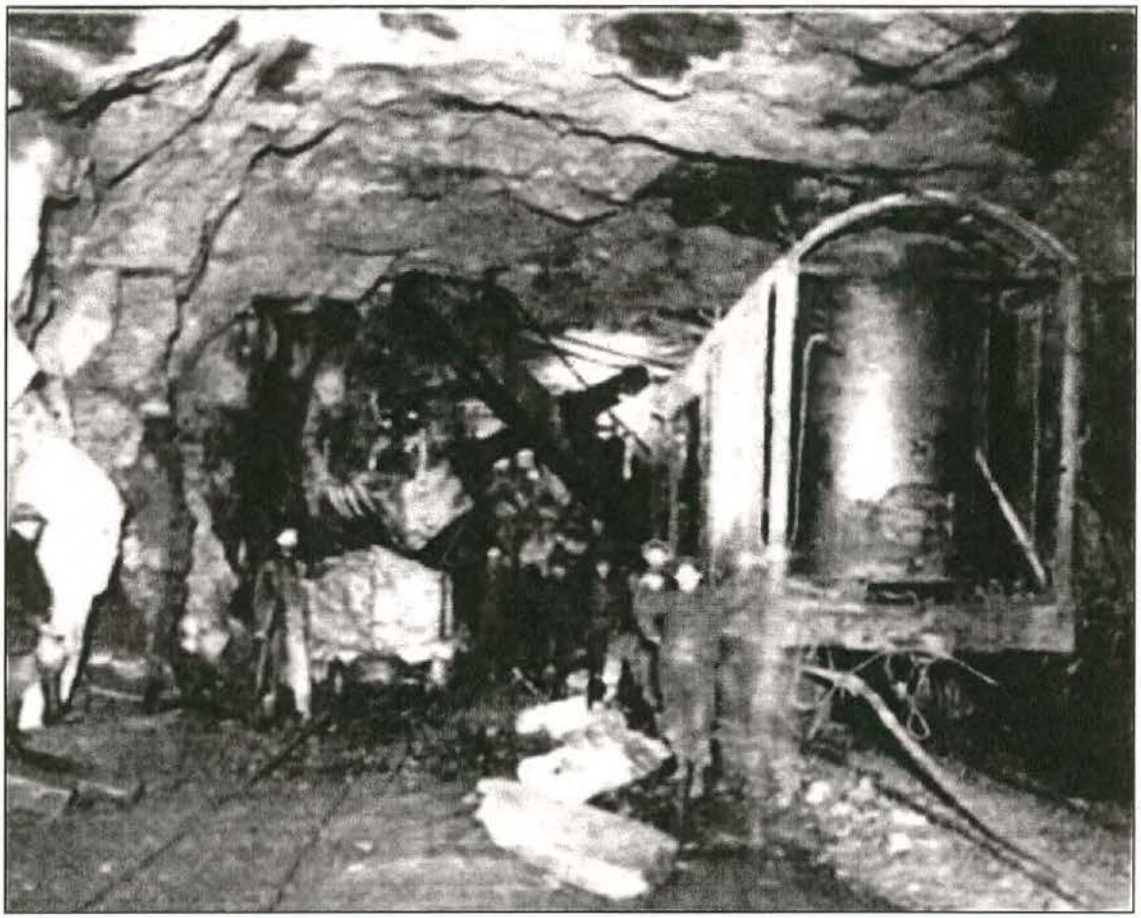

Figure 16 **Air Operated Steam Shovel Used in Cross-Town Tunnel** (The New York Tunnel Extension: Description of the Work and Facilities Vol. II, No.1158, Plate LIX, Fig. 1.)

PROJECT	AMTRAK Fire and Life Safety SCADA Replacement and Upgrading	FIGURE NO. 16	
SCALE	N/A	URS	PROJECT NO. PRJ29112351
SOURCE	See Above		ATTACHMENT 5

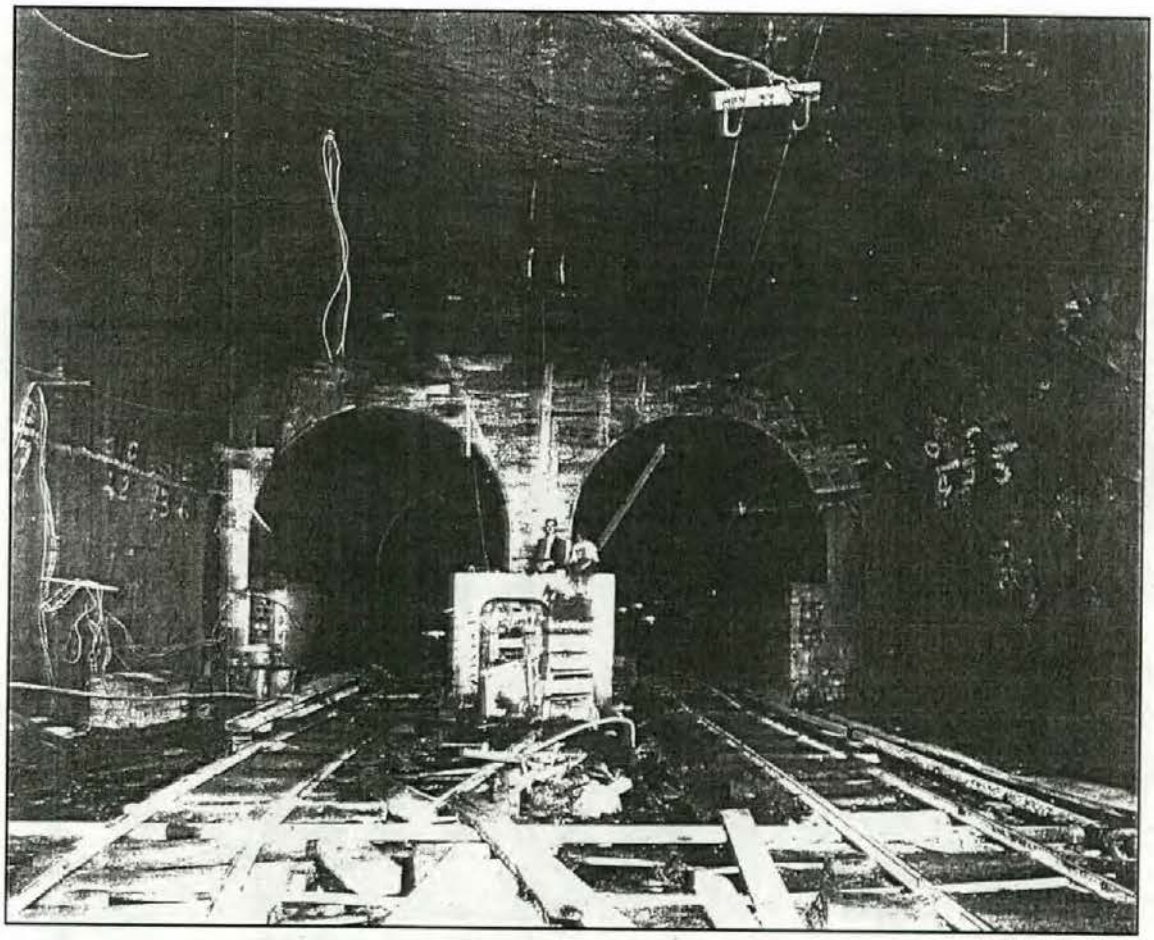

Figure 17 33rd Street Intermediate Shaft -Twin Tunnel - Showing Section of Telephone Chambers, August 19th 1908 (The Smithsonian Institution, National Museum of American History, Archives Center - Catalog # 80.0032.0000 - Photo 2324.)

PROJECT	AMTRAK Fire and Life Safety SCADA Replacement and Upgrading	FIGURE NO. 17	
SCALE	N/A	URS	PROJECT NO. PRJ29112351
SOURCE	See Above		ATTACHMENT 5

Figure 18 **Front Street Long Island, "D" Line - Group of Workmen at Back of Trailing Platform Where Tunnels Meet, February 21th 1908** (The Smithsonian Institution, National Museum of American History, Archives Center - Catalog # 80.0032.0000 - Photo 2077.)

PROJECT	AMTRAK Fire and Life Safety SCADA Replacement and Upgrading	FIGURE NO. 18	
SCALE	N/A	URS	PROJECT NO. PRJ29112351
SOURCE	See Above		ATTACHMENT 5

Figure 19 **Pennsylvania Station Service Building c. 1910** (Historic American Building Survey - HABS No. NY-5417-A.)

PROJECT	AMTRAK Fire and Life Safety SCADA Replacement and Upgrading	FIGURE NO. 19	
SCALE	N/A	URS	PROJECT NO. PRJ29112351
SOURCE	See Above		ATTACHMENT 5

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

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

RESOURCE EVALUATION

DATE: 2/20/04 STAFF: Kathy Howe

PROPERTY: The High Line MCD: Manhattan

ADDRESS: vicinity of Tenth Ave. from Gansevoort St. to W. 34th St. COUNTY: New York Co.

PROJECT REF: 03PR00864 USN: 06101.014509

I. ☐ Property is individually listed on SR/NR:
name of listing:

☐ Property is a contributing component of a SR/NR district:
name of district:

II. ☒ Property meets eligibility criteria.

☐ Property contributes to a district which appears to meet eligibility criteria.

Pre SRB: ☐ Post SRB: ☐ SRB date

Criteria for Inclusion in the National Register:

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

B. ☐ Associated with the lives of persons significant in our past;

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

D. ☐ Have yielded, or may be likely to yield information important in prehistory or history.

STATEMENT OF SIGNIFICANCE:

Completed by the New York Central Railroad in 1934 to replace its on-grade Tenth Avenue tracks, the High Line was a key component of the Lower West Side's unparalleled commercial transportation advantages. The 1.45-mile steel and concrete viaduct, abandoned since 1980, is located almost 30 feet above grade and today runs from Gansevoort Street to West 34th Street, roughly parallel to Tenth Avenue.

The High Line satisfies Criterion A as a significant transportation structure important to New York City's twentieth-century industrial development. The High Line connected the industrial concerns along its route with regional and national markets. The general objective of the High Line was to facilitate the movement of raw materials and products in and out of this industrial section of the city. The viaduct

passed through or along many industrial buildings.

The rise of trucking in the 1950s led to a drop in rail freight on the High Line, and in the 1960s, the southernmost portion, between Bank and Clarkson Streets, was torn down. In 1993, the southern section between Bank and Little West 12th Streets was demolished. In the early 1980s, the northern section of the High Line between West 34th and West 35th Streets was demolished for construction of the Jacob K. Javits Convention Center. Despite the removal of these sections, the High Line retains much of its historic integrity and is a visual reminder of one of Manhattan's important industrial transportation corridors.

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

Bernadette Castro
Commissioner

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

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

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

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

Criteria for Inclusion in the National Register:

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

III. ___ Property does not meet eligibility criteria.

STATEMENT OF SIGNIFICANCE:

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

BUILDING-STRUCTURE INVENTORY FORM

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

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

I

YOUR NAME: Michael S. Raber

DATE: February 20, 1997

YOUR ADDRESS: 81 Dayton Road
So. Glastonbury, CT 06073

TELEPHONE: (860) 633-9026

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

* *

IDENTIFICATION

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

DESCRIPTION

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

12. PHOTO:
See attached Photos 1-11.

13. MAP: *See attached figure.*

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

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

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

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

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

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

SIGNIFICANCE.

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

ARCHITECT:

BUILDER: New York City Department of Docks and successor agencies

20. HISTORICAL AND ARCHITECTURAL IMPORTANCE:
See attached page.

21. SOURCES
See attached page.

22. THEME:

9. STRUCTURAL SYSTEM

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

Masonry Bulkhead

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

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

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

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

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

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

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

(See Figure 3)

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

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

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

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

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

(See Figure 4)

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

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

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

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

9. STRUCTURAL SYSTEM (CONTINUED)

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

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

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

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

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

Timber Bulkhead

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

10. CONDITION

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

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

11. INTEGRITY

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

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

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

20. HISTORICAL AND ARCHITECTURAL IMPORTANCE

Summary

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

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

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

Urban and Commercial Redevelopment Context

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

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

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

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

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

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

Historic Engineering Context

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

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

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

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

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

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

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

In addition to the masonry bulkheads, the Hudson River waterfront south of West 59th Street includes two sections of timber-crib bulkheads, noted above. The most exposed timber bulkhead is at Little West 12th Street (on the north side of the Gansevoort peninsula), and a buried section apparently survives outside of HRPC's planning jurisdiction from West 35th Street to 37th Street. Both timber bulkheads appear to be late-19th-century examples of what was, by then, a well-established and relatively standardized means of construction. When timber was relatively inexpensive, cribwork was a cheap form of bulkhead requiring only hand tools after any dredging phases. Disappearance of marine borers from the harbor beginning about 1850 made most bulkhead components permanent. Periodic replacement of all components subject to decay above mean low water complicates any identification of extant cribwork bulkheads with particular decades, and minimizes the significance of these upper elements. Cribwork bottoms are the least documented and probably most varied elements in timber bulkheads throughout the port, however, and tend to remain well-preserved under water. The bottoms of the Hudson River examples, buried at least 20 feet underwater, could include important information on once-widespread vernacular engineering practice.

National Register Criteria of Significance

As discussed under "Condition" (Item 10) and "Integrity" (Item 11), the masonry bulkheads are in fair to good condition. Beyond integrity, National Register eligibility is based on meeting at least one of four criteria of significance, summarized as follows:

A. Association with important historic events or activities;
B. Association with important persons;
C. Distinctive design or physical characteristics, including representation of a significant entity whose individual components may lack distinction; and
D. Potential to provide important information about prehistory or history.

The masonry bulkheads appear to meet at least Criteria A-C, and possibly Criterion D. The central place of the bulkheads in more than 60 years of City waterfront development, the considerable engineering and architectural investment made in bulkhead construction, and the influential role played by some bulkhead types in regional waterfront engineering, all appear to satisfy Criterion A. The central role of George B. McClellan (1829-1885) in initial bulkhead planning

and design appears to satisfy Criterion B. McClellan was one of President Lincoln's most important generals early in the Civil War, and was also an unsuccessful candidate for the American presidency in 1864. Criterion C is met by the presence not only of distinctive, influential engineering designs, but of the full range of bulkhead types built by the Department throughout the period of New York City's direct involvement in Hudson River waterfront development.

Even the latest type (see Figure 5: Type IV), similar to relieving-platform designs used elsewhere in the ports of New York and other cities, remains significant as part of the Department's long sequence of bulkhead designs. The masonry bulkhead appear well-documented in surviving drawings, descriptions of construction methods (e.g., Greene 1917: 88-94), and possibly in surviving original specifications. It is possible, however, that the surviving structures include undocumented details reflecting minor adaptations to bottom or other site conditions. Such undocumented details in the masonry or timber bulkheads could meet Criterion D.

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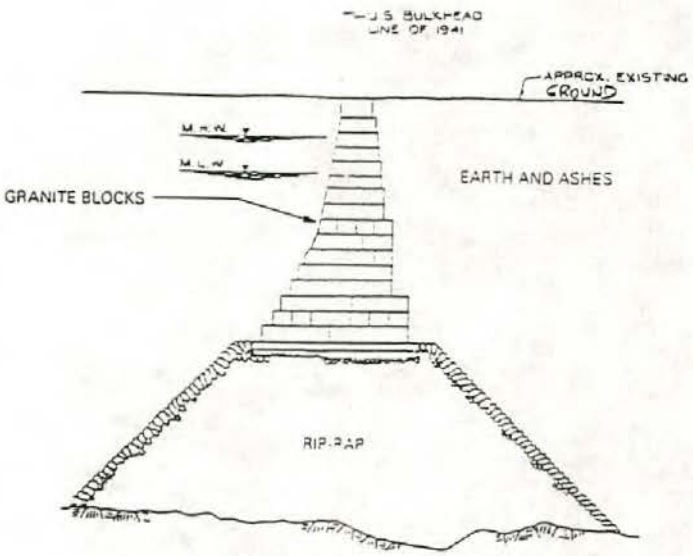
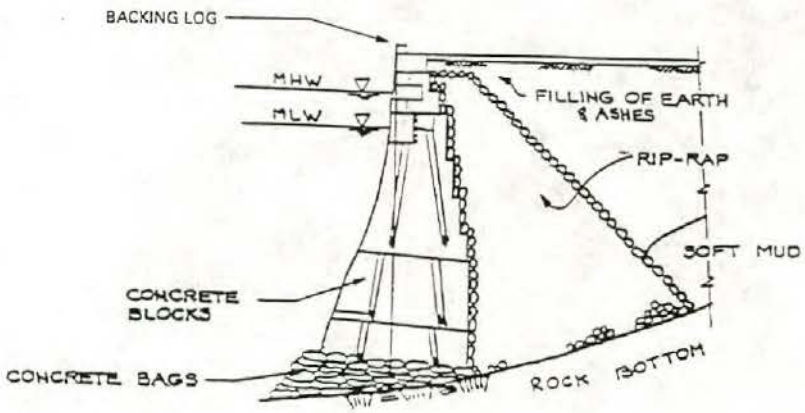
Figure 2

Bulkhead Type I Sections

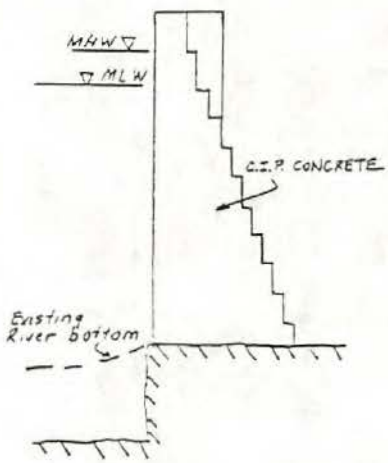
Type I: Granite or Concrete Bulkhead on Firm or Rock Bottom



TYPE I-A
Granite blocks on rip-rap. Built in 1871 at Battery as first Department of Docks bulkhead.



TYPE I-B
Granite wall supported by 1-3 pre-cast concrete blocks and concrete base. Built c. 1872-1920 at Cedar Street and between 52nd-59th Streets. (Portion between 48th-54th Streets outside HRPC's planning jurisdiction.)



TYPE I-C
Concrete wall. Built c. 1915-1936 between 44th-52nd Streets.

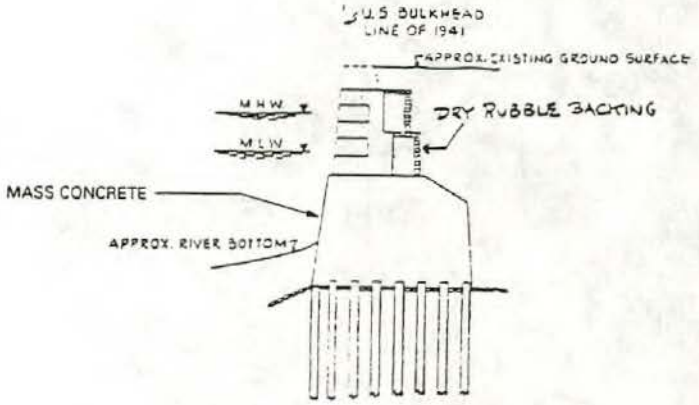
0 25 FEET
SCALE

Note: Type I was typically built on firm bottoms less than 40 feet below mean high water.
Source: Mueser Rutledge Consulting Engineers.

Figure 3

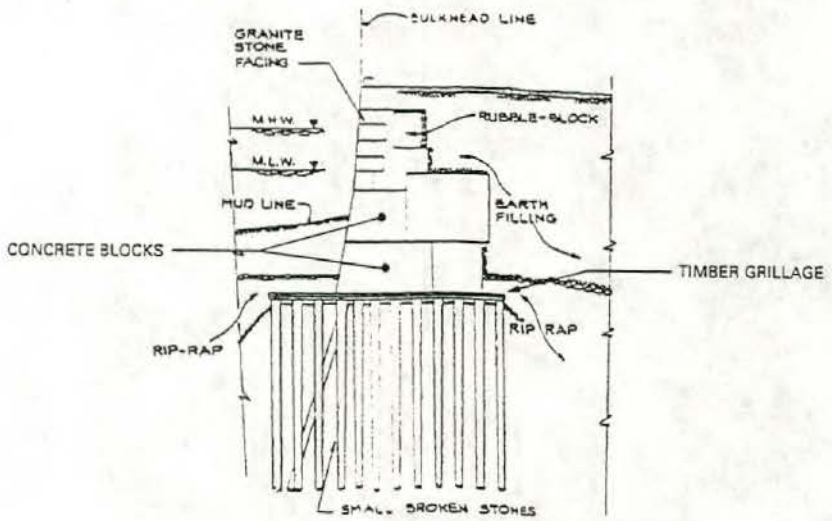
Bulkhead Type II Sections

Type II: Pile-Supported Granite Bulkhead Without Timber Relieving Platforms



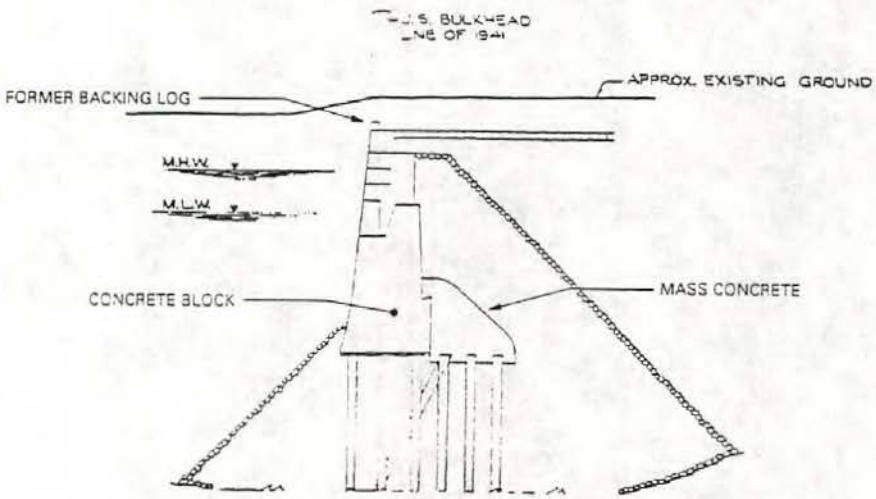
TYPE II-A

Granite wall on mass concrete block, resting on 2-inch thick concrete bed. Built c. 1873-1875 in several sections between Murray and Horatio Streets; some sections replaced by Types III-B and IV.



TYPE II-B

Granite wall on concrete block on 2-timber-thick grillage, with inclined bracing piles. Built c. 1875 at Morton and Christopher Streets.



TYPE II-C

Granite wall on pre-cast concrete block, with mass concrete backing and inclined bracing. An alternative to Type III-C timber-relieving platform. Built c. 1900 at Rector Street.

0 25 FEET

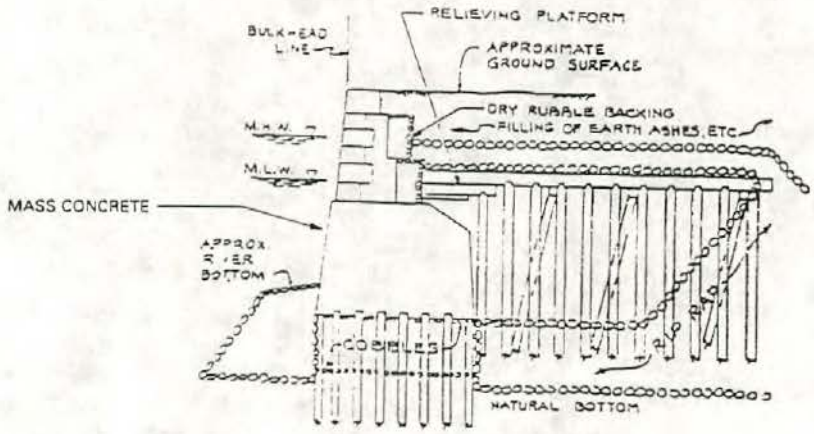
SCALE

Note: Type I I was usually built on soft or deep mud bottoms 40-170 feet below mean high water.
Source: Mueser Rutledge Consulting Engineers.

Figure 4

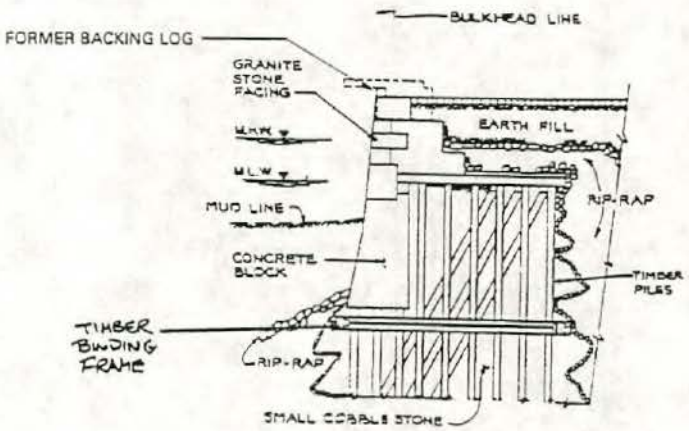
Bulkhead Type III Sections

Type III: Pile-Supported Granite Bulkhead With Timber Relieving Platforms



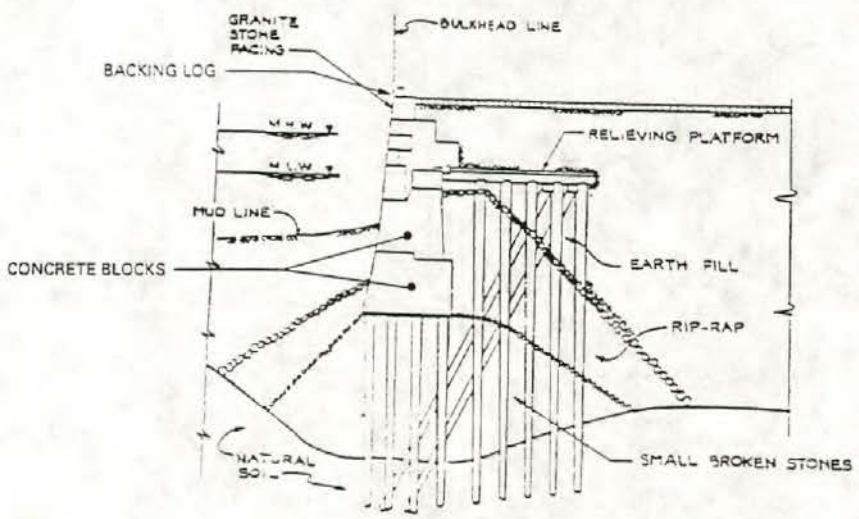
TYPE III-A

Modified form of Type II-A. Built c. 1874 at Canal Street.



TYPE III-B

Granite wall on narrow concrete block, with inclined bracing piles taking lateral thrusts to below base block, and timber binding frame around piles. Built 1876-1898 in many areas between Warren and 38th Streets.



TYPE III-C

Granite wall on wider concrete blocks, similar to Type III-B without binding frame. Built c. 1899-1915 in many areas between Carlisle and 44th Streets.

0 25 FEET

SCALE

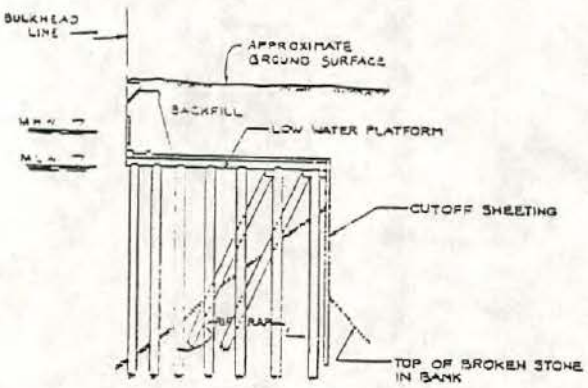
Note: Type III was built on soft or deep mud 40-170 feet below mean high water. The relieving platforms were encased in fill or cut off from open water.

Source: Mueser Rutledge Consulting Engineers.

Figure 5

Bulkhead Type IV Section

Type IV: Concrete Bulkhead With Timber or Concrete Relieving Platforms



TYPE IV

Concrete bulkhead with timber or concrete relieving platforms on piles. Built c. 1920-1960 in many areas, as replacement of some older bulkhead types and as new construction.

0 25 FEET

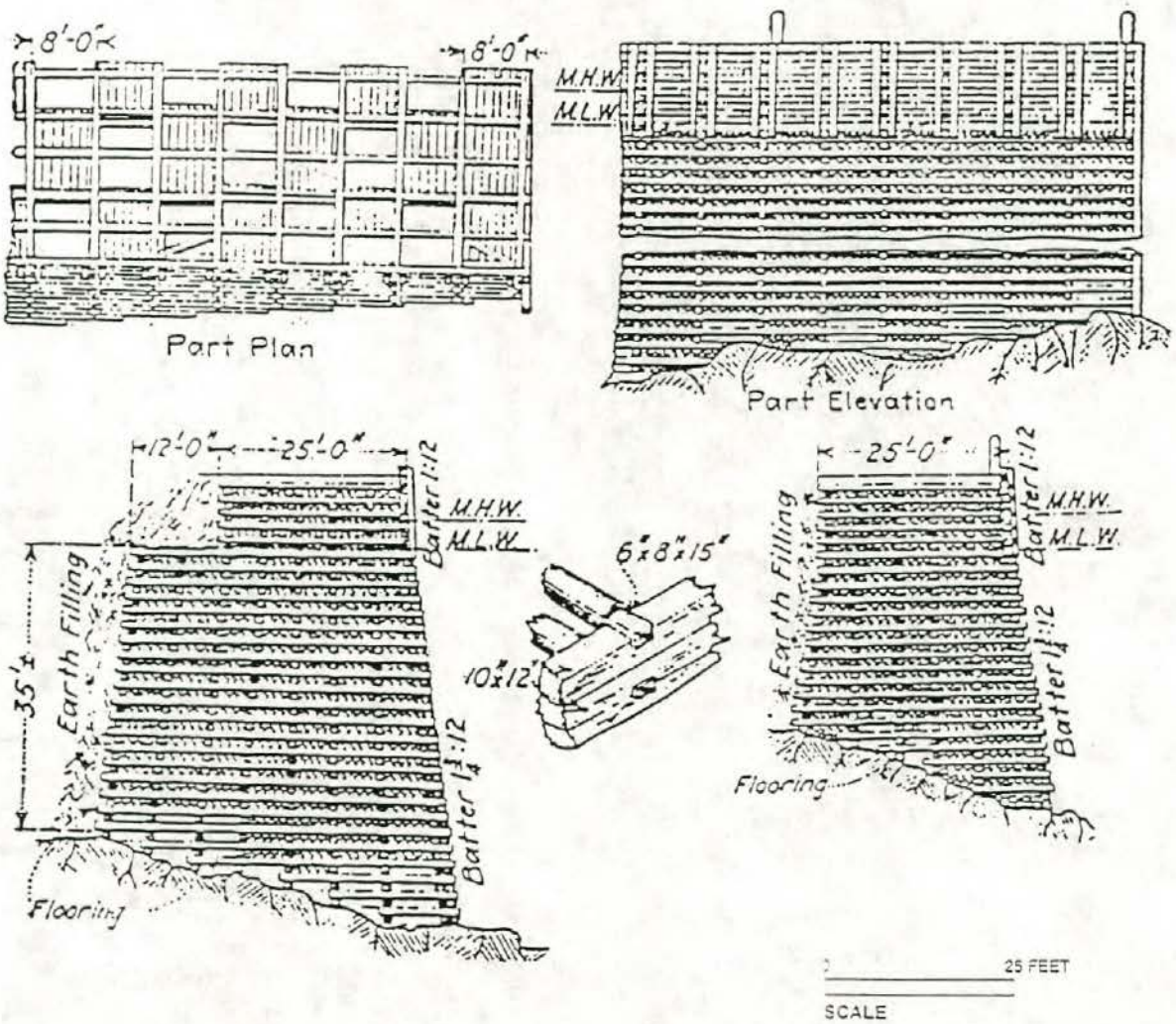
SCALE

Note: Type IV generally replaced Type III-C, with relieving platforms exposed to open water.
Source: Mueser Rutledge Consulting Engineers.

Figure 6

Bulkhead Type V Sections and Other Views

Type V: Timber Crib Bulkhead



TYPE V

Layered, rock- and earth-filled timber cells, with outer face of squared timbers above mean low water.

Note: This is a typical design and does not reflect possible crib-bottom variations adopted to specific bottom conditions. On the Manhattan waterfront south of West 59th Street, the only remaining cribwork bulkhead along the water is a late 19th century example at Little West 12th Street. There is also a cribwork bulkhead, built c. 1885-1890, buried near the water between West 35th and West 37th Streets, in an area outside HRPC's planning jurisdiction.

Source: Carleton Green, *Wharves and Piers*, 1917, pg. 53.

Photo 1

**View southeast of granite bulkhead
at approximately Canal Street (just north of Pier 32)
showing new railing mounted in bulkhead
along western edge of interim public safety zone
(bikeway/walkway)**

Type II.A

December 1996

Photo 1

View southeast of granite bulkhead at approximately Canal Street (just north of Pier 32) showing new railing mounted in bulkhead along western edge of interim public safety zone (bikeway/walkway)

Type II.A

December 1996

Photo 2

View northeast of granite bulkhead at Watts Street, with varied concrete and granite coping treatments and new railing

Type II.A

December 1996

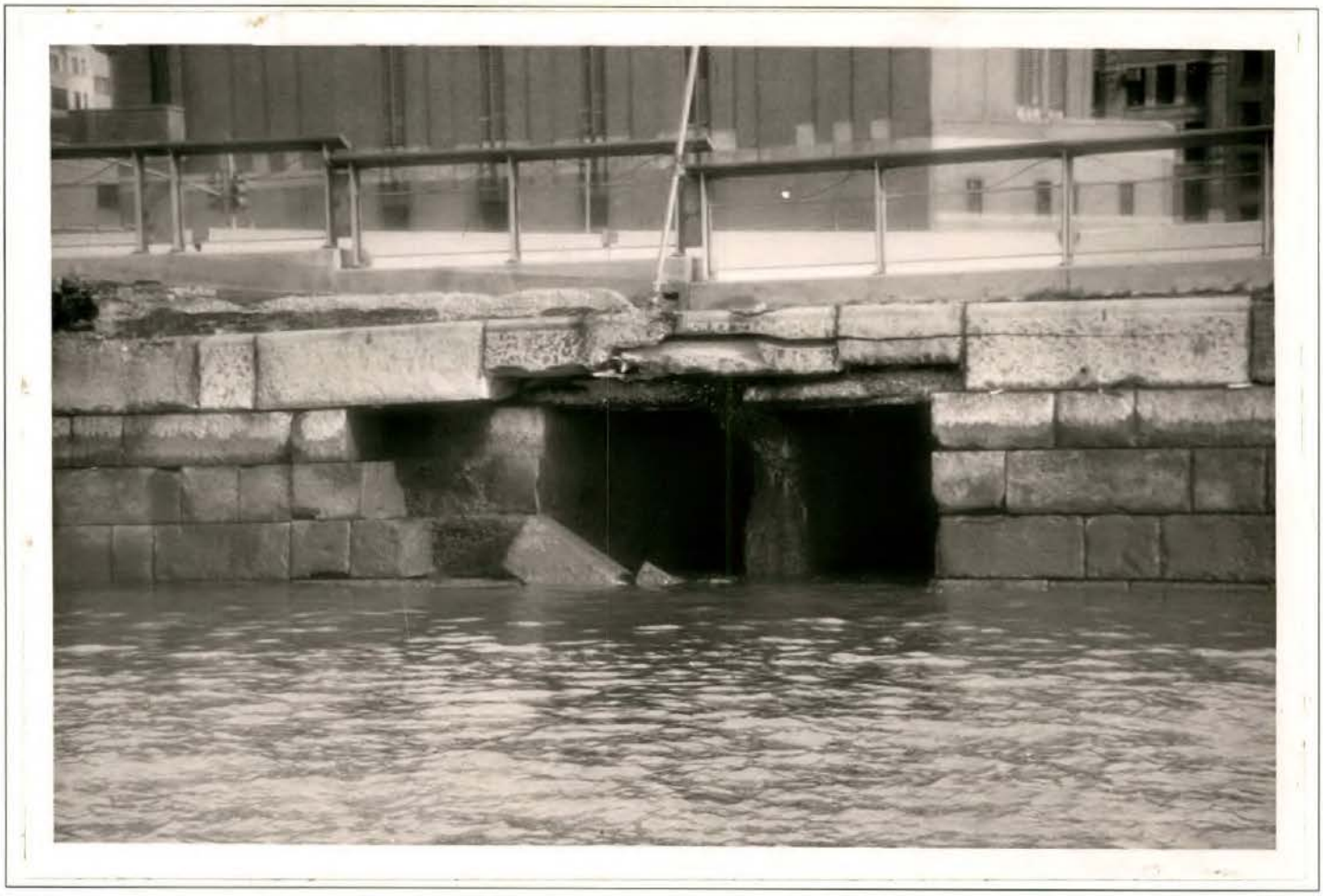


Photo 3

View east of granite bulkhead near Canal Street at stream outfall, with original coping blocks, partially collapsed facing, exposed interior facing, and new railing

Type III.A

December 1996

Photo 4

View east of granite bulkhead at 30th Street, with eroded original face and missing coping blocks

Type III.B

December 1996

Photo 5

View east of granite bulkhead at Vestry Street with outfall, concrete replacement coping, and new railing

Type II.A

December 1996