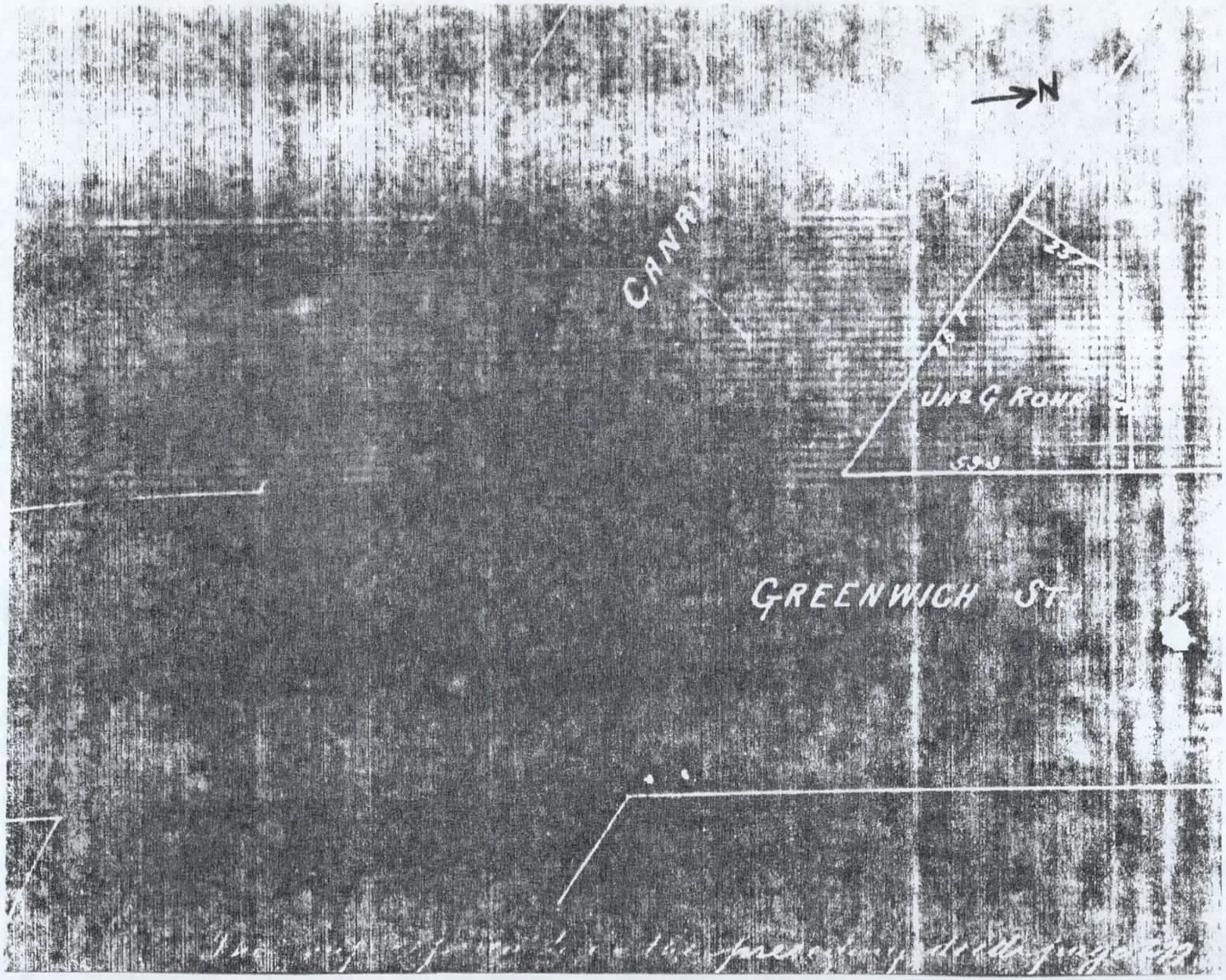


FIGURE 40. The tip of Block 595--i.e., that portion of the block that is within the present project area--is shown at right, in this copy of an October 20, 1820 deed map, owned by John G. Rohr (New York County Deeds, Liber 148: 277).

along Canal Street from the intersection of those two streets. The present project area extends approximately 56 feet north of this intersection along Greenwich Street and 80 feet northwest of the intersection along Canal Street, as measured along the present building line. Structures on this lot would therefore have been located within the present project area. The 1822 tax records indicate that by that year, J. G. Rohr had three houses on this property. The 1821-22 edition of Longworth's City Directory lists "John George Rohr, merchant tailor" at "Greenwich c. Canal."

In 1822, Alexander Stewart leased four lots and houses to John Rohr (New York County Deeds, Liber 160: 356-58). The houses are mentioned in the tax records beginning with this year. The description of the property in the land records and the accompanying map (Figure 41) indicates that two of the lots fronted on Greenwich Street and two on Canal Street, immediately adjacent to the property of John George Rohr, mentioned in the preceding paragraph. Assuming that the modern and early nineteenth-century building lines are the same, the southernmost portion of both of the lots and house sites fronting Canal Street would fall within the project area; however, the project would not affect the two lots and house sites fronting Greenwich Street. John Rohr is referred to in the 1822 deed as a mason (Liber 160: 356-58). He was the son of the tailor, John George Rohr, who leased the corner lot. Longworth's Directory for 1823-24 lists John Rohr as a mason "on Canal near Greenwich."

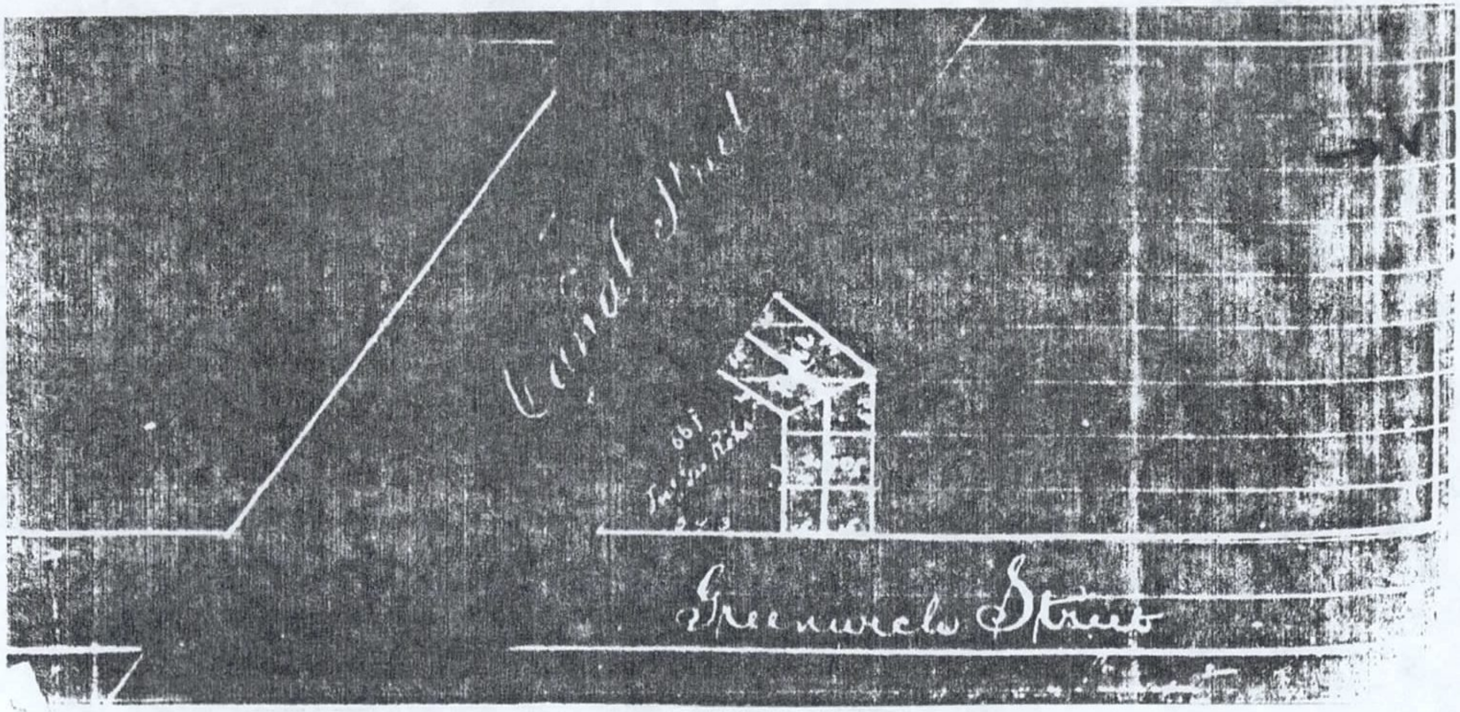


FIGURE 41. The tip of Block 595 as it appears on a copy of an 1822 deep map (New York County Deeds, Liber 160: 358).

In May 1825, a petition from a number of inhabitants was put before the Common Council that the houses on Canal Street be "regularly numbered" (MCC 1784-1831 XIV: 506). The tax records for 1826 show John G. Rohr owning buildings at 482 and 484 Greenwich Street and John Rohr owning buildings at 486 and 488½ Greenwich Street. The 1827 tax records show all these structures in the possession of John Rohr, probably reflecting a transfer of property within the Rohr family from father to son. In 1828 the property at 488½ Greenwich Street is no longer listed although there is a listing for 486½, which may simply reflect a correction of a previous misnumbering of Rohr's contiguous properties. Tax records indicate that John Rohr may have sold the two properties and houses fronting Canal Street (Nos. 244 and 246) to John R. Murray in 1828.

The Longworth 1825-26 City Directory lists "Nathaniel Thurston music store" at 482 Greenwich Street, suggesting that John G. Rohr had rented all or a portion of one of the three structures on the corner lot for commercial or mixed commercial-residential purposes.

The property lying northwest of John Rohr's two lots fronting Canal Street was sold in 1824 by Alexander and Sarah Stewart to Samuel Browner, a "Bandbox maker" (New York County Deeds, Liber 181: 294-97). The property contained a two-story brick building at this time. Tax records suggest that this house was built between 1822 and 1823. In the latter year, the "Double House and ½ lot" was taxed to Samuel Larned, although the property must have remained in the ownership of Stewart, since it was he who sold it to Browner in 1824. This property, which is shown on a map attached to the deed (Figure 42), extended 31.5 feet along Canal Street northwest of John Rohr's property. Assuming that the building lines shown on modern maps and those shown in Figure 42 are the same, this property would not be included within the project area.

(4) Greenwich-Canal-Renwick-Spring Street Block (Block 594B)

Block 594B is bounded by Greenwich, Canal, Renwick, and Spring streets. The southernmost end of the block falls within the present project area (see Figures 3 and 32). Tax records indicate that before 1816 all the land on this block within the project area was owned by Leonard Lispenard. Before his death, Lispenard must have sold this land to Jane Renwick, as it is shown in her possession in 1817. A map dated to this year (Filed map 9A in the Office of the Register) shows Jane Renwick's property gridded into lots. A tracing of this map, including the boundaries of the project area, appears herein as Figure 43. The property was divided so that the lots facing Greenwich Street were 90 feet deep and those fronting Renwick Street were 60 feet deep. The lots fronting Canal Street contained varying amounts of land, owing to the fact that Canal Street crosses the rectangular grid established by the parallel Hudson, Renwick, Greenwich, Washington, and West streets.

According to the tax records, the first houses on this block within the project area were constructed in 1825. They

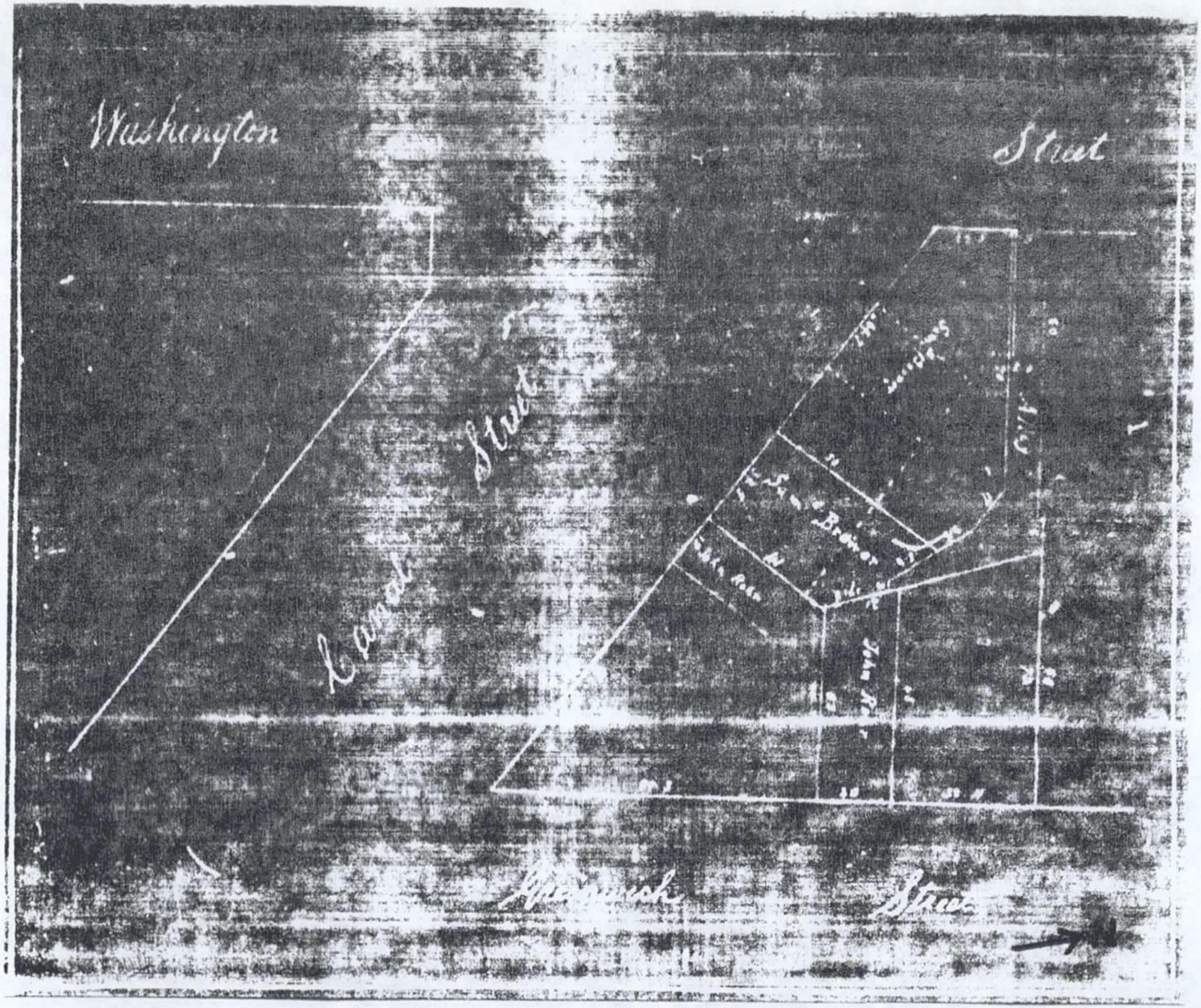


FIGURE 42. The tip of Block 595 (at right) in a copy of an 1824 deed map (Liber 181: 294-97).

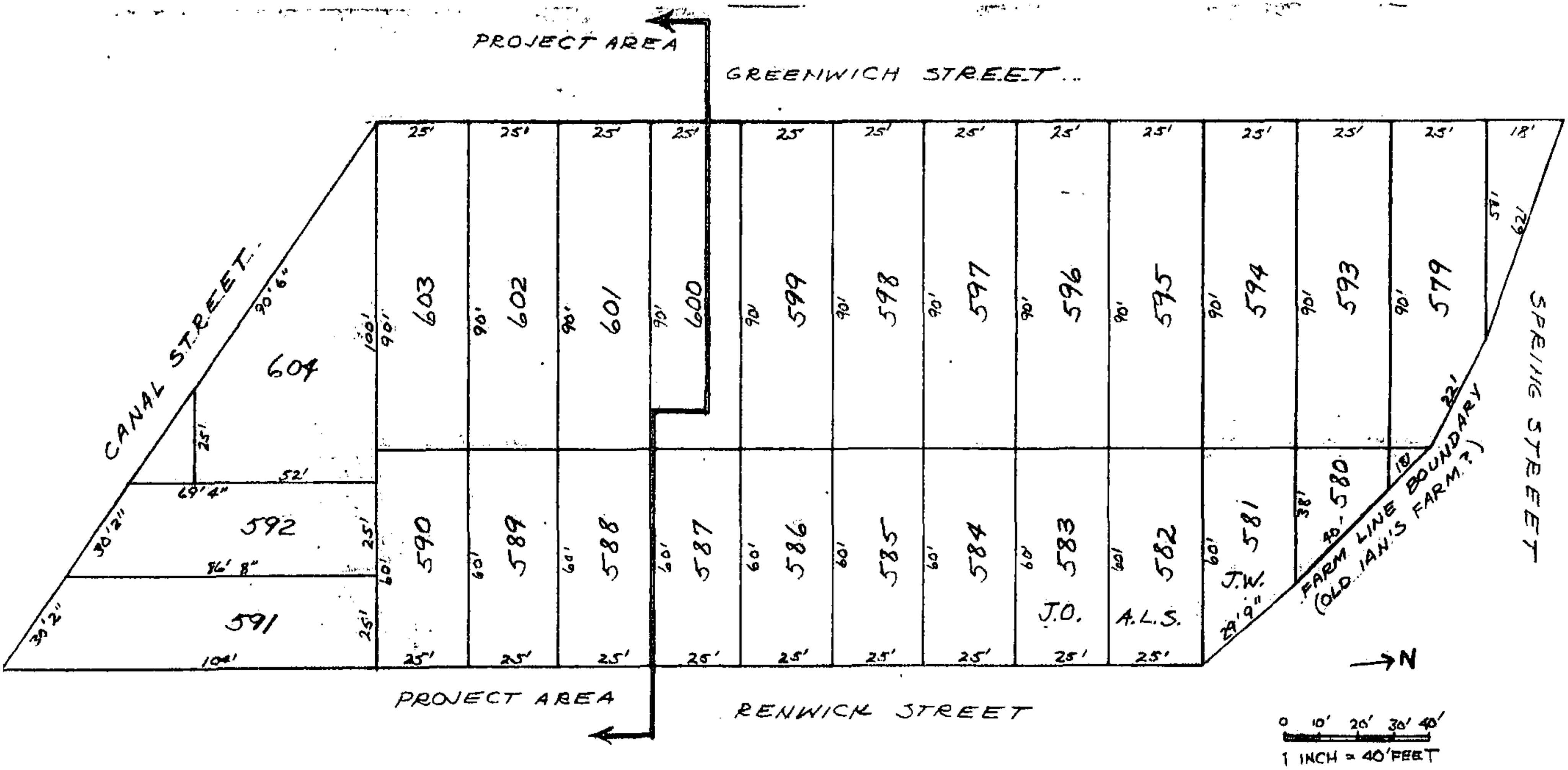


FIGURE 4 3. Tracing of Filed Map 9A (Jane Renwick property), dated 1817, Office of the Register of the City of New York, for block 594B.

fronted on Greenwich Street and were situated on lots numbered 602 and 603 in Figure 43. They were constructed by H. Waterbury and C. W. Sanford, who had acquired these lots from Jane Renwick between 1823 and 1825. Construction of houses on the other two lots fronting Greenwich Street, lots 600 and 601, did not occur until 1826. The houses were built by A. Ross, who acquired lot 601 directly from Jane Renwick. Lot 600 had passed through intermediate ownership before its purchase by Ross.

The first house to be built on the lots fronting Renwick Street (588-590) were constructed in 1830. At this time the property was listed in the possession of Isaac Jacques, who had purchased it from Jane Renwick. Jacques also acquired the property fronting on Canal Street (lots 591, 592, and 604) and constructed six houses on it in 1827. The division of land into lots excluded a small triangular piece fronting on Canal Street and bounded on the north and west by lots 604 and 592 (see Figure 43). This property is apparently the lot noted in the tax records between 1821 and 1826 as belonging to James Nelson. It may have been the remaining portion of the lot on which Nelson formerly had a stable, part of which was taken for the construction of Canal Street. No structures are noted on this piece of property in the 1820's. It was presumably acquired by Isaac Jacques together with the Renwick property.

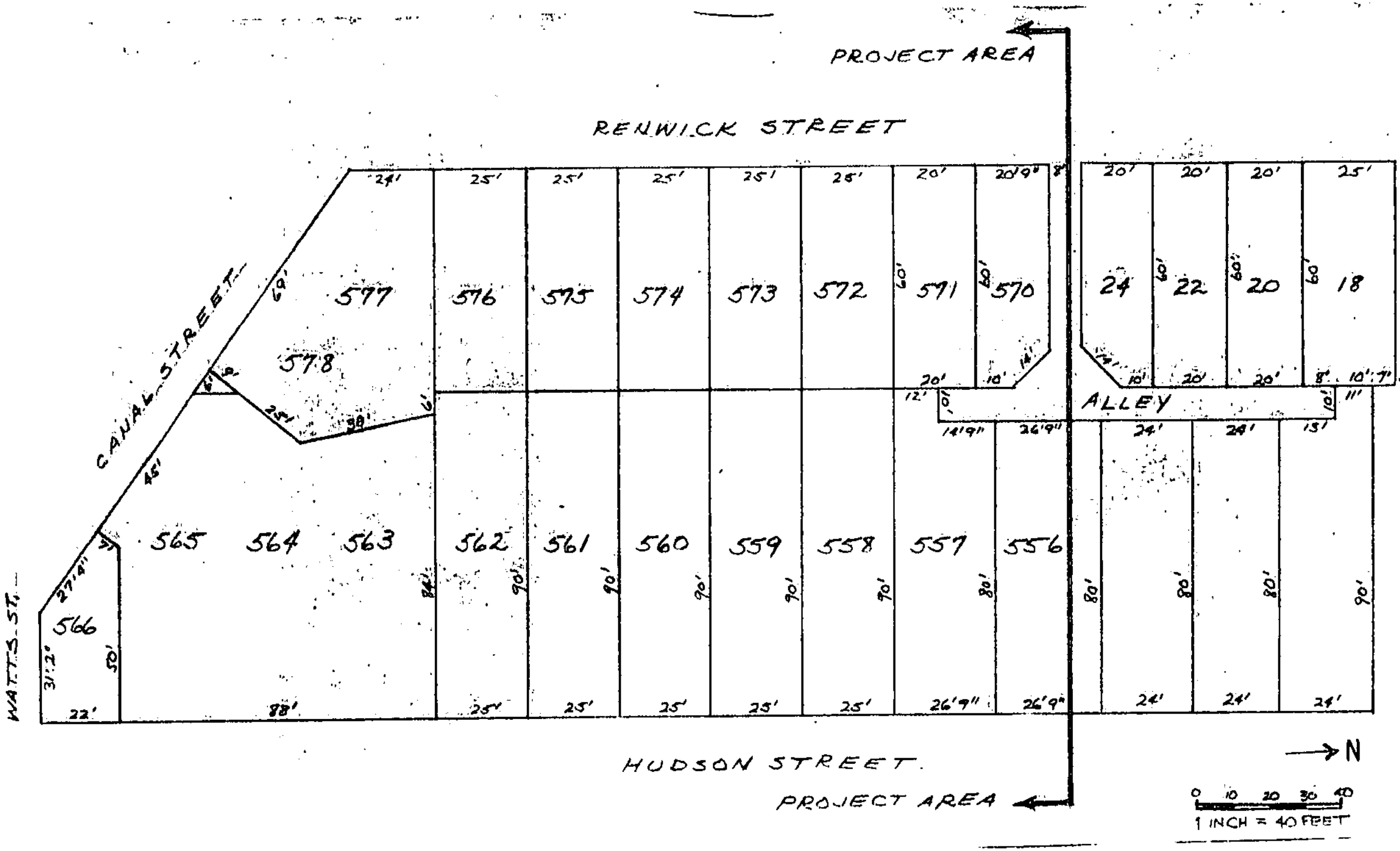
(5) Renwick-Canal-Hudson-Spring Street Block (Block 594A)

Block 594A is bounded by Renwick, Canal, Hudson, and Spring Streets. The southern end of this block falls within the present project area (see Figures 3 and 32). According to tax records, all the property on this block within the project area was in the possession of Alexander Stewart following the division of the Lispenard estate. There was no available map which showed the boundaries of the lots following the initial division of the land. Therefore, lot numbers and approximate lot boundaries were, where possible, based on the property records (see Figure 44). Lot numbers were assigned to other lots for purposes of reference.

As was the case in the Greenwich-Canal-Renwick-Spring Street block directly to the west (Block 594B), the lots facing Renwick Street were 60 feet deep and those fronting Hudson Street were 90 feet deep. The exception was the northern portion of the block, where some of the lots were only 80 feet deep to allow for a 10-foot alley to the rear permitting access from Renwick Street. A number of lots fronted Canal Street. From the land records, it was not possible to determine either the precise boundaries of these lots or their lines of intersection with the lots fronting Renwick and Hudson streets.

According to the tax records, the first houses on this block within the project area were constructed in 1818 at the corner of Canal and Hudson streets. A house on the corner lot (566) was in the possession of B. Owens. Five additional houses were apparently constructed as a commercial venture by Stewart himself on lots 563 through 565. These houses were apparently acquired in 1824 by George Rohr, probably the same John George

FIGURE 44. Map of Block 594A showing lots. Data were compiled from various tax and deed records.



Rohr who owned property on the Washington-Canal-Greenwich-Spring Street block (Block 595). In 1826 the listing in the tax records was changed to John Rohr, who was probably George Rohr's son; at this time John Rohr also owned the corner lot.

The next houses to be constructed facing Hudson Street were built in 1825 on lots 556 and 557, the northernmost lots in the project area. Structures were built on the remaining lots fronting Hudson Street between 1826 and 1830. Lots 556 through 562 each contained two houses by 1830, and other lots on this block also apparently had more than one house.

The first structures that fronted on Renwick Street were built on lots 572 and 573 in 1823. Another house was constructed on the adjacent lot, 574, in 1825. Houses were built on the remaining lots fronting on Renwick Street in 1827.

Seven houses were constructed on the property fronting on Canal Street in 1824. Several of these houses were owned by George Rohr. By 1826, the Rohr family owned 10 houses on block 594A, and Teunis van Winkle owned 11 houses. They were apparently commercial ventures, and most of these houses were probably rented to others.

(6) Hudson-Watts-Varick-Broome Street Block (Block 578)

Block 578 is bounded by Varick, Watts, Hudson, and Broome streets. Except for its northwestern corner, it is entirely within the project area (see Figures 3 and 32).

Annual tax assessment record books for the early nineteenth century divide this block into "wards" rather than "lots"; however, the latter term will be used here to avoid confusion. We were unable to locate a map showing the original division of the land within the project area. However, by searching the tax assessment books and then tracing the property transactions it was possible to construct a map showing the location of the various properties on the block (see Figure 45).

According to tax records and deeds, Alexander L. Stewart and Robert M. Livingston owned the lots on this block in the latter part of the second decade of the nineteenth century. This Livingston is not the same person as Richard M. Livingston, who was married to Sarah Bache, Anthony Lispenard's granddaughter. As noted previously, that Lispenard heir disposed of his share of the estate in 1815.

According to the tax records and deeds, the property at the corner of Broome and Varick streets (lot 2875) was owned by Alexander Stewart prior to 1816. The tax records indicate that one of the earliest structures on the block was built on this property by Jonathan Archer, who is listed as having a house here in 1816. By 1818 this property had been transferred to Charles D. Bevoise, who apparently constructed a second house which fronted on Broome Street.

The property within the project area fronting on Broome Street west of this corner lot consisted of seven lots, which were owned by Robert Livingston in 1819-20. Six of these lots (2899-2904) were sold to "John and Caleb Brush, lumber merchants" in 1826 (New York County Deeds, Liber 210: 261). The tax records

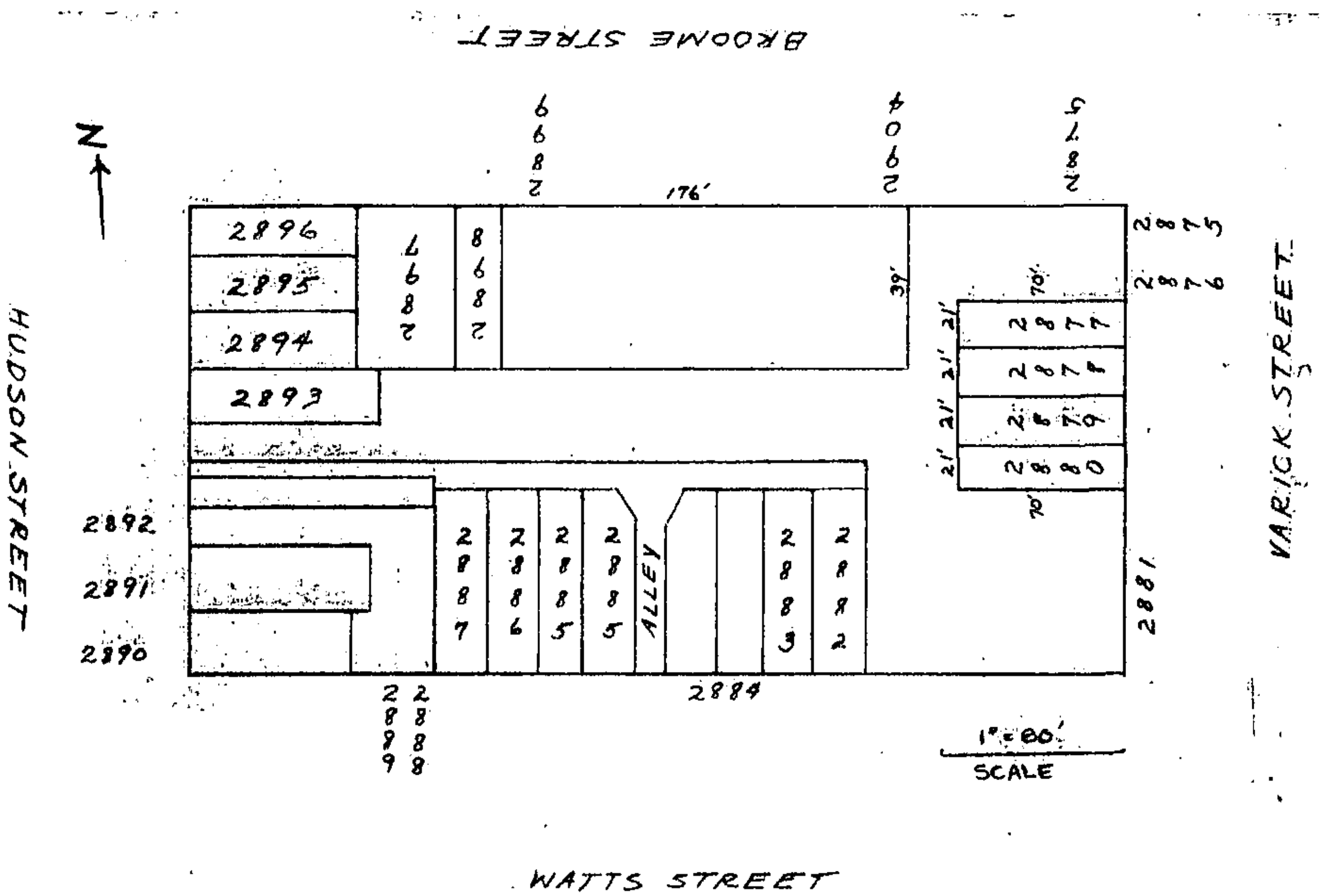


FIGURE 45. Map of Block 578 compiled from tax assessment and deed data.

show this property owned by "Joshua Brush" in 1827, and Brush apparently constructed the first houses on each of these lots in 1828. Apparently the Brush family constructed these houses as a commercial venture rather than for their own residential use.

Lot 2898 was located west of the Brush property. It was sold by Livingston in 1826-27 to Samuel Y. Clarke, who had built a house on the property by the latter year. A portion of this lot is included within the project area.

The property fronting Broome Street west of lot 2898, as well as the lots fronting Hudson Street just south of Broome Street (lots 2893-97; see Figure 45) are outside the present project area. (The first structures on these properties were constructed between 1820 and 1827.)

The three lots fronting Hudson Street at the corner of Watts Street (lots 2890-92) are within the project area. These were leased by Alexander L. Stewart to William Langham, a mason, in 1818 (New York County Deeds, Liber 145: 28-32). Langham erected nine two-story brick houses on this property and then transferred the lease to Samuel Brown and Edward Innet (New York County Deeds, Liber 182: 171-76). Tax records show Brown and Innet in possession of the property in 1820, with Brown having the two lots nearest the corner. The records suggest that the houses were constructed as a commercial venture between 1819 and 1820 and that two of the nine houses erected by Langham fronted on Watts Street (lots 2888 and 2889). These are among the properties which came into Innet's possession.

All the properties fronting on Watts Street were owned by Alexander Stewart following the Lispenard estate division. According to the tax records, a stable was constructed in 1826 on lots 2886 and 2887. The 1907 Bromley atlas shows a 2½-story brick stable at the same location.

Lot 2885 was located between the stable and an alley which ran northward from Watts Street. The first house on this property was erected in 1824 by Joseph Dean, who built a second in 1826. Lot 2884 was located immediately east of the alley. According to the tax records, Joseph Dean also erected the first houses on this property--two were begun in 1823 and were completed by 1824. In the latter year, construction of a third house was begun by Alexander Stewart. This house was completed in 1825 when it is shown in possession of John Young, identified in deeds as a mason (New York County Deeds, Liber 186: 327,330). The 1826 tax assessment shows five houses on this property. Stewart, who had apparently leased these structures to Dean and Young, had also apparently constructed a sixth house on the property by 1828. The dimensions of this property and at least one of the leases indicate that some of the houses must have fronted on the alley, which ran perpendicular to Watt Street for 80 feet (New York County Deeds, Liber 186: 327).

Lot 2883, which adjoined this property to the east, was also owned by John Young, who apparently built the first structure there in 1825. Tax records indicate that in 1818 two houses stood on the easternmost of the lots fronting on Watts Street

(2882). The houses were in the possession of a "Mrs. Mayham" and "Allint M. Bogart" at this time.

The property on the corner of Watts and Varick streets contained two of the earliest structures to be erected on the block, both owned by John R. Bogart and both facing Varick Street. Thus, the two Varick Street corners of block 578 were the sites of the earliest construction.

Five lots (2876-2880) fronted on Varick Street between the two corner lots. The two lots adjoining each of the corner lots contained structures before 1820. A foundation was constructed by Charles D. Bevoise in 1818 on the property adjacent to the Varick-Broome Street corner lot (lot 2876). Bevoise also owned the corner property at this time. The house was completed before 1820. The property adjacent to the Varick-Watts Street corner (lot 2880) contained a house by 1817, at which time the property was owned by John Zabriskie. Structures on the three properties in the middle of the block (lots 2877-2879) were not built until 1826, at which time G. W. Harris owned all three parcels.

The dimensions of the first structures to be built on Block 578 are not known. However, from the dimensions of the properties given in the land records, it is apparent that in addition to the alleyways mentioned therein there existed a substantial amount of open space in the center of the block at the rear of the structures fronting the streets (see Figure 45).

(7) Canal-Varick-Watts Street Block

A small piece of land now part of the Holland Tunnel entrance area was formerly the western tip of the triangular-shaped block bounded by Canal, Watts, and Varick streets. This small piece of property fronting on Hudson street was referred to in the early nineteenth-century tax assessors' annual books as "Hudson between Canall and What [*sic*]." The tax records indicate that the first structures on this property were two houses erected in 1824 by John Le Grange. (See Figures 3 and 32.)

d. FOURTEENTH STREET INTERCHANGE AREA

1) The van Rotterdam House

The Manatus map, which depicts Manhattan in 1639, shows a number of farmhouses along the shore of the Hudson. Two of these are identified as belonging to Jan van Rotterdam. Stokes identifies this individual as Jan Cornelissen (1927: 118). The location which Stokes gives for Cornelissen's tracts of land places the interchange within the more southerly of the two tracts, and he locates the house shown on the Manatus map as "not far from the river, probably near Tenth Ave. and 16th St." (Stokes 1927: 119). This would place the house immediately east of the area of proposed construction. However, this location can only be considered approximate inasmuch as no scale is given on the Manatus map and because of the inaccuracies inherent in the maps of this period.

Cornelissen's southernmost tract became vested in Allard Anthony and Paulus Leendertsen van der Grift in 1662. Since "both men were, or had been, burgomasters of New Amsterdam," the tract became known as "the Burgomaster's Bouwery" (Stokes 1927: 118). Stokes places it between 14th and 24th streets and between Eighth Avenue and the Hudson River (Stokes 1916: 192). In 1679 the land became the property of the Mandeville family. (On his landmark map, Stokes cites the Jans House.)

2) Greenwich House

The Ratzer map of 1766-67 (as redrawn by Janvier 1894: 118) shows a complex of structures and gardens immediately north of the Great Kill Road, which ran along the route of the present Gansevoort Street. The structures are labeled the property of Oliver Delancy Esq. (see Figure 46). Delancy was an alderman of the city in 1758, one of Governor Tryon's Counselors in 1773, and a general in the British Army during the Revolutionary War (Lamb 1877; Leonard 1910; Booth 1859). The house attributed to Delancy on the Ratzer map is identified by Stokes as Greenwich house, built in 1700 (Stokes 1927: 157). He locates it "on the bank of the North River, between 12th and 13th Sts." (Stokes 1926: 1058). The location of the house and gardens as shown on the Ratzer map indicates that all of the Greenwich house property was located south of 14th street.

3) The Obelisk

The earliest public monument erected in New York City was built in 1759 or 1760 east of Greenwich house. It was an obelisk erected in honor of General Wolfe and others who died fighting in the French and Indian War and may have been erected by Delancy

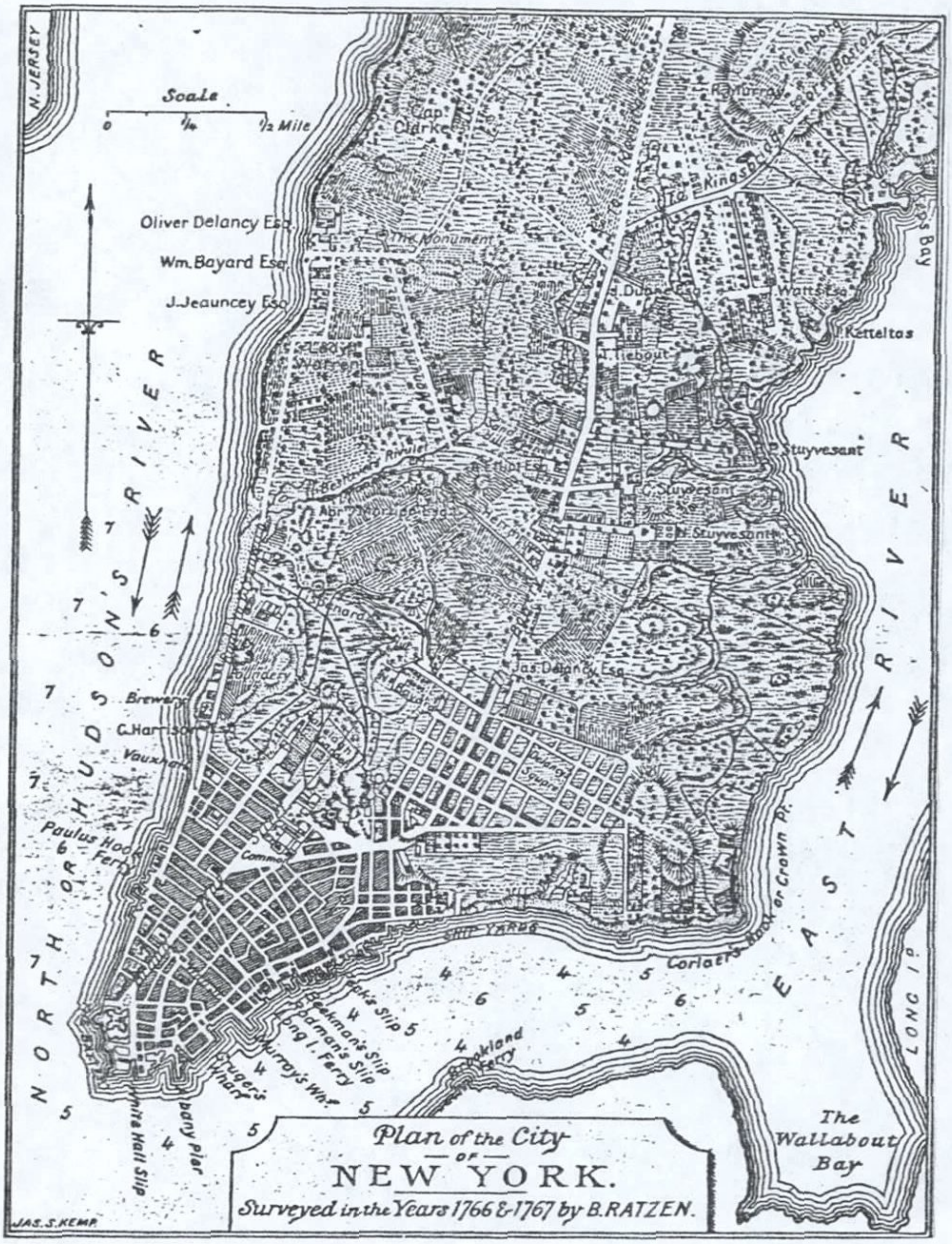


FIGURE 46. Ratzer's 1766-67 map, redrawn by Janvier for inclusion in his 1894 work entitled *In Old New York*.

himself (Stokes 1922: 716; Lamb 1977: I, 682; Johnston 1971: 238; Janvier 1894: 118). The location of the monument is given by these sources as approximately 8th Avenue at either 14th or 15th Street. It is shown on both the Montresor and Ratzer maps (Figures 19 and 46) as well as the 1778 Kitchin map (Figure 47). Its location on the Ratzer map would place it west of 8th Avenue between 14th and 15th streets. The obelisk site is thus well east of the project area.

4) 19th-Century Ownership

The 1815 *Blue Book of Farms* shows that by this date the block bounded by 9th and 10th avenues and 14th and 15th streets had been gridded into lots. Most of the land within the project area was owned by John Jacob Astor, with additional land at the corner of 14th Street and 9th Avenue owned by the Clinton family.

By 1851-52, the Perris and Hutchinson and Dripps maps (see Figures 48 and 49, respectively) show seven to nine buildings on this block. By 1854, only 13 small frame structures appear, which had commercial or mixed commercial/residential uses. Three areas were at that time used for coal- or lumberyards.

e. THIRTIETH STREET INTERCHANGE AREA

1) Couwenhoven-Scott House

The project area between 30th and 31st streets was owned by Johannes van Couwenhoven in 1675, who built a house and barn on the property. John Morin Scott purchased this land before 1764. Scott had built a house there, and Stokes notes that "in all probability the original house was Johannes van Couwenhoven's"

FIGURE 47. The 1778 Thomas Kitchin *Map of New York I* was drawn during the British occupation of New York in the Revolutionary War.

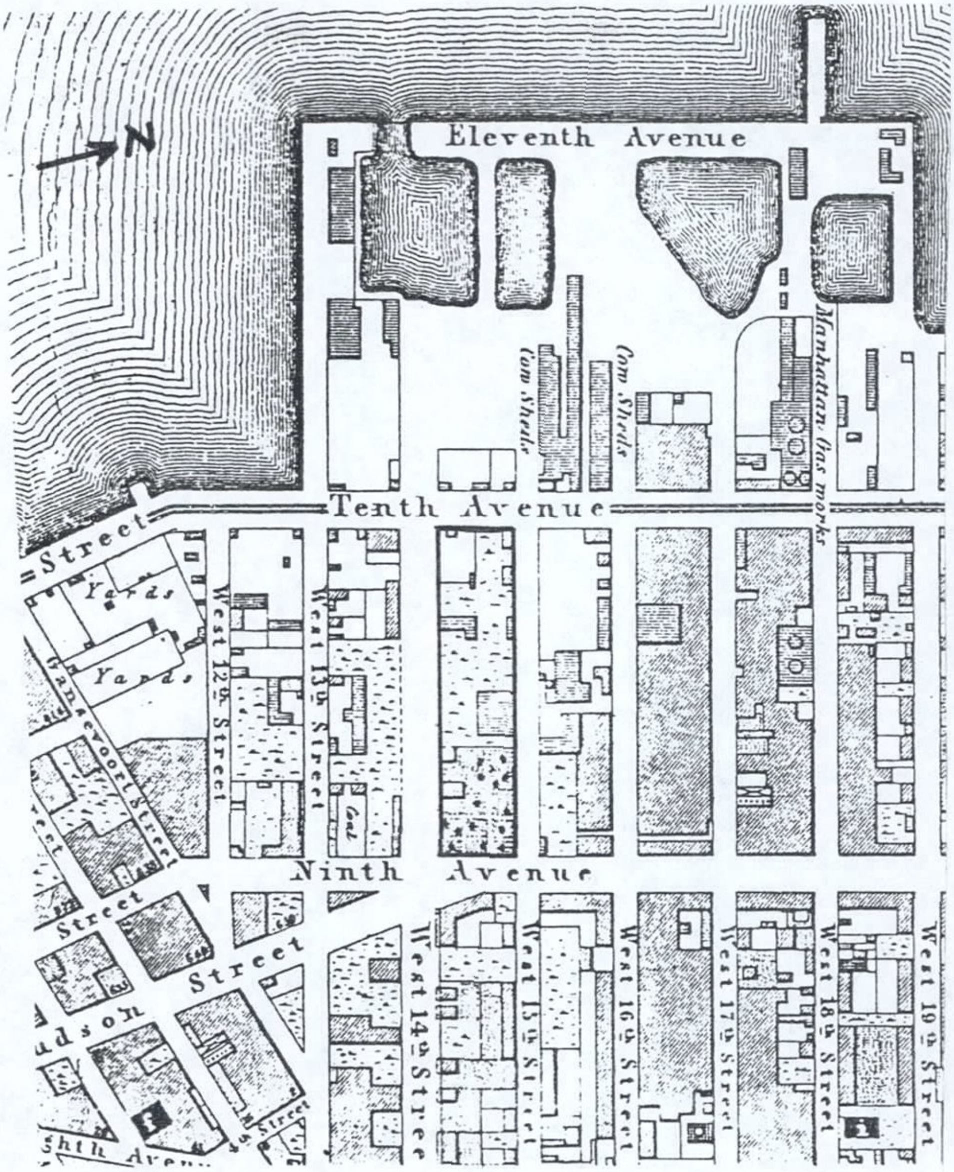


FIGURE 48. Portion of the 1851 Perris and Hutchinson map including the 14th Street Interchange Area (predominantly the block between Ninth and Tenth avenues and W. 14th and W. 15th streets). (See Figure 1 for exact project area boundaries.)

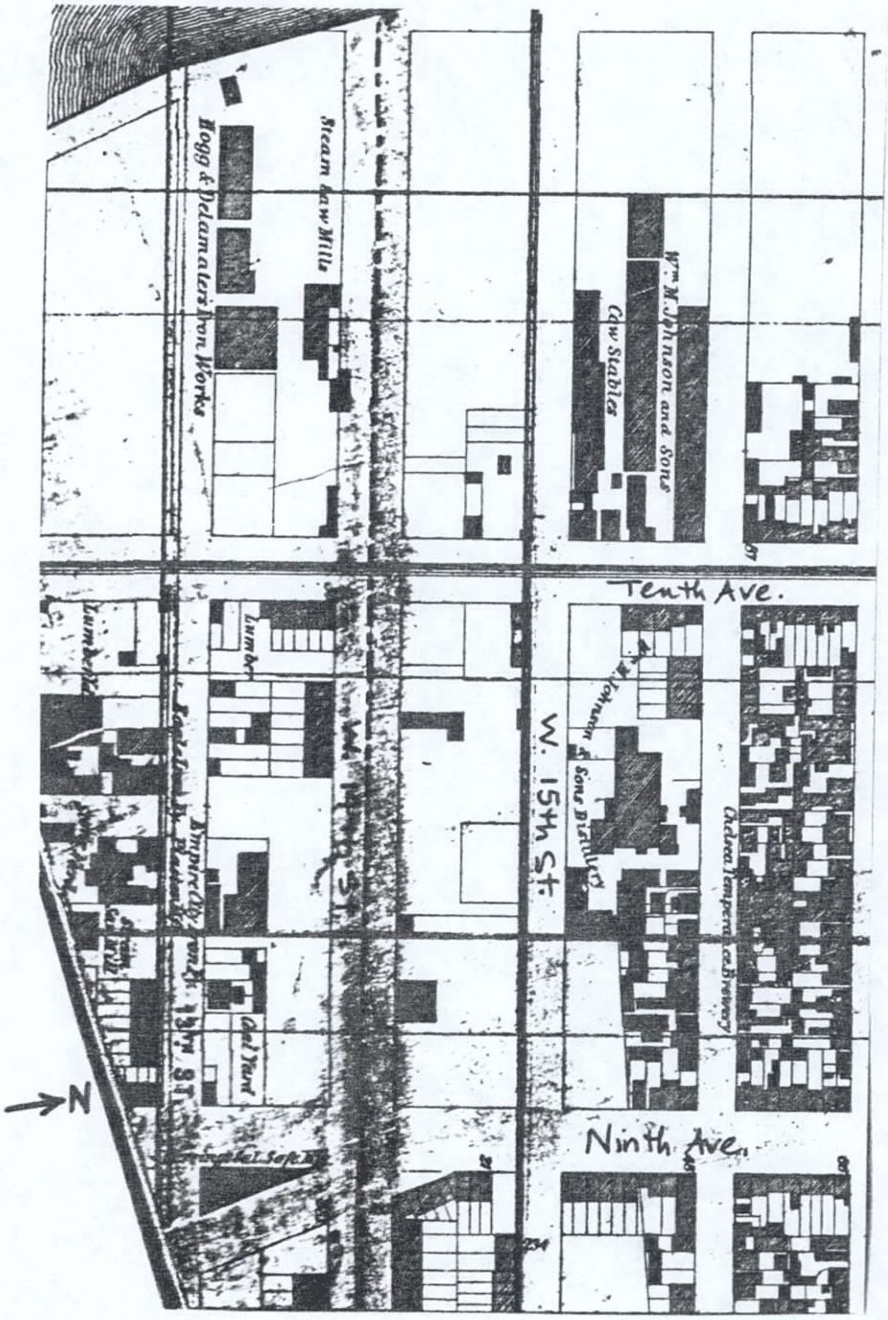


FIGURE 49. Portion of the 1852 Dripps map including the 14th Street Interchange area (most of which lies in the block between Ninth and Tenth avenues and W. 14th and W. 15th streets). (See Figure 1 for exact project area boundaries.)

(Stokes 1927: 101). Both the 1766-67 Ratzer map (Figure 46) and the 1778 Kitchin map (Figure 47) show Scott's house slightly west of the road known as the Abington or Fitzroy Road, which ran along the present route of 8th Avenue (Johnston 1971: 238). The maps show the house as being approximately 500 to 600 feet west of the road, which would place it several hundred feet east of Ninth Avenue, well east of the project area. Scott's heirs sold the property to Samuel Franklin and William T. Robinson, merchants, in 1792 (Stokes 1927: 102).

2) 19th-Cenutry Ownership and Structures

The 1815 farm map shows that most of the land within the project area between 30th and 31st streets was owned by George C. Shrapple at that time. This map also shows a farmhouse about 200 feet east of Ninth Avenue, in the same location as the Scott-Couwenhoven house previously mentioned. It also shows another farmhouse to the south and two others to the north on the same north-south line (i.e., approximately 200 feet east of Ninth Avenue, and therefore east of the project area).

The 1815 map shows the shoreline approximately 400 feet west of Tenth Avenue at 30th Street sloping westward to a point approximately 600 feet west of 10th Avenue at 31st Street. At 31st Street, a dock is shown extending west-southwest for approximately 200 feet. Portions of it could be preserved beneath the subsequent landfill that constitutes the western portion of the block between 10th and 11th avenues.

The 1854 Perris atlas shows most of the project area between 30th and 31st streets taken up by facilities of the Hudson

River Railroad, including a blacksmith shop, a machinist's shop, a forge, and stables. A row of brick structures on the east side of 10th Avenue included Budds Hotel on the southeast corner of 31st Street and 10th Avenue.

4. Historic Cultural Period: The Project Area in the Industrial Era

a. DEVELOPMENT OF WATERFRONT TRANSPORT FACILITIES

1) Introduction

a) SCOPE OF STUDY

(1) Project Area in Perspective

The Port of New York consists of 47 harbor areas, the generally accepted boundaries of which, defined by the Port Authority of New York and New Jersey and the U.S. Army Corps of Engineers, are the Port Chester Harbor on the east; the north shore of Long Island Sound, the Bronx River, and the Harlem River on the north; the Passaic River and the navigation limit on the Raritan River on the west; and the Raritan River and Sandy Hook Bay on the south. Because it has historically provided a direct link to Manhattan for both the passengers and freight of the ferry, steamship, canal, and railroad companies, the project area along West Street must be considered the core of this larger port area.

Physically, New York Harbor has ideal harbor conditions, containing, as it does, a well-sheltered deep-water approach via the Narrows and a relatively small tidal fluctuation of 4.75 feet. The Hudson River is the backbone of the port, but other waterways--natural and man made--determined the complex regional transportation network that by the late nineteenth century had been complemented and compounded by the railroads. New York was a magnet for the iron rails, whose routes were influenced by the region's physiography. The

4.5-mile long Westway study area became the economic focal point of the region and the nation--indeed, the world--for well over a century.

(2) Types of Facilities: Definitions

This section of this report deals with the facilities constructed within the study area to accommodate the various methods of transportation peculiar to the waterfront. It concentrates on those constructions which were intermediaries between the actual vessel or vehicle which accomplished the move and the shore proper. Although the various transportation objects involved in this process are described herein, the intention is to provide a history not of ships, railroads, or other vehicles of transportation but rather of the built environment that accommodated them. In general, the following narrative discusses the fabric of the West Side docks in a progression, over time, from the east side of West Street westward to the various subsequently developed pier lines.

The term "dock" generally refers to the activity of loading and unloading ships as well as to the structure on which that activity takes place (see Figure 50). The building of such waterfront facilities undoubtedly can be traced at least to the Babylonians, Egyptians, and Mesopotamians of 4,000 B.C., all of whom possessed navies. Although the construction methods are not exactly known, records of Egyptians dock-building date to 3,200 B.C. Perhaps the most sophisticated of such waterfront facilities of the ancient world were built at Carthage by the Phoenicians. Originally a dock was a basinlike

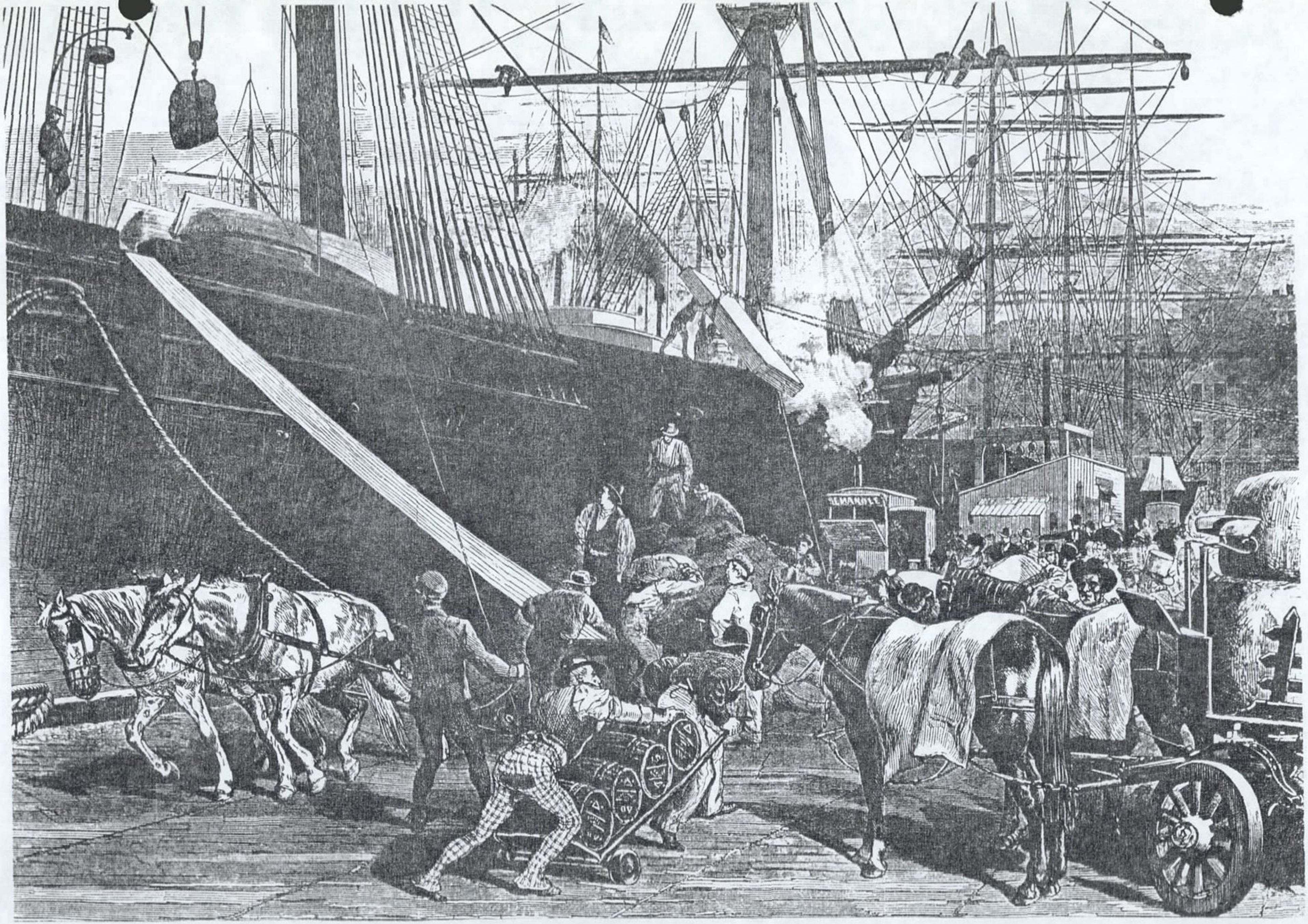


FIGURE 50. Drawing from *Harper's Weekly* (as reproduced in Grafton 1977: 234) showing stevedores unloading a ship in 1877.

enclosure used for many purposes, including building and repairing ships (dry basins) and providing berthing space for ships in the normal course of traffic and cargo transfer (wet basins). Today, the sophisticated dry dock still performs the former activity. In the case of the latter function, a group of structures evolved--e.g., quay, wharf, pier--each especially designed for a given purpose. Integral to the development of these structures have been considerations of water depth for berthing and of the value of waterfront real estate.

A quay wall is perhaps the oldest and most common form of dock. It is simply a retaining wall built along the shore which is topped with a deck or platform to serve both as a barrier to protect the shore and as a ship loading and unloading facility. Until the mid-nineteenth century, quay walls were built of stone masonry. Later, concrete was adapted to the purpose, specifically hydraulic portland cement. Structurally, the main design problem of the quay is the lateral force exerted by the back fill, the traditional solution to which relied on the mass of the stone wall. Engineered solutions are now achieved with lighter constructions of tiebacks and braced trestle frames. The docking costs inherent in quay walls are high because of the large amount of waterfront space that they occupy. Because of this fact, few quay walls were built in the study area.

A wharf is a structure that extends parallel with the shore, is connected to the shore, and usually provides berthing only at its outshore face. The wharf is designed to obtain greater dock depth without the expense of building a quay. It is usually a timber-framed, open-trestle-mounted platform, relatively small and narrow in size and affording limited berthing. With the increasing length of steamships, the more economical pier-bulkhead system was developed to replace the wharf.

A pier is a platform structure extending into navigable water at an angle to the shore. In most cases it provides berthing on both sides and functions as both a mooring facility for securing vessels and a transfer platform for cargo and passengers. Its principal parts are its deck and its supporting platform. Piers may be of solid fill construction, open construction (on piles), or a combination of the two. The area of water between piers is a slip, and the quay wall at the shore end is called a bulkhead. Piers are sometimes covered with sheds to shelter loading and unloading activities and/or to provide storage space. The structure built along the bulkhead, normal to the finger pier, is called the headhouse, and it is through the headhouse that the covered pier is entered.

Appurtenances to docking facilities include various deck fasteners: bitts, cleats, chocks, and bollards to hold mooring lines; and winches and capstans for pulling the hauling lines. Impact and abrasion to the structures is absorbed by fenders. Various cranes, hoists, forklifts, chutes, conveyors, and elevators are utilized to transfer freight to and from the dock structures.

The most sophisticated vessel-to-land docking arrangement was developed for the ferry service between the West Side of Manhattan and the New Jersey waterfront. Adjustable aprons, buffer platforms, spring piling, and the ferryhouse itself were developed to facilitate the movement of passengers and vehicles on and off the ferryboats. The railroads further adapted this transfer method in the float bridge, which permitted box cars to be driven up onto a tracked barge and pushed or pulled by tug to another part of the port. Freight, broken down on piers and placed in scows or barges, and also moved by tug, is termed lighterage. The car float system introduced in the 1860's did not replace lighterage but rather coexisted with it--i.e., both methods were employed throughout New York Harbor.

(3) Methodology

The histories of New York City that deal with its rich maritime past were consulted chiefly in the library of the South Street Seaport Museum. A physical construct of the study area was developed by comparing the numerous historic maps gathered by the HCI research team. Although these maps vary in the amount of information they contain on the offshore structures, they do generally indicate changes in land form and shifts in pier functions. The Dripps 1852 *Map of the City of New-York Extending to Fiftieth Street* and Bromley's 1908 Atlas *Map of Manhattan Island* ... were referred to frequently because they offer a 50-year comparison and because they are generally acknowledged to be accurate documents. Perhaps most informative, and certainly very entertaining, was Galt and Hoy's c. 1879 illustration of the city and its immediate environs as if seen from a balloon over the Upper Bay. Specific to piers, the Harbor Commissioners' map of c. 1857 (Kurth and Rosa 1857), the Daniel Ewen waterfront maps of 1827-30, and the Department of Docks map of 1873 provided reliable information. Most detailed of the maps was the *North River Volume of the Survey for the Commissioners of the Sinking Fund* 1867.

The West Street file of photographs and illustrations from the New-York Historical Society was examined, and the South Street Seaport Museum's photographic collection was reviewed. The iconography of the project area is very rich, and the present project permitted a sampling rather than an exhaustive search. The following text is enhanced by some of these images.

General information on ports and harbors, which also included specific references to New York, were researched at the Annex to the New York Public Library. These included L. F. Vernon-Harcourt's *Harbours and Docks* ... of 1885, and R. S. MacElevee's books entitled *Port and Terminal Facilities*, 1918; *Wharf Management, Stevedoring and Storage*, 1921; and *Port Development*, 1925. A comparison of early twentieth-century ports, including New York, was contained in B. Cunningham's *Port Studies* of 1929.

Previous research efforts by HCI on waterfront facilities of railroad companies on the New Jersey side of the Hudson River provided an entre to information regarding the railroad companies in the present study area. John Droege's *Freight Terminals and Trains* (1912) and *Passenger Terminals and Trains* (1916) were used. Some piers were illustrated in section in Walter Berg's *Buildings and Structures of American Railroads* (1893). The baseline for this record of activity was Gratz Mordecai's lengthy-titled *A Report on the Terminal Facilities for Handling Freight of the Railroads Entering the Port of New York, Especially of those Railroads Having Direct Western Connections*, written for *The Railroad Gazette* in 1885. A microfilm of this document was examined in the New York Public Library.

A final valuable research tool was the work reported herein in Section II, C, 2 by Leo Hershkowitz, historian at Queens College and a primary investigator on this project. His study of the petitioning process for waterfront improvements on the West Side between 1800 and 1860 was extremely illuminating to the present topic. His background data on the evolution of the West Side waterfront and the development of West Street were invaluable assets, and have been included in the present section where applicable. The reader is asked to pardon the repetition of portions of the previously presented text; they have been included only to clarify the present discussion.

b) ORIENTATION

(1) City Grids

Although the project area is located in Manhattan, noted for the rigid street grid that covers most of the island, the corridor under study falls within the multi-oriented grids of the downtown area. West Street itself, as it progresses generally northward, takes a number of turns and bends (see Figure 1). As a linear corridor, West Street is interrupted by landfills at Gansevoort Street, where the incinerator is located, and at W. 23rd Street, where the ferry terminals were located.

A total of six various grids intersect West Street from the east. Battery Place, Morris, and Rector streets are of one inclination. The streets between Carlisle and Chambers streets are a second. A third extends from the Reade-Duane street area northward to Barrow

Street, where the two Greenwich Village grids--from Christopher to Bank Street and from Bethune to Gansevoort Street--continue northward. From this point, north of Little W. 12th Street to W. 44th Street, the main Manhattan grid pattern is followed to the northern tip of the island.

(2) Pier Numbers

In analyzing the offshore structures within the project corridor, it was necessary to make reference to the adjacent street names because of the changing numbering systems adapted for the piers.* Before the establishment of the Department of Docks in 1870, piers 1-54 spanned from Battery Place to Hammond (W. 11th) Street. By the 1890's, the W. 11th Street designation was number 48. When Gansevoort was dredged at the turn-of-the-century, piers 48-52 spanned to the West Washington Market at Gansevoort Street. Pier 54 was then located at W. 24th Street. In the first decade of this century, the Chelsea Piers were built between Little W. 12th Street and W. 22nd Street, creating nine new piers. They were numbered 52-63, excluding No. 55. This meant that former pier 54 at W. 24th Street became new pier 64, and that each existing pier north of this point increased its number by 10 (yielding the current 1983 numbering system).

*Using the same reasoning, in Section II, C, 2, Professor Hershkowitz also chose to refer to the waterfront facilities by their adjacent street names. In that section, the decision was also made to discuss the facilities in alphabetical order. That methodology was not followed here.

2) *Period of Exploration, Settlement, and Colonization (1600-1776)*

Without the benefit of docking facilities, the practices of unloading a ship at anchor and conveying cargo or passengers ashore were accomplished via smaller, shallower vessels. This method was undoubtedly used during the periods of exploration and early settlement in New York. By the mid-seventeenth century, a preference existed for anchorage in the more protected East River. A floating dock on De Heere Gracht (Broad Street Ditch) was built to serve as a transfer point between the intermediate vessel and the shore. In 1647 the first stable pier was built by constructing a timber cribbing and filling it in with rocks (Condit 1980: 13). This structure may have been located at Schreyer's Hook. A second, larger pier was built at the foot of Moore Street, also in the East River, in 1659, perhaps of different construction inasmuch as it was called "the Bridge." Its construction followed the initial straightening at the waterfront by filling. This manipulation of the shoreline, which yielded a uniform water depth from Stadt Huys to the De Heere Gracht, commenced in 1654, when a weighhouse was also built along the East River (WPA 1941: 33).

Ferry service was first established to Brooklyn in 1638 between Peck Slip and Fulton Street. By 1661 Willem Jansen provided ferry service to New Jersey from the Battery area to Communipaw, Jersey City. Initial vessels were rowboats and canoes, and service was on demand. Flat-bottomed sailboats were also adapted for people, animals, and wagons alike.

In 1664, the British took New Amsterdam from the Dutch and renamed the city New York. The De Heere Gracht was filled in and the resultant wide street was named Broad Street. New docks of stone were built from Coenties Slip to Whitehall Slip, and a new city hall was constructed in 1675. Preference for the East River over the Hudson, or North River, continued during British colonization in the last quarter of the seventeenth century.

In March of 1701, the Common Council appointed a committee to provide for convenient streets, wharves, and slips to be constructed on land between high water and low water on the Hudson River, basically to accommodate the petitions of several individual proprietors who owned the land along the river. The result was some improvement of the lower parts of Greenwich Street, principally by the extensions of title to land 200 feet beyond high water (MCC 1675-1776: II, 138-39).

In 1730, the Montgomerie Charter officially extended the shoreline of the city 400 feet from the low water line into the Hudson and East rivers. For the Hudson, the grant ran from the Bestaver's Killitie or riverlet, which emptied into the Hudson at present Charlton Street, to the tip of the island at Fort George, site of the present Custom's House. A series of private grants were made by the city between 1739 and 1770 from Marketfield Street (Battery Place) to the Albany Basin between Albany and Cedar streets, none of which extended beyond the 400-foot low water mark of the Montgomerie Charter (MCC 1675-1776: III, 89-90, 93; IV, 167-68).

The first dock construction on the Hudson River, c. 1730 (Condit 1980: 13), included Ellison's Wharf north of Cedar Street, Thurman's Slip between Liberty and Cortlandt streets, Comfort's Dock at the foot of Thames Street, and Ell's or Elde's Slip at Battery Place near Broadway. Dey's Dock was south of Dey Street and was built in 1743 (Stokes 1918: 988, 989, and 991). These sites are generally one to two blocks east and outside of the study area.

The first regular ferry service between Paulus Hook, Jersey City and New York was instituted in 1764. Landing at the east side of the Hudson took place at Mesiers Slip, which was built for the ferry at Cortlandt and Washington streets. Two years later, another ferry to New Jersey was established at Thames Street. A wharf known as King's Wharf was established between Cortlandt and Dey streets at Washington Street before 1767. Between 1771 and 1775, the Corporation Dock was built at Fulton and Greenwich streets. The Hoboken Ferry was established there in 1775.

Thus, at the time of the Revolutionary War, the construction of docking facilities on the Hudson River had concentrated between Thames and Fulton streets and along Greenwich Street to Cortlandt Street, where it projected out almost to Washington Street. South and north of these areas the shoreline was little improved. The East River continued to be preferred for docking over the Hudson. Most port activity and regular ferry service ceased with the outbreak of war.

None of the docking facilities just mentioned dating from the period of British colonization is within the present Westside Highway study area. Nor do any known facilities dating from the earlier period of exploration and settlement exist in this study area. However, the construction associated with the Battery Tunnel connection which occurs at Greenwich Street does possibly affect Colonial era docks.

3) The National Era (1776-1830)

a) EFFECTS OF WAR ON THE HARBOR

In the course of Revolutionary War, only the Hoboken Ferry (in 1778) reestablished its service. George Washington returned to New York in 1783 to find the city devastated from fire, neglect, and enemy occupation. Port facilities were in a state of decay and disrepair. The commerce and shipping once spurred by Colonial enterprise had stagnated (Bunker 1979: 16).

In the second half of the 1780's, a pier was built at Fulton and Washington streets (1785), a dock was constructed between Dey and Cortlandt streets (c. 1787), and Mesier's Slip was renamed Cortlandt Slip (1788) (Stokes 1918: 989-91). Congress passed the nation's first maritime legislation in New York in 1789 (WPA 1941: 78). The port's advantages were quickly realized as rebuilding coincided with the search for new trading ties. Locally, the most ambitious undertaking of this time was the building of the Albany Basin Piers from Thames to Cedar streets in 1791 and the subsequent basin between them in 1796. Thus was built what was perhaps the first substantial dock building of the new nation on the Hudson River.

b) CREATION OF WEST STREET

The Common Council in 1795 and 1796, expressing fear that indiscriminate water lot grants could prevent the drainage of water from the interior streets into the river, passed an ordinance creating an outer street of the city 70 feet wide beyond which no grants ought to be made and no buildings erected. In 1798 this outer road was officially called West Street, but it was also known as the Seventy-foot-Street. City officials expected an improvement in public health and increased safety to ships as a result of the ordinance, which also provided that piers could be constructed but only in such a way as to allow for the ebb and flow to wash away all dirt and impurities (MCC 1784-1831: II, 214-15, 420-21; III, 397-98).

In 1799, another ferry was established to Hoboken from Christopher Street, where construction of a new state prison had begun in 1796. Before 1797, docking facilities were constructed at Liberty Street (Barden's or Lindsey's Wharf), between Albany and Rector streets and Washington and West streets (Pollack's Wharf), between Park Place and Murray Street and Washington and West streets (Rhinelander's Basin), between Harrison and Jay streets at Washington Street (Rhinelander's Dock), and at Park Place between Washington and West streets (Rhinelander's Wharf). By the turn of the nineteenth century, piers and other harbor facilities had been constructed in the North (Hudson) River along Greenwich and Washington streets to about Chambers Street (Condit 1980: 14), with some movement beginning westward between Washington and West streets.

By 1800, the concept of West Street was established. It was not until somewhat later in the nineteenth century, however, that Manhattan's land mass was extended westward and the street and bulkhead were constructed. In 1790, the Port of New York was handling 5.7 percent of the value of the nation's foreign trade (Chinitz 1960: 9). This percentage soared during the nineteenth century, and the intensely concentrated docking facilities along the Hudson River played a pivotal role in this development.

In 1803 the Paulus Hook Ferry was reestablished at Cortlandt Street, and in 1805 a ferry was inaugurated from Vesey Street to Weehawken, New Jersey. Again, the ferry boats at this time were either sailboats or rowboats, or some combination of the two. Most common were the pirogues, or twin-masted boats with pointed ends, capable of carrying both passengers and cargo (Solberg 1982: 12). The impact of steam navigation and the technological innovations involved in its development on Hudson River ferry service were only a few years away. John Stevens had already patented the true reciprocating steam engine and the vertical water tube boiler in 1791, and by 1804 he was operating a paddle wheel steamboat between his estate in Hoboken and New York.

c) EFFECTS OF STEAMBOAT TECHNOLOGY

Stevens' innovations were capitalized upon by Robert Fulton, who inaugurated steamboat service between New York (at a point near the State Prison) and Albany with the *Clermont* on August 17, 1807 (Bunker 1979: 69-70). Stevens' response to Fulton was the more impressive *Phoenix*, which braved the Atlantic Ocean in a successful voyage between Hoboken and Philadelphia in 1809; of the two inventors, however, it was Fulton who attracted financial backing. Thus, within the first decade of the nineteenth century the stage was set for a transformation of the New York waterfront from sail to steam power.

In 1807 the State Legislature in Albany appointed a commission to plan for the growth of the city. Its major concern was real estate development, and subsequently a plan was devised to organize Manhattan into a system of streets and avenues. This relentless grid plan was drawn up and published in 1811 as the *Map of the City of New York and Island of Manhattan as Laid Out by the Commissioners*. With many revisions, this document was to govern the physical growth of New York for over a century. The map, however, is not an accurate depiction of the city at any time in its history.

Important dock constructions occurred during the first decade of the nineteenth century. These included the Reade Street pier (1805); the Corporation Basin between Fulton and Dey streets at Washington Street (1806-1807); the Carlisle Street Wharf between Washington and West streets and Dean's Dock at Murray Street (before 1807); piers at Jay Street and Fulton (then Partition) Street at West Street (1808); and the Canal Street Basin from Broome (Hoboken) to Spring streets (1810) (Stokes 1918: 983-91).

The growth of New York as a port was dealt a temporary setback by President Thomas Jefferson in 1807, when he issued an embargo prohibiting American ships from leaving port for foreign trade and foreign vessels from taking cargoes from U.S. docks. To say the least, this act devastated all American ports, not only New York.

James Madison repealed the embargo in 1809 and the maritime activity recovered.

But, over the opposition of New York merchants and shipowners, new agression was on the horizon and posed another problem. As the nation prepared for war with England, the Hudson riverfront sprouted fortifications to protect the city. These included the South Battery, the North Battery or "Red Fort" off Hubert Street (see Figure 51), and Fort Gansevoort as the "White Fort" at the foot of Gansevoort Street. All were solid landfill. The batteries were reached by bridges, whereas Fort Gansevoort was a rectangular extension to the shoreline.

Ocean shipping continued to tie up along the East River. Even as late as 1813, the Common Council reflected that it was "...much more hazardous to vessels to lie at wharves in the winter at the North than the East Side" (WPA 1941: 118). Ice and northwesterly winds were among the acknowledged North River hazards. Even the 1811 Commissioners map envisioned only five major docking facilities on the Hudson: the Albany Basin, the Corporation Basin and Dock, the Duane Street Basin, the Canal Street Basin, and Townsend's Dock at Twelfth Street. West Street is shown as the "outer street" envisioned at the end of the last century, running from the Battery to Christopher Street at the State Prison. The continuity of the street, however, was to be broken by the four basins. The shoreline north of Christopher was irregular, and, with the exception of Townsend's Dock, it was seen as unimproved. The plan contrasts to the very regular "paper grid" of the streets and avenues east of West Street.

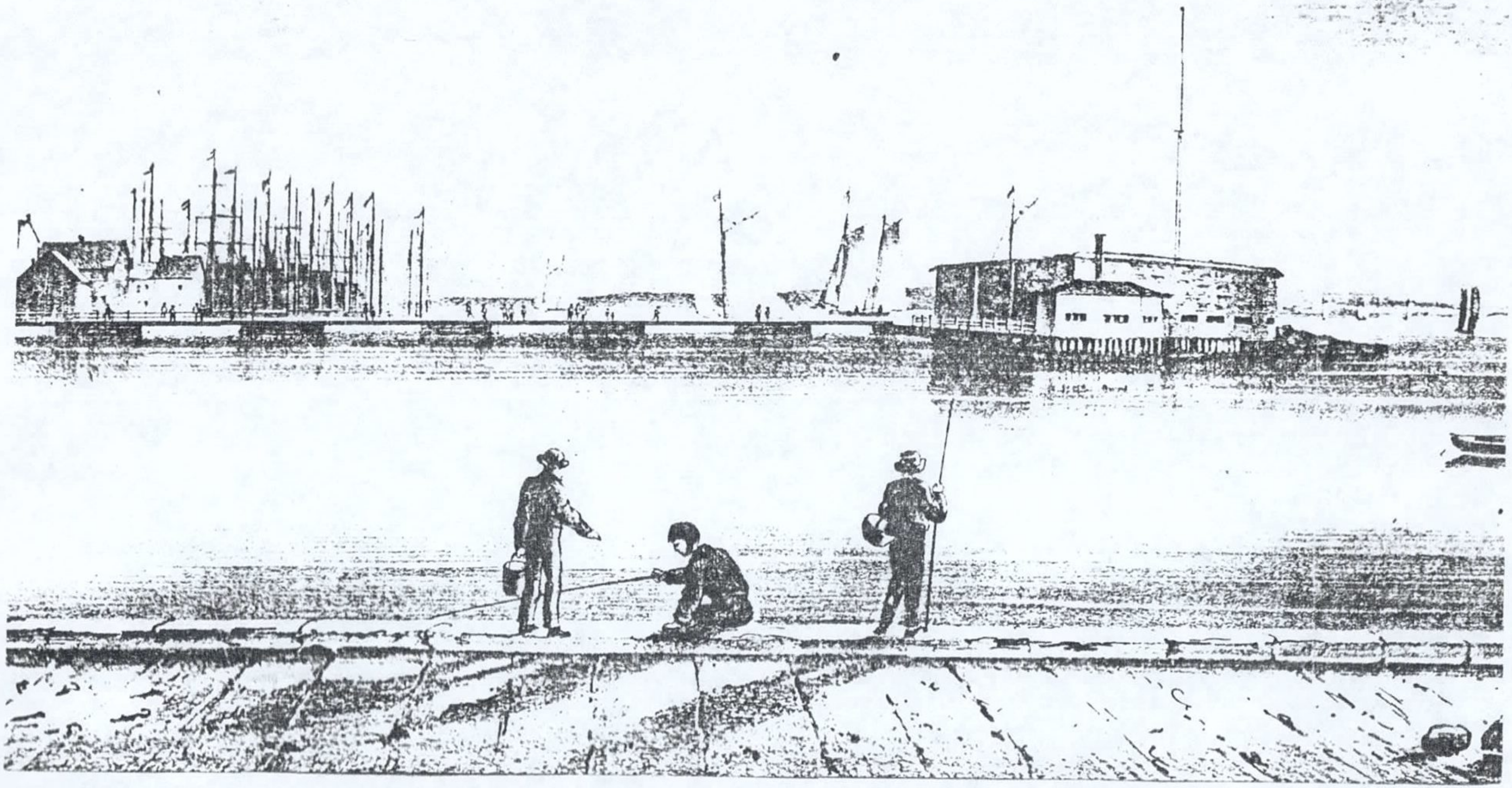


FIGURE 51. Portion of drawing entitled "NORTH BATTERY, FOOT OF HUBERT ST. LOOKING SOUTH, 1820" (Collections of the Museum of the City of New York, No. 8591). Note block and bridge access, solid-fill fort foundation, and pile-supported appendages.

The process of filling-in and straightening West Street was usually initiated by petitions addressed to the Common Council from involved property owners and merchants asking that basin be filled in or a pier erected. In this way the distance between Washington Street and West Street was increased from the original 160 feet to 200 feet. Still, the 70-foot dimension of West Street remained as before.

The years of the War of 1812 saw continued developments by Stevens and Fulton in steamboat technology, and the resultant evolution of docking facilities on the Hudson--the latter in response to the former and to the actual extension to West Street. The Corporation Basin, for instance, was filled in 1812 for the Washington Market, and the Albany Basin was partially filled in 1813 (Stokes 1918: 988-89).

In 1808 Fulton, along with Robert Livingston, secured a 30-year monopoly on steamboat operation on the East and Hudson rivers, which was not overturned until 1824 by the U.S. Supreme Court (Solberg 1982: 13-14). In defiance, Stevens initiated the first regular Hudson River steam ferry service in 1811 between Hoboken in New Jersey and Vesey Street in Manhattan. Fulton responded in 1812 with steam ferry service on the Paulus Hook ferry, reconstructing a slip at the Cortlandt Street pier for his vessels (see Figure 52). Under pressure, Stevens withdrew his service in the same year and dismantled his boat. Fulton's first East River steam ferry was the Peck Slip to Fulton Street, Brooklyn service established in 1814.

Fulton, operating out of a foundry and dry dock in Jersey City, constructed the *Jersey* and its sister ship the *York*. Both were operable by 1813 and were controlled by an association later known as the York

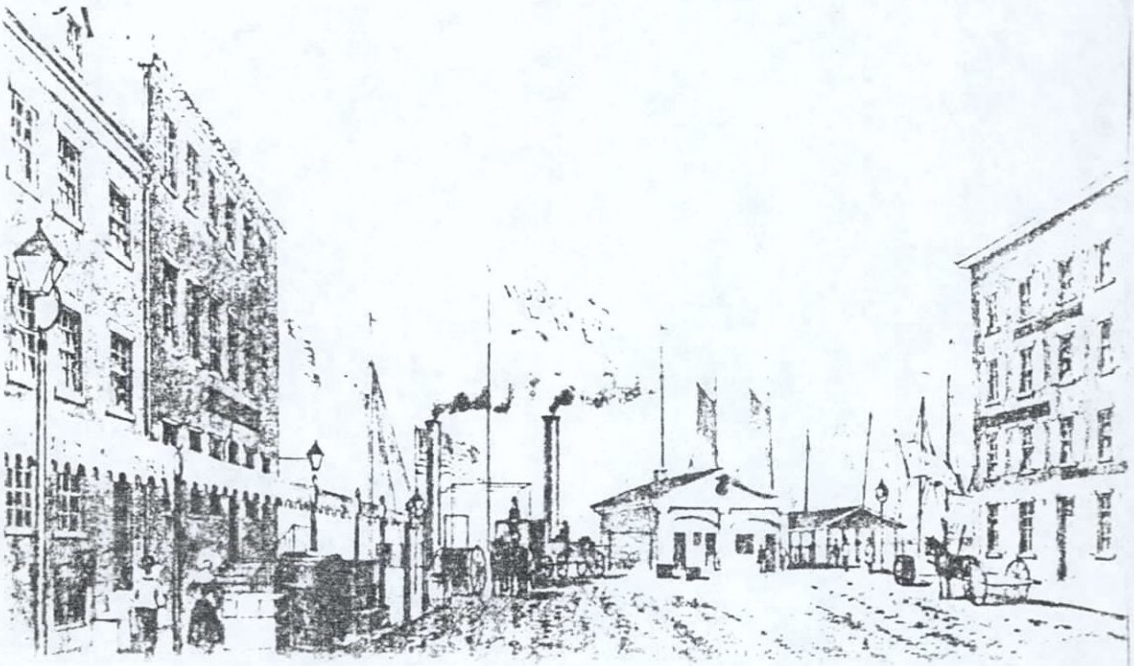


FIGURE 52. Fulton's Ferry to Paulus Hook, New Jersey at Cortlandt Street, 1831 (Collection of Museum of the City of New York, No. 8602).

and Jersey Steam Boat Company (Winfield 1874: 250; HCI 1977: 65). The best description of the *Jersey* is given by Fulton himself:

> She is built of two boats, each ten feet beam, eighty feet long and five feet deep in the hold; which boats are distant from each other ten feet, confined by strong transverse beam knees and diagonal braces forming a deck thirty feet wide and eighty feet long. The propelling waterwheel is placed between the boats to prevent it from injury from ice and shocks on entering or approaching the dock. The whole of the machinery being placed between the two boats, leaves ten feet on the deck of each boat for carriages, horses and cattle, etc. The other, having neat benches and covered with an awning is for passengers, and there is also a passage and stairway to a neat cabin, which is fifty feet long and five feet clear from the floor to the beams, furnished with benches and provided with a stove in winter. Although the two boats and space between them give thirty feet beam, yet they present sharp bows to the water, and have only the resistance in the water of one boat of twenty feet beam. Both ends being alike and each having a rudder, she never puts about. (Winfield 1874: 250-52)

Steam provided better motive power than did either manpower or wind. The docking problems were the same for steamboats as for sailboats, even if more controllable. Sometime between 1812 and 1827 Fulton is credited with inventing the float bridge, the movable apron that can be raised or lowered according to tidal level or vessel draft by hoists and counterweights in order to maintain a continuous, albeit angled, plane between boat and bulkhead. At first, the float bridge aided the transfer of wheeled vehicles and animals; it was later adapted for railroad cars. John Stevens contributed the "spring piling" or funnel-shaped slip that guided pilots to safe docking when conditions were less than ideal (Condit 1980: 46-67). The impetus of steam brought about improved docking methods for the ferries, the first vessels to convert to the new motive power.

In 1818, steam towing was inaugurated in New York Harbor when the bay steamer *Nautilus* towed a corsair through an iced-up harbor and the Narrows to a quarantine dock (Bunker 1979: 72). In the following year, the *Savannah* made the first steam-assisted (it was under sailpower most of the time) trans-Atlantic crossing from Savannah, Georgia to Liverpool. Despite this early use of steam, another 30 years would pass before steam seriously affected trans-Atlantic sailing (WPA 1941: 156).

As sailing ships continued to dominate foreign trade, the preferred docking remained the East River. However, the tramp system of independently owned cargo seekers prevailed. Before 1817, the nearest thing to scheduled sailings was achieved by the British government mail service, which ran between Falmouth, England and New York approximately on a monthly basis (WPA 1941: 142). On January 5, 1818 the ship *James Monroe* was advertised to set sail for Liverpool from New York, whether fully booked or not. This event launched the famous "Black Ball Line," the first regular trans-Atlantic service of any kind (Chinitz 1960: 10). The ships were designated "packets" to distinguish them from the irregular "regular traders." The Black Ball Line was followed by the Red Star and Swallowtail lines in 1822 and by Griswold's X Line of 1823, which sailed for London. The effect of this type of business on the Port of New York as a whole was profound, although of little direct consequence to the West Side.

The impetus of the Cotton Triangle, involving Southern planters, English textile manufacturers, and New York shippers, spurred the use of New York port facilities for transshipment. On the New York waterfront, cotton bales passed fron intercoastal vessels to trans-Atlantic ships. Nothing in these transactions actually passed directly to or from New York; the port simply functioned as a "middle man." This period witnessed the concentration of services involved with maritime trade. Banks and insurance companies, as well as customs clearance agencies and travel document preparation firms, were all efficiently available in New York City. By 1830 the percentage value of the nation's foreign trade handled by New York had climbed to 37 from the 5.7 percent of 1790 (Chinitz 1960: 9).

4) The Early Industrial Period (1830-1860)

a) THE HUDSON RIVERFRONT IN TRANSITION

During the early industrial era, the Hudson River docking infrastructure was impacted greatly by transportation systems--canals, railroads, and steamships--as the New York economy was regionalized. Berthage and docking activity on the West Side began to rival that on the East River. By 1840 there were 63 wharves on the East River and 50 on the Hudson. Docking facilities were also being built in Brooklyn and Jersey City. The random wharf, quay, and pier gave way to an urbanized waterfront of bulkheads and piers from the Battery to Hammond (W. 11th) Street. Still, the construction of docking facilities was in private hands, with virtually no controls exerted by the public. The old facilities quickly became inadequate. Sand and silt sifted into the slips between the docks. In 1836 Mayor Lawrence pointed an admonishing finger at the "decaying timbers around our wharves and bulkheads that cause the spread of disease" (WPA 1941: 155). These events corresponded with the industrialization of the Hudson River.

b) CANALS

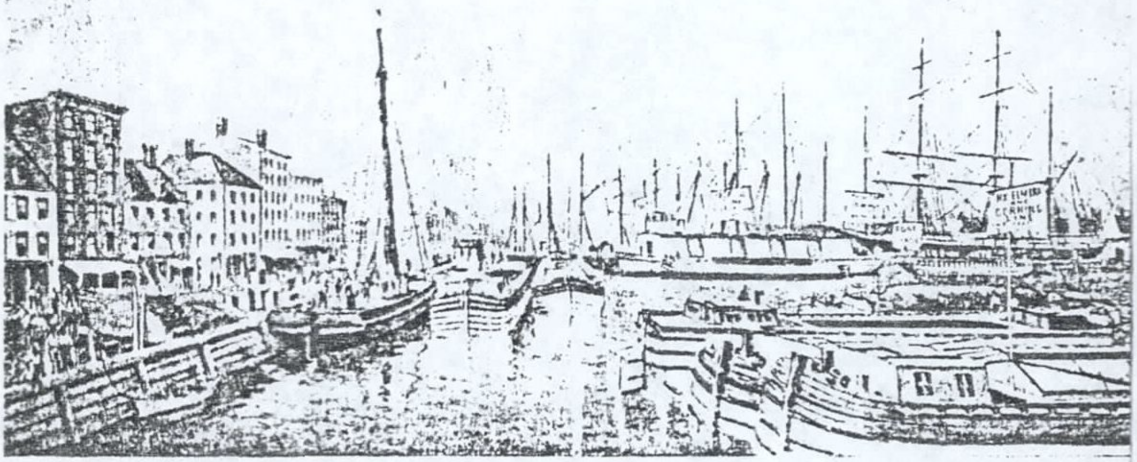
In 1825 the Erie Canal was opened with great pomp and ceremony. Eastbound came cattle, wheat, flax, liquor, lumber, flaxseed, potash, corn, rye, oats, buckwheat, and barley. Westbound went farm machinery, refined sugar, textiles, clothing, and manufactured goods of all kinds. Some items went directly from canalboat to trans-Atlantic ships at New York, which again functioned as a port of transshipment. The principal impact of the Erie Canal, however, appears to have been on domestic rather than foreign trade. The Erie Canal carried 218,000 tons of freight in 1825, a figure that rose to 1,417,046 tons in 1840 and 4,116,082 tons in 1856 (Bunker 1979: 32). The Delaware and Hudson Canal opened in 1828 from Honesdale, Pennsylvania to Rondout, New York, near Kingston on the Hudson River. Here, as with New Jersey's Morris Canal (opened to Newark from Phillipsburg, New Jersey in 1831 and extended to Jersey City in 1836) and the Delaware and Raritan Canal (opened in 1834 from Bordentown to New Brunswick), the main cargo hauled by the D&H Canal from Pennsylvania was anthracite coal. This material literally fueled the fires of the early industrial period in and around New York City, as well as in other ports via transshipment through New York.

Up and down the Hudson and in and around the harbor, strings of canal barges were now towed by steam tugs. Formerly this operation had been conducted by the steamers (WPA 1941: 130-31). The 80 X 14-foot boats of the Erie Canal (Shaw 1966: 202), the 70 X 8½-foot boats of the D&H Canal (Sanderson 1974: 72), the 90 X 10-foot canal barges of the D&R Canal (Veit 1963: 75), and first the 75 X 9-foot and later (after 1846 renovation) the articulated 87 X 10½-foot Morris Canal boats became prominent vessels within the harbor (see Figure 53). Because canal activity was closed down in winter, canal boats were commonly tied over at city wharves. The Lackawanna Coal Company leased the old North Battery at Hubert Street, then pier 38. The D&H Canal was located at the Jay Street pier 33, where a T-shaped pier is listed on the 1852 Dripps map as the "Kingston & Rondout Pier." The availability of anthracite provided by the canals corresponds to the location of New York City's iron industries along the Hudson River. A few blocks to the east, the great blocks of Greek Revival houses erected in this era in the West Village and Chelsea still survive.

By 1840 in New York City there were 417 commercial establishments involved in foreign trade, plus thousands of dry goods, grocery, and general merchandise stores, all consuming, to varying degrees, merchandise brought into the city. Also located here were 173 leather factories, 11 distilleries, and 7 sugar refineries (Bunker 1979: 30). The Erie Canal had made the raw materials of the immediate Midwest accessible to New York City, where they were processed and the resultant variety of products were distributed.

c) STEAMBOATS

Contemporary with this proliferation was an influx of immigrants, willing and able to provide labor for the rapidly expanding economy. During a seven-year period in the 1840's, at the time of the Great Famine in Ireland, over 1.5 million Irish emigrated to the United



HUDSON RIVER CANAL BOATS AT THEIR DOCKS ALONG WEST STREET, NEW YORK. WATER COLOR DRAWING BY F. S. COZZENS FOR VALENTINE'S MANUAL.

FIGURE 53. Watercolor drawing for 1921 Valentine's Manual by F. S. Cozzens showing Hudson River canal boats at their docks along West Street (Collection of the Museum of the City of New York).

States, mostly through the Port of New York. In 1847 the State of New York established by legislation the Immigrations Commission, which would eventually (1855) occupy Castle Clinton (Bunker 1979: 94). Some steamship companies, such as the Inman Line, launched a new fleet of fast ships in 1850 aimed at accommodating the incoming hordes. In Inman's case, the increased business corresponded with a shift in its base of operations from Philadelphia to New York.

The great steamships were coming to New York. Berthing was favored along the Hudson River, and it concentrated, c. 1850, at four areas where the longer "finger" piers were located: the Battery to Morris Street; at Cedar to Albany streets; at Cortlandt to Chambers streets; and at Canal Street. From Spring Street north to W. 11th Street were located shorter docks (except at Clarkson Street), near the lumber, iron, packing, and refinery activities. These shorter docks were generally 250 feet long and 30 to 35 feet wide, having various forms at pier ends. They accommodated ships and canal boats rather than steamers. The speedy packet boats, which reached their peak of activity between 1835 and 1840, eventually yielded to the trans-Atlantic steamers, for which the Hudson River docking facilities were rebuilt. The East River at last released its grip on shipping. However, shipbuilding was still almost exclusively an East River activity.

The opportunity of the West Side to develop as the main docking center for the steamship was facilitated by many events. Perhaps the most catastrophic was the December 1835 fire on Wall Street. Fanned by high winds, the fire consumed some 700 buildings (WPA 1941: 152).

Hardest hit were shipping facilities, wholesale and dry goods establishments, and other commercial structures. The fire followed the economic depression of 1833-34, when, after a long period of growth, there had occurred a temporary lull in port activity. Recovery was short in coming.

Trans-Atlantic mail service was handled by the steamship companies, which received government subsidies for doing so. Until the mid-1840's, U.S. mail was carried via foreign lines and principally by the Cunard Line. In 1847 the U.S. Post Office put its New York to Liverpool service out to bid to provide competition for the Cunard Line. The award went to the Collins Line of New York, owned by E. K. Collins. Collins had established the first New York to New Orleans packet service in 1832 and had begun trans-Atlantic crossings on his Dramatic Line in 1835. To carry the mail, he had new steamships built, and in 1852 the *Baltic* set the New York to Liverpool record of 9 days, 13 hours. In a wave of bad luck, however, the Collins Line lost two ships in 1854 and 1856, and by 1858 the company was out of business--a victim of both ill fortune and Congress, which cut its subsidy in half (Bunker 1979: 116).

The Panic of 1857 set in motion the beginning of the end for American shipbuilding and operating in the ocean. The Port of New York, however, continued to handle the nation's commerce, regardless of the flag under which the cargo came (Albion 1970: 386), and it came under many flags. Samuel Cunard, the Halifax shipowner, built a fleet of the best steamers in 1847-50 to compete with the Collins Line. The decade of the 1860's witnessed the arrival of the French and German companies.

The Gold Rush to the West produced a dual-legged steamship service between New York and Panama and between Panama and San Diego or San Francisco. The former opened in 1847 as the U.S. Mail Steamship Company; it was followed one year later by the Pacific Mail Steamship Company (Bunker 1979: 28). By the mid 1860's, steamboats to California berthed at pier 43 at Spring Street within the Canal Street hub. Steamboat service to other coasts and ports by 1852 included lines to Havana and Chagres from piers 2 and 30; Coastal Steamer van to Boston vial U.S. Mail Line from pier 2; Boston and Fall River Line from pier 3; to Charleston from pier 4; to Philadelphia from pier 12; Boston, Lowell, and Lawrence from pier 18; and Hudson River lines at piers 14 and 24. Steamboats for Newark berthed at pier 26 and the Johnston's Line, pier 19.

The Fall River Line established service between Fall River, Massachusetts and New York as the Bay State Steamboat Company in 1847. This event followed the completion of the railroad between Fall River and Boston two years earlier.

Additional steam ferries were established after the Fulton monopoly was overturned. Another Hoboken Ferry was placed in service at Canal Street in 1824, and then at Hoboken Street in 1828. A third ferry to Hoboken opened at Christopher Street in 1841. Other ferries from Canal Street were established as well: to Jersey City and Fort Lee in 1849: and to Bulls Ferry (North Bergen) in 1853. In 1852 the Bulls ferryboats were landing at 39th and 86th streets (Stokes 1918: 942, 943). Ferry service remained in the hands of non-railroad-controlled companies until c. 1854. Even as the railroad companies encroached on the Hudson River services, many other ferries retained their independence. The Stevens family was involved in the Hoboken Ferry, for instance, into the 1850's. Hotels appeared within the blocks to Washington Street, adjacent to the ferry landings along West Street.

d) EARLY RAILROADS

The railroad companies of this early industrial period of 1830-1860 were, of course, the third transportation system, after canals and steamboats, to impact the West Side waterfront. They arrived into the study area in two ways. The first was the mainline of the Hudson River Railroad, which enjoyed direct access to Manhattan. The second consisted of the three companies which had mainlines terminating on the west shores of the port: the Camden and Amboy Railroad, the New Jersey Railroad & Transportation Company, and The Erie Railroad. At South Amboy and Jersey City, New Jersey and at Piermont, New York these railroads transferred passengers and cargo to steamboats, which docked and discharged their contents along Manhattan's West Side.

The Hudson River Railroad (HRRR) was organized in 1847, and John Jarvis was appointed its chief engineer. That year the Common Council gave permission to lay a double track (initially a single track) of rails from Chambers Street at Hudson Street, up Hudson to Canal Street, from Canal to West Street, thence along Tenth Avenue to 30th Street, and over to Eleventh Avenue at 32nd Street. From that point the line was to run along the river to the Spuyten Duyvil's creek, where it was to cross on a bridge and extend to Poughkeepsie along the east bank of the Hudson River. Thirtieth Street was established as the locomotive limit, and stations were to be erected at 31st Street and at Chambers and Hudson streets (Harlow 1947: 142-43).

The Spuyten Duyvil Bridge was not completed until 1853, but the line from Canal Street to Poughkeepsie was in service in 1849. Its impact on the West Side waterfront was phenomenal. The Hudson River Railroad was the first company to serve the waterfront docks directly. The result was the intensive commercialization and industrialization of the corridor from Battery Place to 72nd Street. To serve the East River piers, the New Haven Railroad, like the New Jersey companies, had to transship all freight between cars and vessels (Condit 1980: 35). The Hudson River Railroad completed the shift from the East River to the Hudson.

By 1852, in its yard at 31st Street, the HRRR had built a stationhouse (a through station) a car house and baggage office building, and an enginehouse. In this yard, locomotives were replaced by horses, which drew the cars further downtown. For this reason, the 31st Street Station was the company's main New York depot until Grand Central Station opened in 1871. The depot at Chambers Street was simply a car shed to and from which the company's rolling stock was animal-powered. The 31st Street sites are within the project area associated with the connection to the Lincoln Tunnel. (See Figure 89.)

The triangular area south of the Clinton Market at Canal Street and West Street, shown on the 1852 Dripps map as part of the Clinton Market (see Figure 28) was also leased by the HRRR and thus presumably contained the company's Canal Street depot. Canal Street at West Street was the focus of intense activity in the 1850's. The Collins Line occupied pier 41 opposite Canal Street, the Clinton Market was still active, ferries to various harbor landings were concentrated there, and steamboats to upriver Hudson landings occupied adjacent piers.

New York's other important early railroad, the Erie, built its mainline from Dunkirk, New York on Lake Erie southeastward to Piermont, New York, north of the city on the west bank of the Hudson. Steamboats from Piermont docked at pier 31 between Duane and Reade streets, where the company occupied a very large (55 X 630-foot) pier, the eastern half of which contained covered sheds. Opposite the pier on the east side of West Street stood the company's neo-Classical New York depot and offices (see Figure 54).

The Camden and Amboy Railroad, New Jersey's first railroad (built in 1832 from Bordentown to South Amboy), enjoyed the prime location of pier 1 opposite Battery Place. Toward the bulkhead half of the 50 X 650-foot pier was a long shed where the company's steamboats from South Amboy docked.

The New Jersey Railroad and Transportation Company opened its rail-ferry terminal in Jersey City in 1838 after cutting a 40-foot deep slice through Bergen Hill. Although passenger ferry service between Paulus Hook and Cortlandt Street would eventually come under the company's control, by 1852 it occupied pier 16 just south of the Cortlandt Street Slip.

These two New Jersey railroads eventually formed the nucleus of the Pennsylvania Railroad's New York=Philadelphia corridor. Other rail lines joined them on the Hudson County waterfront. The railroads came to dominate the harbor's land- and waterscape of the post-Civil War period.

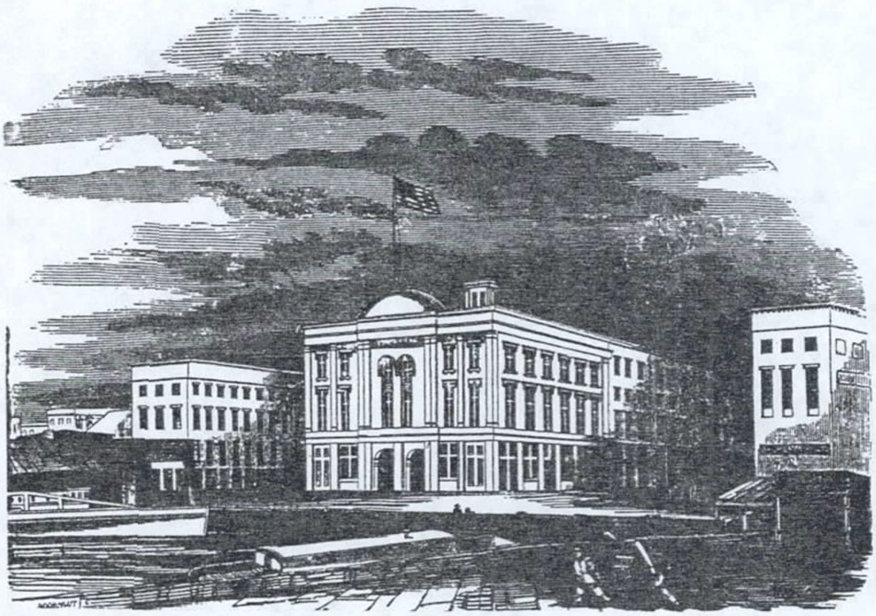


FIGURE 54. Woodcut view of the Erie Railroad's Duane Street Depot, 1851, looking toward the city from the river (pier 30 at Chambers Street). The Duane Street pier 31, with shed, is at left (*Men of the Erie*).

e) EXPANSION AND REGULATION

In the 1850's, the area between Marketfield Street and Castle Garden was filled out to West Street (see Figure 55). Marketfield Street, now fronting Battery Park, was renamed Battery Place. By 1857 the Harbor Commissioners' map (Kurth and Rosa 1857) had established a fixed limit for pier length and a new bulkhead line that provided for a wider outer street. Although most of the existing bulkheads shown on the 1857 map were not in compliance with this limit (exceptions were the Cortlandt Street Ferry; the Barclay Street Ferry; the Franklin Street, Vestry Street, and Watts Street bulkheads; the Hoboken Street Ferry; and the Spring-Charlton street, Leroy Street, Morton-Christopher street, and Perry Street bulkheads), the intent was a 120-foot right-of-way for West Street and a 600-foot (plus or minus) length for piers. As demonstrated by the request for proposals from dock builders regarding the Amos Street pier, pier 51, in 1858, the response to these new regulations was the extension of many piers. Except for the block at the outer end of this pier, the new additions were of pile-supported construction.

f) PIER BUILDING UNTIL THE MID-NINETEENTH CENTURY

The 1647 pier was a solid pier, constructed from a simple crib of timber, filled with rock for some stability, and given a relatively smooth top. Within the early urban environment of the late eighteenth and early nineteenth centuries in New York, this type of structure had severe disadvantages, chief among which shortcomings was the rapid silting-up that occurred between such piers. By 1795-96, the New

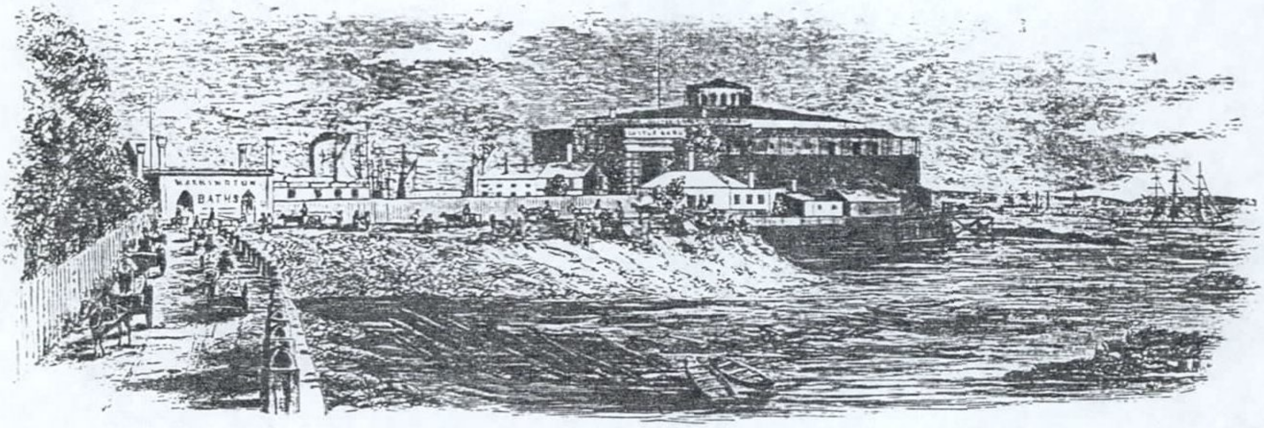


FIGURE 55. View of land filling near Castle Garden, 1853
(*Illustrated News* July 23, 1853: 179).

York Common Council required piers to be constructed so to allow for the river's tidal ebb and flow (MCC 1784-1831: II, 214-15, 420-21: III, 397-98).

One way to allow both current and tide to flow below the structures was to build a pier like a bridge. Masonry barrel vaults spanning between masonry abutments, thus permitting water to enter on two sides, was a solution, but expensive because of the masonry construction and water location. The cheaper solution was the block-and-bridge method, whereby a series of timber-framed blocks were sunk in the silt, filled with rocks, and then spanned, or bridged, with timber. This method of construction seems to have become prevalent in the early nineteenth century.

Because of the hazards to shipping caused by the Hudson River, especially to sailing ships, the river ends of early nineteenth-century piers frequently if not always possessed T- or L-shaped appendages. These additions reportedly provided a barrier to ice in the river and protection from northwesterly winds. They unquestionably provided additional berthing, and therefore increased the piers' economic value. The T- or L-shaped pier is a wharf form, in that it provides a deep berthage parallel to the shoreline. In New York, however, these constructions were called T- or L-shaped piers; thus the historical nomenclature has been known to use the terms "pier" and "wharf" interchangeably.

With the advent of steam-powered pile-drivers the building of piers on piles became prevalent. Frequently, pile piers were added to block-and-bridge piers. The use of blocks to provide additional protection to parts of the pile pier was also a feature of 1825-60 piers. The pile pier relied upon the collective strength of regularly sized timber members: piles, pile caps, cross braces, fenders, rangers, and decking. This engineered solution provided the standard form for pier construction into the twentieth century, when concrete and steel offered new possibilities.

5) *The Post-Civil War Period (1860-1900)*

a) THE TECHNOLOGICAL TRANSFORMATION

In the early 1860's, the trans-Atlantic steamship companies, foreign owned and operated, flocked to New York as the United States settled its internal disputes. Many of these lines incorporated the screw propeller method of propulsion utilized by the Inman Line, and the sidewheel provided some resistance to the rolling to which the screwships were subjected. The Cunard Line clung to the old boats into the 1860's (WPA 1941: 191). The North German Lloyd Line (1860-61), the Anchor Line (1861-62), and the Compagnie Generale Transatlantique, or "French Line" (1864), enjoyed the post-Civil War revival of North Atlantic trade, which peaked in 1866 (see Figure 56).

As railroad passenger service was being brought to the various terminal facilities in Hudson County, the rail companies, led by the New Jersey Railroad and Transportation Company, began in the 1850's to take control of ferry service to Manhattan. In 1853 the NJRR directors petitioned the New Jersey Legislature for the authority to run and operate its own ferryboats. The request was granted the following year, and a new terminal facility was constructed in Jersey City by 1858 (Condit 1980: 49). The railroad and Paulus Hook ferry services were now consolidated under one roof on the west side of

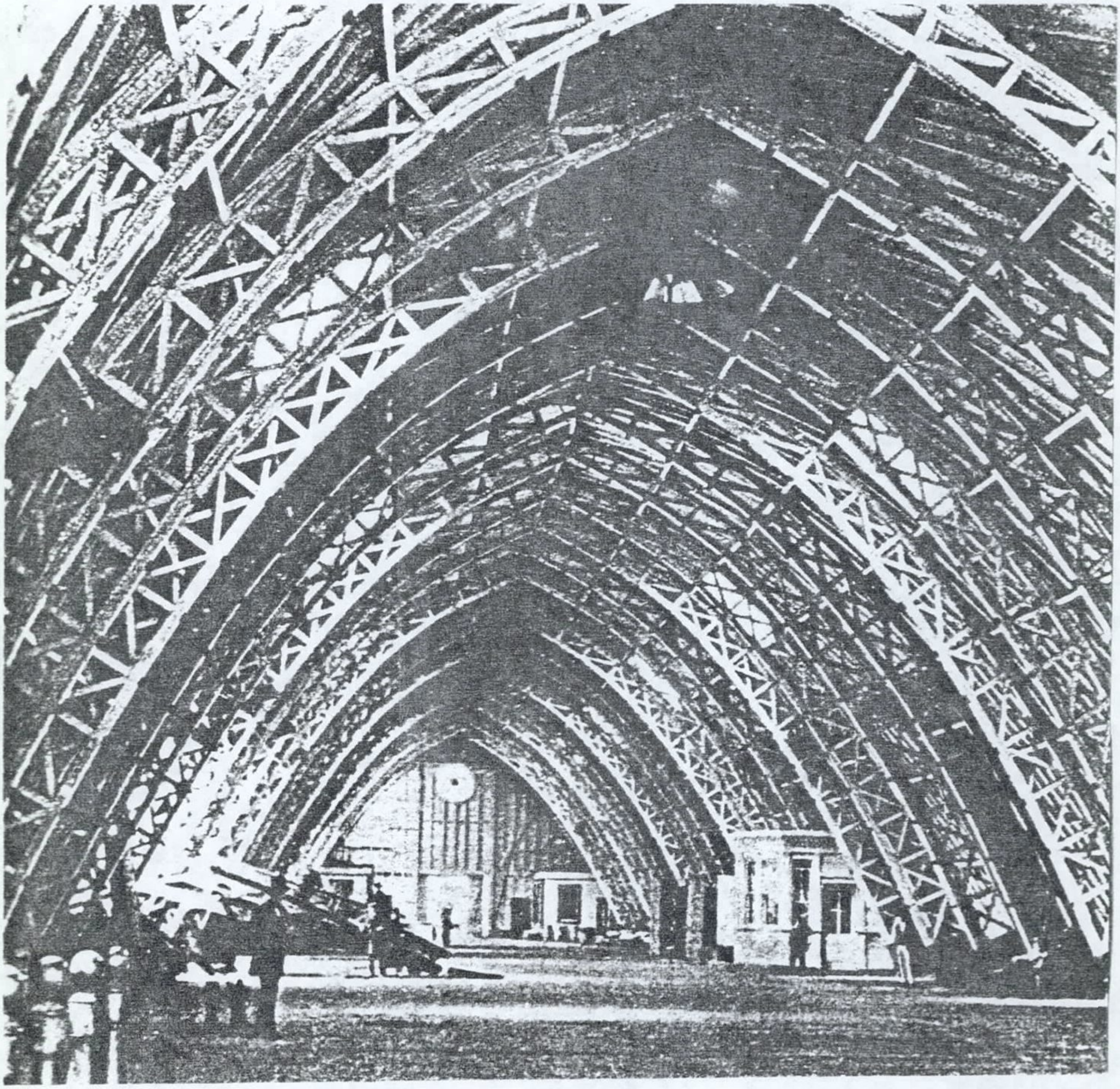


FIGURE 56. Interior (date unknown) of Morton Street pier, occupied by Compagnie Generale Transatlantique (Silver 1968: 161).

the river. The Manhattan landing continued to be the foot of Cortlandt Street.

By 1870, other railroads had established new ferry lines or had taken over existing services. The Central Railroad of New Jersey (CRRNJ) reinstituted the abandoned Cummunipaw Ferry from its Jersey City terminal to Liberty Street in Manhattan. The Morris & Essex Railroad (M&ERR) assumed control of the Barclay Street and Christopher Street ferries to its Hoboken terminal. The Erie, which had completed a tunnel through Bergen Hill in Jersey City in 1861 to establish a more advantageous tidewater terminal site, instituted the Pavonia Ferry first to Chambers Street and later to W. 23rd Street. The NJRR added another New York ferry terminal at Desbrosses Street, near Canal Street.

The railroads also moved very rapidly to control the freight business in and around the port as they outstripped the hauling ability of the canals. By 1866 the railroads developed the float bridge, an adaptation of Fulton's ferry loading and unloading device, which permitted full freight cars to be carried across the harbor on floats, pushed and pulled by tugs. Each float bridge generally had two sets of tracks, each capable of holding five cars, and a raised platform between the tracks. The transfer bridges carrying the tracks were generally 100-foot long Howe Truss bridges hinged at the shore end and suspended by heavy iron chains from a frame near the outer end. Via counterweights and a hand gear, the bridge was made adjustable to both the tide and the draft of the float, the latter changing dynamically as it was loaded or unloaded (Mordecai 1885: 36). The float bridge method provided an alternate to the lighterage system of breaking down freight on a pier between railroad freight cars and scows or barges. It stimulated the steam towing industry in the 1860's, which assumed major proportions in the 1870's (WPA 1941: 198).

The impact of these developments on the Port of New York was tremendous congestion. A contemporary observer noted the following:

> New York is the most inconveniently arranged commercial city in the world. Its wharfs are badly built, unsafe and without shelter; its streets are badly paved, dirty and necessarily overcrowded; its warehouses, are at a distance from the ships, and for the most part without the proper labor-saving machinery.--; its railroad depots have no proper relation to the shipping or to warehouses. (*New York Evening Post* 1867)

The docking facilities were cheaply built and lacking in any regularity of angle to bulkhead, size, shape, or width of berth. The 120-foot bulkhead line for West Street had been for the most part ignored. However, the possibility for 600-foot piers had been fully exploited. In short, the Harbor Commissioners pier and bulkhead lines had not brought the desired order to West Street.

In fact, the overlapping jurisdiction of the various public bodies involved with the waterfront contributed to the disarray. The Commissioners of the Sinking Fund issued grants of land underwater and leased wharf property. The Board of Aldermen authorized the construction of piers and bulkheads as well as landfilling. The Dockmaster collected wharfage, the Comptroller collected rent, the Street Commissioners took charge of repairs and dredging of waterfront property, and Harbor Masters appointed by the Governor regulated and stationed vessels at their wharves (WPA 1941: 197-98).

b) THE 1870's EXPANSION

The establishment of the Department of Docks in 1870 was preceded in 1867-68 by a survey of the Wharves, Piers, and Slips Belonging to the Corporation of the City of New York. This many-volumed survey was done by the Commissioner of the Sinking Fund. Volume 1 deals with the North River. The survey did not include all docking facilities; however, of those analyzed, the highest valued property was pier 41 between Hoboken and Canal streets, occupied by the Collins Line and assessed at $400,000. The Hubert Street solid pier, formerly the North Fort site, was assessed at $351,000. Piers 31 at Duane Street (Erie Railroad), 40 at Watts Street, and 45 at Charlton Street were each valued at $350,000. The bulkhead and piers 20, 21, and 22 at West Washington Market were valued at $343,500. This survey also projected costs to reconstruct or extend piers to a pier line that was some 600 feet from West Street.

The Department of Docks centralized the red tape involved in the previous multijurisdictional system. An initial Board of Fire Commissioners appointed by the mayor was reduced to three in 1873, having the power to control the construction, alteration, and maintenance of wharves and the dredging of channels (Dept. of Marine and Aviation 1951: 15). It also actually produced some regularity on the waterfront. West Street was to become a 250-foot wide outer street having a pier line that permitted structures from 400 to 500 feet long and from 60 to 80 feet wide. Intervals for slips between the piers were to be between 150 and 200 feet (Vernon-Harcourt 1885: 625). To accommodate West Street's new width, the Department of Docks devised a new bulkhead of quaylike construction. Mud and silt were dredged out to a depth of 35 feet below mean low water. Gravel was placed at the bottom of this excavation and protected by riprap on both sides. Into the gravel were driven 90-foot long wooden piles, which were sawn off to a uniform height of 10 feet below the finish grade of West Street. Fifteen feet below their tops, the piles were cross-braced; there, on a 4-inch plank floor, sat the actual bulkhead wall. Diagonal bracing piles were also driven through this upper area joining the upper ends of the inside piles to the outer piles beneath the bulkhead wall. This system relieved the lateral force exerted by the backfill on the wall, which was the main problem with cheaper timber cribbing methods. The granite-faced bulkhead of coursed ashlar blocks had a concrete backing and footing (see Figures 57 and 58). Initially the concrete was placed in blocks, but this system was changed in 1874 to pouring in mass (Vernon-Harcourt 1885: 426-27). The areas above the pile caps and behind the bulkhead wall were filled with earth, ashes, and other materials, and the paving blocks were laid on top (Mordecai 1885: 39).

Even with lengths of 90 feet, many piles never reached firm footing through the river bottom's deep stratum of sand, clay, and mud, which was the reason for consolidating the upper level of the piles with gravel and stone directly below and behind the bulkhead wall. This design was finalized in 1876 after six revisions (Vernon-Harcourt 1885: 426-27).

Although the advocated bulkhead design which was to lead to a 250-foot wide West Street was resolved by the mid-1870's, the actual execution of a uniform bulkhead line was only very gradually complied with over the next few decades. As late as 1910, numerous encroachments into the right-of-way still existed, especially south of Cortlandt Street where some old bulkheads maintained the 70-foot width of West

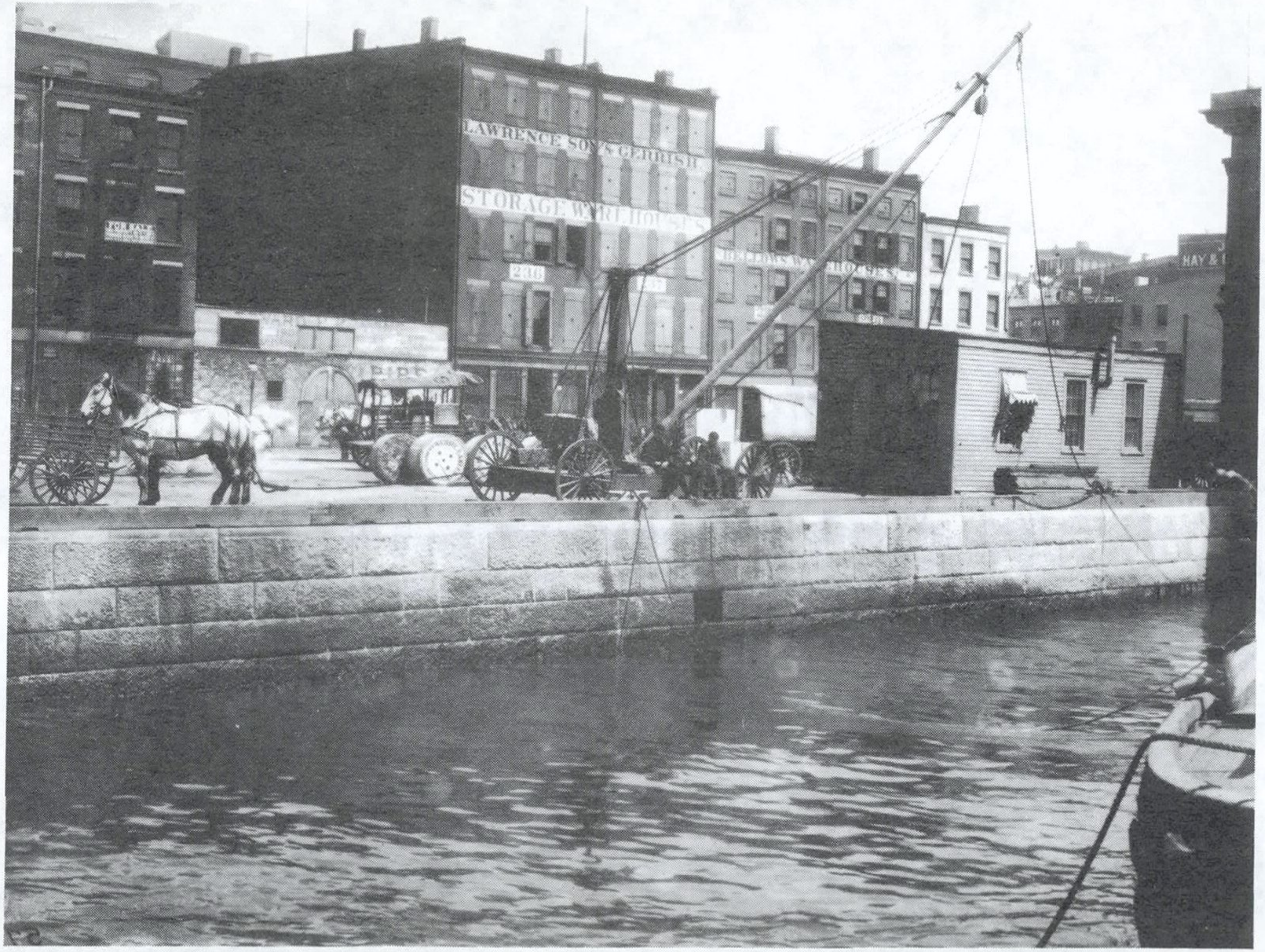


FIGURE 57. View of standard granite-faced department of docks bulkhead (undated photograph, Collection of the South Street Seaport Museum).

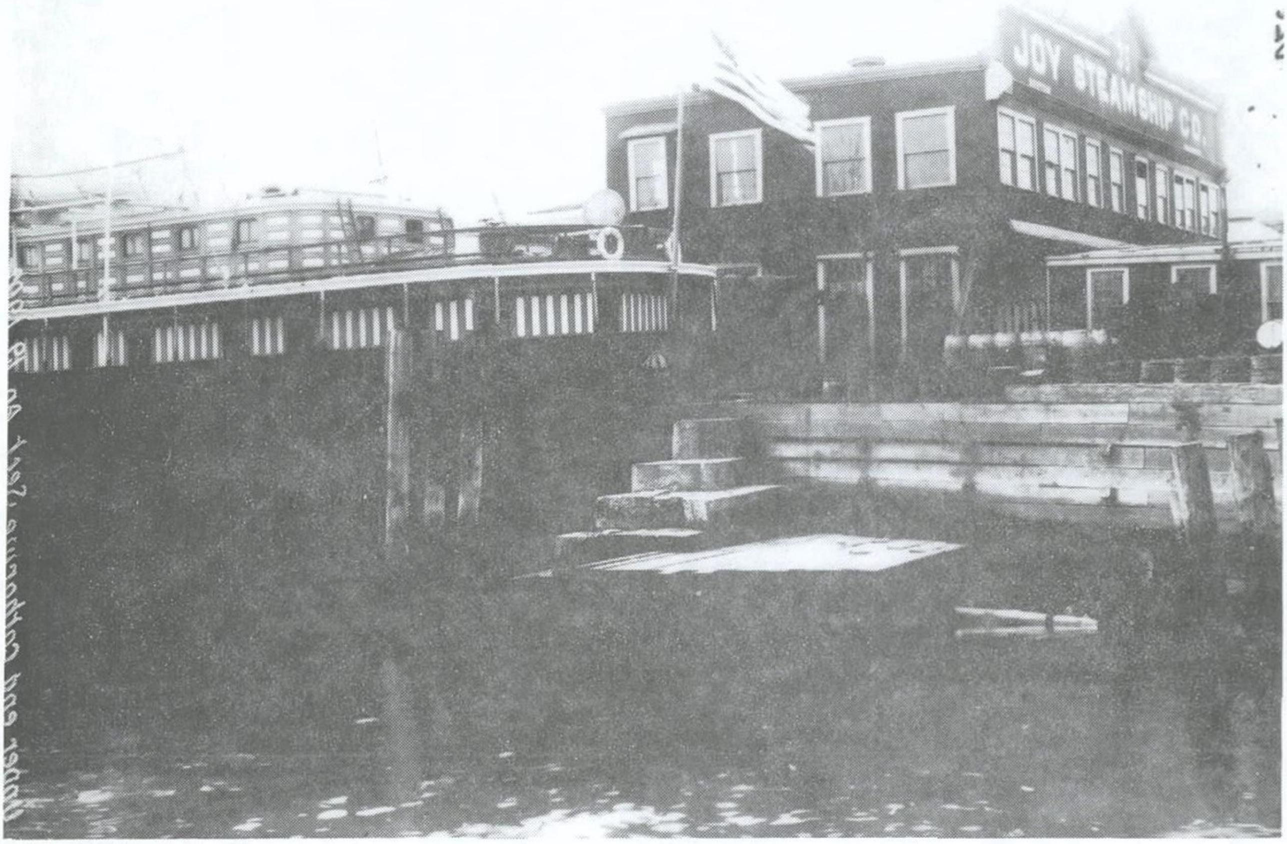


FIGURE 58. Unfinished bulkhead construction at old pier 35, Catharine Street, East River, 1902 (Collection of South Street Seaport Museum).

Street. Therefore, although standards had been set, exceptions and some lack of conformity persisted. Ultimately, a wider West Street and well-built bulkhead were accomplished.

The piers were also subject to some standards of construction. Preference for wooden construction continued to the turn-of-the-century. The pile-supported pier was estimated in the 1880's to have a useful life of 20 years, requiring repair, especially to the deck surface, after only 10 years of service (Vernon-Harcourt 1885: 625). The piles themselves remmained remarkably well preserved underwater, suffering only in the 4.5-foot area of tidal fluctuation that produces decay. The teredo, a marine borer of destructive potential, was not a major problem in the harbor. It may have been driven off by the city's practice of sewage discharge from the bulkhead (Vernon-Harcourt 1885: 625).

The physical improvements brought about by the regulation of the Department of Docks had economic justification. Some of the layout inefficiencies were eliminated by controlling width, length, and spacing dimensions. The ultimate effect was a doubling of potential pier square footage from that of 1870. Therefore, at the same time that the railroad companies were expanding their control of domestic freight, the city was providing for a very accommodating environment in which to build.

Overall economic conditions had suffered a severe slump in 1873. Waterfront workers first began to realize their collective power in the post-Civil War period. In 1874 the first major strike by dockworkers took place, when 8,000 laborers walked off their jobs. The action collapsed after five weeks' time with uncertain results. Another strike of 1887 was more successful; the International Longshoreman's Association was formed in the 1890's (Bunker 1979: 150).

Besides the innovations and improvements in bulkhead and pier construction, the river itself required maintenance and modification to accommodate the ever-increasing size of steamships. The Rivers and Harbors Act of March 3, 1875 authorized the improvement of the Hudson River channel to maintain a navigable depth for shipping. This activity began with the removal of sand bars off Jersey City (WPA 1941: 205).

As already mentioned, the demise of the Collins Line was symptomatic of the overall decline of the American flag steamships, both abroad and in New York. Of the 182 ships operated by 48 lines out of the Port of New York during the 1865-90 period, 54% were owned by nine companies. Of these nine, none was an American concern. Size and speed of trans-Atlantic liners generated new competition between the foreign lines. From the 1870's to the turn of the twentieth century, the length of the big steamships grew from just over 400 to 700 feet. At the same time, the prized "blue ribbon" was awarded for record-setting runs across the Atlantic. In 1867 the Inman Line's *City of Paris* won the ribbon from the Cunard's *S.S. Russia* (Bunker 1979: 130).

The White Star Line was organized in 1871, and its ship *Adriatic* made the fastest crossing in 1872. The Netherlands-American Steam Navigation Company, forerunner of the Holland America Line, was organized in 1873 (WPA 1941: 200).

Coastal and intercoastal steamships remained American domain, and in the 1870's new companies were organized to serve these various ports. Among the newcomers were the Merchant's Steamship Line to New Orleans; the Santo Domingo Line to Puerto Plata, Samana, and San Diego; and the Texas Line to Galveston and Houston (WPA 1941: 199-200).

Generally, the non-trans-Atlantic steamship service was scattered throughout the waterfront from Battery Place to Canal Street and did not require the same length of docking facilities needed by the ocean-going steamers. In contrast, longer piers were concentrated on the Canal Street to West 11th Street waterfront. The T-shaped piers of the 1850's were replaced by the 500-foot finger piers.

The Inman Line occupied the pier at Charlton Street. In a northward progression were located the Guion Line at King Street, the National Line at West Houston Street, the Cunard Line at Clarkson Street, the French Line at Morton Street, the White Star Line at West 10th Street, and the Anchor Line at about Charles Street. The concentration of the trans-Atlantic steamships in the Canal to West 11th Street corridor created open space on the downtown waterfront that was quickly seized by the railroads.

In the 1880's, the twin screw propeller came into general use, and steam pressure and piston speed increased as coal consumption decreased (WPA 1941: 209). Immigration regulations passed by Congress in 1882 paralleled the technological advance; only the sick and persons likely to become public charges were barred from entering. For some companies, larger and faster steamships were equated with more people arriving more frequently under the welcoming gesture of the Statue of Liberty. In 1892, Ellis Island was established to handle immigrants arriving on trans-Atlantic crossings.

c) RAILROAD FREIGHT

(1) General Background

Unlike the direct movements of giant steamships in and out of berths, the railroad navies had only to complete short and varied waterlegs across a river or the harbor. Owing to the lack of a belt railway system, the various harbor waterfronts--especially that of Hudson County in New Jersey--were developed to separate and classify various kinds of freight for connection across water to their ultimate destinations. The port thus acquired a remarkable flexibility for connecting railroad to railroad, railroad to industry, railroad to consumer, or railroad to trans-Atlantic shipping. Any business or industry within the lighterage limits* of the harbor was accessible to all railroads entering the port.

The lighter is a shallow draft vessel used to "lighten" a ship by removing part or all of its cargo. It is generally used where a harbor has limited depths of water or for inner-harbor movements. The latter is the case in New York Harbor, where most of the export and import freight was handled by lighter. Lighters permitted cargo transfer between railroad and steamship via assistance from cranes, elevators, and other devices. Domestic freight was carfloated, a more efficient system for local traffic,

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*Lighterage limits in 1906 were Fort Lee/135th Street on the Hudson; Randall's and Ward's islands on the East River; Bergen Point, Bayonne on the Kill van Kull; and Bay Ridge, Brooklyn and Clifton, Staten Island on the south end of the Inner Harbor (*The Railroad Gazette* 1806: 355).

by floating the boxcar on a tracked float directly to its local destination.

A lighter (c. 1885) could hold about 450 tons of freight. Some lighters were self-propelling and had their own hoists (both steampowered). Grain was transferred from lighters to other vessels by floating steam elevators. Steam hoists were located either on vessels or on the docks (Mordecai 1885: 9-10).

Free lighterage refers to the fact that the railroad companies charged freight rates for the port as an entity, not according to the final dock destination. The Pennsylvania Railroad, for example, charged the same rate for a given item whether it was bound for a retailer in Jersey City, New Jersey or in Brooklyn, New York, despite the fact that the Brooklyn-bound item required lighterage from the PRR Jersey City yards to a Brooklyn dock. The free lighterage concept apparently began in the canal era, when canal boats were delivered to any point on the waterfront. Railroads terminating on the west coast of New York Harbor were able to compete with the canal companies and the Manhattan-based New York Central (Hudson River Railroad) by considering the lighterage to be a continuation of the railroad haul (MacElevee 1918: 88). Competition between the companies was not abated nationally, however; rate wars in the 1860's and early 1870's generated rivalries between port cities.

In 1877 the railroads reached an agreement whereby a rate structure was established. The New York Central withdrew support for the measure in 1880 but was rebuked by the Arbitration Commission in 1882. This agreement reaffirmed the system of fixing freight below the New York and Boston rates at Baltimore and Philadelphia. The handicap of Baltimore and Philadelphia's inland locations was thus balanced against Boston and New York's more direct access to the North Atlantic (MacElevee 1918: 38).

To handle freight in the Port of New York, the railroad companies required a vast navy, and extensive docks, piers, and float bridges, in addition to the normal yards for classifying, delivering, and forwarding freight (Droege 1912: 5). The cost of the profits to be made in hauling goods in and out of New York was high. Real estate was either bought outright or created by filling, and unique rail head-tidewater interchanges developed. The pier, built of varying materials and methods of construction during the nineteenth century, became codified under the guidance of the Department of Docks. A preference for pile-supported structures permitted a greater sanitary potential for the waters in and around the piers to carry off pollution with the tide. The railroad companies' need to store freight, for varying lengths of time, generated a corresponding necessity for covered piers, some of multistory construction. The railroad companies innovated pier construction types--long-span trusses in heavy timber, iron or iron with timber, and finally, into the twentieth century, steel and concrete. Like the trainshed, the railroad freight pier building type both generated and reflected the railroad engineers' structural developments. In addition, regulations such as those generated by the Produce Exchange requiring flour for export to be held for 5 days for inspection before shipping, influenced the ways in which piers were organized (Mordecai 1885: 10). Barrel storage necessitated spaces for unloading, relocation, and inspection on the piers.

Classes of freight included those goods hauled, weighed, and shipped in large lots, such as machinery, coal, or lumber (Class I); goods requiring weighing by price and shorting, such as dry goods or groceries (Class II); and goods requiring temporary storage for inspection or destination verification, such as grain or flour (Class III). The sequence of classes (I-III) reflects expanding spatial requirements as well as increased supporting apparatus and labor needs. Actual hauling of the freight in the city was done not by the merchants or by the railroad companies but by third parties operating drays and horses and contracting for a fixed rate per piece or ton, depending on the freight. Each dray (c. 1885) held 3 to 4 tons of heavy freight hauled by a 2-horse team (Mordecai 1885: 4-5).

(2) New York Central and Hudson River Railroad

Because of its advantageous location on Manhattan Island, the Hudson River Railroad built the most extensive freight facilities along the West Side of all the railroad companies. Post-Civil War expansion of the company's freight activity was garnered by Cornelius Vanderbilt, who bought the HRRR in 1864 by controlling most of its stock. Vanderbilt also gained control of the New York Central in 1867 and formally merged the two companies in 1869 (Condit 1980: 39).

With the completion of Grand Central Terminal two years later, the passenger service in the Hudson Street-West Street-Tenth and Eleventh avenues corridor shifted uptown to 42nd Street. This grand scheme for a consolidated passenger depot was accompanied by equally impressive freight terminals.

(a) Saint John's Freight Terminal. To understand the transformation of the block bounded by Hudson, Varick, Laight, and Beach streets, one must look to the early nineteenth century. William Stanton Root, reminiscing in an article published in *The Railroad Gazette* of November 13, 1903, described the property in 1831, then St. John's Park, as bearing

> ... the same relation to the city at that time which Central Park does today; its beautiful trees and shrubbery were the pride of all New Yorkers, while facing the park and in the adjacent streets were the homes of the most opulent and aristocratic families of the metropolis. (Root 1903: 808-809)

It is difficult to visualize this block's former land use as one exits from the Holland Tunnel today and is guided around the vehicular circle that currently occupies the site. However, an even more dramatic change took place at this location when the New York Central-Hudson River Railroad built a huge freight terminal here in 1867. This parcel of land was reserved for a park at the end of the eighteenth century and was ceded to the city by its owner, Trinity Church Corporation, for that purpose in 1805 (Stokes 1915: 397). First known as Hudson Square, it also became known as St. John's Park after another Episcopal Church, Saint John's, was completed opposite the park on Varick Street in 1807.

As described, the square was lined with the Federal and Greek Revival townhouses of that era, which complimented the Georgian-styled church designed by John McComb (see Figure 36). *The Traveller's Guide to the Hudson River* (1867) described the park as "beautifully laid out in walks, with shade trees, and kept in excellent order" (Watson 1867: 18). [See Section II,C,3,C,6.]

The general industrialization of this neighborhood, from Chambers to Canal streets, preceded the actual transformation of Saint John's Park. By the 1860's, the horse-drawn railroad cars of the Hudson River Line cluttered the once elegant area (see Figure 59).

At the close of the Civil War, Commodore Vanderbilt purchased Saint John's Park from Trinity Church. Carl Condit provides a vivid description of what followed:

> The construction gangs of the Hudson River rooted up shrubbery, tore up the sod, cut down 200 trees, and built a great three-story stone-walled depot in 1867-68. The stub-end terminal tracks of this combined freight and passenger station turned off at right angles from the approach lines in Hudson Street. (Condit 1980: 39)

Utilizing the latest techniques in "fireproof" building construction, Saint John's Freight Terminal was a brick building with a concrete and stone masonry foundation, iron columns and beams, and floors laid on brick vaults (Mordecai 1885: 24). The square doughnut plan covered the entire four formerly green acres (see Figures 60-62). By the 1880's the terminal was convenient to the dry goods and grocery trades and contained refrigerated storage facilities for cheese, butter, eggs, and fruit. Freight from city jobbers moved

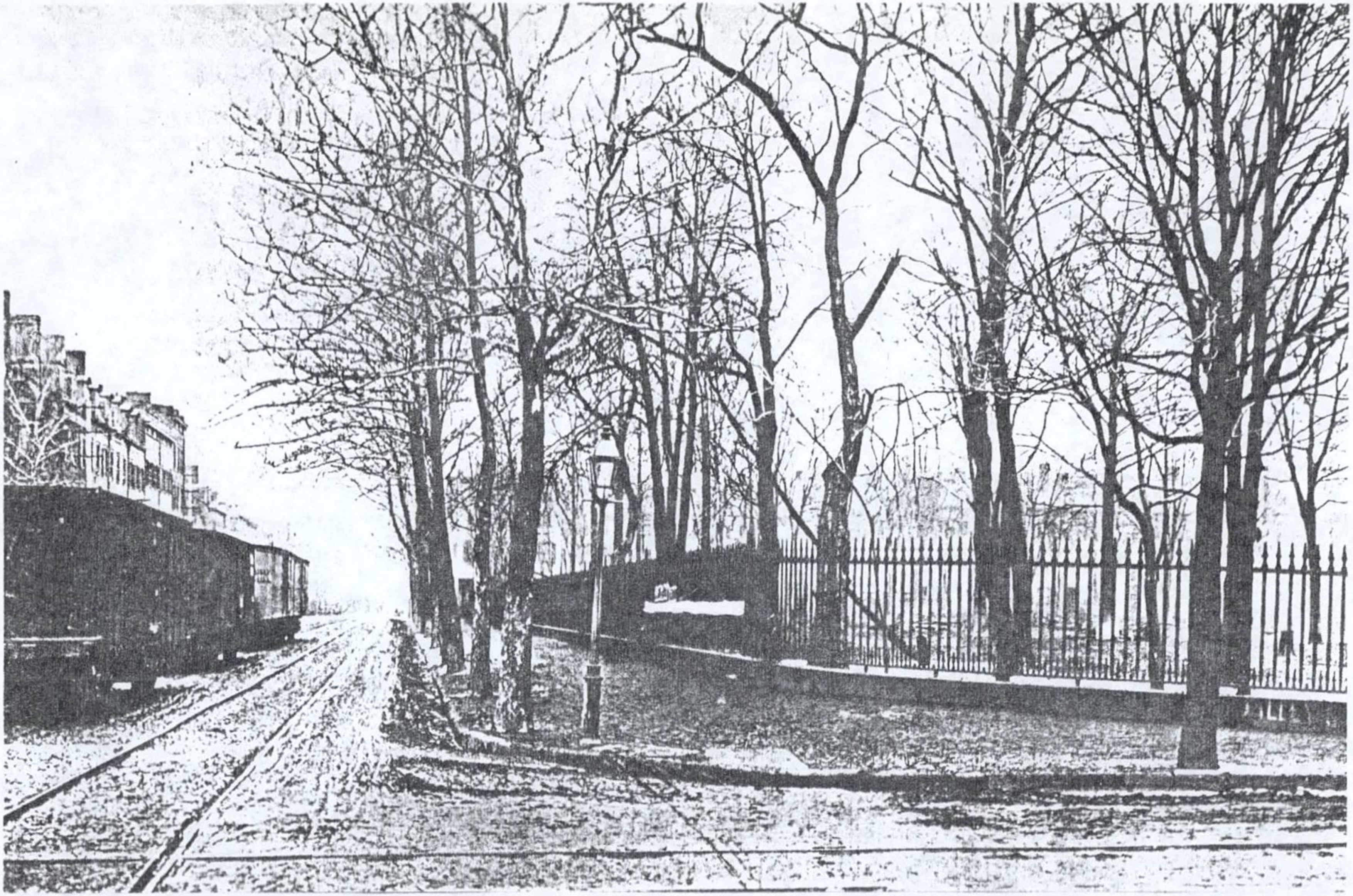


FIGURE 59. St. John's Park, c. 1865 (Black 1973: 79). Shown in this view is the corner of the park at Hudson (left) and Beach streets (foreground, center and right). Federal-style houses are visible behind the freight cars standing in Hudson Street at left.

FIGURE 60. View of Hudson River Railroad's Saint John's Square freight station, 1867-68 (Condit 1980: 37). Hudson Street appears in the foreground.

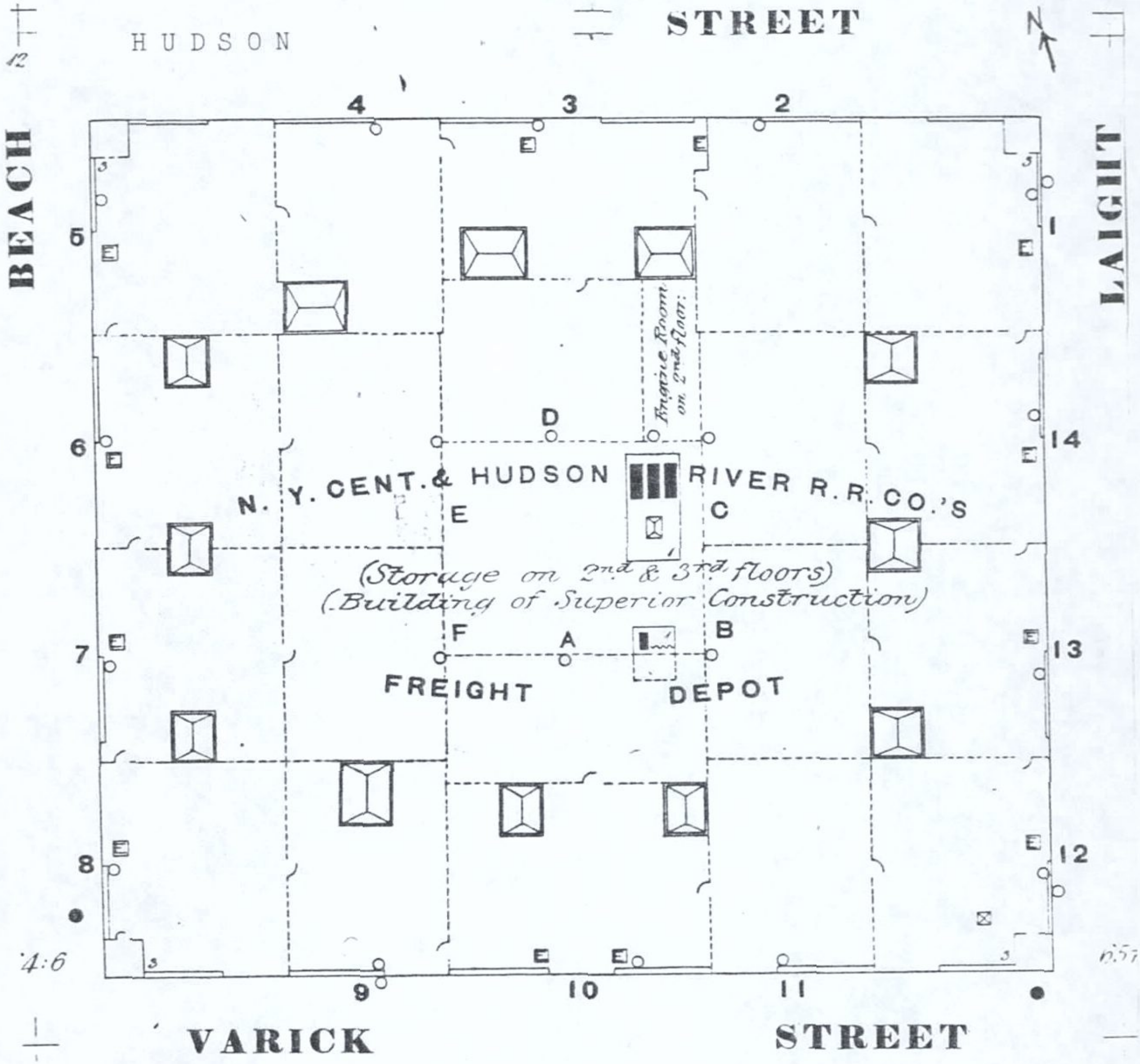


FIGURE 61. Portion of the 1894 city atlas map (No. 107, Vol. 1) which shows only the St. John's Park block, then occupied by the New York Central & Hudson River Railroad Company's Freight Depot. The central courtyard is apparent.

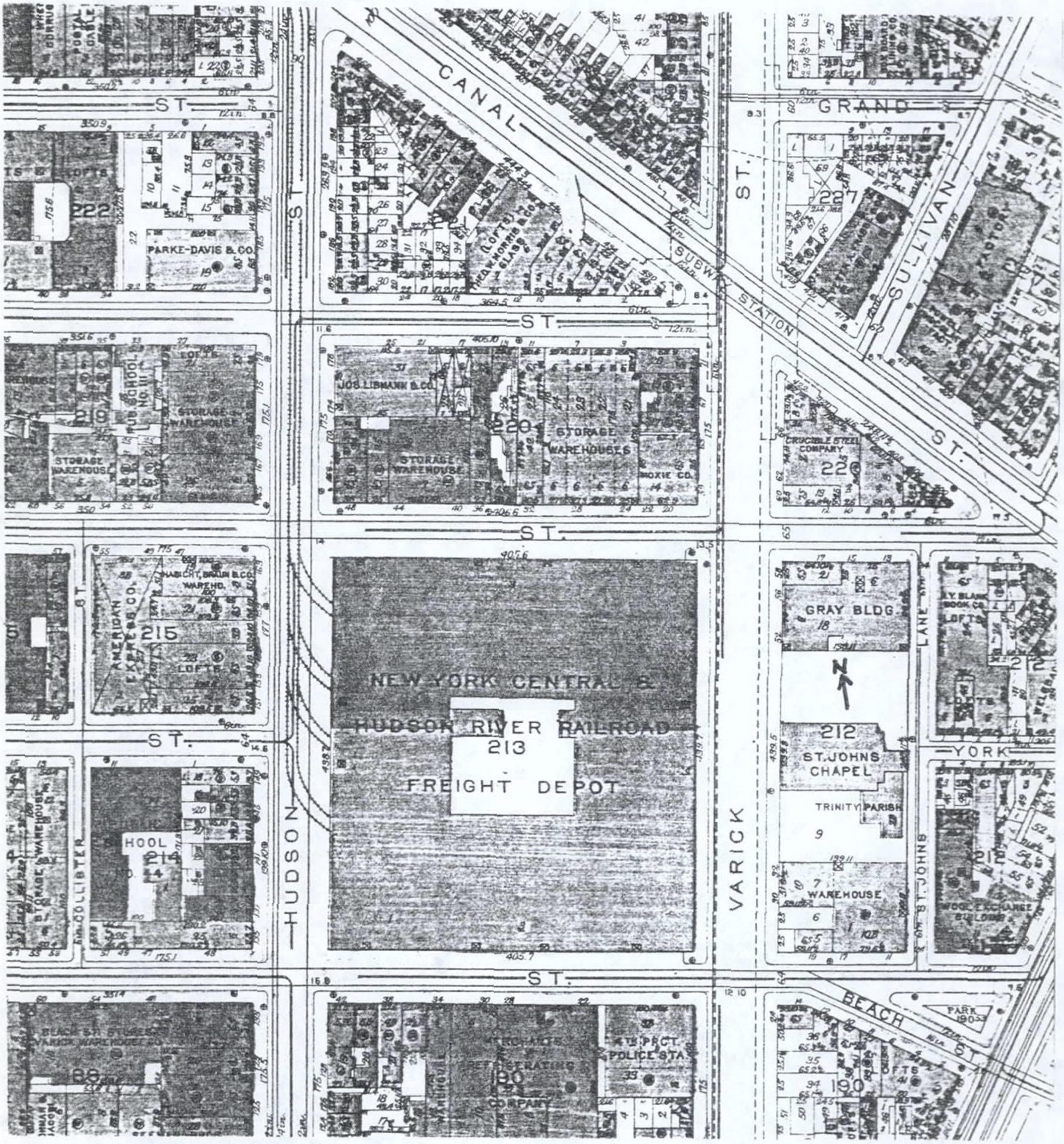


FIGURE 62. Bromley's 1916 atlas map showing the New York Central & Hudson River Railroad Freight Depot, presently located in HCI's Area 3. Note St. John's Chapel still standing to the east on Varick Street and the relatively vacant courtyard at the center of the depot building.

westward from the terminal as well. The entire first floor was given over to eight tracks entering from Hudson Street, each holding 12 cars apiece. The upper two floors consisted of warehouse space.

Vanderbilt's designer was reported to be I. C. Buckhout, engineer of Grand Central Station. He capped the Hudson Street elevation with a statue of the Commodore. Unveiled in 1869, it remained on the freight house until 1929, when, a few years before the terminal was demolished, it was relocated to the front of Grand Central Station (Harlow 1947: 191). The vehicular circle associated with the Holland Tunnel has obliterated all remains of the terminal building.

(b) <u>30th Street Freight Terminal</u>. In conjunction with the operation of Saint John's Terminal, the NYC-HRRR relied upon its 30th Street depot-yard to distribute cars either to the downtown station or to the West Street steamship docks. The aforementioned locomotive limits had dictated that the yard classify freight going beyond 30th Street. The former passenger and freight depot located there was absorbed and expanded into the new terminal in 1863, as the land further west, lying between 11th and 12th avenues, was obtained. Here occurred the Hudson River Railroad's major interaction with Hudson River activity until the 1870's. In 1877-82 the 60th Street yards opened, and in 1878 another station was established downtown at Barclay Street to relieve the volume handled by Saint John's.

By the mid-1880's, the Hudson River Railroad local freight business was handled at its Midtown (by then 34th Street) yard. The line's southernmost pier was utilized for lighterage freight, with tobacco relegated to its south platform and meat to its north side. A middle pier handled lumber and provisions, and the northernmost pier, an open pier containing a 10-ton derrick, was set up to handle the direct transfer of lumber. This complex also included two hay sheds, a shed for eastbound freight, and another for westbound freight (Mordecai 1885: 19). At the end of West 32nd Street the company had by 1889 erected a single-story covered pier, number 62. Designed by Walter Katté, Chief Engineer for the New York Central & Hudson River Railroad, it utilized an iron frame clad in corrugated iron siding (Berg 1893: 227). This extensive freight complex was bounded on the north by the Manhattan Market.

Before 1877, car float operations were handled at this yard, and export grain lighterage extended 115 miles upriver to Athens, New York (Mordecai 1885: 9). In that year, the company built grain elevator A at the 60th Street yard. It built another grain elevator, B, in 1879, and car floats, piers, and sheds had been constructed by 1882. (The 60th Street complex is, of course, outside the present study area.)

As mentioned, the Barclay Street Station was establsihed in 1878 to relieve the burden at Saint John's. It was also convenient to manufacturers, agents, and storehouses. Built adjacent to the Delaware, Lackawanna & Western Railroad ferry to Hoboken, it was an L-shaped covered pier and bulkhead shed containing 66,000 square feet. Wooden lattice roof trusses spanned 50 feet across the pier and in four 66-foot spans across the bulkhead shed. The shed frame was clad in corrugated iron siding (Mordecai 1885: 20). Car floats and lighters handled local freight business at this location.

(3) Pennsylvania Railroad

The Pennsylvania Railroad began its control of the corridor from Philadelphia to New York via Jersey City in the late 1860's. Existing rail facilities along the West Street waterfront at that time included the Camden & Amboy Railroad at Battery Place and the Cortlandt Street ferry area of the New Jersey Railroad and Transportation Company. Although lacking direct access to Manhattan, the Pennsylvania was nonetheless a chief competitor for port traffic. It built extensive New Jersey yards between 1872 and 1876 in the Kearny meadows, Harsimus Cove in Jersey City, and at its rail/ferry terminal at Exchange Place, also in Jersey City. West Street pier facilities provided the connection to the carfloat and lighterage operations in the Harsimus-Exchange Place yards.

By the mid-1880's, the Pennsylvania Railroad was operating out of five separate locations along West Street, including three piers downtown at pier 1, Battery Place, and at piers 4 and 5, Morris Street (see Figure 63). At both the Battery Place and the Morris Street locations, groceries were moved along the company's main lines, southern, and western freight routes. Adjacent to the main ferry terminal at Cortlandt Street, pier 16 handled New York Division Freight as well as southbound items to Baltimore.

FIGURE 63. View of piers 5 & 4, Pennsylvania Railroad, and piers 3 & 2, Lehigh Valley Railroad, c. 1900 (Collection of the South Street Seaport Museum).

By 1885 the Pennsylvania moved to develop the old Hubert Street fort site to handle western division dry goods. Covered sheds were built at pier 27 at Hubert Street, at pier 28 at Laight Street, and at pier 29 (formerly old 39) at Vestry Street, where the Philadelphia and Pennsylvania Division and southern freight were handled (Mordecai 1885: 40; see Figure 64). This complex of piers was located south of the Desbrosses Street ferry to Jersey City, established in 1860.

Built in 1883, pier 1 at Battery Place was a single-story covered shed pier of wood frame construction spanned by heavy timber trusses 63 feet long (see Figure 65). The frame was clad with corrugated iron siding (Berg 1893: 233). Pier 27 at Hubert Street (1885) was of similar construction, except that its trusses, which spanned 73 feet, were of timber combined with iron tension members (Berg 1893: 232). The downtown facility at Morris Street represented major intrusions into the West Street right-of-way, where the 180-foot wide headhouse, east of the bulkhead, resulted in the former 70-foot street width for West Street. Fifty-foot headhouses at Hubert Street yielded a 200-foot street width. Therefore, even though new bulkheads were constructed to the new line, headhouses continued to be built into West Street.

(4) Central Railroad of New Jersey

The eastern terminus of the Central Railroad of New Jersey was Elizabethport, New Jersey until 1864, when the Communipaw rail/ferry terminal was built on the shore of Jersey City, south of Paulus Hook. Here the company bridged Newark Bay and filled in the former mud flats

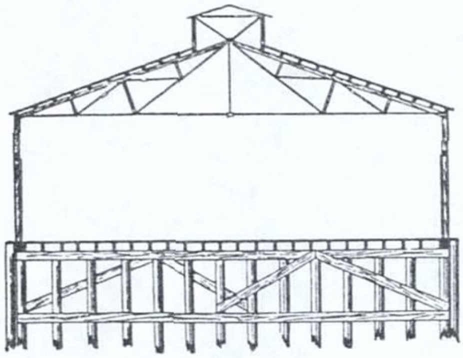


FIG. 396.—CROSS-SECTION.

FIGURE 64. Cross section of pier 27 at Hubert Street, built by the Pennsylvania Railroad in 1885 (Berg 1893: 233).

FIGURE 65. Cross section of pier 1 at Battery Place, built by the Pennsylvania Railroad in 1883; piers 4 and 5 are of *similar* construction (Berg 1893: 233).

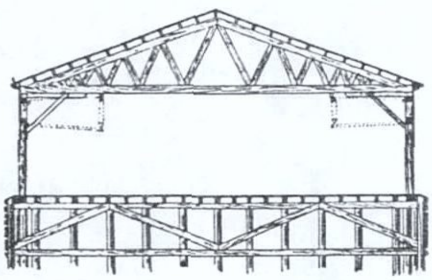


FIG. 397.—CROSS SECTION.

of the South Cove in order to build its extensive yards. In New York, ferry service was established and freight piers built at Liberty Street.

By the 1880's, the Manhattan facilities included piers 12 through 15, from Carlisle to Liberty streets. The piers were all one-story sheds of varying length. The ferry terminal, dating from the initial construction period, was a Rennaissance Revival structure, Palladian in plan, balanced about a dual ferry slip arrangement. A five-bay, two-story headhouse contained pedestrian ferry access (see Figure 66).

(5) Delaware, Lackawanna & Western/ Morris & Essex Railroads

The Morris & Essex Railroad reached Hoboken tidewater in 1862 via the Hoboken Land and Improvement Company from Newark and the Erie tunnel through Bergen Hill in Jersey City. The M&E was in turn leased by the Delaware, Lackawanna and Western Railroad in 1868. Passenger terminal facilities had been constructed on Newark Avenue in Hoboken in 1862, and the railroad's freight, especially coal, spilled over across the Hoboken/Jersey City border into the latter's northern waterfront. New Jersey commuters, longer distance travelers, and coal from the Scranton Coal Company were the main commodities of the Lackawanna's business until well into the late nineteenth century.

The railroad's ferry terminals in Manhattan were located at Barclay and Christopher streets. The DL&W/M&E complex at Christopher Street was similar to that of the Jersey Central at Liberty Street--a five-part plan with piers (43 and 45) on the wings and the two-story

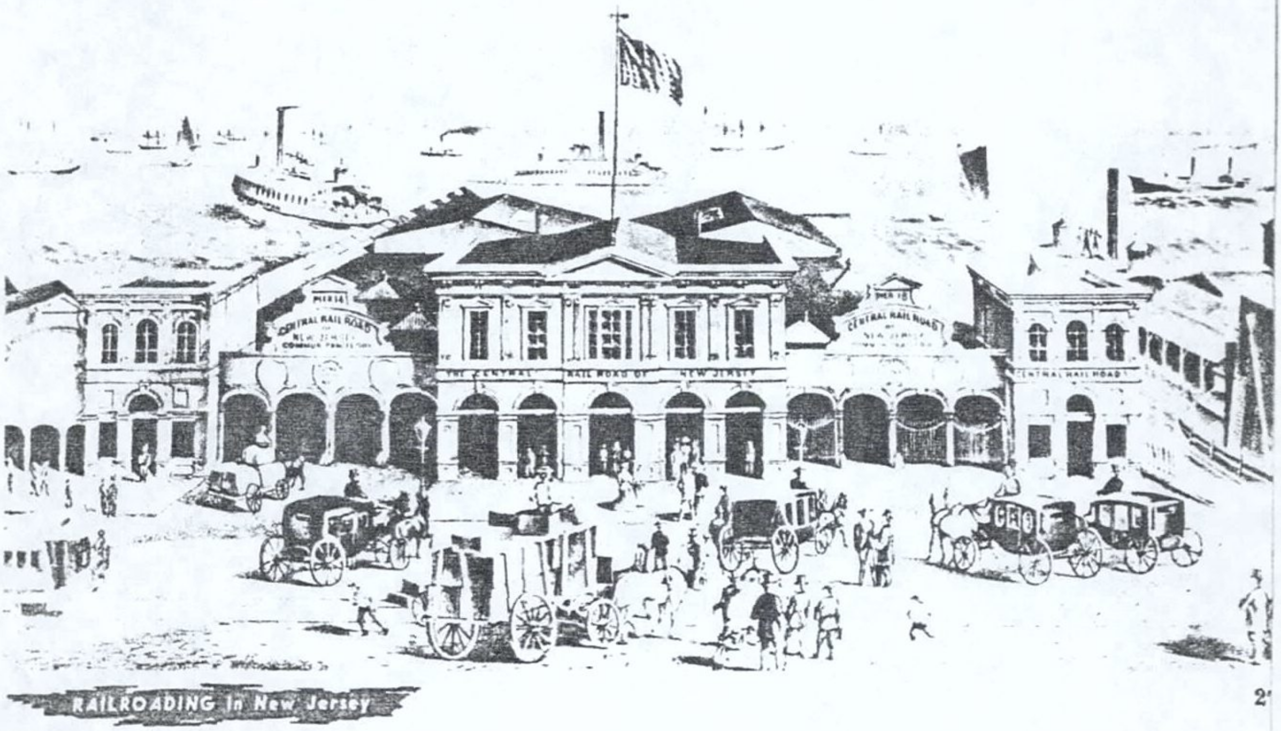


FIGURE 66. Central Railroad of New Jersey Liberty Street Ferry Terminal and piers 14 and 15, 1870 (Cunningham 1952: 27).

ferryhouse at the center, separated by access ways for vehicles. This Rennaissance Revival ensemble, depicted in a c. 1887 photograph (Figure 67), shows the 250-foot wide West Street clear all the way to the bulkhead. Not the compliance with the 1871 guidelines which it might appear to be, the space was necessary to accommodate the vehicles that had to line up before boarding the ferry.

Freight operations of the Lackawanna were not that substantial in Manhattan in the late nineteenth century. Its coal barges were pushed and pulled from the Jersey City yard to various points in and around the harbor, serving many needs.

(6) Erie Railroad

Of the major railroad companies that occupied the Hudson County, New Jersey shoreline, the Erie controlled a relatively shorter length of waterfront than did the Jersey Central, the Pennsylvania, or the Lackawanna. Freight and passengers were handled at the Pavonia yards and terminal, and coal from the Delaware & Hudson Canal Company and from the Pennsylvania Coal Company was moved at Weehawken, north of Hoboken, where the Lincoln Tunnel is presently located (Mordecai 1885: 51). The company's main New York depot was at Chambers Street, where the ferry terminal was also located (see Figure 68). By the mid-1860's, a second uptown terminal had been built at West 23rd Street. Freight was concentrated from Warren to Reade streets.

Like the Lackawanna at Christopher Street, the Erie ferry terminal was pushed out to the bulkhead limit of 1871 and was flanked on the north by the company's freight piers. The French Second Empire-styled ferry building was two stories tall and crowned with a mansard

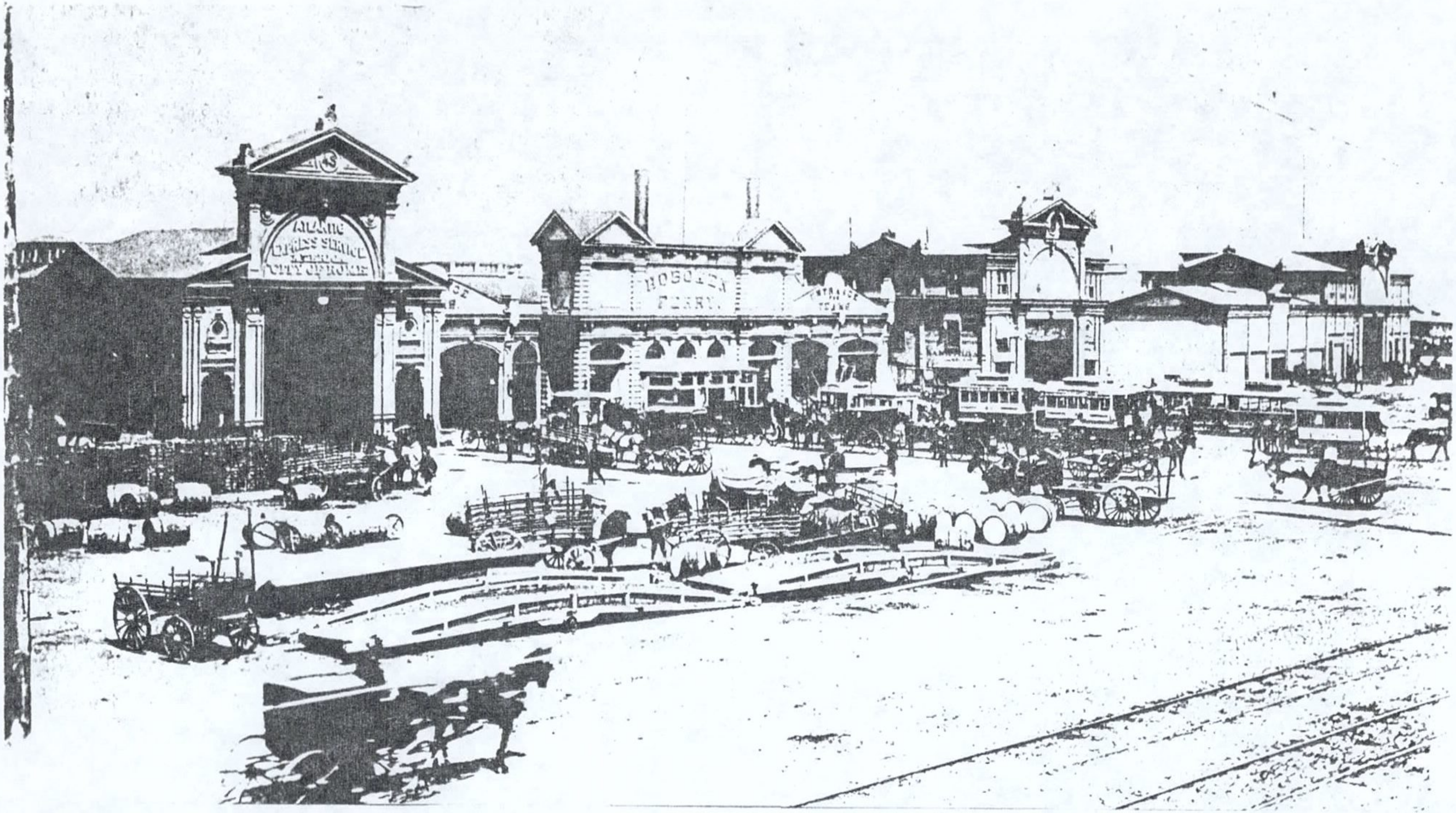
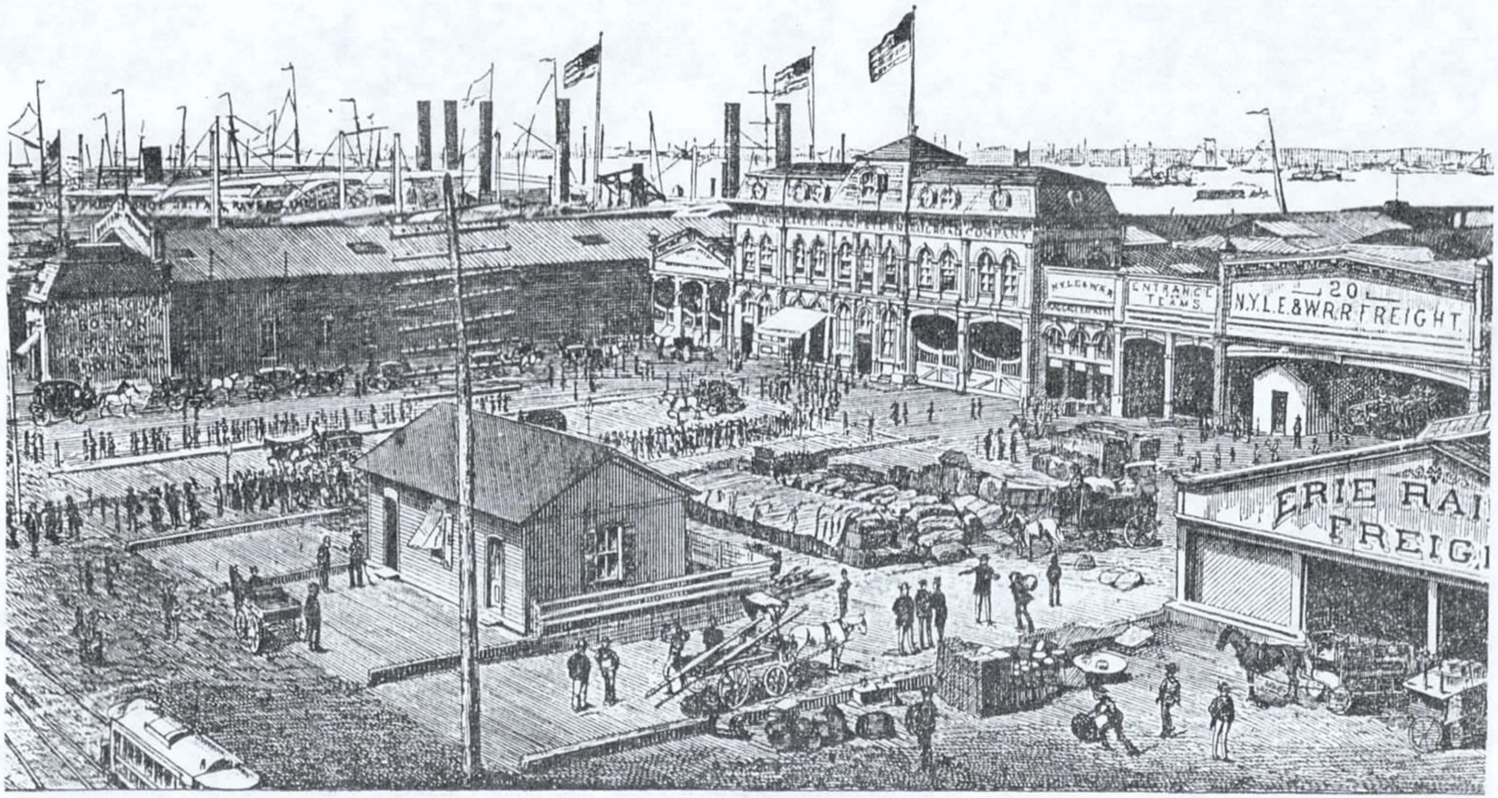


FIGURE 67. Copy of historic photograph of the Hoboken Ferry at Christopher Street and piers 43-45, c. 1887 (Black 1973: 81, Plate 72).



50 Views of New York and Environs.

NEW YORK AND ERIE RAILROAD BUILDINGS AND BOSTON STEAMER PIERS.

From foot of Chambers to Barclay Street, Hoboken Ferry.

Charles Magnus, Publisher.

FIGURE 68. Undated drawing (c. last quarter, nineteenth century) of New York, Lake Erie and Western Railroad's Chambers Street Ferry Depot (built in the 1860s) and piers 20 and 21 (Collection of Museum of the City of New York, West Street File).

roof. Although classicized with a pediment roof at a later date, this terminal survived into the 1950's. The initial freight piers--such as pier 21--were of wood frame construction, were covered with one-story sheds, were spanned by standard Erie wooden lattice trusses, and were clad with corrugated iron siding (Berg 1893: 232). Unlike the ferry building, the pier was not clear of the West Street right-of-way. By 1885, much of the local New York freight, especially the cheese business, was located here, and westbound freight was moved to Jersey City in barges from the West 23rd Street area (Mordecai 1885: 51).

6) The Twentieth Century (1900-1982)

a) THE CHAOS OF WEST STREET AND THE NEW ORDER

Whether a person was a long-distance traveler from Washington, D.C. or a produce handler from New Jersey, he shared a scorn for having to enter West Street on a busy work day. By the 1890's, the outer street was cluttered with headhouse intrusions, drays and other horse-drawn vehicles of all kinds, and people hurrying about their business. As an outer street, West Street ran only to around West 11th Street, where it ran one block inbound from then Thirteenth Avenue (present-day Twelfth Avenue) to Gansevoort Street, the location of the Second West Washington Market built in 1889. It was in this area that Tenth Avenue formed an elbow connection to West Street.

The westward-projecting land mass between West Street and what was then Thirteenth Avenue and between West 11th Street and

Gansevoort Street was industrialized through the middle and later years of the nineteenth century. It formed a northern limit to the concentration of trans-Atlantic steamship facilities that extended southward to Canal Street. The great ocean-going vessels grew in length from the 500 footers of the 1880's to vessels over 600 feet in the 1890's.

As the city continued to move northward in the 1890's, the area around 23rd Street became an area of urban focus. The impacts of the World's Columbian Exposition of 1893 were being felt throughout the country, resulting in a combined interest in city planning, Beaux Arts architecture, and urban order. The study area during this time was modified to accommodate and/or include longer steamship piers, a more regular and continuous bulkhead, and additional railroad freight facilities. In a rare cooperative venture, the Port of New York railroad companies together built a Union Ferry terminal at 23rd Street in the Beaux Arts Classical style.

Like West Street, the harbor itself became incredibly congested with vessels of all kinds. Probably the most bothersome were the tugboat-assisted barge, lighter, and car floating activities. Inner port railroad connections provided by the free lighterage system instituted in the second half of the nineteenth century had become, by the second decade of the twentieth century, a sore point. The inefficiencies and delays of the system became apparent during World War I. Upon America's entering into the European conflict, the Federal government's response to the overcrowding of the harbor was to sponsor other port developments to handle incoming freight during the war (WPA 1941: 232). New York's response was the New

York-New Jersey Port and Harbor Development Commission of 1917, out of which the Port of New York Authority was founded in 1921.

b) TRANS-ATLANTIC STEAMSHIP TERMINALS

(1) Gansevoort Piers

In 1897 the area from West 11th to Gansevoort streets and from West Street to Thirteenth Avenue (present-day Twelfth Avenue) was dredged, making West Street an "outer Street" to the West Washington Market (see Figure 69). West Street was given 200 feet of the distance to the bulkhead line. The other 50 feet was given over to the headhouses of the then latest trans-Atlantic steamship piers. Here, four companies relocated to the accommodations provided by 700-foot-plus piers spaced with 250-foot slips (see Figure 70). They included the White Star Line at piers 48 (W. 11th Street) and 49 (Bank Street); the Allan State Line Steamship Company and Wilson State Steamship Company on the south and north berths of pier 50 (between Bethune and W. 12th streets); and the Cunard Line Steamship Company at piers 51 (Jane Street) and 52 (Gansevoort Street).

The uniform facade treatment used in the Gansevoort Piers provided the most visual cohesion along West Street seen to that time. It was a continuous two-story treatment, metal clad and articulated in pilastered bays. Each company had subtle detail variations within its classicism, including variations in architectural orders, fenestration, and pediments at the pier heads. The new order brought about the most successful three-dimensional definition of West Street.

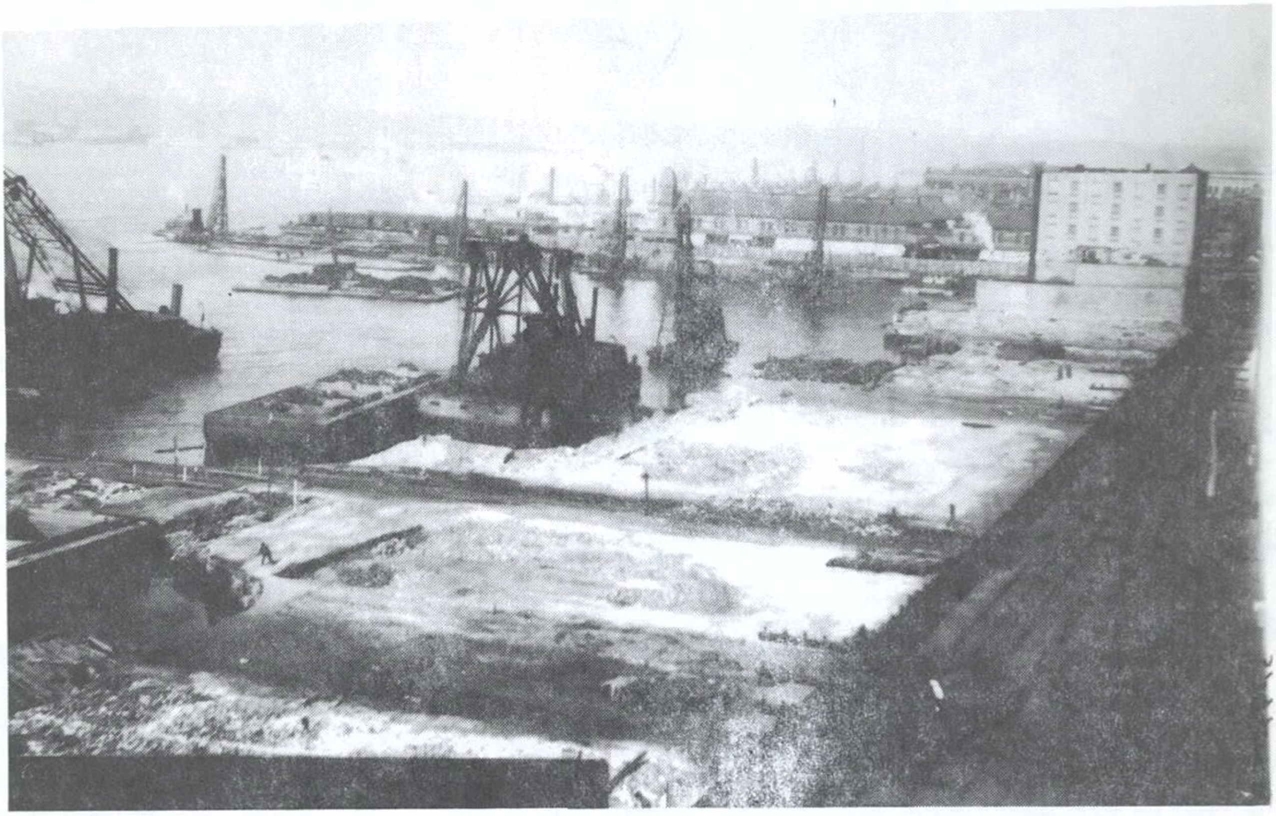


FIGURE 69. Dredging for Gansevoort Piers between Bank and Gansevoort streets, 1897-98. West Street is at the right and the West Washington Market is in the background (Collection of South Street Seaport Museum).

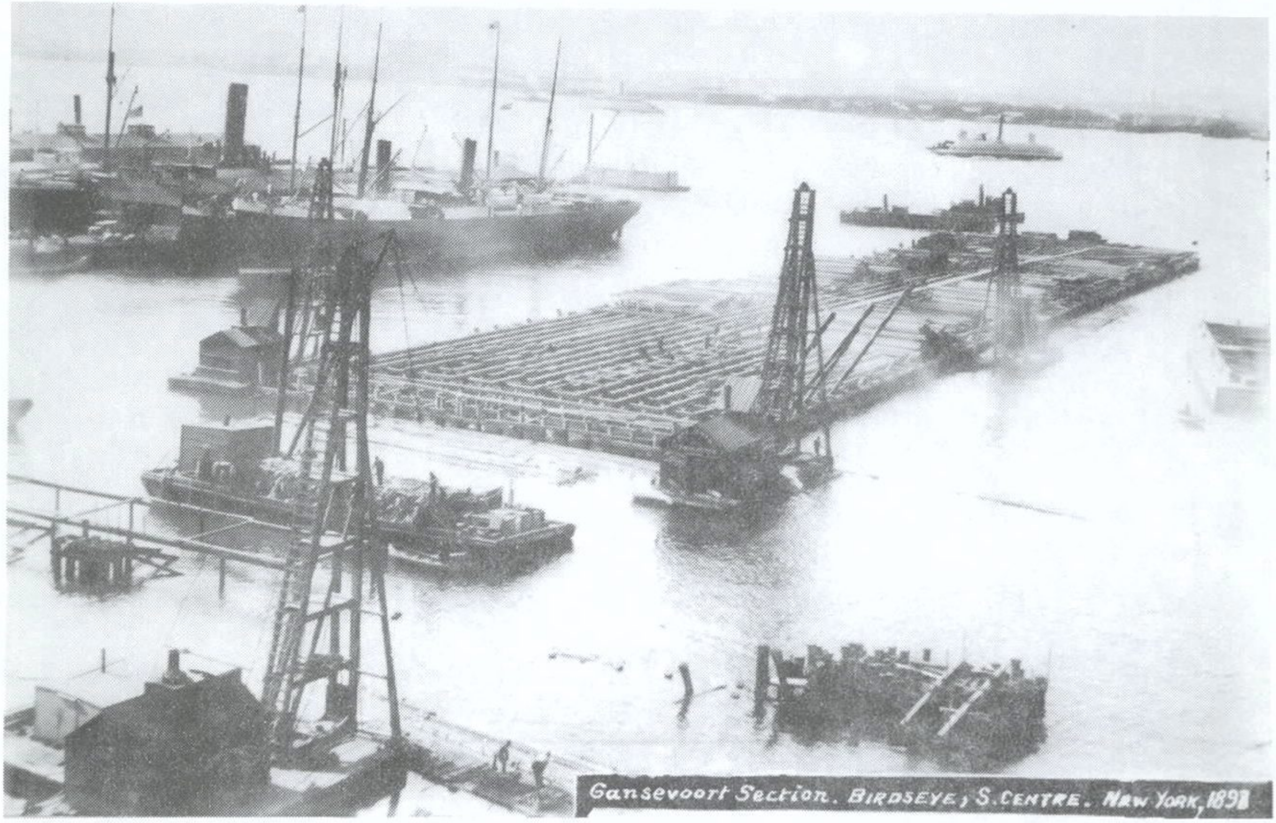


FIGURE 70. Construction of pier 48, W. 11th Street, Gansevoort Piers, 1897-98 (Collection of the South Street Seaport Museum).

The sharp-edge of the street's west side became defined in an architectural style rather than by merely a gable end of a shed. The prominent pier headhouse contained various offices and rest facilities, besides providing the access through which one entered the pier. Perhaps in a more abstract, yet very real, way the relationship of West Street to the Hudson River was altered so that they became separated visually.

The Gansevoort Piers varied in width as well as length. Piers 48, 49, and 50 were all 125 feet wide and 732, 719, and 704 feet long, respectively. Pier 51 was 110 feet by 689 feet, and pier 52 measured 75 feet wide by 678 feet long (see Figure 71). This last pier was attached to the West Washington Market land mass along Gansevoort Street. Therefore its north berth was half the length of its south berth.

With this rather abrupt block at Gansevoort, the West Washington Market formed an obstacle in the flow of vehicular traffic moving to or from West Street south of Gansevoort. This situation apparently prevailed until the construction of the West Side Highway; however, the rapidly increasing length of trans-Atlantic steamships continued to create the need for ever-longer piers, even longer than those at Gansevoort. Thus, before a mere decade of use, the Gansevoort Piers were superceded by new construction north of the West Washington Market.

FIGURE 71. Gansevoort Piers, housing the Cunard Steamship Company, pier 51, and the North German Lloyd Line, pier 52, c. 1900 (Collection of the South Street Seaport Museum).

(2) Chelsea Piers

The most successful effect of the City Beautiful Movement on the urban design of the Hudson River waterfront occurred in the first decade of the twentieth century. From the West Washington Market north to West 23rd Street, a new Eleventh Avenue was laid out as the outer street. New piers were constructed from little West 12th Street to West 22nd Street, and the ferry terminals of the Central Railroad of New Jersey, the Delaware, Lackawanna & Western, and the Erie Railroads were built at West 23rd Street. These were placed opposite a park* where Eleventh Avenue bends uptown to the main Manhattan grid and Twelfth (then Thirteenth) Avenue bends to the northwest.

As in the Gansevoort Piers development, the existing land mass was dredged out to obtain slip depth and pier length. A new bulkhead at 23rd Street and the existing West Washington Market created anchors at the ends of the new piers. These piers were planned to berth the longest ocean liners of the time. In the first years of the new century, steamships over 700 feet long were being built, and the piers were designed for an 825-foot dimension. Nine were constructed in all: the end two, 53 and 62, were attached to adjacent land forms and provided one-sided berthing; the other seven (54-61) contained two berths. (*Note:* There was no pier 55, an arrangment that allowed

*Formerly an Erie Railroad Yard, Smith Park was acquired by the city at this time but was neither designed nor landscaped until 1936 [WSHP n.d.: 5 Far (f)]. However, the concept of a green space closing the southern end of Eleventh Avenue and fronting the ferry terminals was part of the early twentieth-century City Beautiful planning.

the Hudson River Piers north of West 23rd Street to be renumbered simply by increasing their present numbers by an even 10. For instance, pier 54 at West 24th Street became pier 64.) (See Figures 72 and 73).

The Cunard Line relocated from Gansevoort to piers 53, 54, and 56, occupying the 60 by 825-foot pier and the two 100 by 825-foot piers (see Figure 73). The street grid shift is reflected in the 178-foot slip between piers 53 and 54. This slip splays out toward the river as pier 53 reflects the Gansevoort orientation and pier 54 is aligned with the other Chelsea piers. The Chelsea piers are not aligned with the orientation of the adjacent street grid but rather have their own direction, almost due east-west and normal to the inclination of this section of Eleventh Avenue (see Figure 72). The French Line used pier 57 (the standard 825 by 120-foot size). the Atlantic Transport used pier 58, the White Star Line used piers 59 and 60, the Red Star Line was located at pier 61, (800 x 120 feet), and the American Line occupied pier 62 (measuring 800 by 60 feet).

The headhouses lining Eleventh Avenue were 50 feet wide, except at piers 60, 61, and 62 where they were 70 feet. The line of two-story buildings, like that at the Gansevoort Piers, was interrupted at the pier pavilions, which contained pronounced large semicircular arches and were topped with open pediments (see Figure 73). Unlike Gansevoort however, the headhouses at Chelsea were of scored stucco, simulating stone masonry construction, on metal lath combined with steel and concrete. They were the most permanent structures built along the Hudson River waterfront, avoiding the more typical corrugated iron siding in favor of simulated

FIGURE 72. Undated view (c. 1930's) of Chelsea piers, looking northward from pier 53. The West Washington Market is at the left and the Miller or West Side Highway is at the right. (Collection of the South Street Seaport Museum.)

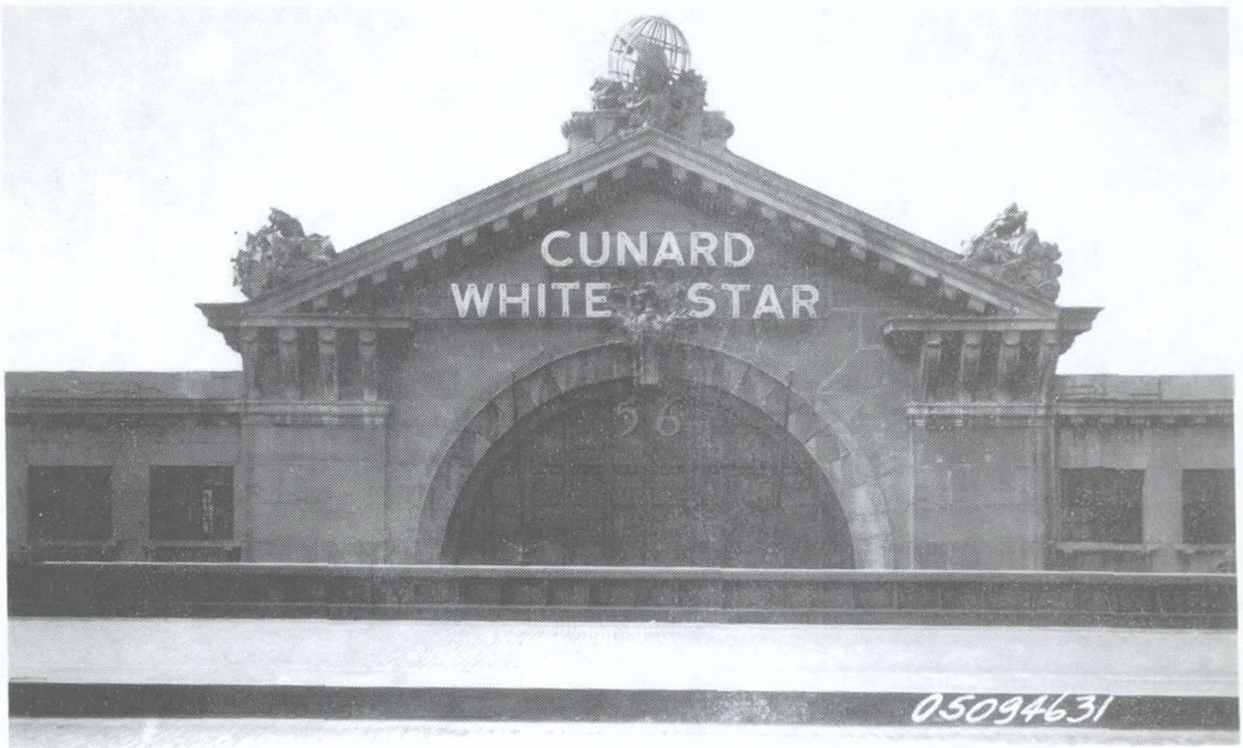


FIGURE 73. Undated photograph (c. 1930's) of Chelsea pier 56, Cunard-White Star Line, as seen from the elevated West Side Highway (Collection of the South Street Seaport Museum).

coursed ashlar. They sat on a granite base and exhibited simplified detailing.

The piers themselves, built with timber piles and a concrete deck, were two-story constructions in steel clad in corrugated iron. Structurally the system used here--I-section columns, built-up plate girders, and lightweight roof trusses--became codified twentieth-century pier construction.

The roof parapets of the headhouses which held the pediment details failed and were removed in 1951-52 (Dept. of Marine and Aviation 1952: 49). Pier 57 was destroyed by a fire in 1947 and demolished in 1949. The new pier that replaced it was built at Haverstraw, New York and floated to its Chelsea location (Dept. of Marine and Aviation 1952: 35). The northern Chelsea Piers (59, 60, and 61) were substantially renovated between 1963 and 1968 to accommodate general break-bulk cargo freight. Metal curtain walls clad the headhouses, which were widened to 220 feet and were spanned with bow joists carrying the single-story roof. Pier 59 had its shed removed, but 60 and 61 remained basically intact.

The great ships of the early twentieth century used the Chelsea berthing. The Cunard Lines's *Mauretania* and *Lusitania,* built in 1907, utilized the turbine engine instead of the traditional reciprocating type. The White Star Line responded with the 880-plus-foot series of the *Olympic*, which was the largest ship in the world when it visited New York in 1911; the *Titanic*, which sank in the North Atlantic on its 1912 maiden voyage; and the *Britannic*, which also sank, in the Aegean Sea in 1916 (Bunker 1979: 130-32). In 1914 the International Longshoremen's Association obtained the first port-wide

FIGURE 74. Undated photograph (c. 1930's) of pier 84 at W. 44th Street, built in 1925 (Collection of the South Street Seaport Museum).

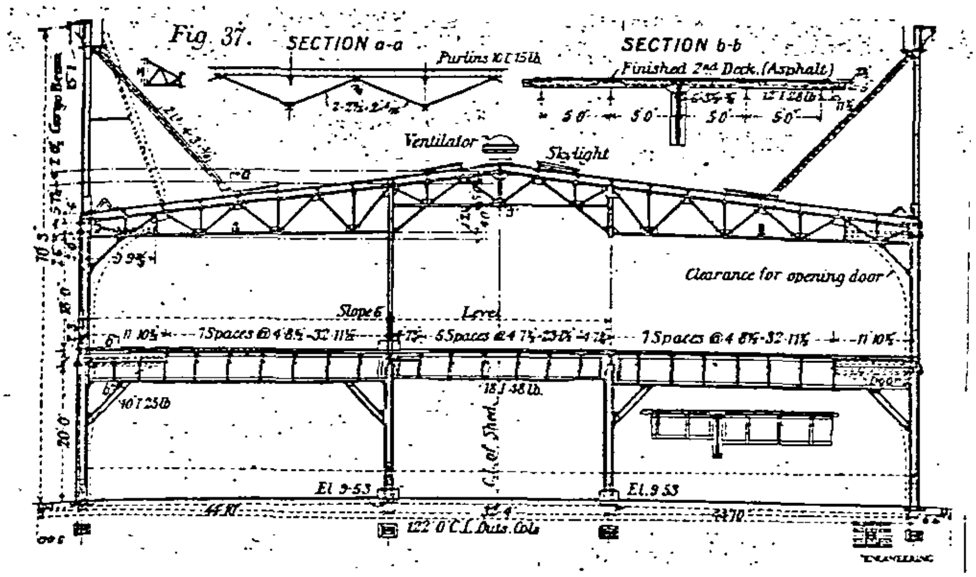


FIGURE 75. Transverse section of shed on pier 84 at W. 44th Street (Cunningham 1929: 21).

these piers into the Consolidated or Eisenhower Passenger Ship Terminal. Inasmuch as the present study area ends at West 44th Street, this last ensemble of trans-Atlantic ocean liner piers is beyond the limits of the present project. However, it is mentioned here as the last chapter in the story of the development of such facilities along the Hudson River waterfront.

c) NEW FERRIES

It was in the first decade of the twentieth century that ferry service on the Hudson River had its last great gasp of activity. Railroad tunnels under the Hudson to New Jersey were at last being built by two separate companies. The Hudson and Manhattan Railway--the on-again-off-again tunnels from Midtown and Downtown Manhattan to the rail terminals of Hoboken and Jersey City and beyond to Harrison and Newark--opened in 1908 to connect West 19th Street and Sixth Avenue in New York to Hoboken, New Jersey. This mainly commuter service tapped into the Delaware, Lackawanna & Western, the Erie, and the Pennsylvania railroad ferry terminal clientele by offering an alternative to crossing the river by ferry. The other tunnel, the Pennsylvania Railroad's ambitious Penn Station project, offered service to 33rd Street from various points. The enterprise resulted in that company's eventual abandonment of its Exchange Place, Jersey City ferry service. The dreams of the nineteenth century, assisted by the new technology of the electric motor, had become the reality of the twentieth century.

As already discussed, the ferry terminals, like railroad stations, were clad in the prevailing architectural style of the day. They were pile-supported platforms placed between adjacent piers. Typically, each terminal contained two slips. The boats were loaded and unloaded with the assistance of transfer bridges à la Fulton. The speed with which ferries could be filled and out of the slip became critical to commuters.

By the late nineteenth century, double-level fences were in use, and the engineered response to these boats was twofold in New York. First, two sets of bridges were designed to occupy separate levels; typically, the lower apron was intended for vehicular loading, and pedestrian bridges above gave direct access to the upper ferry. Second, via bridges over West Street itself, ferry passengers could avoid crossing that chaotic thoroughfare at street level.

Leading the way in the second-level crossing of West Street was the Pennsylvania Railroad. In 1889 the company wanted to build pedestrian bridges over West Street, but its request for authorization was denied by City Hall (Condit 1980: 164). However, by 1891, when the company was reconstructing its Jersey City ferryhouses, it also announced the bridging of West Street (*Engineering News* 1891: 316; see Figure 76). The supporting editorial announcement in *The Railroad Gazette* November 22, 1889, quoted in Carl Condit's *Port of New York*, provides a vivid picture of the problem:

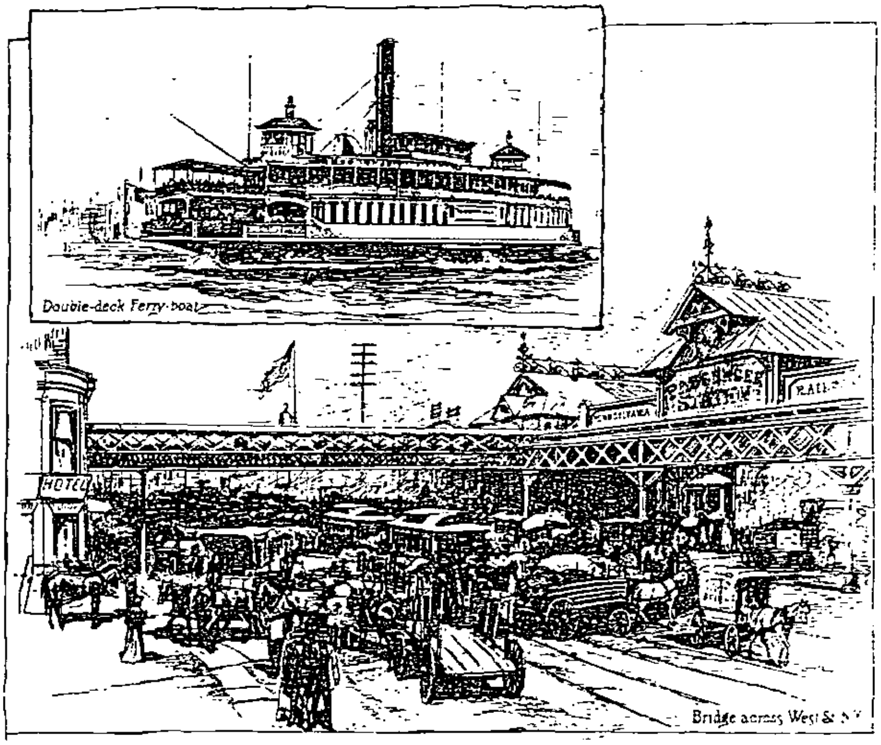


FIGURE 76. Cortlandt Street Ferry Terminal of the Pennsylvania Railroad c. 1890 showing bridge over West Street. Inset shows double-deck ferryboat (Grow 1979: 46).

> The West Street crossings to the various railroad ferries are so dangerous and so extremely disagreeable that it is a wonder that they have not long ago been bridged. The street is densely crowded with teams. The policemen at crossings cannot keep them clear, and the great crowds who use the ferries morning and evening pass through with real danger to life and limb. The street is also one of the dirtiest in New York City, which is the equivalent to saying that it is one of the dirtiest in the world. (*The Railroad Gazette* 1889: 772)

By the turn-of-the-century, the best operational ferryboat was dual-engined with fore and aft propellers (*The Railroad Gazette* 1904: 650). The first boat to adopt the propeller instead of the traditional sidewheel was the *Bergen* of the D.L.& W. line. This boat was landed in 1888 at Delameter Iron Works in Newburg (Cudahy 1975: 7). The propeller-driven boat and the dual level loading method defined the "state of the art" for the ferryboat as it entered the twentieth century.

The influence of the electric motor on ferries was especially evident in the raising and lowering of the bridges. In his *The Port of New York* (1980: 374), Carl Condit summarizes the solutions to ferryhouse logistics in terms of the major functioning parts of the slip and the connecting bridge, as follows:

> (1) the shaping of fender racks to conform to a half-plan of the boat;
> (2) the sheet piling of the racks backed and braced by a framework of stringers, posts and braces to absorb the impact of the colliding vessel by means of a spring action devised from the natural elasticity of the timber frame with its bolted connections;
> (3) double-level bridges composed of heavy timber plank floors on three dimensional platform frames designed to transmit the impact and rolling loads of moving vehicles to;

(4) a movable platform with a framework massive enough to absorb the major part of the impact and to transmit the remainder through rubber springs to;
(5) a bumper platform rigidly attached to wales, or inclined bracing piles, which absorb the final residue of energy from the impact by the resistance of the piling to bending and direct compression;
(6) the suspension of the bridges by means of hangers, depending from laminated timber arches with high elasticity combined with resistance to shocks derived from the tendency of the laminal to straighten themselves, or to oppose the maintenance of the arch form;
(7) the raising and lowering of the bridges by means of electric motors supplemented by counterweights.

The dynamic loading of the entire system was compounded in the early part of the century by the appearance of motor vehicles, which eventually replaced horse-drawn transports.

By the close of the nineteenth century, the Central Railroad of New Jersey maintained ferry service at Liberty Street to Jersey City. The Pennsylvania operated ferries, also to Jersey City, at Cortlandt, Desbrosses, and West 23rd streets. The Delaware, Lackawanna and Western offered service from Barclay Street and Christopher Street to Hoboken. The Erie Railroad located its ferries to Jersey City at Chambers Street and West 23rd Street. A latecomer to the Hudson River waterfront was the West Shore Railroad, which had its ferry landing at Weehawken. Control of the West Shore line was assummed by the New York Central after extensive and expensive road construction along the west shore of the Hudson had put the company in poor financial straits. The Manhattan ferry landings were two: the traditional "Weehawken Ferry" site at West 42nd Street, first established in 1856, and another combination ferry and freight station at Franklin Street, pier 23 (see Figure 77). The 70 by 676-foot pier 23 was covered by a single-story covered shed clad in the standard iron siding. The bulkhead followed the standard Department of Docks design, 250 feet from the east side of West Street. The handsome headhouse, like its contemporary steamship pier headhouses, was 50 feet wide yielding a net width of street of 200 feet. Its structure was iron frame and it was clad in galvanized sheet iron siding. Distinguishing the building was a tall clocktower rising about 100 feet. The design was that of Walter Katté, Chief Engineer for the New York Central and Hudson River Railroad, and it was executed in 1891-92 (*Engineering News* 1891: 480). It may have been the last non-Beaux Arts-influenced ferry terminal built along the Hudson River.

The movement of the city northward by the first decade of the twentieth century was marked by the constructions around Madison Square, the Flatiron Building on Broadway, and the concentration of three railroad-controlled ferry terminals at West 23rd Street and Twelfth Avenue. This complex served to anchor the Chelsea Pier development on the north side. The Erie Railroad and the Pennsylvania Railroad had pre-twentieth century terminals at this location. The Pennsylvania was constructing its monumental passenger terminal from the designs of McKim, Mead and White at 33rd Street, rendering its 23rd Street ferry terminal obsolete. Simultaneous with the Chelsea Pier constructions, the Erie, the Delaware, Lackawanna and Western, and the Central Railroad of New Jersey built side-by-side ferry terminals between 1904 and 1907.

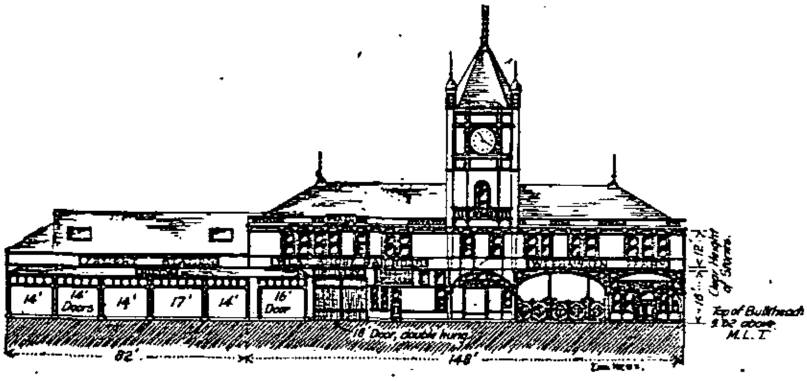


FIG. 398.—ELEVATION ON WEST STREET.

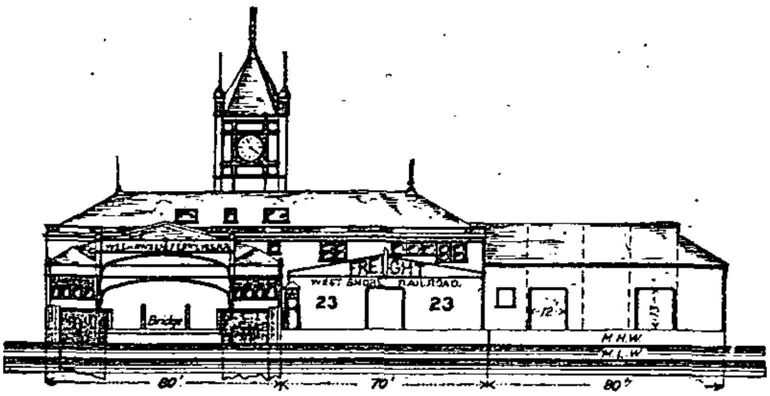


FIG. 399.—ELEVATION FROM RIVER.

FIGURE 77. Views of West Shore Railroad, Franklin Street Ferry and pier 23 (Berg 1893: 233 and 234).

Although not strictly a "union" terminal--i.e., various railroad companies did not share common facilities--the West 23rd Street undertaking was a remarkable cooperative venture. The common plaza (later Smith Park) between 22nd and 23rd streets and between Eleventh and Twelfth avenues provided a common focal point, and each separate terminal was designed so that the architectural features of the three facades would produce a harmonious effect (*Engineering News* 1905: 23; see Figure 78). There were six slips in all. The Jersey Central had a single slip along the south end adjacent to pier 62. The DL&W had three slips in the middle, and the Erie occupied two slips on the north end. Each facade was organized into bays with pilasters, each having large elliptical arches on the second level and various openings at the first level covered by a continuous canopy. The four bays of the Hoboken/Lackawanna Railroad Ferry were divided in two by a tall clocktower similar to the one atop the Hoboken Ferry terminal, being built at the same time.

The Beaux Arts planning of the spatial sequence internally reflected the two-level loading technology. The Erie front was organized in three bays (see Figures 79 and 80). At the first level, team loading and unloading and passenger egress flanked the central lobby entrance. The lobby, where tickets were purchased, opened up beyond to a waiting room. Stairs led to a second waiting room on the second level, where bridges connected the terminal with the ferryboats. An open well tied the two waiting areas together. Across the entire front of the second level was a bank of some seven offices. The Erie used two buffer platforms behind their transfer bridges.

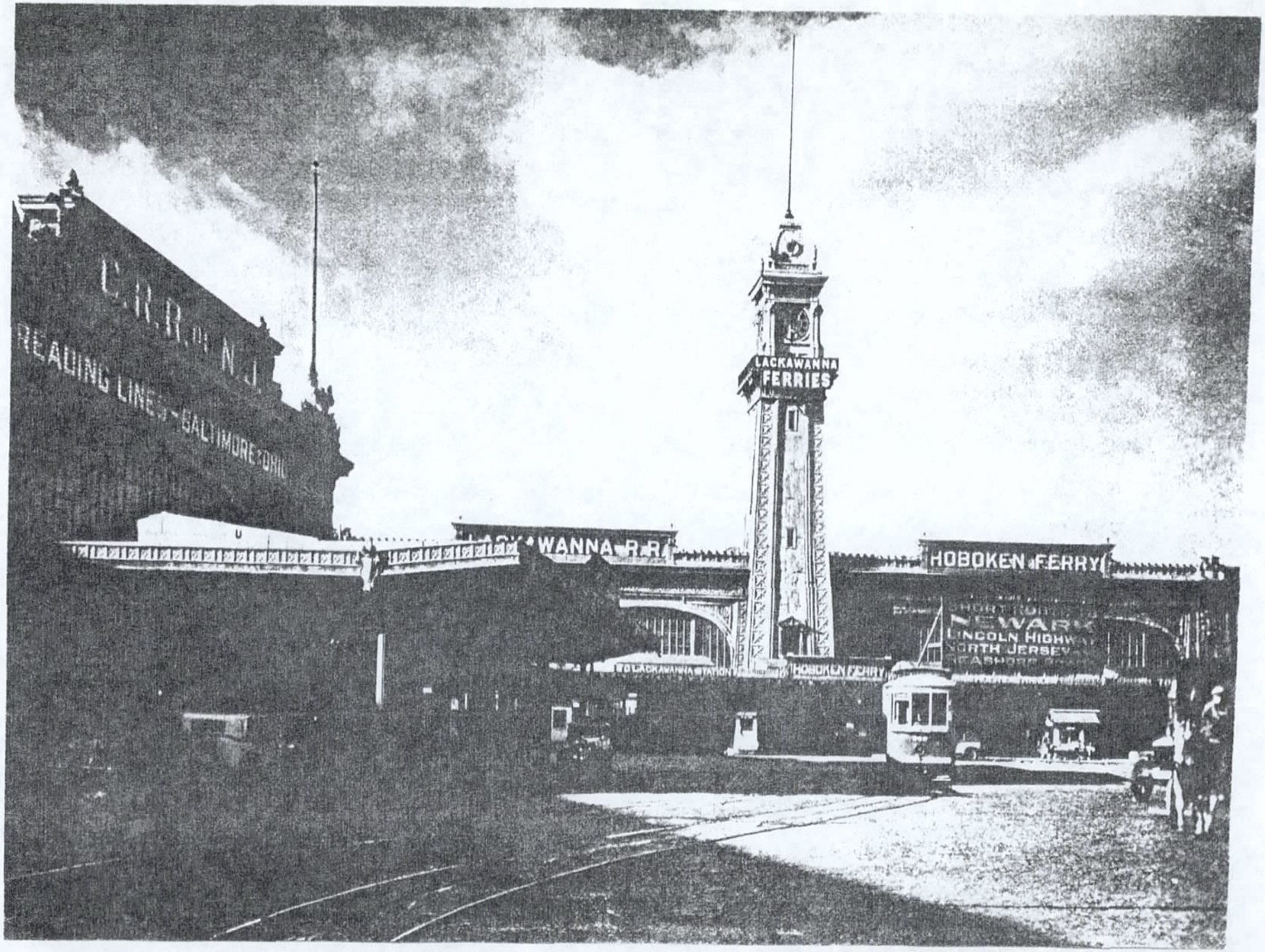


FIGURE 78. Copy of historic photograph of the 23rd Street ferries of the Central Railroad of New Jersey and the Delaware, Lackawanna and Western Railroad (Nathan 1968: 158).

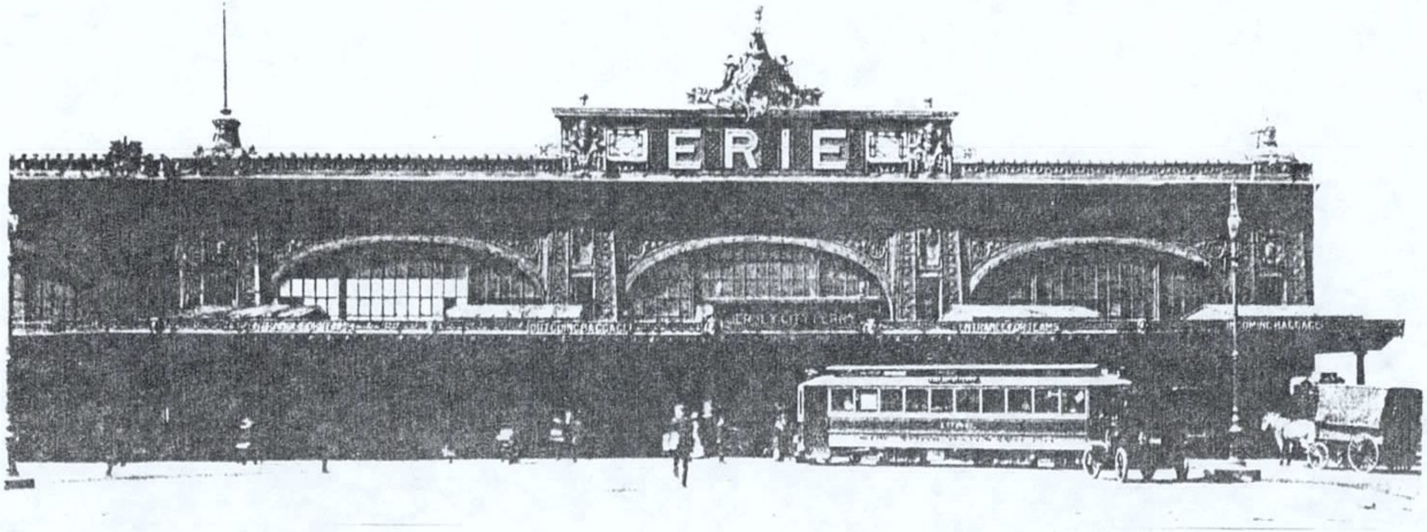


FIGURE 79. Copy of published photograph of Erie Railroad's 23rd Street Ferry (*Seaport* 1982). Built c. 1904-1907, this view was probably taken c. 1910.

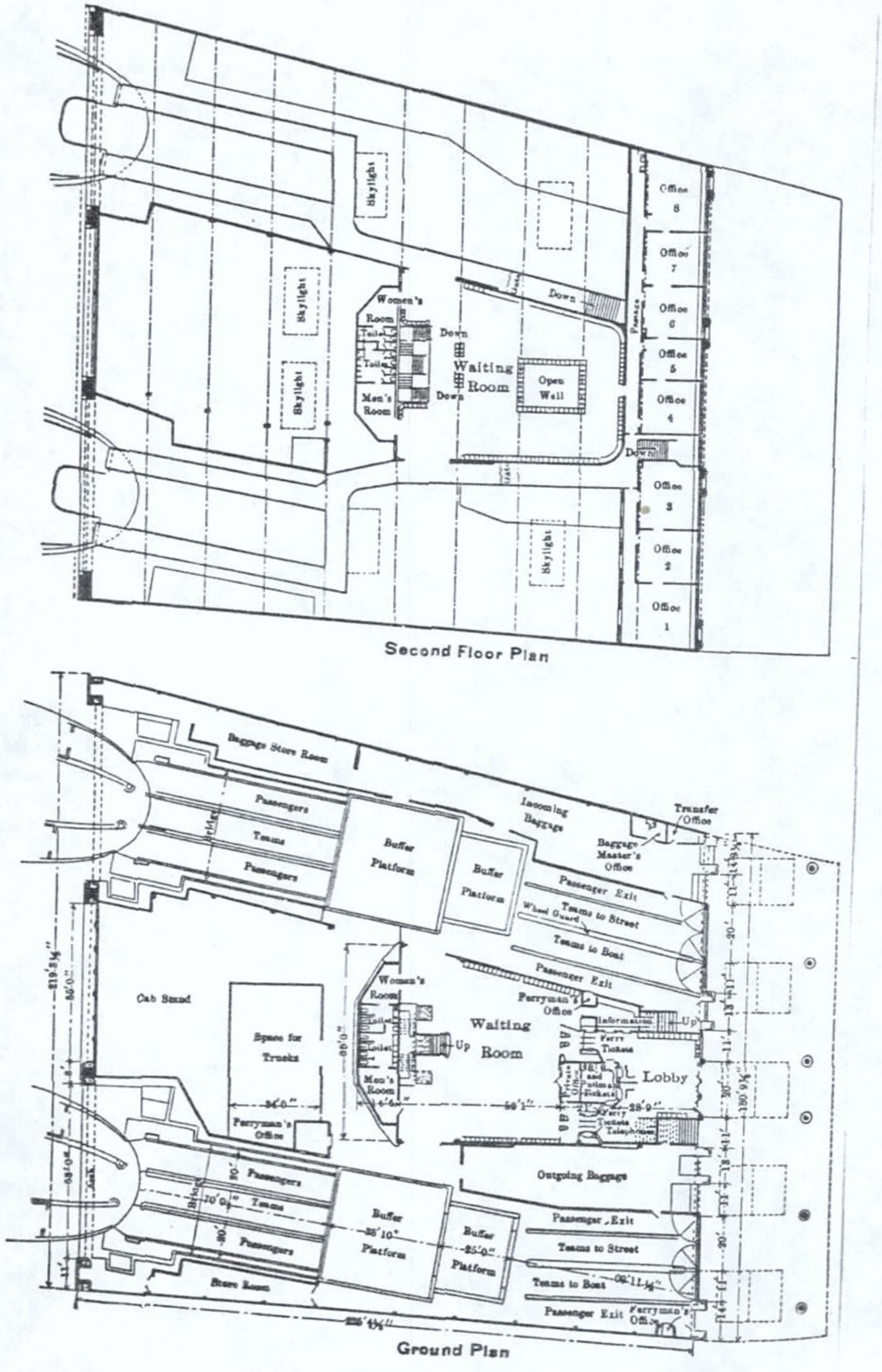


FIGURE 80. Plans of Erie Railroad Ferry Terminal at 23rd Street (Droege 1912: 140, Fig. 101).

Far less successful architecturally was the long, narrow single-slip Jersey Central facility. The space was given over on the south side to a long driveway for teams and direct exit for passengers. Along the north side, a passage/vestibule to the lobby, ticket offices, and main waiting room consisted of a long narrow sequence of spaces. The stair in the main waiting room led to another on the second floor, beyond which bridges led to the upper decks of the ferryboats. Typically, the ferryhouse (river) facade used the same elliptical arch as did the Twelfth Avenue facades to create the sheltered opening for the boats. These were distinguishing features of all Beaux Arts ferryhouses along the river.

During the same time, the Jersey Central undertook a complete reconstruction of its Liberty Street facilities, ferryhouse, and freight piers at Cedar and Albany streets between 1905 and 1909. The bulkhead shed and ferryhouse took 50 feet of width from West Street, leaving a 200-foot corridor (*Railroad Age Gazette* 1908: 1,289). The new ferryhouse was built behind (west of) the former one, which permitted continuation of service. After it was completed, the old building was taken down and the space given over to West Street. A pedestrian bridge over West Street gave direct access to ferryboats. Team and passenger exits were paired at the end pavilions on the first level, which was treated as a basement architecturally. The Ionic order was raised on this basement to a superhuman scale. Lobby and baggage areas were located in the middle position of the basement level. The articulation of the Ionic pilasters created a rhythm of a three-bay central portion joined to single-bay end pavilions by short links. The solid parapet above the central portion was surmounted by CENTRAL R. R. OF NEW JERSEY and crowned with a clock. The pedimented pavilions were joined to the middle section by an open balustrade. The standard interior spatial organization had a lobby with ticket offices and a direct stair access to the second level waiting room, entered off West Street. The main waiting room was entered from the lobby on the first level. An annex waiting room spanned between the two bumper platforms, and a smoking room south of the main waiting room provided ancillary space.

In this terminal the Beaux Arts principles of good spatial planning combined with the facade plane articulation of adapted classical detailing are very well represented. Also, in terms of construction technology, the use of structural steel frameworks, either clad or filled-in with hollow tile, represents the state of the fireproofing art at that time. The copper facades were attached to this framework.

Few improvements to ferry terminals took place after this period. Railroad tunnels and vehicular tunnels, and later bridges, were on their way to curtailing ferryboat service to its present-day status--the line to Staten Island.

d) RAILROAD FREIGHT

The national emergency associated with World War I brought attention to many of the Port of New York's problems, particularly those of congestion and inefficiency. As mentioned previously, the government's response to these problems extant in New York Harbor was to create competition for New York in other ports. The versatility of the lighterage system led not only to a congested harbor but also to above average terminal cost borne by the railroad companies operating out of New York. Even the Port of New York Authority seemed to take the point of view that the freight problem was primarily a railroad dilemma (Chinitz 1960: 40). Railroads continued to concentrate on the technology of engines and rolling stock and not on the less advanced peculiarities of loading and unloading methods.

One freight-moving innovation that was made in the port during this era, and for which the Pennsylvania Railroad is given credit, was the utilization of the electric motor to raise and lower transfer bridges. The prototypes were built in the Jersey City Greenville Yards (1904-1906), with connections to Bay Ridge, Brooklyn, giving the Pennsylvania Railroad the closest system possible to a New York belt railway for freight. The motors saved a great deal of time in raising and lowering the bridges. Typical car floats of the day held 12 cars, six to a side, and had a center loading platform. The New Haven, New York Central, and Pennsylvania lines had longer 20- to 22-car car floats (Droege 1912: 224). Lighter capacities were between 600 and 700 tons by the end of the war. Some companies had self-propelled steam lighters with 300- to 500-ton capacities and the ability to handle heavy pieces and tow scow lighters (MacElevee 1918: 73-74). Most business, however, continued to be pushed and pulled by tugboats.

Lighterage categories in New York Harbor after the war could be classified into three types. The first were public lighters, common carriers charging whatever the traffic would bear (in 1917, 7½ to 9¢ per 100 pounds). The second were the charter lighters, either leased or chartered but not operated by their owners. The third were the private companies, such as the railroads or terminal companies (MacElevee 1918: 72).

Car floats and lighters were concentrated south of West 23rd Street. Actual transfer bridge facilities on the Hudson River were generally located north of West 23rd Street along the recently filled Twelfth Avenue. North of the 23rd Street ferries, the Baltimore & Ohio Railroad had a yard, freight station, and warehouse along West 26th Street and float bridges opposite Twelfth Avenue (see Figure 81); the Lehigh Valley was at 26th to 27th streets, with float bridges; and the Erie Railroad moved its 23rd Street freight yard to between 28th and 29th streets, with float bridges. The New York Central's yards, by far the largest, were located between 36th and 33rd streets; with transfer bridges between 32nd and 33rd. The West Shore Railroad, a New York Central company, was located between 35th and 37th streets. The Pennsylvania, with most of its facilities Downtown, had a yard between 37th and 38th streets. A transfer facility along Twelfth Avenue was placed opposite this yard and covered pier No. 77.

Twelfth Avenue was interrupted by the Consolidated Gas Company facility between West 41st and 42nd streets. A waterside coal hoist led to the gasification works between Twelfth and Eleventh avenues. The New York Central had its 42nd Street freight station at pier 83, adjacent to the West Shore Railroad and the New York, Ontario and Western Railroad Ferry Terminal.

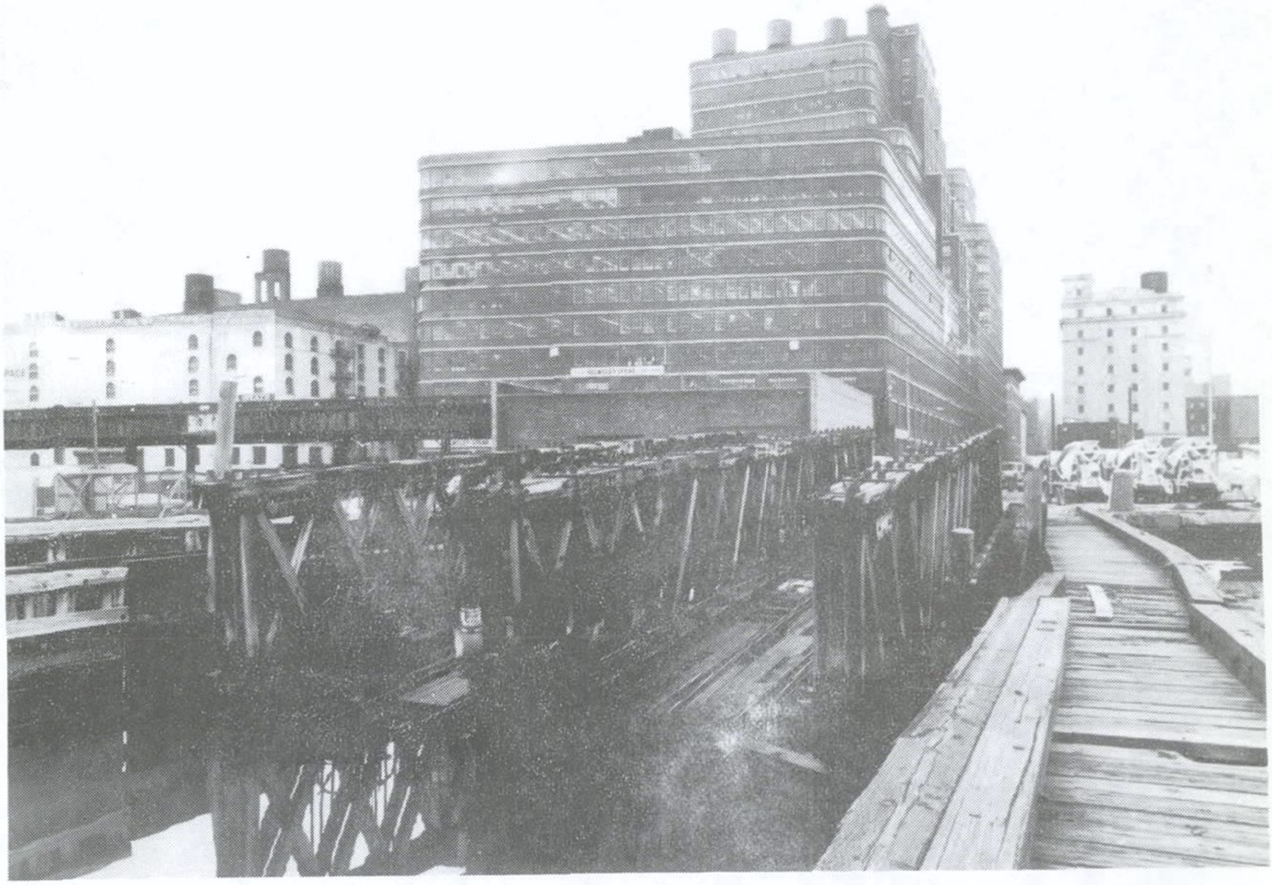


FIGURE 81. View eastward at Baltimore & Ohio Railroad float bridges, W. 26th Street (Michael Spozarsky, photographer, 1980).

The New York Central's large yard, of course, was the 60th Street yard, well north of the study area. As previously mentioned, this yard was already developed in the late 1870's and 1880's. Only in the early twentieth century did the other companies begin to join the New York Central in the Midtown area. No company moved farther north than the New York Central.

Of all the technological changes affecting the movement of freight in and out of the Port of New York, none was as far reaching or devastating as vehicular trucking. The fact of the matter was, simply, that the New York piers were not designed to handle trucks. The Holland Tunnel construction in the late 1920's meant that freight could be unloaded from vessels tied up at the West Side docks and loaded directly onto trucks for westbound movement. Lighterage was no longer the exclusive method.

On the docks, the loading and unloading of trucks was accomplished by "public loaders." These were middlemen operating between the longshoremen, who worked the steamships, and the truck owners, who found it increasingly slow, irritating, and uneconomical to handle freight with their employees (Chinitz 1960: 43). It was not until the Waterfront Commission of 1953 that the public loaders were abolished and the regular longshoremen were given truck-loading responsibilities. The congestion of the railroad lighterage system thus finally gave way to the chaos of trucking interfacing with shipping on ill-prepared pier facilities.

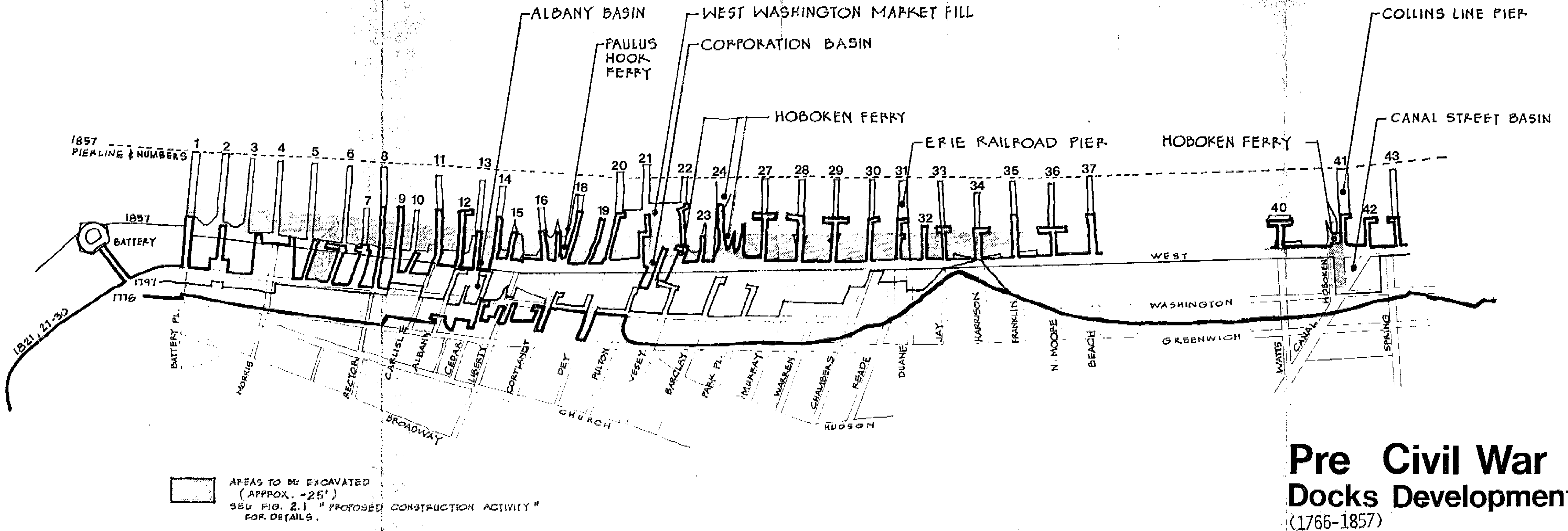
The new methods generated a decentralization of freight terminals. In the 1930's, not only after the construction of the Holland Tunnel, storage facilities were constructed on both sides of the harbor. The Pennsylvania Dock and Warehouse Company erected 2,000,000 square feet of dry, and 400,000 square feet of refrigerated, storage space in Jersey City, New Jersey. Also in New Jersey, the Lackawanna built its 1,000,000-square foot storage terminal in Jersey City, and 2,000,000 square feet of space was added to the Bayway Terminal in Elizabeth. Meanwhile, in New York City, the Port Authority Building was erected, occupying the entire city block between 15th and 16th streets and 8th and 9th avenues (WPA 1941: 265). Therefore, the response to the congestion of the West Side waterfront, aggravated by the advent of the motor vehicle, was the creation of increased competition within the port area.

Over time, the number, size, and type of waterfront facility built on the Lower West Side evolved rapidly for a number of reasons. To depict this progressive development, two schematic maps were prepared of Area 2 (see Figure 3 for location of Area 2) showing the shoreline filling and longshore building in the nineteenth century, both before (Figure 82) and after (Figure 83) the Civil War. Each is based on analysis of a variety of historic maps and documentary sources. Such analyses and schematics, of course, give only general locations; however, they do accurately illustrate the continued redevelopment of the West Side waterfront in a period of intense growth--the Industrial Revolution.

bargaining agreement with the various New York employers (Bunker 1979: 150). Advances in pier- and shipbuilding were temporarily set back with the outbreak of the War in Europe.

By 1920, some steamships had reached a length exceeding 950 feet. Inasmuch as the Chelsea Piers were inadequate to handle such berths, the city, from the designs of T. F. Keller, Chief Engineer of the Department of Docks, built the 950 by 135-foot pier 84 at West 44th Street in 1924-25 (Cunningham 1929: 15). Because Twelfth Avenue and its bulkhead are cut back inland at 44th Street, pier 84 had a 950-foot berth on its north side and a 680-foot berth on its south side. Its headhouse is no wider than the pier, but absorbs the first four bays of the two-story pier shed itself (see Figure 74). The avenue facade is an endwall which is organized similar to the Chelsea pier ends, with a stilted semicircular arch and steel and glass infill; its cladding, however, is brick and terra cotta. The typical pile-supported pier had a concrete deck, a plate girder supporting system for the second floor, and a lightweight steel truss roof system (see Figure 75). On the roof, along each of the unequal sides, was a continuous cargo beam supported by columns extending upward from the structural bays below.

The era of 1,000-foot steamships was not far off. The *Normandie* and the *Queen Mary* were built in 1935 and 1936 respectively, and New York was quick to construct appropriate berthing facilities. Between West 48th and 52nd streets, three piers--88, 90, and 92--were designated the Trans-Atlantic Steamship Terminal in 1936 (WPA 1941: 230). They contained dual berthings of 1,000-, 1,100-, and 1,100-foot lengths, respectively. In 1974, the Port Authority renovated



Pre Civil War
Docks Development Schematic
(1766-1857)

BASED ON:

1. RATZER, BERNARD, "PLAN OF THE CITY OF NEW YORK", 1776, (KITCHIN ENG., JEFFREY & FADEN, PUBLISHERS).
2. B. TAYLOR (DEL.) & J. ROBERTS (PUB.), "NEW AND ACCURATE PLAN OF THE CITY OF NEW YORK IN THE STATE OF NEW YORK IN NORTH AMERICA", PUBLISHED IN 1797.
3. EWEN, DANIEL, "MAPS AND SURVEYS" 1821, UPDATED 1827-30.
4. A. KURTH & ROSA, C.E.'s AND SURVEYORS, "MAPS COPIED FROM THE ATLAS OF THE HARBOR COMMISSIONERS" 1857.

HISTORIC CONSERVATION & INTERPRETATION, INC.
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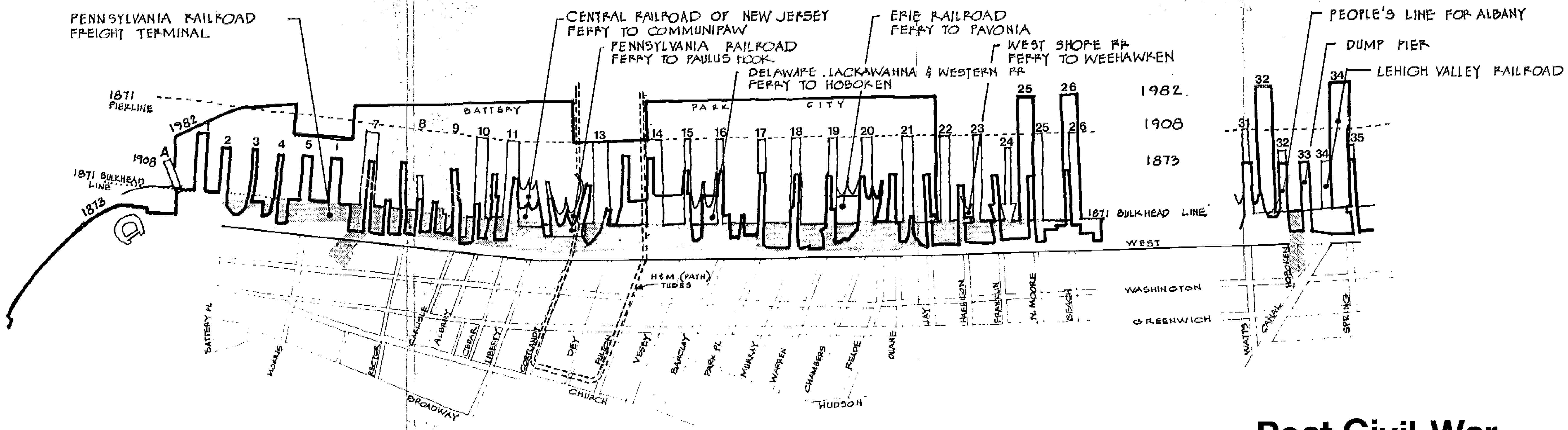
FIGURE 82



AREAS TO BE EXCAVATED (APPROX. -25')
SEE FIG. 2.1 "PROPOSED CONSTRUCTION ACTIVITY" FOR DETAILS.

NUMBERS AT END OF PIERS REFER TO DEPT. OF DOCKS SYSTEM IN 1871 & 1982.

Post Civil War
Docks Development Schematic
(1873-1908)

BASED ON:

1. DEPARTMENT OF DOCKS, "MAP SHOWING THE HIGH AND LOW WATER MARK AND THE ORIGINAL CITY GRANTS OF LANDS UNDER WATER MADE TO VARIOUS PARTIES FROM 1686 TO 1873, NEW YORK CITY, 1873, GEN. CHARLES K. GRAHAM, ENG'R.
2. BROMLEY, G.W., "MAP OF MANHATTAN ISLAND IN 1908 SHOWING STREETS, BUILDINGS, DIMENSIONS, ELEVATION ABOVE HIGH WATER, ETC.
3. MAP PREPARED BY LOCKWOOD, KESSLER AND BARTLETT, INC., 1978.

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FIGURE 83

b. *DEVELOPMENT OF WEST SIDE INDUSTRIES*

1) *Introduction*

The rise of New York City from its founding as New Amsterdam to its present state of preeminence among the world's cities and ports was based on and accelerated by its thriving commerce. Often relegated to a secondary level of importance is the industrial development associated with the port and fostered not only by local needs and consumption but also by this acknowledged trading base. Industrial development did lag behind commercial growth in New York, but, once established, New York's industries became necessary and prosperous additions to the port.

2) *The Colonial Period (to 1776)*

First Dutch and then English interests in Colonial New York were primarily concerned with exporting America's vast raw materials, partially in exchange for manufactured goods from Europe. Industry thus remained unsupported until after the Revolutionary War. Particularly under British rule, when industrial expertise and the necessary raw materials were readily available, industry was actually restrained through regulations and taxation, inasmuch as Colonial manufacturing would have competed with Britain's expanding market for manufactured goods (O'Callaghan 1850: IV, 487-98).

Despite the lack of support from Colonial authorities, some industries germinated, the most conspicuous of which probably being shipbuilding and gristmilling. Shipbuilding and marine repair were entirely associated with the East River shore, where nearly all the Colonial era docks and wharves were built. During Dutch occupation, shipbuilding was mostly limited to small craft construction. The rare construction of a larger vessel included Adriaen Block's *Onrust,* built in 1614 to replace the *Tiger,* which burned off Manhattan Island, and the later and costly 600-800 ton *New Netherland* (*Ships and Shipping of Old New York* 1915: 7, 11).

Although trading under English rule was greatly stimulated in the seaport town of New York, shipbuilding remained underdeveloped compared with that trade in the other colonies. As late as 1769, New York ranked nearly last of all the colonies in numbers of ships built, launched, and owned, with Massachusetts and Rhode Island the easy leaders (*Ships and Shipping* ... 1915: 30). New York's shipyards were mostly located on the East River shore between Beekman and Catherine streets, with some clustering near Dover Street. As previously stated, the North or Hudson River shore remained generally unoccupied, inasmuch as the East River, which provided a better-protected, more accessible sailing lane and berthage, became the center of activity. However, two shipyards can be documented as existing on the North River during the eighteenth century. Rhinelander's shipyard is shown on the 1803 Goerck-Mangin *Plan of the City of New York* (Figure 21) between Warren and Chambers streets near present West Street (Janvier 1894: 54). Rip Van Dam is said to have built and launched vessels earlier in the eighteenth century from what later became the rear of the Trinity churchyard (Bishop 1868: I, 62).

Gristmilling has always been an important settlement feature. It is thus not surprising that wind-powered and tidal waterpowered gristmills were located early on at appropriate sites throughout New York Harbor. Tidal gristmills utilized existing marshes mostly along the Brooklyn waterfront. Windmills were situated at various hilly or windy locations in close proximity to the Colonial town on Manhattan Island. On the West Side, the earliest such structure was probably the Gristmill at the Fort, built before 1628 near Battery Place at Greenwich Street. Stokes (1918: 961) states that this mill was in ruins by 1662, with portions of it being reused for a mill on the Commons or City Hall Park at that time. As shown in Figure 84, another windmill was located opposite Maiden Lane in 1695 (Janvier 1894: 25). This structure was probably Meiser's Mill, erected between 1682 and 1686 near Liberty and Cortlandt Streets and demolished by 1788 (Stokes 1918: 961). The *Plane of New York* (Lyne 1729) identifies this same location as "Old wind-mill Lane" (Figure 85; Janvier 1894: 37).

Other early industries eventually built in the Colonial era included sugar-houses, potteries, tanyards, breweries, and the simple, elongated rope-walks. They supplied local markets only, and many tended to cluster beyond the then northern limit of the town around the extensive meadows of, and adjoining, the East River and Collect Pond. This manufacturing neighborhood was the first example of an industrial location pattern in New York City, where, for many decades, the dirtier industries were built on lands outside the village/city limits but close to the water resources necessary either for processing or, later, for transporting the product. As the city grew northward, however, these neighborhoods failed to

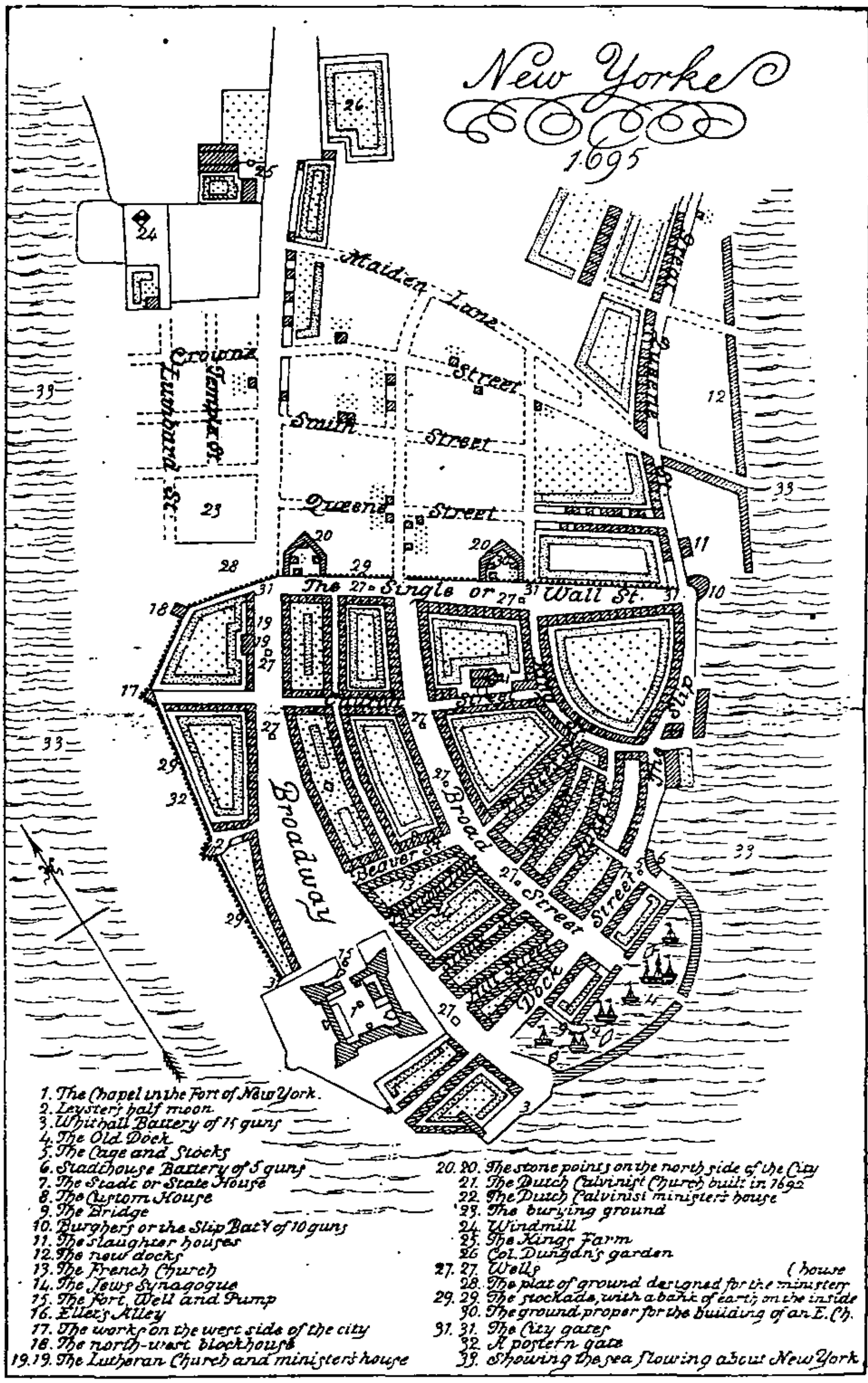


FIGURE 84. Map of New York in 1695, as redrawn for Janvier (1894).

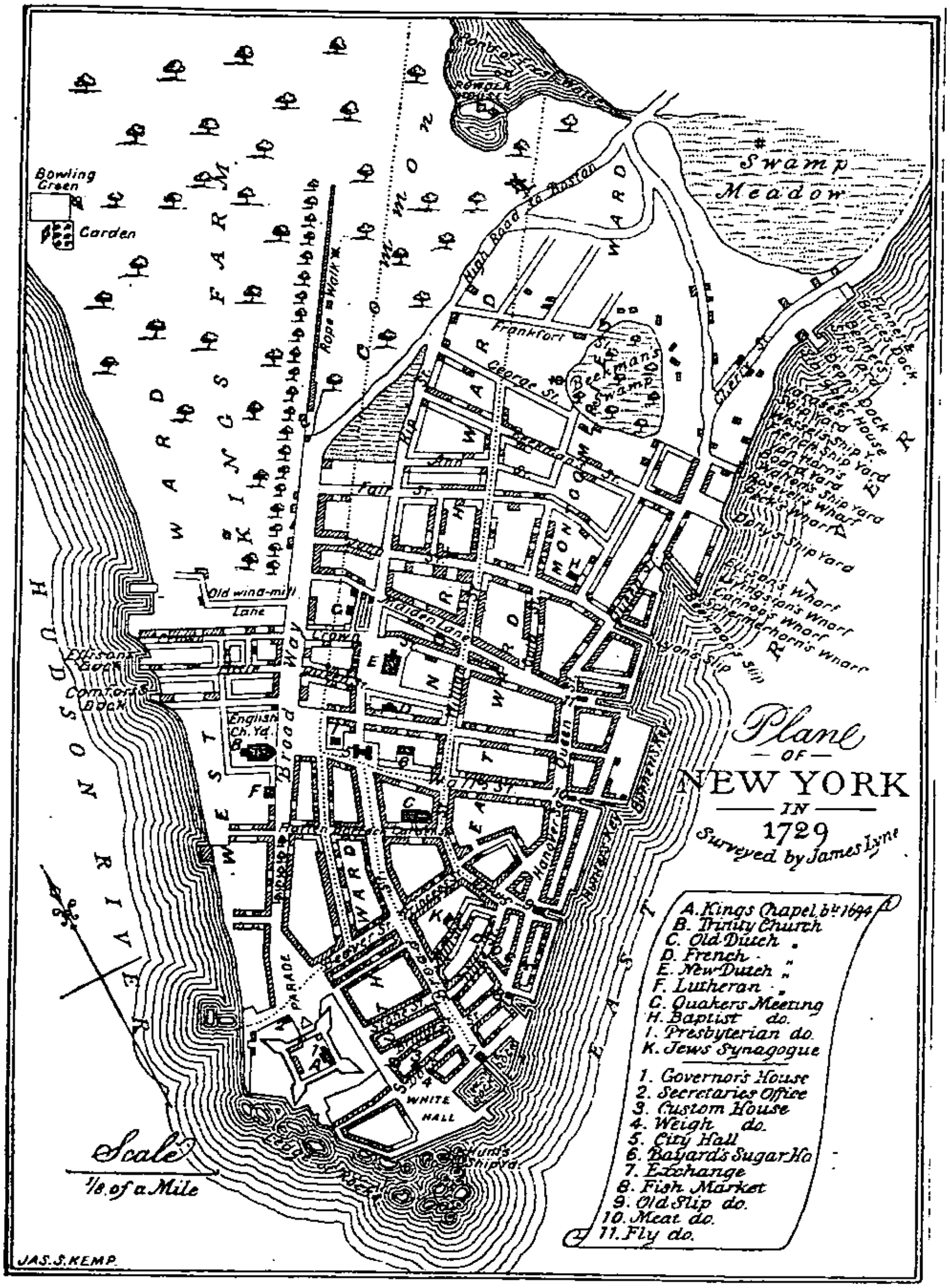


FIGURE 85. Lyne's *Plane of New York in 1729*, as redrawn for Janvier's *In Old New York* (1894).

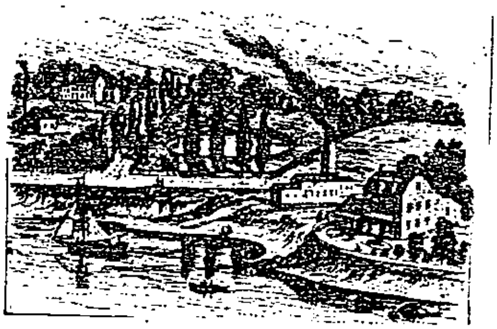
survive as solely industrial areas and generally became mixed with residences and commercial establishments (Abbott 1974; Baugher-Perlin *et al.* 1982: 29-31).

A few other scattered industries did occupy the relatively open lower West Side in the Colonial period. The 1755 Maerschalck *Plan of the City of New-York* identifies a "Rope Walk" on the north side of Cortlandt Street west of Broadway. Several other rope walks are known to have used open land in the nothern central and northeastern sections of New York (Janvier 1894: 37). At these walks, workers made rope, obviously a necessity for outfitting ships, by walking out long strands of flax or hemp and twisting them together. Rope walks, first in open fields and later in covered sheds, were from a few to several hundred feet long.

Brewing was another traditionally common early endeavor in human settlement patterns. At least two early breweries were in or near the study area. Leonard Lispenard erected a brewery c. 1750 at a location Stokes identifies as near 111-119 Watts Street (1918: 963). In Section II, 3, c of this report, an 1811 historic map shows its possible location as on Watts street southwest of Canal Street (see Figure 34). A brewery was also located south of Lispenard's house on the west side of the Road to Greenwich. Called "Garrison's Brewery" on the 1775 Montresor *Plan of the City of New-York & its Environs* (Figure 19), it is also shown, but not so labeled, at the same location on the property of "G. Harrison, Esq." on the 1766-67 Ratzer map (see Figure 16).

Another typical Colonial industry was the iron industry. Several maps, including the Ratzer map (1766-67), show a foundry or air furnace on the Road to Greenwich immediately north of the Harrison estate near the foot of what became Harrison Street (Figure 16). This business was probably the New York Air Furnace Company, noted by Wilson (1892: 466-68) as being owned by Gilbert Forbes, Peter T. Curtenius, Richard Sharpe, and others. Curtenius and Sharpe cast a large cylinder for the steam engine of the waterworks constructed under the direction of Christopher Colles. This casting may have been the "first performance of the kind ever attempted in America" (Bishop 1868: I, 534). (Curtenius was also New York State Auditor for several years, as well as a U.S. Marshal after 1810.) Stokes writes that the furnace of Sharpe and Curtenius completed various ironwork projects, including a cylinder for the city waterworks prior to the Revolutionary War (Stokes 1922: 874; 1926: 1,212). The *Common Council Minutes of New York City* for 1771 report payments or contracts signed to Sharpe, Curtenius, Forbes, and Andrew Lyell for various ironwork, including a fence around the Bowling Green and for stoves and bars at Bridewell Prison (MCC 1675-1776: VII, 2286, 2292, 2311). The casting completed at this furnace for the local community was the first of much ironwork produced along the Hudson River. Steamship repair and construction predominated in this area in the nineteenth century. Figure 86 shows a 1761 view of the West Side near the above-mentioned furnace and brewery. Note the improved but open landscape of this time period, as well as the various structures.

Sawmilling is also a traditional and important occupation in the Colonial settlement pattern. As for gristmilling, the sawmilling



NORTH RIVER SHORE, TOWARDS LISPENARD'S, 1761.

FIGURE 86. This 1761 view shows the Hudson River shoreline at the Harrison and Lispenard estates. The Montresor and Ratzer maps (Figures 19 and 16, respectively) both show, from south to north, the Harrison estate house, brewery, and furnace located between the Road to Greenwich and the river. The Ratzer map shows a road eastward to the Lispenard estate. In this view (reprinted in Wilson 1892: 310), it would appear that an unidentified structure is at the far left (not shown in either the Montresor or the Ratzer maps), the Lispenard house sits above it on a hill, the foundry (note profuse smoke produced from chimney) is just right of center, and the Harrison house is at the far right. The brewery is not depicted, although the Montresor map shows it to be located between the house and the foundry.

sites and the technologies chosen in New York were suited to the particular environment of the region. Manhattan Island and the Netherlands share the lack of significant falls of water. Thus, the Dutch colonists, and the English who followed them, relied on the wind as well as the tides for motive power in their milling. The exact locations of the earliest sawmills are known only to be on Nut (Governors) Island and near the fort.

In general, the sawmilling technologies employed in the New World, however, differed from those in Europe for some very basic reasons. In the Old World, labor was plentiful and timber had become scarce; in the New World, exactly the reverse was true. This difference resulted in the rapid evolution in the New World of the mechanical sawmill, which needed relatively little labor and processed large amounts of raw material regardless of the waste inherent in such a system. The advent of steam only accelerated this evolution. F. and P. Rhinelander reportedly operated a mill business at Barclay and Greenwich streets on the North River, where they had "a quantity of Northern White oak square timber" and had "it in their power to furnish house frames of the best quality, and at very moderate prices" (*New-York Daily Advertiser* March 7, 1787).

3) The National Period (1776 to 1830)

There can be no doubt that many of the above-mentioned industries continued to operate after, and possibly through, the serious interruption of the port's activities for the seven years of British occupation in the Revolutionary War. The postwar new nation clearly needed to motivate and nurture manufacturing interests if it hoped to survive and prosper. However, it was not until after the War of 1812, when British and American relations had improved, that the port began to establish itself, prospering and expanding onto the previously neglected shoreline of the North River.

Before this period, Boston and Philadelphia had easily overshadowed New York as centers of commerce and culture, whereas Savannah and Charleston may have rivaled it. Several events occurred during the second and third decades of the nineteenth century which helped to raise New York to its subsequent premier position in American commerce. These events also obviously helped to stimulate industry.

After 1815, Britain chose New York as a dumping ground for vast quantities of its manufactured goods that it could not market during its conflicts with the United States and France (Albion 1939: 60). New York's merchants seized this opportunity to establish intricate trade patterns requiring a great variety of goods to move into or through New York, much of which was related to the cotton triangle trade. Commercial activity proliferated along the East River shore and spilled over onto the shore of the less hospitable North or Hudson River. The few simple Hudson River docks and slips constructed along the lower West Side near the close of the Colonial era were now joined by a host of others.

Another event, or, more accurately, a series of events that promoted industry in this era was experimentation with steam-powered vessels, leading first to successful inland waterway transportation and eventually to trans-Atlantic travel. In the summer of 1787, John Fitch, who had already run a steamboat on the Delaware River, conducted a similar trial of a steamboat with a screw-type propeller on New York's Collect Pond. By 1807 Robert Fulton was operating the *Clermont* up and down the Hudson, thereby inaugurating the important steamship packet runs on this waterway (Albion 1939: 14). However, it was not until after peace was achieved with Britain in 1815 that the Hudson River packets began to flourish.

Condit states that the key to understanding New York's history is to understand movement (Condit 1980: xiii). Steamboats were certainly catalysts in the development of Manhattan's West Side. Regularly scheduled packets dramatically shortened travel time to and from the hinterland for both passengers and cargo. Packet trips to Long Island Sound and to Raritan Bay eliminated much of the wagon or stage traffic to Providence, Boston, and Philadelphia. When the Black Ball Line to and from the great manufacturing district of Liverpool initiated regular trans-Atlantic sailing trips in 1818, New York was well on its way to becoming the busiest American port. By 1825, the opening of the Erie Canal was celebrated not only as a tremendous engineering feat but also as an expansion of New York's resource base; it was to remain unrivaled throughout the century.

Steamship and canal traffic on the Hudson River did not shift activity away from the busy East River shore but rather helped the city to expand into the West Side. Before 1830, most of this expansion occurred in commercial rather than industrial operations. The aforementioned tanyards, potteries, breweries, etc. were still scattered about the city except for a continuing concentration at its northeastern limits in and about the swamps then surrounding today's Canal Street. One location toward the West Side was the New York Refining Co., at

Church and Leonard streets (*The New York Register and Directory* 1808-1809). Indeed, the rapid expansion of New York's commercial interests to upstate New York, New England, the South, the Caribbean, and Europe resulted in a wealth of raw materials and manufactured goods passing through the port. This trade probably lessened the need for New York City-based industry for several years.

4) The Early Industrial Period (1830-1860)

During this period, the West Side of Manhattan reflected the general growth of the City of New York; it included a mix of residential, commercial, and industrial establishments (Abbott 1974). The city expanded from the already crowded East Side to the west and north and quickly occupied the Hudson River shoreline to about 14th Street. The arrival of the Age of Steam had a tremendous impact on the Hudson waterfront, as Stokes testifies in a description of the area c. 1846:

> The shore front from the Battery northward along the Hudson differed greatly from that of the East River. Instead of the forests of masts which rose there, the Hudson for some distance was crowded with funnels. Instead of sailing-vessels, steamers were in the slips, as varied in their classes and sizes as they were in their destinations. Ferry-boats for Jersey City and Hoboken, larger boats for Newport, and for Allyn's Point and Stonington, where they connected with railway lines for Boston, were succeeded by steamers plying to and from the Hudson River towns. Still further up the river, lay the tugs, some employed to tow sea-going craft to and from the harbor, others to tow sloops, barges, and schooners up and down the river. The upper slips were occupied by barges and the smaller sailing craft engaged in river trade. The quays here, as on the East River shore, were lined with rows of warehouses, and towards the upper end of the city factories made their appearance. (Stokes 1918: 655-56)

Factories--predominantly ironworks and sugar refineries-- as well as warehouses, lumberyards, coal yards, stone yards, and packing houses occupied the recently filled and established blocks adjoining

West Street. Serviced by the numerous steamers on the Hudson River, these interests, assisted by the city, continually improved the waterfront by filling in the tidal shoreline and constructing new piers to replace the obsolete slips, wharves, and piers of the Colonial and National eras (these changes have been fully documented in Sections II, C, 2 and II, C, 4, a).

Many of New York's industries that moved into the West Side tended to cluster loosely in what could be termed neighborhoods. Among the most notable of these areas was that near westernmost N. Moore Street, close to the earlier sites of Lispenard's brewery and the New York Air Furnace Company. The *Map of the City of New-York Extending Northward to Fiftieth Street* (Dripps 1852) shows these industries in detail (see Figure 87). Within the few blocks surrounded by Franklin (south), Greenwich (east), Vestry (north), and West (west) streets were situated Birkbecks Iron Foundry (West Street between Franklin and N. Moore streets), the North River Iron Foundry (N. Moore Street between West and Washington streets), Truesdell's Oil Factory (Beach Street between West and Washington streets), the City Foundry (West Street between N. Moore and Beach streets), the West Street Iron Foundry (West Street between Beach and Hubert streets), Swift's Sugar Refinery (Laight Street between West and Washington streets), and the Phoenix Foundry (West Street between Laight and Vestry streets).

Within this neighborhood at an earlier date but gone by 1852 was the West Point Foundry on the northeast corner of Beach and West streets (see Figure 88). This company was noted for producing in 1830 the first American-made locomotive, the *Best Friend*, built for the South Carolina

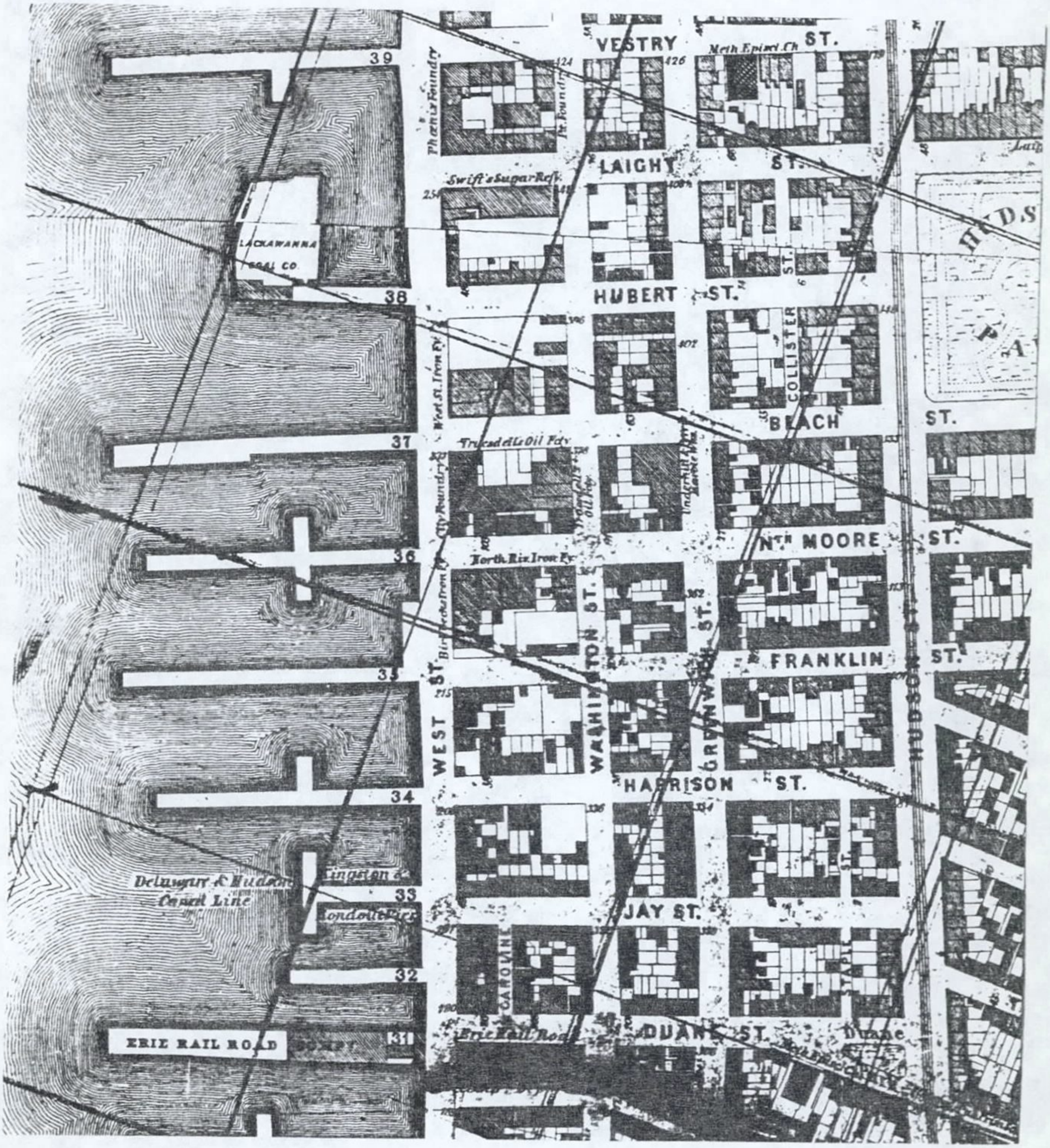


FIGURE 87. Portion of the Dripps 1852 map showing the industrial "neighborhood" centered on N. Moore Street between Greenwich Street and the Hudson River. Note the locations of canal and railroad line piers near these industries.

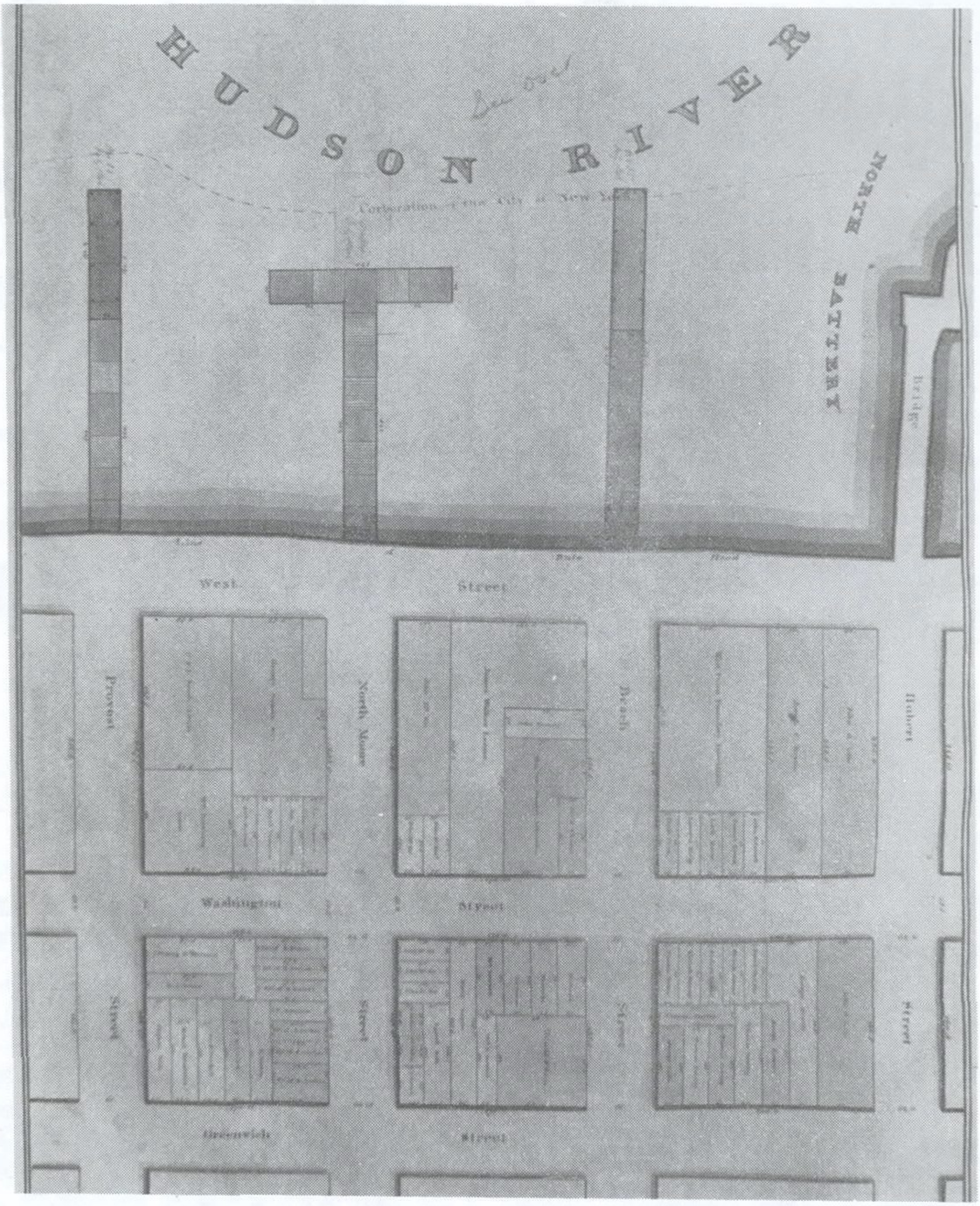


FIGURE 88. Portion of the 1827-30 Ewen waterfront maps showing the "West Point Foundry Association" located on the northeast corner of Beach and West streets and occupying roughly one-third of that block.

Railroad, as well as several other early locomotives (Rutsch *et al.* 1979: 41). Castings produced upriver at the West Point Foundry's Cold Spring, New York operation were shipped to the Beach Street branch to be finished and machined. David Matthew, a mechanic and apprentice at the West Point Foundry and later a superintendent at the Utica and Schenectady Railroad, sketched the New York location of the foundry, showing a millwright shop, blacksmith shop, engine shop, pattern shop, machine shop, and office (Matthew 1884). An interesting note is that Adam Hall, documented by Matthew (1884) as one-time Superintendent to Engineer at the West Point Foundry, was by 1838 associated with the Phoenix Foundry on nearby West Street.

By this 1830-60 era, New York City ranked with Glasgow, Scotland in the field of steamship construction (Albion 1939: 148). What with the need to service both national and international steamship traffic, much of this New York City steamship-related industry undoubtedly dealt with the repair, as well as the fabrication, of such items as engines and boilers. Hull construction maintained its location in the established East River shipyards.

As shown on the Dripps map of 1852 (see Figure 89), the West Side industries benefited from a close relationship to the canal and, at that time, newly formed railroad line facilities on the waterfront. Along the Hudson River shore in the vicinity of the above-mentioned industrial neighborhood existed piers for the Erie Railroad (No. 31), the Delaware & Hudson Canal (No. 33), and the Lackawanna Coal Company (No. 38). For the ironworks, for example, barges carrying raw materials and much-needed coal traveled from the canal and railroad termini on the west bank of the

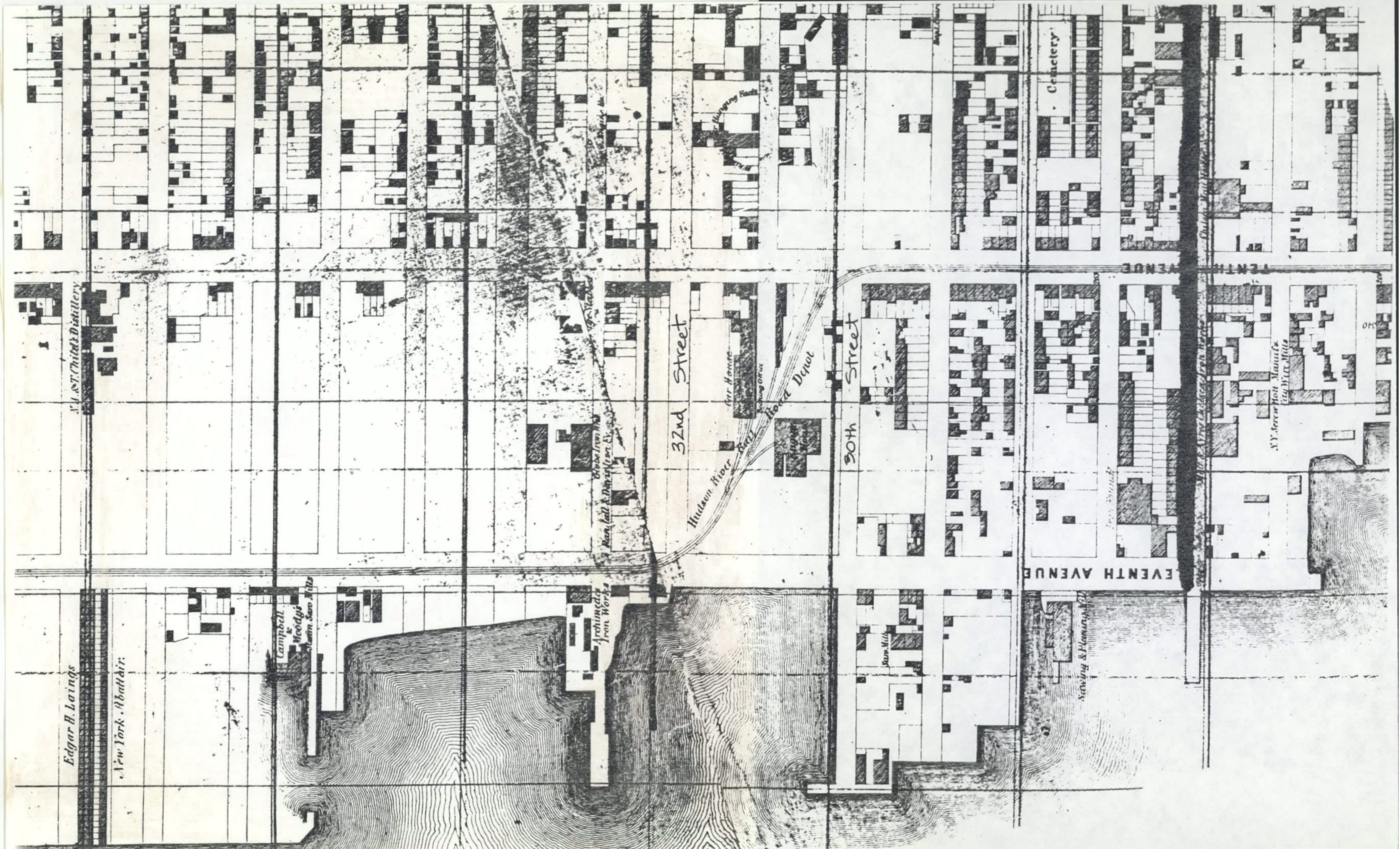


FIGURE 89. Section of 1852 Dripps map showing the industrial district which at that time was growing around the Hudson River Rail Road Depot, located between 30th and 32nd streets and between Tenth and Eleventh Avenues.

Hudson River to the companies' piers and warehouses on the east bank in New York City.

However, it was not until 1851 that direct railroad service came to the West Side with the completion of the Hudson River Railroad along the east shore of the river from Chambers Street in the city upriver to East Albany, New York (Condit 1980: 32-35). The Hudson River Railroad was an understandable added stimulus to the development of West Side industries, particularly near the railroad's extensive yards in the previously undeveloped region between 30th and 32nd streets and from 10th Avenue to the river. Here, an industrial district grew up in the relatively open land adjoining the railroad depot yards (see Figure 89).

Ironworks predominated in this area as elsewhere on the West Side, with (from north to south) the Archimedes Iron Works on the river west of Eleventh Avenue at 33rd Street; the Globe Iron Works and Randall & Davis Iron Foundry, both on 33rd Street between Tenth and Eleventh avenues; an unidentified iron foundry on 27th Street between Tenth and Eleventh avenues; and the Mott & Ayres Chelsea Iron Works on 26th Street, also between Tenth and Eleventh avenues. Industries ancillary to the ironworks were the N.Y. Screw Bolt Manufacturers and the City Wire Mills, both on 25th Street between Tenth and Eleventh. Three sawmills were also present in the vicinity of the depot, all located on the river west of Eleventh Avenue: Campbell & Moody's Steam Saw Mills between 36th and 37th streets; an unidentified "Saw Mill" between 29th and 30th streets; and an unidentified "Sawing and Planing Mill," between 27th and 28th streets. Other industries in the vicinity of the depot were Edgar H. Laing's New York Abattoir (on 39th Street between Eleventh

Avenue and the river); N.A. and T. Child's Distillery (on 39th Street between Tenth and Eleventh avenues); and the Whiting Paper Hanging Factory (on 31st Street between Ninth and Tenth Avenues). (See Figure 89.)

The several ironworks in this district were undoubtedly active in steamship and railroad work, whereas the other industries were taking advantage of the new location--i.e., available and relatively inexpensive undeveloped land close to ship and rail service. The mid-century establishment of this district around the railroad yards began the eventual move of many industries from the lower West Side, by then congested, to open land uptown--today's Midtown. Following the pattern established earlier, industries continued to locate on the northern edge of the city where they flourished until incursions of residential and commercial interests dislocated them northward yet again.

Of course, a variety of other industries remained scattered throughout the West Side, still close to the ever-important river transportation. Among the rowhouses, hotels, shops, markets, warehouses, merchants, lumberyards, coal yards, and stone yards there existed various industries, including the still-predominant iron-related industries--ironworks, iron foundries, boiler works, etc.; sugar refineries (which, in 1852, were concentrated, for the most part, between Van Dam and King streets and between Hudson Street and the river); gasworks; breweries; distilleries (of turpentine as well as of liquor); plaster manufactories; marble works; potteries; paper hanging factories; packing houses; soap and candle factories and spice mills (ancillary to the packing houses); and the ever-present sawmills and planing mills (usually on or close to the river) (Dripps 1852; Perris 1857-62: Vols. 1, 2, 4, and 6).

Specifically noteworthy industries include Stuart's Sugar Refinery, begun in 1832 at Greenwich and Chambers streets where R.L. and A. Stuart operated a steampowered refinery in three wooden buildings before moving to a nine-story building on Greenwich and Reade streets in 1849. The Christy, Constant and Co. Paper Hangings Manufactury commenced making and printing wallpaper in 1836 at a brick building on 23rd Street (Bishop 1868: III, 150, 179). Ridley & Co. began to manufacture confectioneries at 1 Hudson Street in 1801, later moving uptown to Broadway. From 1855, Phelan & Collender, billiard table manufacturers, were located in a five-story building on Tenth Avenue between 36th and 37th streets. The company was an association between Michael Phelan, Hugh W. Collender, and a Mr. O'Connor (*The Great Industries of the United States* 1872: 251-52, 399-404).

5) Expansion of the Industrial Base (1860-1900)

Through the remainder of the nineteenth century, New York City's industrial base continued to expand in direct relation to its physical growth. West Side industries continued to be very diverse, still represented heavily by foundries, gasworks, sawmills, packing houses, breweries, and print works. Industry also continued to pioneer the spread of the city northward along the Hudson River. By 1870 the West Side was densely built up northward to about 23rd Street, where light industries, commercial establishments, and warehouses were at that time still directly served by the Hudson River Railroad (by then the HRRR had merged with the New York Central Railroad). Beyond 23rd Street to about 42nd Street existed a looser pattern of shops, factories, yards, flats, and rowhouses (*Lloyd's Mammoth Map of New York City* 1867; *The City of New York* 1879).

A typical example of the industrial development that took place during this period is the Delamater Iron Works. This internationally renowned works began in the 1830's as an association of three Greenwich Village engineers who repaired ships out of their machine and blacksmith shop near West and Laight streets. By 1838 James Cunningham, Adam Hall, and Peter Hogg had expanded their shop to nearby 260 West Street, where they had established the Phoenix Foundry. Having quickly developed a fine reputation in repair work and boiler and engine construction, they soon took on a neighbor, William Delamater, as cashier and advisor, and his son, Cornelius H. Delamater, as a clerk (Porter 1918).

The success of this ironworks was greatly enhanced after 1830 when the Swedish engineer Captain John Ericsson began designing and commissioning a variety of projects there. Ericsson was the genius behind many of the United States' earliest steam frigates, as well as a variety of new engines, hoisting equipment, propellers, and iron-clad vessels, all of which he had built at his associates' yard. By 1842 Hall and Cunningham had moved on to other ventures and the foundry became the Hogg & Delamater Iron Works, owned by Peter Hogg and the younger Cornelius Delamater. During these first years, the works had built over fifty propeller-driven steamers and other miscellaneous machinery and vessels, including several iron canal barges.

Hogg & Delamater soon outgrew its location and expanded to adjoining properties between Laight and Vestry streets on West Street. By the early 1850's, the partners had opened a second yard on newly filled waterfront well uptown near the foot of W. 13th Street, then at Tenth Avenue (see Figures 90, 91, and 92). While in the process of moving the entire operation uptown, Hogg was offered a partnership in

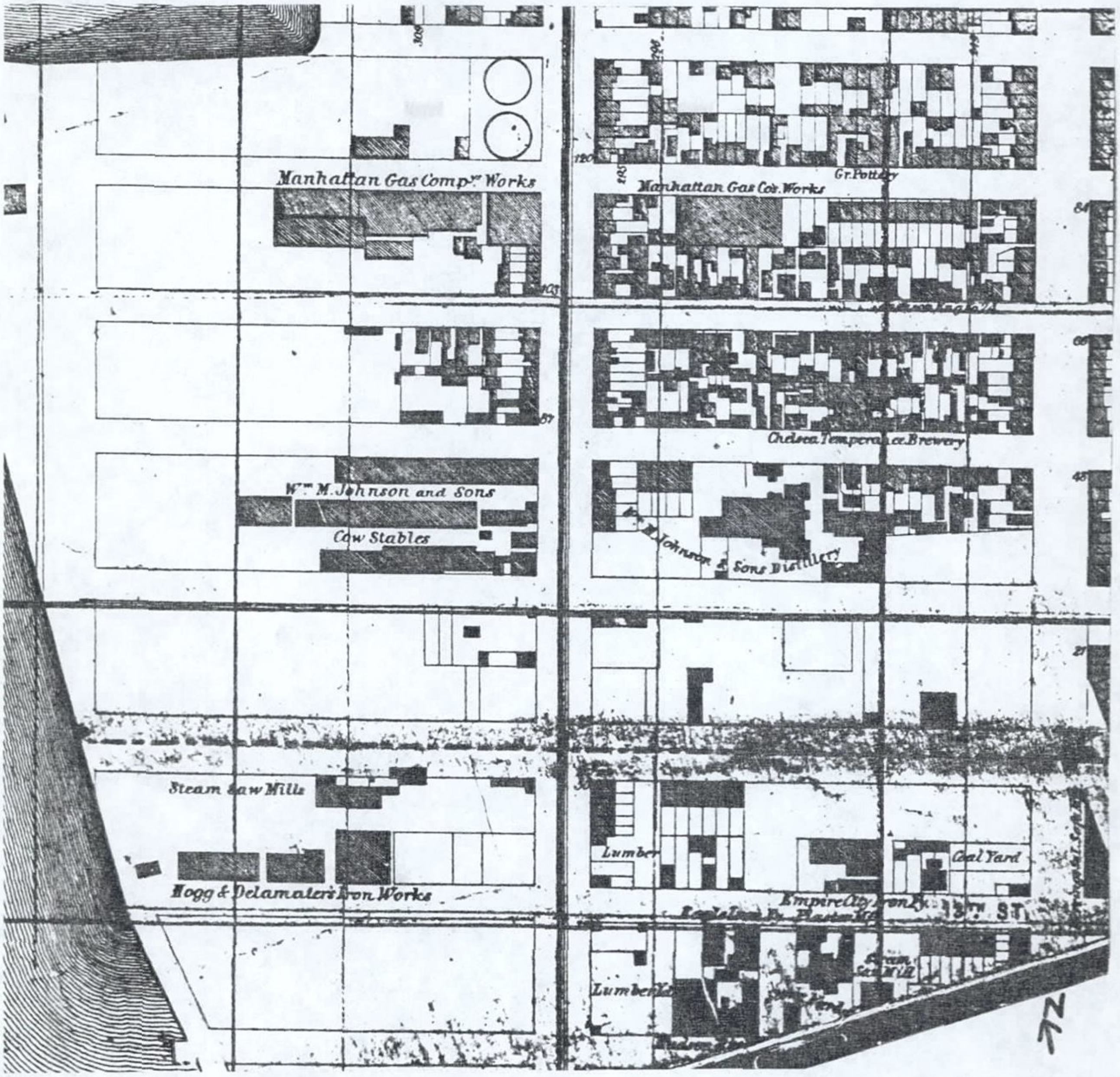


FIGURE 90. Portion of 1852 Dripps map showing "Hogg & Delamater's Iron Works" on the river between 13th and 14th streets.

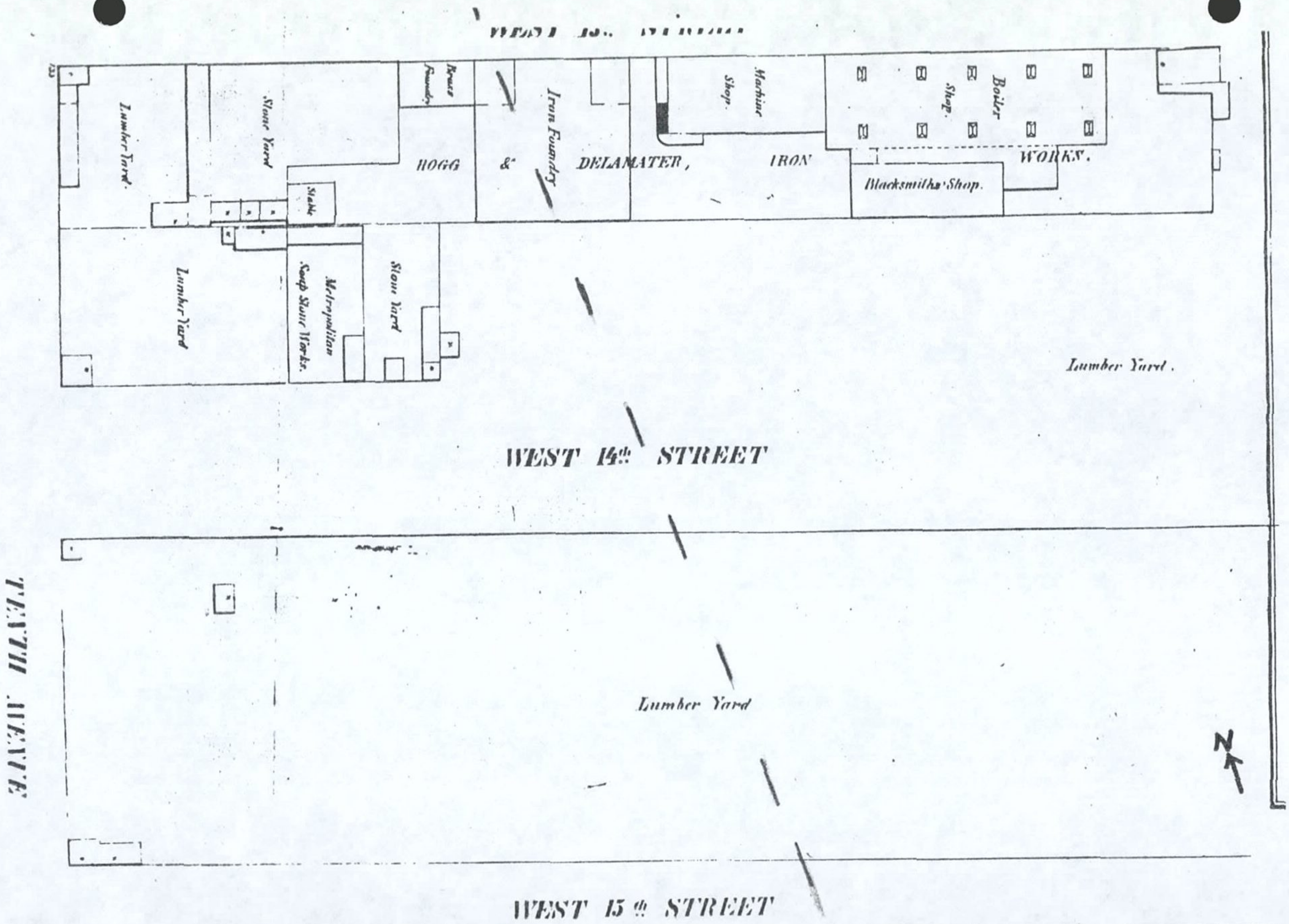


FIGURE 91. Portion of 1854 Perris atlas map showing the Hogg & Delamater Iron Works. Dashed line through the block is the approximate location of the present bulkhead (shoreline).

FIGURE 92. Views of the Delamater Iron Works in the 1880's taken from Company letterheads.

a sugar house and left the ownership of the ironworks to his original clerk. The name of the business thus became the Delamater Iron Works (Porter 1818; *Sought, Seen, Heard* n.d.).

By 1876 the Delamater works was employing an average of 1,200 men. A sampling of the projects completed there until its closing in 1890 includes the boilers and engines of the iron-clad *Monitor* (c. 1862); the complete construction of the similar *Dictator* (1863); the engines and propellers of the first completely American-built steamboat, the *Princeton* (c. 1842); equipment for the Moller & Martin Sugar Refinery at Grand Street (c. 1858); steampowered rock drills invented by John Waring, Simon Ingersoll, and Addison Rand (c. 1871); engines for scores of ships; machinery for the Stevens Battery; derricks for the City of New York of 100-ton capacity (c. 1875); and many of Captain Ericsson's inventions, from propellers to caloric engines (Church 1890; Porter 1918; *Sought, Seen, Heard* n.d.; *Asher & Adams Pictorial Album of American Industry* 1976: 23).

The history of the Delamater Iron Works has been given as an example here to illustrate industrial trends it shared with many West Side industries in the nineteenth century. The first is the already mentioned need of these industries for room to expand, which drew them to pioneer in uptown development along the riverfront. Often this pioneering resulted in the first filling in of the shoreline. Second is their essential propinquity to the transportation network including and associated with the river--e.g., for either repairing or constructing the ships, barges, and rail cars; for importing raw materials and exporting products; etc. Employees and associates of the earliest and more successful industries also commonly left to start up new industries and businesses, both in New York City and elsewhere. In that way, it could be said that the Delamater Iron Works spawned several other foundries, a hoisting machinery company, and at least one sugar refinery. During these "glory days" of the Port of New York, the success of one industry often stimulated and led to successes throughout the city, creating commercial and industrial explosions.

By the end of the nineteenth century, industrial development in New York City and on the West Side was moving toward specialization into a few specific manufacturing interests. Ship construction and repair had shifted out of the city in general to the Delaware River drainage and south (Albion 1939: 148). Industries were still diverse but less so than previously. Some of the more prominent industries located along the now thoroughly congested West Side of the 1890's included Copeland & Bacon (manufacturers of hoisting and mining equipment at Liberty Street), the New York Biscuit Company (over 1,000 employees at a building which still exists on 10th Avenue near 15th and 16th streets), John Dwight & Co. (first bicarbonate of soda factory in America, located first at W. 25th Street and later on the upper East Side), the Terminal Warehouse Company (11th Avenue at the river between W. 27th and W. 28th streets), Western Electric Company (electrical supplies manufactured at their 10-story building on Greenwich and Thames streets), and the American Bank Note Company (engravers and printers, with headquarters near Trinity Place)(King 1892: 849-92).

Another long-established West Side industry was Benjamin T. Babbit, manufacturer of soap, potash, and saleratus (baking soda), located between 64 and 74 Washington Street from 1850 to at least 1894

(*The New York Directory and Register* 1849-1890; Sanborn Insurance Co. 1894). Today, the site of this former factory is occupied by the entrance to the Brooklyn and Battery Tunnel.

As Moses King wrote in reference to the activities of the Hudson River side of Manhattan,

> ... There are armies of brewers, myriads of iron-workers, cohorts of cigar-makers, and great numbers of makers of pianos and furniture, of boots and shoes, of hats and caps, of sugar and molasses, of millinery and jewelry. (King 1892: 849)

The West Side and all of New York was clearly brimming with industrial activity through the nineteenth century. In 1880, King estimated that there were at least 11,000 factories in the city employing over 250,000 persons (King 1892: 849). However, by this time the three largest twentieth-century West Side industries--clothing, meat preparation, and printing/publishing--were beginning to emerge as leaders in terms of numbers of people employed and value of product produced (Haig 1927).

United States Census returns for the second half of the nineteenth century and the early twentieth century, although reported only cumulatively for New York County, do show the strength of industry in New York and also the steady concentration of capital and labor in a few particular industries. After 1860, the men's clothing industry maintained a lead as the industry with most capital invested and hands employed; industries that rivaled but did not equal these statistics included the manufacture of boots and shoes, iron castings, machinery, and women's clothing, and the production of footstuffs--bread, crackers, and other baked goods (U.S. Census of

Manufacturers 1860, 1870, 1880, 1890, 1900, 1910). Printing, later grouped as "printing and publishing," was also an important industry, and by 1880 it ran second only to men's clothing in capital invested, and third to men's clothing and foundry/machining shops in number of hands employed. Statistically stagnant or declining industries during these decades included shipbuilding and sugar refining.

The census returns also suggest certain shifts in industrial diversity through changes in the industrial categories through time. For instance, the 1860 census listed brass founding, machinery/steam engines, and ten subheadings under "iron." By 1880 all these categories were summed under "foundry/machining shops," making direct chronological comparisons difficult for the researcher but also suggesting a possible shift in the industrial base.

6) *The Twentieth Century*

Commercial and industrial expansion continued into the twentieth century as ocean-going vessels increasingly dominated the Hudson River piers and shoreline. The now firmly established and uniform shoreline and piers off West Street and 11th and 12th avenues serviced the movement not only of goods but also of increasing numbers of passengers traveling to and from ocean liners berthed along the improved, open Hudson River shoreline.

Industry on the West Side became dominated by the fields of clothing manufacture, food (i.e., meat packing and preparation), and publishing/printing. Machine shops also continued to be present. Many of the buildings these establishments built and/or utilized still exist, most obviously within today's garment district or in the Gansevoort Market district. However, the other various West Side industries previously mentioned steadily left Manhattan Island under spatial and financial pressures, including that from residential and commercial interests also needing to expand within the limited real estate of the island. Freed from the necessity to be located on the Hudson River in Manhattan by improvements to movement brought about by trucks, cars, and various Hudson River crossings [e.g., the McAdoo Tubes (today's PATH, c. 1907) and other bridges and tunnels], industry once again moved to the outskirts of the city, this time to locations on Long Island or in New Jersey. Other industries simply quit the region altogether, as many of the ironworks had done earlier.

Edward Pratt, in his dissertation titled *Industrial Causes of Congestion of Population in New York City* (1911), shows through surveys of industrial and census statistics that many industries in New York City migrated to Brooklyn or New Jersey during the first decades of the twentieth century owing to urban congestion, to which they contributed, and to the subsequent rising rents or land values. Citywide, industrial proprietors cited that huge numbers of immigrant labor and the accessibility to markets were reasons to remain on Manhattan, but also that rising property costs were chasing many establishments to the suburbs, such as lumberyards; producers of stone, clay, and glass items; and manufacturers of a variety of wood products (from pianos to veneer). Such establishments required considerable grounds, either for their shops or for storage of bulky raw materials and/or products. Manhattan, including the once open West Side, was now too congested.

In comparing statistics from the U.S. Census and the Report of the Department of Factory Inspection for New York State, Pratt documents clearly the dominance of the clothing industry in New York after 1860, with other important industries being metals; machinery and conveyances; food, liquors, and tobacco; and printing and paper goods. Again, in reference to the metals and machinery industries, he notes that the once prominent marine engine and machine building activities located on the West Side, and in New York in general, were byproducts of the Age of Steam (Pratt 1911: 40). By 1911, no iron foundries remained. The machinery manufacturers who remained cited "long establishment" as a primary reason for staying in Manhattan, despite rising costs and loss of the marine business.

Obviously, the garment, meat packing, and publishing businesses have remained active in Manhattan. However, with the nation's goods now moved by truck on the region's highways, the once prevalent clustering of industry at the riverfront has become nonessential. Consequently, industry has moved from the West Side.

7) Industrial Sites in the Project Area

The preceding historical narrative had two purposes: to give a perspective and overview to industrial development and interests over time in New York City--particularly on the West Side from Battery Place to W. 44th Street (the south and north limits of the present project area) and to identify the possibility of extant potentially significant cultural resources that would be disturbed by the proposed construction/design procedures for the Westside Highway project (see Figures 2.1-2.3). The first objective has hopefully been achieved in the preceding pages; the second is discussed herewith.

Most of the aforementioned industries were close or adjacent to, but not actually within, the present study area (see Figure 1). Most, again, have been replaced by later construction. Some have been removed totally and/or may still exist but will not be disturbed by the proposed highway project. An example of the last situation is the Delamater Iron Works. Figure 91 shows that most of the site of this renowned industry was physically dredged away. Only portions of the southeast corner of the complex might remain buried beneath present-day West Street (at 13th Street between Tenth Avenue and the river). However, the proposed work for this area is road surface reconstruction, which would not damage the resource, if it remains.

A last category is the potentially significant cultural resource that may remain in an area slated for a construction/design procedure which would damage the resource. Such a site may well remain in the Midtown Interchange Area--the Whiting Paperhanging Factory Site. Located on the north side of W. 31st Street between 9th and 10th avenues (see Figure 3), this manufacturing company first appears on the 1852 Dripps map, where it is identified as "Whiting's Paper Hanging Factory" (see Figure 93). Other maps of the area in subsequent years continue to show the location of this factory, and it probably was in business well into the 1890's.

An 1859 map (Perris 1857-62: Vol. 6, Plate 89) shows the same site as a "Paper Hanging Factory." In 1880, however, the Robinson map indicates new ownership of this operation, which is shown as the "W. Young, Wall Paper Factory" (Robinson 1880: Plate N). Finally, the Bromley atlas of 1891 also shows the same site as a "wall paper factory,"

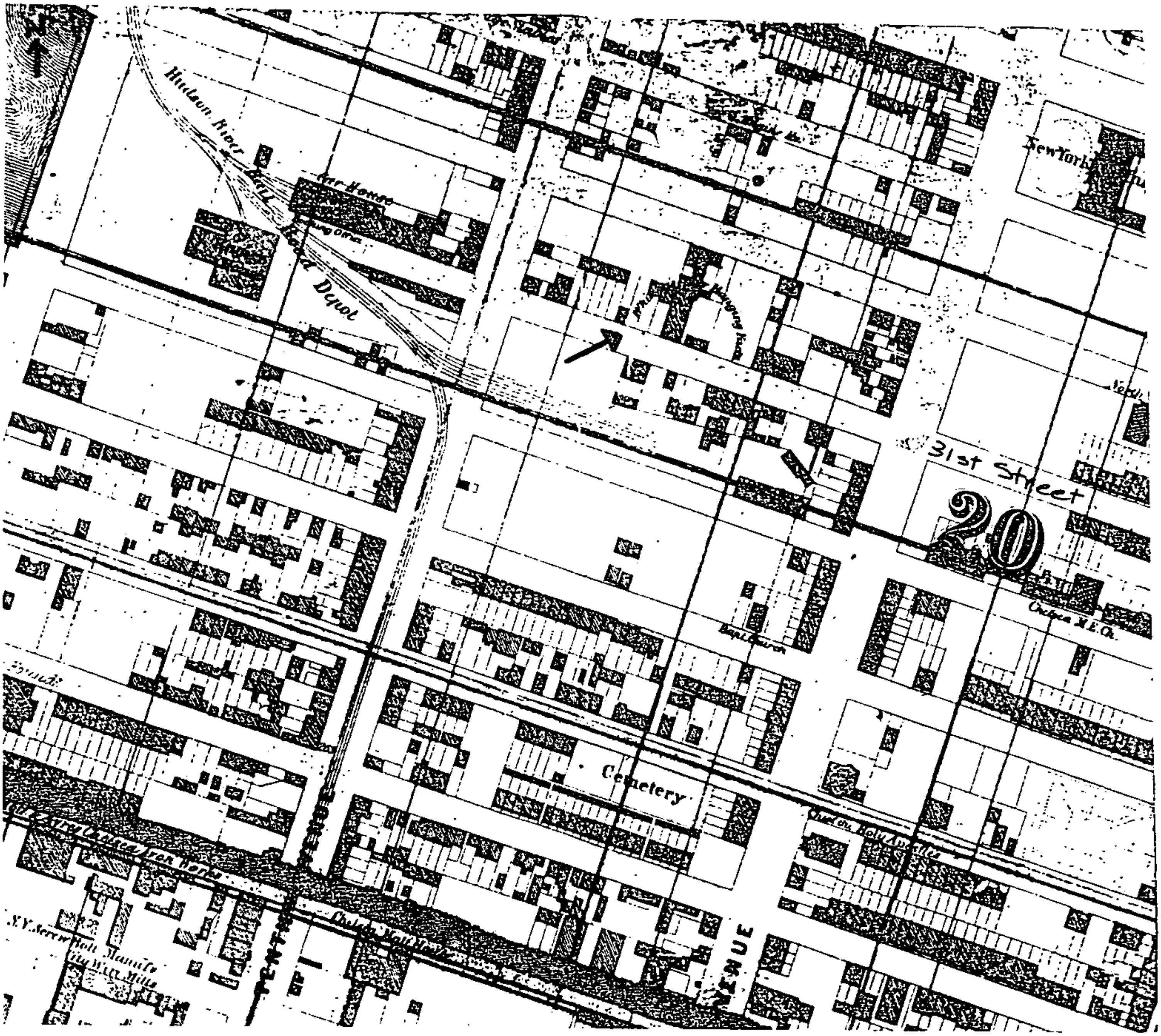


FIGURE 93. The Dripps 1852 map shows Whiting's Paper Hanging Facty. on the north side of 31st Street between Ninth and Tenth avenues (see arrow).

but ownership is not indicated. The factory buildings continue to appear on subsequent Bromley maps dated to 1899, 1916, and 1934; but they are not identified; hence, we conclude that the wallpaper manufacturing operations ceased before the turn of the century. By 1955 most of the structures on the north side of W. 31st Street are gone (Bromley 1955), and the area was clear by 1975 (Sanborn 1975).

A review of nineteenth-century business directories indicates several different owners of the paperhanging factory. During the 1850's, the business is listed as "Whiting & Co. 271 W. 31st" (Wilson 1855-56, 1856-57, 1858-59). However, by 1866 the company is listed as "Whiting, Young & Co., 285 W. 31st"(Baldwin 1866). The Whiting-Young partnership apparently continued well into the 1870's, but the directories give a new address, "427 W. 31st" (Rand 1876-77, 1878). By 1883 the company is listed under a new partnership name, "Whiting & Campbell" (Rand 1883-84), but by 1889 the directory listing reverts back to "Whiting & Sons" (*The Combined Business Directory* ... 1889).

Unfortunately, little is known about the manufacture of paperhangings or wallpaper during the nineteenth century. In general, wallpaper was either block-printed or printed with roller presses, the latter being the more common method. Roller presses were made of wood or rubber and they printed the decorative patterns on long rolls of paper. From the roller presses, the paper went through a drying operation, after which it was cut and rolled by machine.

Evidently, the manufacture of paperhangings was a fairly large business in New York City during the nineteenth century. For example, the 1860 United States Census lists 7 such establishments in New York County employing some 480 people. In 1870, this branch of the decorative arts apparently declined, inasmuch as the census that year lists only 3 establishments in New York County with 63 "hands" employed. However, by 1880 there were 11 wallpaper manufacturing companies in New York City which employed more than 1,300 men, women, and children. This was probably the peak growth period of this type of business. By the 1890 census, the number of companies had declined to 9, having only 87 employees.

The brick and stone buildings of the old paperhanging factory on W. 31st Street are no longer standing. Instead, the site is now a paved and macadamed parking lot. Some portion of the building foundations are undoubtedly buried beneath the surface. Evidence of early brickwork, possibly remnants of the factory and adjacent structures, can be seen along W. 31st Street.

The Whiting Paperhanging Factory site possibly contains potentially significant cultural resources of an industrial archeological nature. These resources, if they are extant, may well yield important information on the history of an industry about which little is known. The proposed Westside Highway construction/ design activity on this site will be the driving of piles. A survey of the several borings made and recorded in the vicinity of this site (on 9th Avenue and on the northwest corner of 9th Avenue and 31st Street) revealed a range of only 10.8 to 23.0 feet of unsolidified material over bedrock. Unfortunately, details of this unsolidified material are not part of the record (*Rock Data Map of Manhattan* 1940).

c. *DEVELOPMENT OF WEST SIDE MARKETS*

1) *Introduction*

Food marketing was one of major enterprises located on the West Side of Manhattan Island from the late eighteenth through the early twentieth centuries. Food handling here ended only with the transformation of the market industry as a whole by the move toward the transportation of produce via motor vehicles and the subsequent exponential increase in traffic that could not be accommodated on Manhattan. Before the Age of the Internal Combustion Engine, various West Side markets were the principal trading spots within the metropolitan New York area (and, to a certain degree, along the entire East Coast) for produce, grains, meats, and other related products. Clearly, then, markets were related to and tightly integrated with the development of the general infrastructure of the area, especially from a rather small site in 1771 to a series of four large sites by 1900. More often than not, the activity seemed constantly to outdistance the structures' abilities to house it. Studies of, proposals for, and changes to marketing facilities were frequently undertaken. The resulting profile of change at these markets, the evolution of sheer scale, and the architectural solutions for the sheltering of marketing all contribute to the understanding of the physical and social changes occurring in this culture over the past two centuries.

It should first be understood that all but one of the markets in question were public facilities which were built and managed by the city on city-owned land. Markets were under the direction of clerks, who were appointed by and answerable to the Committee on Markets. The Committee, in turn, served the Board of Aldermen. Stalls were available for vendors to sell their different types of produce. In return, the vendors paid a user fee to cover costs. The arrangement was simple enough in concept, but spatial limitations and differences in desirability led to conflicts and controversy. The most apparent conflict was between those producers who wished to sell their goods directly and those who specialized as brokers.

Public sentiment favoring the producers' (i.e., the farmers') right of access to the markets remained strong throughout the eighteenth and nineteenth centuries. This belief was rooted in traditional democratic values reinforced by the conviction that the more middlemen were involved in the process the higher would be the prices to the public. The realities of the business and politics, however, insured the dominant position of the brokers. Thomas De Voe had much to say regarding this classic struggle in 1867, and much more could be said in the context of a social and economic study of marketing.

Regarding the patronage of the West Side markets, there was apparently an early shift from retail to predominantly wholesale buyers. During the eighteenth century, when New York City was relatively small and nonindustrial, all public markets seemed to have been intended for the general public. However, starting with the first market on the West Side--the so-called

Bear Market--trading facilities seemed to favor large-scale wholesale activity, as the need arose.

Markets as economic enterprises could not compete against commercial establishments for space along the lower East River shore, which constituted the best natural anchorage and berthage in the Colonial era. In addition, markets were noxious neighbors, not only a result of their own refuse and of the city's poor sanitation facilities in the days when many animals were brought live to market, but also owing to the presence nearby of associated food-processing industries--e.g., rendering plants, glue factories, tanneries, etc. These slaughterhouse-related activites all needed freshwater sources and ample cheap space. It may also be that marketing of fresh produce was curtailed in winter, a time when the Hudson was reportedly particularly inhospitable. Thus the West Side shoreline would have served these enterprises well enough.

Access via the Hudson River to upstate New York, to New Jersey across the river, and to coastal traffic overall made the West Side the natural Manhattan location for food distribution to neighborhood markets. In the mid-nineteenth century, wholesale marketing activities were further served and greatly enhanced by the Hudson River Railroad, which was laid out along the west side of Manhattan. Rail access assured the prominence of the West Side markets until well into the twentieth century. With the exception of the Fulton Market on the lower East Side, all the city's major markets were located along the Hudson.

During the nineteenth century, market activity on the West Side grew with the same surprising speed as the city itself, for the obvious reason that the volume of food traded was in proportion to the population. As a result, the need arose not only for a greater number of facilities, but also for much larger types of market buildings. In fact, during a period of only about 40 years spanning the mid-1800's, the traditional market structure became obsolete, and was replaced by buildings of unprecedented size and design. The following description of the markets is concerned with these structures and their evolution. At this stage the main intent is to determine the locations, periods of activity, and structural design of the markets.

2) *The Bear, Washington, and First West Washington Markets*

Each of these three markets was really a stage in the development of one major market site which began in the late eighteenth century on Greenwich Street and continued over the next century, expanding steadily westward on landfilled water lots. Located between Fulton and Vesey streets, both the sites of the Bear and Washington markets now lie beneath the stylobate of the World Trade Towers, placing them technically outside the present study area. Just as the Washington Market evolved from the Bear, so the other west side markets--the First and Second West Washington, the Gansevoort, the Manhattan, and the Oyster markets--all evolved from the Washington Market.

When the Bear Market was established in 1771, it was known for a brief time as the Oswego Market, having been built in part with materials from the recently demolished Broadway Market-house, which had also been called the Oswego Market. It was the sixteenth market built in New York, and nearly 150 years of market activity had preceded it. Located on the west side of Greenwich Street, the new market was at that time considerably removed from the main part of town, and vendors at first experienced difficulty in selling their produce. [In Figure 20, the 1797 Taylor-Roberts plan shows "The Bear Market"--barely legible in the copy--bounded by Washington, Partition (Fulton), Greenwich, and Vesey streets.] The location however, was already owned by the city and lay adjacent to the Corporation Docks, which offered unloading facilities for boats. The lag in custom was only a temporary condition, and the new Bear Market soon became one of the two largest markets in the city, the other being the Fly Market at the foot of Maiden Lane.

At first the Bear Market consisted of a 166 x 28-foot brick building, probably similar in plan to the traditional market design of that day, exemplified by the Fly Market structure, a gable roof supported on plain piers. Changes made to this complex over the next 30 years included the filling of water lots to increase the space, the addition of a cupola and bell to the main building, and the building of auxiliary market buildings. The filling in of water lots became the leading method for the waterfront markets to acquire new land. This process at the Bear began in 1784, when the wharf next to the market was docked out to create 9 lots 23 feet wide and from 60 to 90 feet deep (De Voe 1867: 314).

In 1792, the market structure was enlarged somewhat in order to accommodate the construction of cellars for the use of the vendors. At about this same time, a new structure was added on Vesey Street, just west of Greenwich Street. The two market buildings were then officially referred to as the Upper and Lower Hudson markets. Popularly, the Lower Hudson continued to be called the Bear (ostensibly because at least one bear had been known to have been slaughtered and sold there) and was occupied largely by the butchers, whereas the Upper Hudson came to be called the "Buttermilk Market" because it was occupied largely by New Jersey Dutch farmwomen who sold, among other products, large amounts of buttermilk.

In 1805, a third market building was erected. Also on Vesey Street, it was situated on line with and west of the Buttermilk Market and was intended for the sale of fish. In the same year a bell and cupola were erected on the northwest corner of the old market building. Despite these improvements, in July 1805 a committee advised that

> ... the ground on which Hudson Market now stands is too valuable to be appropriated for a market, and is situated in a street too important for the purpose; that it is in a state of decay, and will be useless in two or three years. The Committee, therefore, are of the opinion it will be for the public advantage to run a new bulkhead across the slip and proceed to fill up the same, and to erect a substantial and commodious market on the ground to be filled up.

The 1796 map of New York (Stokes 1916: Plate B-117) and the Commissioners' 1811 map (see Figure 5) document the transition which the city underwent during those years. The earlier map shows the Bear Market bounded on the west by Washington Street and the Corporation Docks, whereas the latter map shows the block from Washington to West filled and the dock relocated along West Street. (It should be remembered that the 1811 map showed a great deal of planned, not actual, situations, especially regarding lower West Street.) The three market buildings--the Bear, Buttermilk, and Fish markets--are shown in 1811 in their original places. The construction of the new market proposed for the Washington-Partition (Fulton)-West-Vesey street block in 1805 was not actually undertaken until 1812.

When it was completed late in 1813, the new market was intended to replace the three earlier shelters, which were removed that year. At first it was known popularly as the Bear Market, but the official title of "Washington Market" eventually became its established name. The structure as built was more substantial than its predecessors, constructed of brick with stone piers. The original plan called for an open square (actually a parallelogram) which would fill the block. In 1813, however, only the Washington Street section and connecting 50-foot sections running along Fulton and Vesey streets were constructed. The center section of the Washington Street block was two stories and was intended to have a cupola surmounting it, which was eventually commissioned in 1828.

There is conflicting evidence about the early evolution of the interior and western portions of the Washington Market block. Maps dated 1811 and 1817 both indicate that the block was fully filled and that West Street was complete in this vicinity. However, De Voe quotes extensively from an 1828 Market Committee report describing a basin behind the market which interrupted West Street and the bulkhead of which came within a few feet of the west side of the market (De Voe 1867: 427-28). Apparently the 1827-30 Ewen waterfront map (Plate 6) documents this arrangement (see Figure 94). The market boats entered this slip and unloaded their goods next to the main building. The 1811 and 1817 documents indicate what was either a preferred plan or possibly a temporary condition. The Ewen map shows the actual situation in 1827-30. After 1828, the basin was reduced to a 327 x 192-foot space west of West Street, and a new "Country and Fish Market" was constructed along the east side of that street in 1834. This new structure was connected with the original 1812 market along Vesey Street by the 1824 fish market structure, which was rebuilt as well in 1834. Thus, the entire block, with the exception of a portion along Fulton Street, was enclosed by the market as originally planned. In 1843, the ever-growing demand for space by the "country people" resulted in the construction of a market building along Fulton Street, which completed the original "square doughnut" plan.

Despite the fact that it took thirty years to complete the original market plan, the demand for space always far exceeded the space available. Only 50 stands in the market serviced as many as 2,000 farm wagons on market days. The wagons parked in the streets around the market in the early hours of the day, creating a good deal of noise and obstructing traffic.

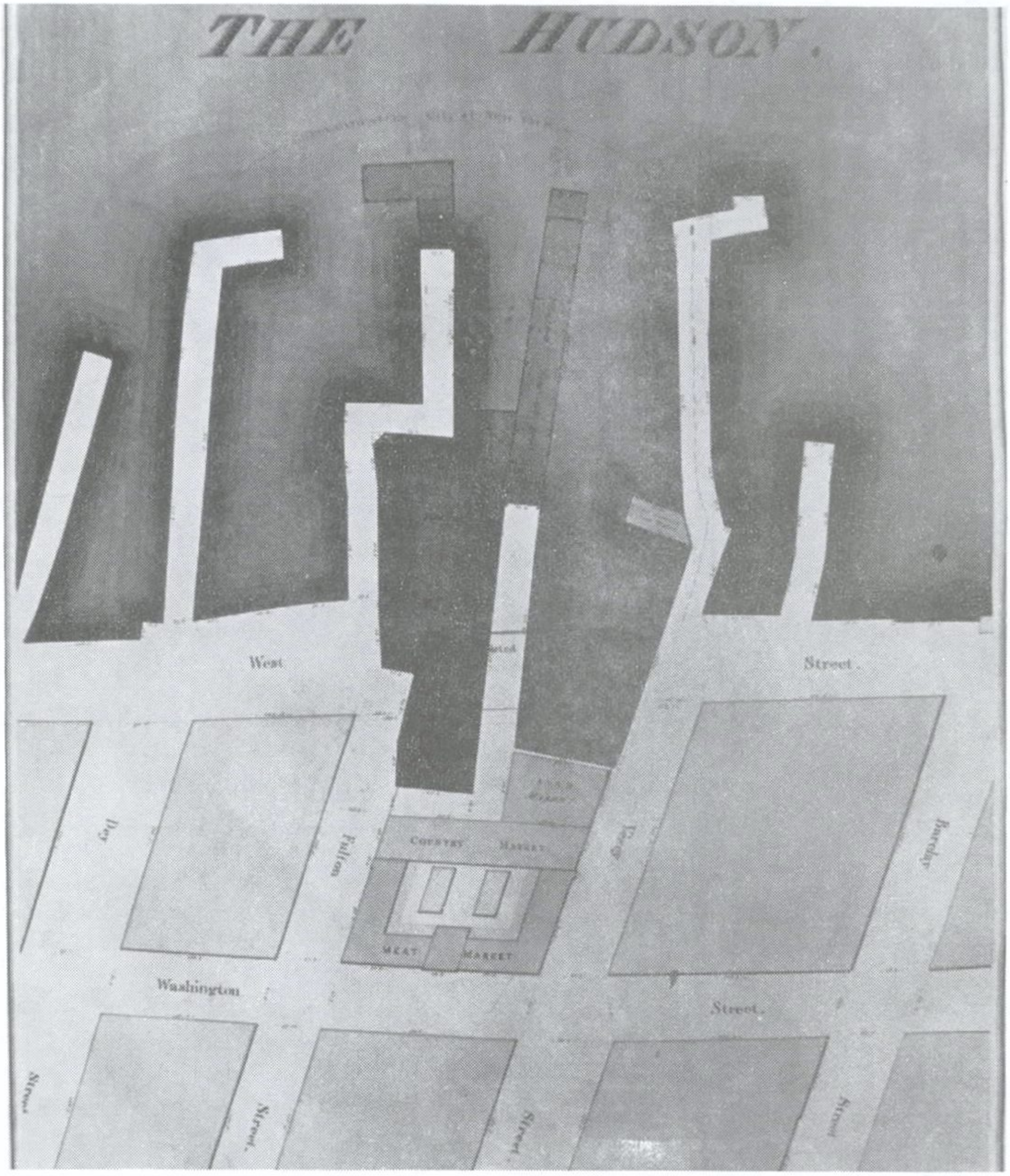


FIGURE 94. This plate from the 1827-30 Ewen waterfront map series shows the Washington Market before West Street was completed.

Relief from this situation was gained in the late 1840's when some 400 additional stands were made available in rather inexpensive wood structures erected on newly filled land west of West Street in what had been the most recent Corporation basin. This new market area became known, simply, as West Washington Market. Its status remained undefined at first, while the Corporation, the Board of Aldermen, and the Mayor disagreed as to the future policy concerning the filling of water lots. The 200 feet filled west of West Street in 1844 and an additional 162 feet being requested were opposed by the mayor, which compounded the problems of any building and management programs. The new market remained plagued by legal problems until 1861. That the structures on the site were makeshift is documented by De Voe's account of the July 11, 1860 fire in the West Washington Market. He states that with the help of a strong west wind, nearly two hundred sheds were destroyed in a few hours and that about two weeks later "the burnt space was again covered with sheds, but of more attractive appearance than their predecessors ..." (De Voe 1867: 452). During this early period of the West Washington Market, goods were still delivered by water.

The mid-nineteenth-century appearance of the Washington and West Washington markets is documented in Nagel and Weingartner's color lithograph entitled *Panorama of Manhattan Island, 1854* (Eno Collection, No. 334). It is an aerial perspective drawn as if from the hills behind Jersey City. Depicted is the square Washington Market complex, composed of a relatively large structure with cupola and tower and lower arcade-type structures fronting on Fulton, Vesey, and Washington streets. The West Washington Market extends into the river and consists of a series of long gable sheds perpendicular to West Street. A more detailed view of the main Washington Market building on Washington Street is given in an 1859 drawing (Hollyer plate 109), and Figure 95 depicts this building in 1869.

During the period that these drawings were made, these markets were increasingly becoming objects of scandal and civic discontent. As early as 1851 a committee was formed which prepared a report complete with plans and cost estimates for new market structures (Reports of the Committee on Repairs and Supplies in Relation to Rebuilding Washington Market, Doc. No. 15). The majority report called for a new three-story structure on the site of the old Washington Market which would cost $375,000. This report noted that although consumers had moved uptown, a booming wholesale trade activity justified the new structure. The minority report suggested building a 290 x 312 one-story iron structure on the West Market side at a cost of $150,000. This report was of the opinion that all market activity would move uptown within 20 years. Both this observation and the two proposals were ignored, however, and business in the inadequate facilities continued into the 1880's. (See Figure 96.)

In the early 1880's, a comprehensive redevelopment of the Washington and West Washington markets was undertaken. The old Washington Market was demolished in July 1883 (*The New York Times*

FIGURE 95. The Washington Market in the 1869 *Harper's Weekly* (March 6, 1869; T.R. Davis) showing wagon loads of produce which were brought from the country every day. (Grafton 1977: 204.)

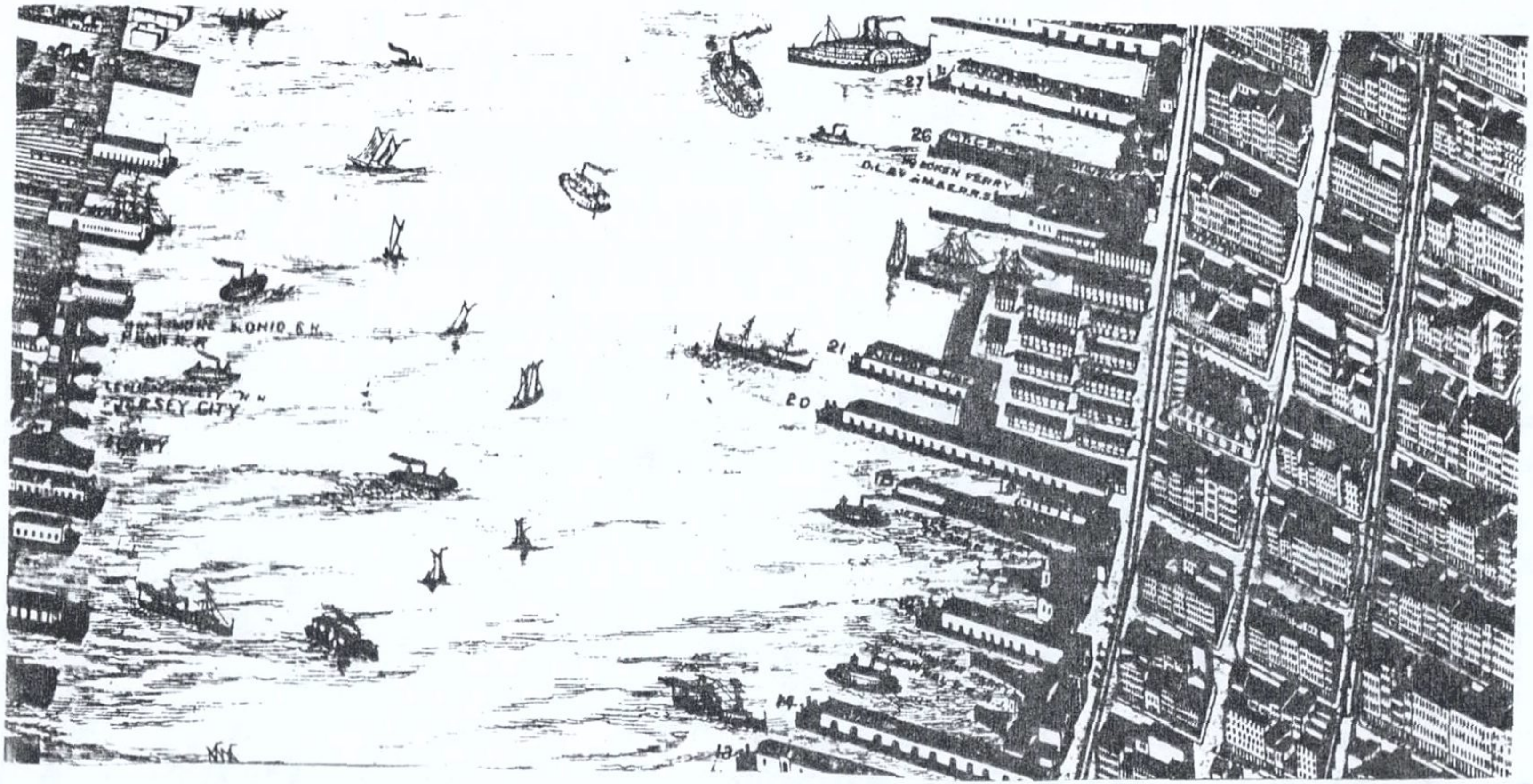


FIGURE 96. Portion of the 1879 Galt and Hoy bird's-eye view of New York. The Washington and West Washington markets are east and west (respectively) of West Street between Vesey and Fulton streets.

July 25, 1883) and replaced with a much larger iron structure that covered the entire block. The first half of this structure opened the following year (*Evening Post* June 12, 1884) and was devoted to retail marketing, whereas the West Washington Market by this time specialized in wholesale activity (see Figure 97). The new Washington Market continued in use until the 1930's, and is well documented photographically (New York Public Library Photograph Collection, Nos. 1044-C1, C6; 1043-F4; 0849-C7; and 1011-E7).

3) The Second West Washington Market and the Gansevoort Market

On January 26, 1889, a few years after the new Washington Market had opened, the new facilities for the second West Washington Market opened. These facilities were located on another water lot west of West Street but further uptown, near Gansevoort Street. They were intended to accommodate wholesale marketing, particularly of meats and vegetables. The structures represented a dramatic departure from the earlier facilities, both in order-lines and scale. The layout consisted of 10 buildings built of brick and terra cotta measuring 50 x 183 feet and arranged in a five by two grid. Docking facilities on the river, as before, allowed for water cargo access (*The New York Times* Jan. 27, 1889: 9; *Harpers Weekly* Dec. 29, 1888: 1,007). For the 420 stalls in this new $1,000,000 complex there were 2,800 applicants; demand obviously continued to exceed supply. However, at least the market activity had a proper setting, one that insured an adequate level of cleanliness, efficiency, and safety while at the

FIGURE 97. View westward c. 1885 at the West Washington Market across West Street. The market building in the background incorporated private streets commemorating the Grace, Thompson, Hewitt, and De Voe families. The Hudson River can be seen through arch in extreme left at Grace Avenue (Black 1973: 63, Plate 57).

same time offering a dignified presence complete with Romanesque towers and detailing.

The formal design of the new West Washington Market was intended to take advantage of the open space immediately to the east, which was occupied by the Gansevoort Market. This market, established in 1884, was bounded by Gansevoort, Little West 12th, Washington, and West streets, another landfilled block which had previously been the site of Fort Gansevoort, built in 1812. Gansevoort Market was designed to accommodate farm wagons and consisted of ten parallel streets, each 33 feet wide separated by 6-foot walks. About 400 wagons could be parked on the block on market days. Of course, as always, this space was inadequate, and the long-established tradition of taking over the nearby streets on market nights continued (*Harpers Weekly* Dec. 29, 1888: 1,007).

The arrangement of the Second West Washington and Gansevoort markets is well documented photographically. "Market Day," a photograph from 1900, gives one of the best impressions of the open-air activity at the Gansevoort Market with the West Washington Market forming a screen or backdrop to that activity. Also visible in this photograph is the city pumphouse on the southwest corner of the Gansevoort Market, which still remains (New York Public Library Photograph Collection, No. 1050, B2; also Nos. 0850, B5 and E5). Activity at this site continued into the 1930's, when the West Markets were finally demolished and the site used for a city incinerator. The Gansevoort site, on the other hand, was built on and occupied by meat wholesalers, as are many of the buildings on adjacent lots.

4) The Clinton Market

The Clinton Market was roughly contemporary with the old Washington Market, and was similar architecturally. Located at the lower (Hudson) end of Canal Street, the site was bounded by Canal, West, Washington, and Spring streets. The main market building was begun in 1827 and completed in 1829 (see Figure 27). Never the major market site that Washington Market became, it nevertheless was successful for a time and expansion of the facility was necessary. Facilities were added on the block bounded by West, Washington, Canal, and Hoboken streets in 1834, which served as a country market with 38 stands. In 1848 the increase in river trade resulted in the construction of a shed to the southwest of the main market building along Canal Street. One of the few views available of Clinton Market is a detail of a panorama of New York from the North River drawn in 1844 by Robert Havell (Eno Collection No. 173). A two-story headhouse with cupola is clearly visible with its gable end facing the river. Extending out toward the bulkhead is at least one one-story arcade. A number of sloops and a steamboat are also depicted docked near the market.

By c. 1850, the country market activity, having declined, was discontinued, and the Hudson River Railroad was granted a lease which continued until 1860. At that time the structure was badly deteriorated and was removed, leaving an open lot to be used for farmers' wagons (*Tribune* May 5, 1860).

In his capacity as Superintendent of Markets, Thomas De Voe included the Clinton Market in his 1873 report entitled *Report Upon the Present Condition of the Public Markets of the City & County of New York.* In it, he indicated that its returns to the city amounted to $13,188. Comparison of this amount with $144,563 for the Washington Market and $113,033 for the West Washington Market, the largest in the city, for the same year, gives an idea of the Clinton Market's relative trade volume. De Voe had earlier mentioned in his book that a "considerable business is done here in selling meat by the quarter and at wholesale, and there is also a large trade in oysters, clams & c. on the slip adjoining" (De Voe 1867).

The late nineteenth-century activity at the Clinton Market is sketchy. Apparently the original brick building was replaced by a metal structure, as indicated on the 1894 Sanborn map. Jut how late the market activity continued is unclear, but it is certain that all business was suspended when the block was acquired and used for the construction of one of the ventilation towers for the Holland Tunnel.

5) The Manhattan Market

The Manhattan Market was established in 1871 as the first modern megastructure for market activity. It was situated on the block bounded by 34th and 35th streets and 11th and 12th avenues. As such, it was the largest market in plan--the only one to occupy a full city block. At the time that it was being constructed, it was considered to be the future principal market "if Washington Market is removed" (Richmond 1872: 212-13). It seems possible that politics had a hand in the failure of the prophecy. Its status was not typical in the first place, inasmuch as it was under the control of a private company.

In plan, the Manhattan Market was well organized, and, designed as it was around a rail siding, it reflected the recent chages in and current status of transportation. Rails entered the building through large doors on 11th Avenue, which were located in a large ornate three-story headhouse. They then ran the length of the block, servicing the various stalls which faced 34 and 35th streets. The structure was composed of stone and brick with iron interior supports. In the 1872 rendering (Richmond 1872), the structure is shown having a high roof covering the rails, surmounted by a large tower and cupola. It is not clear, however, whether this was actually built.

Products sold at this market included grain, beer, produce, meat, ice, and hay. On one of the Sanborn maps, the entire market is referred to, simply, as the "Hay Exchange." Like the other markets on the West Side, the Manhattan Market was phased out in the 1930's. The headhouse facade of the original structure was removed c. 1935 (New York Public Library Photograph Collections, Nos. 0426, E6 and E8), and the sheds along 34 and 35th streets were razed in 1938.

6) The Oyster Market

Perhaps the least documented of the West Side markets, the Oyster Market is known mainly from drawings made in 1903

(*Picturesque New York*). Located along West Street near Christopher Street, it was primarily a docking area for oyster boats. One interesting note is that in the drawings the structures depicted along West Street appear to be similar to the oyster boats themselves, small in size with the same low-bowed roofs. None of these structures survives today.

III. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

The final task in the documentary portion of a cultural resources survey is to analyze the collected data and decide what places within the study area are likely to contain potentially significant cultural resources. Section II of this report has presented the complete body of research data investigated for the project. Section III, which follows, concentrates on data analysis and research conclusions and recommendations.

Following the format established in Section II, Section III presents its findings relative to cultural periods, the grossest categories of which are the prehistoric and historic eras. It ties the likelihood of extant potentially significant cultural resources from each era to physical locales within the study area. Four areas have been thus identified in the course of this survey as sensitive to the presence of such resources (see Figure 3):

1. Aboriginal habitat zone
2. Lower West Street
3. Canal Street Interchange
4. Whiting Paperhanging Factory site (Midtown Interchange)

Area 1 designates a likely area for aboriginal habitation. Areas 2 and 3 are likely locales primarily for historic cultural resources, but the research has indicated that Area 3 may contain potentially significant cultural resources from the prehistoric era as well. Area 4 is likely to contain only historic period cultural resources.

In making recommendations for further cultural resource research, the proposed construction and/or design plans for the Westway Project were taken into consideration. Figure 2 (see Figures 2.1, 2.2, and 2.3) illustrates the types of physical treatment that the study area is slated to receive during the building of the highway. The proposed construction/design activities are identified in Figure 2 as follows:

A Areas to be excavated (approximately to -35')

AA Areas to be excavated (approximately to -25')

B Areas to be dredged (-5' to -15')

C Areas to be filled by dredge spoil

D Areas in which piles will be driven

E Areas in which foundations for ramps and above-ground structures will be placed

F Areas in which road surfaces will be reconstructed

G Areas in which present tunnels will be protected by deep pile-driven bridges

B. PRIOR DISTURBANCE

In formulating the research design for the Westside Highway Cultural Resource Survey Archeological Work Program, one of the proposed tasks (Task 3) was identified as "Documentation of Prior Disturbance Within the Project Area." It entailed the gathering of data relevant to subsurface disturbance both from city agencies--such as building, water, sewer, and road departments--as well as from private concerns, such as the utilities companies which routinely disturb the city's subsurface strata. It was hoped that the overall result of this research--coupled with the review of the prehistoric and historic record--would enable us to predict the probable presence or absence of given cultural remains owing to prior subsurface intrusions. Such an anticipation proved to be overly optimistic. Such disappointments in attaining research goals are commonplace and emphasize the fact that research designs must be flexible so as to be adjusted to the actual conditions encountered during the research process.

In carrying out their study of prior disturbance in the project area, the archeologists followed their original research design by studying the development and manipulation of the built environment at three levels of intensity. In the first step, they examined the broad outlines of the development of the entire study area, including roads, waterfront development (e.g., piers), and standing structures. At this level, the entire study area was encompassed. Documentary evidence of historical activity was, of course, integrated into this study of the cultural landscape. Upon completion of step 1, and based on its findings, they further investigated those portions of the project area which possessed the likelihood of containing potentially significant cultural remains. At this point, deed, tax, and census research was conducted on these more intensely sampled areas. Finally, in step 3, they evaluated, as completely as was possible from the documentary sources, the potential for particular site remains of a potentially significant nature to be recovered by excavation, if they would be affected by the project.

An example of investigations of previous disturbance that successfully reduced the areas that might contain potentially significant cultural resources was the study of the Canal Street Interchange area. Here, by analyzing a series of historic maps showing the buildings within this area over the nineteenth and twentieth centuries, and by analyzing detailed lot-by-lot deed data and building department records, researchers were able to define given areas on which construction had either not been recorded or did not reach a level which would have disturbed cultural remains from earlier periods.

Most often, however, although the actual occurrence of prior disturbance could be documented, the extent of the intrusion could not. For example, research records for street construction--sewers, gas, electricity, street gradings, etc.--were available but usually no records existed as to how wide or even how deep excavations for a utility line had been made. All that is generally available from construction and maintenance plans are the size, depth, and location of the given intrusion.

At first it was thought that a conservative estimate of the size of these previous excavations could be made and placed on maps. However, in collecting the data, we were informed by individuals having a knowledge of the below-ground strata of New York City's streets that we would not be able to formulate very accurate maps. In addition, they told us that excavators in the city streets could expect to find all manner of remnants and surprises. For example, Consolidated Edison construction engineers working in lower Manhattan have many times uncovered wooden water pipes from the city's oldest and shallowest utility system (Schmidt 1978-83: personal communication). Despite the fact that these streets contained a host of later, active utilities, these unused wooden pipes persisted through all subsequent excavations. Of course, as an entire system they did not survive; however, in some places, although the record shows that the same territory was subsequently disturbed, the later excavators either completely missed the relics from the previous system or only partially exposed them.

We realized that the originally conceived research design to construct overall maps of all prior disturbance would not now be accurate enough to allow us to predict with certainty that no cultural resources remained in given portions of the study area. That is, the documentation of former disturbances could not be registered closely enough to preclude that significant portions of physical remains from earlier periods might not still be present in the ground. It is in part for this reason that when they design new construction, city engineers make new soil borings in addition to the extensive extant boring logs already available. Likewise, city contractors who bid on excavations having thoroughly designed plans still find unwelcome surprises awaiting them in the ground.

Instead of preparing overall base maps of prior disturbance, then, we revised our research design to concentrate on what proved to be the more practical case study approach. In it, each potential cultural resource site noted in the documentation was checked against its location in the proposed highway project area. If, after analysis, we found that the documentation showed that the site might still be present, and if we furthermore found that it would be disturbed by the proposed construction/design plans, we gathered these pertinent data into specific case studies. When it became obvious that possible cultural remains would not be disturbed by the proposed work, those files were set aside to make way for the continued analysis of those potential remains that might be affected by the Westway Project.

In a number of instances, potentially significant sites were discarded from consideration because the evidence collected from the study of prior disturbance showed that there was no doubt that they had been removed altogether. Excavations into the earlier filled area at Gansevoort in the twentieth century, and the removal via dredging and pier rebuilding operations of the site of the Red Fort at the end of Hubert Street, are both examples of the value of research into prior disturbance.

C. CULTURAL RESOURCES OF THE PREHISTORIC ERA: AREAS OF LIKELY ABORIGINAL HABITATION

1. Introduction

The preceding general discussion of prehistoric human occupation, presented in Section II,C,1 of this report, has provided a basis on which to predict the kinds of cultural properties that may have existed in the study area. Summarized therein are the available data about the ways prehistoric peoples lived in the northeastern United States in general and in coastal New York in particular. This information has been applied to projections of potential site locations within the study area (see Section II,C,1,e). Therefore, see Section II,C,1,a-h for the complete analysis of the prehistoric era documentary research and the archeologists' correlation of these resultant data with the data from the paleoecologists' study of the project area. Portions of that discussion are summarized in the following text to place the conclusions and recommendations in context.

By correlating environment and cultural behavior in the study area, this research has attempted to reconstruct past environments. It has also considered the archeological potential of the study area with regard to prehistoric cultural resources. Inasmuch as the previous absence of systematic field investigations has produced difficulties in identifying the study area's extant prehistoric resources, this research has evaluated the probable attractiveness of the study area for prehistoric peoples and has located those areas where prehistoric peoples were likely to have lived and worked.

This consideration of the prehistoric occupation of Manhattan required reconstruction of the area's paleoecology. Palynologists and geologists have demonstrated that the climate and land surfaces of the shoreline areas have changed radically through time. Recession of the Wisconsin glaciation in northeastern North America dramatically affected local environments. As the glacier receded (soon after 15,000 B.P.), sea level began to rise. The change in sea level affected shorelines both on the seacoast and along the shore of the Hudson River. Rising sea level in turn caused river and sea waters to inundate the land surfaces such that some land surfaces that were available for human occupation and utilization during prehistoric times presently lie underwater. Thus, evidence of prehistoric human land use in the study area has probably been drowned by the Hudson River. For archeology in the study area this situation implies that knowledge of the locations of former shorelines is critical to understanding prehistoric occupation. Reconstruction of these shorelines has allowed comparison of their present and prehistoric topographic features, and areas of likely prehistoric occupation, as well as other areas not likely to have been of interest to prehistoric populations, have been identified.

2. Archeological Sites in the Study Area

Areas in the coastal New York Region which have been evaluated to have been similar prehistorically to the Westside Highway study area have provided archeologists with a wealth of data about aboriginal life. Any extant prehistoric cultural remains that may have existed in the present project area early on were subsequently covered over by the expansion of the city before the advent of systematic archeological research. Therefore, no aboriginal sites have been reported to have been found in the study area, nor are any artifacts attributed to such a site known to exist in any artifactual collections.

However, archeologists have long reviewed a variety of documentary evidence pertaining to Indian habitation in Manhattan. From this evidence, which includes references to sites in the Canal Street and Gansevoort areas, we conclude that although no aboriginal sites have been recorded within the boundaries of this project's study area, the potential certainly exists that as-yet undiscovered prehistoric cultural resources may be extant in those environments which are so similar to other locales in the region, unobscured by urban development, that have produced aboriginal site remains.

3. Reconstruction and Analysis of Drowned Shorelines

The reconstruction of Hudson River shoreline environments in the proposed Westway Project study area provided a basis for determining those areas considered the most likely places on Manhattan Island to have been selected by prehistoric populations for habitation prior to European contact. Using methods previously described in Section II,C,1,d of this report, the archeologists studied boring data and the paleoecological research results. They then examined actual samples taken from Westway borings and formulated the resultant data into a series of data base lines in table form. These tables establish the prehistoric era shorelines for the project area at various time periods. Table 1, entitled Sea Level Curve (p. 32), shows the sea level in the study area over the last 12,500 years and gives the date range for each 10 feet of rise. Table 2, entitled Changes in Shoreline Relative to Sea Level (pp. 56 ff.), describes the shoreline in some detail during several time periods. Table 3, entitled Shoreline Features of Possible Significance for Prehistoric Human Settlement (pp. 64 ff.), summarizes the research. (These data were plotted on Figure A10. Figure 4 is a simplified version of Figure A10.)

To analyze the study area in the prehistoric period, it was necessary to formulate a model of the type of areas likely to have been aboriginal habitats. Such a model is defined as having provided one or more of the following prerequisites: potable water; estuary and marsh environments providing habitats for shellfish, fish, and waterfowl; shelter from inclement weather and high water conditions (except for temporary hunting camps); areas where land animals could be hunted or trapped; areas having good landings for canoes; and, to a lesser extent in this coastal zone, land suitable for agriculture.

4. Conclusions and Recommendations

a. DESCRIPTION OF PROJECTED HABITATION AREAS

This section focuses on those locales within the project area considered as most attractive for prehistoric human settlement. The reader should consult Tables 2 and 3 and Figures A10 and 4 throughout the following discussion.

The shoreline analysis indicates the area from south of the line of Harrison Street to approximately the line of Desbrosses Street as a prime location for prehistoric occupation in relation to the stated settlement criteria. As early as 10,500 B.P., about -80 feet below present sea level, this area contained a headland which was surrounded by water on three sides with a narrower "neck" projecting west of the project area (Map Reference Area 12). The presence of peat in the boring logs suggests that this headland was surrounded by a marsh, an area possibly attractive to prehistoric people. At this time, the highest ground on the headland was represented by Map Reference Areas 19 and 8. At approximately 7,700 B.P., about -60 feet below present sea level, the headland still existed although the rising sea level reduced its boundaries and inundated the projecting neck. The southeastern part of the headland was penetrated by a cove by this time (Map Reference Area 16), and peat was still indicated in some locales, suggesting the continued presence of marshland. Another cove may have penetrated the land in the northeastern portion of this area (Map Reference Area 17). The northern boundary of the headland may have been at Vestry Street. The highest ground in the area remained that indicated by Map Reference Areas 19 and 8.

By approximately 7,000 B.P., about -50 feet, the former higher ground on the above-discussed headland became an island with a shallow bay to the east and some marshland. Map Reference Area 8 was the highest land in the area. Map Reference Areas 7 and 9 were headlands delimiting the bay.

By approximately 6,500 B.P., about -40 feet, the only portion remaining above the water would have been two small islands (Map Reference Area 8). By 6,000 B.P., about -30 feet, these islands would have been inundated.

Borings indicate the presence of peat north of Map Reference Area 19 in the vicinity of the Holland Tunnel. In historic times an inland marsh existed in the vicinity of Canal Street, and this wetland area drained the Collect Pond near the present location of City Hall. It is possible that at times of lower sea level, this marshy area extended to the west. This freshwater wetlands area--which may have been only several hundred feet north of the headland/island--would have increased the variety of resources available to occupants of the headland/island (Map Reference Area 19) and would have increased its attractiveness for aboriginal occupation.

At approximately 6,500 B.P., from -30 to -40 feet, the data indicate the likelihood that a bay existed approximately between Carlisle Street and the southern PATH Tubes. The headlands of the bay, Map Reference Areas 2 and 4, are only partially within the project area. In addition, the southernmost headlands contained a knoll (Map Reference Area 3). This high ground may have been attractive to aboriginal occupants. At the mouth of this bay were located a series of slightly elevated land surfaces (Map Reference Area 5), which may have been attractive areas for the collection of resources but were not likely places for occupation.

Between Vesey and Murray streets, the irregular shoreline contained several coves and headlands. At approximately 7,000 B.P., about -40 feet, two coves, Map Reference Area 18, were present in an area extending from south of Barclay Street to Park Place. One boring suggests the presence of marsh in at least a portion of this area.

At 6,000 B.P., about -30 feet, a cove was present at Vesey Street (Map Reference Area 6). In the vicinity of Murray Street was located a small projecting headland and cove, with high ground on the headland (Map Reference Area 10).

North of Canal Street, there are significantly fewer topographic features in the project area that demonstrate the settlement criteria previously discussed in relation to prehistoric human settlement.

b. CONCLUSIONS

Reconstruction of the prehistoric shorelines and comparison of the topographical characteristics with prehistoric settlement pattern models indicate several areas which may have been attractive to prehistoric human populations as loci for occupation and resource exploitation. In particular, this analysis identified the area approximately between Harrison and Desbrosses streets in the project area (Map Reference Area 19) as the most likely area of prehistoric occupation. The analysis also identified the area surrounding the historic period wetlands near Canal Street, and a nearby freshwater stream, as potentially attractive to prehistoric people.

c. RECOMMENDATIONS

In the area offshore and just south of the Canal Street Interchange--Area 1 in Figure 3--we recommend that some additional how many?

data be gathered by taking additional soil borings and by archeologically analyzing samples from them. In the other area (Area 3 in Figure 3) in which potential aboriginal habitats were evaluated as likely--i.e., in the Canal Street marshlands--the testing recommended herein for potentially significant historic cultural resources will also allow for the infield investigation for the presence of potentially significant prehistoric cultural resources at the same time. For this reason, then, no testing specifically for prehistoric resources is recommended for Area 3.

Because of the data collected for this study on sea level changes and what is known about prehistoric settlement preferences, the area in question (Map Reference Area 19) seems one that may well have appealed to prehistoric inhabitants between about 7,500 and 6,000 B.P. The flotation and chemical analyses reinforce the possibility of prehistoric use of the area; however, the sample size on which these inferences are based is very small, and the possibility of contamination of samples is a real one. Therefore, how many a large series of borings, done carefully over an area stratified by the likelihood of finding material (based on geomorphological criteria and knowledge of subsistence-settlement practices in the relevant period), randomly sampled, and controlled to some extent for contamination by the presence of an archeologist who will inspect borings as they are taken, will be essential as part of this phase, which, after all, is designed to assess the likelihood of cultural resources being present at all. The strength of this approach lies in the number of borings taken; a sufficient number will both control contamination problems (making it clear whether they are really contaminated or are mixed and disturbed deposits) and provide a quantity of material large enough to determine whether evidence of human activity is, indeed, present.

how do you know if material only represents artifacts washed into the Hudson?

It has been suggested that deposits of river-borne silt or sand will protect fragile sites lying off sea coasts (Barber 1979). Although we do not know whether similar deposits would help to protect sites lying in the Hudson bottom, it seems a likely possibility that they would. Therefore, the area just south of Canal Street would be a likely area to have been thus protected.

The potential for finding prehistoric resources at this point, by means of borings, is really a separate issue from that of the feasibility of recovering any sites located. In our opinion, the issue of feasibility of recovery is a problem for a later stage in the cultural resource survey process.

d. DISCUSSION

The era in which cultural resource surveys have been undertaken as a regular part of publicly financed construction projects spans approximately the last decade, although some such projects were undertaken previously (e.g., Edward Rutsch conducted an archeological investigation of the Beverwyck Manor in Parsippany-Troy Hills, New Jersey for the New Jersey Department of Transportation in connection with U.S. Interstate 80 as early as 1970). In that time, almost all students of our region's cultural resources have come to rely on available engineering borings for a basic knowledge of the below-ground conditions of given site study areas. If cultural resource surveys are timed so that the borings are available to the surveyors, the value of this knowledge of the buried strata to archeologists cannot be underestimated, even though the availability of such data is now beginning to be taken for granted.

The results of the study of these data in the course of the present project is an example of this analytical process being taken a step further. Not only were the boring data compiled by the Westway staff readily available and worked up into comprehensive profiles of the strata in the study area for use by the archeologists, but actual samples of bored cores were also available for analysis by the archeologist's subconsultant in ways that have revealed a great deal about the study area's past in terms of its potential for human habitation.

Having found out so much from these investigations of the environments of the past, we are beginning to ask if additional opportunities for research employing boring data and samples are available. For instance, if a potential habitation area, such as that in Area 1 located offshore south of Canal Street (Map Reference Area 19), is sampled via borings, and if the resultant samples are studied using archeological laboratory methods, then (1) could aboriginal habitats be located, and (2) what could be learned from samples from sites identified in this manner?

still unknown if this is possible

Before addressing these potentials, it is worthwhile to review the results of borings analysis reported in the cultural resource work already completed in the area. Pertinent topics of concern are how effective this analysis of borings has been, whether archeological sites have indeed been located in this way, whether any archeological sites have been successfully sampled by borings, and whether other public agencies undertaking cultural resource surveys have employed the analysis of borings as a regular part of their required research. The following discussion documents an affirmative response to these research questions, but, at the same time, the methodology of borings analysis is only now being sorted out as to its real value. It is our opinion that by refining the techniques now used in sampling to better suit the purposes of the archeologist, a real contribution can be made.

Historic Conservation and Interpretation, Inc. is presently engaged in two cultural resource surveys involving the analyzing of borings samples. Both are being undertaken in the coastal New York region for proposed sewerage construction projects supervised by the New York State Department of Environmental Conservation (Water Quality) and the U.S. Environmental Protection Agency (Region II, New York). The first is located in the Oakwood Beach section of Staten Island. In a previous survey, borings made for engineering purposes were analyzed by cultural resource investigators, who found a shallow, buried stratum of dark soil (Pickman and Yamin 1978). HCI was subsequently chosen to test this stratum, using conventional excavating techniques (Rutsch 1983), as a matter of

This is a land site

course for the preliminary environmental assessment. In other words, the stratum is being tested with no substantial clue to its cultural nature pre-established other than the facts that it is noted in the soil boring logs and that the archeologists have evaluated it as having potential as a site of human occupational remains. In no way was testing precluded because the potential significance of the subject stratum, by National Register criteria, was not a demonstrated fact in the initial documentary survey portion of the cultural resources work.

In the second instance, a series of islands and coastal landscapes located along the south shore of Long Island--between Coney Island and Brighton Beach in Brooklyn, Kings County, New York--had been built upon in the twentieth century for the Belt Parkway. A sewer line is now proposed to be constructed next to that highway, which joins island portions of the National Gateway Recreation Area. Here, in the initial cultural resources documentary survey (Gimigliano 1983), our firm first formulated a sensitivity model to test for the location of cultural resources. Using this model, we located areas where potential sites lay. In the infield research portion of this work, HCI archeologists have become part of the engineering soil boring team in those areas in which there was adjudged to be site potential. The field work is now beginning and results are not available, but the archeologists have gained some valuable insights into the potential for obtaining borings, which are reflected in the new techniques we are suggesting for the sampling program for the Westway Project (Church and Rutsch 1983).

was this material 70 ft under water?

In yet another cultural resource survey--the Ridgewood Aqueduct along the proposed Nassau Expressway in Queens and Nassau counties, a project for the City of New York and the New York State Department of Transportation--the study of engineering borings has proved quite successful. The initial documentary study (Rothschild, Pickman, and Harris 1978) used boring data in part to relocate the aqueduct site, which had been noted earlier in the twentieth century and then buried. HCI personnel participated in the assessment of the remains of the historic aqueduct water delivery system, which the borings had helped to locate (Church and Rutsch 1979).

Wasn't this a land site?

In another cultural resource project, one which bears some resemblance to the Westway Project situation, boring samples made for engineering purposes are being analyzed for the presence of deposits of aboriginal site material. At the Cedar Creek Sewerage Treatment Plant site on the south shore of Long Island in Nassau County, New York, extensive samples of shells from the covered shell midden on that site have been taken via soil borings in a project which was instrumental in locating and evaluating the site as the Seaford Archeological Park National Register site. Ron Wyatt, of the Nassau County Museum, was the archeologist responsible for that work (Wyatt 1976). Our firm is now formulating a contract to complete this initial analysis as well as to investigate the results of further sewerage facility construction on or near this National Register site (Wyatt 1979B; Rutsch and Johannemann 1983). In this instance, working with an engineer lately retrained as an archeologist, Edward Johannemann, of the Long Island Archeological

but was this under water?

Project at the State University of New York at Stony Brook, we are studying the problems encountered with the samples made for engineering purposes. Here, as mentioned, are shell middens (mostly hard clam) from 4 to 9 feet deep covered with 10 feet or more of fill material. The 1970s borings were to have produced continuous sample cores for archeological use as well as for their primary engineering purposes. The 8-inch diameter split-spoon system, often used to obtain such borings, was not successful in producing the long, continuous, and uncontaminated sample necessary for the vertical control which would allow archeologists to compare the site contents at various time/depth intervals. The small diameter of the split spoon and the motion of the drill rig pushed the shell away or so disturbed it that only a fragmentary sample was obtained and the very necessary vertical control was lost.

sounds like a land site

In the work we are presently undertaking, a new hand-operated boring will be made by Dr. Richard Pardi of the Queens College Radiocarbon Laboratory. Archeologists Johannemann and Rutsch are anxious to see his techniques, which are made in ways traditional to methods developed by sedimentary geologists and are said to be quite effective in some environments and at limited depths.

We are also exploring two other possibilities for improving the archeological research potential of samples taken from bored holes. In the first experiment, the formulation of which is currently being discussed with toolmakers in the Stony Brook University Physics Laboratory, applied vibration on a drill pipe of larger than normal diameter will become a factor in obtaining new samples from the Seaford Park Archeological site shell middens.

In the second avenue of investigation, a sampling method in which a wrapping of foil is used to decrease contamination is being considered. In this work we have used the advice of both Karl Rubenacker of Vollmer Associates, Engineers, and Peter Deming of Mueser, Rutledge, Johnston and DeSimone, the latter of which is in charge of the borings being made in the Beltway near Coney Island in connection with the project mentioned earlier.

In summary, then, it can be said that the field of cultural resource studies has derived real value from the analysis of borings made for engineering purposes. Boring logs can be made even more useful when geologists on borings rigs are sensitized to observe and note the phenomena which archeologists are seeking, or when archeologists are actually placed on the drill rig as observers while the samples are being taken. Furthermore, archeological sites, even well-covered sites, can be recognized and thus found by the use of engineers' borings, as Pickman has demonstrated.

Sites once found can be sampled, but it is in the sampling process that techniques are being modified for effectiveness. Modifications discussed herein involve taking a sample of a thick shell midden and an uncontaminated sample from a stratum of more soillike consistency.

So far on the Westway Project, boring samples have been used for environmental reconstruction in a way that has seldom if ever before been employed in a documentary level survey. We are how many? where?

now recommending, for the first time, that extensive borings be made to take samples of a potential site located by our sensitivity model in a manner specifically designed for collecting an archeological sample. In other words, we suggest that an archeological sample should be taken rather than use an available data base collected for other than archeological purposes. We see such a technique as a logical outcome of this ongoing use of borings to both locate potential cultural resource sites and to sample those sites thus found or which exist in the deeply buried or inundated circumstance of our urban coastal region. Furthermore, we feel that it is entirely proper for this recommended work to be undertaken as a necessary infield testing portion of the environmental impact statement for the Westway Project.

But he doesn't cite inundate sites being tested this way. No one doubts that borings can be useful in land sites or in determining the depth of landfill on a site. But he has not addressed issue of currents, ~~w~~ erosion to original shore line, probability that this material may simply be washed to the shore, or that the material may simply be water washed stones & shells & not archaeological debris.

D. CULTURAL RESOURCES OF THE HISTORIC ERA

1. Introduction

The following pages discuss the data presented in Section II,C,2-4 of this report concerning the potentially significant historic era cultural resources within the project area which will be affected by the proposed construction/design plans for the Westway Project. Also included, as was done for cultural resources of the prehistoric era, are conclusions, recommendations, and a discussion concerning additional cultural resource research.

Areas 2 through 4, identified in Figure 3 as likely to contain potentially significant historic cultural resources, are discussed in the following text in numerical order. Area 3 may also contain potentially significant cultural resources from the prehistoric era. The test excavations suggested for the historic era resources can be designed to be expanded to test for possible prehistoric resources as well. (The reader should consult Section II,C,2-4 for the documentary sources of the data discused herein.)

2. Area 2: Lower West Street

a. *INTRODUCTION*

Lower West Street, indicated as Area 2 in Figure 3, includes the major portion of present-day West Street, in which the proposed construction/design activity is to include excavation to a depth of 25 feet below today's ground surface (see Figures 2.1 and 98). Area 2 has the potential to contain potentially significant cultural resources from the historic era.

In the early historic era--in fact, until the turn of the nineteenth century--Area 2 was part of the Hudson River. In the post-Colonial period, the Lower West Side waterfront was the scene of rapid expansion, including the building of docks and other longshore facilities. Formerly, such facilities were confined mostly to the Lower East Side, the city's better anchorage. However, increasingly into the nineteenth century, waterfront facilities and landfilling practices continued to expand into the area where proposed excavation for the Westway Project will take place.

FIGURE 98. View of Lower West Street (Area 2 in Figure 3), looking generally southward from North Moore Street. The piers are at the right, the cranes in the distance mark the construction site of Battery Park City, and the World Trade Center is visible extending off-camera top left. (Michael Spozarsky, photographer, April 1983.)

Over time, the number, size, and type of waterfront facility built on the Lower West Side evolved rapidly for a number of reasons. To depict this progressive development, we compiled two schematic maps of Area 2 showing the shoreline filling and longshore building in the nineteenth century, both before (Figure 82) and after (Figure 83) the Civil War. Each is based on analysis of a variety of historic maps and documentary sources. Such analyses and schematics, of course, give only general locations; however, they do accurately illustrate the continued redevelopment of the West Side waterfront in a period of intense growth--the Industrial Revolution.

The rapid development of the Lower West Side waterfront was advanced initially by several important and concurrent events. In 1807, Robert Fulton invented the steamboat. The period 1815-25 saw the end of the War of 1812 and the completion of the Erie Canal, as well as the start of the modern period of immigration, industrialization, and urbanization. Later, between 1820 and 1860, many more major changes occurred, turning a rather backward underdeveloped waterfront, expecially when compared with the East River side, into an important marine terminus for the entire city.

Hand-in-hand with the proliferation of waterfront facilities was the landfilling process. Some records and maps have been found indicating the filling of waterfront areas and the laying out and granting of water lots. Thus, we have pieced together a framework of nineteenth-century landfilling operations, but we do not know how they were actually carried out.

b. PROPOSED TYPOLOGY, HISTORIC LOWER WEST SIDE PIER CONSTRUCTION

From the documentary research conducted on the topic of historic pier development within the project area, we have formulated the following tentative typology for the evolution of longshore facilities on the Lower West Side waterfront of Manhattan. Until further research has been done on this topic, the typology will remain untested and hypothetical.

Pier building in this area evolved in several ways and stages. It was first a response to the less than hospitable environment of the West Side, including strong west and north winds and the more dynamic movement of ice floes. Later this evolution was spurred by new demands made by steam vessels; ocean-going, coastal, and Hudson River boats; and cargo-carrying canal barges, which arrived in ever-greater numbers as well as in ever-increasing size. These demands were met by the city's new abilities to manipulate the environment. These innovations were made possible by increased amounts of capital available for investment in new facilities, and by technological advances made in the Industrial Revolution. Therefore, ever-larger and more powerful tools were invented to accomplish the work of dredging, digging, and the moving and setting in place of large amounts of material.

1) Solid Piers

The earliest pier construction consisted of building a timber frame or crib, setting it in place, and then filling the structure with solid material. The record shows that such piers came apart as the crib timbers rotted, presumably especially at the intertidal zone.

2) Basins

A basin was created by building a short pier at right angles to a main (solid construction) pier, thereby affording protection from the wind and ice of the open river for the berths along the main pier. Besides protecting the craft in the basin, this type of short pier provided valuable additional wharfage space on its river end, thereby increasing the value of the original structure. In the nineteenth century, basins continued to be used on the West Side, although new techniques must have been used in building the basins' piers.

3) Block and Bridge Piers

In this first half of the nineteenth century, piers of the type called "block and bridge" were introduced to the waterfront. This type of construction was greatly encouraged by the city's government, which was repeatedly and increasingly called upon to work out some single set of rules for all to follow when building and operating New York's crowded longshore facilities. In bridge and block construction, a row of either masonry or timber crib rectangles (blocks) was built into the river. Spaces were left between blocks to be spanned by bridges. This type of pier allowed for a much freer flow of water in and around the shoreline, permitting the tide to remove the city's filth and replace it twice daily with relatively fresh water.

4) Additions to Piers

This category is a catchall for a variety of methods used on the Lower West Side waterfront in the mid-nineteenth century to increase the capacity of piers by providing additional berths and by affording some protection from the rougher waters and wind of the open river. Included are additions in pier length and changes in pier shape--e.g., T-shapes, F-shapes, etc. Although maps give us some idea of this rapid change and growth, very little is known about actual construction techniques and the materials used.

5) Ferry Slips

The advent of the double-ended steam-powered ferryboats in the nineteenth century, which plied the river between the Lower West Side and New Jersey, brought about a new shape of pier to accommodate it. Both pier form and function changed in this case. The ferry slip was constructed of steam-driven pilings rather than filled cribbing (see Pile Piers, which follows), but it was the physical arrangement of the slip that was noticeably different. The slip was so arranged as to guide the end of the ferryboat into the bulkhead where it could be quickly tied, loaded, and unloaded. The city's remaining ferries at the Battery are still utilizing this invention, which the Stevens family of Hoboken adapted for its pioneer steam ferry service to Hoboken.

6) Pile Piers

As described briefly for the ferry slip, the advent of steam technology allowed the pile pier to replace both the solid and the block and bridge types of pier construction. Pilings were steam driven into the river sediments, resulting in a firm and cheap foundation for a wooden truss structure, which tied the pilings together and itself supported the pier's deck. Spaces left between the piles allowed the tidal water to ebb and flow freely along the shore. This type of pier became the waterfront standard. It is only now being removed from the harbor, as drift and abandoned shoreline facilities are cleared by the Army Corps of Engineers.

This seems very clear, so why excavate?

c. LANDFILLING AND WEST STREET

Between 1857, when the Harbor Commissioners of the city first established a limit on pier construction by drawing pierhead and bulkhead lines, and 1871, when these lines were redrawn by order of the New York State Legislature, a semblance of order was brought to the West Side shoreline development. In fact, in order to provide bigger docks for late nineteenth-century trans-Atlantic steamers, several areas of filled land on the West Side were reexcavated. Most dramatic at this time was the final laying out of West Street to its present wide proportions. The last industries that had blocked West Street relocated away from Manhattan, and landfilling ceased until the Battery Park City fill was placed.

During all this time, from the end of the Revolution to the 1870s, landfilling had taken place in Area 2 in piecemeal fashion. Figures 82 and 83 depict this evolution in the two periods centered on the Civil War, and reflect New York City's rise to a preeminent North American port of the Industrial Period.

Basically, when new land was needed or when deeper-water berths were required, the solution was to fill the spaces between existing piers and to build new piers further out into the river. To accomplish this task, one had only to construct or sink a bulkwork between the two piers and then fill in the newly constructed enclosure with solid material. We have a fair record of how this process was done, but no details of the bulkworks that were built--

only a vague idea of the techniques by which fill materials were handled and the landfill reinforced.

Landfilling accounts for other locales in the region may shed some light on the process in general. On the Lower East Side, archeological excavations have revealed that derelict vessels, for example, were incorporated into the fill in Colonial times. Across the river, old Morris Canal barges were chained together, filled with stone, and sunk to construct part of the bulkworks of landfill which the Central Railroad of New Jersey built in Communipaw Bay to create a vast railyard in the late nineteenth century (HCI 1977). Thus, it would appear that any timber available was placed in the fill to add to its stability. (See also Section e, Discussion.)

d. EVALUATIONS AND RECOMMENDATIONS

It is in part because of this lack of knowledge concerning the landfilling process that we have evaluated Area 2 as likely to contain potentially significant historical cultural remains. The information that is potentially contained in the site remains from the building of longshore facilities and from the landfilling process can significantly help us understand the process by which New York City changed from a minor coastal port to a World Class city and trading center. Questions concerning construction details, such as what was used to fill the land, can be answered only by excavation. Was the fill cultural debris? Or even vessels, as on the East Side? Or mostly industrial coal ash and clean fill dirt? Again, no detailed records have been found to describe how landfilling was accomplished.

We therefore believe that only test excavations will reveal whether significant cultural remains are present.

The fill itself presents us with the possibility of answering another set of questions. In other testing along the New York Harbor, nineteenth-century fill has been found to contain a wide sample of cultural material, ranging from domestic trash to the industrial waste from sugar houses, glass factories, ironworks, etc. Here, then, may lie deposits of artifacts that reflect the very fabric of the nineteenth-century city.

Further evaluation of the likelihood that Area 2, Lower West Street, may contain potentially significant cultural remains has led us to analyze the results of the Westway Project borings. Although the borings provide important data, the logs made and the samples taken do not adequately sample the contents of the historic fill deposits (they were, of course, not designed to do so); however, they do give us some close estimates of their depths. The fill materials have therefore been determined to constitute an approximate 25- to 30-foot deep layer overlying the natural river bottom strata all along West Street in Area 2, which is slated for excavation up to depths of 25 feet (see Figure 2.1). Figure 99 is a north-south profile of the soil strata just west of the World Trade Center, prepared by the Westway Project staff in their analysis of borings taken for the project. The typed labels have been inserted for clarity. Also inserted is the -25-foot elevation (dashed line), which shows the limit of the proposed excavation. The historic fill depth shown in Figure 99 is typical for Area 2, running approximately to -34 feet.

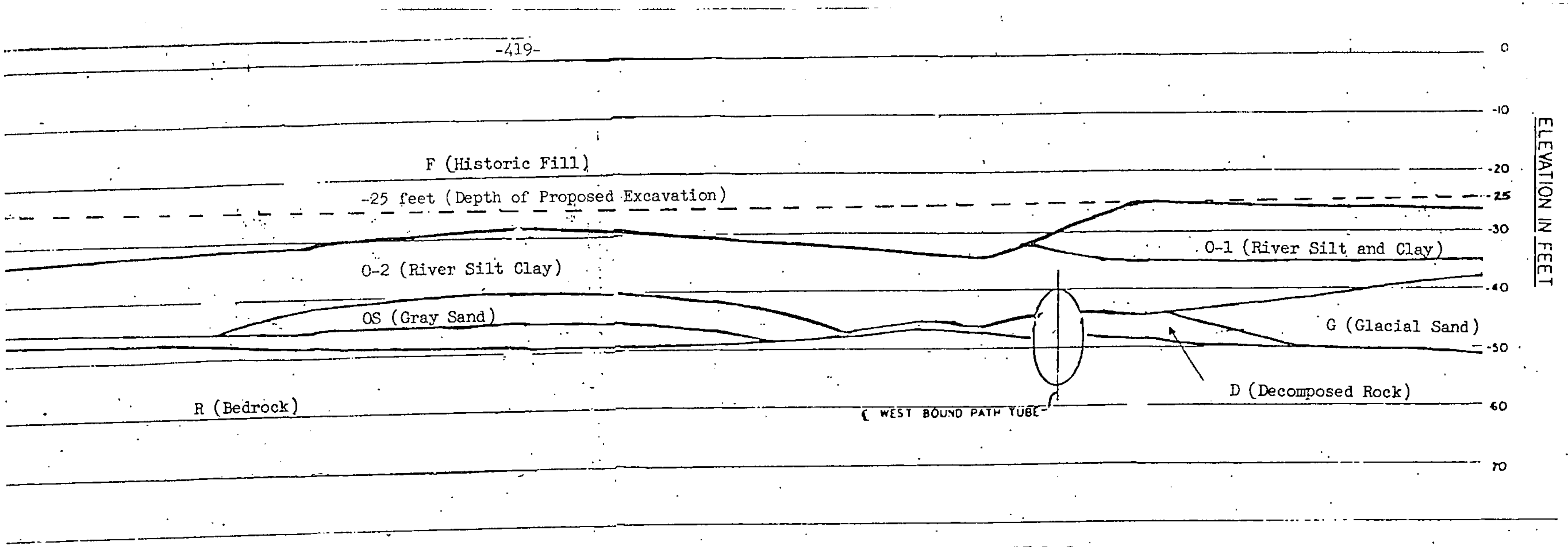


FIGURE 99. North-south profile of the soil strata found west of the World Trade Center. Dashed line indicates depth of proposed excavation for West-side Highway in Lower West Street area. (Source: Analysis of borings data, Mueser, Rutledge, Johnston, and De Simone.)

GENERAL STRATA DESCRIPTIONS

F - Fill - Loose to compact gray-black medium to fine sand, some gravel, silt, cinders, wood, trace of brick, shells, coal, glass, mica organic silt, rock fragments and asphalt.

O-1 - Black organic silty clay - Soft to medium gray-black organic silty clay, trace fine sand, fine sand lenses, wood, shells, brick, cinders, vegetation, gravel, mica and glass.

O-2 - Gray organic silty clay - Soft to stiff dark gray to gray organic silty clay, some wood, trace medium to fine sand pockets and layers, fine to medium sand, shells, vegetation, gravel and mica.

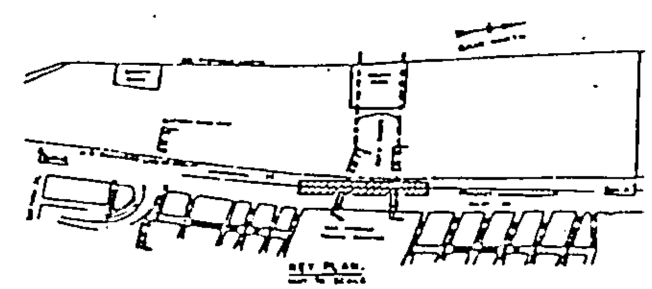
OS - Gray sand - Loose to medium compact gray medium to fine sand, some organic silt and clay, trace gravel, peat, shells, brick, wood and mica.

G - Glacial granular soil - Compact to very compact red-brown and gray fine to medium sand, some silt, trace clay, mica, coarse sand, gravel, occasional boulders.

GT - Glacial granular soil, till - Very compact gray and brown medium to fine sand, some silt, gravel, trace mica, clay, coarse sand, occasional boulders.

D - Decomposed rock - Gray micaceous silty fine to coarse sand, some rock fragments.

R - Bedrock - Gray to dark gray unweathered excluding joints to slightly weathered mica schist, mica gneissic schist, and granitic gneiss, broken at surface, jointed to massive at increased depth.



In summary, then, we evaluate the potential cultural remains in Area 2--described in the preceding pages--as likely to be potentially significant cultural resources, because it is probable that they will meet criterion D of the criteria for evaluation of significance of the National Register of Historic Places--i.e., they will yield, or may be likely to yield, information important in prehistory or history. It is the opinion of HCI's historians and archeologists, both on staff and acting as consultants on this project, that study of the potential cultural resources buried in Area 2, only partially recorded in the documentary record at best, would yield important cultural data. These resources include the vernacular longshore structures built on the Lower West Side waterfront in the nineteenth century; the concurrent landfilling process; and the contents of the landfill itself. (For an expanded discussion, see Section e, which follows.)

The questions that such study would answer deal with pier construction and repair, including materials and methodologies; the creation of bulkheads; and the landfilling process, as well as the analysis of all cultural material that may be present. Assessment of Area 2's cultural potential can only be made through test excavations, which we hereby recommend. Such tests would be made to archeological specifications. The cultural material recovered would be analyzed to reveal the composition of the material lying in the Lower West Street zone and to determine whether it does, indeed, meet criterion D.

but the report seemed to indicate a clear view of this.

e. *DISCUSSION*

Note: The following discussion of the potential significance of the nineteenth-century cultural materials which may be present in Area 2, Lower West Street, has been written in response to initial review comments concerning this significance made by the NYSDOT and the FHWA on the first draft of this report [submitted in two parts in May (Part II) and June (Part I) of 1983.]

Industrial archeologists, who make up part of the HCI research team, have long realized that the traditional archeological methodology used to study preindustrial and prehistoric cultures must be adjusted before it can be useful in analyzing the generally well-documented post-industrial nineteenth-century cultures. One of the authors of the present report, Edward Rutsch, has written the following paragraphs on the appropriate methodologies for approaching the archeology of the nineteenth-century landscape, stressing the need for assessing the large extant data base:

> Although ... [New York]* has always functioned as an integral part of a larger region, it was during the second half of the nineteenth century and the twentieth century that factors outside the state assumed more importance than ever before. These determinants, which brought rapid changes to the culture, have been lumped under the general term "Industrial Revolution." It is worth noting that many chroniclers of this era have chosen transportation developments as the prime example of the profound changes brought about by the Industrial Age. It is true that the ability to ship people and goods in huge numbers and tonnage without much concern for the variances in weather and local conditions affected changes in the culture to an extent that has

*This essay was originally written for New Jersey, but the concepts discussed are applicable to the Metropolitan New York area. Therefore, "New York" has been substituted for "New Jersey" herein.

> never before been experienced in human history. However, almost every other facet of the culture was also changed effectively by the increasing amount of non-human energy that was harnessed to accomplish the tasks of mankind.
>
> As one might expect, the effects of the "Industrial Revolution" are evidenced in the changes wrought on the cultural landscape. It is the symbolic meaning of this record on the cultural landscape or built environment that cultural historians--using archeological methodologies--read, study, analyze, and interpret. The most important examples of this physical record are the significant sites which the historic preservation movement is attempting to save so that the country's cultural heritage and patrimony are not lost as it builds for the future.
>
> Archeologists have very limited experience as students of this period of ... [New York's] cultural history, and they must adjust traditional archeological methods to the reality of the historical data that are available for study. Thoughtful students will discern that the great changes which occurred in the nineteenth century, as well as the fact that the period was so recent, demand the application of methodological approaches geared to fit the available sources of information.
>
> Basically, the data base of the period post-dating 1865 reflects two obvious factors when compared with the study of prehistory and the earlier historic periods. First, the written record is much larger and more readily available than for any earlier age. Second, more of man's efforts to modify his natural environment are discernible either above or on the surface of the ground. The abundance of this era's physical remains results from two major factors: 1) the fact that the period is recent and is represented by the topmost stratum of the cultural landscape; and 2) the fact that man's activities in harnessing the vast energies employed in the Industrial Revolution have affected and modified the land much more extensively than ever before. (Rutsch 1982: 241-42)

Because of this necessity of dealing with a copious extant data base, both physical and documentary, industrial archeologists have been questioned as to whether they were not really industrial historians. It has even been suggested that perhaps archeological site material of the nineteenth century is not really old enough to be a significant cultural resource meeting criterion D of the National Register of Historic Places. Nothing could be further from the truth of the matter. In the first place, American Industrial Archeology is committed to field investigations and analysis of nineteenth-century industrial site material as an important method of studying industrial history. This viewpoint has best been expressed by Dr. Laurence Gross, an industrial archeologist at the Merrimack Valley Textile Museum, North Andover, Massachusetts, in his article published in the Journal of the Society for Industrial Archeology entitled "The Importance of Research Outside the Library: Watkins Mill, A Case Study" (Gross 1981):

> Several recent trends in the field of United States history may be seen, in combination, to encourage a more holistic approach to the subject. Exploration of new areas, such as the history of the inarticulate, the new labor history, even the history of technology, aims, by concentrating on topics previously ignored or slighted, to create a more complete and/or accurate picture of the past. A parallel movement toward interdisciplinary approaches suggests the possibility of combining the two trends. Interest in material culture and occasional attention to artifactual evidence on the part of established scholars (often those connected to a museum), raise the possibility that industrial archeology may offer a significant opportunity for some of these new historiographical focuses.
>
> Traditionally, students in standard areas of history such as economics or labor were not prepared for or encouraged in a material approach. Those trained in the use of physical evidence, such as archeologists and historians of architecture and the arts, gave little attention to such subjects as the relationship

between industrial structures and machinery, and to the experience of the work force, the development of technology, or other fields related to the industrial past. The value of the artifactual record did not go totally unrecognized:

> The physical things of technology in many ways remain the ultimate source for the history of technology. Preserved products and tools as well as other traces left by these technologies--including railroad cuts and canal segments, razed factories and mine shafts--constitute repositories of information poorly understood by the general historian.... The means of technology are physical; the objectives of technology are also physical or material. Three-dimensional physical objects are the expression of technology--in the same way that paintings and sculpture are the expression of the visual arts. They call for the same attention and celebration that is accorded works of art. [Hindle 1966: 10]

It is in such areas, those broadly encompassed by industrial archeology, that I would argue the existence of significant potential for contributions to the historical record.

Before examining the special nature of physical evidence and the types of information it may offer, I should like to point out that (1) the value of written sources and interpretation is not to be slighted. Because of the nature of our evidence (largely documentary, whether interpretive or descriptive), paper sources will remain the historian's primary resource; and (2) artifacts may be misinterpreted, as may other sources; but their continued existence provides us with the opportunity to reassess them. Thus, we can correct our mistakes.

Obviously, our evidence of history remains incomplete and our conclusions about it therefore open to question. Historians have tended to concentrate on highpoints, the dramatic events and changes. This perspective responds to the availability of information and allows scholars to present their view of the relationships between events involved.

The dangers of such an approach are as plain as are its advantages and strengths. It accepts the importance assigned by others to the information on which it is based, giving attention to those areas (for example the content of party platforms) where records are extant. By seeking to establish broad interpretations, it moves away from the

> events which carried historical developments along between the visible and documented peaks. Insofar as its incompleteness permits error to enter, it magnifies the mistakes by the very breadth of conclusion for which it aims. Instead of a vital story of contest, advances and disappointments; of individuals, idiosyncracies and specificity, one often finds only generalized accounts, overall interpretations of cumulative effects, a homogenized history based on sources far removed from the individual instances upon which past developments rested.
>
> The more complete our understanding of any part of history, the greater our ability to generalize without distorting, to repesent the broad view without misleading. Current attention to the inarticulate, the workers, and others carries with it the implication that these topics have not received sufficient attention, that their relationship to history is not fully appreciated. I will argue that industrial archeology can serve these pursuits, just as it can provide new and detailed information by which to evaluate and amend previous interpretations in the history of technology, labor, and business. (Gross 1981: 15-17)

A logical question at this juncture is, are there examples in the New York Harbor area in which culture historians have recognized the usefullness--i.e., the significance--of industrial period remains? We do not believe that a prolonged analysis of the urban archeology recently performed in the downtown areas of Manhattan and the filled land along the East River areas would be very useful, since these sites were located on already established significant remains of the sixteenth through the eighteenth centuries. Such early material is not present in any but a casual way in the West Street area presently under consideration. There seems to be little doubt that the cultural material from these earlier centuries is considered to be significant, but we are here concerned with the cultural material of the more recent nineteenth and early twentieth centuries, during which time the filled land in the Lower West Street area was made and which we suggest should be tested.

In the following paragraphs are given examples and summaries of ongoing research in three separate areas of New York City's culture history in which there is active interest and a professed evaluation that such inground remains as we are considering in the Westway Project constitute a significant cultural resource: (1) vessels, (2) landbuilding techniques, and (3) pier, bulkhead, and dock construction.

Norman Brouwer, Ships Historian for the South Street Seaport Museum, has worked on many projects during the last six years which dealt directly with the significance of New York Harbor vessels that either were extant and derelict or were buried in historic-era fill. In this capacity, he worked as a consultant both for HCI and for Geddes Brecher Qualls Cunningham in the cultural resource reconnaissance survey of Liberty State Park, Jersey City, New Jersey, performed for the New Jersey Department of Environmental Protection and the U.S. Army Corps of Engineers (HCI 1977; Brouwer 1977B-D). In the following discussion of the relevance of archeological discoveries to the illumination of our knowledge of historic shipbuilding, he refers to the Black Tom Channel portion of the aforementioned Liberty State Park reconnaissance survey:

Historians have been encouraging a further widening of the scope of marine archeology--ultimately to cover all of man's experience with wooden boat and ship construction. We are beginning to realize that this entire ship-building heritage could be extinct in the near future, overshadowed as it is by new technologies and standardization. Leaders in this movement have been John Gardner, curator of small craft at Mystic Seaport, and Basil Greenhill, Director of the National Maritime Museum of Great Britain and recent author of *Archeology of the Boat.* [Greenhill 1976]

The broadening scope of archeological inquiry has led in turn to men recording not just archeological discoveries, but their relevance to wooden boat or shipbuilding tradition itself. The new work at Black Tom thus adds directly to that broader scope....

The work in New York harbor, revealing as it has been, has barely scratched the surface. By one estimate well over 2000 wrecks and abandoned ships lie sunk in shallow water or embedded in the harbor shore--among them the better documented types of vessels like side-wheel steamboats on Shooters Island and at Brighton, Staten Island; four-masted schooners at Port Johnson and Mariners Harbor; and the last known full-rigged ship *Occidental* ... also at Port Johnson with the schooners.

The day must also come when the now common harbor barges and wooden-hulled tugs also receive proper regard and documentation. Both great ship and small working craft are, after all, together the solution to a problem--the problem of transporting people or goods from one point to another over water, a problem solved with inherited knowledge and trial and error, with the natural resources best at hand.

All of them--the barges and lighters, the schooners and full-rigged ships--are part of our shared sea heritage. We have begun at last in the Black Tom project to consider that the time has passed when, as nearly happened with the New York harbor sailing lighter, a chapter of our sea story should be allowed to fade from memory, leaving no meaningful record behind for us all. (Brouwer 1977A: 12, 14)

As a result of Brouwer's Liberty State Park work, one of the vessels thus surveyed was determined to be a significant cultural resource. The last example of a wooden mine sweeper built for use in the First World War, and the last wooden ship constructed by the U.S. Navy, she was recorded in a mitigation plan to Historic American Engineering Standards by Brouwer.

In the Symposium on the Archeology of New York City, which took place at the American Museum of Natural History in February of 1980, archeologist Edward Larrabee presented a model for the landfilling and landbuilding techniques that occurred at Fulton Street, Cliff Street East to South Street, all on the East River side of Manhattan between 1700 and 1810 (Larrabee 1980; Kardas and Larrabee 1980; see Figure 100). It was, to our knowledge, a first attempt by an archeologist to place a large area of Manhattan's built environment in a second, or vertical, dimension.

As is common to documentary historical studies, we have succeeded in formulating a one-dimensional model of the development of the filled land in the Westway Project study area (see Figures 82 and 83). The profiles of below-ground strata provided by the engineers' boring data are insufficient to provide a profile of the West Side filled land that would be comparable to that established by Kardas and Larrabee in Figure 100. Test excavations into this landfill would supply the data necessary to formulate such a two-dimensional profile, which is necessary for understanding the human, or built, landscape.

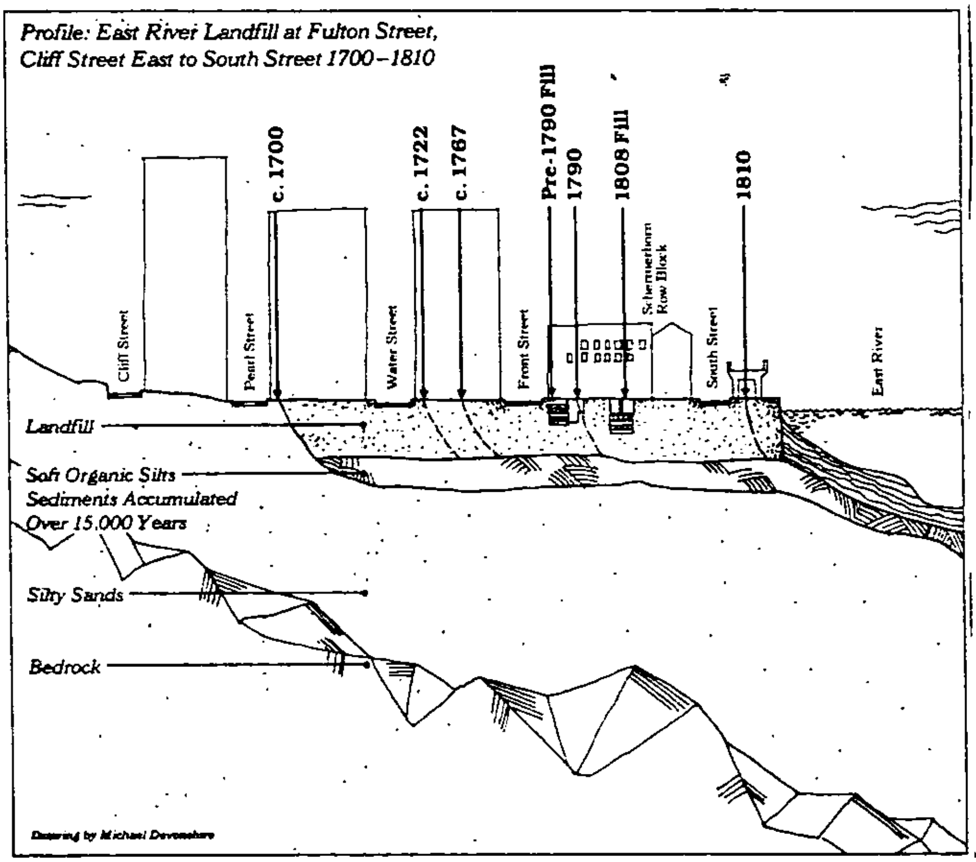


Figure 100. Profile of East River landfill at Fulton Street, Cliff Street East to South Street, 1700-1810 (Kardas and Larrabee 1980). Note the two excavations made into pre-1790 and 1808 fill material.

Earlier in Section III of this report (see Section III, D,2,b), we presented a hypothetical typology of historic lower West Side pier, bulkhead, and dock construction, based on the data gathered from the documentary record. These buried structures are an integral part of the study area's industrial archeological fabric, significant culturally both as part of the landfill and for what they can tell us about their actual construction. To test the validity of the hypothetical typology, and to verify, illuminate, and document these features, it is our opinion that test excavations are warranted. It is from such relatively small beginnings that the pattern of culture appears to those individuals who otherwise see these fragments as part of an overall confusion.

It has not been our purpose in this discussion to state that these three types or examples of significant cultural resources are the only categories of information that make the lower West Street area potentially significant. The nature of the material that makes up the fill, the artifacts that may be recovered, all play a part in reweaving the rich fabric of our culture history.

3. Area 3: The Canal Street Interchange

Area 3, shown in Figure 3 and in large scale in Figure 32, may contain potentially significant cultural resources from both the prehistoric and historic eras. Although the zone is labeled "Canal Street Interchange," only portions of this interchange have been identified as potentially culturally sensitive (see Figures 3 and 32): (1) the Hoboken Street site; (2) the Lispenard House site; (3) seven previously undisturbed areas; and (4) sites of potential aboriginal habitation.

a. HOBOKEN STREET

The Hoboken Street site--so named for the street formerly occupying this location--is within the Canal Street Interchange area and is evaluated as likely to contain potentially significant cultural resources of the type already discussed at length for Area 2--i.e., the remains of longshore facilities and landfilling activities. The Hoboken Street site today is within Canal Street (see Figure 101). It is as wide as the former street bed and extends eastward from the present shoreline (bulkhead line) on the west side of West Street to the west side of Washington Street. [For a depiction of the site's development over time, see Figures 82 and 83; for its history, see Section II,C,3,c,3).]

Evaluations and recommendations made for potentially significant historic cultural resources that may be extant in Area 2 are also applicable to the potentially significant cultural resources that may well exist in the Hoboken Street site in Area 3. As stated pre-

FIGURE 101. View westward at the Hoboken Street site. Hoboken Street is now defined only by its southern edge of buildings (left). It ran one block between Washington Street (entering at left) and West Street (visible as line of pier buildings across the background). (Michael Spozarsky, photographer, April 1983.)

viously, the proposed construction/design activity is the driving of pilings. Borings taken in the vicinity of this site indicate the presence of about 30 feet of landfill and black to gray river mud, which we evaluate as containing the historic period's most concentrated deposits (*Rock Data Map of Manhattan* 1940: Vol. 1, Sheet 16; Mueser, Rutledge, Johnston, and DeSimone, Westside Highway Project borings). The anticipated potentially significant historic cultural resources include, as in Area 2, longshore structures and landfill areas.

It is our opinion, then, that the potentially extant historical cultural resources at this site, again like those in Area 2, are likely to meet criterion D of the criteria for evaluation of significance for inclusion on the National Register of Historic Places. We recommend that test excavations be made to determine the presence or absence, and the nature, of these potentially significant resources.

b. LISPENARD HOUSE SITE

The site of the Lispenard House lies just south of Canal Street beneath the surface of Hudson Street at its intersection with Desbrosses Street (see Figures 3, 32, and 102). The proposed construction/design activity for the Westway Project to be carried out at this site is the driving of piles. The site remains, if extant, are potentially significant historic cultural resources. [For a summary of the history of this site, see Section II,C,3,c,4).]

FIGURE 102. View southwestward at the site of the Lispenard House--under the eastern sidewalk and street pavement of Hudson Street (receding southward left of center) at its intersection with Desbrosses Street (entering at right). The photographer is standing in Canal Street. (Michael Spozarsky, photographer, April 1983.)

Analysis of the known subsurface conditions existing at the site of the Lispenard House, the remains of which, if extant, are likely to constitute a potentially significant cultural resource, indicates that the building's possible remains may lie in relatively undisturbed subsoil. Examination and analysis of the subsurface conditions here included a review of soil borings made by the city as well as of the record of public utilities which lie in the pertinent area of Hudson Street.

First, the borings show that as much as 8 to 12 feet of fill may be present in the Lispenard House site area (*Rock Data Map of Manhattan* 1940: Vol. I, Sheet 16). Unfortunately, the strata tables of borings made before 1940 are not as useful analytical tools as are those recently taken for Westway.

Second, the records of the Subsurface Office of the Manhattan Borough Bureau of Topography were examined for the Hudson-Desbrosses Street area. Although utilities have been thickly laid along each curb of Hudson Street and a substantial sewer occupies its center, a large portion of the street--approximately 20 feet to either side of the center line--showed no record of utility lines.

It must also be remembered that Hudson Street, laid out in 1797 (see Figure 35), was subsequently used for a railroad right-of-way holding at least a double line of tracks that connected the St. John Park Freight Station with the north. This use of Hudson Street by the railroad may mean that a substantial bed of fill--i.e., firm enough to support tracks and rolling stock--may be present. Whether, as a result, the Lispenard House site was excavated or whether it was given several feet of protecting cover remains to be discovered through testing. We recommend that archeological test excavations be made to determine the presence or absence and nature of the Lispenard House cultural remains.

The proposed highway construction activity in this area indicates that piles will be driven. More specific construction plans, as they become available, may show that deep subsurface disturbance may not be necessary at this specific location. We have recently learned that it may also be possible for the highway to be designed to miss this site. If such design changes are made, our recommendation for testing will, of course, become inappropriate.

c. PREVIOUSLY DISTURBED AREAS

Research has revealed that portions of seven blocks within the Canal Street Interchange (Area 3) are areas that have remained relatively undisturbed plots of ground throughout the historic period. In one of these blocks, the undeveloped plot is located at the center of St. John's Park (later St. John's Freight Depot, Block AKA 213 221; see Figures 3 and 32). In a second--the Canal-Varick-Watts block--the land is part of the Holland Tunnel entrance area. In the remaining five blocks, the previously undisturbed plots are primarily backyard areas--places where only outbuildings or structures such as cisterns or wells were built (Blocks 220, 578, 594A, 593B, and 595; see Figures 3 and 32).

1) Previously Undisturbed Plots

As noted earlier in this report, by 1830 each lot on the blocks immediately north of Canal Street which will be affected by the proposed construction/design plans for the Westway Project contained residential structures; residential structures also fronted on Laight Street on the block presently bounded by Hudson, Laight, Vestry, and Varick streets. With a few exceptions, we were not able to determine the dimensions of these structures. The first atlas which shows the actual size of structures was published by William Perris in the 1850's. Although some of the structures shown on the Perris atlas may not have been the first to be erected at particular locations, for purposes of analysis we have assumed that the dimensions of the structures shown by Perris were approximately the same as those of the original buildings. The development of the blocks to be affected by the project from 1857 through the present was determined by examining a series of atlases (Perris 1857; Robinson and Pidgeon 1884; Bromley 1899, 1922, 1934) as well as the project map.

The general nature of the archeological resources which may be present requires consideration of the overall pattern of development in this area. The 1857 Perris atlas shows that large areas in the center of each block remained devoid of structures, except for a few outbuildings. These central areas most probably were the loci of the wells and/or cisterns and privies used by the area's early nineteenth-century inhabitants. Some of these cisterns, wells, and privies may have been located within outbuildings. The atlases examined in the course of the present project show that the central open area in the middle of each block became smaller through time as the buildings became larger. With the development of New York's drinking water system following construction of the Croton Aqueduct in the 1840's, and with the inception of the city's sewage system in the latter half of the nineteenth century, it was no longer necessary to use "backyard" areas for sources of drinking water and for privies. Rather, they could be utilized by structures.

Archeological "features," such as cisterns, wells, and privies, often contain artifactual deposits. To assess whether any such deposits, or other types of archeological resources, may have escaped destruction as a result of more recent construction, we supplemented our examination of maps and atlases with an examination of building records located at the Department of Buildings' records office at 1 Centre Street and at the New York City Municipal Archives. Based on our experience, we have assumed that where the basement depth of the most recent structure to stand on a lot is 10 feet or greater, there exists a strong liklihood that any archeological resources associated with earlier construction have most probably been destroyed. Where basement floors are shallower than this depth, archeological resources from earlier periods of construction are more likely to remain intact beneath the more recent basement floors. This assumption is especially appropriate for the nineteenth- and early twentieth-century structures, constructed without the use of modern earth-moving machinery, which were the most recent buildings erected on most of the lots within the project area. The record depositories just noted, with a few exceptions, contain records only for currently standing structures. Since all structures on Block 578 (bounded by Hudson, Watts, Varick, and Broome Streets) and structures on portions of the other blocks have been previously demolished, basement depths were not available for these areas. This information was available for standing structures on Blocks 594A, 594B, and 220.

In analyzing the likelihood of the existence of extant potentially significant archeological cultural resources in these previously undisturbed locales, four subareas were identified and assigned importance according to the likelihood of each to contain such resources. The first two levels were considered most likely, the second two least likely. Thus, only subareas 1 and 2 have been shown on Figure 32: (1) as a dark screen; (2) vertical lines.

The first of the four subareas (dark screen in Figure 32) consists of spaces that have undergone relatively little disturbance. They tend to be located to the rear of structures fronting the streets and would have been the loci of the early nineteenth-century privies, cisterns, and wells previously noted, where no subsequent structures having basements were built. These early nineteenth-century "backyard" areas could, therefore, contain buried and relatively undisturbed cultural remains in these cisterns, wells, and privies. In addition, they could contain relatively undisturbed ground surfaces from this period, which were buried under demolition debris as successive buildings were constructed around these open areas. These surfaces could contain refuse (sheet middens) associated with the earlier nineteenth-century structures (and possible eighteenth-century structures, in some locations). In addition, these undisturbed ground surfaces could contain artifacts from any prehistoric occupation of the area which may have taken place.

In some locations, the 1857 map shows stables or other outbuildings, the construction of which most likely would not have disturbed the ground to any great depth.

The second subarea is indicated by the vertical line screen in Figure 32. These areas appear as open spaces in the 1857 atlas and could therefore have been the loci of the archeological "features" previously mentioned; however, buildings were subsequently placed over them. Where the basement floors of the most recent buildings are not indicated as being 10 feet deep or greater, it is possible that "truncated" features could exist beneath these most recent basement floors. In other words, the bottom portion of the cisterns, wells, and privies which were most likely located in the open areas to the rear of the earlier buildings could lie preserved beneath the basement floors of the more recent, larger buildings. In addition, other sub-floor deposits, such as those discussed in the preceding and following paragraphs, could be located in the areas identified as subarea 2.

The third subarea is not represented on Figure 32. Previous excavations in Manhattan revealed that in the nineteenth century demolition debris was often allowed to accumulate on top of basement floors when a building was razed; later structures were built on top of this debris. Thus, artifacts deposited on the earlier floors, and debris from the demolition of these early buildings, as well as foundation walls, could remain beneath the more recent basement floors.

Subarea 4 consists of areas covered by existing structures whose basement depth is 10 feet or greater. These are the areas in which the presence of intact archeological resources is least likely.

a) BLOCK 595

Block 595 is bounded by Greenwich, Canal, Washington, and Spring streets. Only the triangular-shaped southern end of the block is included in the project area. The structures on this block within the project area were razed between 1927 and 1934, and a filling station was constructed. This block could be the locus of structures and a Revolutionary War earthwork indicated on eighteenth-century maps, and also of the early nineteenth-century "backyard" resources noted previously. Although we could not determine the exact location of the eighteenth-century resources with respect to the present street grid, it is possible that they were located within the project area. (See Figures 3 and 32.)

b) BLOCKS 594A AND 594B

Block 594A is bounded by Hudson, Watts, Canal, Renwick, and Spring streets. Block 594B is bounded by Renwick, Canal, Greenwich, and Spring streets. Southernmost portions of both blocks are within the project area (see Figures 3, 32, 103, and 104).

The portions of Blocks 594A and B immediately east and west (respectively) of Renwick Street could also be the locus of structures shown on eighteenth-century maps. However, the building records for lot 12 on Block 594B contain the data from two soil borings, one placed

FIGURE 103. View northwestward across Canal Street (foreground) at the southeast corner of Block 594A (bounded by Hudson, Watts, Canal, Renwick, and Spring streets; see Figure 32). The view is intended to illustrate the present-day conditions in this portion of the project area, Area 3. (Michael Spozarsky, photographer, April 1983.)

FIGURE 104. View westward across Hudson Street (foreground) at Block 594A, at the area marked "Parking" on Figure 32. The buildings in the background are fronting Renwick Street in Block 594B. (Michael Spozarsky, photographer, April 1983.)

near the Canal Street sidewalk and the other approximately 35 feet northeast of Canal Street. Both show 6 feet of peat beneath 9 to 14 feet of overlying fill. The presence of peat indicates that the Canal Street marsh extended to this area, and therefore any eighteenth-century buildings would have to have been located further to the north. However, the northern edge of the marsh, and the structures, still could have been situated within the project area. As indicated in Figure 32, large areas of Block 594A could remain relatively undisturbed. The front portion of the building on lot 47 on Block 594B has a basement excavated in 1919, but its depth is unknown. We have also assumed that construction of the existing one-story building on Block 594A would not have resulted in extensive disturbance of underlying archeological deposits. In some cases, the records give the foundation, rather than the basement, depths; in all cases, these are less than 10 feet. The basements of these buildings, if any, would be shallower than the depths of the foundations.

c) BLOCK 578

Block 578 is bounded by Varick, Watts, Hudson, and Broome streets. Except for its northwestern corner, it is entirely within the project area. (See Figures 3 and 32.)

The buildings on this block were demolished in the mid-1920's prior to construction of the Holland Tunnel, and the paved area known as Freeman Square was constructed. Therefore, records indicating the basement depths within the project area were not available. The structure fronting on Varick Street and occupying lots 24 and 25 is indicated on the 1922 atlas as a seven-story building. Although this description does not necessarily mean a deep basement, we assume that it is less likely to contain intact archeological materials. Most of the other structures which stood on this block prior to the 1920's demolition were 2½- and 3½-story buildings. The exceptions were one four-story building (lot 34), two five-story buildings (lots 32 and 33), and a six-story building (lots 30, 30½, and 31) fronting on Watts Street. Large areas in the center of this block remained open prior to the demolition. We have assumed that the paving of Freeman Square would not have resulted in disturbance to any great depth.

One building of interest was located on lots 40 and 41 fronting on Watts Street. It is indicated on the 1922 atlas as a 2/2½-story stable. It is likely that this stable is the original structure built at this location in 1826.

d) BLOCK 220

Block 220 is bounded by Varick, Laight, Hudson, and Vestry streets. It is only partly included in the project area (see Figures 3 and 32).

The first houses to stand on this block were constructed as early as the first decade of the nineteenth century, somewhat earlier than those standing on the other blocks in the vicinity. These structures fronted Laight Street, and associated archeological "features" would have been located to their rear. The construction of the late nineteenth- and early twentieth-century commercial structures with 10-foot basements would have probably destroyed them in most areas. A possible remaining locus of such features is the open area in lot 25. Cultural remains associated with the early nineteenth-century structures fronting on Varick Street, built somewhat later than those fronting on Laight Street, may remain in the heavily screened and vertical-line areas in Figure 32. Early building extensions existed within these areas, and a later 3-story extension was constructed in lot 18. Later one-story extensions in lots 17 and 19 are assumed not to have resulted in any extensive disturbance of earlier archeological deposits. The structures fronting on Varick Street were demolished in the 1920's prior to construction of the Holland Tunnel; backyard "features" could be preserved beneath the present sidewalk at this location.

Lot 14 was the site of the Laight Street Presbyterian (later Baptist) Church. The Church is shown on an 1884 map, but by 1902 a 6-story commercial building stood on the site. This structure was demolished in the 1920's.

e) CANAL-VARICK-WATTS STREET BLOCK

A small piece of land now part of the Holland Tunnel entrance area was formerly the western tip of the triangular-shaped block bounded by Canal, Watts, and Varick streets. This small piece of property fronting on Hudson Street was referred to in the early nineteenth-century tax assessors' annual books as "Hudson between Canall and What [*sic*]." The tax records indicate that the first structures on this property were two houses erected in 1824 by John Le Grange. (See Figures 3 and 32.)

f) DISCUSSION

The seven blocks in question were, for the most part, settled in the 1820's as residences. Later the area became one of mixed use, incorporating industry and some commerce into the formerly predominantly residential area. Other archeological projects in Manhattan have excavated nineteenth-century material, but very little has (1) dated to the early nineteenth century, and (2) been associated with residential use of an area. Nor can we assume that the existence of nineteenth-century deposits elsewhere means that the excavation of a sample of the material in Area 3 is irrelevant. Inasmuch as archeologists believe that something can be learned about the past from excavated material which is not available from other sources (*for example*, how people ate, or the nature of the relationship between socioeconomic status and material possessions), then this material could be significant.

It is also relevant that the nineteenth-century material which has been recovered to date comes from lower Manhattan on its east side. Settlement and development of the east and west sides had quite different histories and trajectories; they centered around different land use patterns and functional needs. Each is therefore unique in its potential for information. If historic features or other deposits exist in this seven-block area under discussion, they could contain material from the 1820's to the 1840's (when the Croton Aqueduct was built), when the area was a relatively affluent one. Again, however, we should keep in mind that at this stage we are considering only the possibility that cultural resources may exist.

2) St. John's Park

Block 221 was laid out as a public park in 1803, and St. John's Episcopal Chapel was built on its east side (see Figure 36). Also called Hudson Park or Square, the block became the center of what has been described, for its time, as one of the most prestigious residential areas of the city. The chapel and the surrounding homes were built in the Federal Style of architecture.

In approximately 1865, the Hudson River Railroad included Hudson Street, bordering Hudson Square on its west side, as part of its system. Figure 59 shows the park at the corner of Hudson and Beach streets c. 1865, with both the rail line and railroad cars visible in Hudson Street.

In 1867, the railroad bought the park, cleared it, and built a railroad freight depot on the site (see Figure 61). In the plan of the depot (Figure 61), it is apparent that the building was a hollow square with an open central courtyard laid out just about where the center of Hudson Park had been. Temporary sheds, and perhaps workers' privies, may have been built here, but the courtyard was relatively empty of substantial structures until the depot was razed in the mid-twentieth century. In 1916 (see Figure 62), although the area had lost its residential character, St. John's Chapel still stood. St. John's Park today is used as a traffic circle at the New York exit of the Holland Tunnel (see Figure 105).

Borings taken in this area, logged at the Bureau of Topography, Manhattan Borough President's office, reveal a range of from 5 to 6 feet

FIGURE 105. View eastward from the corner of Hudson and Beach streets at Block 221, St. John's Park (compare with Figure 32 plan). The building in the background occupies the site of the former St. John's Episcopal Chapel. (Michael Spozarsky, photographer, April 1983.)

of fill lying over gravel or sand subsoil. The borings refer to the upper stratum as "filled ground" (*Rock Data Map of Manhattan* 1940: Vol. 1, Sheets 15 and 16). The proposed construction/design plans are for the driving of piles.

Figure 32 shows Block 221 as containing subareas 1 (dense screen) and 2 (vertical-line screen). The former indicates the relatively undisturbed piece of ground at the center of Hudson Square/St. John's Park which became the open courtyard of the Hudson Railroad Freight Depot. As previously undeveloped land in Area 3, we make the evaluation that this central portion of Block 221 may contain potentially significant cultural resources of a prehistoric or historic nature. We recommend test excavations to determine the presence or absence and the nature of such resources.

In the remainder of the block (shown in vertical-line screen, Figure 32), only the site of one of the freight depot buildings, estimated to have been built on grade, should be studied. This investigation could coincide with the testing of the center courtyard area. We further suggest that control tests be made where this building stood, which would allow us to determine the nature of the freight depot remains as well as what may remain from earlier times below this stratum from the industrial period.

d. ABORIGINAL SITES

It was mentioned earlier (Section III, C) that areas of higher land around the Lispenard Meadows met the criteria for likely sites of aboriginal culture habitation. Here, the record shows, ample freshwater natural resources existed side-by-side with the numerous advantages afforded by the rich estuarine marsh environment. In addition, the surrounding uplands provided yet another environmental zone offering another variety of natural resources for aboriginal habitation, not the least of which was fertile, arable soil. Nearby, available by land or canoe, lay the Hudson River, beyond which extended the entire harbor, providing access to exploit an even wider variety of natural resources.

The likelihood that remains of aboriginal sites may be found in the subsequently heavily urbanized developed land within Area 3 is small, but it does exist. Elsewhere on Manhattan Island, aboriginal sites such as those which may exist here have been discovered to exist, even under many feet of fill. Therefore, the previously undisturbed plots in the Canal Street Interchange Area, identified in Figures 3 and 32, may contain potentially significant prehistoric cultural resources.

We therefore recommend that all archeological testing carried out in the Canal Street Interchange Area, as previously discussed, be extended to a depth below the lowest historic cultural levels. In this way, testing can be performed for aboriginal cultural remains at the same time as investigations for historic period cultural resources are carried out.

4. Area 4: The Midtown Interchange -- The Whiting Paperhanging Factory Site

A nineteenth-century paperhanging factory was formerly located on the north side of W. 31st Street between 9th and 10th avenues in New York City (see Figure 3). This manufacturing company first appears on the 1852 Dripps map, where it is identified as "Whiting's Paper Hanging Factory" (see Figure 93). Other maps of the area in subsequent years continue to show the location of this factory, and it probably was in business well into the 1890's. The factory buildings continue to appear on subsequent Bromley maps dated to 1899, 1916, and 1934, but they are not identified; hence, we conclude that the wallpaper manufacturing operations ceased before the turn of the century. By 1955 most of the structures on the north side of W. 31st Street are gone (Bromley 1955), and the area is clear by 1975 (Sanborn 1975). [For the documentary research on this site, see Section II, C, 4, b, 7).]

The brick and stone buildings of the old paperhanging factory on W. 31st Street are no longer standing. Instead, the site is now a paved and macadamed parking lot (see Figure 106). Undoubtedly, some portion of the building foundations are buried beneath the surface, and evidence of early brickwork, possibly remnants of the factory and adjacent structures, can be seen along W. 31st Street.

We evaluate the Whiting Paperhanging Factory site as possibly containing potentially significant cultural resources of an industrial archeological nature. These resources, if they are extant, may well

FIGURE 106. View northeastward at the site of the former Whiting Paperhanging Factory, presently a parking lot, on the northeast corner of W. 31st Street and Tenth Avenue. (Michael Spozarsky, photographer, April 1983.)

yield important information on the history of wallpaper manufacture. In that respect, it is our opinion that they might meet criterion D of the criteria for evaluation of significance for inclusion on the National Register of Historic Places.

A survey of the several borings made and recorded in the vicinity of this site (on 9th Avenue and on the northwest corner of 9th Avenue and 31st Street) revealed a range of only 10.8 to 23.0 feet of unsolidified material over bedrock. Unfortunately, details of this unsolidified material are not part of the record (*Rock Data Map of Manhattan* 1940).

The proposed Westway Project construction/design activity on the site will be the driving of piles. Although it is only possible that the anticipated site remains, if extant, will be evaluated as a significant cultural resource, we recommend that test excavations be made to determine the nature of those remains. Tests should be made to culturally sterile soil.

Reviewers of the first draft of this report (May-June 1983) at the New York State Department of Transportation and Federal Highway Administration have suggested that the Cooper Hewitt Museum in New York City contains in its collections a wide variety of wallpaper produced in the period in question and not a little knowledge of how it was manufactured. Therefore, they have asked what industrial archeological excavations of a small, obscure wallpaper factory--one of many and therefore not unique--are going to contribute to the general knowledge of this historic industry.

An initial point to make, and, we believe, the only problem that need actually be addressed at the end of the documentary phase of the cultural resource survey research process, is what does the site contain--i.e., are there present any physical remains or indications of the building's use in our culture history? Test excavations are designed to answer this first question. If these test excavations are productive--i.e., historic material culture is present--a second question is then appropriate: are the remains significant enough to warrant additional archeological attention before they are destroyed?

It is difficult to hypothesize what might be left in the ground from such a factory, but let us suppose that there are still present any or all of the following: wallpaper-making machinery; wallpaper-making tools; markings on a floor or work surface that indicate work patterns; machinery mounts to which wallpaper machines were attached; indications of the power train that operated the factory; etc. Let us, in fact, suppose that sufficient remains are left so that this site is evaluated as a significant cultural resource by virtue of the fact that through careful research--both excavation and analysis of the data recovered--we will be able to recreate a typical late nineteenth-century New York City small manufacturing operation. Would it not be possible that this plant might contain information within its remains that is not verifiable either in any documentary source or from studying museum collections of samples of its period's product? Is it not possible that this reconstruction will show the blending of several techniques, perhaps some pre-industrial and craft-oriented and some industrial? And that this mixture of old and new technologies used at this time and place was unique? Might not this site reconstruction provide insights into the factory's struggle to produce wallpaper in a growing, competitive, quickly industrializing mass market?

It may well be possible to answer these sorts of questions from excavation if the work setting and artifacts necessary for such an analysis are present. If such remains were found and analyzed it is not inconceivable that an interpretive display of this very site would one day be part of an appropriate museum's exhibit, if not Cooper-Hewitt then in a museum of American arts or an institution dedicated to American cultural history. For it has been our experience that very little is known about such work places, and that it is precisely the ordinary, usual operations which are not recorded historically and are thus subsequently lost.

In short, we are suggesting that if we do not look at this site, we will never know what it contains. Testing in simple urban sites such as this one need be neither extensive nor expensive. We believe that two days of field work, scheduled to minimize interruption to the site's present activity (parking lot), would be sufficient time in which to conduct the preliminary test excavations recommended.

E. GENERAL SUMMARY--FINDINGS AND RECOMMENDATIONS

All data collected on the study area have been analyzed toward the following goals:

1. To determine the location within the study area of sites likely to contain significant cultural resources; and
2. To determine which of the potentially significant sites identified in (1) will be disturbed or destroyed by the proposed construction activities for the Westside Highway.

This analysis has resulted in the identification of four areas within the study area in which one or more sites likely to be significant have been indicated, and where the proposed construction activities have been assessed as likely to damage or destroy the remains of these potentially significant sites. These four locales are as follows:

1. The potential aboriginal site area offshore below (south of) Canal Street, where the proposed construction activities will be dredging, filling, and pile driving.
2. The lower West Street Area, where historic shoreline facilities, land-building remains, and possible abandoned vessels will be impacted by proposed excavations to a depth of 25 feet.

3. The Canal Street Interchange area, containing a number of potential sites, including potential aboriginal sites, early nineteenth-century backyards, a colonial period farmstead, a city park-turned-freight station, and an area of early docks, a drainage canal, and shoreline building activities. Pilings will be driven throughout.
4. A single factory site on the north side of 31st Street between 9th and 10th avenues, where the remains of a mid-nineteenth-century paperhanging factory will have piles driven through it.

These sites are shown on Figure 3, a map of the study area. For comparison, Figure 2, a map indicating the various types of proposed construction activities, is also provided. (See also Figures 4 and 32.)

1. Area 1

Reconstruction of the prehistoric shorelines and comparison of the topographical characteristics with prehistoric settlement pattern models have indicated several areas which may have been attractive to prehistoric human populations as loci for occupation and resource exploitation. In particular, this analysis identified the offshore area approximately between Harrison and Desbrosses streets (see Figures 3 and 4) as the locale in the project area most likely to contain prehistoric cultural resources which may still be intact and could be potentially eligible for nomination to the National Register. A second likely habitat for aboriginal settlement is located in the general resource area

3 (Canal Street Interchange) but is discussed here. It is the region surrounding the wetlands known in the historic period as Lispenard's Meadows.

Our recommendation is that some further test samples be gathered in both areas of potential aboriginal habitation. In the offshore area, sampling may be accomplished by making further test borings, thus obtaining carefully controlled samples of the strata identified as having high potential for cultural remains. These samples should then be analyzed by prehistoric archeologists.

The Lispenard Meadows area should also be sampled. Sampling can be accomplished by carefully searching for remains of aboriginal culture in the test excavations to be made in our suggested sampling in the Canal Street Interchange area.

2. Area 2

The downtown West Street zone stretches from the Battery northward to N. Moore Street (see Figure 3). Historic analysis shows that this area contained a succession of historic shoreline facilities, each abandoned and eventually incorporated into landfilling operations. Many of these docks, piers, wharves, and basins are especially famous in the history of the city and have been documented fully in Section II,C,2-4 of this report. In addition, the process of landfilling incorporated structures such as bulkheads as well as a variety of cultural materials from trash to derelict vessels; several of the latter were noted in the literature (see also Figures 82 and 83).

We recommend that a sample of these potentially significant historic sites be tested further in order to ascertain what actual remains are present.

3. Area 3

The Canal Street Interchange area contains three potentially significant sites, in addition to the previously mentioned possible aboriginal sites. The first is identified as the Hoboken Street site. Here, in an area once called Hoboken Street just inboard (east) of the Canal Street area of West Street, lay the Canal Street Basin, later docks, a succession of Hoboken Ferry slips, a small park, and a succession of street coverings. Borings show the area to contain considerable fill strata and to be located outside the area previously disturbed for the Holland Tunnel's construction. We recommend testing.

A second potentially significant site located in Area 3 is the Lispenard House site. Lispenard, the historic owner of this area whose name is associated with the wet meadow which largely drained along the proposed Canal Street Interchange area, built a substantial house and formal garden. Documents indicate that the house site is located in the bed of Hudson Street near its intersection with Desbrosses Street. Study of the street shows it was laid out in the late eighteenth century and was extensively used as a southern extension of the railroad right-of-way to the freight terminal on nearby St. John's Park in the mid-nineteenth century. Borings and other underground data, such as the records of utilities, show that substantial portions of Hudson Street have not been disturbed and thus may contain remains of this historic house site. We recommend testing.

Also in the Canal Street Interchange area are portions of seven city blocks which have never, or only minimally, been developed or built on, insofar as the present documentation has been able to determine. In five blocks, these sites consist of backyard plots; in the sixth, the undeveloped land lies within St. John's Park; in the seventh, it is in the Holland Tunnel entrance area. There are likely to exist in these areas significant features of the type which meet criterion D of the National Register of Historic Places. Here, the slow accretion of cultural material may include remains from any portion of the city's culture history, from the prehistoric era to modern day. We recommend test-sampling these sites.

4. Area 4

The proposed construction activity for the nineteenth-century Whiting Paperhanging Factory site on 31st Street includes the driving of piles. The area is today under a macadam parking lot. Inasmuch as the site may contain significant remains of this industry, we recommend test excavations.

SUMMARY TABLE OF RECOMMENDATIONS

AREAS LIKELY TO CONTAIN SIGNIFICANT REMAINS	PROPOSED CONSTRUCTION ACTIVITY	RECOMMENDED CULTURAL RESOURCE RESEARCH
1. Aboriginal Habitat Zone	Excavations to 25 feet; dredging and filling	Make borings and analyze
2. Southern Portion West Street	Excavations to 25 feet	Test a sample of the sites
3. Canal Street Interchange	Piles to be driven	
A. Hoboken Street		Test
B. Lispenard House Site		Test
C. Previously Undeveloped Areas		Test a sample of the areas
D. Aboriginal Habitat Zone (Lispenard Marsh)		Test as part of A-C
4. Whiting Paperhanging Site (Midtown Interchange Area)	Piles to be driven	Test

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IV. APPENDICES

An initial review of the final report for this project submitted to the FHWA and the NYSDOT in June of 1983 included the comment that certain highly technical portions of the manuscript might best be placed in a technical appendix. It was also the opinion of the reviewers that a list of the personnel involved in this project, as well as a description of their research responsibilities and efforts, might best be listed in an appendix.

Therefore, four appendices have been extracted from the original manuscript and placed at the end of the revised report (September 1983). They are the following:

APPENDIX I: DESCRIPTION OF PROJECT PERSONNEL RESPONSIBILITIES AND RESEARCH EFFORTS

APPENDIX II: PALEOENVIRONMENT OF THE STUDY AREA

APPENDIX III: MAP SHOWING CONTOURS OF GLACIAL GRANULAR SOIL SURFACE AND LOCATION OF WESTWAY PROJECT BORINGS

APPENDIX IV: FLOTATION OF SELECTED SOIL SAMPLES

The bibliography has been designated as APPENDIX V and has been placed at the end of the manuscript.

A. APPENDIX I: DESCRIPTION OF PROJECT PERSONNEL RESPONSIBILITIES AND RESEARCH EFFORTS

Cooperating on the Westside Highway Cultural Resource Survey Archeological Work Program were historians, cultural geographers, paleoecologists, and archeologists specializing in prehistoric, historic, and industrial archeology. Many of these participants are experienced professional cultural resource surveyors and managers as well. Each author was able to present his or her work from a particular perspective while at the same time coordinating his or her data with those presented by others. The interaction among the authors on this project was productive.

The HCI research team which carried these tasks to completion consisted of the following individuals: Edward S. Rutsch and Nan Rothschild, Primary Investigators and co-Project Directors: Primary Investigator Leo Hershkowitz; Archeologist/Research Coordinators Sydne Marshall and Arnold Pickman; Industrial Archeologist/Research Coordinator Herbert Githens; Archeologist Crew Chiefs Patricia Berkman, William Bolger, David Church, Edward Lenik, and Brian Morrell; Archeologists Eugene Boesch, Diane Dallal, Kate Morgan, and Marie-Lorraine Pipes; Graphics Artists Herbert Githens and Lynda Spozarsky; Editor Mary Jane Rutsch; and Technical Typists Katherine Hartley, Liana Hoodes, Susan Mescher, and Jo-ann Straat. Acting as consultants to the project in their fields of expertise were Bert Salwen, archeologist, New York University, specialist in cultural resource management and urban archeology; Theodore Z. Penn, Historian of Technology at Old Sturbridge Village, Massachusetts; and Norman Brouwer, Ships Historian, South Street Seaport Museum, New York City.

Authorship of the preceding report is shared by a number of individuals, each with expertise on a particular subject. Edward S. Rutsch was the author of the overall research design concept and co-directed all research efforts with Nan Rothschild.

The documentary research was presented in two sections relative to chronological cultural history: (1) a description of the study area's prehistoric physical environment; and (2) a description of the study area's cultural history from the prehistoric era to the present. The first contains a synopsis of the research results of the subconsultants: Richard R. Pardi, Director, Queens College Radiocarbon Laboratory; and Dennis Weiss, Chairman, Department of Earth and Planetary Sciences, City College. [The overall subconsultant to HCI for this work was the Research Foundation of the City University of New York (CUNY), which administered both the Queens College (Pardi) and City College (Weiss) projects.] The work of both these individuals is presented in its entirety in APPENDIX II: PALEOENVIRONMENT OF THE STUDY AREA, including Changing Sea Level and Shoreline (Pardi) and Paleoecological Investigations (Weiss).

The second section of Part II, DOCUMENTARY RESEARCH, contains the results of research first for the prehistoric cultural period--written by Sydne Marshall, Arnold Pickman, Nan Rothschild, and Eugene Boesch--and second for the historic cultural period. The text for the historic era is introduced by Leo Hershkowitz in his overview on the development of the project area's shoreline until 1860. Authors Arnold Pickman and Nan Rothschild, with research assistance from archeologists Morgan, Dallal, and Pipes, were the authors of the Colonial/Federal era research section. For the industrial period, Herbert Githens was the author of the section concerned with the development of the West Side waterfront's transport facilities; David Church wrote the section on the West Side's industrial development, with assistance from Edward Lenik; and William Bolger was responsible for the research on the West Side's historic markets.

Research for this project was conducted in the following libraries, museums, archives, files, research institutions, data repositories, and agencies (public and private), on a local, regional, and national basis: Columbia University Library, New York City; Consolidated Edison, Inc., Engineering Construction Dept., New York City; the Cooper-Hewitt Museum, New York City; County Clerk's Office, County of New York; the Harbor Defenses Museum, New York City; the Historic American Engineering Record (HAER), U.S. Dept. of the Interior, National Park Service, Washington, D.C.; the Free Public Library of Jersey City, N.J.; the Library of Congress, Washington, D.C.; the files of the Manhattan Borough President's Office, New York City, including the Department of Subsurface Facilities, the Bureau of Topography, and the Dept. of Buildings; the Monel Engineering Library, Columbia University, New York City; the Municipal Archives of the City of New York, New York City; the Museum of Natural History, New York City; the Museum of the American Indian, Heye Foundation, New York

City; the Museum of the City of New York, New York City; the National Archives, Washington, D.C.; New York City Bureau of Buildings, Office of the Register of the City of New York, New York City; New York City Department of Docks, New York City; New York City Landmarks Preservation Commission, New York City; the New-York Historical Society, New York City; New York Public Library, New York City (both main branch and annex); New York State Archives, Albany; New York State Division for Historic Preservation, Albany; New York State Museum, Albany; New York University Library, New York City; library of Port Authority of New York and New Jersey, New York City; Steam Museum of Pratt Institute, Brooklyn, N.Y.; Queens College, Historical Documents Collection, City University of New York; Smithsonian Institution, Museum of Science and Technology, Washington, D.C.; library of the Society of American Engineers, New York City; library and archives of the South Street Seaport Museum, New York City; library of Stevens Institute of Technology, Hoboken, N.J.

Data pertinent to the cultural resource survey for the Westway Project study area were discussed with many individuals who are either professionally or avocationally interested in and informed about this subject. When such personal communications were cited in the text, they were included in the bibliography (see APPENDIX V). Those which were not so cited are included in the following list: Leonard Bianchi, archeologist, New York University; Theodore Conrad, New York Harbor historian and historical architect, Jersey City, N.J.; Richard Deily, Iron and Steel Institute, Green

Brook, N.J.; Dr. Leonard Eisenberg, archeologist, State University of New York at New Paltz; Charles Emmerich, Roebling Chapter, Society for Industrial Archeology (SIA); Thomas Flagg, Roebling Chapter, SIA; Margot Gayle, Friends of Cast Iron Architecture, New York City; Robert Holton, Roebling Chapter, SIA; Charles Howell, millwright, Sleepy Hollow Restorations, Tarrytown, N.Y.; Paul Huey, N.Y. State Dept. for Historic Preservation, Albany; Donald Jackson, HAER, Washington, D.C.; Meta Janowitz, archeologist, Montville, N.J.; Edward Johannemann, archeologist, State University of New York at Stony Brook, Long Island; Dr. Susan Kardas, archeologist, Historic Sites Research, Princeton, N.J.; Dr. Edward Larrabee, historian/archeologist, Historic Sites Research, Princeton, N.J.; Conrad Milster, Curator, Pratt Institute Steam Museum, Brooklyn, N.Y.; Jack Sawinsky, Engineering Construction Dept., Consolidated Edison, Inc., NYC; Paul C. Schmidt, electrical engineer (ret.), Consolidated Edison, Inc., NYC; Dr. Ralph Solecki, Professor of Anthropology, Columbia University, NYC; Peter Stott, Massachusetts Historical Commission, Somerville, Mass.; John Vetter, archeologist, U.S. Environmental Protection Agency, Region II, and Professor of Archeology, Adelphi University, Long Island, N.Y.; Dr. Robert Vogel, Curator of Civil Engineering, Museum of History and Technology, Smithsonian Institution, Washington, D.C.; Dr. Peter O. Wacker, cultural geographer, Dept. of Geography, Rutgers University, New Brunswick, N.J.; G. Greeley Wells, Sanborn Map Company, NYC; Merrill Wilson, historical architect, State Historic Preservation Office, Denver, Colorado; John Young, historical architect, formerly of Urban Deadline, NYC.

B. APPENDIX II: PALEOENVIRONMENT OF THE STUDY AREA

1. Introduction

The following data comprise a descriptive evaluation of the paleoenvironment of the Westway Project area. Contractually, the work was performed by the Research Foundation of the City University of New York, acting as subconsultant to HCI. Actually, its authors are Richard R. Pardi, Director, Queens College Radiocarbon Laboratory, who wrote CHANGING SEA LEVEL AND SHORELINE, and Dennis Weiss, Chairman, Department of Earth and Planetary Sciences, City College, who wrote PALEOECOLOGICAL INVESTIGATIONS.

2. Changing Sea Level and Shoreline

a. PROJECT DESCRIPTION

The work on the Westway Project performed at Queens College Radiocarbon Laboratory had two phases: (1) an analysis of the sea level record of the past 12,000 years in the vicinity of the proposed project; and (2) an examination of the environmental conditions as they may be reflected in the chemistry of the cores.

The first phase of this work was designed to yield an accurate picture of the location of shorelines for the area of the lower West Side of Manhattan for the time since the end of the Pleistocene Epoch. Specifying the position of the shorelines at any particular time is essential for evaluating the possibility of the presence of archeological sites. Radiocarbon analyses were performed on 30 samples of organic matter selected from several hundred samples obtained from the core sample collection taken for the Westway Project. These samples were chosen on the basis of their likelihood of being sea level indicators--i.e., the samples are from organic-rich horizons just above either bedrock or glacial gravels. In addition to the samples taken for this project, 30 other samples from Manhattan Island and vicinity, previously analyzed for other projects, have been included in Table A1 and Figure A1, which follow. The data have allowed us to define the sea-level curve with the maximum precision and reliability.

TABLE A1. Sea level data including 30 additional radiocarbon dates previously reported in the literature for the Manhattan area. Mean depths are in meters, age and error are in ^{14}C years BP.

Sample Number	Mean Depth	Age	Error
1398	.7	660	110
733	.85	0	90
734	1.55	1420	120
1395	1.6	500	70
1399	1.8	2695	145
295	2.25	1800	90
1397	2.7	3035	120
844	2.7	1210	185
211	2.9	2295	160
847	2.93	1960	130
735	3.15	2000	105
L-1038A	3.26	2280	250
842	3.4	2080	160
736	4.65	2545	135
732	4.65	2990	100
848	4.65	930	170
262	4.95	3460	95
731	5.15	3530	110
730	5.35	3050	95
737	5.75	3730	200
1393	6.6	3050	95
738	6.83	3320	140
1392	7.3	4495	125
1396	7.5	4175	145
W-3014	8.06	4620	250
740	8.8	4300	280
261	8.4	4605	115
1406	10.1	4330	460
1407	10.3	6610	215
845	11.03	4820	95

TABLE A1. (Cont.)

Sample Number	Mean Depth	Age	Error
742	11.25	5320	170
808	11.25	5475	135
809	11.75	6840	230
896	11.95	7230	185
267	12.9	5650	170
L-617	15.55	6600	700
306	15.6	7975	390
266	17.9	7115	240
265	18.2	6395	100
1029	19.5	8190	130
269	20	8100	200
I-5665	20.15	9380	270
1380	21.6	8955	270
1373	21.6	7105	155
1028	21.7	8745	150
1389	21.8	7645	185
1027	22.3	10500	500
1026	23.2	9170	225
1386	23.4	10145	255
1379	23.8	10740	355
1322	27.7	11415	250
I-5663	24.63	12270	180
1321	24.7	7920	200
1374	23.2	8690	190
1025	25.2	11295	215
1324	27.7	11100	250
1329	29.3	11990	220
1326	30.8	11615	200
L-606A	33.1	11950	200
1315	41.3	12275	260

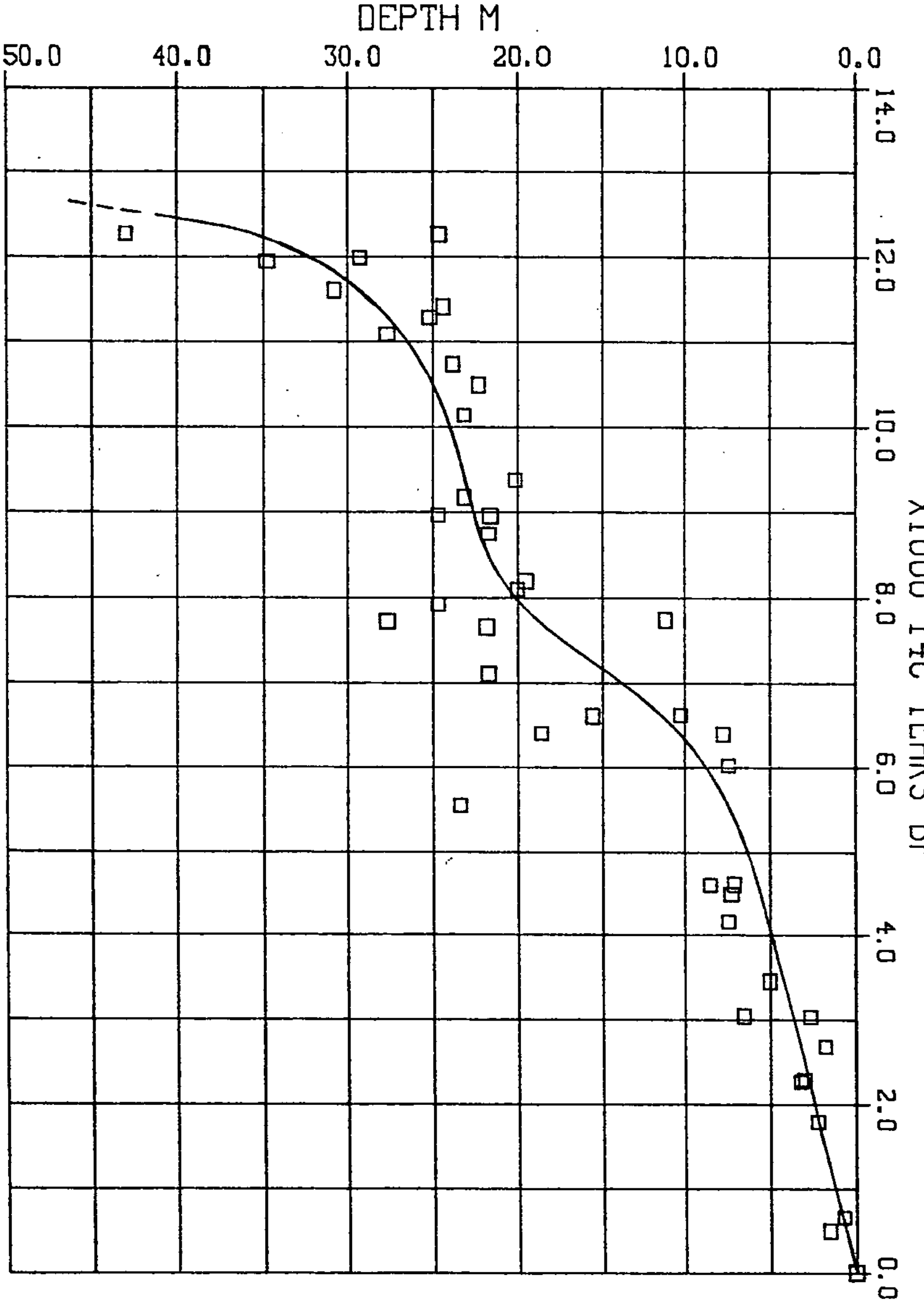


FIGURE A1. Sea level curve, showing depth in meters from approximately 12,000 BP to the present.

The second phase was a direct attempt to locate potential archeological horizons by the chemical record contained in the core sediments. It is to be expected that certain chemical elements, phosphorus, for example, might be artificially concentrated in certain horizons owing to human activity (anthrosols). Since sedimentary diagenesis (the processes of change occurring in a sediment during burial) will have a profound impact on the chemistry of these now subaqueous sediments, the chemical analyses were done in two stages: (1) two cores (WT-515 and TT-380, two of the same cores analyzed by Dr. Dennis Weiss at CCNY for paleoenvironmental purposes) were sampled from top to bottom; and (2) a series of samples (all from HV cores) representing possible paleosols were analyzed (some of the same samples were examined for archeological remains by Dr. Nan Rothschild at Columbia University). The samples submitted for chemical analyses are listed in Tables A2, A3, and A4. The position of the cores from which the samples were taken is shown in Figure A2.

b. SEA LEVEL AND SHORELINE POSITION

The results of the sea level analyses are shown in Figure A1. The resultant sea level curve reflects three processes which controlled the formation and accumulation of organic sediments within the Hudson estuary: (1) the rise in postglacial sea level; (2) isostatic adjustments following the retreat of the last glacial ice; and (3) land subsidence of the New York Bight. The last process appears to have been relatively constant (1.6 mm/yr) for at least since the end of the last glacial maximum (Cinquemani *et al.* 1977).

TABLE A2. Results of chemical analyses on possible paleosols (HV core samples). Data are ppm referred to acid insoluble fraction of each sample.

WESTWAY HV CORE SAMPLES

CORE	SAMP	DEPTH	P	K	CA	MG	MN	FE	AL	B	CU	ZN	NA
HV19U	S15D	67	471.9	823.1	1759.9	4896.5	535.7	13092.9	6209.4	16.6	18.8	51.8	6067.4
HV19U	S16UD	69.3	386.3	645.2	1920.6	4801.5	405.1	12228.9	3901.2	18.7	17.2	40.1	5064.1
HV29	S7D	30	755.5	1046.9	1877	2835.8	1067.2	17652	3964	22.3	15.2	51.8	3421.9
HV31U	S8D	38	703.7	894.4	2326.2	2579.3	253.4	16432.6	2693.7	22.5	172.6	304	5754.8
HV31U	S9D	41	799.3	1046.8	3806.6	3521.1	311.8	21507.4	4726.5	17.7	117.3	316.2	6915.3
HV35	S7D	45.5	319.2	1057.8	33986	2659.6	304.9	10278.3	2884.6	17.2	6.3	26.6	4651.5
HV36	S5D	37	981.7	1030	2484	2844.7	881.3	16733.6	4016	18.9	19.7	39.7	5057.2
HV43	S13D	61	419.8	602.3	4125.1	4417.1	270.1	15222.8	4745.7	13.1	8	45.6	4125.1
HV49	S12D	61	421.4	623.1	2913.8	4178	202.4	12714.3	4466.2	10	10	49.3	3313.6
HV53	S9D	65.5	512.8	1531.4	6573.7	4334.3	337.3	13400.2	4153.7	22	8.6	38.6	5706.8

TABLE A3. Results of chemical analyses for core WT-515. Data are ppm referred to acid insoluble fraction of each sample.

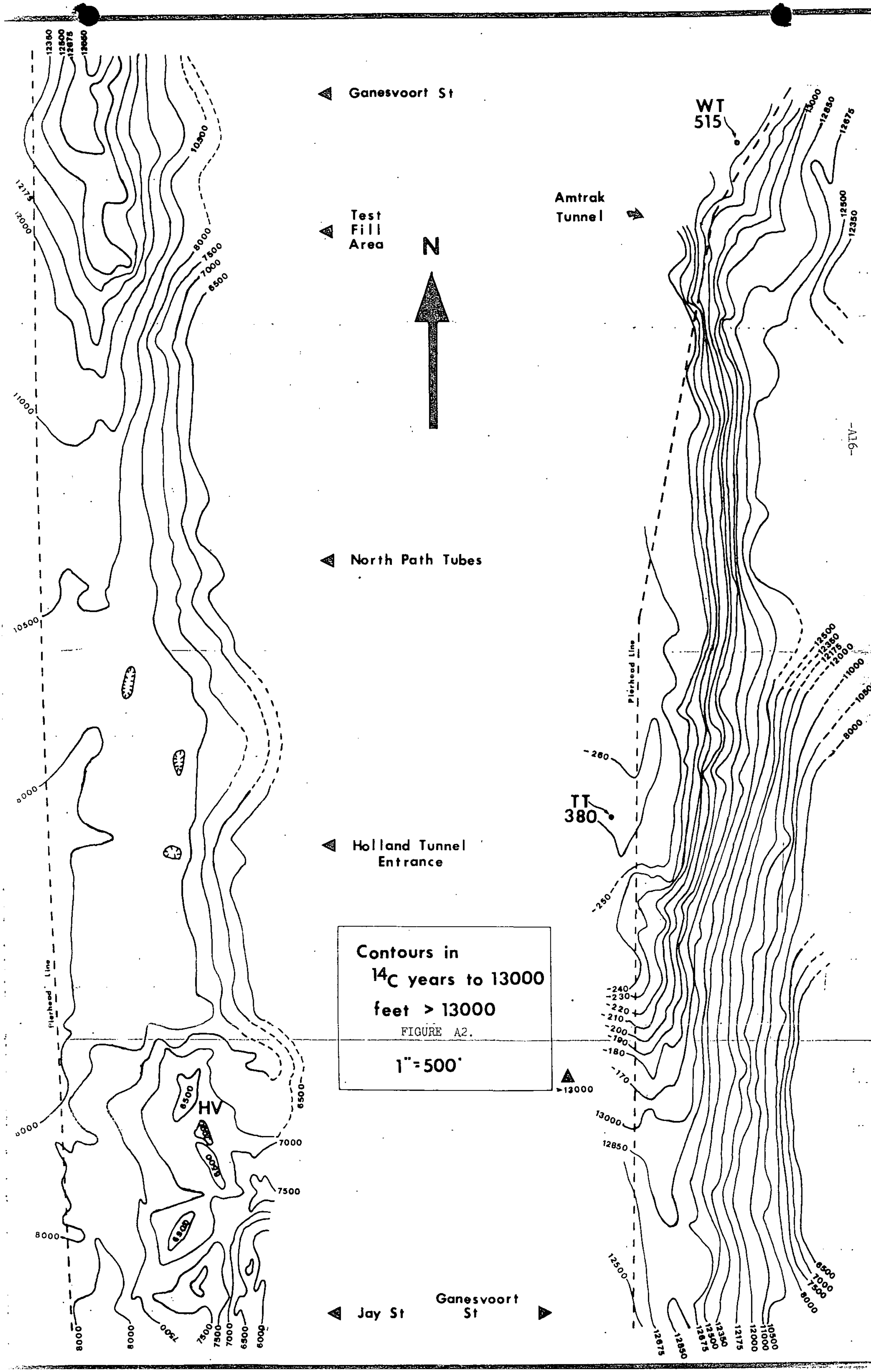
WESTWAY WT515 CORE SAMPLES

SAMP	DEPTH	P	K	CA	MG	MN	FE	AL	B	CU	ZN	NA
S1D	48.6	614.3	756.8	4683.8	2345.3	119.4	7229.4	1625.7	10.8	139.1	233.1	7229.4
S2D	53.6	429.2	926.1	55886.7	2659.1	368.4	6558.5	1685.3	14.7	7.5	37.3	6916.2
S3D	58.5	790	1059.1	443105.6	3109.5	505.2	7734.9	1992	22.3	51.5	111.7	13506.9
S4D	63.5	596.5	1438.3	4025.9	3495.2	622.1	8051.8	1903.1	32.2	9.5	28.1	11748.3
S5D	68.5	670.5	1010.9	3988.8	2279.8	622.3	8321.5	1753.7	23.3	8.5	22	6464.7
S6D	74	672	1176	3860.4	2577.2	543.3	7899.6	1865.8	25	9.6	22.8	8543
S7D	79	583.5	1095.5	4296.1	2491.7	554.9	8914.5	1714.8	22.1	8.2	22.1	8198.4
S8D	84	531.6	1092.3	4304.1	2376.3	426.7	6546.5	1533.5	21.7	7.5	20.2	9367.7
S9D	89	567.7	1101.6	4474.1	2338.6	443.6	7294	1661.8	22.1	8.6	27	7406.8
S10D	94	489.2	1230.8	3455.6	2526.7	370	8142.2	1785.1	25.2	8.4	25.9	8868.5
S11D	99	562.3	1390.2	4647.1	2686.7	519.3	8591.4	1784.6	25.7	7.8	26.5	9880.1
S12D	104	625.8	1460.4	3940.8	2785.6	506.1	7611.1	1873.8	30.1	7.7	23.9	9233.8
S13D	109	802	1593	4901.5	3000.3	980.3	8911.9	1852.9	31.5	7.4	21.9	9506.1
S14D	114	527	1054	7002.8	2591.7	358	6425.2	1685.7	20.9	6.8	22	6930.6
S15D	119	554.4	815.8	5439	3125.6	455.6	7098.9	1472.7	19.4	9.1	20.8	5933.4
S16D	129	553.2	1273.8	6333	4294.8	276.9	6005.4	1375.7	17.8	5.8	17.1	14376.7
S17D	134	480.6	803.4	4946.8	2876.8	466.6	5999.3	1662.9	11.5	8	20.3	5052
S18D	139	584.6	1283.5	4497.4	4047.7	563.9	13388.6	3459.6	14.1	13.8	34.5	5777.5
S19D	144	523.4	992.1	4105.5	3380.2	420.8	9032.1	2825.9	9.2	10.9	31.1	3934.4
S20D	149	579.8	916.2	4805.6	3652.3	679.2	16627.6	2630.3	12.4	11.2	31.3	4741.6
S21D	154	653.5	2188.6	5471.7	7561.6	778.9	26332.7	8587.6	18.6	17	60.7	8055.6
S22D	159	673.7	2119.6	4655.7	7116	764.6	31378.9	8857.2	17.7	19.3	65.4	4239.3
S23D	164	556.8	1750.1	5062.5	6472.8	672.5	20973.4	7593.8	13.3	14.1	52.4	4917.9
S24D	169	730.4	1818.7	6969.2	7938.2	950.3	25641	8944.5	15.6	19	62.9	4546.8
S25D	174	577.4	1140.8	5599.3	5564.3	699.9	19142.6	5739.2	11.5	14.6	42.3	2810.1
S26D	179	749.7	1593.7	7836.9	7874.6	953.2	26977.1	8515.1	16.9	22.2	60.2	4069.1
S27D	184	738.7	1369.7	7980.9	7201.4	864.9	25613.4	7535.5	15.9	20.4	56	3210.9
S28D	189	769.5	1473.7	7623	7114.8	1049	26934.8	8276.4	18.8	19.6	64.6	2693.4
S29D	194	629.2	1069.3	6983.5	6183.3	665.6	20077.8	6147	16	16.3	47.6	2513.3
S30D	198.5	704.2	1227.9	7765	7042.7	693.4	23439.7	7440	16.6	19.5	55.2	2549.8

TABLE A4. Results of chemical analyses for core TT-380. Data are ppm referred to acid insoluble fraction of each sample.

WESTWAY TT380 CORE SAMPLES

SAMP	DEPTH	P	K	CA	MG	MN	FE	AL	B	CU	ZN	NA
S8D	86	575.6	1338.3	4317.1	2928.4	831	12627.7	2780.9	30.9	24.8	37	7770.9
S9D	91	522.1	1468.5	6055.3	3285.1	659.9	11675.5	2868.1	29.3	19.5	34.4	9572.5
S10D	96	571.1	1183.5	5505	2811	571.1	10700.5	2639	27.1	16.1	32.3	7053.3
S11D	101	554.5	1224.2	6121.4	2776.2	550.9	11918.9	2851.8	26.6	14	33.1	6625.6
S12D	106	497.3	1084.5	5146.2	2756.1	229.6	10154.3	2466	22.1	10.7	30.7	5008.1
S13D	111	518.5	986.9	4449.4	3378.9	347.9	7661.1	2013.9	20	8	25	5419.6
S14D	116	554.4	980.9	4655.9	3443.9	319.5	8778.7	2128.9	19.1	8.5	27.3	5260.1
S15D	121	638.3	977.1	4814.3	3534.1	395.8	10662.9	2346.5	21	11	29.2	5206.6
S16D	126	558.5	1081.3	4798.2	3480.5	422.5	9202.5	2338.2	20.4	10	27.5	6158.9
S17D	131	645.1	1032.2	5340.5	3548.3	415.7	12939	2383.5	21.5	10	27.5	5340.5
S18D	136	636.2	993.2	4807.3	3305	512.5	10038.8	1898.1	19	8.8	24.3	7069.6
S19D	141	698.6	998	4740.6	3361.2	449.1	10229.9	1999.6	17.4	7.8	24.2	5738.7
S20D	146	566.3	863.8	5053.9	3376.4	853	9964.5	2028.7	16.1	8.9	26.8	5233.1
S21D	151	609.9	1072.7	5083	3715.9	623.9	10551.7	2439.8	19.2	10.8	28.7	6625.5
S22D	156	551.3	895	4475.3	3329.6	483.3	8628.4	2398.7	16.4	9.6	27.2	4797.5
S23D	161	615.4	1074.1	5184.4	3517.2	619.1	10891	2767.5	17.1	11.1	30.5	5296.3
S24D	166	565.9	953.9	4698.6	3281.9	569.5	9290.5	2719.5	16.3	10.3	29.1	4627.4
S25D	171	573.6	892.3	4036.6	3197.4	488.6	10374.9	2602.5	14.8	9.5	27.9	4497
S26D	176	588.3	971	4146.5	3363.3	421.7	11908.1	2658	17	10.9	29.7	5493.3
S27D	181	512.2	778.8	4139.7	3031.1	331.1	7683.1	2511.9	12.9	9.1	26.3	3613.5
S28D	186	575.1	1060.3	4061.8	3411.2	549.9	10136.5	2674.3	17.2	11.8	30.5	6002.8
S29D	196	601	830	4794.4	3513.5	665.4	11485.2	2536.7	15.3	10.7	29.3	4114.6
S30D	201	481	716.1	3812.5	3071.4	466.7	9371.1	2305.3	13.1	8.5	25.2	4667.7
S31D	206	596.3	819.9	4579	3542.5	748.9	13311	2701.2	15.9	11	31.9	4259.5
S32D	211	383.3	386.8	3049	2017.6	321.9	6342.1	1230	8	4.8	16.3	2630.9
S33D	216	640.1	866.7	4783.1	3740.1	834.3	13917.8	2916.6	14.7	12.9	33.8	4459.4
S34D	221	681.5	939.7	5595.6	4268.4	839.3	15854.2	3586.9	15.4	13.6	40.5	4447.7
S35D	226	647.2	693.7	5507.2	3754.9	776	14161.5	2893.1	12.5	12.5	32.5	2986
S36D	231	648	752.4	5724.1	4032.1	774	12384.3	2984.4	15.1	13.6	34.5	3816.1
S37D	236	771.4	775	5839.7	4253.6	868.7	14851.6	3586.7	14.4	14.4	38.2	3712.9
S38D	241	670.8	681.5	5345	3694.9	810.7	13739.4	2894.9	13.2	11.4	31.9	3120.9
S39D	246	794.5	845.5	6924.7	4774.4	841.8	18332.2	3972.5	16	16	43	3936.1
S40D	251	783.3	964.4	8535.6	4729.7	1067.8	20803.3	3953.7	20.3	19.2	46.5	4766.6
S41D	256	791.1	1107.6	6292.7	4526.3	956.7	23662.3	4636.7	20.9	14.7	46.7	5225.5
S42D	266	286	305	9088.7	2551	170.4	3511.5	1122.3	65.4	8.6	14.1	8985.4
S43D	271	326.7	221.8	10032.3	3378.9	199.2	3023.6	905.7	6.6	8	10.1	10903.2



Contours in ^{14}C years to 13000

feet > 13000

FIGURE A2.

1" = 500'

Thus, most of the portion of the curve in Figure A1 from about 6,000 BP to the present is dominated by crustal subsidence. Once the crustal subsidence component is subtracted out, the remaining curve can be seen to be composed of three eustatic/isostatic sea level rise regimes. Sea level rose rapidly in a period before 13,000 BP to about 11,000 BP, very little eustatic rise occurred between 11,000 and 8,000 BP, and a second period of rapid rise took place from about 8,000 to 6,000 BP.

These periods of rapid sea level rise should be expected to be advantageous for the preservation of occupational sites. The first period, until about 11,000 BP, occurred before man was likely to have entered the area in any numbers (Haynes 1977). The second, from about 8,000 to 6,000 BP, is a more favorable time for possible human occupation to have taken place. The questions of when during this period sections of the study area were inundated by rising sea level and which areas were the most likely to have been habitable can be addressed by reference to the map of shoreline positions (Figure A2).

The shoreline position map has been drawn on the assumption that the top of the glacial gravel/sand surface as interpreted by the Westway Project's engineers (see Mueser, Rutledge, Johnston and DeSimone's Project Soils Reports) is the same as that surface onto which rising sea level deposited the first layers of organic-rich sediments at or near mean high water. Contours to the top of this surface from present sea level have simply been replaced with their equivalent age in years before present taken from

Figure A1 . (For the engineer's glacial gravel/sand surface contour map, see *APPENDIX III, Figure A10,* Sheets 1-18.)

The topography of this surface is generally highest in the southern portion of the study area near Canal Street and lowest at the northern end near the Amtrak tunnel. In the northern section the slope falls continuously toward the west from the present shoreline. In the southern section, the slope reverses near the present pierhead line; thus, apparently for some time an island or peninsula existed a short distance offshore, extending some unknown distance into the Hudson to the west. This island or peninsula was not inundated until about 7,500 BP. Before that time it was separated from the mainland of Manhattan by a valley, which may have carried the stream at Canal Street north for some distance approximately along the strike of the Westside Highway project centerline.

There is a "delta"-like feature at Canal Street, which, however, is largely bedrock cored but may nevertheless have been used by the Canal Street stream. This feature, extending about 500 m west into the Hudson from the present shoreline, was above sea level until approximately 6,500 BP. It was a relatively gently sloping hill, perhaps containing patches of marsh. The shallow valley extending to the north from the "delta" was probably marshy for several hundred years, until the island/peninsula was overrun by rising sea level (about 7,500 BP).

c. *CHEMICAL ANALYSES*

The chemical analyses performed in this study have been done for survey purposes; they were designed not so much to give a detailed picture of an occupational area (such as reported by Heidenreich and Navratil 1973) as to identify which areas might be productive for future investigation. Thus, only anomalies in the concentration of some elements were sought, anomalies which might possibly be related to human occupation, such as those for phosphorus, potassium, calcium, and iron. [Acidity or alkalinity (pH) might have been another tool for identification (see Deetz and Dethlefsen 1963); however, the quality and storage of the samples seemed to preclude any meaningful measurements of pH.] Other elements such as zinc and copper are potentially useful for identifying modern, twentieth-century influence on core sample composition.

Phosphorus has been the most often-used element for the detection of anthrosols (Schwartz 1967). This element is present in soils in several forms, both organic and inorganic (Eidt 1977). Eidt discusses a methodology for distinguishing anthropogenic from nonhuman sources of phosphorus. His scheme for sample preparation, however, is elaborate; the preparation of samples for analysis here was done more directly.

None of the results for the cores TT-380 and WT-515 demonstrates any positive anomaly in the concentration of phosphorus in either the upper portions of the cores or near their bottoms. If anything, the phosphorus content of core TT-380 is significantly low near the bottom. One possible paleosol sample, HV36, S5D, does show a slightly elevated phosphorus content. This sample was taken just north of Laight Street. Similar positive phosphorus anaomalies are absent from other samples north or south of Laight Street.

The variability in all other chemical elements seems to be related to two simple causes--changes in the content of shell fragments ($CaCO_3$) and changes in salinity (compare the results of the chemical analyses with Weiss's findings in Section 3 of this appendix, dealing with paleoenviroments). Some shell concentrations are probably related to natural changes in environmental conditions; whether others are anthropomorphic should be evaluated only in light of other evidence in this report (see discussion in Section II, C, 1 of this report--Prehistoric Cultural Period).

Diatom assemblages have been examined for two samples (HV29, S-7D and HV31U, S-9D). Both of these samples (chosen before the chemical analyses were completed) appeared superficially to be the best candidates for paleosols among the HV core samples owing to their oxidized condition and high humic content. However, the diatom assemblage would not support the conclusion that either of these samples was a paleosol. The diatom assemblage was not significantly different from that of any other taken from estuarine core-bottom samples--i.e., it was indicative of brackish or marine conditions with only a normal mixture of freshwater forms.

d. CONCLUSIONS

The portion of the study area north of approximately Gansevoort Street was inundated by rising sea level at least as early as 13,000 BP. The prospect of archeological remains below any historical fill or natural estuarine deposits in this area is slim. South of Gansevoort Street, the archeological prospects appear brighter. A long valley, which may have carried a fresh-water stream, strikes north-south throughout this southern portion of the study area. It was dry land until about 9,000 BP. An accessible island of indeterminate size just offshore and probable marshes with shellfish resources provided other conditions favorable to habitation. The island/peninsula was near-shore dry land at about the same time (10,000 - 6,000 BP) that midden sites were being occupied only tens of kilometers north near Ossining, New York.

An examination of the Project Soils Report as well as the results of the chemical analyses presented herein for some of the HV core samples clearly shows that the area south of Laight Street was considerably modified by artificial fill right down to nearly the level of the glacial gravels (the area south of the "HV" in Figure A2). Although the layer sampled for chemical analysis in this area might actually represent a valid paleosol, artifical fill appears to have extensively modified sediments above the glacial gravels. It seems likely that the area between Laight Street and the north PATH Tubes may have been occupied by aboriginal Americans but may not have been extensively modified by modern man.

3. Paleoecological Investigations

a. PURPOSE AND SCOPE

The purpose of this study was to extend our knowledge of the postglacial marine occupation of the lower Hudson Valley in order to determine those events that led to the development of the present estuary. Foraminifera comprise a well-known taxonomic group, which is an integral part of the benthos in the brackish water portions (salinity greater than 0.5°/oo) of most estuaries. These single-celled microscopic shelled animals belonging to the Phylum Protozoa are normally found in sufficient numbers to allow their use in stratigraphic and paleoecologic studies. Shells of larger organisms, such as clams and snails, are often broken or destroyed by the coring devices used in such work.

b. SITE SELECTION, LOCATION, AND DESCRIPTION

The cores chosen for this study were selected from the hundreds obtained for the design of the proposed "Westway." The following criteria were used to make this determination:

1. The cores contained the longest possible length to bedrock to insure the oldest and most complete sediment, stratigraphic, and paleoecological record.
2. The core sites were as far beyond the pier and/or bulkhead line as possible to insure that dredging, filling, or other human activities had not disturbed

the sediments deposited in the estuary.

3. The driller's record for the cores did not indicate disturbed or other man-derived materials.

Ten sites were initially selected and the cores from seven examined. Only four cores contained foraminiferal material suitable for this study. Their locations are shown in Figure A3, and pertinent site information is given in Table A5.

All cores generally displayed a stratigraphic sequence, above bedrock, consisting of a basal coarse sand or gravel overlaid by varying thicknessess and sequences of gray clayey silt with traces of fine sand, which, in turn, were overlaid by gray organic silty clay. The uppermost portion of each core was comprised of black organic silty clay. This material is presently being deposited in the estuary. Figure A4 shows the stratigraphic sequences found in the cores and how these sedimentologic units may correlate with each other. In core VT255, the organic silty clay is found in direct contact with and overlying the basal sand sequence. In core TT380, a dark gray silty fine sand is found in the lower portion of the gray clayey silt. The stratigraphic sequences found in all cores is similar to others described by Reeds (1927, 1933), Richards (1930), and Weiss (1974).

The Hudson River in the project area should be correctly described as a partially stratified estuary. Chute *et al.* (1975) reported that the salinity found in the vicinity of this study is partially mixed during the fall, winter, and spring, and displays a distinct two-layered structure during summer months. A northward

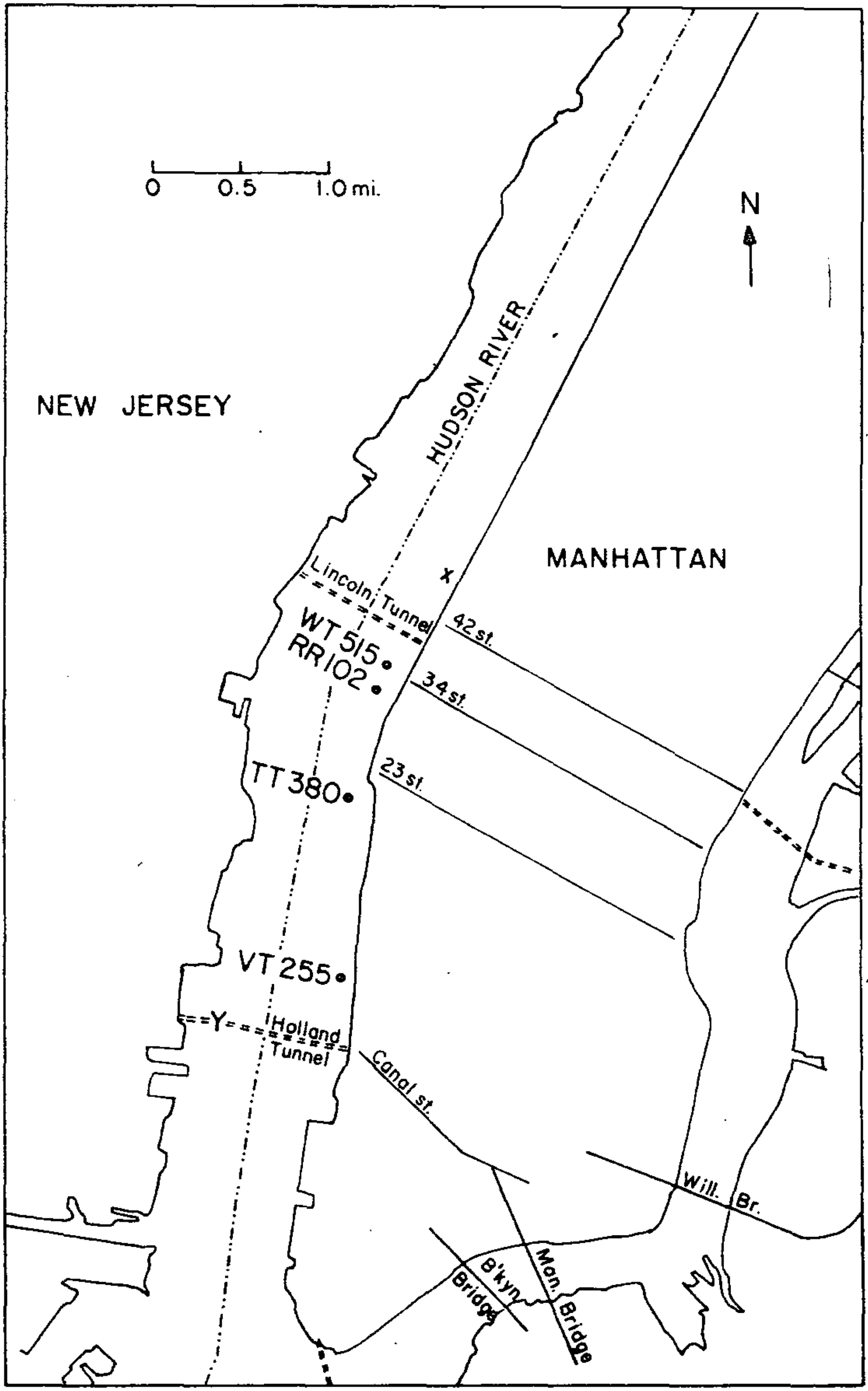


FIGURE A3. Map showing the location of core sites analyzed for foraminifera.

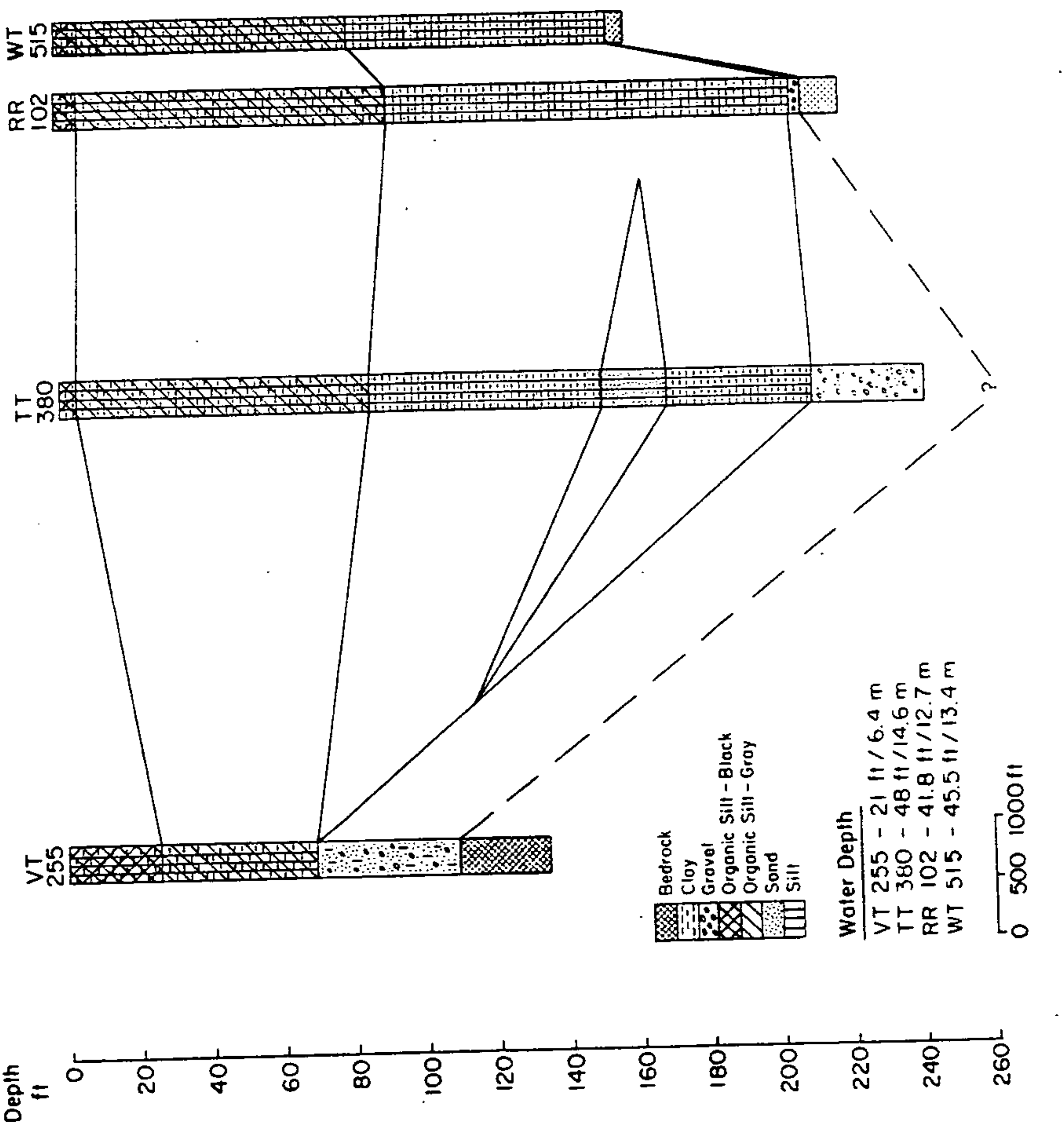
TABLE A5 .

DATA FOR CORE SITES ANALYZED FOR FORAMINIFERA

Core	Location	Water Depth	Length (to Bedrock)
VT255	Barrow St. Piers 42-45	21 ft/6.4 m	109.5 ft/33.4 m
TT380	W. 20th St. Piers 60-61	48 ft/14.6 m	243 ft/74.1 m*
RR102	W. 31st St. Pier 72	41.8 ft/12.7 m	209.5 ft/63.9 m
WT105	W. 35th St. Pier 76	45.5 ft/13.9 m	155 ft/47.2 m

*Not to bedrock.

FIGURE A4. Stratigraphic correlation of cores studied.



progression of high salinity during the low flow periods of summer was noted by Rachlin *et al.* (1975). In the vicinity of this study area, bottom water salinity is reported to have an annual range from 10°/oo to 26°/oo and an annual average of 20°/oo (Weiss 1975). Bottom water temperatures have been measured to range from 3°C to 22°C and average annually at about 14°C.

c. METHODS OF STUDY

All samples available from the four cores studied were examined for their foraminiferal content. Approximately 100 g of material was removed from each core sample and treated, using a "wrist-action shaker," with a 10% solution of potassium hydroxide. This treatment allowed the material to be disaggregated. The treated sample was then wet sieved onto a nested set of screens with mesh openings of 2.00, 1.00, 0.500, 0.250, 0.125, and 0.063 mm. Each sieve catching was dried in a hot air oven and weighed to determine the percent weight of each size fraction. The material on the 0.125-mm screen was then used for foraminiferal analysis. The foraminifera were separated from the sediment component of the catching by using the carbon tetrachloride flotation method. The material was placed into the carbon tetrachloride and the foraminifera floated to the surface. They were then decanted off and allowed to air dry. When sufficient numbers permitted, up to 500 foraminifera were counted per sample. In all instances, the foraminifera were identified and their relative abundance determined. Foraminiferal distribution diagrams were constructed for each core (see Figures A5 through A8). Using the species found

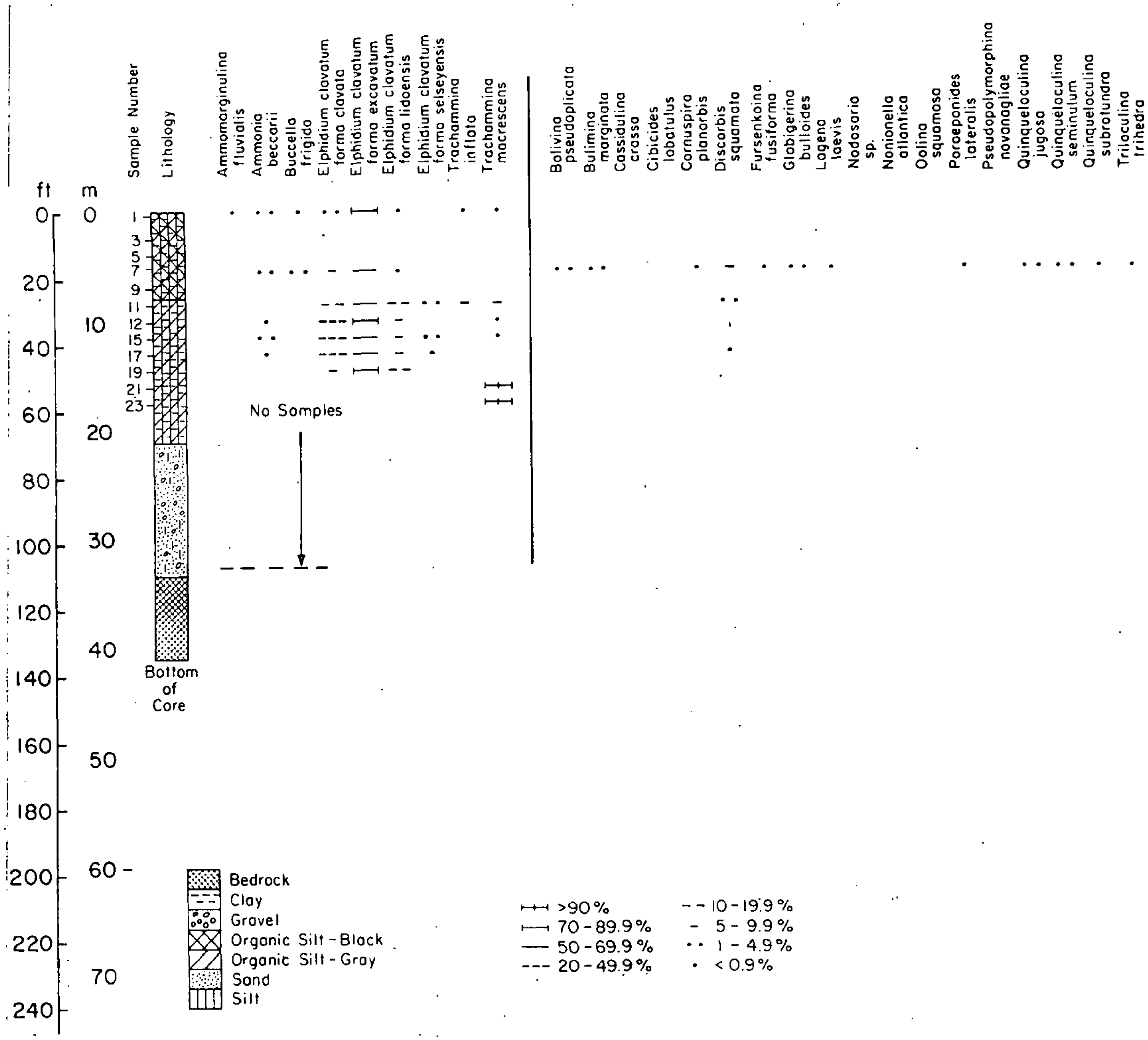


FIGURE A5. Foraminiferal distribution in core VT 255 (Barrow St./piers 42-45).

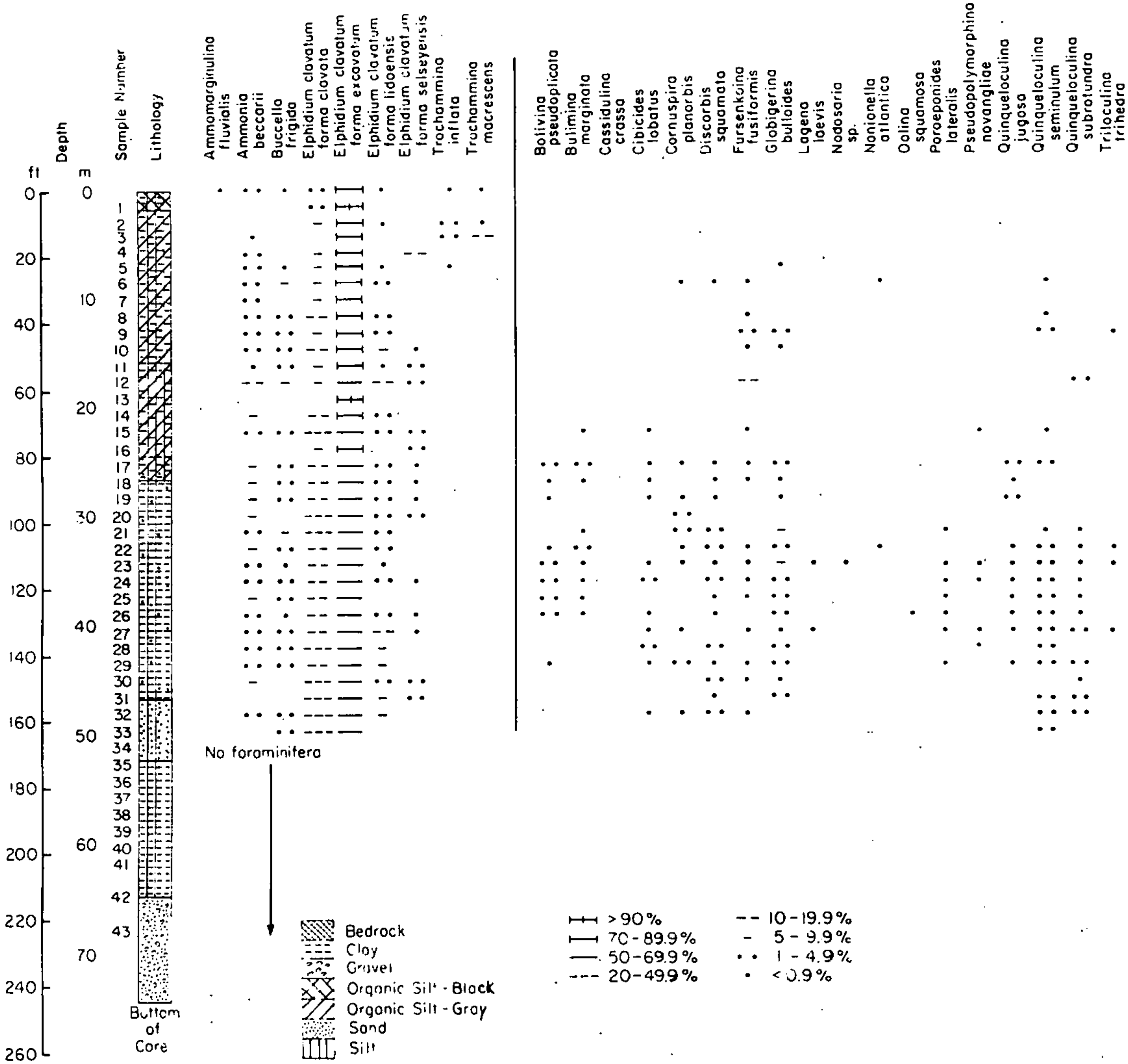


FIGURE A6. Foraminiferal distribution in core TT 380 (W. 20 St./piers 60-61).

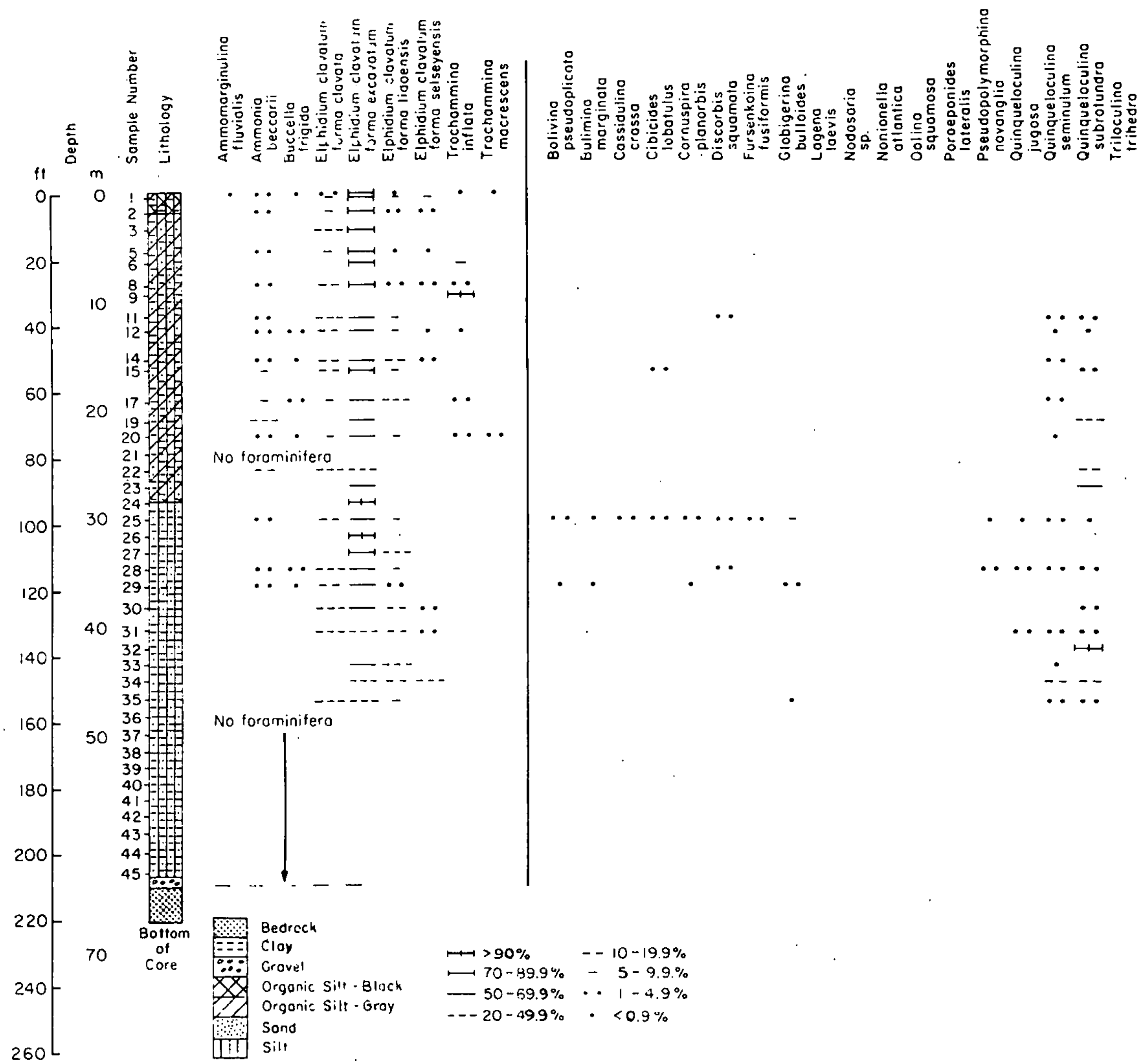


FIGURE A7. Foraminiferal distribution in core RR 102 (W. 31 St./pier 72).

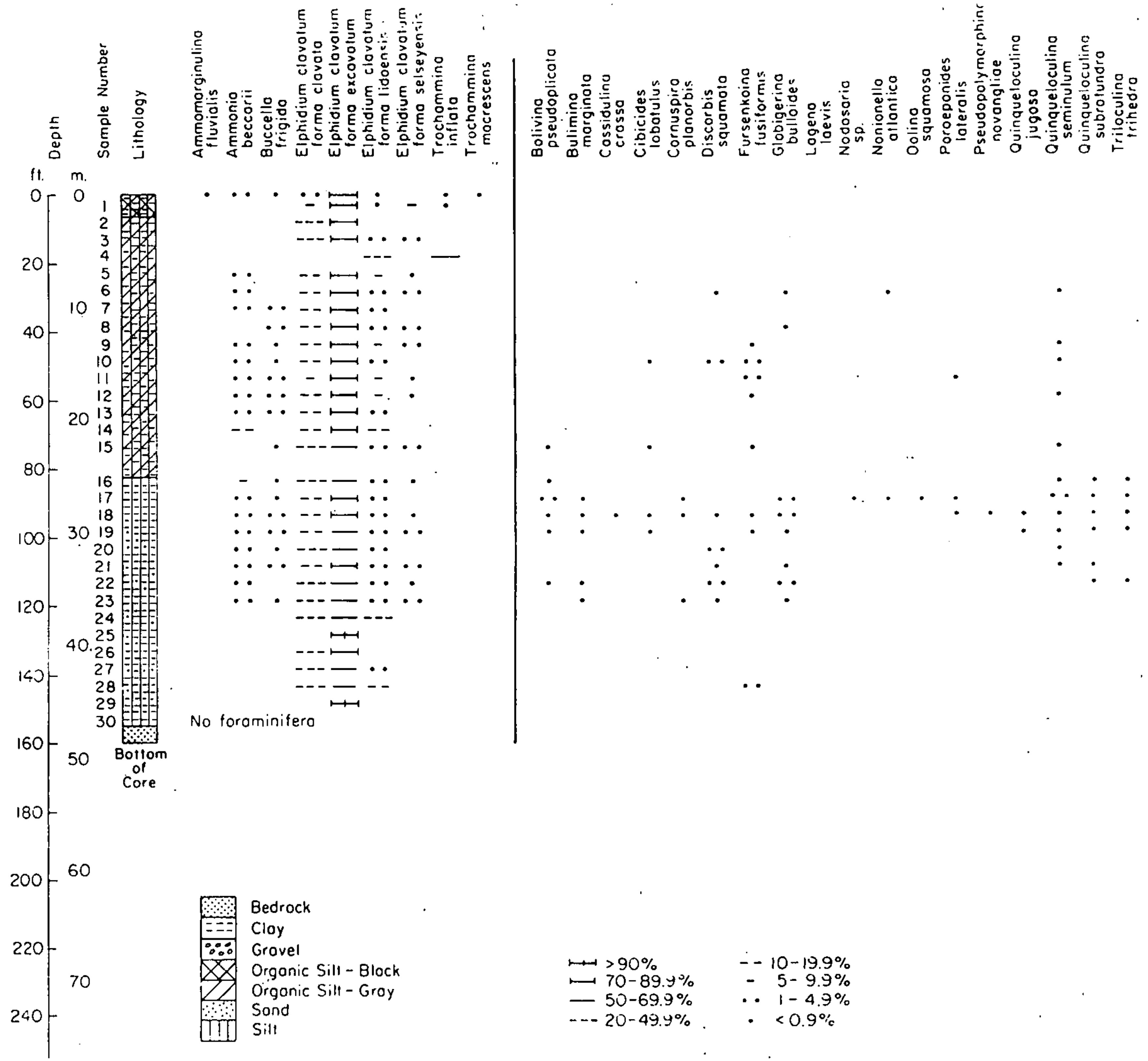


FIGURE A8. Foraminiferal distribution in core WT 105 (W. 35 St./pier 76).

and the number of foraminifera in each sample, we determined the salinity conditions at the time of deposition of each sample horizon. This information is presented on Figure A9 and indicates whether conditions were less saline (fresher) or more saline (marine) than today.

d. RESULTS

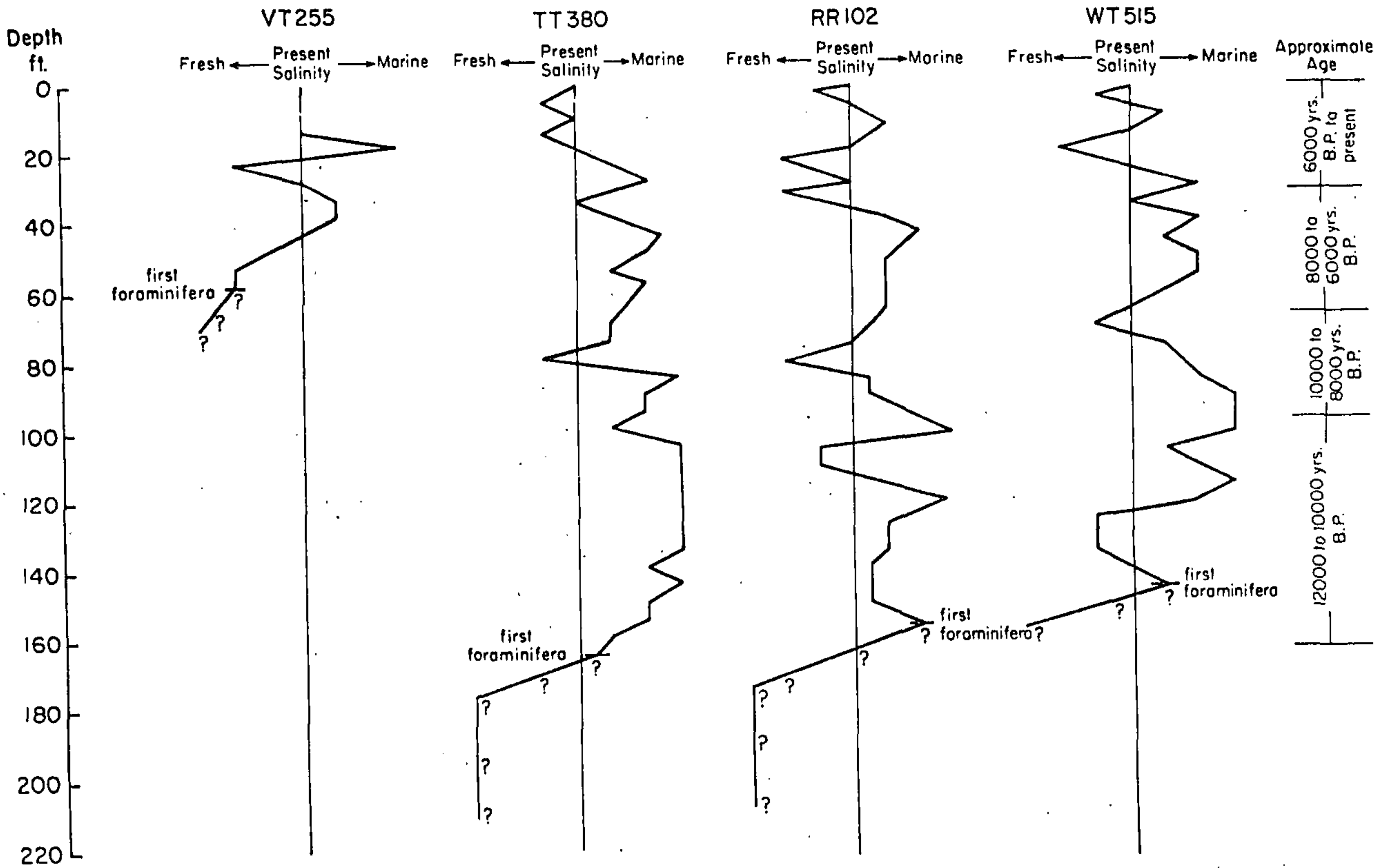
Figures A5 through A8 show the foraminiferal species found in the samples from cores VT255, TT380, RR102, and WT515, respectively. All depths indicated on the diagrams are relative to the water/sediment interface (mudline) and not sea level, the purpose being to establish a common reference horizon for all cores. Foraminifera listed to the left of the solid vertical line on the diagrams are those presently thriving in the study area. Those foraminifera listed to the right of the line are not indigenous to the present estuary. Core VT255 has the shortest foraminiferal record. Foraminifera first appear in this core at a depth of 48 ft (14.6 m). Longer stratigraphic records were found in cores TT380, RR102, and WT515, with the first appearance of foraminifera occurring at 163 ft (49.7 m), 153.5 ft (46.7 m), and 148.5 ft (45.3 m), respectively.

The foraminifera found in the cores can be grouped into three assemblages, as follows:

Elphidium Assemblage

Ammomarginulina fluvialis
Ammonia beccarii
Buccella frigida
Elphidium clavatum forma *clavata*
Elphidium clavatum forma *excavatum*
Elphidium clavatum forma *lidoensis*
Elphidium clavatum forma *selseyensis*

FIGURE A9. Paleoenvironmental changes in the lowermost Hudson River during the past 12,000 years.



Trochammina inflata
Trochammina macrescens

Ammonia/Elphidium Assemblage

Ammonia beccarii
Buccella frigida
Cibicides lobatulus
Discorbis squamata
Elphidium clavatum forma *clavata*
Elphidium clavatum forma *excavatum*
Elphidium clavatum forma *lidoensis*
Quinqueloculina jugosa
Quinqueloculina seminulum
Quinqueloculina subrotundra
Triloculina trihedra

Virgulina/Elphidium Assemblage

Ammonia beccarii
Bolivina pseudoplicata
Buccella frigida
Bulimina marginata
Cassidulina crassa
Cibicides lobatulus
Cornuspira planorbis
Discorbis squamata
Elphidium clavatum forma *clavata*
Elphidium clavatum forma *excavata*
Elphidium clavatum forma *lidoensis*
Elphidium clavatum forma *selseyensis*
Globigerina bulloides
Lagena laevis
Nodosaria sp.
Nonionella atlantica
Oolina squamosa
Poroeponides lateralis
Pseudopolymorphina novangliae
Quinqueloculina jugosa
Quinqueloculina seminulum
Quinqueloculina subrotundra
Triloculina trihedra
Virgulina fusiformis

Elphidium clavatum is the dominant foraminifera in all assemblages, comprising at least 60% of the number of individuals present in most samples. The other species listed, although not found in comparable percentages, are indicative of specific environmental conditions of importance. The *Elphidium* assemblage is indicative of the foraminifera presently found in the vicinity of the Westway Project area. The *Ammonia/Elphidium* assemblage is denoted by the appearance of peak amounts of *Ammonia beccarii*, *Quinqueloculina jugosa*, *Q. seminulum*, *Q. subrotundra*, and *Triloculina trihedra*, as well as the presence of *Elphidium clavatum*. The *Virgulina/Elphidium* assemblage is marked by the presence of *Bolivina marginata*, *Bulimina pseudoplicata*, *Globigerina bulloides*, and *Virgulina fusiformis*, in addition to forms of *Elphidium clavatum*.

e. DISCUSSION

The three foraminiferal assemblages identified from the core samples are similar to those found in modern estuarine, coastal, and shelf environments. The *Elphidium* and *Ammonia/Elphidium* assemblages are currently found in the waters of the Hudson Estuary and adjoining New York Bay. The *Virgulina/Elphidium* assemblage is characteristic of the waters of the Atlantic continental shelf off the northeastern United States, including the New York Bight, Block Island Sound, Buzzards Bay, and eastern Long Island Sound.

The *Elphidium* assemblage is characterized by foraminiferal species presently found in and around the Westside Highway project area. The assemblage presently occurs in the Hudson Estuary from just north of Spuyten Duyvil and extends south to the New York Bight (Weiss 1975). It has also been reported in western Long Island Sound (Buzas 1965) and Buzzards Bay (Parker 1952). The assemblage is characteristic of salinities of about 20 to 25°/oo and water temperatures averaging 13°C.

The *Ammonia/Elphidium* assemblage is typically found in the area extending from the Upper Bay to the inner New York Bight. It is indicative of waters with salinities ranging from 25 to 32°/oo and is normally found in the more open and unrestricted coastal and estuarine areas. Weiss (1975) reports that, depending on salinity conditions, this assemblage may occur in the estuary as far north as midtown Manhattan.

The *Virgulina/Elphidium* assemblage contains species of benthonic foraminifera which presently occur in open marine waters of the near continental shelf. These waters have salinities of from 32 to 35°/oo and depths to 100-150 ft (30.5 to 45.7 m). The assemblage also contains the planktonic foraminifera *Globigerina bulloides*, which is indicative of the subpolar and north temperate waters of the Atlantic Ocean.

The earliest occurrence of estuarine conditions at each core site is marked by the first appearance of foraminifera. Cores TT380, RR102, and WT515, which have the longest sediment record, show the earliest signs of saline conditions at about 11,000-12,000 years BP. The first occurrence of foraminifera in these cores is made at slightly shallower depths from the most southerly, TT380, to the most northerly, WT515 (Figure A9). Weiss (1974) also reports the first occurrence of foraminifera at two additional lower Hudson Estuary sites. The first is reported at the Holland Tunnel site (Figure A3), which shows the first sign of saline conditions and foraminifera at about 12,000 BP, and the second is at W. 50th St. (Figure A3) at 10,500 BP. Thus, a northward progression of salinity and estuarine conditions, with higher than present salinity, occurred as early as 12,000 years BP and continued to about 10,000 BP. At the lower Hudson Estuary core sites, these conditions are noted primarily by the presence of the *Virgulina/Elphidium* and *Amminia/Elphidium* assemblages (Figures A6 through A9). Occasional reductions in salinity during this period are marked by the occurrence of the *Elphidium* assemblage.

Between 10,000 and 8,000 years BP, a reduction in salinity is noticeable in curves shown in Figure A9. It is also evident in Figures A6 through A8 by the presence of the *Elphidium* assemblage and a marked reduction in the number of foraminifera present in each sample. This event correlates with a reduction in the rate of rise of sea level. At about 8,000 BP, sea level again began to rise rapidly. The foraminiferal assemblages show a concurrent increase in salinity, with the return of the *Virgulina/Elphidium* and *Ammonia/Elphidium* assemblages (Figures A6 through A9). This rate of rise was maintained until about 6,000 BP, when the present rate of rise was established. Figures A6 through A9 show this change by noting the presence of the *Elphidium* assemblage.

Scott and Medioli (1982) also report a similar high-low-high salinity pattern for the waters off the coast of Nova Scotia. They attribute this sequence to the "peripheral bulge" theory of Newman *et al.* (1971) and with recently developed geophysical models developed by Farrel and Clark (1976), Peltier *et al.* (1978), and Quinlan and Beaumont (1981). It is therefore postulated that a landward migrating bulge resulted in a short-lived period of crustal (isostatic) uplift at which time salinity was reduced and the rise of sea level was diminished.

The first appearance of foraminifera at the site of core VT255 occurred at about 7,000 to 8,000 years ago. This date corresponds to the second period of rapid rise of sea level and correlates to the high salinity conditions observed in the upper parts of TT380, RR102, and WT515. The organic silty clays containing foraminifera are found directly above basal coarse sands (Figure A5). It it therefore highly likely that an unconformable boundary marks the initial inundation of this area by estuarine conditions. Weiss (1974) reports similar events in the Hudson Valley in the vicinity of Tarrytown and Ossining. This event probably marks that point in time when the present extent of the estuary, as well as the present near salinity conditions, were established. Topographic data (see Section 2 of this appendix) also indicate that the Westside Highway project area south of the VT255 site was exposed and subjected to possible subaerial conditions prior to 7,000-8,000 BP. It is thus very possible that during the early stages of marine transgression and estuarine development, the course of the Hudson Estuary in the vicinity of lower Manhattan was west of its present position. Therefore, the estuary as recognized today obtained its maximum extent about 7,000 years ago.

4. Glossary

anthropogenic. Involving the impact of man on nature; induced or altered by the presence and activities of man.

anthrosols. Sediments that have been deposited or disturbed by man.

basal. Of or relating to the foundation or base.

benthos. Organisms that live on or in the bottom of bodies of water.

bight. A bend or curve, especially in a river or a mountain chain; a bend in a coast forming an open bay; a bay formed by such a bend--e.g., the New York Bight.

diagenesis. The reconstructive process by which changes are produced in sediments during or immediately after their deposition and which is caused by such forces as the weight of overlying strata or hot waters.

diatom. Any of the unicellular or colonial algae constituting a class (Bacillariophyceae), having a silicified cell wall that persists as a skeleton after death and forms diatomite, and forming a large part of the plankton of both fresh and salt water.

disaggregate. To destroy the aggregation of; separate into component parts.

estuary. A water passage (as the mouth of a river) where the tide meets the current of a stream: tidal river; an arm of the sea at the lower end of a river; a drowned river mouth caused by the sinking of the land (or rising of the sea) near the coast.

eustacy. Worldwide change of sea level as contrasted with local diastrophic uplift or subsidence of the land.

eustatic. Relating to or characterized by eustacy.

foraminifera. An order of Rhizopoda comprising large chiefly marine protozoans that have one or more nuclei, that are generally enclosed in a typically calcareous shell having minute openings for slender branching pseudopodia and consisting of several successively formed communicating chambers each larger than the preceding, that have a complex life cycle in which sexual and asexual generations alternate, and that are so abundant that their shelly remains constitute a major part of various sedimentary limestones (as chalk) and serve to identify geologic horizons.

horizon. The geological deposit of a particular time, usually identified by distinctive fossils; a stratigraphic level or position in the geologic column; a natural soil layer. Any of the reasonably distinct layers of soil or its underlying material seen in a vertical section or profile of land and gradually developed as a result of natural soil-forming processes (as the incorporation of organic matter with disintegrated rock material).

humic. Relating to or composed at least in part of organic matter; relating to or derived from humus.

isostasy. General equilibrium in the earth's crust.

isostatic. Subjected to equal pressure from every side; being in hydrostatic equilibrium; relating to or characterized by isostasy.

paleoecology. A branch of ecology concerned with the identification and interpretation of the relation of ancient plants and animals to their environment and with the characteristics of ancient environments.

paleoenvironment. The ancient environment.

palynology. A branch of science concerned with the study of pollen and spores, whether living or fossil.

sedimentologic. Of or relating to sedimentology.

sedimentology. The description, classification, and interpretation of sediments.

taxonomic. Of or relating to or having the character of taxonomy.

taxonomy. Study of the general principles of scientific classification; the systematic distinguishing, ordering, and naming of type groups within a subject field; classification.

C. APPENDIX III: MAP SHOWING CONTOURS OF GLACIAL GRANULAR SOIL SURFACE AND LOCATION OF WESTWAY PROJECT BORINGS

Figure A10 comprises APPENDIX III. It contains, in 18 sheets, the contours of the surface of the glacial sands as interpolated by Mueser, Rutledge, Johnston and DeSimone, based on the engineering borings for the Westway Project. On the original full-size sheets (those reproduced herein are at half-scale), the archeologists plotted the prehistoric shorelines and the Map Reference Areas referred to in Section II, C, 1 of this report entitled Prehistoric Cultural Period. The bulk and complexity of the following 18 sheets of Figure A10 resulted in its placement in an appendix at the end of the report. For better reader comprehension of the information contained in Figure A10, the shoreline position data and Map Reference Areas it contains have been plotted on a copy of the project area base map, resulting in Figure 4.

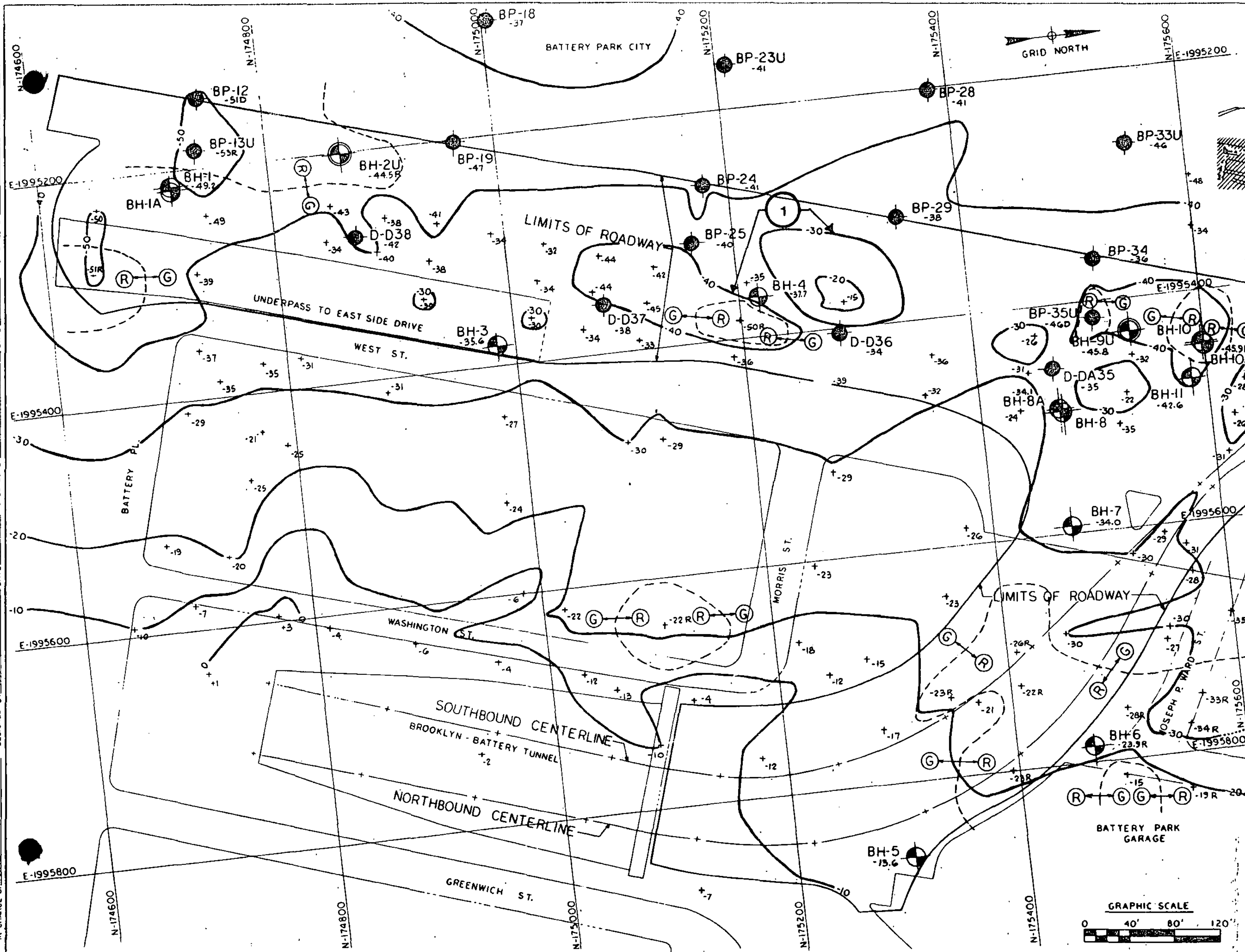
KEY TO MAP REFERENCE AREAS IN FIGURE A10

Figure A10 was plotted on 18 full-scale sheets of the project area from Mueser, Rutledge, Johnston and DeSimone. Pertinent data have been transferred to half-scale prints of these 18 sheets, included herein.

Map Reference Area	Sheet Number
1	1
2	2
3	2
4	3
5	2,3
6	3
7	6
8	7,8
9	9
10	4
11	10
12	6
13	7
14	8
15	9
15A	9
16	5
17	8
18	4
18A	4
19	7
20	9
21	16-18

FED ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I - 478 - 1 ( ) 17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL



NOTES:

1. For notes relating to base plan see Drawing No. B-BH-1.
2. Contours shown have been developed by linear interpolation between borings and by smoothing the resulting contour lines. Variations and deviations from these lines must be expected to exist.
3. The surface of glacial granular soil contoured includes both Strata G and GT. Where borings did not encounter either Stratum G or GT, the surface of decomposed rock or bedrock has been used to provide a continuous contour of relatively incompressible material.

LEGEND:

- Boring made in 1980.
  - A: Elevation top of glacial granular soil.
  - D: Glacial granular soil not encountered, top of decomposed rock shown.
  - R: Glacial granular soil not encountered, top of bedrock shown.
- Previously made boring providing reliable detailed information. For complete reference see General Notes on Dwg. No. GS-5R.
- \+ Previously made boring of moderate or limited quality which was used in contour preparation. For identification of boring number and quality refer to "Project Soils Program Report, Review of Existing Data and Establishment of a Project Subsurface Program" by the GSE dated August 28, 1980.
- ----- Limit of glacial granular soil.
- (G) Indicates area where glacial granular soil of Stratum G or GT was encountered.
- (R) Indicates area where no glacial granular soil was encountered over rock.

FIGURE A10.

-A44-

SHEET 1 OF 18 FIGURE NO. 3.8

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

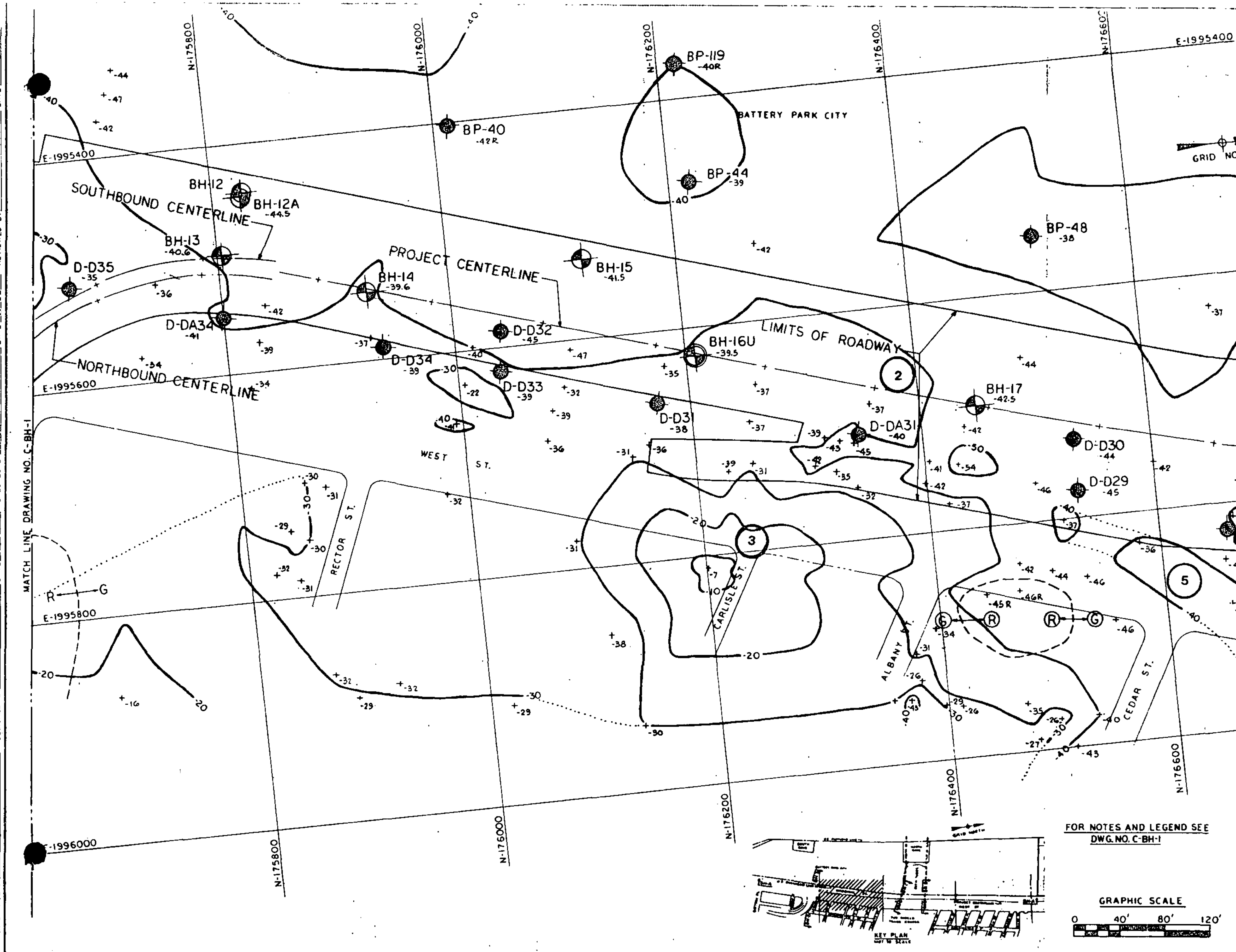
CONTOURS OF GLACIAL GRANULAR SOIL SURFACE - SHEET No. 1

BROOKLYN BATTERY TUNNEL TO HARRISON ST

DRAWING NO.	DATE	SCALE	SHEET NO.
C-BH-1		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESMONE
WOODWARD - CLYDE CONSULTANTS, INC.

DESIGNED BY H.K. DATE 11-80 CHECKED BY L.W.M. DATE 11-80 REVIEWED BY DATE



FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I-478-1( )17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL

FIGURE A10.

-A45-

SHEET 2 OF 18 FIGURE NO. 3.9

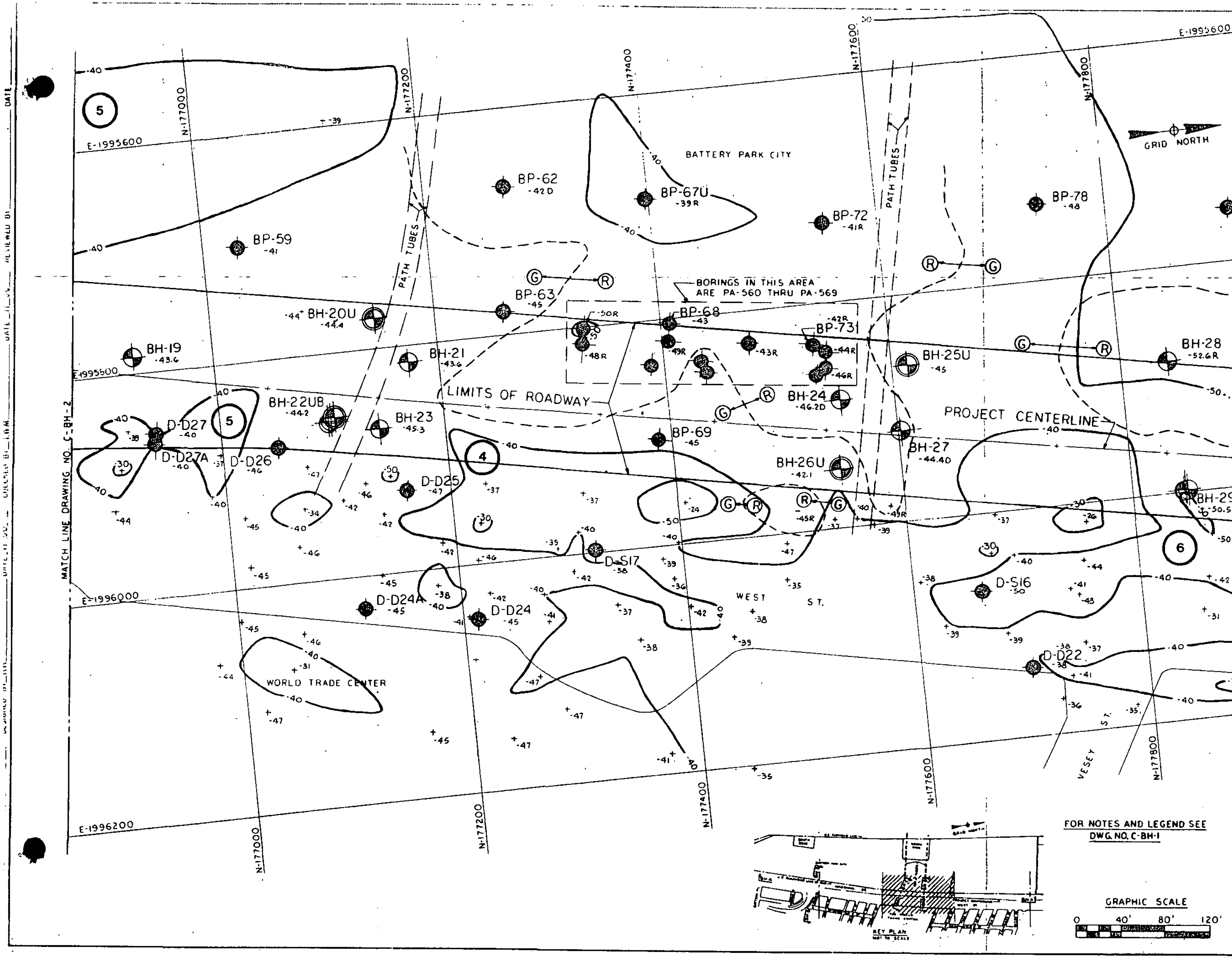
INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF GLACIAL GRANULAR SOIL SURFACE SHEET No. 2

BROOKLYN BATTERY TUNNEL TO HARRISON ST.

DRAWING NO.	DATE	SCALE	SHEET NO.
C-BH-2		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESMOND
WOODWARD – CLYDE CONSULTANTS, INC.



FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I - 478 - 1 ( ) 17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL

FIGURE A10.

-A46-

SHEET 3 OF 18 FIGURE NO. 3.10

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF GLACIAL GRANULAR SOIL SURFACE – SHEET No. 3

BROOKLYN BATTERY TUNNEL TO HARRISON ST.

DRAWING NO.	DATE	SCALE	SHEET NO.
C-BH-3		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESIMONE
WOODWARD – CLYDE CONSULTANTS, INC.

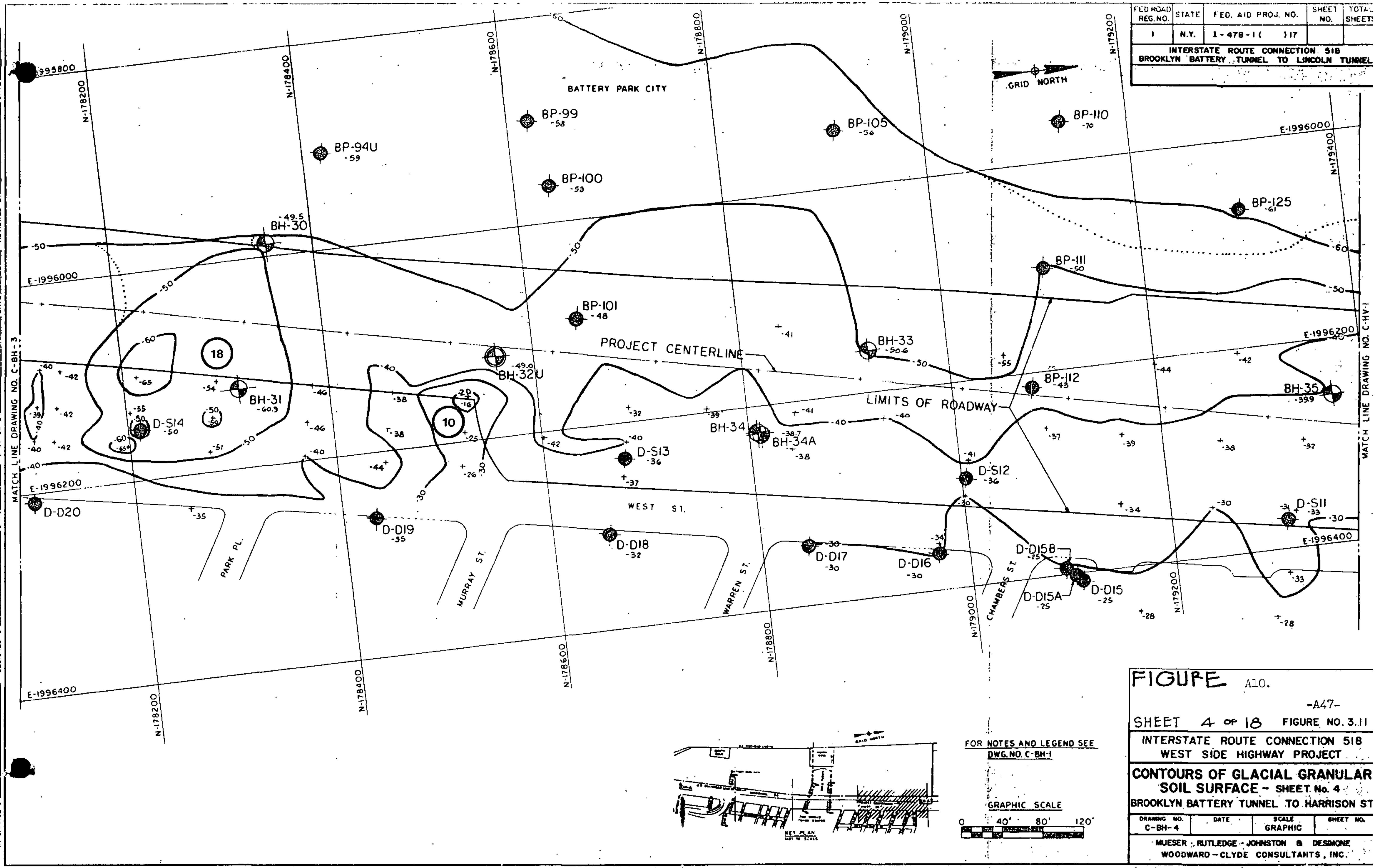
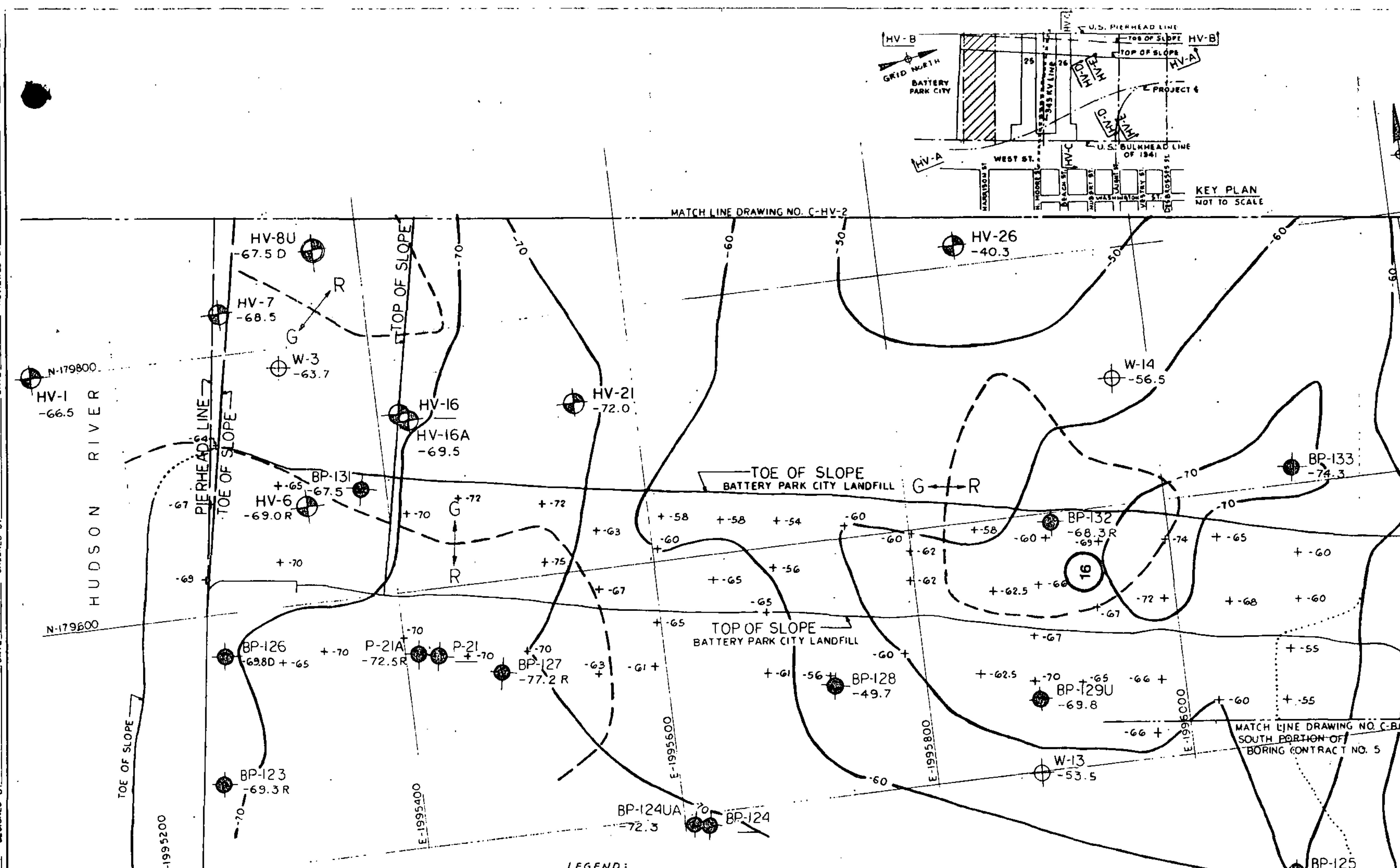

FED. ROAD REG. NO. 1
STATE N.Y.
FED. AID PROJ. NO. I-478-1( )17
INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL
GRID NORTH
BATTERY PARK CITY
PROJECT CENTERLINE
LIMITS OF ROADWAY
WEST ST.
PARK PL.
MURRAY ST.
WARREN ST.
CHAMBERS ST.
BH-30
BH-31
BH-32U
BH-33
BH-34
BH-34A
BH-35
BP-94U
BP-99
BP-100
BP-101
BP-105
BP-110
BP-111
BP-112
BP-125
D-S11
D-S12
D-S13
D-S14
D-D15
D-D15A
D-D15B
D-D16
D-D17
D-D18
D-D19
D-D20
MATCH LINE DRAWING NO. C-BH-3
MATCH LINE DRAWING NO. C-HV-1
FOR NOTES AND LEGEND SEE DWG. NO. C-BH-1
GRAPHIC SCALE
0 40' 80' 120'
KEY PLAN
SHEET 4 OF 18
FIGURE NO. 3.11
INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT
CONTOURS OF GLACIAL GRANULAR SOIL SURFACE - SHEET No. 4
BROOKLYN BATTERY TUNNEL TO HARRISON ST
DRAWING NO. C-BH-4
SCALE GRAPHIC
MUESER, RUTLEDGE, JOHNSTON & DESMONE
WOODWARD-CLYDE CONSULTANTS, INC.

FIGURE A10.



LEGEND:

- Borings made in 1979 or 1980.
  - A: Elevation top of granular soil.
  - D: Glacial granular soil not encountered, top of decomposed rock shown.
  - R: Glacial granular soil not encountered, top of bedrock shown.
- Previously made borings providing reliable detailed information. DN series made by Warren George, Inc. in 1977 under the inspection of the DEPARTMENT during Boring Contract No. 1.
- Previously made borings providing information of moderate detail or reliability.
- Previously made borings providing limited information.
- Limit of glacial granular soil.
- (G) – Indicates area where glacial granular soil is anticipated.
- (R) – Indicates area where no glacial granular soil was encountered over rock.
- \+ "Hard bottom" sounding data taken from Battery Park City construction dredging records.

NOTES:

1. For notes see Dwg. No. B-HV-1.
2. Contours shown are interpolations between borings and may not represent actual subsurface conditions.
3. Where borings did not encounter glacial granular soil the surface of decomposed rock or bedrock has been used to provide a continuous contour of the surface of relatively non-compressible material.

NOTE:

For Boring No. BH-35 see Soils Report for south portion of West Side Highway Project Boring Contract No. 5.

FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I-478-1( )17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL

FIGURE A10.

-A48-

SHEET 5 OF 18 FIGURE NO. 3.18

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF GLACIAL GRANULAR SOIL SURFACE

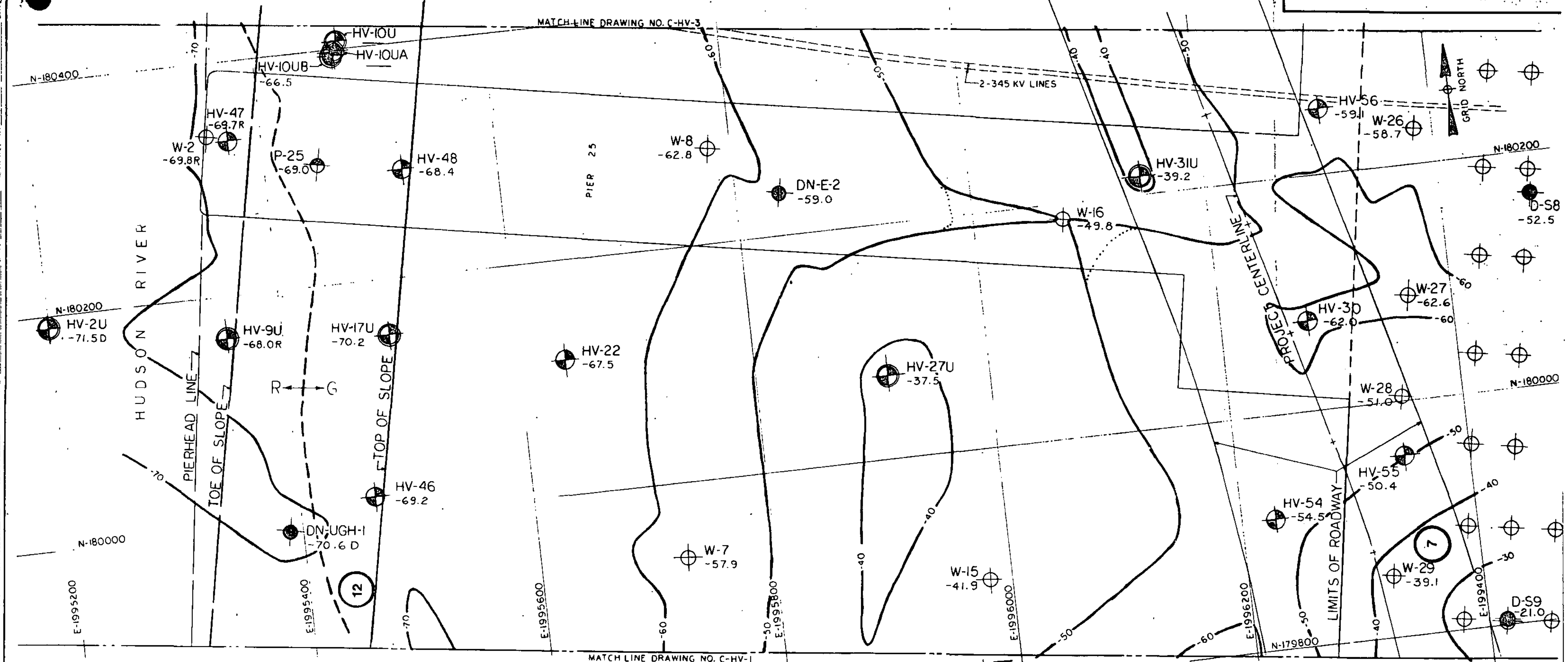
SHEET No. 1 – HARRISON ST. TO VESTRY ST.

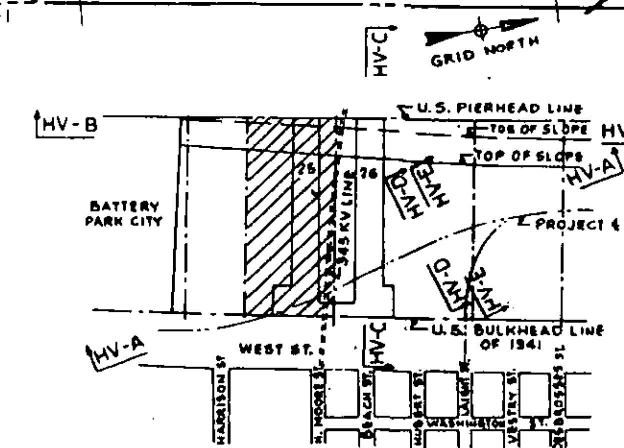
DRAWING NO.	DATE	SCALE	SHEET NO.
C-HV-1		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESMONE
WOODWARD – CLYDE CONSULTANTS, INC.

FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I - 478 - 1 ( ) 17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL





KEY PLAN
NOT TO SCALE

FOR NOTES AND LEGEND SEE DWG. NO. C-HV-1

GRAPHIC SCALE

0 40' 80' 120'

FIGURE A10.

-A49-

SHEET 6 of 18 FIGURE NO. 3.19

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF GLACIAL GRANULAR SOIL SURFACE

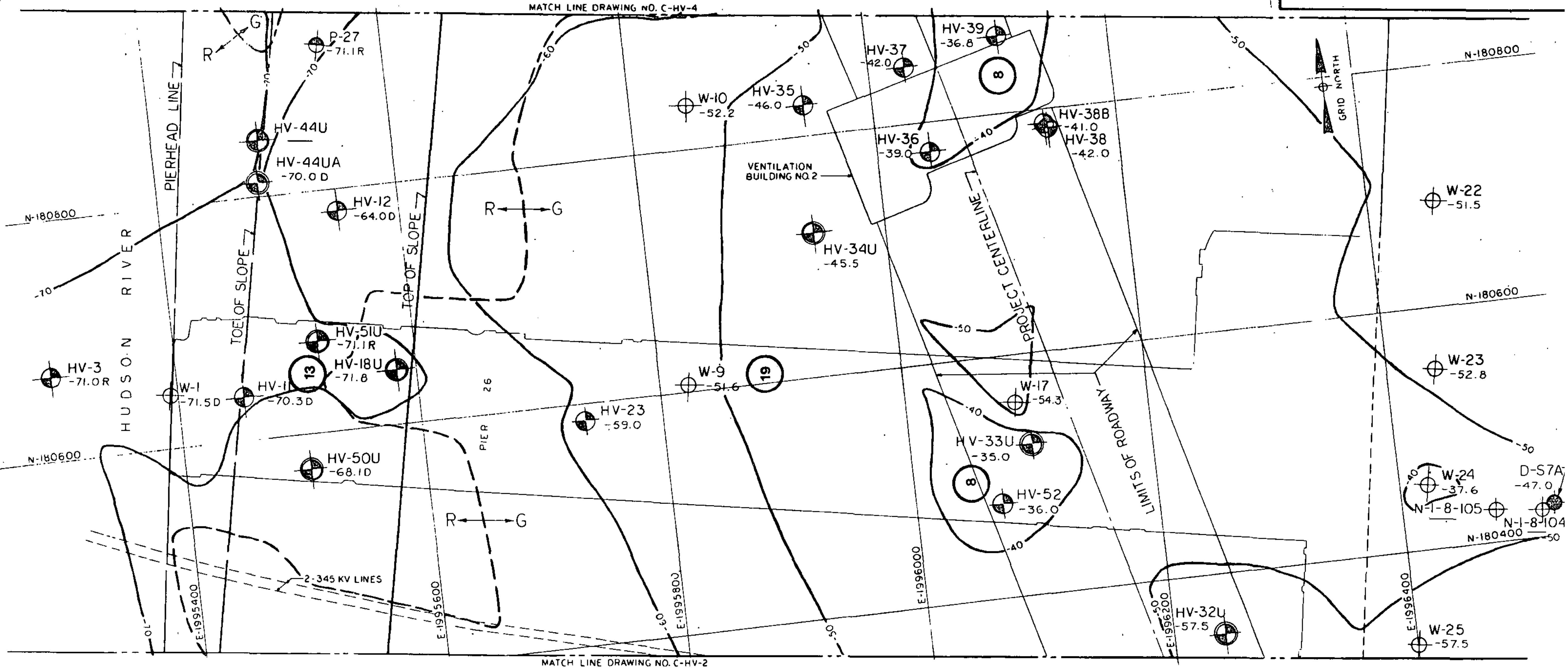
SHEET No. 2-HARRISON ST. TO VESTRY ST.

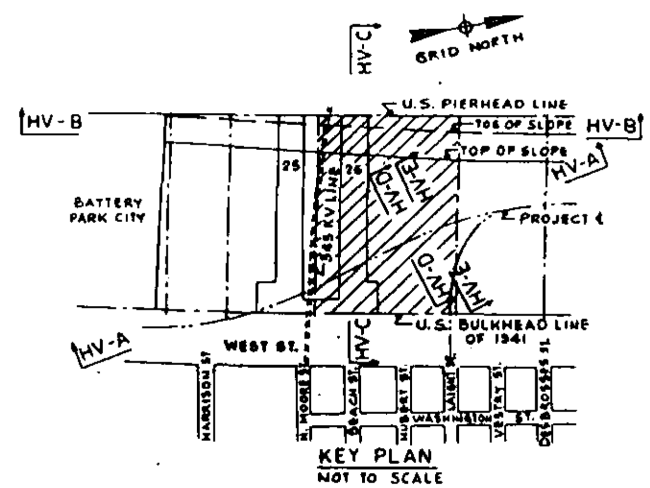
DRAWING NO.	DATE	SCALE	SHEET NO.
C-HV-2		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESIMONE
WOODWARD—CLYDE CONSULTANTS, INC.

FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I - 478 - 1 ( ) 17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL





KEY PLAN
NOT TO SCALE

FOR NOTES AND LEGEND SEE DWG. NO. C-HV-1

GRAPHIC SCALE
0 40' 80' 120'

FIGURE A10.

-A50-

SHEET 7 OF 18 FIGURE NO. 3.20

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF GLACIAL GRANULAR SOIL SURFACE

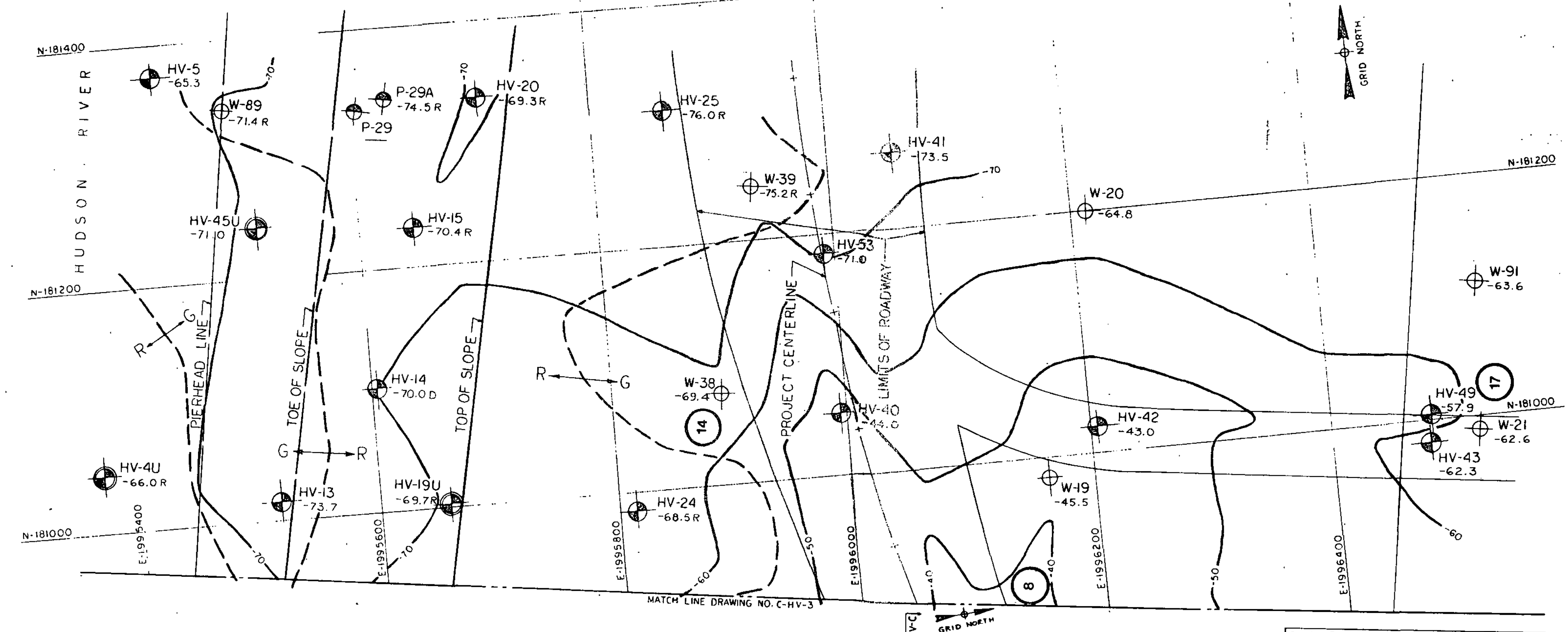
SHEET No. 3-HARRISON ST. TO VESTRY ST.

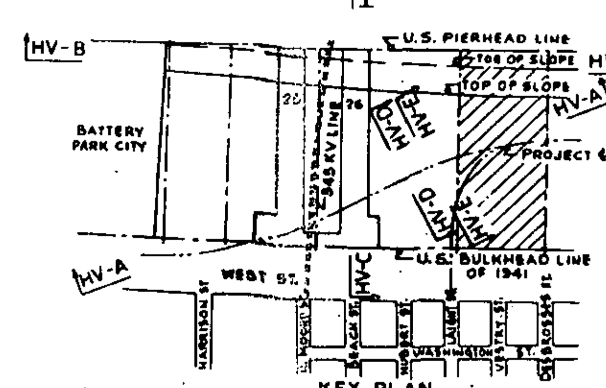
DRAWING NO.	DATE	SCALE	SHEET NO.
C-HV-3		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESIMONE
WOODWARD-CLYDE CONSULTANTS, INC.

FED ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I-478-1( )17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL





KEY PLAN
NOT TO SCALE

FOR NOTES AND LEGEND SEE DWG. NO. C-HV-1

GRAPHIC SCALE
0 40' 80' 120'

FIGURE A10.

-A51-

SHEET 8 OF 18 FIGURE NO. 3.21

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF GLACIAL GRANULAR SOIL SURFACE

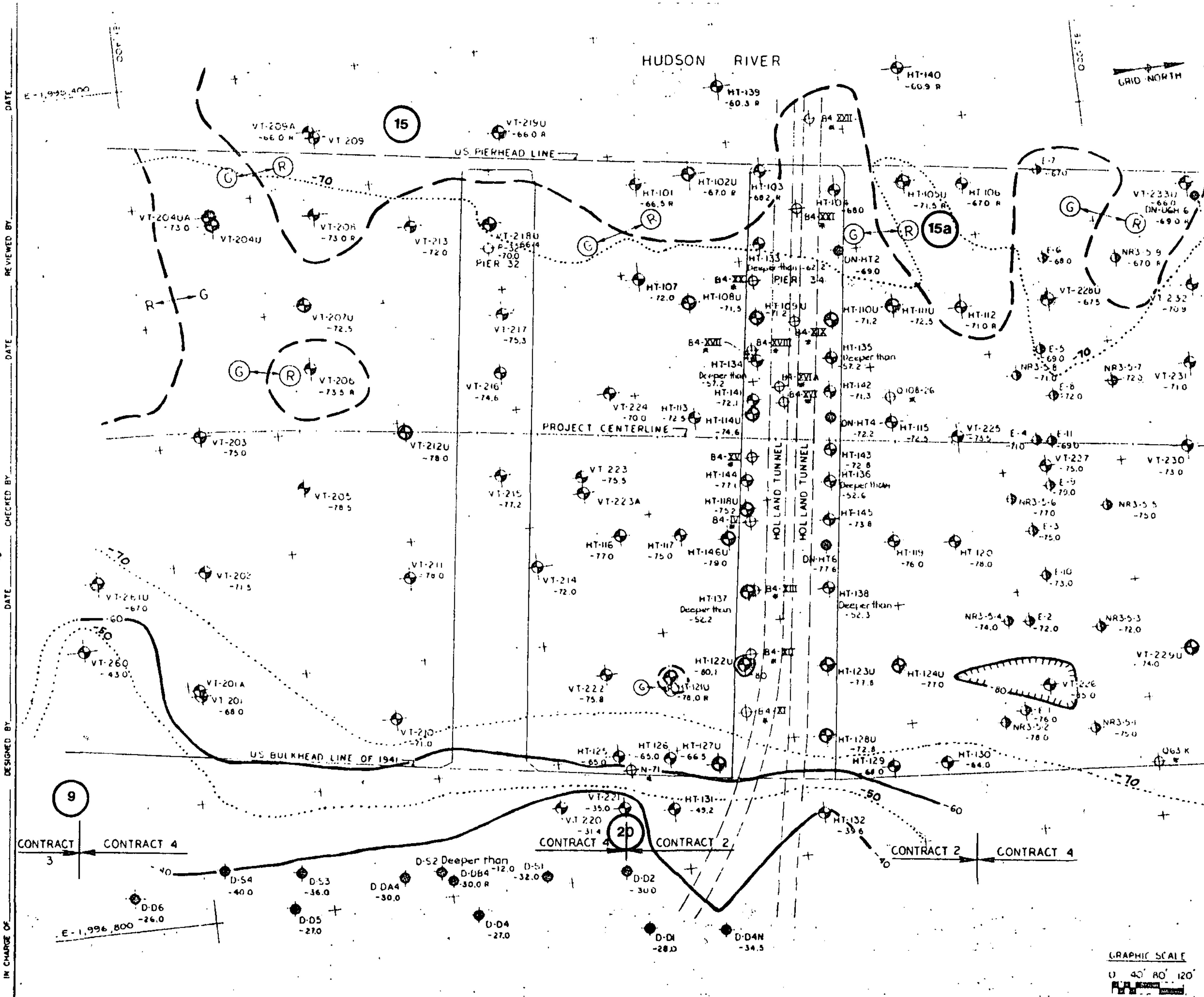
SHEET No.4-HARRISON ST. TO VESTRY ST.

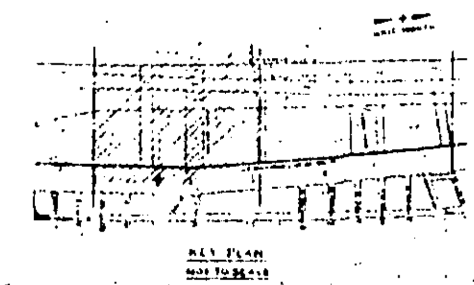
DRAWING NO.	DATE	SCALE	SHEET NO.
C-HV-4		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESMOND
WOODWARD-CLYDE CONSULTANTS, INC.

FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I - 478 - 1 ( ) 17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL





NOTES:

1. For General Notes see Fig. No. 3.14
2. Contours shown are linear interpolations between borings and may not represent actual subsurface conditions.
3. When borings did not encounter compact granular soil of stratum S-1 or G, the surface of decomposed rock or bedrock has been used to provide a continuous contour of the surface of relatively non-compressible material.

LEGEND:

Borings made in 1979 through 1981; A: Elevation top of compact granular soil.
D: Granular soil not encountered, top of decomposed rock shown.
R: Granular soil not encountered, top of bedrock shown.
- Previously made borings providing reliable detailed information. DN-series made by Warren-George, Inc. in 1977 under the inspection of the DEPARTMENT during Boring Contract No. 1.
Previously made borings providing information of moderate detail or reliability.
Previously made borings providing limited information
- Insufficient information available to determine compact granular soil surface
— — — Limit of compact granular soil.
(S-1) or (G) - Indicates area where compact granular soil is anticipated.
(R) - Indicates area where no compact granular soil was encountered over rock.

FIGURE A10.

-A52-

SHEET 9 OF 18 FIGURE NO. 3.15

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

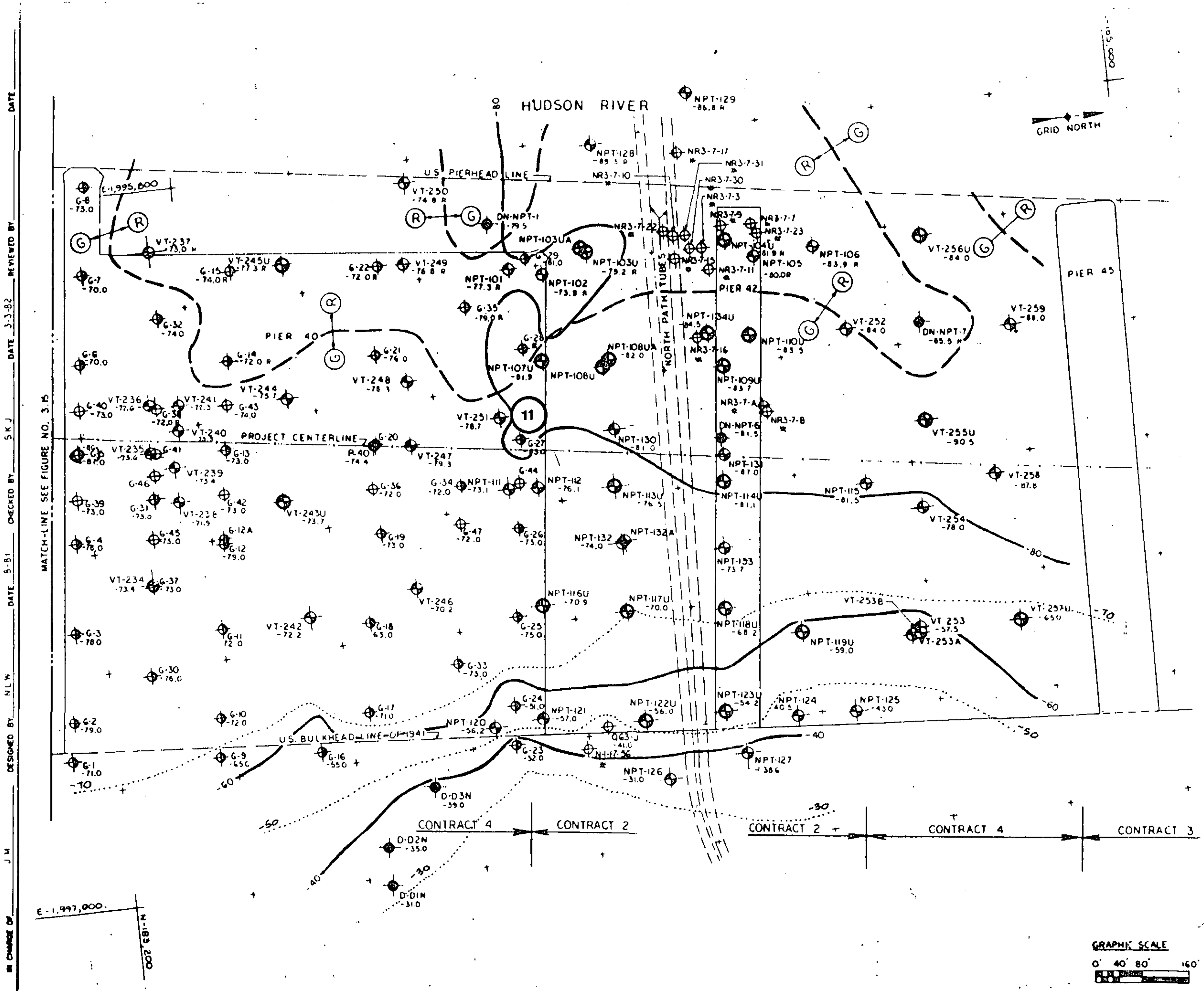
CONTOURS OF COMPACT GRANULAR SOIL SURFACE – SHEET NO. 1
VESTRY ST. TO WEST 10th ST.

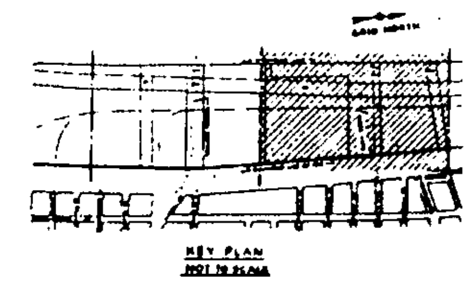
DRAWING NO.	DATE	SCALE	SHEET NO.
C-VT-1		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESIMONE
WOODWARD - CLYDE CONSULTANTS, INC.

FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I-478-1( )17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL





For Notes and Legend see Figure No. 3.15, contained in the Soils Report - Boring Contract No. 4. See also Fig. No. 2.3 revised.

DATE	BY	REVISION
8-9-82	SK	ADDED BORINGS NOS. VT-234, VT-235, VT-236, VT-238, VT-239, VT-240 & VT-241. REVISED CONTOURS.

FIGURE A10.

-A53-

SHEET 10 OF 18 FIGURE NO. 3.16

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF COMPACT GRANULAR SOIL SURFACE – SHEET NO. 2

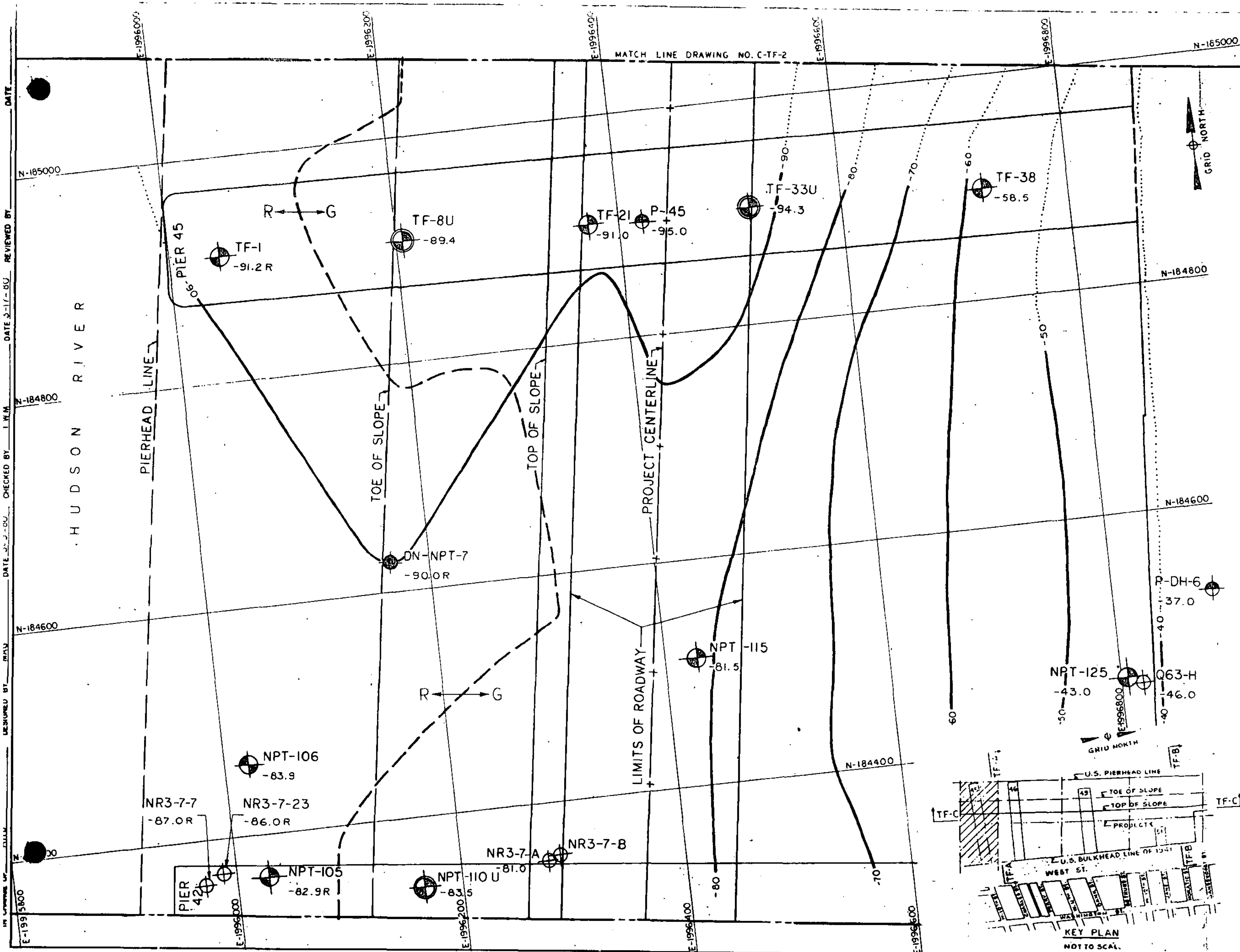
VESTRY ST. TO WEST 10th. ST.

DRAWING NO.	DATE	SCALE	SHEET NO.
C-VT-2		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESMOND
WOODWARD – CLYDE CONSULTANTS, INC.

FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I-478-1( )17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL



NOTES:

1. For notes see Dwg. No. B-TF-1.
2. Contours shown are interpolations between borings and may not represent actual subsurface conditions.
3. Where borings did not encounter glacial granular soil the surface of decomposed rock or bedrock has been used to provide a continuous contour of the surface of relatively non-compressible material.

LEGEND:

- Borings made in 1979 or 1980.
  - A: Elevation top of granular soil.
  - D: Glacial granular soil not encountered, top of decomposed rock shown.
  - R: Glacial granular soil not encountered, top of bedrock shown.
- Previously made borings providing reliable detailed information. DN series made by Warren George, Inc. in 1977 under the inspection of the DEPARTMENT during Boring Contract No. 1.
- Previously made borings providing information of moderate detail or reliability.
- Previously made borings providing limited information.
- Limit of glacial granular soil.
- (G) - Indicates area where glacial granular soil is anticipated.
- (R) - Indicates area where no glacial granular soil was encountered over rock.

GRAPHIC SCALE
0 40' 80' 120'

FIGURE A10.

-A54-

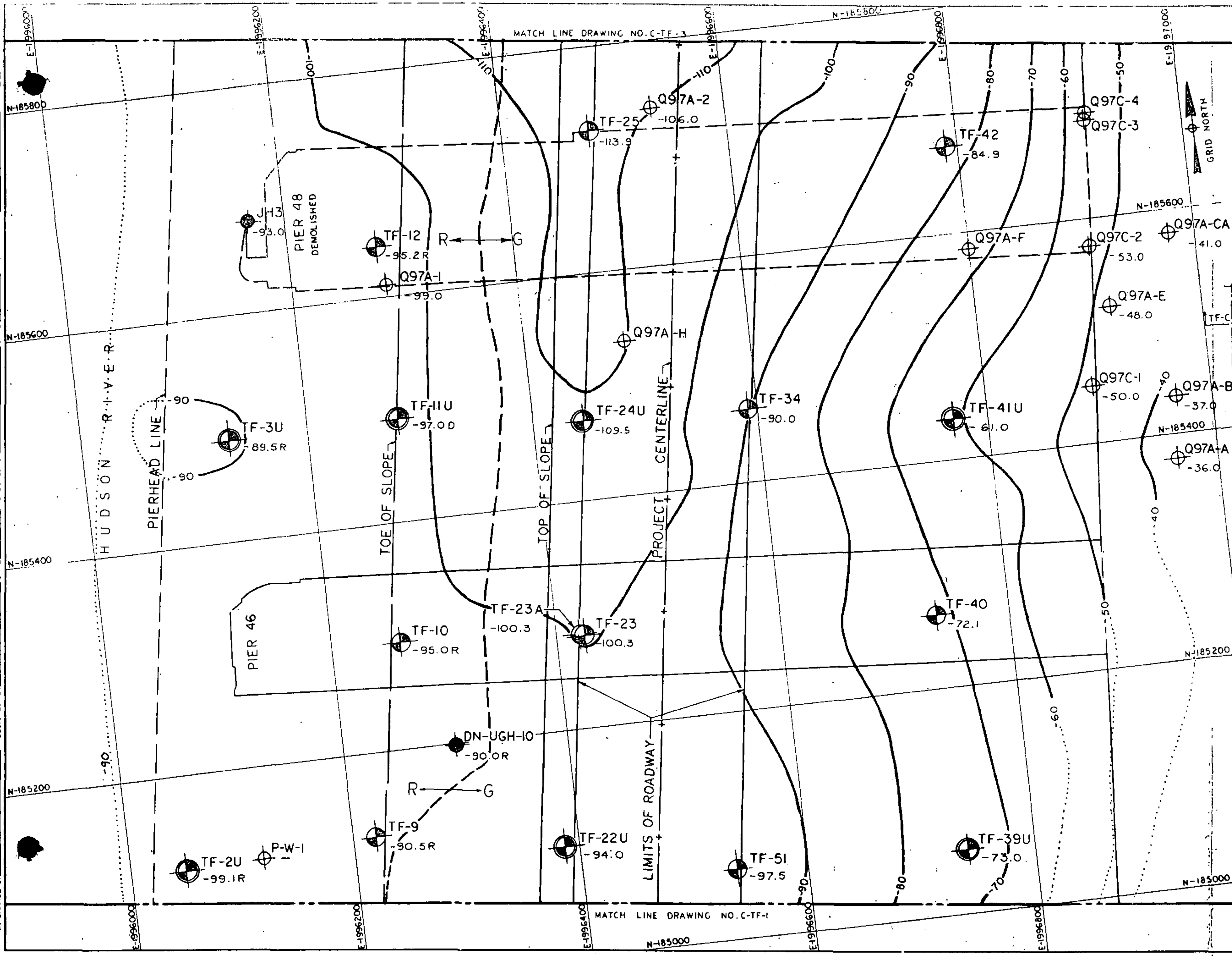
SHEET 11 OF 18 FIGURE NO. 3.10

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF GLACIAL GRANULAR SOIL SURFACE
SHEET No. 1 - TEST FILL AREA

DRAWING NO.	DATE	SCALE	SHEET NO.
C-TF-1		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESMONE /
WOODWARD - CLYDE CONSULTANTS, INC.



FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
I	N.Y.	I-478-1( )17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL

FIGURE A10.

-A55-

SHEET 12 OF 18 FIGURE NO. 3.11

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

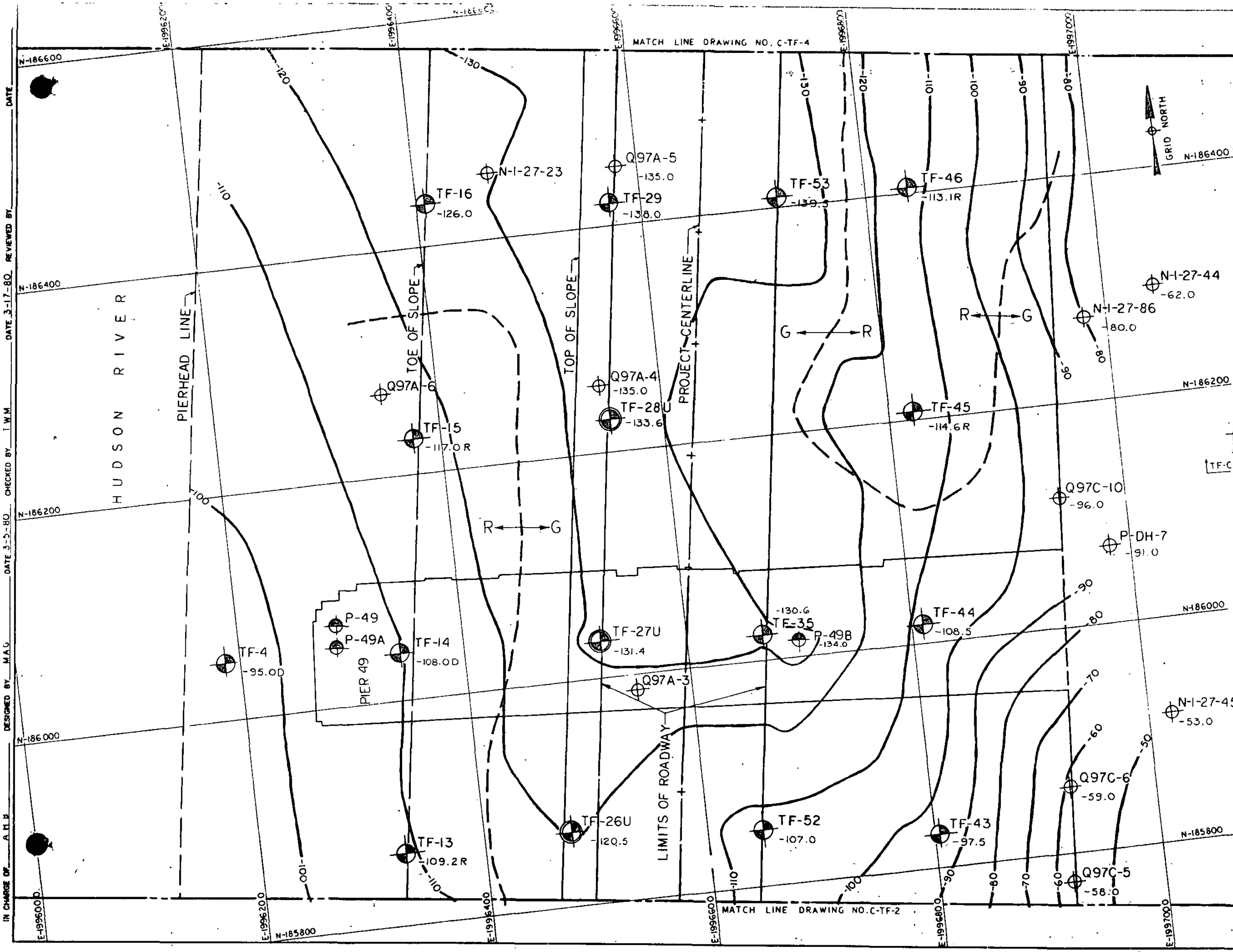
CONTOURS OF GLACIAL GRANULAR SOIL SURFACE
SHEET No. 2 - TEST FILL AREA

DRAWING NO.	DATE	SCALE	SHEET NO.
C-TF-2		GRAPHIC	

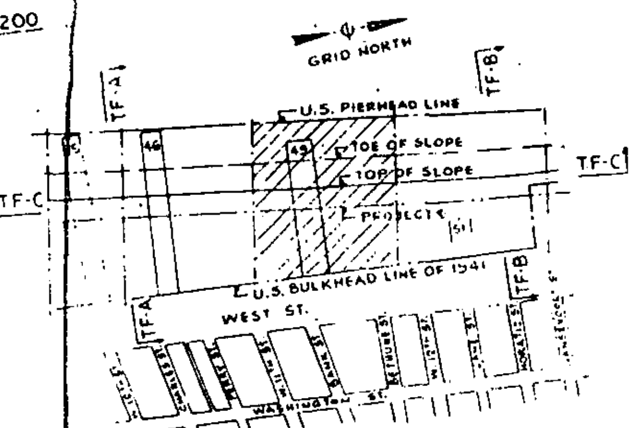
MUESER · RUTLEDGE · JOHNSTON & DESIMONE
WOODWARD-CLYDE CONSULTANTS, INC.

FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I - 478 - 1 ( ) 17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL



FOR NOTES AND LEGEND SEE DWG. NO. C-TF-1



KEY PLAN
NOT TO SCALE

GRAPHIC SCALE
0 40' 80' 120'

FIGURE A10.

-A56-

SHEET 13 OF 18 FIGURE NO. 3.12

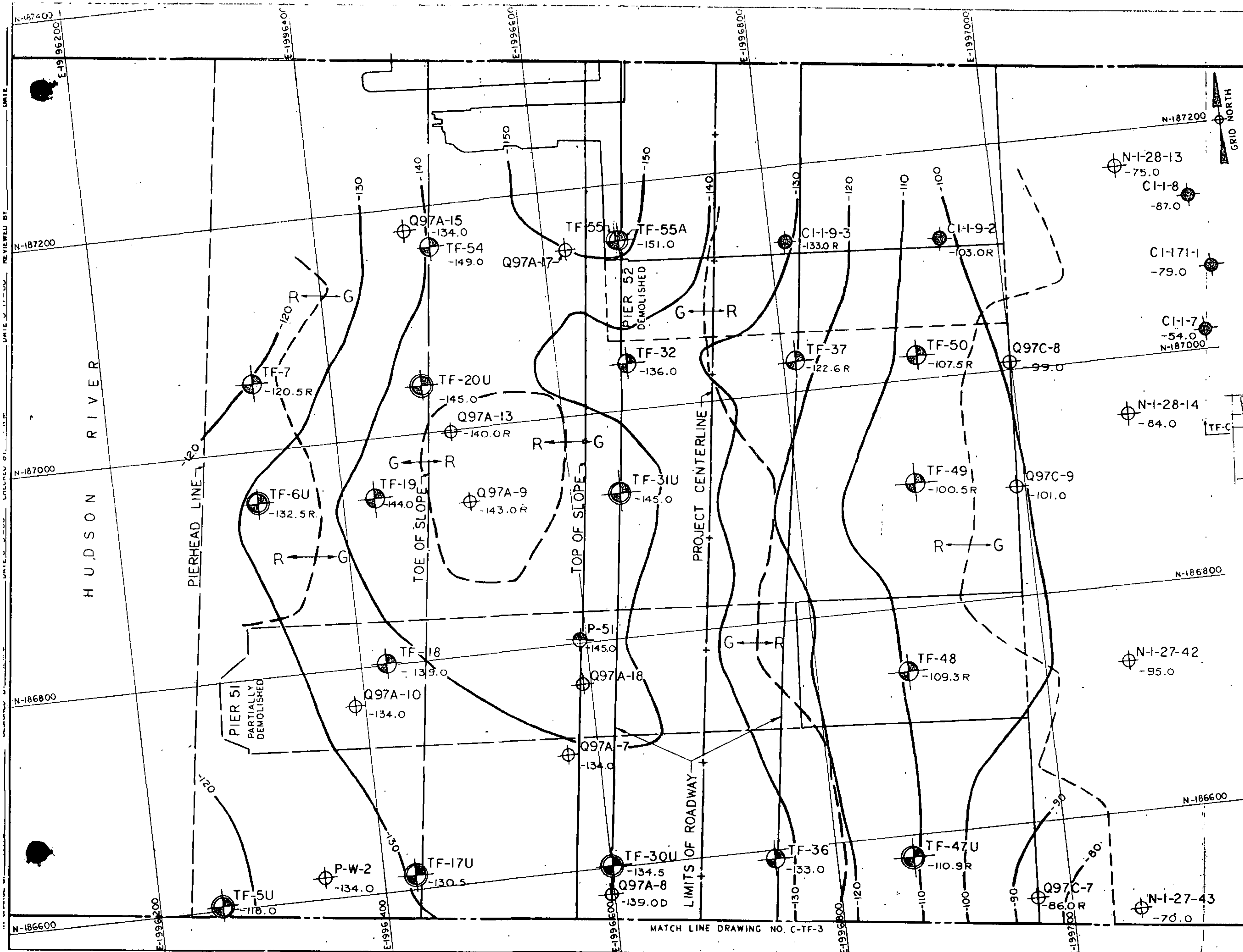
INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF GLACIAL GRANULAR SOIL SURFACE
SHEET No.3 – TEST FILL AREA

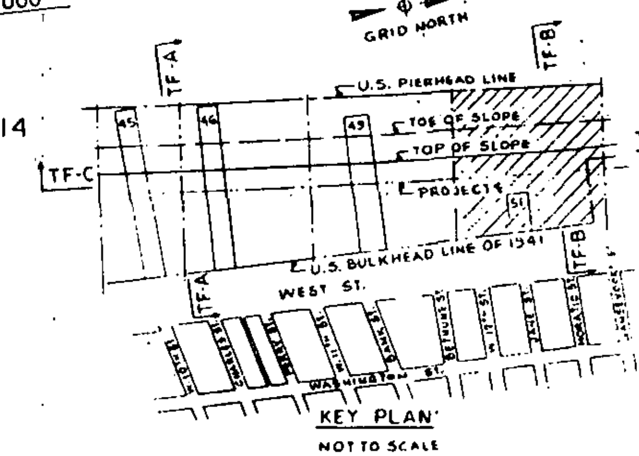
DRAWING NO.	DATE	SCALE	SHEET NO.
C-TF-3		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESIMONE
WOODWARD–CLYDE CONSULTANTS, INC.

DESIGNED BY MAG DATE 3-5-80 CHECKED BY IWM DATE 3-17-80 REVIEWED BY IN CHARGE OF AHB



FOR NOTES AND LEGEND SEE DWG. NO. C-TF-1



GRAPHIC SCALE
0 40' 80' 120'

FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I-478-1( )17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL

FIGURE A10.

-A57-

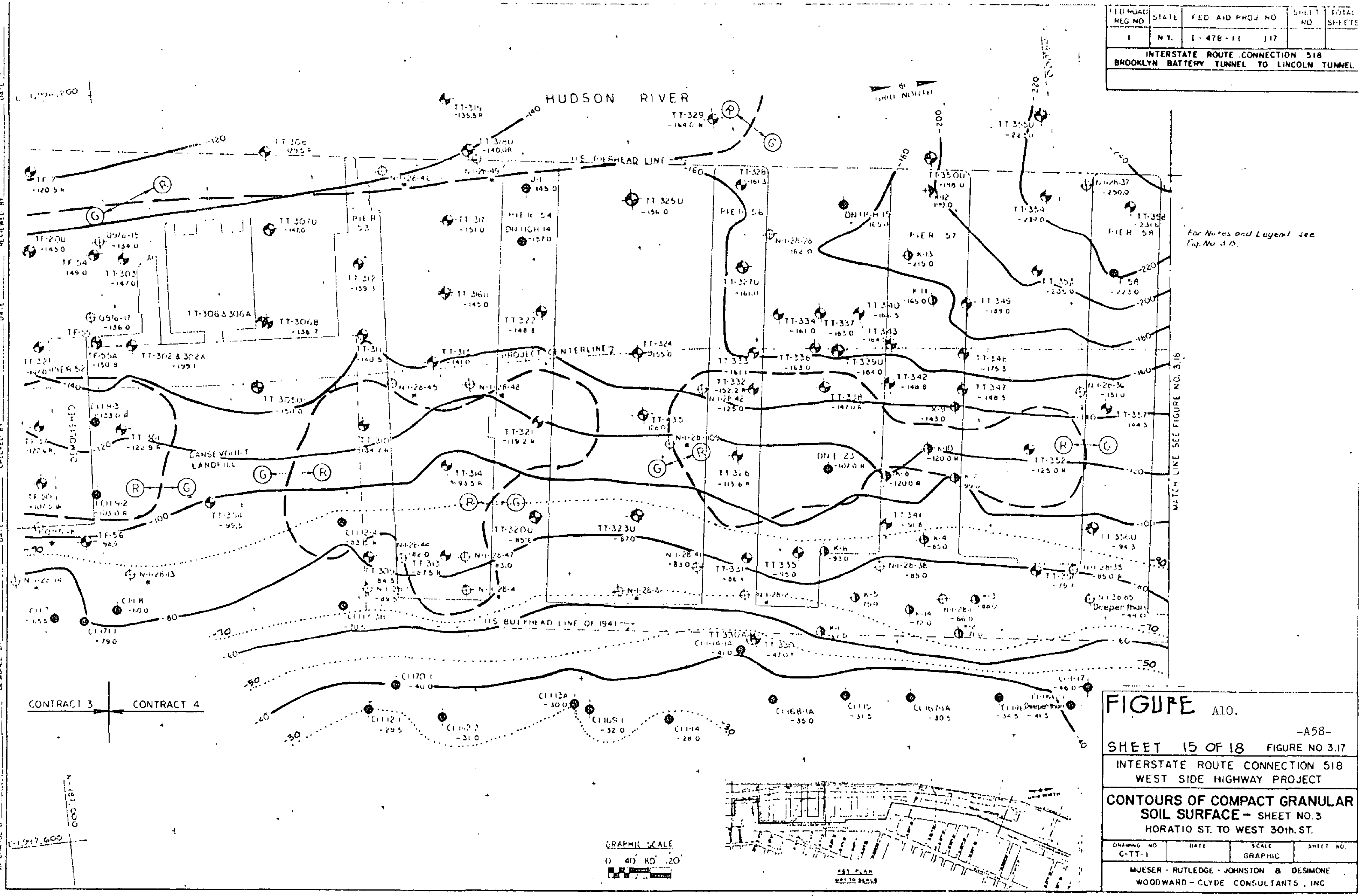
SHEET 14 OF 18 FIGURE NO. 3.13

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF GLACIAL GRANULAR SOIL SURFACE
SHEET No. 4 - TEST FILL AREA

DRAWING NO.	DATE	SCALE	SHEET NO.
C-TF-4		GRAPHIC	

MUESER · RUTLEDGE · JOHNSTON & DESMONE
WOODWARD-CLYDE CONSULTANTS, INC.



FED ROAD REG NO | STATE | FED AID PROJ NO | SHEET NO | TOTAL SHEETS
1 | N.Y. | I - 478 - 1( ) 117
INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL
HUDSON RIVER
GRID NORTH
U.S. PIERHEAD LINE
PIER 53
PIER 54
PIER 56
PIER 57
PIER 58
PIER 52
PROJECT CENTERLINE
GANSEVOORT LANDFILL
DEMOLISHED
U.S. BULKHEAD LINE OF 1941
For Notes and Legend see Fig. No 3.15.
MATCH LINE SEE FIGURE NO. 3.16
CONTRACT 3
CONTRACT 4
GRAPHIC SCALE
0 40 80 120
KEY PLAN
NOT TO SCALE
FIGURE A10.
-A58-
SHEET 15 OF 18
FIGURE NO 3.17
INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT
CONTOURS OF COMPACT GRANULAR SOIL SURFACE - SHEET NO. 3
HORATIO ST. TO WEST 30th. ST.
DRAWING NO | DATE | SCALE | SHEET NO.
C-TT-1 | | GRAPHIC |
MUESER · RUTLEDGE · JOHNSTON & DESIMONE
WOODWARD - CLYDE CONSULTANTS, INC

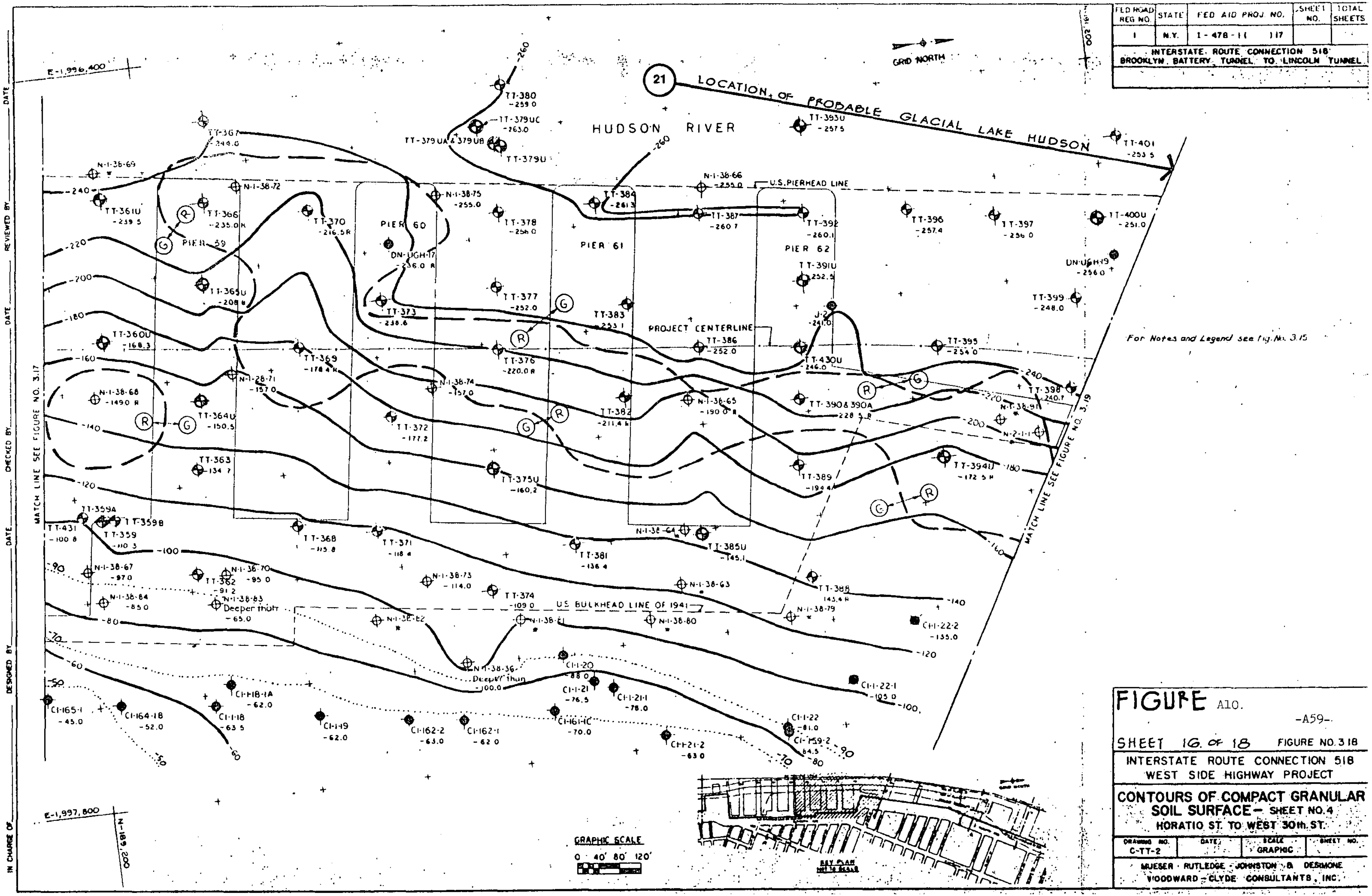


FIGURE A10.

-A59-

FED. ROAD REG. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.	I - 478 - 1 ( ) 17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL

For Notes and Legend see Figure No. 3.15.

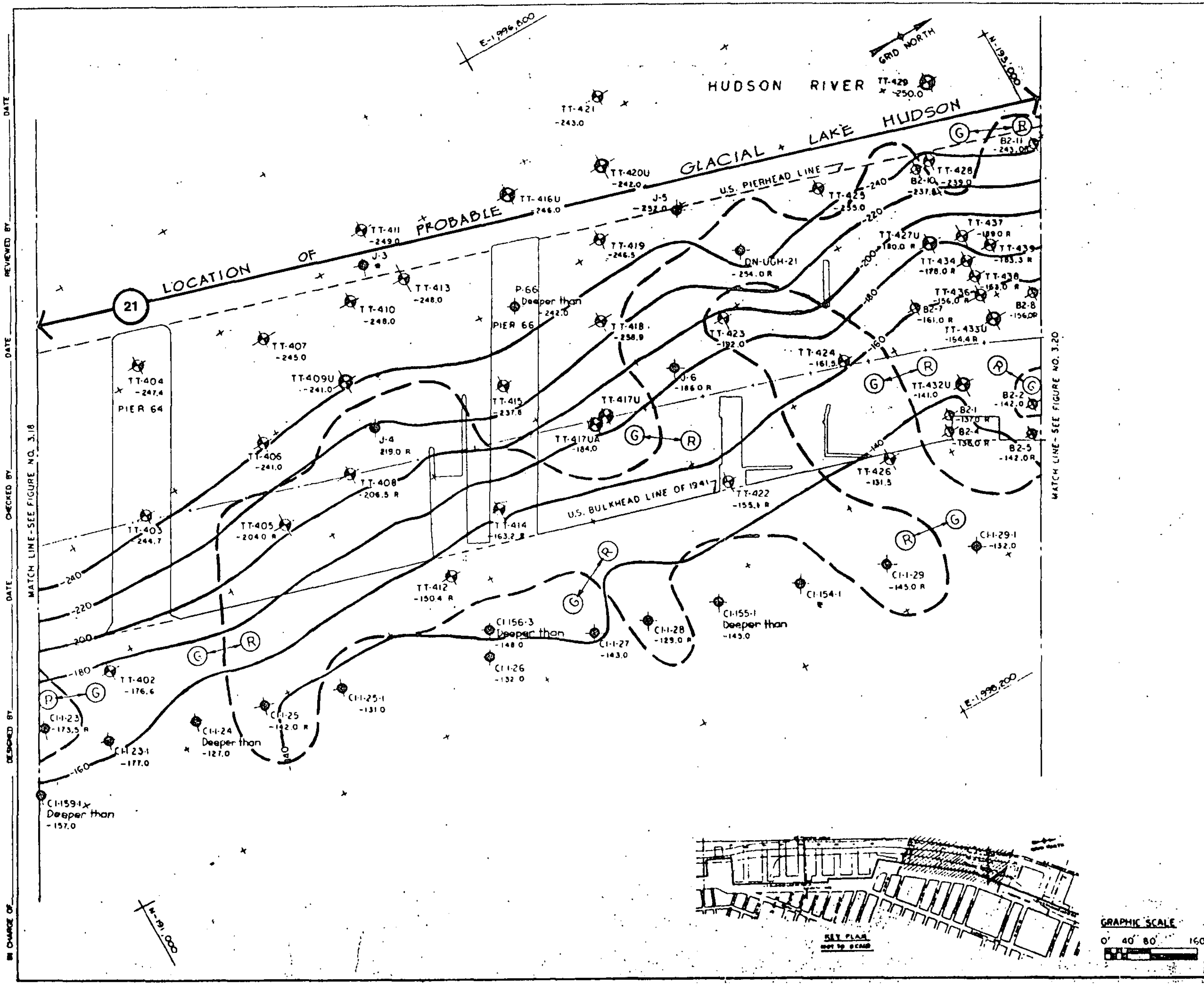


FIGURE A10.

-A60-

SHEET 17 OF 18 FIGURE NO. 3.19

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF COMPACT GRANULAR SOIL SURFACE — SHEET NO. 5
HORATIO ST. TO WEST 30th ST.

DRAWING NO.	DATE	SCALE	SHEET NO.
C-TT-5		GRAPHIC	

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FED. ROAD REG. NO	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
I	N.Y.	I - 478 - 1 ( ) 17		

INTERSTATE ROUTE CONNECTION 518
BROOKLYN BATTERY TUNNEL TO LINCOLN TUNNEL

For Notes and Legend see Figure No. 3.15.

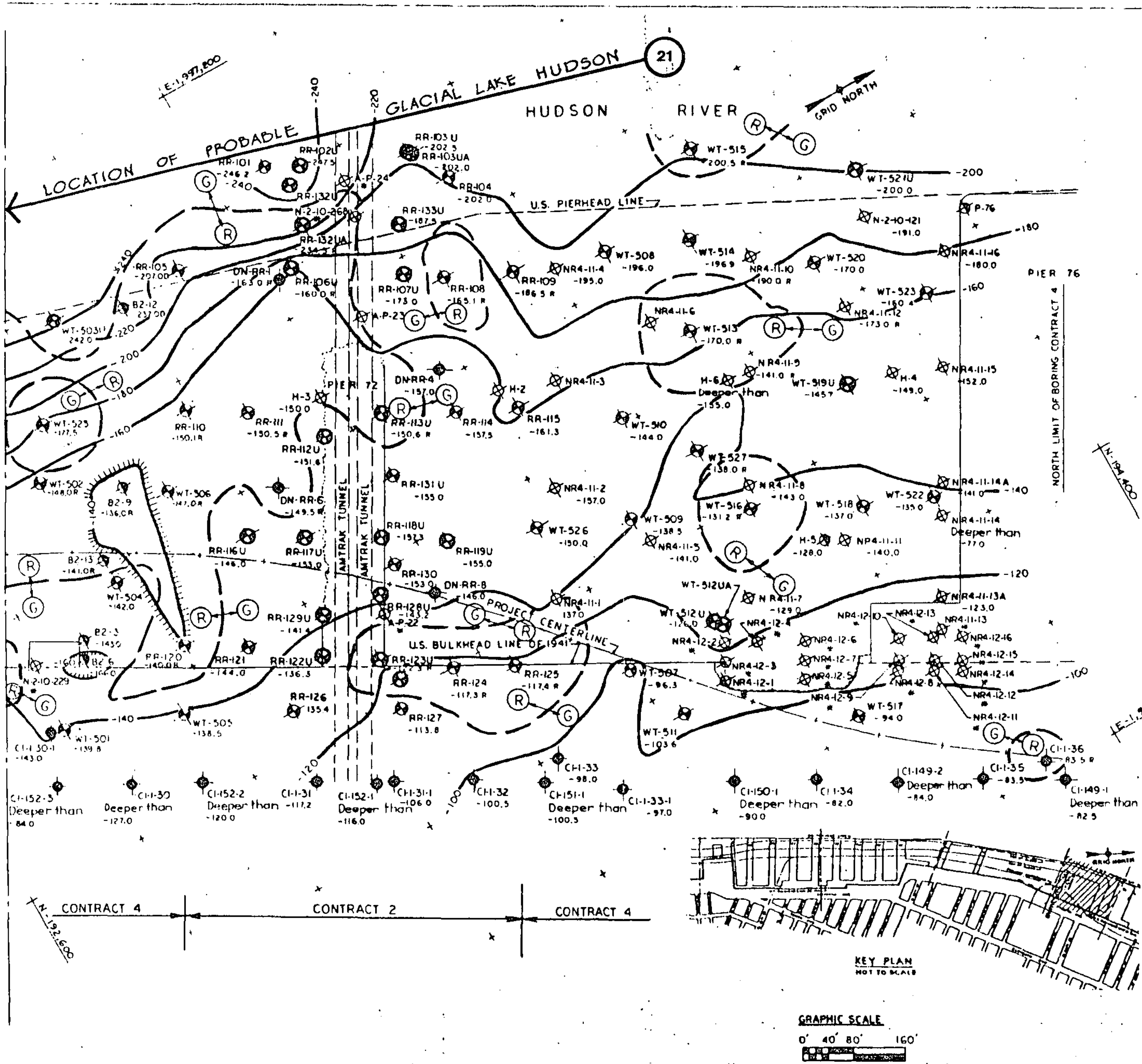

FIGURE A10.

-A61-

SHEET 18 OF 18

FIGURE NO. 3.20

INTERSTATE ROUTE CONNECTION 518
WEST SIDE HIGHWAY PROJECT

CONTOURS OF COMPACT GRANULAR SOIL SURFACE — SHEET NO. 6
WEST 30th. ST. TO WEST 35th. ST.

DRAWING NO.	DATE	SCALE	SHEET NO.
C-WT-1		GRAPHIC	

MUESER, RUTLEDGE, JOHNSTON & DESIMONE
WOODWARD-CLYDE CONSULTANTS, INC.

IN CHARGE OF — DESIGNED BY — DATE — CHECKED BY — DATE — REVIEWED BY — DATE

D. APPENDIX IV. FLOTATION OF SELECTED SOIL SAMPLES

The following is a summary of the procedures and data involved in the flotation analysis of a series of soil samples from engineering borings taken for the Westway Project. Seven of eleven samples (HV35, Sample 7, Bag 2; HV36, Sample 5, Bag 2; HV37, Sample 6; HV39, Sample 4, Bag 1; HV55, Sample 10; HV53, Sample 9; and VT220, Sample 6) underwent flotation and microscopic sorting. Five of these seven (HV35, Sample 7, Bag 2; HV36, Sample 5, Bag 2; HV37, Sample 6; HV39, Sample 4, Bag 1; HV 55, Sample 10) were derived from deposits that were potentially sensitive in terms of the presence of cultural materials. The remaining two of the seven floated samples (HV53, Sample 9; and VT220, Sample 6) did not represent these deposits and were used as control samples. The bulk weight of these samples ranged in size from 24.42 to 374.53 grams. Prior to flotation, one 15- and six 50-gram subsamples were removed from the total bulk of seven of the samples in the event that further soil chemistry analysis might be desired. These subsamples were also scanned under a binocular microscope, but were not floated.

The remaining four of the eleven samples (HV35, Sample 7, Bag 1; HV37, Sample 7; HV39, Sample 4, Bag 2; and WT502, Sample 15) also represent other than the potentially sensitive deposits and were analyzed as additional control samples. These samples, each weighing 50 grams, did not undergo flotation but were looked at microscopically, after which they were retained, along with the subsamples previously described, for further possible soil chemistry analysis.

The method of water flotation developed by Struever (1968) for use in laboratories was used in the processing of the seven samples that were floated. The material within each sample recovered after flotation was then separated into four size categories. This process was accomplished by sieving the floated material through a 2-millimeter screen, a 1-millimeter screen, and a 500-micron screen. The fourth and last size category was for residue material less than 500 microns in size. Each size category, as well as each of the additional four 50-gram control samples, was examined and hand sorted under low-power (10X) magnification. All seed and faunal material was collected, and the quantities present were recorded (see Table A6). The size category of smaller than 500 microns was considered residue (Asch and Asch 1980) and was not sorted or recorded quantitatively. This size category consisted of decayed organic debris and sand particles and, in some instances, it produced nothing at all.

Table A6 shows that the presence of seeds, bones, charcoal, and, except for one control sample, coal is restricted to the samples from the potentially sensitive deposits. The samples from this area also display much heavier concentrations of shell when compared with the control samples. The exact species of shellfish could not be determined; however, clam shell fragments seemed to be the predominant shell form present. The presence of the bone, charcoal, coal, and, especially, the seeds in the samples from the potentially sensitive deposits, together with the heavier shell concentrations, seem to differentiate this area from other areas tested by the borings. However, the amount of material recovered from the floated samples is too small to make any precise determinations as to its significance. (See Tables A6 and A7 for compilations of data.)

TABLE A6. ANALYSIS OF SELECTED SOIL SAMPLES*

Sample	Bulk Weight	Soil Subsample Weight	Total Wt. of Floated Materials	Total Wt. of Heavy Fraction	Seeds (No.)	Bone (Wt.)	Charcoal (Wt.)	Coal (Wt.)
SAMPLES FROM POTENTIALLY SENSITIVE DEPOSITS								
HV35, Sample 7, Bag 2	159.66	50	0.08	109.58	1	0	0.01	0.01
HV37, Sample 6	374.53	50	1.03	323.50	3	0.21	0	0.04
HV36, Sample 5, Bag 2	24.42	15	0.12	9.42	0	0	0.04	0
HV39, Sample 4, Bag 1	282.43	50	0.33	232.1	4	0.01	0	0.06
HV55, Sample 10	202.44	50	1.44	151	3	<0.01	0	0.01
CONTROL SAMPLES								
HV53, Sample 9	97.1	50	0.5	46.6	0	0	0	<0.01
VT220, Sample 6	65.7	50	0.7	15.0	0	0	0	0
HV35, Sample 7, Bag 1	50	+	@	@	0	0	0	0

* All weights are in grams.

\+ Bulk sample and soil subsample are the same sample, 50 g. being the total bulk weight used for microscopic sorting and for future soil chemistry analysis.

@ Sample not floated; no floated or heavy fraction produced.

Sample	Bulk Weight	Soil Subsample Weight	Total Wt. of Floated Materials	Total Wt. of Heavy Fraction	Seeds (No.)	Bone (Wt.)	Charcoal (Wt.)	Coal (Wt.)
HV37, Sample 7	50	+	@	@	0	0	0	0
HV39, Sample 4, Bag 2	50	+	@	@	0	0	0	0
WT502, Sample 15	50	+	@	@	0	0	0	0

\+ Bulk sample and soil subsample are the same sample, 50 g. being the total bulk weight used for microscopic sorting and for future soil chemistry analysis.

@ Sample not floated; no floated or heavy fraction produced.

TABLE A7. ANALYSIS OF SELECTED SOIL SAMPLES

Samples	Munsell Soil Color	Sample Depth (Ft.)	Comments
SAMPLES FROM POTENTIALLY CULTURALLY SENSITIVE DEPOSITS			
HV35, Sample 7, Bag 2	5y 6/1 (Light gray-gray, dry)	44-46	Heavy shell concentrations; stone chips present.
HV37, Sample 6	2.5y 6/2 (Light brownish gray, dry)	39-41	Heavy shell concentrations; quartz chips present.
HV36, Sample 5, Bag 2	2.5y 5/2 (Grayish-brown, dry)	36-38	Light shell concentrations; quartz chips present.
HV39, Sample 4, Bag 1	5y 5/2 (Olive gray, dry)	35-37	Heavy shell concentrations; quartz chips present.
HV55, Sample 10	2.5y 6/2 (Light brownish gray, dry)	44-46	Light shell and mica concentrations; quartz chips present.
CONTROL SAMPLES			
HV53, Sample 9	5y 6/1 (Light gray-gray, dry) with inclusions of 5y 8/2 (Pale yellow, dry)	64.5-66.5	Little to no shell present; dressed wood present.
VT220, Sample 6	5y 6/1 (Light gray-gray, dry)	40-42	Small wood particles present.
HV35, Sample 7, Bag 1	5y 5/1 (Olive gray, dry)	44-46	Heavy shell concentrations; light mica concentrations; quartz chips present.
HV37, Sample 7	10yr 6/6 (Brownish yellow, dry)	44-46	No shell present; light mica concentrations; quartz chips present.

Samples	Munsell Soil Color	Sample Depth (Ft.)	Comments
HV39, Sample 4, Bag 2	10r 5/3 (Weak red, dry)	?	No shell, mica, or quartz present.
WT502, Sample 15	5y 6/1 (Light gray-gray, dry)	?	Very light shell concentrations.

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