DRAFT REPORT

CULTURAL RESOURCES SURVEY, NEW YORK HARBOR COLLECTION AND REMOVAL OF DRIFT PROJECT, ARTHUR KILL, NEW YORK REACH; ARTHUR KILL, NEW JERSEY REACH; AND KILL VAN KULL, NEW YORK REACH

Prepared For:

U.S. Army Corps of Engineers
New York District
26 Federal Plaza
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Prepared By:

Panamerican Consultants, Inc.
15 South Idlewild Street
Memphis, Tennessee 38104

Stan Duncan, Principal Investigator
Panamerican Consultants, Inc.

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ABSTRACT

Between October 18, 1995 and April 25, 1996, Panamerican Consultants, Inc. conducted cultural resources investigations for the New York District, U.S. Army Corps of Engineers (Corps) relative to the development of a plan for the implementation of the New York Harbor Collection and Drift Removal Project. The program's aim is to rid New York Harbor of potential sources of drift including deteriorating waterfront structures, such as piers and bulkheads, as well as derelict vessels. The project area of the Removal of Drift Project currently being investigated, and with which this report deals, consists of the Kill Van Kull Reach and both the New Jersey and New York reaches of the Arthur Kill, all navigable waterways which surround Staten Island, New York on its northern and western shores respectively. The Kill Van Kull Reach project area, the waterway predominantly comprising the northern shoreline of Staten Island, extends between the Staten Island Ferry Terminal to the east and Port Ivory to the West. The Arthur Kill New Jersey Reach project area extends along approximately 11 miles of New Jersey shoreline from the Goethels Bridge to just south of the Outerbridge Crossing and includes shorelines in Union and Middlesex Counties, New Jersey. The Arthur Kill New York Reach project area comprises the western shoreline of Staten Island, Richmond County, New York, and extends from the Staten Island Rapid Transit railroad bridge to a point about 800 ft. south of Amboy Road in Tottenville.

Responsible for determining if any properties within the current project area were eligible for listing on the National Register of Historic Places (NRHP) before the implementation of the Drift Removal Project, the Corps initiated a cultural resources reconnaissance survey for each of the three reaches to identify historically significant properties potentially eligible for NRHP listing. A total of 140 vessels and 14 vessel clusters, the former Baltimore and Ohio Transfer Bridge No. 2, and a pier associated with the American Smelting and Refining Company were identified as historically significant properties that would be adversely affected by project activities.

It was subsequently recommended that properties and vessels, or representative vessel features, identified as significant would require documentation prior to the implementation of the Drift Removal Project. To this effect, Panamerican Consultants conducted additional cultural resources investigations of the vessels and structures in the form of archival and informant research, field assessment of the properties, and analysis of compiled data, in order to identify those properties and vessels, or representative vessel features, assess potential adverse Drift Removal impacts to these properties and vessels, and to recommend mitigative measures. The framework for these additional studies focused on vessel types rather than on individual vessels, with the vessel types evaluated within the context of the overall sample identified in the three reaches, as well as the context of previous historic vessel studies in the port. These investigations were conducted under Indefinite Delivery Contract No. DACW51-94-D-0034 and in response to the Corps' three Scope of Works entitled *Cultural Resources Survey, Kill Van Kull Reach, Staten Island, Richmond County, New York, Arthur Kill New Jersey Reach, Union and Middlesex Counties, New Jersey, Arthur Kill New York Reach, Richmond County, New York, New York Harbor Collection and Removal of Drift Project* under Delivery Orders No. 0008, 0009, and 0010.

Although conducted under three separate delivery orders, the investigation of all vessels and properties within the three reaches were conducted concurrently as a whole. The results of the study indicate that 50 vessels and the two structures require varying degrees of mitigation in the form of photographic documentation, and/or partial or complete HABS/HAER recordation if avoidance by adverse Drift Removal activities is not feasible.

Copies of the Final Report, a three volume set, are on file with the New York District, U.S. Army Corps of Engineers, and at the New York and New Jersey State Historic Preservation Offices.

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INTRODUCTION

Between October 18, 1995 and April 25, 1996, Panamerican Consultants, Inc. (PCI) conducted cultural resources investigations for the New York District, U.S. Army Corps of Engineers (Corps) relative to the development of a plan for the implementation of the New York Harbor Collection and Drift Removal Project. The aim of the program is to rid New York Harbor of potential sources of drift including deteriorating waterfront structures, such as piers and bulkheads, as well as derelict vessels. The project area of the Drift Removal Project currently being investigated, and with which this report deals, consists of the Kill Van Kull Reach and both the New Jersey and New York reaches of the Arthur Kill, all navigable waterways which surround Staten Island, New York on its northern and western shores respectively. The Kill Van Kull Reach project area (KVK), the waterway predominantly comprising the northern shoreline of Staten Island, extends between the Staten Island Ferry Terminal to the east and Port Ivory to the west. The Arthur Kill New Jersey Reach project area (AKNJ) extends along approximately 11 miles of New Jersey shoreline from the Goethals Bridge to just south of the Outerbridge Crossing and includes shorelines in Union and Middlesex Counties, New Jersey. The Arthur Kill New York Reach project area (AKNY) comprises the western shoreline of Staten Island, Richmond County, New York, and extends from the Staten Island Rapid Transit railroad bridge to a point about 800 feet south of Amboy Road in Tottenville (Figure 1).

As an agency of the Federal Government, the Corps has been entrusted with the protection and preservation of cultural resources that may be adversely affected by their project activities. Therefore, they are responsible for determining if any properties within the current project area are eligible for listing on the National Register of Historic Places (NRHP) prior to the implementation of the Drift Removal Project (i.e., the removal of any sources of drift such as historic hulks and shipwrecks). The Federal statutes regarding these responsibilities include Section 106 of the National Historic Preservation Act of 1966, as amended; Executive Order 11593; the Advisory Council on Historic Preservation Procedures for the Protection of Historic and Cultural Properties (36 CFR Part 800); and the Abandoned Shipwreck Act of 1987.

In fulfilling these responsibilities the Corps initiated a cultural resources reconnaissance survey for each of the three reaches in order to identify historically significant properties potentially eligible for NRHP listing (Figures 2-2D). These reconnaissance studies consisted of the examination of waterfront structures and marine resources, including bulkheads, piers, pile fields, and hulks of various vessel types. The three survey reports concluded that the proposed removal project activities would adversely effect two potentially eligible properties, the former Baltimore and Ohio Transfer Bridge No. 2 in the KVK, and a pier in the AKNJ associated with the American Smelting and Refining Company, as well as approximately 140 potentially significant individual vessels, and a number of vessel clusters that include some of the individual vessels (Figure 3) (Raber et al. 1995a, 1995b; Raber, Flagg, Wiegand, and Weinstein 1995).

As listed in Table 1, of the 140 vessels and clusters, the reconnaissance survey for the KVK identified 44 individual vessels representing 23 different types or varieties of vessels (Figure 4), and 6 vessel clusters made up of 210 individual vessels (Figure 5). The reconnaissance survey for the AKNJ identified 21 individual vessels representing 9 different types or varieties of vessels (Figure 6) and 2 vessel clusters (Figure 7) comprised of 19 vessels (Figure 7). The reconnaissance survey for the AKNY identified 51 individual vessels (Figure 8) representing 23 different types or varieties of vessels and 6 vessel clusters comprised of 189 vessels (Figure 9). The potential significance of these vessels and their preliminary NRHP eligibility was based upon their potential to provide information "needed to define vessel types and vessel conversion practices more fully" and their potential to provide information on "construction details and design variability for partially documented vessel types" (Raber et al. 1995a:132; Raber et al. 1995b:131). Twenty-one vessels not included in the original project catalog developed during these recon-

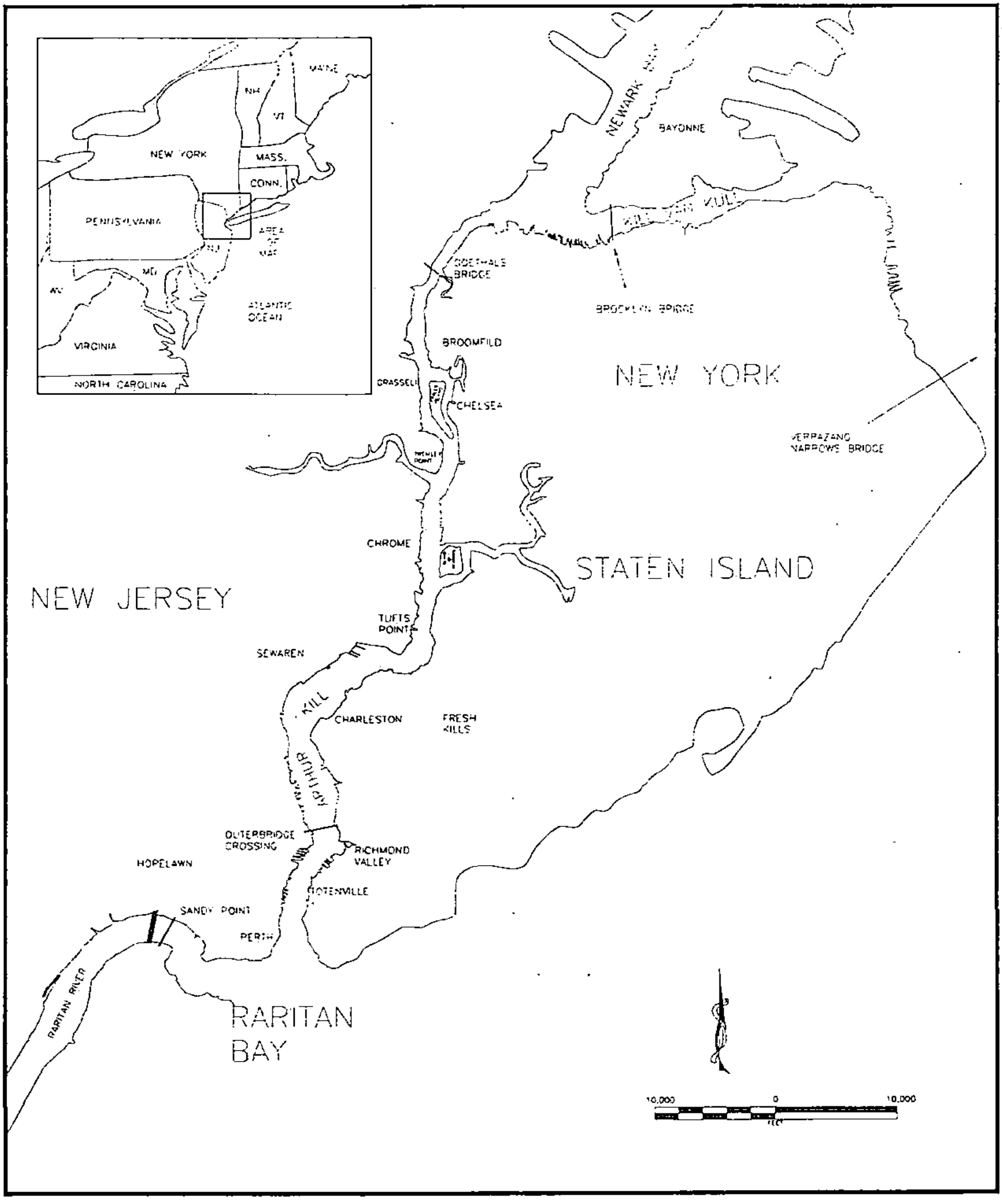


Figure 1. Project area location map.

Panamerican Consultants, Inc. **U.S. Army Corps of Engineers**

Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.

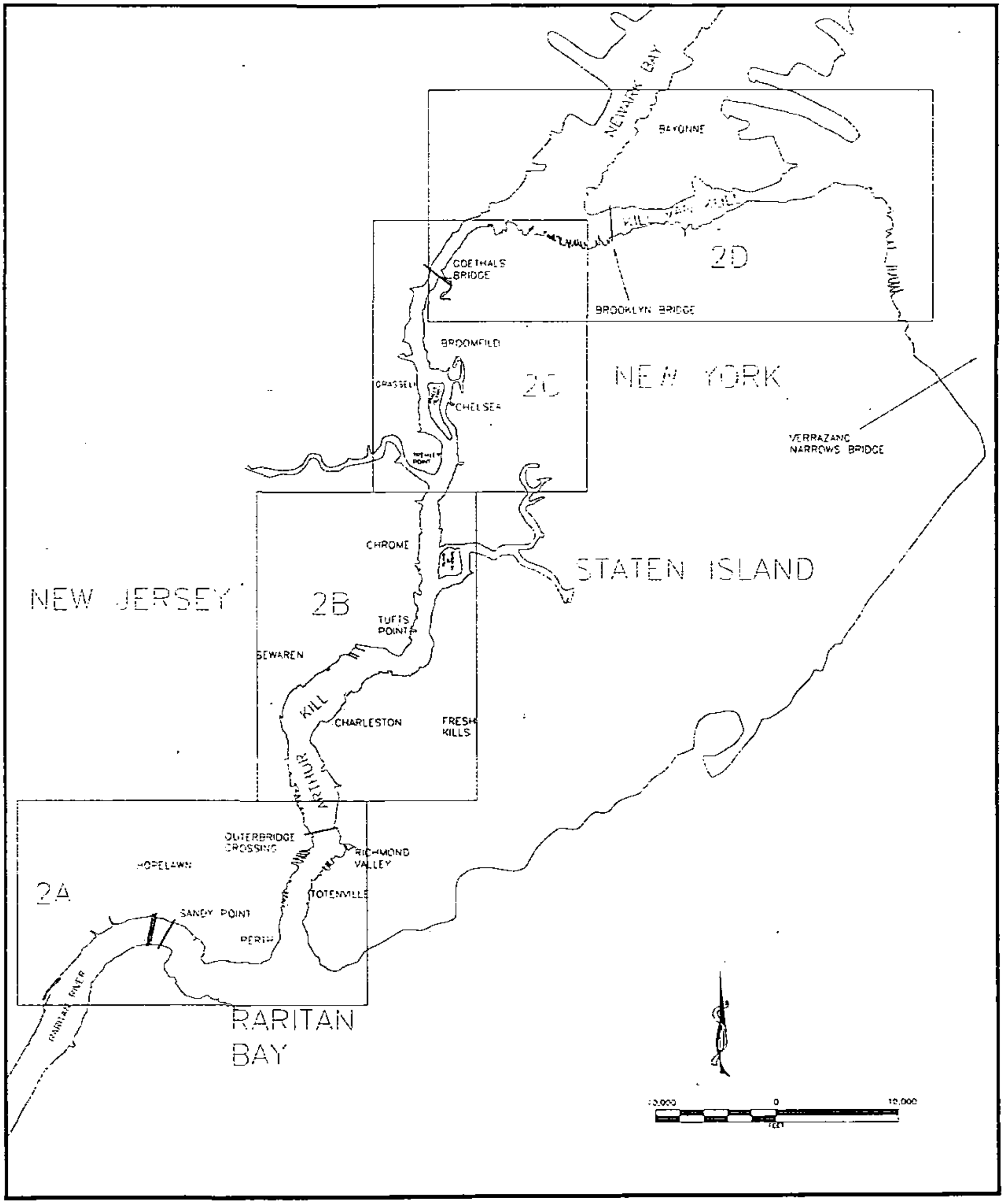


Figure 2. Project area quadrangle location map (see Figures 2A-2D).

Panamerican Consultants, Inc. U.S. Army Corps of Engineers

Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.

Figure 2A. Quadrangle map detail of Figure 2, inset A (USGS 7.5' Quadrangles: Perth Amboy, NJ-NY 1956, photorevised 1970; South Amboy, NJ-NY 1954, photorevised 1981; Arthur Kill, NY-NJ 1966).

Panamerican Consultants, Inc. **U.S. Army Corps of Engineers**
Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.

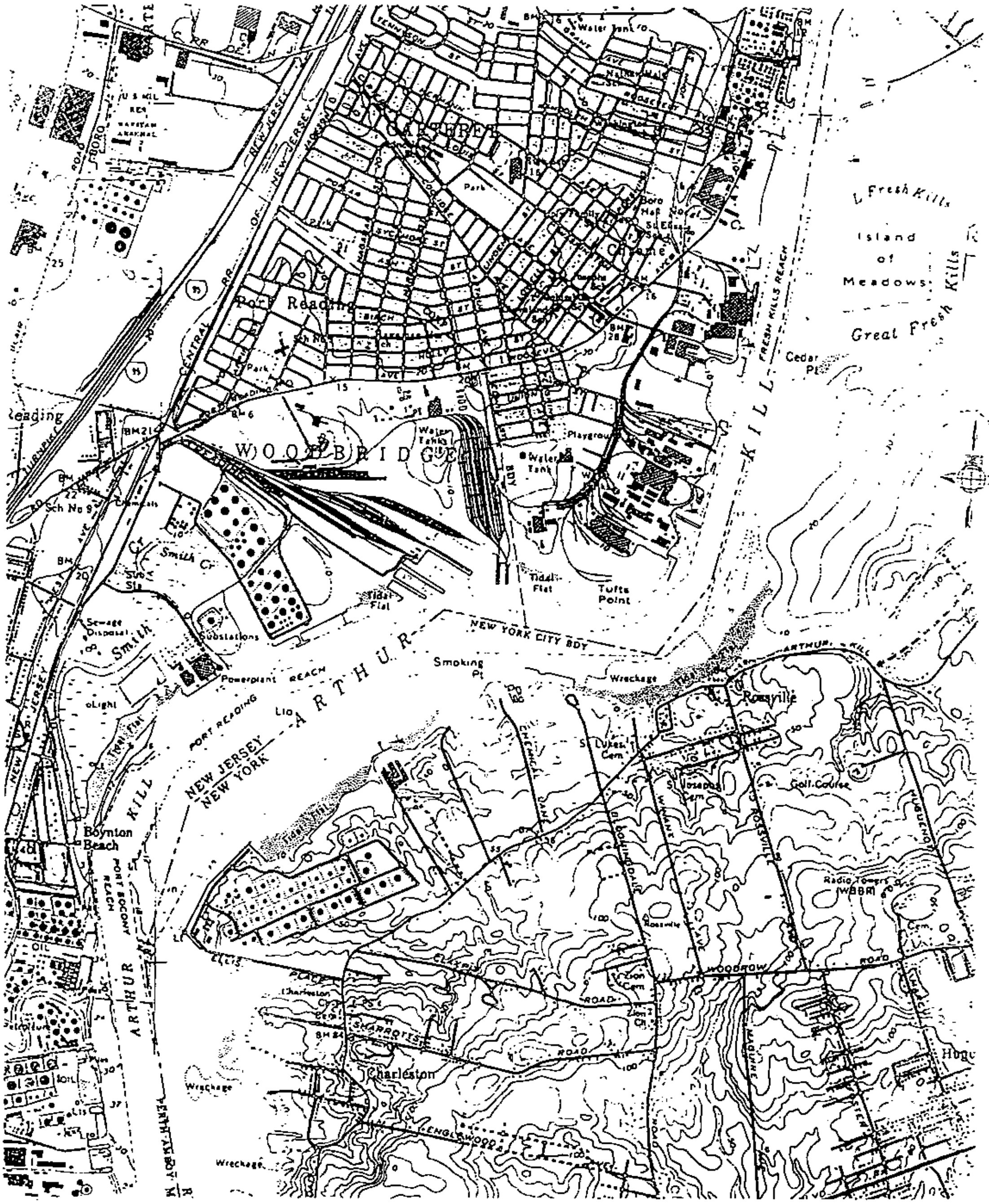


Figure 2B. Quadrangle map detail of Figure 2, inset B (USGS 7.5' Quadrangles: Arthur Kill, NY-NJ 1966; Perth Amboy, NJ-NY 1956, photorevised 1970).

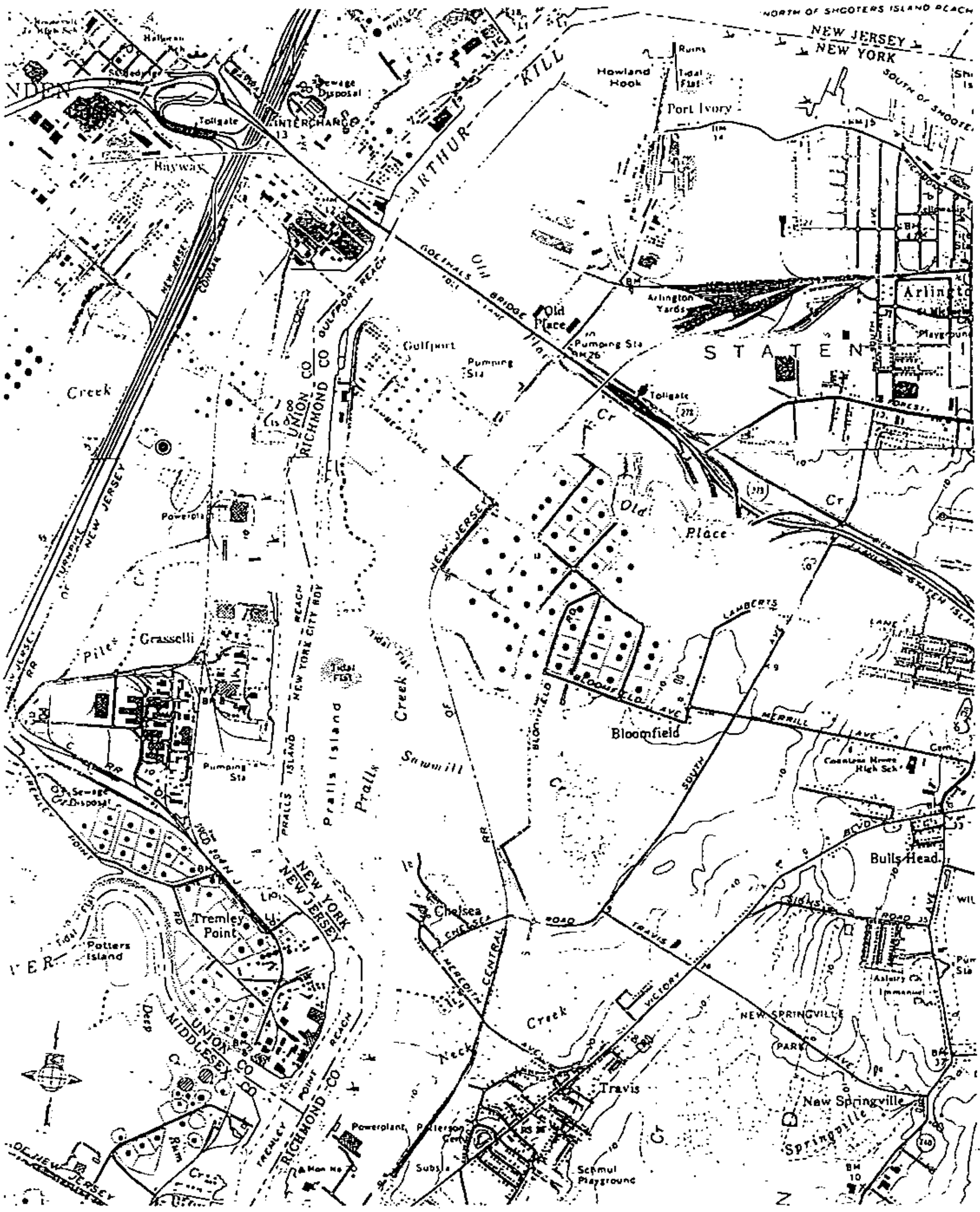


Figure 2C. Quadrangle map detail of Figure 2, inset C (USGS 7.5' Quadrangles: Arthur Kill, NY-NJ 1966; Elizabeth NJ-NY 1967, photorevised 1981).

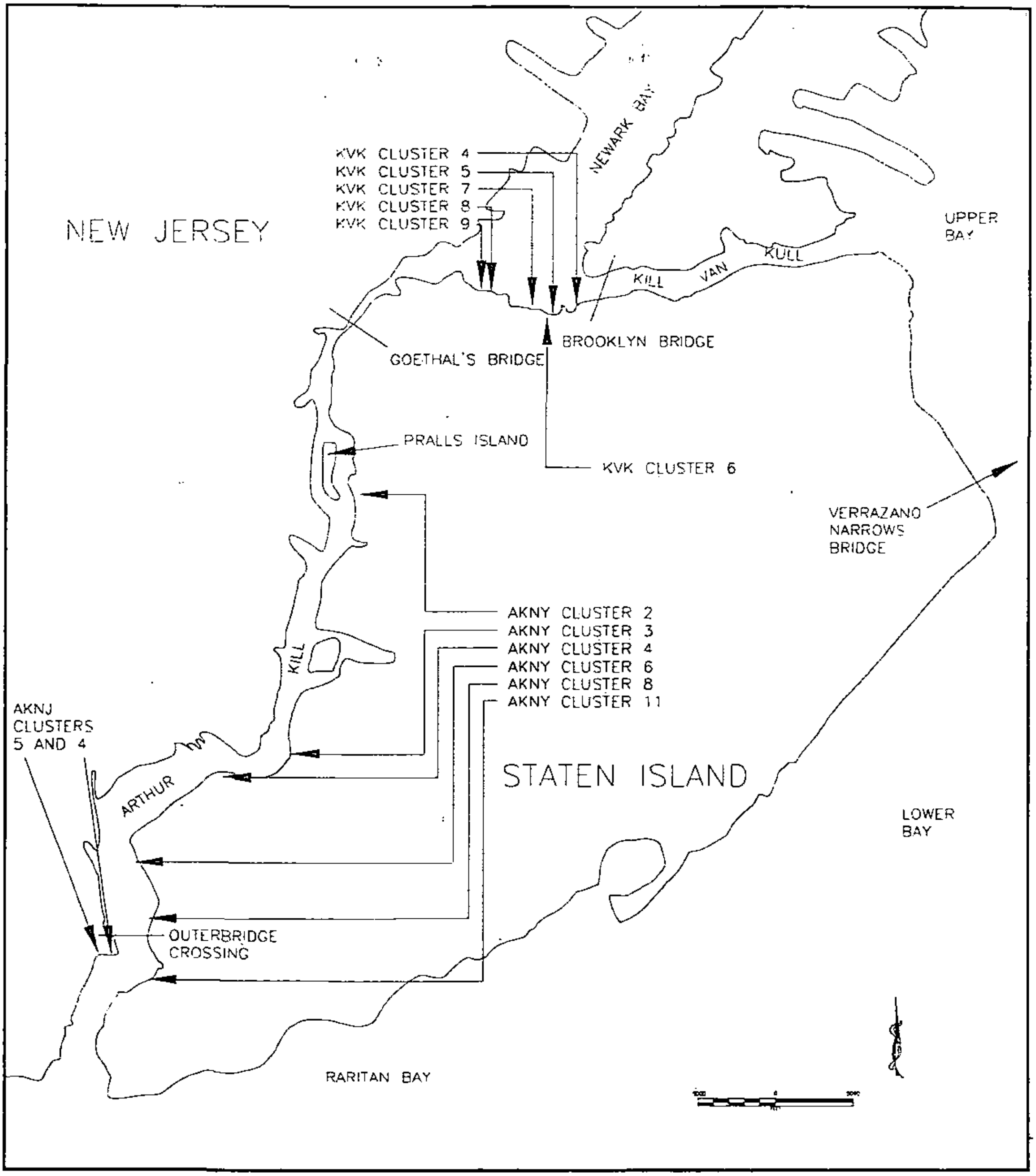


Figure 3. Kill Van Kull, New York Reach clusters.

Panamerican Consultants, Inc.	**U.S. Army Corps of Engineers**
Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.	

Table 1. Vessels Identified in the Arthur Kill, New York Reach; Arthur Kill, New Jersey Reach; and Kill Van Kull, New York Reach

VESSEL TYPE	AKNY	AKNJ	KVK
Steamboat	V. 53		
Double-Ended Ferry	V. 12, V. 13, V. 81 V. 58		V. 5, V. 62, V. 234
Canal Boat	V. 214, V. 219	V. 30, V. 32, V. 34, V. 98, V. 99, V. 103	
Barge		V. 43, V. 46, V. 47, V. 57, V. 58, V. 59	
Lighters, Wood	V. 77		V. 9, V. 15, V. 83, V. 84
Centerboard Schooner	V. 34		V. 10
Lighters, Steam	V. 179, V. 260		V. 28
Derrick Lighter	V. 120, V. 155	V. 14	V. 113, V. 120
Car Float	V. 3, V. 33, V. 196, V. 208, V. 258		V. 78, V. 155
Ocean Freighter	V. 184, V. 195		
Crane Barge	V. 4, V. 193		V. 105, V. 169, V. 193
Work Barge		V. 15, V. 91	
Unknown Barge		V. 95	
Concrete Barge			V. 119
Hold Barge	V. 106, V. 134, V. 135, V. 160, V. 169	V. 41, V. 42, V. 44, V. 52, V. 106	V. 157, V. 166
Deck Scow	V. 104	V. 92, V. 16, V. 92	V. 158
Hopper Barge	V. 50, V. 169, V. 238, V. 242		V. 64, V. 65, V. 75
Rock Scow	V. 244, V. 244A, V. 244B	V. 50, V. 51, V. 55, V. 56	V. 173
Trap Scow		V. 53	
Covered Barge	V. 189, V. 252		V. 144, V. 144A, V. 162, V. 167
Converted Barge	V. 13, V. 48		V. 121
Wood/Steel Barge		V. 151A, V. 151B, V. 151C	
Wood Tug	V. 149, V. 151, V. 152		

Table 1, continued

VESSEL TYPE	AKNY	AKNJ	KVK
Screw Tug	V. 9, V. 41, V. 75, V. 76, V. 84, V. 100, V. 102	V. 97	
Steam Tug	V. 43		
Floating Dry Dock	V. 215, V. 254		V. 68, V. 79, V. 88, V. 89, V. 90
Dry Docks			V. 99, V. 100
Steam Water Boat	V. 43		
Pile Driver			V. 44, V. 112
Barkentine *Hedris*	V. 49		
Schooner Barge	V. 52, V. 54, V. 194		
Fishing Boat *Menhaden*			V. 33
Converted Schooner Barge	V. 72, V. 78, V. 82 V. 83		V. 54, V. 194
Transfer Barge	V. 13		
Bucket Dredge			V. 3
Hydraulic Dredge			V. 36, V. 45
Floating Grain Barge		V. 79	

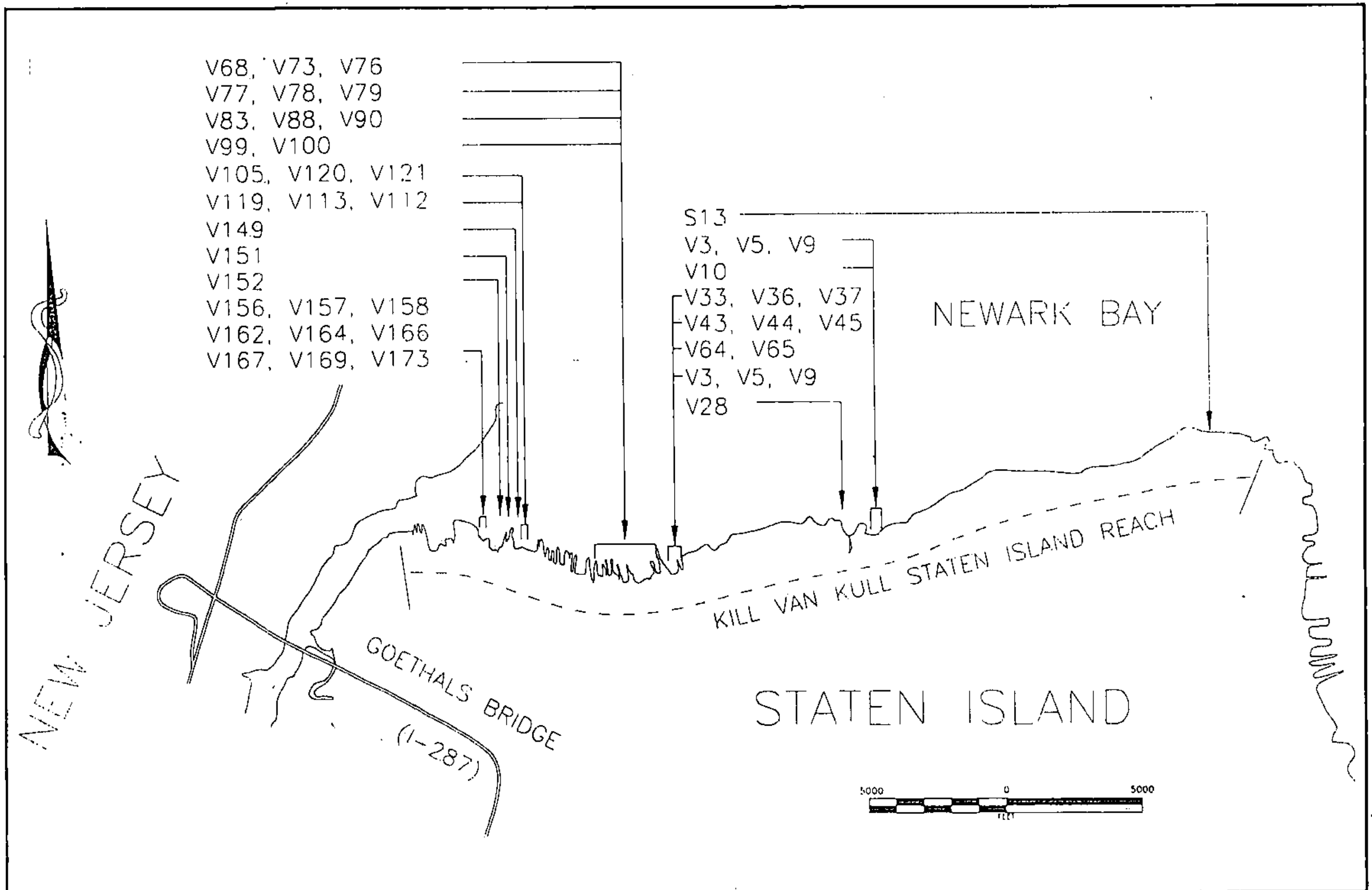


Figure 4. Kill Van Kull, New York Reach vessels.
Panamerican Consultants, Inc. U.S. Army Corps of Engineers

Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.

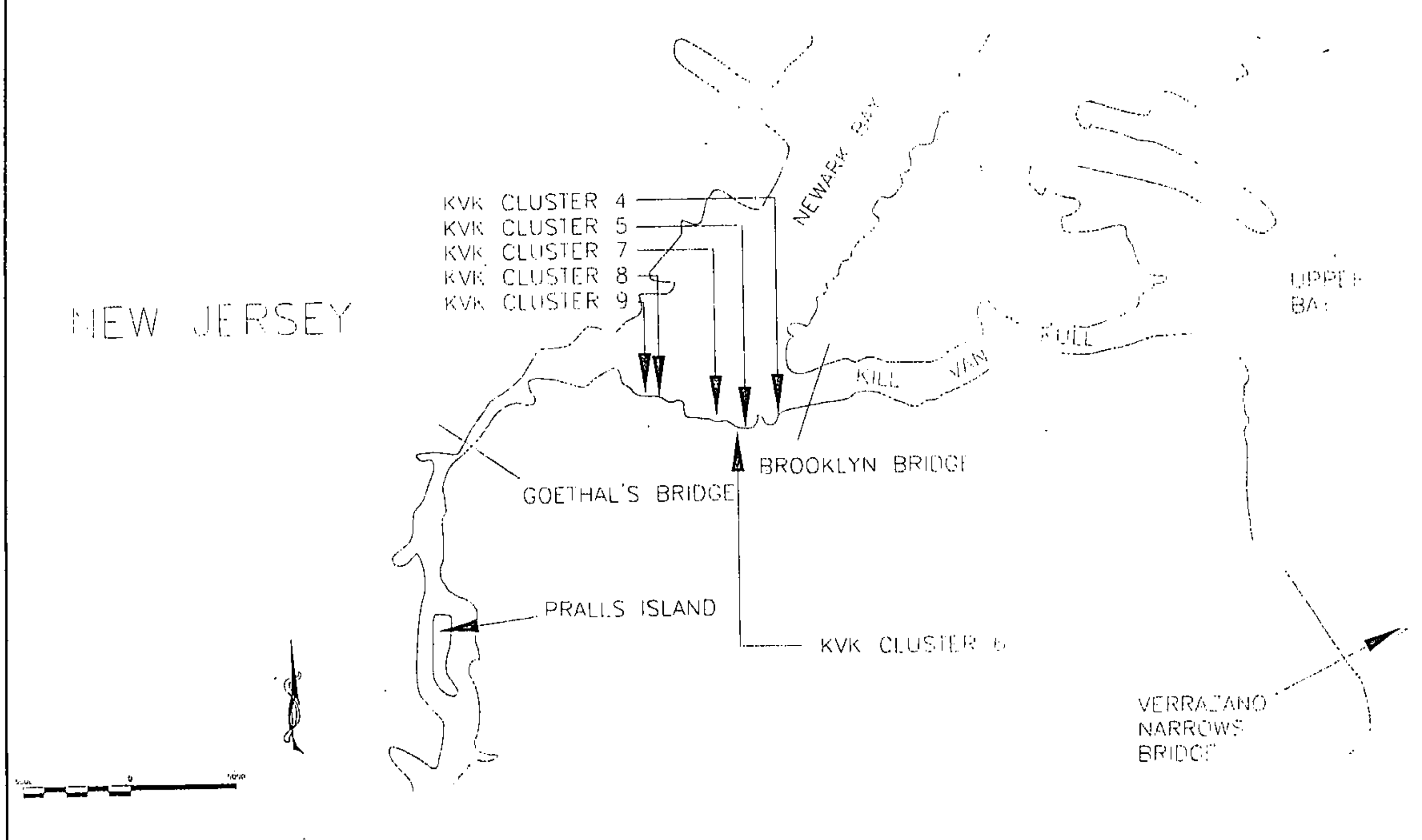


Figure 5. Kill Van Kull, New York Reach vessel clusters.
Panamerican Consultants, Inc. **U.S. Army Corps of Engineers**
Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.

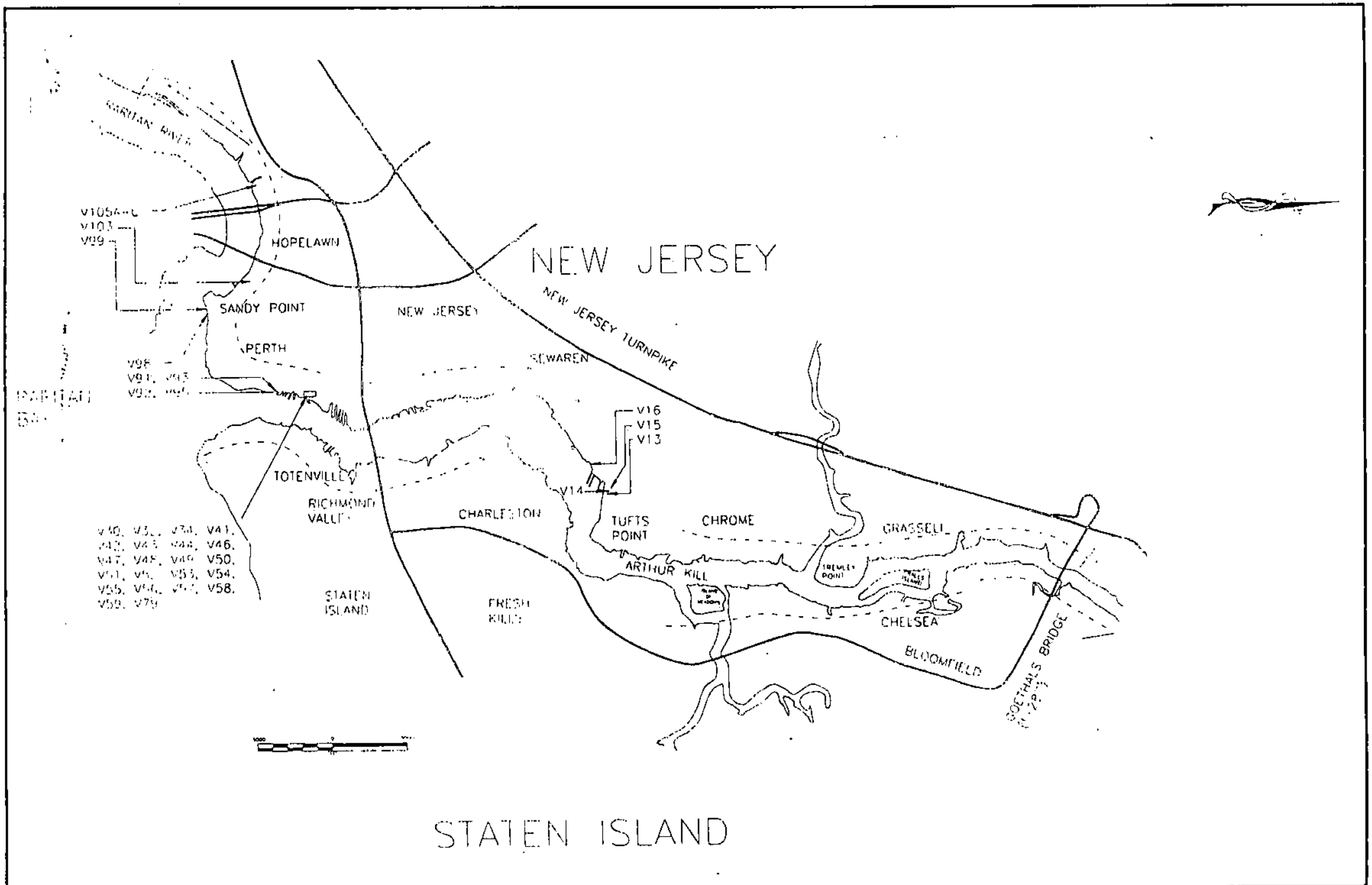


Figure 6. Arthur Kill, New Jersey Reach vessels.
Panamerican Consultants, Inc. U.S. Army Corps of Engineers
Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.

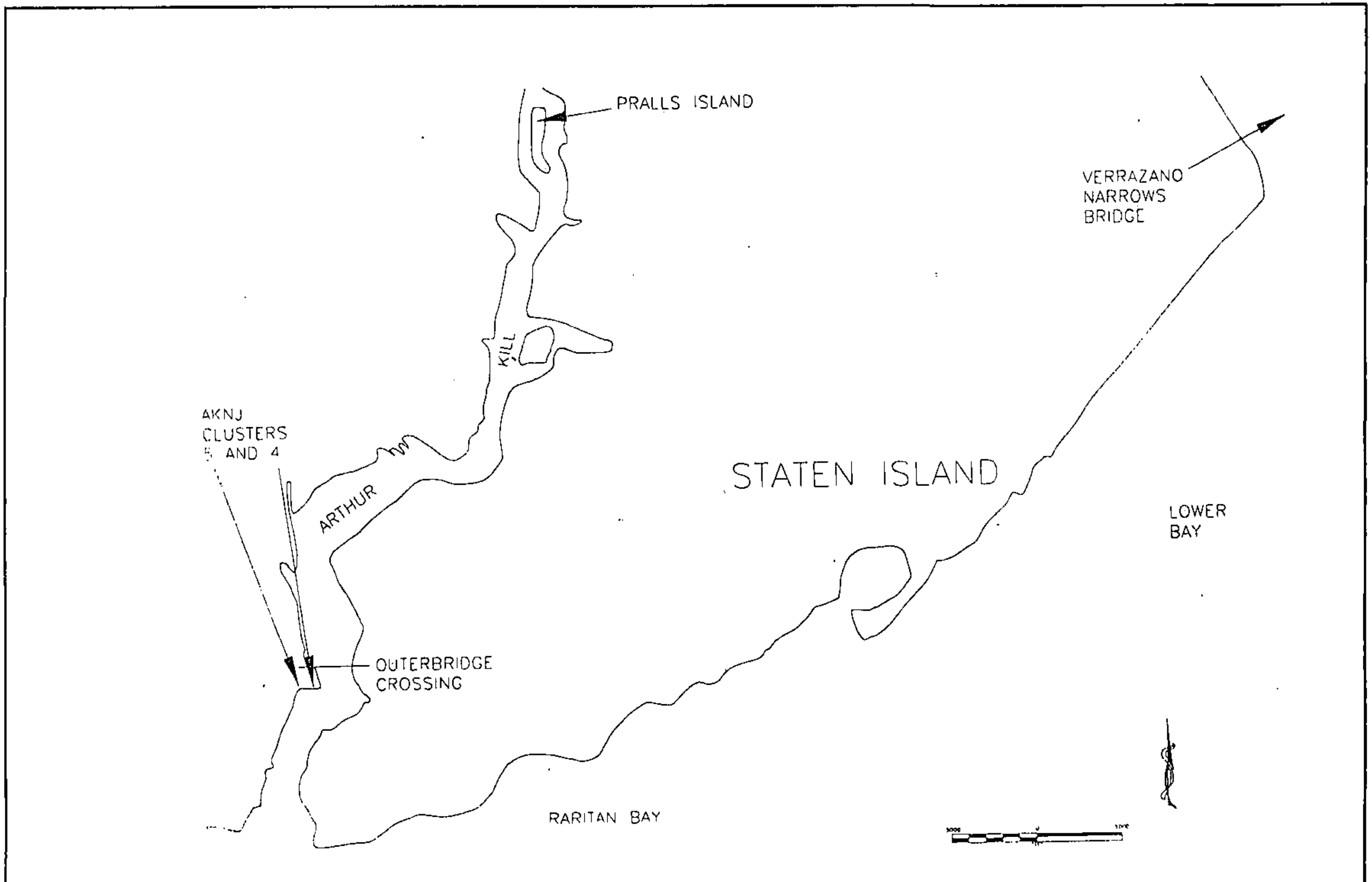


Figure 7. Arthur Kill, New Jersey Reach vessel clusters.
Panamerican Consultants, Inc. U.S. Army Corps of Engineers

Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.

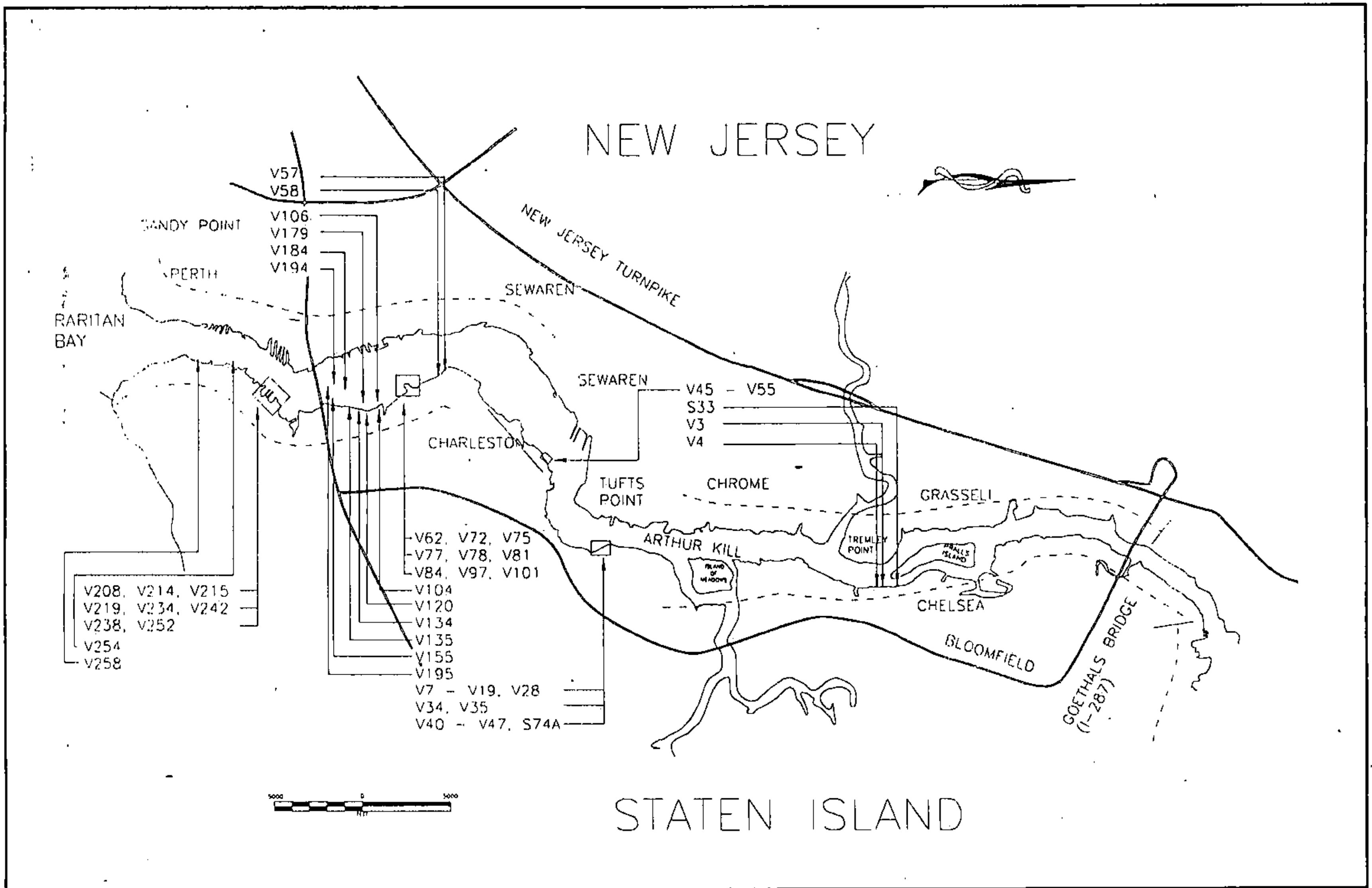


Figure 8. Arthur Kill, New York Reach vessels.
Panamerican Consultants, Inc. U.S. Army Corps of Engineers
Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.

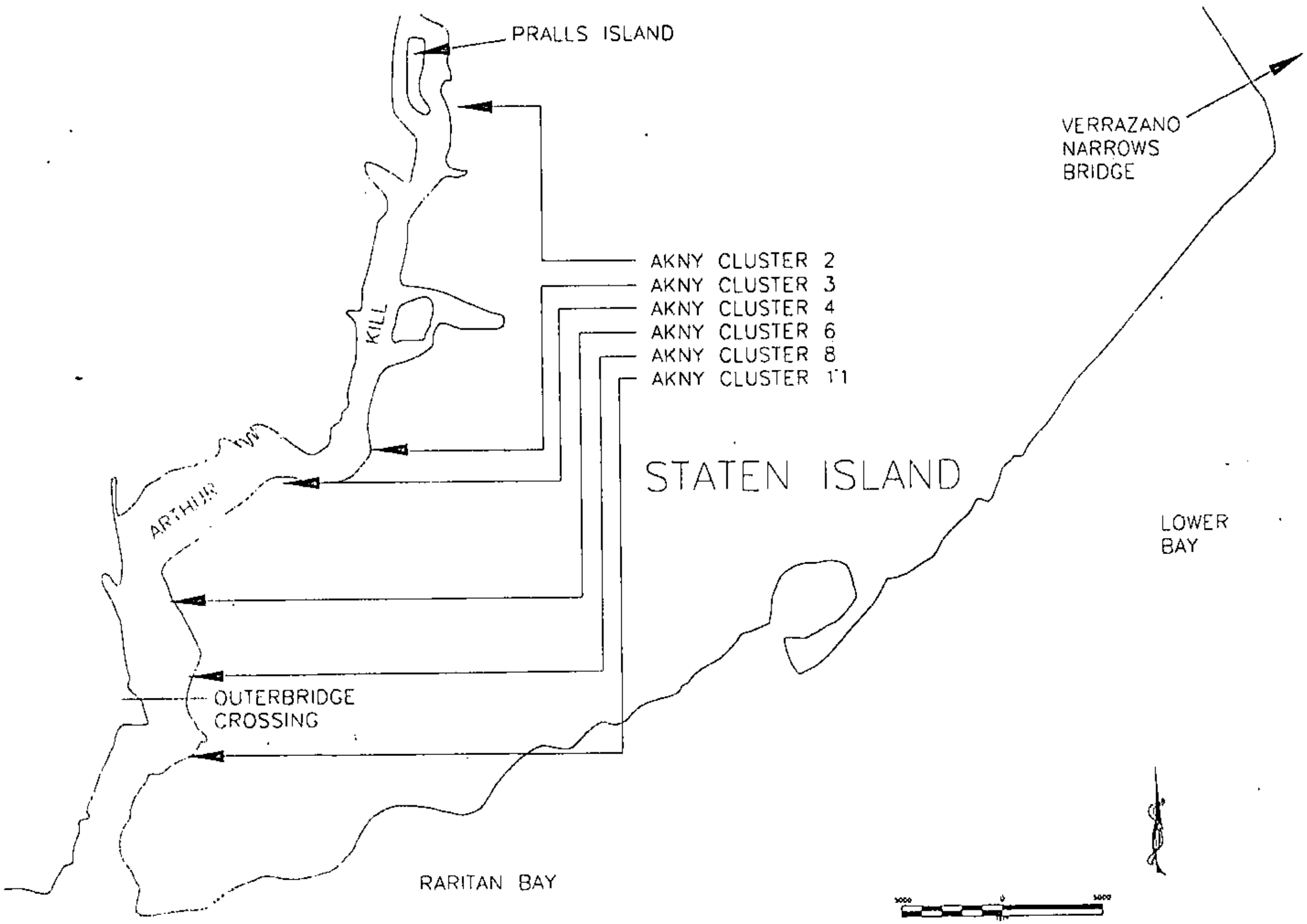


Figure 9. Arthur Kill, New York Reach vessel clusters.
Panamerican Consultants, Inc. U.S. Army Corps of Engineers
Cultural Resources Survey, New York Harbor Collection and Removal of Drift Project, Arthur Kill, New York Reach, Richmond County; Arthur Kill, New Jersey Reach, Union and Middlesex Counties; and Kill Van Kull, Richmond County, New York.

naissance surveys were added to updated catalogs. Eighteen of these vessels are located in the AKNY, and three (steel barges) are located in the AKNJ (Table 1).

For the individual vessel types identified in the three previous investigations, additional studies were recommended to determine what studies had been conducted and what was known about the vessel types identified in the three reaches, and to determine which features within each type represented undocumented construction features or unique design variations. It was subsequently recommended that properties and vessels, or representative vessel features, identified as significant would require documentation prior to the implementation of the Removal of Drift Project. To this effect, PCI conducted additional cultural resources investigations of the vessels and structures in order to identify those properties and vessels, or representative vessel features; to assess potential adverse Drift Removal impacts to these properties and vessels; and to recommend mitigative measures. The framework for these additional studies focused on vessel types rather than on individual vessels, with the vessel types evaluated within the context of the overall sample identified in the three reaches, as well as the context of previous historic vessel studies in the port. These investigations were conducted under Indefinite Delivery Contract No. DACW51-94-D-0034 and in response to the Corps' three Scopes of Work entitled *Cultural Resources Survey, Kill Van Kull Reach, Staten Island, Richmond County, New York, New York Harbor Collection and Removal of Drift Project* under Delivery Order No. 0008; *Cultural Resources Survey, Arthur Kill New Jersey Reach, Union and Middlesex Counties, New Jersey, New York Harbor Collection and Removal of Drift Project* under Delivery Order No. 0009; and *Cultural Resources Survey, Arthur Kill New York Reach, Richmond County, New York, New York Harbor Collection and Removal of Drift Project* under Delivery Order No. 0010 (Appendix A).

Although conducted under three separate delivery orders, the investigations of all vessels and properties within the three reaches were conducted concurrently as a whole. The results of the study indicate that 50 vessels and the two structures require varying degrees of mitigation in the form of photographic documentation and/or partial or complete HABS/HAER recordation if avoidance by adverse Drift Removal activities is not feasible. Divided into chapters on the Historical Background, Research Design, Investigative Results, and Interpretations and Recommendations, the following report describes in detail the methods and results of the investigation.

RESEARCH DESIGN

REVIEW OF PREVIOUS INVESTIGATIONS

MARITIME ARCHAEOLOGICAL RESOURCES. Preliminary research for the Drift Removal Project began with cultural resources assessments of Shooter's Island, Staten Island, Richmond County, New York, and the City of Bayonne, New Jersey waterfront, Elizabeth, Hudson, and Union Counties. The research, performed by Historic Sites Research, Princeton, New Jersey, and WCH Industries, Inc., Fort Washington, Maryland, identified cultural resources impacted by the project. Kardas and Larrabee (1984, 1985) provide a description and history of the City of Bayonne waterfront, Hudson County (1984) and Shooter's Island (1985). The study includes identification and description of the derelict wrecks associated with each project area. The 1984 study identified four vessels as historically significant: *Occidental,* built in 1874, and three WWI Gulf Coast vessels, *Maceratta, Molfetta,* and *City of Austin.* The ships *Estelle Krieger, James Howard,* and *Penrose* also received "significant" status.

The 1985 study singled out four wrecks for intensive study: a covered barge (1923?); the 1873 walking beam, sidewheel excursion steamer *Minerva* (ex-*Jane Moseley*); a steam-powered, wooden-hulled package freighter (1890s?); and the possible hull remains of a nineteenth-century New York harbor sailing lighter. Of these vessels, the covered barge is the only boat intact. Norman Brouwer, Curator of Ships and Marine Historian, South Street Seaport Museum, provided supplemental research associated with selected barges lying at Edgewater, New Jersey in 1985 entitled *Recording of Selected Barges Lying at Edgewater, New Jersey, Supplement to Survey of Cultural Resources in the Form of Derelict Ships, Hudson River Shoreline of Edgewater, New Jersey.*

In 1987, Consulting Nautical Archaeologists assessed the NRHP eligibility of two shipwrecks located north and south of the western extension of the U.S. Dike, South Newark Bay, New Jersey (James 1987). Archaeologists located three more wrecks during the investigation. All five wrecks, one wooden-hulled sidewheel steamboat and four wooden-hulled tugs, revealed little archaeological information and did not meet eligibility requirements for the NRHP.

Citing Kardas and Larrabee (1985), an underwater inspection of seven Port Johnson sailing vessels in Bayonne Reach, New York Harbor, part of the Drift Removal Project, James (1991) determined equipment and access requirements necessary to fulfill memorandum requirements regarding seven previously investigated vessels: *Estelle Krieger*, a four-masted schooner; *Maceratta* or *Marsala*, a five-masted barkentine; *Occidental*, a fully-rigged downeaster converted barge; *Penrose*, a barkentine; *Molfetta*, a barkentine; *City of Austin*, a converted barkentine/barge; and *James Howard*, possibly a rigged schooner later converted to a barge. Additional reconnaissance (Raber et al. 1995a) identified another vessel in the reach—*Matowac*, a schooner. The New York District Corps of Engineers is currently developing mitigation plans for these vessels.

The *Reconnaissance of Marine Cultural Resources* at *"Newark Bay Site,"* Staten Island, New York, prepared for the New York City Department of Environmental Protection (1992), surveyed 35 hulks and "pieces of wooden marine vessels" (Flagg et al. 1992:1) as potential historic cultural resources. This research determined two groupings of hulks and components yielding data significant in maritime research. Recommendations included mitigation should there be environmental impact to the sites.

In 1995, WCH Industries, Inc., Fort Washington, Maryland (Raber, Flagg, Weinstein, and Brouwer 1995), documented wrecks associated with the Bayonne Peninsula Ship-Graveyard, known as the Port Johnston graveyard. The report identified nine other vessels potentially eligible for the National Register. Of these vessels, eight are barge types, and one vessel was identified as a wooden-hulled subchaser.

Raber et al. (1995a, 1995b) and Raber, Flagg, Wiegand, and Weinstein (1995) investigated approximately 500 derelict vessels along the coastline separating Staten Island and New Jersey as part of the New York Harbor Collection and Removal of Drift Project. In assessing the significance of derelict harbor craft, Raber et al. developed preliminary typologies based on observation, written descriptions, drawings, consultation, and field inspection. The data presented here are an extension of Raber et al.'s (1995a, 1995b) and Raber, Flagg, Wiegand, and Weinstein's (1995) research.

TERRESTRIAL ARCHAEOLOGICAL RESOURCES. Because the removal of derelict sites associated with the project area has minimal impact on New York, Staten Island, and New Jersey shoreline sites, the following information is not intended as a thorough research of corresponding terrestrial sites. For a detailed review of project area terrestrial archaeological research, see Raber et al. (1995a, 1995b) and Raber, Flagg, Wiegand, and Weinstein (1995).

PREHISTORIC HISTORY OVERVIEW

Preliminary research on the prehistory of the project area includes Skinner 1909, Skinner and Schrabisch 1913, Williams 1968, Horwitz 1969, Rubertone 1974, Kraft 1977, Lavin 1980, Jacobsen 1980, and the Staten Island Institute of Arts and Science's Sandy Ground and Indian Sites Records.

Prehistorically, Staten Island and the adjacent New Jersey coastline contain heavy concentrations of prehistoric archaeological sites. Present on Staten Island are sites dating from Paleoindian through the Contact period. In Mariners Harbor, which lies opposite Shooter's Island on the Staten Island shoreline, several sites date from the Archaic to the Contact period. Recent research includes Bowman's Brook, a large site complex that includes five occupational components, including a Late Woodland component (Smith 1950; Ritchie 1969); the Archaic Goodrich site (Ottesen and Williams 1969); and the multicomponent Old Place and Goethals Bridge sites (Anderson 1964, 1967).

LATE WOODLAND PERIOD (A.D. 1000-A.D. 1600). By the time of seventeenth-century European settlement, Late Woodland Indians practiced maize horticulture. Typically associated with increased sedentism, warfare, and fortification, evidence suggests the Delaware and Leni-Lenape peoples of the Lower Hudson Valley did not engage in maize horticulture or conflict, and occupied unfortified scattered hamlets (Raber et al. 1995b). Staten Island contains many Late Woodland sites, including Smoking Point. Of the sites along the Kill Van Kull, only the Bowman site is attributed to the Late Woodland period, although other sites along the channel are probably from this period.

CONTACT PERIOD (A.D. CA. 1600-A.D. 1700). At the time of European invasion, the Raritan Delaware occupied sites in New Jersey along the lower Raritan River near the Kill Van Kull, as well as the southern part of Staten Island. Robert Juet, chronicler of Henry Hudson (1609) as cited in Clute (1877), states that the Raritan, a branch of the Delaware or Leni-Lenapes, occupied sites near the Kill Van Kull shoreline. The expedition found evidence of burial sites near shore as well, and noted the presence of lithic hatchet and projectile points.

The Hackensack also occupied the Island. At Tottenville, the Burial Ridge site had two pit features containing trade materials: an iron knife and a Spanish Medio Real (1685-1700). A single grave site contained a sherd of Dutch pottery and bottle glass, although another burial contained an intrusive(?) iron knife blade. Several artifacts around Tottenville are attributed to the Contact period. There are no sites known for the western shoreline of Staten Island or the New York Kill Van Kull shoreline (Raber et al. 1995b).

RESEARCH OBJECTIVES

Previous research on the Arthur Kill, New York/New Jersey Reach and the Kill Van Kull, New York Reach by Raber et al. (1995a, 1995b) and Raber, Flagg, Wiegand, and Weinstein (1995) concluded that the proposed removal of piers, bulkheads, and derelict wrecks in each reach would adversely effect two potentially NRHP-eligible properties, the former B&O Transfer Bridge No. 2 (KVK) and a pier in the AKNJ associated with the American Smelting and Refining Company, and approximately 140 vessels and 14 vessel clusters. This research (1) provides additional information on project vessels, structures, and clusters identified by Raber et al. (1995a, 1995b) and Raber, Flagg, Wiegand, and Weinstein (1995) as potentially significant and (2) further defines their significance. Vessel or cluster significance is based on the National Park Service National Register Bulletin No. 20, *Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places*.

The data presented here identifies each vessel according to type, location, approximate date of abandonment, general condition, and photographic documentation. Each site also receives specific NRHP recommendations.

THEORETICAL CONTEXT

Any attempt to understand the archaeological record requires a means and method to assess the age of artifactual material. The term "style" relates to artifacts contained in known archaeological deposits in which the artifacts display a regular and distinctive distribution. Generalizations about the temporal and spatial distribution of style led to the establishment of a standard procedure for the definition of type.

"Type" is the basic conceptual tool for cultural research. Archaeologists debate, however, on what constitutes a "type." A great deal of attention is paid to the means by which taxonomic classifications (types) are ordered. Typology then finds expression through a seemingly endless series of classifications.

Regardless of the means by which materials (and cultures) are classified, a cultural-historical paradigm attempts to descriptively acknowledge particular artifactual patterns which occur chronologically and regionally in the archaeological record. Attributes or characteristics are arbitrarily determined (despite claims to the contrary) by investigators in order to facilitate the chosen method of seriation. The types are then arranged into some sort of spatial/temporal or functional sequence.

Raber et al. (1995a, 1995b) and Raber, Flagg, Wiegand, and Weinstein (1995) previously constructed typologies for individual vessels within the project area. The typologies incorporate various definitions, i.e., construction (wood, iron, steel), design (barge, tug), function (ferry, freighter), rigging (barkentine, schooner), or environment (harbor, canal, coast). These typologies serve the purpose of NRHP evaluation and are applicable here.

ARCHIVAL AND RESEARCH SOURCES

PCI researchers investigated the following archival and research facilities. In New York, the Brooklyn Historical Society; the Canal Boat Museum, Syracuse; Chittenango Landing Canal Boat Museum, Chittenango; East Meadow Public Library, East Meadow; Hudson River Maritime Museum, Kingston; Lockwood, Kessler, and Bartlett, Syosset; Museum of the City of New

York; National Maritime Historical Society, Peekskill; New York City Municipal Archives Library; New York Historical Society Library, Manhattan; New York Public Library, Manhattan—General Reference Division, Maps Division, Science and Business Library, United States History Division, Local History Division, and Genealogy Division; New York State Bureau of Land Management, Albany; New York State Department of Environmental Conservation, Long Island City; New York Department of Transportation, Albany; New York Transit Museum, Brooklyn; Port Authority of New York and New Jersey, Manhattan; South Street Seaport Museum, Manhattan; Snug Harbor Cultural Center, Staten Island; Staten Island Chamber of Commerce; Staten Island Historical Society; Staten Island Institute of Arts and Sciences, Staten Island Topographical Bureau, St. George Branch of New York Public Library, Staten Island; SUNY; Webb Institute of Naval Architecture, Glen Cove.

In New Jersey, research facilities investigated include the New Jersey State Historical Preservation Office, Trenton; New Jersey Department of Environmental Protection and Energy, Tidelands Management Program Aerial Photo Library; New Jersey Historical Society, Newark; New Jersey State Museum, Trenton; Perth Amboy Public Library, Perth Amboy.

The following organizations or firms provided information on various subjects: East Carolina University, Greenville, North Carolina; Great Lakes Shipwreck Museum, Sault Saint Marie, Michigan, Institute of Great Lakes Research, Bowling Green, Ohio; University of Memphis; Mid-Atlantic Technologies, Wilmington, North Carolina; Tidewater Atlantic Resources, Washington, North Carolina; United States National Archives, Merchant Enrollment Records, Washington, D. C.

RESEARCH PROBLEMS

Problems associated with maritime field research typically fall into two categories: (1) logistics and (2) environmental constraints. Logistically, several issues must be addressed. Twenty-one vessels not included in the original project catalogs were not identified during the development of updated catalogs. Eighteen of these vessels are present in the Arthur Kill New York Reach. As outlined in the Scope of Work, Task 1, the eighteen items (Vessel Nos. 40A, 104A, 107A, 114A, 184A, 197A, 200A, 202A, 203A, 212, 235A, 244A, 244B, 245A, 249A, 249B, 249C, and 240D) are not sufficiently documented for field investigation.

Because the condition and rates of deterioration of project-area derelict sites result from the amount of environment exposure, some of the sites are easier to investigate and observe than others. PCI personnel made every attempt to observe and catalog data associated with each site. The quality of site investigation therefore depended on the accessibility and exposure of each site.

As stated by Raber et al. (1995b), there is minimal documentation associated with the origin and identification of project-area vessel clusters. "There have been no consistent methods for studying derelict vessel groupings" (Raber et al. 1995b:9). In a 1994 article in the Staten Island Advance (14 August), Joseph Sauerhoff, owner of the Arthur Kill Charleston site, stated that the abandoned barges have been on the Kill for some 40 or 50 years, but "nobody knows who they belong to...they have no identification." Previous research suggests illegal activity (dumping) associated with derelict vessels along Staten Island (Flagg et al. 1992).

As outlined in the Scope of Work, Task IV, Section B for each reach, vessels should be evaluated within the context of the overall sample represented by previously identified vessels. For this reason, the study focused on vessel types rather than individual vessels. Regarding vessel clusters, their significance lies in the information they might reveal regarding the firms or individuals responsible for creating the clusters. Fourteen vessel clusters (two for the Arthur Kill, New Jersey Reach, six each for the New York and Kill Van Kull Reach) contain 418 vessels, many of which are included in the 140 vessels previously identified.

The methods employed here for cluster data depend on local informants and comparison of aerial photography. While conclusions based on such are suspect, they at least provide a chronological history of the clusters within the project reaches.

SITE DOCUMENTATION. Logistically, documentation of each site depended on (1) the condition of each wreck site, (2) the amount of exposure during tidal currents, (3) accessibility, and (4) weather conditions. Deterioration of the wreck sites often prohibited closeup inspection because of the inherent danger associated with boarding a vessel. Tidal currents exacerbated this situation, since tides determined site accessibility (by boat or foot) and the amount of wreck exposed. Weather conditions determined the quality of photography. A small percentage of sites no longer exist or are not visible at low tide.

METHODS

The rationale for investigation is (1) to understand construction, function, design variation, and history of harbor derelict vessels; and (2) to identify the historical significance of vessel clusters within the Arthur Kill and Kill Van Kull Reaches. Between October 16, 1995 and April 25, 1996, PCI conducted Phase 1 reconnaissance of previously investigated vessels and structures along the Arthur Kill, New York and New Jersey Reaches, and the Kill Van Kull, New York Reach. Utilizing previously recorded data from Raber et al. (1995a, 1995b) and Raber, Flagg, Wiegand, and Weinstein (1995), visual, written, and photographic cataloging provided the basis of documentation. To date, no UTM or latitude/longitude site coordinates are available. The lack of accurate site bearings is understandable, given the large number of derelict vessels within the project area.

Each site is has a numerical assignment. A site is defined as a numerically designated derelict vessel. Location, therefore, is verified visually using aerial photographs and detailed reproductions. The quantity and degree of data depended on (1) site accessibility, (2) site condition, (3) local environment.

The determination of significant vessel clusters relied in large part on the availability of data. There are no detailed investigations of local waterfront history (Raber et al. 1995a). For years locations along the Staten Island and corresponding New Jersey waterfront "have become dumping grounds for abandoned barges and other hulks...creating a hazard to navigation and an eyesore" (Staten Island Advance 1974:1). Comparison of aerial photographs and insurance maps provide chronological sequences, but the clusters represent "disposal behavior," though some clusters are evidently connected with harbor industries.

Four principal approaches prevailed during research: (1) full description of a site; (2) visual determination of typologies wherein grouping is done primarily to reduce repetitive description, the division of criteria chosen by Raber et al. (1995a, 1995b) and Raber, Flagg, Wiegand, and Weinstein (1995); (3) classification aimed toward standardization of description and comparison over wide areas; and (4) development of a true typological method wherein types become specific groupings of structural features which have proven historic significance.

Following the proliferation of containerization and trucking industries in the 1960s, harbor craft typical of the project area were left abandoned along both coastlines of the Arthur Kill and Kill Van Kull channels. All the wrecks are in various stages of deterioration.

As stated by Norman Brouwer, Curator of the South Street Seaport Museum, New York City (Kardas and Larabee 1985), there is a lack of data associated with barge and lighter construction and their builders. The likelihood of discovering individual histories or ages for most of the project-area wrecks is minimal. Their significance, therefore, must lie in documentable construction details.

Discussion of Expected Results

The research provides baseline data for NRHP evaluation. Based on observation, previous investigations, and research associated with similar vessel "types," the present data offer documentation and analysis of project-area shipwrecks. The evaluation constitutes sites selected for the NRHP.

NRHP

As stated in National Register Bulletin 15, *How to Apply the National Register Criteria for Evaluation* (National Park Service nd), and Bulletin 20, *Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places* (National Park Service 1985), "the quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association." To be considered significant and therefore eligible for nomination to the NRHP, the property must meet one or more of the four National Register criteria:

> A. Be associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. Be associated with the lives of persons significant in our past; or
>
> C. Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> D. Yield, or likely to yield, information important in prehistory or history [National Park Service 1985:5-6].

Properties found potentially eligible, eligible, or listed on the NRHP must be considered within the framework of the proposed action. If adverse impact to such a property is possible, alternatives to the proposed action, i.e., avoidance, must be evaluated. If avoidance is not practical, additional activities relative to the evaluation of the resource may be required.

A vessel's significance, as stated in Bulletin 20, is based on a "representation of vessel type and (its) association with significant themes in American history and comparison with similar vessels" (National Park Service 1985:4). Of the five basic types of historic vessels which may be eligible for NRHP nomination as stated in National Register Bulletin 20, *Nominating Historic Vessels and Shipwrecks to the NRHP*, the vessels within our three project areas fall into two defined categories, "hulks" and "shipwrecks." Bulletin 20 defines hulks as "substantially intact vessels that are not afloat, such as abandoned or laid up craft that are on a mudflat, beach or other shoreline." "Shipwreck" is defined as "a submerged or buried vessel that has foundered, stranded, or wrecked. This includes vessels that exist as intact or scattered components on or in the sea bed, lakebed, river bed, mud flats, beaches, or other shorelines, excepting hulks" (National Park Service 1985:3). The significance of shipwrecks, as opposed to intact vessels (i.e., hulks), "requires that the wreck display sufficient integrity to address architectural, technological, and other research concerns" (Pearson and Simmons 1995:129).

The photographs and archival data presented here show selected features of site details and serve as an outline for NRHP evaluation. The COE New York District has a complete catalog of wreck sites included in Appendix E as outlined in the Scope of Work. Construction plans for project area types are presented in Volume II. Specific recommendations are made in the "Conclusions and Recommendations" section of this report.

WRECK/SITE CONDITIONS

Hull deficiencies in wooden vessels associated within the project area are typically grouped into three categories: time, environmental stress, and structural damage, particularly due to salvage and burning. Serious deterioration of wooden-hulled vessels can occur with little or no outward sign of damage. Decay (dry rot) is most often found in wood exposed to wind and water, which is the case with most of the project-area sites. Wood decay is caused by various fungi whose growth depends on temperature (50 to 90 degrees F), available food (wood), and moisture. Wood suitable for fungus growth must have at least a 20 to 30% moisture content, a condition promoted by poor ventilation (Pearson 1987).

Dry wood or waterlogged wood does not rot. Not all wood has the same resistance to decay. Under freezing conditions, wood structural members with a high moisture content may appear sound, when in fact they may be in advanced stages of decay.

The other principal form of shipwood deterioration is marine borer attack. Marine borers are present in varying degrees in almost all salt and brackish waters. Wood-boring mollusks are the worms (*Teredinidae*) and piddocks (*Pholodaceae*). Mollusks bore into wood below the mudline "by the rasping action of their clam shell grinders" (Pearson 1987:15). No species of wood is immune to attack, and no method of protection is completely effective. Heavy pollution of the Arthur Kill and Kill Van Kull channel between ca. 1880-1910 probably had the same effect on *Teredine* spp. colonies as it did on oyster colonies. In the case of the project area, only a few wrecks exhibit visible signs of infestation, though infestation below the water line is obviously not visible. Approximate dates for *Teredine* eradication are not available.

Historically, the Arthur Kill channel is a vital link for the import and export of supplies and products to a host of industries. The waterfront along the New Jersey shoreline of the Arthur Kill consists of factories, bulkheads, marshlands, marinas, derelict boats, environmental ruin, and industrial intensity. The landscape is characterized as "an environmental wasteland of belching smokestacks, huge holding tanks, weathered bulkheads and dilapidated piers" (Hirsh 1980:D10). Six towns front both the Arthur Kill and the Raritan River. Coupled with these townships are hundreds of petroleum storage tanks. The area is heavily industrialized.

Pollution in the Arthur Kill and Kill Van Kull channel is unfortunately part of its history. The harbor's heavy industrialization, particularly in the nineteenth century, "exacted a heavy ecological toll on the Kills, establishing patterns of pollution that persist to this day" (Hurley 1992:16). During the first half of 1990, the Arthur Kill and Kill Van Kull suffered from a series of refinery and tanker accidents. Over one million gallons of petroleum spilled into the project area (Hurley 1992).

American oil industrialization began in 1859 when Edward Drake discovered crude oil in western Pennsylvania. Railroad and pipeline transportation networks naturally gravitated toward New York City's port facilities. Companies located in Queens and Brooklyn first, then moved west across the Hudson to northern New Jersey, the refiners' preferred location (Hurley 1992).

Although smaller refineries occupied waterfront sites from the Raritan River to Jersey City during the 1870s, the area gained its reputation as a giant petroleum district when Standard Oil Company moved into Bayonne in 1877 (Hurley 1992). By the turn of the century, Standard Oil claimed the Bayonne refinery as the largest refining plant in the world. Standard Oil built another refinery, the Bayway plant along the Arthur Kill in Linden, New Jersey, in 1909. By the 1920s, refineries along New Jersey's eastern shoreline produced nearly 1,000 barrels of finished oil per day (Hurley 1992).

Almost every stage of the refining process involved pollution: crude oil storage tank seepage, distillation waste, spilled kerosene, and the disposal of thousand of gallons of sulfuric acid and caustic sodas. Unlike other urban rivers, oceanic tidal flows entering the Kills from north and south eliminated much-needed flushing action. Oil and acidic sludge saturating the refinery grounds eventually seeped into the channel. A Standard Oil plant investigator stated:

> [A] ditch that carried 'oily and waxy refuse' from paraffin stills to a marsh on the premises 'from whence it eventually finds its way into the creek or remains as a thick and offensive coating on the ground.' In one area, this 'nasty semifluid mass' formed a lake thirty feet across. Far worse conditions prevailed at another nearby refinery, the Ocean Oil Company, where high tides swept the premises, washing oil, tar, and sludge acid into the Kill Van Kull [Hurley 1992:18].

Pollution decimated the area's oyster crop. Fish fared some better, though caught fish tasted of oil and kerosene. Pollution eventually ended commercial fishing in the project area.

Oil production increased during WWI, as did the pollution. The refineries along the Arthur Kill and Kill Van Kull in New Jersey made the project area one of the busiest shipping lanes in the world. Oil spills became such a problem that in the early 1920s, areas on the channel occasionally broke out in flames (Hurley 1992).

Since WWI, New Jersey's northeastern shoreline has established itself as a petroleum-based manufacturing center. Tanker and barge traffic in the Kills is heavy. Despite efforts by the Federal government to regulate water quality (Clean Water Act of 1972, etc.) "tankers spill over 50,000 gallons of oil into New York harbor each year" (Hurley 1992:19).

Since the 1990 Exxon (Standard Oil) disaster, the project-area waters are apparently on the mend, but to a limited degree. Industrial and residential runoff, coupled with industrial discharge, continually pollute the channel, but Ed Johnson, Curator of Science at the Staten Island Institute of Arts and Sciences, stated that things have improved in the Kill since 1990. "A lot of people think all these waterways are so polluted [around Staten Island]...they are...but they're a lot cleaner" (Staten Island *Advance*, 29 July 1994).

HISTORICAL OVERVIEW

ENVIRONMENTAL SETTING

GEOLOGY AND SOILS. The project area rests within the Piedmont Plateau of the Appalachian province, the southern and eastern boundaries section of the Coastal Plain province of the Atlantic slope (Figure 10). The Atlantic Coastal Plain, "a sequence of strata lapping over the margins of the continent," extends from the north shore at Long Island to Florida along the Atlantic Ocean and westward toward the Piedmont (Strahler and Strahler 1973:203). These coastal sediments (exposed sea bottom) consist of sand, clay, and marl layers (Schuberth 1968). The plain has slopes less than 5-6 feet per mile, though steeper slopes occur inland (Kummel and Lewis 1940).

Bedrock geology underlying the project area consists primarily of widely exposed sedimentary red shales and sandstone siltstone up to 10,000 feet thick (Van Houten 1969). The formation (Triassic period Brunswick) underlies the lower Raritan River and the Arthur Kill along the edge of the Piedmont Plateau (Schuberth 1968; COE 1979). As stated in Raber et al. (1995a), much of the Arthur Kill's bedrock is some 30 feet below mean sea level.

The surface geology of Staten Island is generally composed of landform and glacial deposits (ground moraine, terminal moraine, and outwash sediment) left by the Wisconsin ice sheet some 55,000 to 10,000 years ago (Hershkowitz et al. 1985). Glaciers in the vicinity of New York City retreated some 17,000 to 15,000 years ago. In their wake, glacial scarring left diverse microenvironments, i.e., estuaries, bogs, marshlands (fresh and salt water), uplands, and midslope zones.

During this era, pro-glacial Lake Hackensack "deposited a mixture of clay, silts, sands and gravel on western Staten Island" (Berger 1987:4). As the lake drained (13,000 B.P.) a stream cut through sediments to form the Arthur Kill Valley (Silver 1984). Early occupation of the area probably occurred around 12,000 B.P.

Sea levels rose to some 30 feet below its present level by 5,000 B.P. With rising sea levels, the Arthur Kill was an intermittent freshwater stream. The stream, despite its steep valley locale, did not prohibit eastern or western human passage (Silver 1984). Rising sea levels continued to some 14 feet below present levels by 2,000 B.P. The western sections of the Island shifted from an upland and inland grass, oak, and pine forest to a coastal lowland zone (Silver 1984).

BEDROCK GEOLOGY. Staten Island's basement rock consists of early Paleozoic Wissachickon or Manhattan formation metamorphic gneiss and schist. "It is one of the few places in New York City where metamorphic, igneous, and sedimentary rocks occur together in a relatively small area" (Okulewicz 1990:1). During the Richmond Water Tunnel excavation between Staten Island and Brooklyn in the 1960s, a 1,000-foot shaft sunk in Tompkinsville encountered Manhattan schist, Fordham gneiss, and Inwood marble, along with various granite intrusions (Okulewicz 1990).

The Fordham gneiss is a metamorphic rock derived from either ancient greywacke sandstone or rhyolitic volcanic ash, dated approximately 575 million years old (Okulewicz 1990). It forms the basement upon which all other overlying rocks in New York City are found.

This group of bedrock, collectively known as the New York City Group, includes metamorphic Manhattan schist, an initial deposition of sedimentary black shale, and a 435-million-year-old marine basin from the Cambrian Period of the Paleozoic Era (Okulewicz 1990). Manhattan schist is one of several schist members, each distinctive in mineralogy and texture.

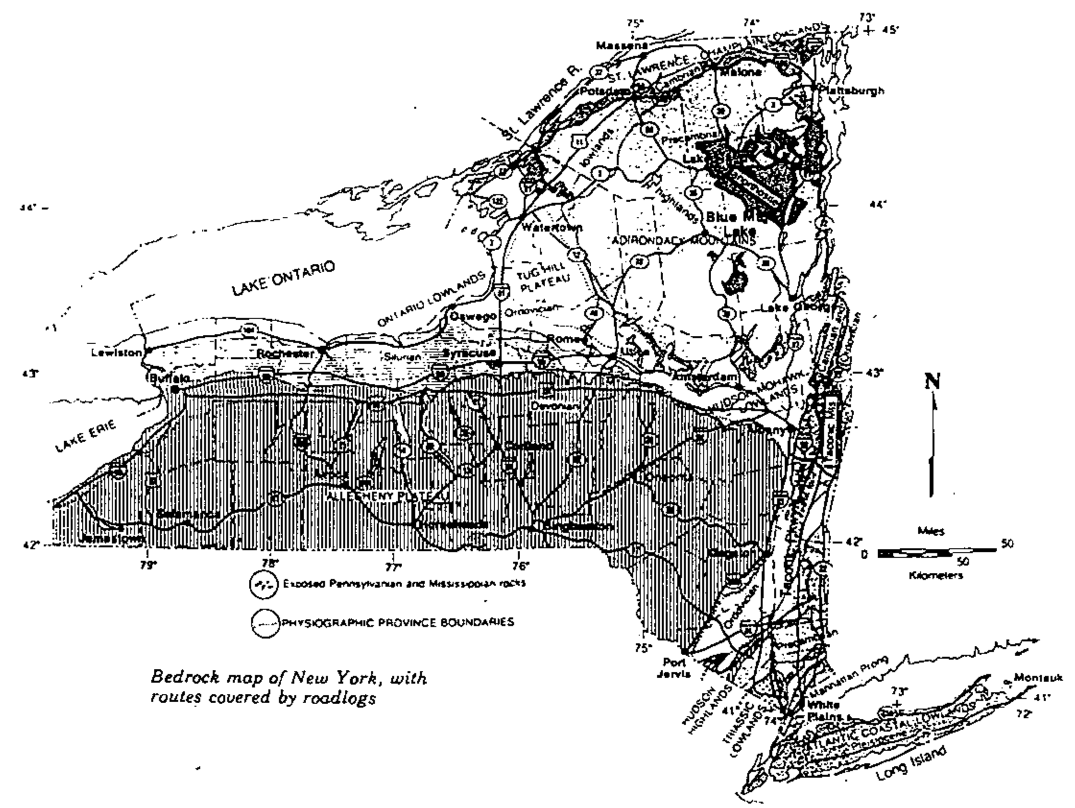


Figure 10. Bedrock map of New York state with state highway routes (Van Diver 1985).

TOPOGRAPHY AND SOILS. The Manhattan Prong, characterized "by low, northeast-trending ridges carved from resistant gneisses and schist, and shallow valleys from weaker marble," lies in a confined strip of New York east of the Hudson Highlands and the Hudson River, and underlies Manhattan and Staten Island (Van Diver 1985:12).

The Arthur Kill's New Jersey coastline consists of late nineteenth- and twentieth-century fill at elevations 5 to 20 feet above mean high water. The fill occupies later Holocene saltwater marsh or occupies up to 300 feet beyond high-water marks documented in the nineteenth century (Raber, Flagg, Wiegand, and Weinstein 1995). For the most part, Staten Island surface soils consist of red clay identified as glacial outwash deposits. Deposition includes about an inch of humus and leaf mold with more loam present near house sites and in the stream valley, a primary result of sheet erosion due to deforestation and urbanization (Hershkowitz et al. 1985).

NATURAL WATERFRONT AREA OF STATEN ISLAND. Numerous saltwater marshes surround the project area, particularly Staten Island. The marshes, fringing the shoreline amid shipwrecks, abandoned piers, and docks, include *Spartina alterniflora* and *S. patens*. The northwestern section of Staten Island consists of an interlocking network of creeks, tidal and freshwater wetlands, swamps, and marshes (Dinkins and Schaffer 1992). The network includes Mariner's Marsh, complex of freshwater marshes, ponds, meadows, and streams near Arlington Yard, and Graniteville Swamp, an intact swamp forest (Figure 11).

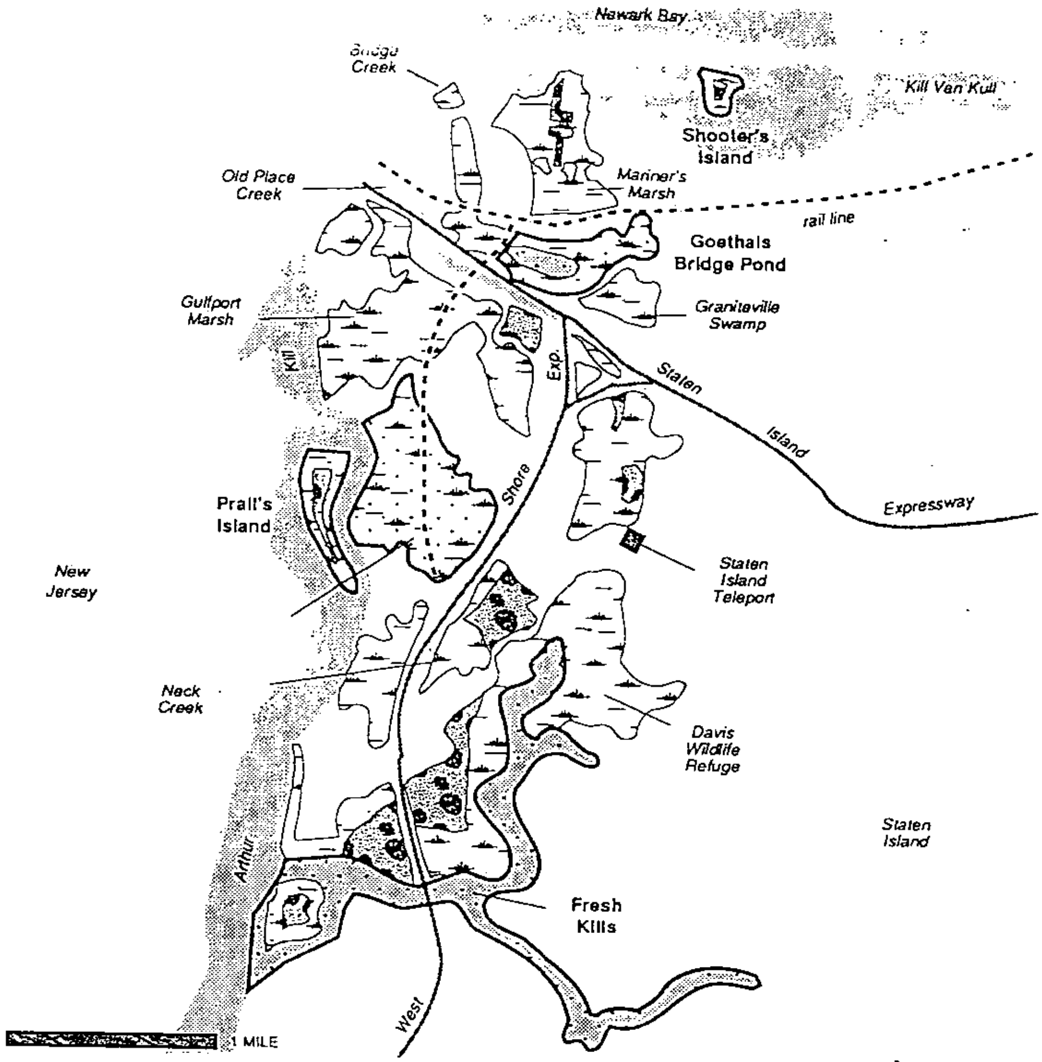


Figure 11. Staten Island Waterfront area (NYC Department of City Planning 1992)).

The project area is in a temperate zone, with cold winters and warm summers. Temperature extremes are moderated through the effect of the Atlantic Ocean. Average temperature over a five-year period at Newark airport measured 54.85 degrees F. Winter snowfall generally occurs from December to March, with traces falling during November and April (COE 1979).

The study area is directly under the influence of ocean tidal action via the upper New York Bay, the Kill Van Kull, and the Arthur Kill channels. In the Arthur Kill, flood tide sets from Raritan Bay to Newark Bay. In the Kill Van Kull, the flood tide sets westward and the ebb tide eastward. Data generated during environmental impact studies by the COE for Shooter's Island (1979) indicated a semi-diurnal tide with a mean range of 4.6 feet at St. George, Staten Island, near the easterly entrance of the Kill Van Kull. Measured ranges from three other areas in the channel indicated increments from 4.6 to 5.1 feet (COE 1979).

CHANNEL MORPHOLOGY/HISTORY

The commercial life of a seaport is dependent on its ability to handle deep-draft ocean-going vessels. The U.S. Army COE, New York District is responsible for navigation in New York Harbor, which includes the project area.

Authorization of dredging along the Arthur Kill channel first occurred in 1874. Subsequent work in the channel occurred in 1880, 1888, 1889, 1890, 1896, 1902, 1912, and 1913 (Kardas and Larrabee 1985). Initial work coincided with the creation of industrial development such as the Singer Industrial complex in 1873.

The U.S. Army Corps of Engineers project to deepen the channels, authorized during the early 1980s, involves deepening the channel from 35 to 40 feet, a depth to accommodate the new giant steamships steaming in and out of Port Newar and Elizabeth (Staten Island *Advance*, 9 April 1993). Long-range plans call for deepening the Kill to 45 feet (Staten Island *Advance*, 18 September 1992) (Figure 12).

The Arthur Kill's deepest natural channel runs closer to New Jersey's shoreline than to Staten Island. At Tottenville, Staten Island, however, the thalweg evidently splits down the middle (Raber et al. 1995a). Present sedimentation studies on the Arthur Kill suggest that southern deposits (oceanic and Raritan River) reach 75,000 metric tons of sediment per year. Of this, about 37,000 metric tons of sediment annually flows into Newark Bay. Fluvial sources provide about 60% of inorganic fine-grained sediments to the system, with oceanic networks supplying about 30% of these materials (Raber et al. 1995a). Bottom sediments in the Arthur Kill are fairly uniform dark-colored silt and clay, with occasional sand (Battelle 1996).

Channels and dredge pits now serve as the channel's thalweg (dominant riverbed channel) and certainly alters the channel's sediment budget. As indicated in previous studies (Raber et al. 1995a), undredged channels and pits quickly fill up. Shoaling rates for the Arthur Kill in 1972 reached .55 feet per year in the main channel, though this figure does not reflect shoreline dredge spoil accumulation. The average annual shoaling rates for that year totaled 55,000 cubic yards (Nancy Brighton, personal communication 5 April 1996). Raber et al. (1995a) suggest slower sedimentation rates for the project area.

EUROPEAN HISTORY

NEW YORK HARBOR. The project area is well documented historically (Adams 1983; Albion 1939; Brouwer 1987; Rush 1920). The following is not intended as a thorough project-area history, rather, it provides contextual history for National Register eligibility evaluation.

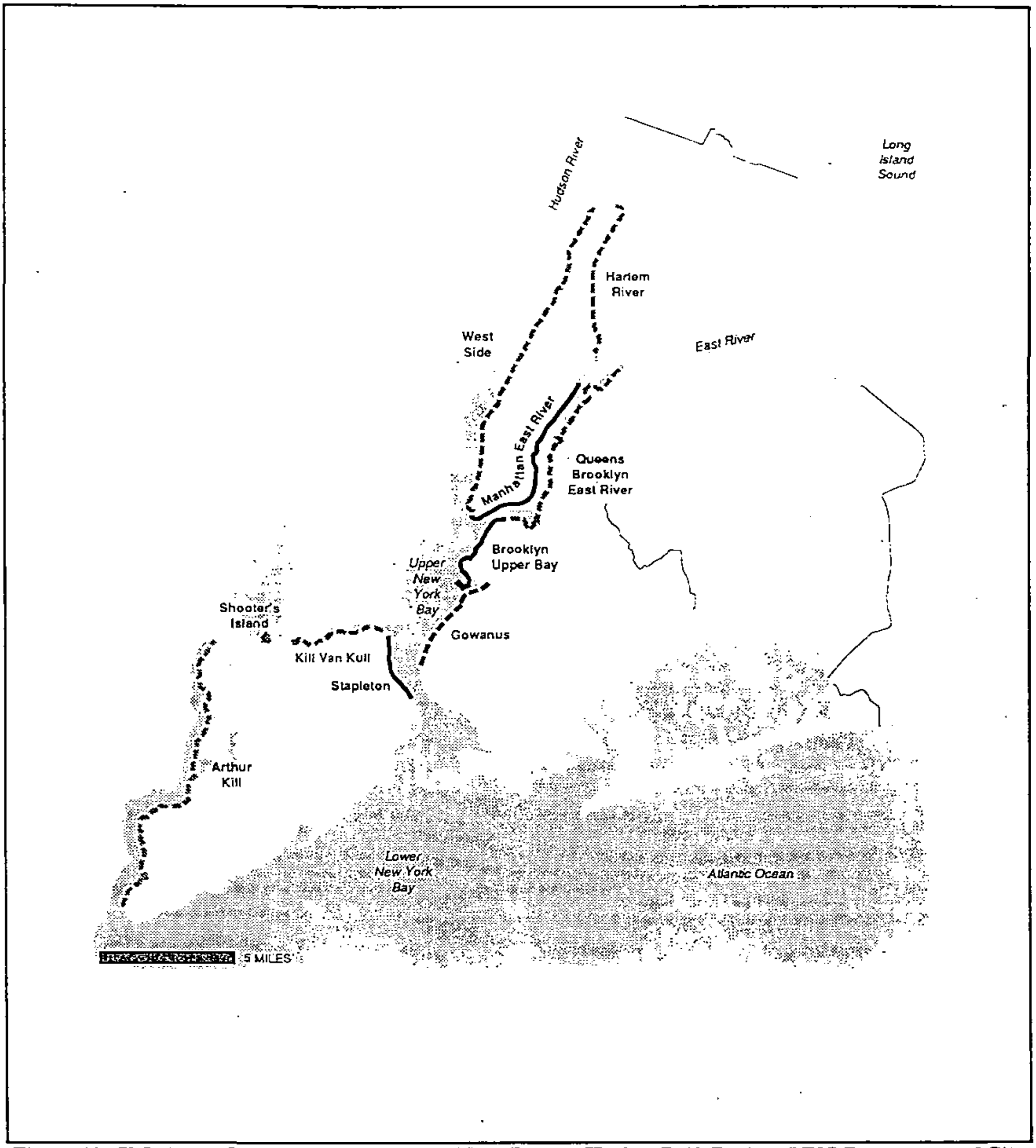


Figure 12. U.S. Army Corps of Engineers, New York District Harbor Drift Project (NYC Department of City Planning, 1992).

Unlike early colonial enterprises founded on political or religious principles, trade prompted New York's development. Early shipping in Manhattan began around 1610, centering around the limited trade and barter of fur, probably beaver (Bank of Manhattan Company 1915). The Dutch began initial colonization of the Island, with the Dutch West India Company establishing a trading post in Manhattan in 1625 (Shumway 1975). By 1650, New Amsterdam, or early New York, featured peoples speaking some 18 languages.

> This broad-minded tolerance, which was the universal Hollandish custom, attracted from Europe bold adventurers bent upon making their fortune. In spite of the interruption of the change from Dutch to English rule, in spite of the constant warfare of the eighteenth century and the British occupation during the Revolution, New York's commerce grew steadily. By 1800, eleven years after the adoption of the Constitution...New York had outstripped its rivals...and had taken the foremost place as the seat of American commerce...[Bank of Manhattan Company 1915:5].

In describing Manhattan's port, historian Robert G. Albion wrote, "At no other spot on the North Atlantic coast was there such a splendid harbor so favorably situated for the combination of transatlantic, coastal, and inland trade" (Albion 1939:16). Since the 1820s, New York has held the distinction as the nation's largest port.

STATEN ISLAND. Relative to the New York-New Jersey metropolitan area, Staten Island is both bound and isolated. Historically, the island's western border, the Arthur Kill channel, and its northwestern border, the Kill Van Kull, played vital roles connecting New York with New Jersey, Philadelphia, and Long Island Sound.

Staten Island rests between New York Bay and New Jersey's northwestern shoreline, the Arthur Kill channel separating the Island from the latter. The Island's geographical center is situated 11 miles southwest of New York City. The Kill Van Kull extends from Newark Bay to New York Bay and separates Staten Island's northwestern shoreline from New Jersey at Bergen Point. Bayles (1887) states that the Island's name is an English rendering of the Dutch form *Staaten Eylandt*, meaning "Islands of the States."

The name "Kill Van Kull" (channel), historically known as the Kills, is apparently Dutch for the "Kill of the Cul" (*Het Kill van het Cul*) (Bayles 1887). *Kill* is a Dutch word for "creek," while *Cul* is possibly French for "bay," thus "the creek of the bay." *Achther Cul*, the Dutch rendering for Newark Bay, meant "Back Bay," the Dutch word *achter* meaning "after" or "behind" (Clute 1877).

De Vries (1655), as cited in Wacker (1975), comments on the immense numbers of water fowl on the Achter Col, stating:

> There are great numbers...of geese, which stay here through the winter, by the thousands, and which afford fine sport with a gun....Land birds are also very numerous, such as wild turkeys...taken by the savages with their hands, who also shoot them with bows and arrows....There are different kinds of fine fish...haddock, plaice, flounders, herring, sole, and many more kinds....There are fine oysters, large and small, in great abundance. In the summer time crabs come on the flat shores, of very good taste [Wacker 1975:23-24].

The description offered by De Vries is a far cry from the fouled and polluted waters of the modern Arthur Kill and Kill Van Kull channels.

Initially, Native American conflict hampered European development of Staten Island. As part of the Province of New Netherland, the Island fell under the jurisdiction of the Dutch West India Company (1621 to 1664) (Black 1982). In 1661, French Waldenses and Huguenots established a modest village near South Beach, apparently the Island's first permanent European settlement (Steinmeyer 1950).

The Dutch surrendered its Island claim to England in 1664. Native American conflict culminated in the "Peach War" of 1655, which depopulated the Island where "settlement had to be recommenced" (Bayles 1887; Black 1982). Staten Island became part of the shire of Yorkshire. Francis Lovelace, who purchased Native American land rights to the island in 1670, laid out lots on the Island's north, south, and west sides. In 1675, the Island obtained separate jurisdiction, and in 1683, a separate county, Richmond.

Demographically, seventeenth-century Staten Island mirrored early Dutch and subsequent English settlements. Under English domain, the Island witnessed the arrival of fugitive French Huguenots in significant numbers. By the mid-1700s, Staten Island included Dutch, French, Belgian, and English populations (Bayles 1887).

Between 1790 and 1810, the Island featured a rural population subsisting on farming, fishing, and maritime commerce. The population (5,347) increased more than 39 percent by 1810 (Sachs and Waters 1988). Agriculture (beef, pork, wheat, rye, apples) and seafood (fish, clams, oysters) sustained the Island's population (Cotz et al. 1985). The community also harvested salt hay from the extensive salt meadows in Northfield, Southfield, and Westfield townships (Akerly 1843).

Commercial oystering dates from the earliest Dutch settlements. The industry even advertised in early Dutch journals (Powell 1976). Considered a staple in the eighteenth century, the industry shipped oysters locally and abroad. Beds thrived in the Arthur Kill's deeper waters, Prince's Bay, the mouth of the Raritan River, and the Kill Van Kull (Hine and Davis 1925; Sachs and Waters 1988).

Extensive marshes north of later Rossville, coupled with the Island's remoteness (relative to New York City and Philadelphia markets), slowed coastal development. Furthermore, large land grants encompassing the Island's southern end restricted settlement. Christopher Billopp received about 1,600 acres on the Island's southwest corner. The grant occupied the Arthur Kill and is the only one noted for the project area (Raber et al. 1995a).

Mark Dusachoy, described in a seventeenth-century deed transaction as a "planter," held some 823 acres in the Smoking Point area (Schneider 1977). By the end of the colonial period, subdivided Billopp grants, together with other smaller grants, lead to increased farming near the Arthur Kill south of Fresh Kills.

Local ferrying operations between Perth Amboy, New Jersey at the end of Amboy Road began in the early 1700s. Perth Amboy received a charter in 1718, making it New Jersey's oldest incorporated city (WPA 1946). Besides local ferry service, given opportunity, the Billopp ferry probably served as a link between New York City and Philadelphia. The ferry operated intermittently from the Amboy Road site until the beginning of the Civil War, when the landing moved one-half mile north (Raber et al. 1995a).

The history of the Port Richmond-Bergen Point ferry dates to the 1690s. Jacob Corsen petitioned the New York Governor's Council in 1750 for a patent stating that he had operated a ferry between Staten Island and Bergen Point for some 60 years. His request, to "erect" his vessel into a public ferry, grew out of fear of competition as a result of increased population. Corsen received the patent, operating the ferry until 1764. New owners took over the operation the same year (Reed 1959).

Eventually smaller communities emerged north of the Billopp grant boundaries as New York/Philadelphia markets expanded. The initial franchise, Old Blazing Star (now Rossville), is located in an area north along the south side of what is now Arthur Kill Road (prehistoric Smoking Point). The name "Blazing Star" apparently originated from taverns at each ferry site. Old Blazing Star remained the project area's principal settlement until after the American Revolution. The New Blazing Star Ferry at Tompkinsville (Linoleumville) opened around 1757 and by 1764 featured a stagecoach connection.

Ferry Service. The New Blazing Star route began in New York City, crossed the North River by ferry to Powle's Hook (Jersey City), to Bergen Neck (Jersey City and Bayonne), to Bergen Point, where the ferry carried passengers and freight across the Kill Van Kull (Reed 1961). The New Blazing Star differed from the Blazing Star Ferry, which ran from modern Rossville, Staten Island to the opposing New Jersey shoreline. The New Blazing Star did not operate during the Revolutionary War.

British forces occupied the island during the Revolutionary War. Up to 40,000 garrisoned British and Hessian troops occupied the island, many stationed near the western shore (Sachs and Waters 1988). This was perhaps due to the location of the Old Blazing Star ferry and its subsequent access to Philadelphia and New Jersey (Schneider 1977). After the war, local officials confiscated and subdivided the grant's remaining acres. Development of the island's hamlets, villages, and industry depended, in part, on transportation networks, i.e., ferries, landings, and roads.

Ferry service provided early links with the mainland. By 1816 Daniel Tompkins' Richmond Turnpike Company opened a road connecting the northeast shore (Tompkinsville) with the New Blazing Star Ferry west in Linoleumville. Tompkins then offered steamboat service between Tompkinsville and Manhattan, establishing a direct route between New York and Philadelphia (Cotz et al. 1985). The ferry at Tottenville linked Staten Island with Perth Amboy, and the one at Holland or Howland Hook with Elizabeth, New Jersey. Another ferry ran across the narrows to Brooklyn. Kill Van Kull service ran between Bergen Point and Port Richmond (Leng and Davis 1930). In the 1830s, a horseboat ferry operated across the Kill Van Kull, The vessel, known as Coyles horseboat, ran during the late 1830s and early 1840s. The project lasted only a few years, the service replaced by rowboats or scows (Reed 1959).

Despite New York Harbor expansion, the Arthur Kill's marshy shoreline prevented large-scale commercial development. In 1810, the Island's primary industries included two textile carding machines, two tanneries, three distilleries, and 59 looms producing some 23,100 yards of flaxen fabric, 12,000 yards of woolen fabric, and 7,000 yards of blended cloth (Sachs and Waters 1988). Even as the channel itself became an increasingly important commercial route, communities along the Arthur Kill remained largely agrarian.

In the early nineteenth century, Manhattan's new middle class sought refuge on the Island's underdeveloped southern shore. The earliest resorts appeared in Tompkinsville (1821) and later north in New Brighton (1837). The grand shoreline became a favorite local retreat. In the 1880s South Beach, later Midland, had 100,000 tourists during peak season (Staten Island 1979). Several large institutions, public and private, medical and non-medical, established expansive residences along the northern shoreline. Settlements gradually developed around these institutions. The wealthy, meanwhile, established their own Island estates.

Early industrial development began on the north shore at Factoryville, now West New Brighton. In 1819 Barrett, Tileston, and Company established a dyeing and printing house there (Leng and Delavan 1924). Port Richmond served as the location for the Staten Island Whaling Company and later the Jewett White Lead Works (1842).

The Island's rich clay and kaolin deposits on the southwest shore along the Fresh Kills and lesser deposits on the north shore lead to an emerging brick-manufacturing industry (Sachs and Waters 1988). German immigrant Balthazar Kreischer, knowledgeable in the construction trades, built a Manhattan brickworks in 1845, and in 1852 built the International Ultramarine Works on the Arthur Kill south of Smoking Point.

In 1854 Kreischer established a clay and firebrick works on the Island which operated in several locations, the earliest and largest located along the Arthur Kill south of Rossville (Sachs and Waters 1988). In 1873-1874, he moved the entire manufacturing operation to a 3-acre site just north of the Outerbridge Crossing. In the 1880s, the family-owned plant produced an estimated 3.5 million bricks annually. Kreischerville became an industrial community. The plant shipped all products by water, building a steam lighter in 1880 (Raber et al. 1995a).

Transportation Improvements. Transportation improvements during the last half of the nineteenth century accelerated Staten Island's industrial growth. The first railroad linked Clifton with Tottenville in 1869 (Leng and Delavan 1924). Small communities developed around the rail stations. Immediately after the Civil War, heavy industry expanded, especially after the 1880s. The emerging transportation industries and the subsequent communities built near their local hubs brought new occupations and services, providing opportunities for blacksmiths, coopers, wheelwrights, grocers, bakers, and printers (Sachs and Waters 1988).

The Staten Island Rapid Transit Railway Company opened a train bridge over the Arthur Kill in 1889. Coaches and horse cars linked north and east shores with Richmond and Linoleumville to the west (Leng and Delavan 1924). By 1880 Staten Island's population totaled approximately 40,000, 90% clustering in villages along the northern and eastern shorelines. The rest of the island remained rural farmland, swamp, saltmeadow, or beach. The Island featured 100 manufacturing plants employing some 1,550 people, mostly young men, though the plants employed 88 females over 15 and 30 children (Sachs and Waters 1988).

Staten Island Shipyards The scarcity of timber following the American Revolution somewhat diminished the Island's shipbuilding trade. After the war, the United States' shipbuilding industry thrived because of low cost (construction) made possible by cheap timber (Hutchins 1948). The growth of the fishing and oystering industries following the War of 1812, and later expansion of recreational boating industries, brought a revival in wooden boat/ship construction and repair.

By 1855, shipwrights in Tottenville (particularly in an area called Unionville), many of Scandinavian descent, produced sloops, schooners, propeller yachts, and coal barges. At one time stores stocked Norwegian newspapers because Staten Island had so many Scandinavian ship carpenters (John Noble Collection 1973). The William H. and James M. Rutan Shipyard built nearly 100 sloops and schooners (manuscript on file, Staten Island Institute of Arts and Sciences). Jacob Ellis operated a shipyard near the foot of Tottenville's Main Street. At the south side of the Ellis yard stood a blacksmith shop (A.E. Rolles) where Ellis' vessel fittings were probably wrought. Before mid-century, sailing lofts, which later manufactured building awnings, established services on the north shore. Rope walks appeared in Rossville and Richmond in the late 1850s (Sachs and Waters 1988).

One of Ellis' shipwrights, Chris Brown, eventually opened a business at the foot of Amboy Road, later building the oceangoing tug *Cyclops*, renowned for towing huge rafts of lumber from Nova Scotia to New York (Staten Island *Advance*, 24 March 1968). By 1880, Staten Island had seventeen shipbuilding firms, eight in Tottenville. From the middle to late nineteenth century, shipbuilding industries played a major role in Staten Island's maritime economy. Staten Island shipbuilding dramatically increased during WWI. Stephen Cossey operated a 20-acre plant which during its 22 year history constructed 1,149 boats. The $30,000,000 industry produced lighters, tugs, dredges, coastwise vessels, and dry docks.

More than anything else Tottenville celebrated its shipyards and the quality and quantity of work done in them. The yards planned and built tugs, schooners, oyster boats, sloops, yachts, and all conceivable craft of ordinary tonnage, besides the work of overhauling, rebuilding, refitting, altering, etc. that is always ongoing. Competent mechanical work gave Tottenville shipyards an excellent reputation all along the coast.

Staten Island's shipbuilding tradition continued into the twentieth century. The Staten Island Shipbuilding Company (est. 1895) is historically known for its steel hulls and diverse designs. The early hulls built by the yard included tugs, carfloats, scows, barges (oil and coal), yachts, schooners, ferryboats, steam and derrick lighters, dredges, drill boats, and in recent years, mine sweepers, cargo freighters, and tankers (Allen 1922). There is a distinct probability that some of the derelict sites associated with the project area are vessels built by the Staten Island Shipbuilding Company.

NEW JERSEY. Early Dutch agricultural settlements met with some success in northeastern New Jersey because of the their proximity to Dutch settlements in Manhattan and Long Island (Wacker 1975). Despite purchasing a large tract of land between the Raritan and Passaic Rivers in 1651, the Dutch West India Company did not settle in New Jersey west of the Arthur Kill. The project area's geography, similar to Staten Island, limited coastal development. Early settlers entered New York and Raritan Bays.

Lacking commerce, manufacturers, or noted cultural achievements, the region remained an isolated salt marsh during the colonial period (Pomfret 1973). A few farms appeared inland. The largest dry-land section north of Perth Amboy, Blazing Star, stretched about a mile north of Tufts Point. Elizabethtown and Woodbridge farmers harvested marsh grass hay and other farm products for sale in Manhattan. Shipping by boat, farmers loaded their products at several small landings along the Arthur Kill. Industrial development eventually engulfed several early landing sites near Woodbridge Creek (Raber et al. 1995b).

The Blazing Star Ferry to Staten Island opened around 1725. The pier, built several times over the years, survived within the project area until WWI. The New Blazing Star Ferry opened ca. 1757 at the foot of present-day Roosevelt Avenue in Carteret. The service ran in different capacities until 1929 (Raber et al. 1995b).

Perth Amboy is named after Perth in Scotland and after the Leni-Lenape (Delaware) word for point, *ambo* (Wacker 1975). Perth Amboy, which occupies the rounded point of land between the Arthur Kill and the Raritan River, at the head of Raritan Bay, is one of New Jersey's oldest communities, yet in 1880 had only 4,808 inhabitants. The site itself was originally part of a tract purchased from Native Americans in 1651 by Augustine Herman, a Staten Island Dutchman. The area is later described in 1682 as "a sweet, wholesome, and delightful place" (WPA 1946:362).

Perth Amboy could not overcome its locational disadvantage to New York; the community was unable to support much commercial activity along the Arthur Kill waterfront. The town's Manhattan packet service (1684) became a link in the New York-Philadelphia route by 1750, but competition from a stage coach and ferry service across the Raritan at New Brunswick and the Arthur Kill (ca. 1764) at the New Blazing Star Ferry ruined the business.

FERRY SERVICE ACROSS THE ARTHUR KILL. Ferry service between Tottenville, Staten Island, and Perth Amboy dates to the Colonial era. Documentation of ferrying dates to 1650, when Raritan Indians transported Dutch travelers across the Arthur Kill, probably in dugouts. Unskilled European boatbuilders had little problem constructing the dugout canoe. Long and narrow, some to 40 feet and made of local timber, the dugout evolved into the New England boat canoe of the eighteenth century (Chapelle 1951).

Christopher Billopp later established ferry service from a point believed to be where Amboy Road meets the Arthur Kill to a point opposite on the Perth Amboy shore (Reed 1955). The service remained in the Billopp family until 1781. Initial service probably featured skiffs, sloops, periaguas, or other small boats. Isaac Doty operated the Billopp ferry (known as Doty's Ferry) from ca. 1757 until his death in 1774, paying rent to the Billopp family for various services rendered. Issac Butler operated the ferry from 1788 until his death in 1828 (Raber et al. 1995b).

Chapelle (1951:9) states that it is possible "to establish grounds for reasonable assumption regarding these boats, in spite of the unsatisfactory colonial records." The colonial skiff is loosely associated with the "dingy" type. Little evidence in the seventeen-h century records suggests that it meant a flat-bottomed rowboat (Chapelle 1951). The eighteenth-century sloop hull had a "strong, fair sheer" and a slightly curved bow without a cutwater (Chapelle 1951:18). The flat transom, with moderate rake, had a rudder hung on the outside. Periaguas, large canoes fitted to sail in eighteenth-century accounts, are also identified as such for New York shallop-type boats. The boat had a foremast "in the eyes of the hull," severely raked forward, carried a short-gaff foresail, the main mast raked aft (Chapelle 1951).

Colonial/Loyalist conflict after the Revolution spilled over into the Arthur Kill vicinity, with the Tories very active in Perth Amboy (Burrow and Hunter 1990). Many Loyalists subsequently moved to Elizabethtown, the oldest English settlement in New Jersey (WPA 1946). Renowned for its tanning and leather trade, ships of 40 and 50 tons sailed up the Elizabeth River as far as Broad Street (WPA 1946). Elizabethtown's economic fortunes rose in the early nineteenth century, a result of small-scale artisans and brass foundries, many associated with carriage and carriage accessory manufacturing (Raber et al. 1995b).

Perth Amboy, on the other hand, witnessed continual economic decline some 20 years after the Revolution (WPA 1946). A small commercial waterfront emerged near Smith Street, the waterfront reflecting the harvest and sale of marsh grass. The waterfront served intermittently as a steamboat landing as early as ca. 1807 with John L. Steven's *Phoenix* and Thomas Gibbon's *Bellona*, operated by Cornelius Vanderbilt. After 1824, regular steamboat service along the Arthur Kill and lower Raritan River "initiated a period of transportation development which gradually linked the project area to economic growth in the Port of New York" (Raber et al. 1995a:24). South Amboy became the terminal for the Camden and Amboy Railroad, New Jersey's first railroad, in 1832 (WPA 1946).

New York City's emergence as the world's leading port provided substantial economic and industrial growth for New Jersey. New York's canal systems and rail networks directly linked the harbor with northern markets. Port expansion in Manhattan, Brooklyn, and New Jersey's Hudson River shoreline made New York the national European trade center. Some of the first American railroads were built north and south of the project area (WPA 1946). The Lehigh Valley Railroad (LVRR), which located in Perth Amboy in 1859, foretold the region's industrial future. The LVRR became one the world's largest coal shippers on the eastern seaboard at the turn of the twentieth century (manuscript on file, Perth Amboy Public Library 1954).

Industrial development followed these rail links, especially in Elizabethtown. However, no rail lines ran along the Arthur Kill or lower Raritan. By 1860, ferry traffic diminished to an extent that only a few rowboats owned by A.M. Dawson crossed the Arthur Kill, at a fare of 12.5 cents one way (Reed 1955). The opening of the Staten Island Railroad the same year established a direct route between Tottenville and the ferry to New York City at Clifton.

South of Woodbridge Creek, clay mining and manufacture of clay products bolstered the local economy, as did barge and boat construction. These industries probably accounted for most of the town's population increase. Revival of the ferry service from Smith Street to Tottenville, Staten Island (1860), coupled with its still-rural flavor, enhanced Perth Amboy's status as a local resort (WPA 1946). Railroad expansion along the Arthur Kill in the 1870s, followed by navigation improvements between Staten Island and New Brunswick, provided new opportunity for industry.

By the 1880s, the scarcity of large-scale rail sites with suitable deepwater connections made the project area attractive to industry (Raber et al. 1995a). Between ca. 1880 and 1905, growth in the clay industries augmented the development of chemical and copper processing industries along the Arthur Kill shoreline. Known as the Chemical Coast, industrial expansion brought two coal (rail) terminals on the Arthur Kill, shoreline routes, and a third terminal in South Amboy. The increased rail traffic witnessed growth in barge construction and repair.

By the 1870s, waterborne traffic along the Arthur Kill increased from six million tons between ca. 1873-1875 to nine million tons by 1900 (Raber et al. 1995b). Putting this figure into perspective, some 55,000 reported vessels used the Elizabethport facilities in ca. 1873. By 1885, freight volume on the Arthur Kill exceeded foreign commerce tonnage from New York.

From 1880 to 1910, Perth Amboy's population doubled. By 1920, the population totaled over 40,000 (New York, New Jersey Port and Harbor Development Commission 1920). Heavy industry developed along the Kill's New Jersey shoreline by virtue of the deeper channel and access to New Jersey's Central Railroad freight terminal. One industry significant to the project area is directly related to Meyer Guggenheim, the first industrialist to build a copper refinery in Perth Amboy. The Guggenheim plant and its history are addressed later in the text.

INDUSTRIAL DEVELOPMENT AND STATEN ISLAND. By the mid-1900s, agricultural chemical production facilities, metallurgic industry plants, clay and brick production facilities, building material factories, copper refineries, shipyards, and emerging petroleum industries lined the Arthur Kill's western shoreline. At Staten Island only a few small industries appeared: the American Linoleum Manufacturing Company, Atlantic Terra Cotta Company, Kreisher Brick Works, and Tottenville Copper.

During the early part of the twentieth century, New York's port handled 40% of all U.S. foreign trade. The average annual value of imports and exports for the port during 1911-1913 totaled $1,809,358,239, or 46.2 percent of that for the United States (Squires 1918). In 1920, nearly half of all foreign commerce for the United States entered through the Port of New York. Some eight million people lived within a 25-mile radius of the Statue of Liberty (Harbor Development Commission 1920). Yet, Staten Island's Arthur Kill waterfront remained underdeveloped.

Local economic fallout following World War I, limited access, and pollution governed the Island's future. When the Department of Health traced typhoid fever to Staten Island oysters, the department condemned the industry (Bureau of Curriculum Research ca. 1980s). Water pollution destroyed oyster beds, and by the early twentieth century, the local fishing business little resembled its admirable past.

Chemical and copper refineries along the Jersey shoreline released gaseous contaminants into the atmosphere. Prevailing westerly winds, in turn, pushed contaminants across the island, ruining agricultural production. Industrial waste eventually made Staten Island's real estate less than desirable. New York City started dumping garbage on the Island in 1916. Initial operations failed in 1918, but in 1946 dumping resumed. Following a series of land transfers, the present Fresh Kills Landfill on Staten Island is considered the largest landfill in the world.

The disposal of garbage, particularly during the nineteenth century, created special problems for local residents. Until 1934, ocean dumping was commonplace. Shoreline residents from Long Island to New Jersey complained of nasty beaches and shorelines. Dead cats, dogs, and chickens, and putrid fruits and vegetables lined the area shoreline. The problem, recognized by local officials, proved difficult to correct, particularly since old habits die hard (Corey 1991).

The garbage scow, a barge filled with garbage, became commonplace on the rivers and channels. An article in the *New York Times* (1880) noted the amount of garbage dumped in the harbor actually filled certain channels (Corey 1991). In 1871, the New York legislature enacted laws prohibiting the dumping of garbage into the waters of the North (Hudson) and East Rivers, Upper New York Bay, and parts of Raritan Bay (Corey 1991). As a result, legal dumping moved to southeastern Staten Island.

SHIPBUILDING IN THE UNITED STATES

As witnessed in the history of Staten Island, the shipbuilding industry is one of the oldest in the United States. This industry, like any other, is controlled by economic forces which change from year to year, decade to decade. The last half of the nineteenth century saw rapid economic change, "so much so as to merit the application of the term 'Maritime Revolution' to this period" (Hutchins 1948:14).

From 1830 to 1865, the period of U.S. shipbuilding was characterized by the growth and expansion of wooden ship construction (up to 1865). The United States led the world in technical expertise, and the period is generally considered the golden age of American shipping and construction (Hutchins 1948). Wooden hulls became stronger and bigger, and carried larger sails and subsequently larger cargoes. In this period the American passenger packet, the clipper ship, and the massive freighter dominated the seas. This period also witnessed advances in steam-vessel production.

STEAM POWER. Use of steam power was the result of several developments associated with the Industrial Revolution. The invention of malleable iron by Cort in 1784 certainly provided the means of shaping iron for power-plant production, as did the work of machinist Samuel Wilkinson and others. In the late eighteenth century, Boulton Watts (Soho) established an engine manufacturing plant which eventually provided an opportunity for European and American engineers to experiment with steam-power propulsion (Hutchins 1948).

In the U.S., John Fitch experimented with marine steam power on the Delaware River near Philadelphia, while John Stevens and Robert Fulton worked between New York and Hoboken, New Jersey. Colonel Stevens operated a steam launch at Hoboken in 1804 (Whittier 1987). When Robert Fulton built the world's first commercially successful steamboat *Clermont* in 1807 (Figure 13), he had little idea what the appropriate hull form should be. The vessel seems to have had a shape similar to a large canal boat (Brouwer 1996), though Dayton (1939) suggests lines similar to a sailing ship. In describing the boat, enrollment records state "she is a square-sterned boat, has a square tuck: no quarter galleries and no figurehead" (Morrison 1958:21). The vessel, built at the Charles Brown Shipyard on the East River near Manhattan, originally measured 140 feet in length by 16 feet in breadth, a ratio of almost 1 to 10 (Morrison 1958). The copper boiler (low-pressure) measured 20 feet long by 8 feet wide, with a 7-foot diameter (Dayton 1939).

The steamboat, rebuilt after its first season, measured 149 feet. Peter A. Schenck, Surveyor of the Port, certified that the boat had one deck and two masts, a breadth of 17 feet 11 inches, and a 7-foot depth (Morrison 1958:21). A contemporary drawing of the boat, later named *North River*, shows a stern similar to those on sailing ships of the period, though with a proportionately wider transom. The paddlebox extended out from the hull with no additional structure forward or aft. There are two masts, one forward and one aft, with yards for square sails which are furled.

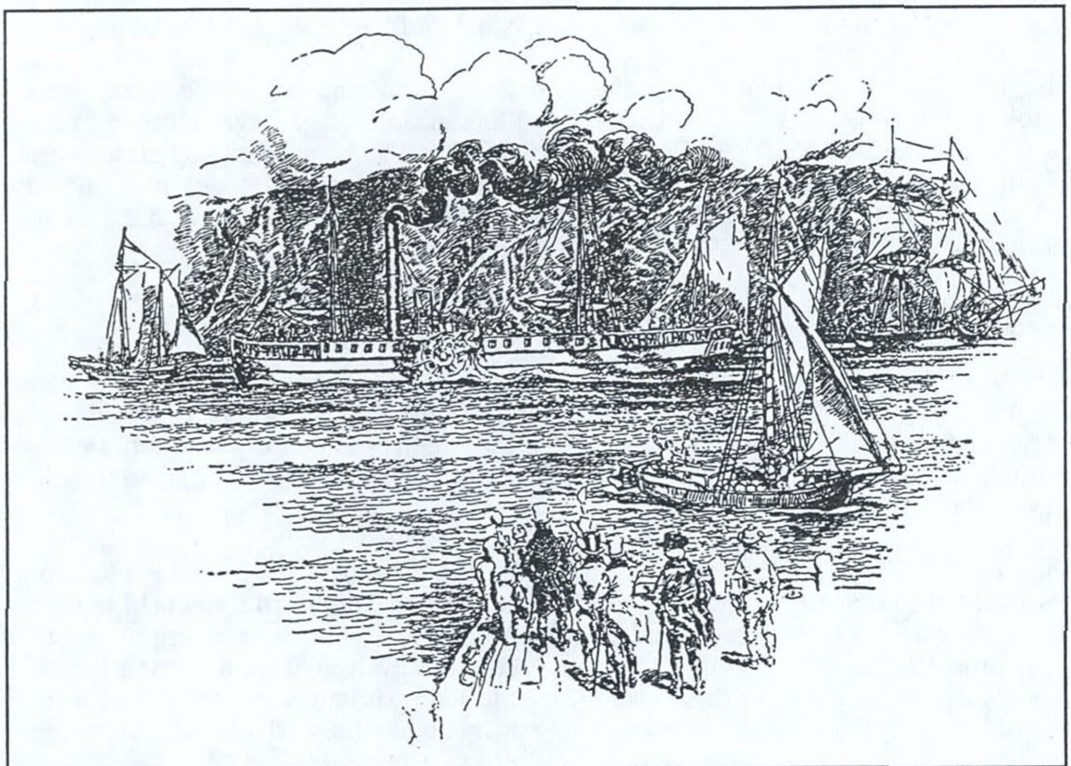


Figure 13. John Wolcott Adams lithograph of *Clermont* (Dayton 1934).

Jean Marestier, in his study of American steamboats *Memoir on Steamboats of the United States of American,* published in Paris in 1824, includes an outboard profile of Fulton's steamboat *Paragon* built for the Hudson River in 1811 (Figure 14). It is very similar to the print described above. The sails are shown set with a very deep square sail on the foremast, a small square topsail above, and a fore-and-aft sail on the second mast set from a gaff and boom. It has a plain bow with a convex curve to the stem, and a bowsprit house on deck from which is set a single jib. The main difference from the first steamboat is the apparent addition of "guards," protective mouldings faired out around the paddlebox.

Ship paddlewheels, called waterwheels at the time, had the same basic design as waterwheels used in powder mills. These wheels, easily modified for marine use, "ideally suited...the conditions which existed on American waterways in Fulton's time" (Whittier 1987:7). Screw propellers, to generate enough thrust from a relatively slow-turning steam engine, had appreciable draft, creating problems for a shallow-draft vessel. On a shallow-draft hull, a pair of paddlewheels generated ample thrust without projecting below the keel line.

Early pioneers of steam propulsion were basically marine blacksmiths. Scientific marine engineering occurred primarily after the Civil War. Early workmanship often featured "poorly planned, drilled, and riveted designs" (Hutchins 1948).

STEAMBOATS OF THE 1820S. The 1820s witnessed two major changes in steamboat design. Sails disappeared within a few years, and length-to-breadth ratios declined (7 to 1 or less). Hulls rounded more at the bilge. Aside from these developments, boats of the early 1820s had most of the same features as the *Paragon.* The *Constitution*, built in New York, had a similar bow, and a transom stern with six or seven windows. The guards around the paddleboxes did not

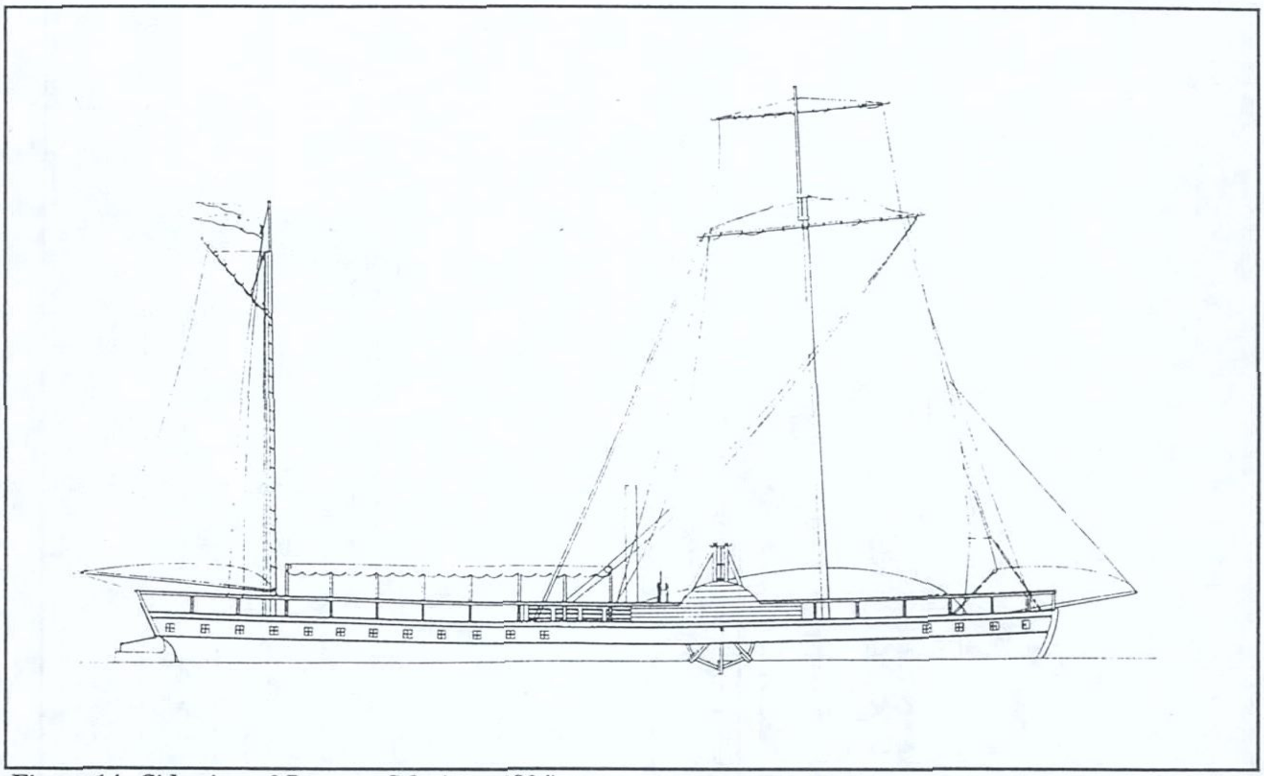


Figure 14. Side view of *Paragon* (Marister 1824).

extend very far forward or aft, but did create some additional space for storing boiler wood. It included a second deck aft of the engine, sheltered by an awning (Brouwer 1996).

The *DeWitt Clinton,* built at Albany in 1828, measured 233 feet in length, 28 feet in beam, 64 feet over the guards, 10 feet depth of hold, and 4.6 feet draft (Dayton 1939). Freeboard reduction brought the main deck much closer to the water. Little transom remained at the stern. The guards extended outboard around the paddleboxes in a continuous curve from bow to stern, supported at intervals by diagonal struts braced against the hull. In addition to providing more space, the guards afforded a practical place to put the boilers (Ringwald 1965). West Point Foundry built the engine, the largest at the time, with cylinders measuring 66 inches in diameter by 10 feet stroke (Dayton 1939).

Marestier (1824) expressed concern over the stress engines and boilers placed on wooden hulls of this type once they exceeded a certain length. Two methods provided additional support. A heavy-timbered truss ran fore and aft on either side, with the highest point sometimes arching over the paddlewheels (Ringwald 1965). These trusses, called hogframes, were a distinctive feature on early wooden-hulled steamboats. The *DeWitt Clinton* also had three masts on the centerline supporting "hogging chains," iron rods extending to either side, offering additional support for the guards. These rods distributed the stress and provided support for the guards.

Crosshead engines powered early steamboats. Developed from Fulton's basic vertical-cylinder layout, this type of engine is named after the crosshead shown in Figure 15 (the small cylinder below the steam cylinder is the condenser). A long piston rod extended above the cylinder to form a T with the horizontal crosshead. The crosshead, a device forming a connection between the piston rod and connecting rod, is similar to the joints in the human body (Hawkins

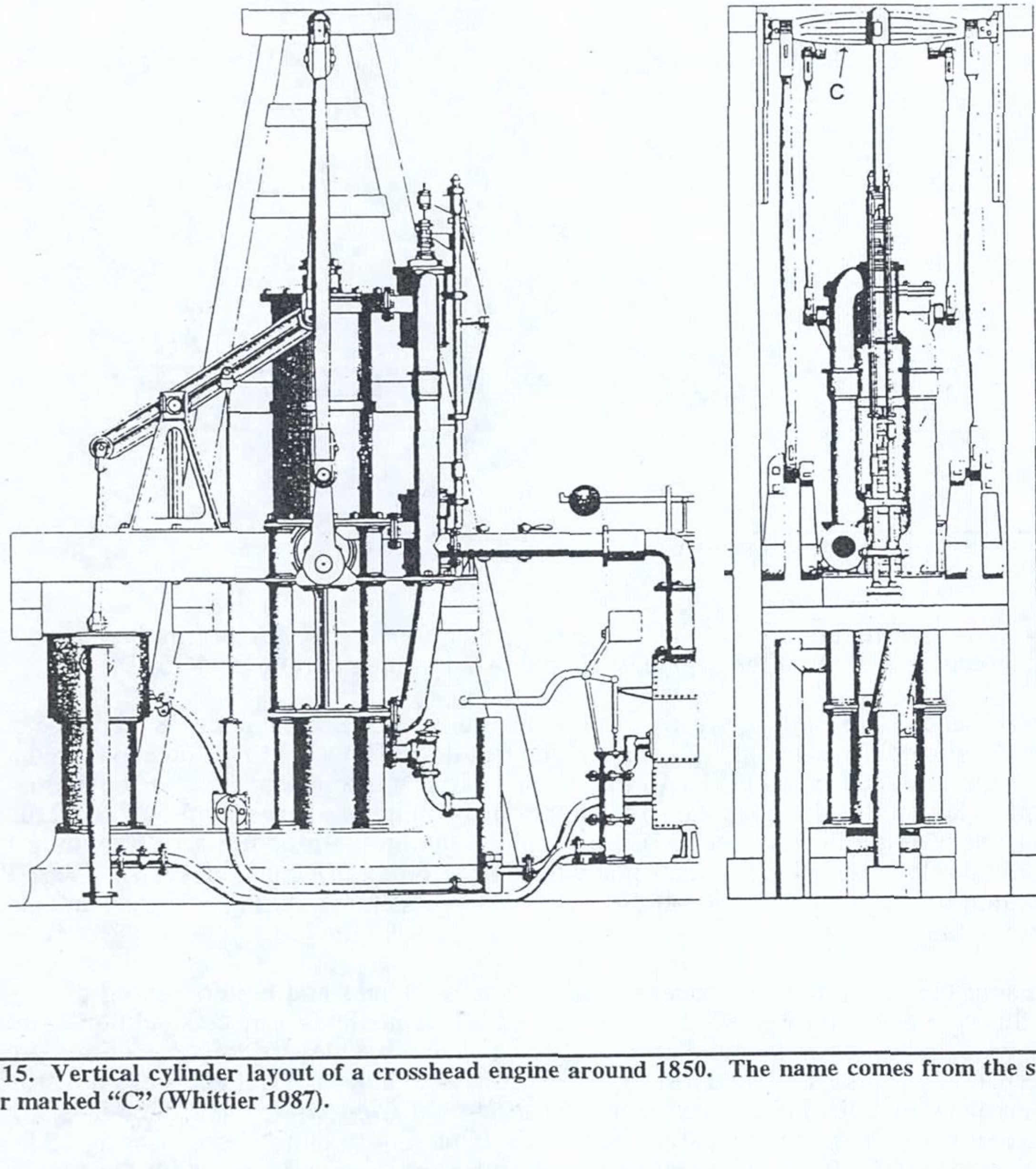


Figure 15. Vertical cylinder layout of a crosshead engine around 1850. The name comes from the sliding member marked "C" (Whittier 1987).

1987[1904]). The engine, positioned athwartships, moved and up and down on vertical guides. The first guides were mounted on simple upright timbers. Later a pair of A-frames (linked together at the top) replaced these timbers. Some steamboaters called it the "gallows frame," suggested by its shape (Whittier 1987). Near the outer ends of the crosshead, two connecting rods attached together. These came down on either side of the cylinder to crank throws on the paddlewheel shafts. As the crosshead rose and fell, the connecting rods rotated the cranks, turning the wheels. Despite the popularity of the walking beam engine, crosshead engine production continued sporadically through the 1830s.

The vertical beam engine, known as the "walking beam," is a uniquely American technology. Developed around 1820, the engine's design appeared as late as the 1950s. Its popularity revolved around its simplicity. The walking beam initially surfaced on lake and river steamers, ferries, and coastal and oceangoing vessels. Introduced as a solution for space and balance problems associated with bigger engines, the walking beam engine also had a vertical cylinder (Whittier 1987). A piston rod attached to a crosshead above; however, above the crosshead, a second rod connected to one end of a diamond-shaped beam. The beam rotated at its center on a bearing mounted at the top of an A-frame, similar to the A-frame of earlier engines. A connecting rod to the single crank throw attached to the other end of the diamond-shaped beam. In this way the beam, rocking back and forth, transferred the up-and-down motion of the piston to the crank, turning the paddlewheels.

Figure 16 shows a walking beam engine built by T.F. Secor and Company, New York. A typical 1850 design, the long stroke piston and double poppet valves minimized the force needed to open them against steam pressure. Cold water passed through the injector pipe, then flowed through openings in a perforated plate into the condenser chamber. From there it mixed and condensed exhaust steam. The water/vapor mixture was withdrawn by air. Note the tie rods connected to the A-frame, in this case wooden (Whittier 1987).

The walking beam apparently got its name from the rate at which it moved, usually in full view above the roof of the steamboat's uppermost deck. In a few later steamboats, it was enclosed in a small uppermost deck. Later still, some steamboats enclosed it in a small, greenhouse-like structure (Brouwer 1996). By the mid-1800s, wrought-iron straps over a cast-iron framework replaced heavy wooden timbers, though wooden frames appeared right up to the end of the walking beam era (Whittier 1987). In the 1880s, A-frames consisted of iron and then steel angular plating. Three known examples of the walking beam engines survive, two in the United States: the ferry *Eureka*, preserved at San Francisco, and the lake steamer *Ticonderoga*, preserved at Shelburne, Vermont. *Jane Moseley* at Shooter's Island predates these.

Walking beam engines, A-frame, and paddlewheel schematics/construction information is not lacking. The South Street Seaport Museum has detailed plans and specifications for many walking beam engines built by W&A Fletcher of Hoboken, New Jersey. The hull remains of *Westfield*, a wooden-hulled beam engine double-ended ferry (V58 Arthur Kill) contain frames, stringers, ceiling, planking, and cribbing. The remains may well provide information on construction and design configurations of inclined-engine shafts and the walking beam.

Steamboats of the Mid to Late 1800s. Through the 1840s and 1850s, the boats on the Hudson River retained the same general characteristics, but increased in size (Ringwald 1965). The *Swallow* of 1836, one of the larger boats of the day, measured 225 feet in length and 23 feet in breadth. The *New World*, built in 1848, measured 352 feet 8 inches in length and 47 feet in breadth. The day boats continued to have modest superstructures, with an enclosed cabin on the main deck aft. The night boats developed into floating palaces. The *New World*, rebuilt as a night boat, had three stories of staterooms above the main deck (Brouwer 1996).

Everything was on a larger scale. The paddlewheels became so big that the paddleboxes equaled the three-storied superstructure in height. Designers came up with extravagant decorations for the outer surfaces, previously left plain. In the 1860s beautiful sunbursts with painted and gilded mouldings became popular. Before the decade ended, the grandest boats had *tromp l'oeil* effects representing interiors of pantheons, or, in the case of *St. John* (1864), an arched passageway receding in the distance of a view of mountains (Brouwer 1996).

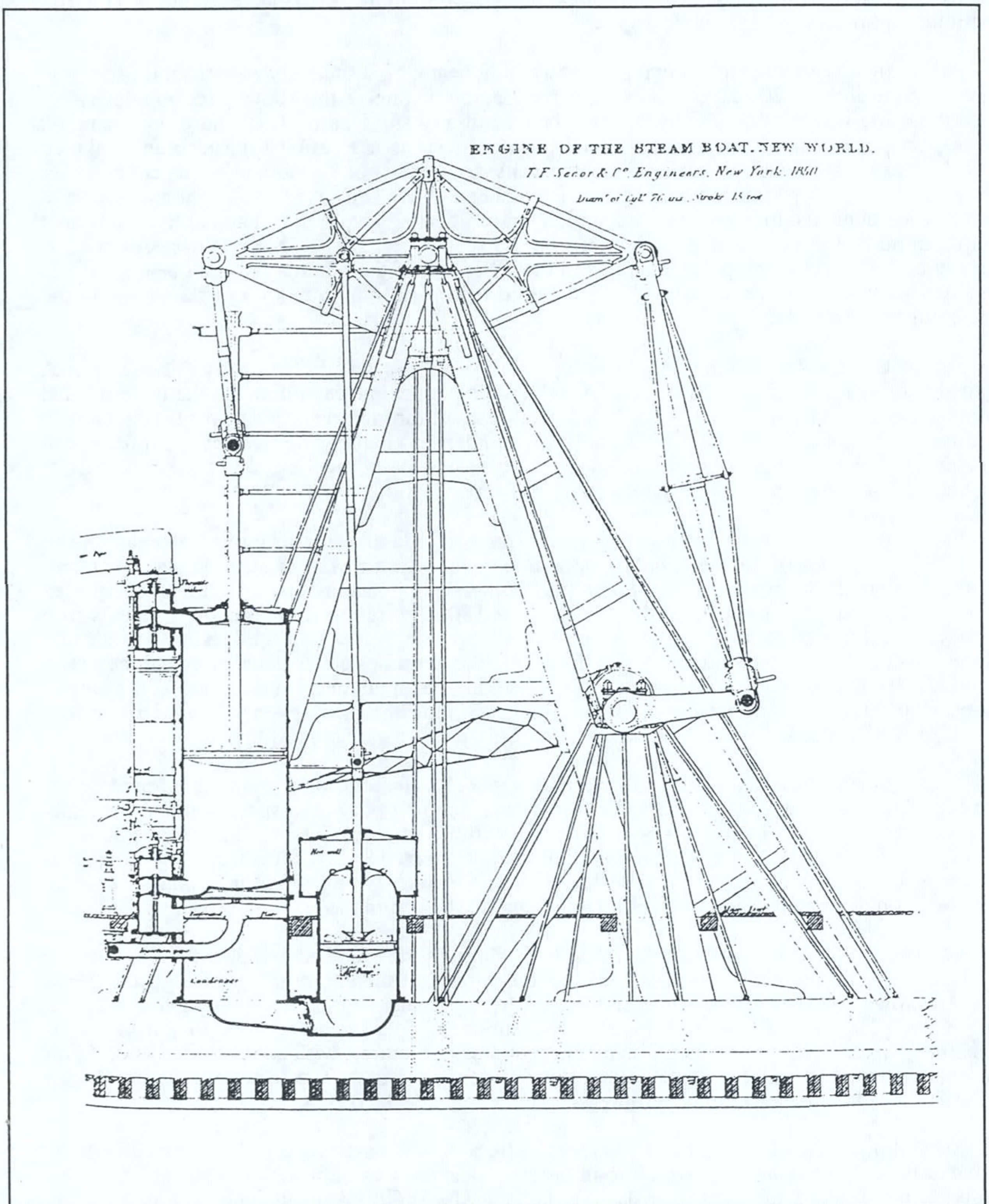


Figure 16. Walking beam engine developed by T.F. Secor and Co. around 1850. The long piston stroke and double poppet valves minimize the force needed to open them against steam pressure (Whittier 1987).

Jane Moseley served as an excursion boat on the Chesapeake Bay in the 1880s. Built in 1873, the steamer measured 200 feet by 32 feet breadth. The vessel featured an exposed single cylinder "walking beam" engine. The vessel then served as a ferry, crossing the mouth of the Bay at Cape Charles, Virginia. By 1919, *Jane Moseley* became *Minerva* and served as a freight boat running the Bay from Baltimore to Old Point Comfort, Newport News, and Norfolk. Apparently brought to New York as a freighter, the vessel now rests at the Shooter's Island site.

The superstructure of *Jane Moseley,* engine machinery, and the paddlewheel shaft are gone. The hull is no longer visible at low tide. The A-frame or "gallows frame" still stands, as do remnants of the paddlewheel, "constitutes the most important artifact on or around Shooter's Island" (Brouwer 1983:6).

DEVELOPMENT OF NEW YORK CITY DOUBLE-ENDED FERRYBOATS: 1812-1860S. Until the advent of the steam ferryboat, regularly scheduled connections to and from New York City (via the harbor) occurred by sloops, periaugers, and rowboats (Cudahy 1990). After Robert Fulton's successful use of steam power with *Clermont,* innovators realized the potential steam power had for ferrying passengers. Steam service soon became a routine and expected feature of New York City life in the 1880s (Spirek 1993). Original designs and characteristics took place under the guidance of Fulton and John Stevens, who, along with other builders, designed the double-ended ferry.

Robert Fulton launched the first double-ended ferry in July 1812, with the construction of the twin-hulled *Jersey*. Built by New York City's Charles Brown Shipyard, the 80-foot-long ferryboat transported passengers over the Hudson River. Fulton's design featured a twin-hulled vessel equipped with a 5-foot draft and a 30-foot beam. The draft allowed easy maneuvering over water (Marestier 1957[1824]). A platform between hulls held machinery, passengers, and cargo. Fulton placed the paddlewheel between hulls, mainly to avoid direct contact with floating ice. He situated the rudders in the same space, one forward, one aft of the paddlewheel. Equipped with fore and aft rudders and a double-ended hull, the ferryboat could travel to and fro across the river without turning.

The *Nassau*, also built by the Charles Brown Yard (1814), retained the twin-hull configuration, but featured a passenger cabin on the main deck (Cudahy 1990). *Jersey* and *Nassau* remained the only two ferryboats operated by Fulton. After Fulton's death, former associates added another twin-hulled ferryboat, *William Cutting*, to the fleet in 1827.

Following visits to the United States in the 1820s, Frenchman Jean Baptiste Marestier wrote an eyewitness account of the Fulton-type ferryboat. The boats, according to Marestier, had platforms between 72 and 79 feet long. The engines rested on the platform center. The paddlewheel rested in front of the engine. The paddlewheel contained eight buckets 8 feet in length, 2 feet in height. Boiler dimensions averaged 18 feet long, 7 feet wide, and 7 feet high. At the end of each platform sat a cabin (Marestier 1957[1824]).

Because ice had a tendency to disrupt the twin-hulled paddlewheel's motion, the Union Ferry Company, "an outgrowth of the original Fulton ferry line interest, finally dispensed with its twin-hulled ferryboats" in 1833 (Spirek 1993:29). The company opted for a single-hulled configuration, which effortlessly sliced through ice. Latter-day New York City ferryboats retained two Fulton designs: a sloping main deck amidships to each end (caused by the paddlewheel shaft's placement above the sheerstrake of the hull) and the characteristic double end (Hall 1884).

John Stevens is credited as most responsible for the prototype of the single-hulled New York City ferryboat. He launched *Hoboken*, a 98-foot steam-powered double-ender, on 1 May 1822. The ferryboat ran between Hoboken and Manhattan on the Hudson River. The boat featured a single hull and a sidewheel port and starboard. To protect the sidewheels, Stevens extended the main deck. The addition, including paddlewheel *sponsons*, provided additional room and loading capacity to the boat. Not intended for oceanic passage, the vessel's design was adapted to the interior waters of New York Harbor (Cudahy 1990).

The demand for ferryboats increased as the boat proved its reliability. The corresponding economic growth in Manhattan and surrounding areas (New Jersey, Brooklyn, and Staten Island) further increased ferryboat demand. New York City's population in the 1800s numbered around 100,000. By 1824, six ferryboats serviced the City's population of 200,000. By 1860, 70 ferryboats serviced nearly 1,176,000 New Yorkers. Some ferryboat companies carried up to 5,000 passengers a day (Spirek 1993).

Into the 1830s, overall ferryboat size increased. Stevens' ferryboat line built *Fairy Queen* in 1826. One hundred forty-nine feet long, the boat measured 16 feet wide with a 6-foot draft. The boat featured a vertical walking beam engine with two paddlewheels. *Fairy Queen* had cabins in the hull, accommodating up to 100 passengers. The boat had a bar on board, and during the summer crewmen stretched an awning over the boat from end to end. A helmsman operated a rudder tiller, who steered with the help of a pilot who stood at the forward end of the vessel (Stevens 1893).

In 1836 the Union Ferry Company operated three new ferryboats. On heavily traveled routes, the company added the 304-ton, 155-foot-long *Brooklyn*, the 155-foot-long *New York* (23-foot beam, 9-foot draft), and the diminutive *Olive Branch* (89 feet long, 23-foot beam, and 8-foot draft). Including these three boats, Union Ferry operated three other ferryboats, ranging in size from 100 to 125 feet in length, 145 to 184 in tonnage (Cudahy 1990).

By the 1840s, shipbuilders all across New York City built double-enders. William H. Webb, noted builder of sailing ships, built three double-enders for the City. *Wallabout* and *New York*, sister ships, measured 94 feet long, 23 feet in beam, and 9 feet draft. The third ferry, *Williamsburg*, built in 1846, measured 115 feet long, 26 feet in beam, and 10 feet in depth. Each of the boats featured a vertical beam engine with a walking beam. These boats operated on the East River (Dunbaugh and Thomas 1989).

The Staten Island ferryboat *Hunchback,* built by Jeremiah Simonson (New York City) in 1852, featured an upper cabin, making it the first double-decked ferryboat in New York Harbor (Cotterell 1978). The wooden housing built to enclose the walking beam gave the boat a lumpish appearance, hence the name.

The 700-ton *Atlantic*, 177 feet long with a overall deck length of 190 feet, had a beam of 32.5 feet. Built in 1857, the New York Times called *Atlantic* the "largest and most perfect ferry-boat ever constructed" (*New York Times* 1858). The *Atlantic* featured a hull designed to plow through ice (*New York Times* 1857).

Another boat, *John S. Darcy*, also built in 1857, measured 191 feet in length, 33 feet in beam, and 11 feet in depth, and "became the largest ferryboat in the New York City area during this time" (Spirek 1993:33). Because some ferries serviced less-traveled locations, many were small. The ferryboats *Ethan Allen* and *Commodore Perry* (527 tons) measured 144 feet in length and 33 feet in beam (Franklin Institute 1859).

The New Jersey Railroad and Transportation Company operated *John P. Jackson* for ferry service between Jersey City and New York City. The 860-ton vessel, built by the Devine M. Burtiss Shipyard, measured 192 feet end to end, with its deck measuring 210 feet stem to stern. The ferry had a 36-foot beam, a 12-foot depth, and a draft of 5 feet 5 inches. The frame was of white oak, chestnut, and other hardwoods fastened together by copper spikes/bolts and treenails.

Its single-cylinder, vertical-beam engine measured 46 inches with an 11-foot stroke. The paddlewheel had a 21-foot diameter and featured 18 buckets (Cudahy 1990; Franklin Institute 1860).

The archetypal ferryboat design established by Fulton and Stevens changed little over the years. Most builder concerns centered around keeping foot passengers separated from wagons and other cargo. Early configurations accommodated wagons near the center of the boat; enclosed cabins provided passenger room and space. Later ferryboat construction kept this configuration, but added a cabin above the main cabin (Grava 1986).

Iron straps provided longitudinal support for most wooden-hulled, shallow-drafted ferries. Copper fasteners, commonplace by the 1860s, held strakes below the waterline together, while iron fasteners served the same purpose above. For the double-ender, one rudder acted as a bow while the other provided direction. Two auxiliary tillers aided steering if for some reason the steering ropes parted from the rudder (Spirek 1993).

Winter ice created hazards for the pilot and his boat. Fulton and Stevens had some success with ice, each approaching the hazard differently. Fulton placed the paddlewheel in the center of the two hulls, but ice between the hulls created handling problems. Stevens' single-hull configuration pushed the ice out of the boat's path, and if caught between ice floes, compressed the ice downward, away from the hull. As a safety feature, Stevens placed cork inside the hull for buoyancy (New York Times 1857).

Boats operating in the harbor faced another hazard: marine borers. Coppering, or sheathing, protected the hull from borer infestation. The combination of sheathing, pitch, horse hair, cloth, or other materials extended the life of the vessel's hull. Ferryboat coppering usually occurred several months after construction completion, allowing for exterior strake expansion. "It is customary not to copper them (ferryboats) until they have been in service for six months" (Journal of Franklin Institute 1860:291). Sheathing could then occur without strain or tear by further expansion.

Vertical-beam engines powered most ferries, though horizontal engines were not unusual. The engine, coupled with a walking beam, extended far above the main deck. An enclosure, running through the center of the boat, partitioned the A-frame and support beams. Boiler locations varied from boat to boat, some positioned deep in the hold, others located near the paddlewheels. Wood originally provided heat for steam, though coal replaced it as a primary heating source in the early 1830s (Cotterell 1978).

As one would suspect with wooden vessels, fire proved an immediate danger during operation. The *Williamsburg* ferry, operating between Manhattan and East River Williamsburg, "adopted...every precaution...to guard against fire, the boilers being quickly felted, and the decks and wood-work around the boilers and chimneys protected by facings of zinc" (*New York Times* 1858). Fire protection for most ferries probably mimicked the *Williamsburg* vessel.

A ferry's main deck more or less rested atop the hull, the deck secured to the hull with bolting along the gunwale. The arrangement provided a means of lowering or raising the deck, "enabling a recently purchased ferryboat...to be specially fitted for the slips of another if necessary" (Spirek 1993:39). Raising and lowering the deck simply involved cutting the deck from the hull, jacking it up, and bolting the two sections together (Stevens 1893).

The main deck featured two gangways. Separated by an enclosed engine space, the gangways provided room for carts and carriages. Log curbs, which conformed to the shape of the deck, funneled carts, wagons, and such off the deck.

In the years following Fulton and Stevens, the main deck superstructure (cabin) expanded, conforming more to the ferryboat's shape (Cudahy 1990). Instead of placing passengers below decks, as happened earlier, builders constructed cabins (which segregated passengers by gender) on the outside guards and/or either side of the paddlewheel boxes. Early Staten Island ferries provided drinks and snacks in the men's cabin.

As passenger traffic increased, builders in the 1850s included a second cabin above the main cabin. This addition commonly appeared on long-distance service, i.e., Staten Island ferryboats. The promenade, or upper deck, supported the upper cabin and the fore and aft pilot house, and provided additional passenger space. The hurricane deck sat atop the promenade deck cabin. Generally, three patterns of pilot house appeared in New York City. A circular freestanding house and a freestanding square house usually appeared on single-decked ferries. A rectangle backed by an upper cabin is normally associated with double-decked boats (Spirek 1993).

The general configuration of New York City ferryboats remained the same for decades. Design evolution focused on increased size and space. Never as ornate as Hudson River steamers, these boats provided ferry service to thousands of commuters. The design is still visible in modern-day ferries (Figure 17).

SHIPBUILDING AFTER THE CIVIL WAR

After the Civil War the American shipbuilding industry saw not only the final development of the American square-rigged ship, but in New York, where builders specialized in expensive packets and clippers, a dramatic decrease in production. Production of New York-built boats dropped from 40 in 1855 to zero in 1862, averaging only four per year over the next decade (Hutchins 1948).

The industry also witnessed a change in the way it did business. Before the Civil War, shipbuilding usually consisted of a small group of shipwrights headed up by a master shipwright. Shippers, on the other hand, had little to do with shipbuilding. After the war, however, capitalists sought out the industry on a large scale. The master shipwright became an employee, this the result of declining activity in the ship market and the increased cost of ship construction (decreased timber supply) (Hutchins 1948). By 1880, the economies associated with the free market system dramatically modified, if not replaced, the old apprenticeship system. Coupled with the advent of railroading, the shipbuilding industry in New York adapted to a new way of doing business, the lighterage business.

HARBOR CRAFT, RAILROADS, AND THE LIGHTERAGE SYSTEM. For years, railroad lighters and carfloats delivered freight to all points on New York's harbor waterfront. In New York Harbor and its surroundings, there remained a far greater tonnage of waterborne freight requiring discharge along piers and waterfronts slips than land-conveyed freight (Harding 1912). Servicing the geographic and commercial needs of the harbor required a "railroad navy." Some 1,500 tugboats, car floats, covered lighters, express lighters, floating grain elevators, and other craft loaded and unloaded freight at specially designed rail-to-water transfer piers (Table 2). This transportation network offered (1) access to the water (slip) side of steamships and (2) access to parts of the harbor not accessible by rail.

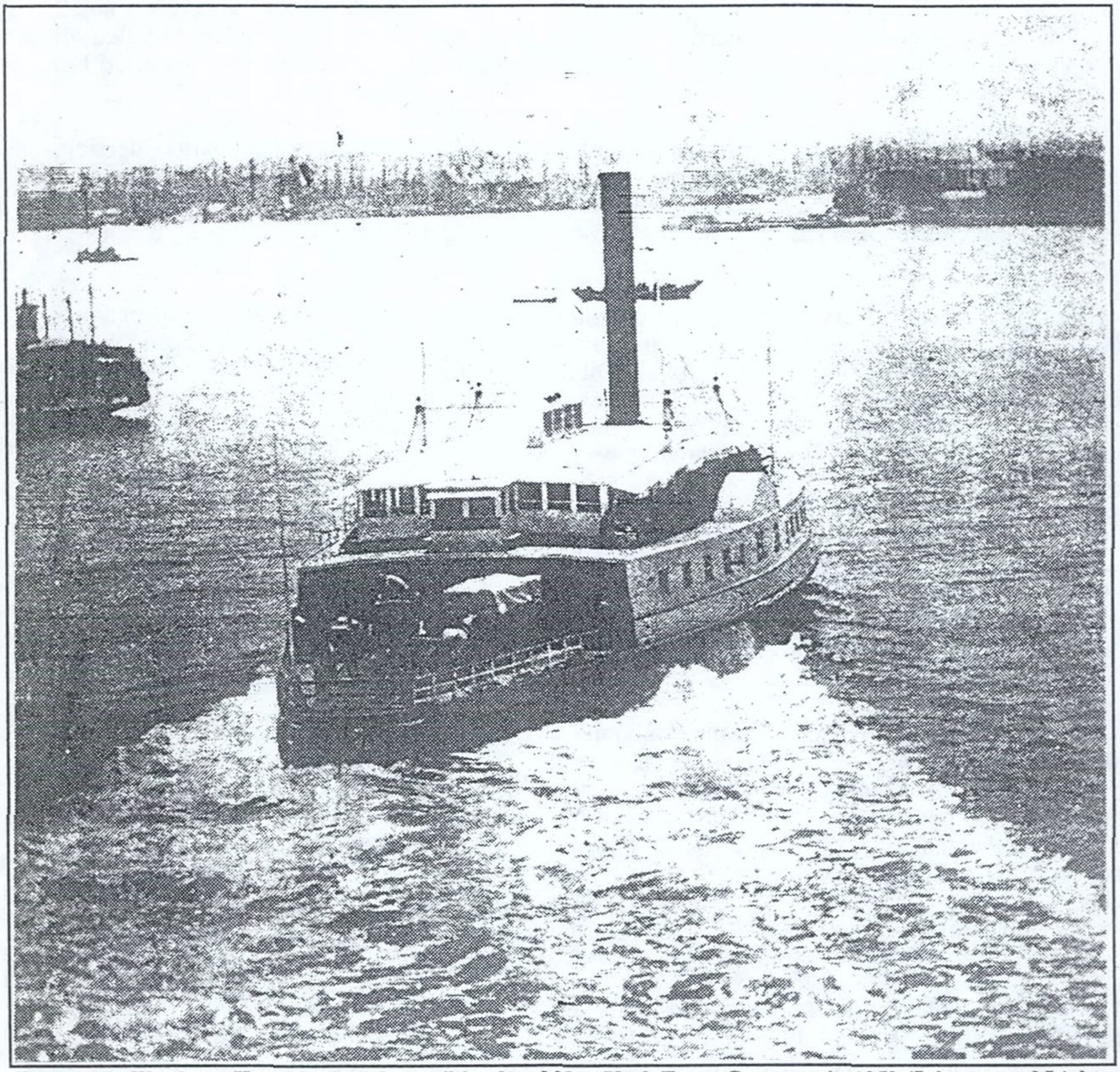


Figure 17. The ferry *Hunchback* of Staten Island and New York Ferry Company in 1859 (Johnson and Lightfoot 1980).

Table 2. Craft in New York by Class and Percent in Each Class 1916 (Squires 1918)

VESSEL CLASS	VESSELS		TONNAGE		VALUE OF	
	NO.	%	GROSS	%	$	%
Tugs/Towboats	559	9.1	57,687	3.2	13,153,417	21.7
Ferryboats	125	2.0	115,363	6.4	11,406,584	18.9
Municipal	16	0.3	15,471	0.9	2,107,199	3.5
Railroad	59	1.0	68,881	3.8	6,779,130	11.2
Other	50	0.8	31,011	1.7	2,520,255	4.2
Unrigged Craft	5,433	88.8	1,641,694	90.4	35,938,792	59.4
Total	6,117	100.0	1,814,754	100.0	60,498,793	100.0

Historically, New York's leadership position in general cargo portage depended on its ability to move or "lighter" goods from ship to pier or ship to ship. The term "lighter" describes a small boat utilized as an intraport cargo carrier. These lighters, sail or steam propelled, handled all types of agricultural and commercial goods, including mail. The usual lighter transported between 500 and 800 tons of freight (Harding 1912).

In New York Harbor, the term also applies to cargo ferrying via scow, barge, derrick, carfloat, or grain elevator, vis a vis waterfront terminals or anchored ocean vessels. The breadth of New York's lighterage activity "reflected America's full scale entry into the industrial age, with its ever increasing demand for imports of raw materials and foreign markets..." (Brouwer 1987:30).

The harbor's vast waterways and dense population initially hindered centralized railroad service. "In response to these challenges, many major railroads established inter-modal networks designed to meet and beat their competitors" (Dibner 1994:6). Of the dozen or so railroad lines built during the mid-1800s, only one line, the New York Central, provided direct rail freight service to Manhattan (Brouwer 1987). From 1835 to 1865, tracks progressively penetrated the harbor, terminating at the nearest navigable waterway. Most came no closer to Manhattan than Jersey City.

In the 1870s, railroads adopted the carfloat interchange system. Cars from southern areas reached New England-bound railroads by flotation barge. In Manhattan, around 1900, and later in Brooklyn and the Bronx, float bridge stations (inland freight stations) provided mechanisms for freight marine/terrestrial interchange. Beginning around 1860, railroads delivered (at no charge) a carload or more of incoming freight to waterfront locations within a designated harbor boundary (free lighterage limits).

Waterfront destinations received the same rate "as though it were physically on the line of the railroad" (Flagg 1994:7). Railroad owners had no choice but to provide free lighterage since the free service directly competed with canal boat carriers who delivered goods directly to ships or terminals, and charging for the service would drive shippers to other East Coast ports. When later investments included port facilities, railroad owners "did not want New York to be placed at economic disadvantage in competition with East Coast ports where goods did not have to be lightered" (Brouwer 1987:31). By the 1920s, railroads owned outright large lighterage fleets.

By 1885, New York Central Railroad maintained 92 lightering boats, the Pennsylvania Railroad, 104 vessels. In 1908 the Lehigh Valley Railroad had 250 craft, the Baltimore and Ohio 142 (Harding 1912). Three other railroads had fleets numbering more than 200 (Brouwer 1987). In 1907 the New York Central fleet moved 304,372 cars on float, or about 1,000/day, in addition to 1,402,358 lightered tons of bulk freight, or some 5,000 tons/day (Harding 1912). In 1917, all railroad freight shipped to or from Manhattan Island (apart from New York Central's track) arrived by lighter or carfloat (French 1917).

Table 3. Railroad Tonnage in 1914, Excluding Interchange, by Commodity, Percentage and Local Movement (Harbor Development Commission 1920)

COMMODITY	CARFLOAT		LIGHTER		TOTAL	
	Tons	%	Tons	%	Tons	%
Grain and Mill Products	593,000	14.0	3,232,000	76.1	4,244,000	100
Foodstuffs	2, 714,000	42.1	1,195,000	18.6	6,442,000	100
Fuel and ores	568,000	1.6	31,903,000	90.9	35,101,000	100
Building Material	829,000	17.0	2,323,000	47.8	4,865,000	100
Miscellaneous	6,100,000	49.0	2,607,000	20.9	12,463,000	100

Expansion of the free lighterage system allowed waterfront industries to develop floating sidings. Terminal companies took advantage of the situation by developing ports within ports, providing steamship piers, loft buildings, and freight stations, all served by private rail networks connected by carfloat. Companies set up special terminals for bananas, coal, grain, and perishables. A Merchant's Association of New York representative described the waters of Manhattan as "an interior *belt line* employed in switching cars between the terminals on the New Jersey shore and the industries...in various parts of the harbor" (Squires 1918:3).

The water belt line or lighterage and carfloat system came under attack around 1910. Independent cost analysis suggested that the system suffered from cost overruns, particularly delay and damage to freight. These allegations, however, often originated from rival ports. Objections also came from urban planners, who complained about the disproportionate amount of waterfront occupied by railroad marine operations. Supporters recognized that if operations moved elsewhere in Manhattan, companies would occupy space even more valuable.

The New York Port Authority (est. 1923) tried to carry out a comprehensive plan aimed at replacing marine operations with land-based belt lines. Railroad executives refused to cooperate with one another. Despite studies showing increased revenue by unifying terminals and belt lines, rail companies preferred the traditional lighterage/carfloat system (Flagg ca. 1970s). The Port Authority modernized pier and vehicular crossings, eventually substituting motor trucks for lighterage.

Modern containerization and trucking diminished the importance of the lighterage system by 1960. By 1976 railroads no longer provided lighterage service. Hundreds of abandoned wooden vessels now litter the channel's shoreline. Flagg et al. (1992) accurately noted that steel barges contain valuable scrap and are less likely abandoned. Some derelicts served as storage units for a time, but eventually lost any useful function.

The lack of railroad initiative aided Manhattan's port decline. Marine business slowed to the point that railroads found it cheaper to transfer freight by truck in New Jersey rather than by lighter. By the early 1970s, most free railroad lighterage in New York's port ended. The last carfloat operation in Manhattan ended in 1976.

INVESTIGATED PROPERTIES

INTRODUCTION

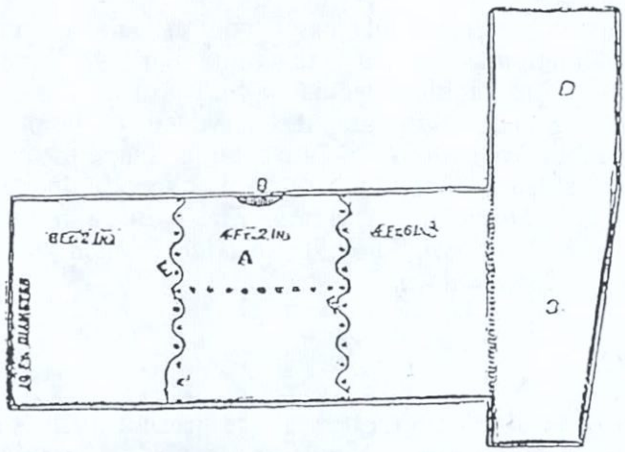
The following presents a general overview of vessel types associated with the project area, providing general historical information associated with a particular "type" previously identified. Specific information (written or photographic) associated with project-area vessels is presented here in paragraph form. Following each section are sites surveyed for the project. Corresponding shipwreck plans are presented in Appendix A and are cataloged here for indexing. Sites, vessel numbers, and clusters are presented in general locations. For specific locations, see *New York Harbor Collection and Removal of Drift Project, Arthur Kill, New Jersey Reach, Arthur Kill, New York Reach, New York Reach, Kill Van Kull, Staten Island Reach; Army Corps of Engineers, New York District, General Location Map.*

DOUBLE-ENDED FERRIES

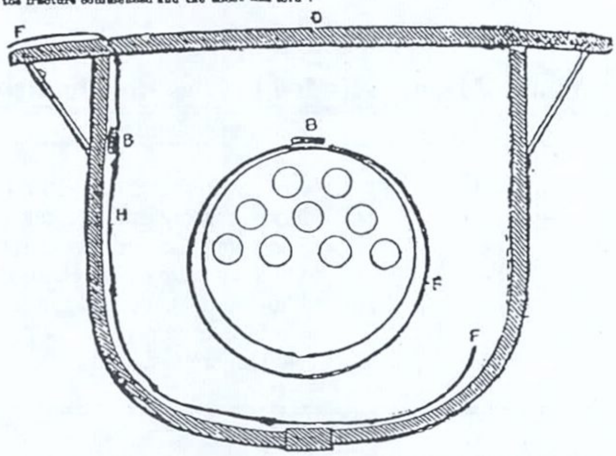
Several double-ended ferries (various engine types) are present in the project area. They feature both beam and inclined engine types. Double-ended ferries (as typed by Raber et al. 1995a, 1995b; Raber, Flagg, Wiegand, and Weinstein 1995) in the project area are presented in Table 4.

Table 4. Summary of Double-Ended Ferries Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 12	Arthur Kill, NY	No	Not best representative, no further work
Vessel 13	Arthur Kill, NY	No	Not best representative, no further work
Vessel 81	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 58	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 5	Kill Van Kull, NY	Yes	Photo and site documentation
Vessel 62	Kill Van Kull, NY	No	No further work
Vessel 234	Kill Van Kull, NY	No	No longer exists



The following sketch shows a cross-section of the boat and boiler after the wreck:- B, at the top of the boiler, is the manhole, as in the first illustration; O is the deck of the boat; F, at the side of the boiler, represents the point at which the fracture commenced and the sheet was torn off upward and around, and lodged against the side and bottom of the boat; F to F represents the sheet of iron, and B the manhole. The force necessary to have accomplished this result must have been tremendous.



The following diagram represents a horizontal section of the boat with the boiler in the bow. A is the plate which was torn from the boiler. B is the manhole, and represents the steps leading from the deck to the fire-room. K the furnace end of the boiler which was thrown into the position represented by the dotted lines in the direction drawn by the arrow. I is the rear end of the boiler which was thrown against the bar in the position shown by the dotted lines and in the direction indicated by the arrow.

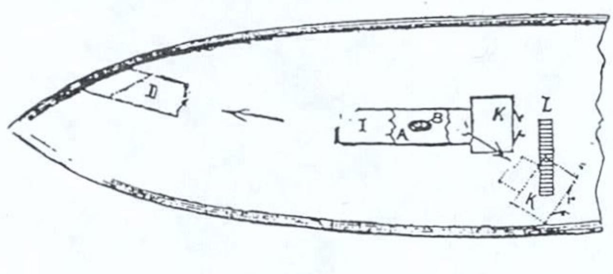


Figure 18. Diagram showing a cross section of *Westfield*'s boiler after the explosion (*NYT*, 3 August 1871).

Arthur Kill, New York Reach

Vessel No. 12 (Figure 19)
Vessel Type: Wooden inclined engine double-ended ferry
General Location: Arthur Kill, New York Reach north of Witte's Scrapyard
Date of Abandonment:1932 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: At low tide the vessel is just visible. A large wooden structure (amidships forward or aft) with iron bits fastened atop is evidently associated with propulsion machinery. Pairs of framing are visible forward and aft of the structure. Metal fasteners are present.
Recommendation: The criteria used for NRHP recommendation are determined by comparative vessel types in the project area. Based on observation, Vessel No. 12 is not the best representative type in the project area.

Figure 19. Remains of Vessel No. 12 at low tide, to east.

Vessel No. 13 (Figure 20)
Vessel Type: Wooden inclined engine double-ended ferry
General Location: Arthur Kill, New York Reach north of Witte's Scrapyard
Date of Abandonment: 1932 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The vessel is scarcely visible at low tide. Framing pair ends are visible. The top of an indistinguishable construction feature is visible amidships. The top rudder structure rises just above the waterline.
Recommendation: Based on observation, Vessel No. 13 is not the best representative type in the project area.

Figure 20. Extant remains of Vessel No. 13 at low tide, to east.

Vessel No. 81 (Figures 21 and 22)
Vessel Type: Wooden inclined engine double-ended ferry
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1940 (Raber et al. 1995a)
Description: An elliptical-shaped vessel, the ferry is heavily framed and features longitudinal wooden cross-bracing. Two longitudinal timbers (inboard of paddlewheel locations?) are supported by cross-bracing. Outer hull planking measures 4 in. thick x 6 in. wide. Paddlewheel guards outboard measure 16 ft. long x 8 ft. wide. Submerged along the starboard and port side are the possible remains of overhanging main deck struts. During low tide, the hull acts as a water reservoir, eliminating further structural observation.
Recommendation: Vessel No. 81 meets significant requirements as outlined in Criterion D, yielding information on the vessel's physical characteristics. This vessel will reveal information on its use, method of construction, and operation. A limited amount of archaeological data exist on boat-construction features associated with inclined engines. Data derived from this site will expand a limited database documentation. Complete photographic documentation and site plan recordation is recommended.

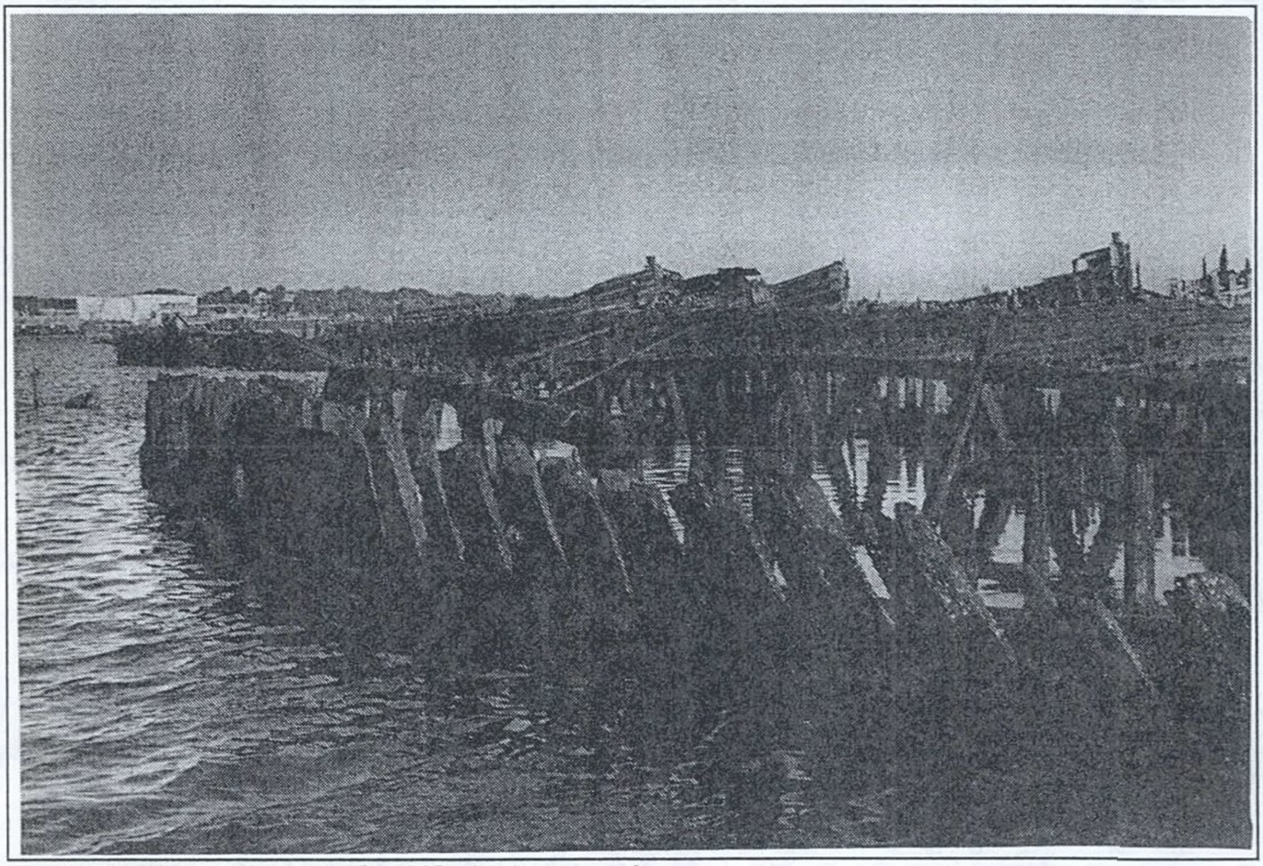


Figure 21. Vessel remains of Vessel No. 81, facing north.

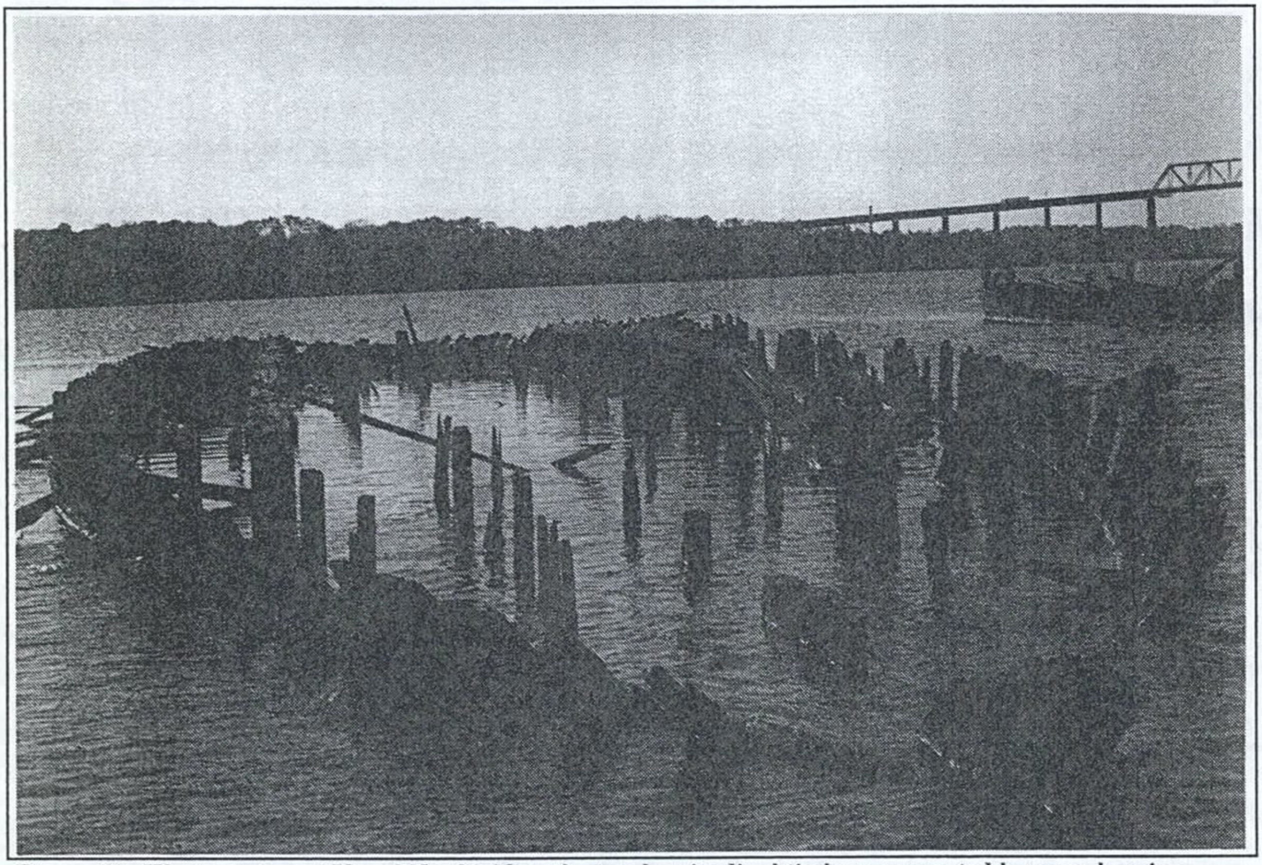


Figure 22. Western view of Vessel No. 81. Note the two longitudinal timbers supported by cross bracing.

BEAM ENGINE FERRIES

Vessel No. 58 (Figures 23 and 24)
Vessel Type: Wooden beam engine double-ended ferry
General Location: Arthur Kill, New York Reach, near Port Mobile
Date of Abandonment: No date
Description: The vessel, tentatively identified as *Westfield*., sits along the Staten Island shoreline. The stem section is well preserved. Visible lower hull remains consist of frames, stringers, ceiling, planking, and cribbing. Cross cribbing is evident on the inboard side of the frames. Stringers are hooked-scarfed horizontally and bolted to the frames by metal fasteners. There is evidence of a round steel scuppers amidships. An apparent wooden frame (with massive metal bolts and turnbuckles), associated with machinery, rests aft atop the stringers.
Recommendation: The vessel is determined significant based on Criteria A and D of NRHP National Register Bulletin #20. Under Criterion A, the *Westfield* tragedy is associated with an event that made a significant contribution to broad patterns of history. The risks of early steamboat travel are well documented. The subsequent investigation and public outcry associated with *Westfield*'s explosion provide insight into the public's concern for mass transit safety. Because the investigation appeared in print (*New York Times*), the event is easily documented. Under Criterion D, the vessel is a good representative of a specific type of architecture, i.e., the New York ferry boat. Field work should include, but not be limited to, sketches, reproduced reference materials, and historic photographs, if available. Description should consist of an original description (historic) and a present (archaeological) site description. Numerous black-and-white photographs of the vessel and site, as well as distinctive construction features, should be taken. Sketches should include measured site plan drawings.

The double-ended ferryboat *Westfield #2,* built in Brooklyn (1862) and owned by the Staten Island Railroad Company, measured 202 x 33 x 13 ft., which indicated that the boat had an overall length of about 220 ft. and a beam over the guards of 55 ft. (Betancourt 1955). The U.S. government requisitioned *Westfield #1* for use as a gunboat in 1862. The boat's commander, Com. Renshaw, fearing capture by Southern rebels, intentionally blew up the vessel. The *Westfield #2* also served in the Civil War as a gunboat, engaged in the West Gulf Squadron and on the Mississippi (*New York Times* [*NYT*], 1 August 1871).

In 1864, the Staten Island Railway Ferry Company began operating ferry service from Vanderbilt's Landing to Clifton to Tottenville. The company's ferries ran hourly between 7:00 a.m. and 6:00 p.m. In 1864, the fleet consisted of *Westfield #2*, *Northfield*, and *Middletown.*

On Sunday afternoon, 30 June 1971, while waiting at the Whitehall Street slip, *Westfield*'s boilers exploded, killing 66 (Cudahy 1990) and wounding about 200 passengers, though the *New York Times* reported 82 dead (3 August 1871). Regardless of body count discrepancy, the *Westfield* remains New York Harbor's worst maritime disaster. The passenger ferry had about between 400 and 800 passengers on board, many of them women and children.

In describing the disaster, a *Times* reporter stated:

> (A)t twenty-five minutes past one o'clock the steam-boat Westfield was laden with a chatting and laughing crowd...who had already begun to enjoy in anticipation a pleasure sail across the upper Bay. Within less than five minutes later...these happy holiday seekers were either dead, dying, or suffering intense agony from being scalded by steam and bruised from falling ties and timber. The forward deck of the ferry-boat...suddenly opened under the feet [*NYT,* 31 July 1871].

Describing the victims, a *Times* reporter lamented:

> Frightfully disfigured...the unfortunate creatures, lying in helpless and silent agony upon their beds, with flesh reddened by severe scalds and huge water blisters growing out of their tortured flesh, presented a spectacle truly pitiable. Many of them had lain unrecognized until yesterday, and the painful longing for a sight of fond relatives or friends at their bedside added intensity to their misery [*NYT,* 1 August 1871].

Word of the disaster spread quickly throughout Manhattan and surrounding areas. The *Times* reported newsboys did good business; local saloons did little business, however. Flags flew at half-mast. Many houses reportedly were draped in black.

The cause of the explosion remains in question, though built-up boiler pressure on a hot summer day certainly played a factor. John K. Matthews, an inspector of steamboats for the New York district, inspected the boiler on 12 June 1871, after it was moved to the slip of the Union Ferry at Atlantic Street for convenience. Inspector Matthews noted that the boiler, filled with water, flowed "so great that before it could be shut off the boiler was filled with water" (*NYT,* 1 August 1871).

Much speculation surrounded corrosion of the boiler by salt water. Salt water certainly corrodes, but a statement by a Mr. Andrews, who overhauled the boilers, read that he found no corrosion "arising from the use of salt water" (*NYT,* 1 August 1871). Andrews claimed the boiler to be in good shape when he completed the work, though it may have received further repairs at the Ferry's company shops on Staten Island, and that for all he knew, "patches may have been put on it" (*NYT,* 1 August 1871).

An official investigation into the explosion also included a published diagram (*NYT,* 3 August 1871) of *Westfield*'s boiler operations. Figure 18 is a diagram of *Westfield*'s boiler. The section labeled "A" is the portion of boiler plate apparently ruptured. The plate sheared off at the transverse dotted lines labeled "E." Section D is the boiler's chimney; Section C is the boiler furnace.

The investigation produced various explosion theories. The most plausible explanation surrounds the boiler safety valve. Apparently even fully opened, the valve lacked sufficient movement to relieve the boiler's pressure. This situation, coupled with the possible rearrangement of a pop-off valve weight, failed to eliminate the boiler's steam pressure (*NYT,* 3 August 1871). Whatever the reason, the disaster had two immediate effects on Staten Island ferry service. First, the Steamboat Inspection Service issued orders for a general inspection of steamboats throughout the country. Second, Staten Island residents clamored for a Staten Island Bridge, a project previously abandoned.

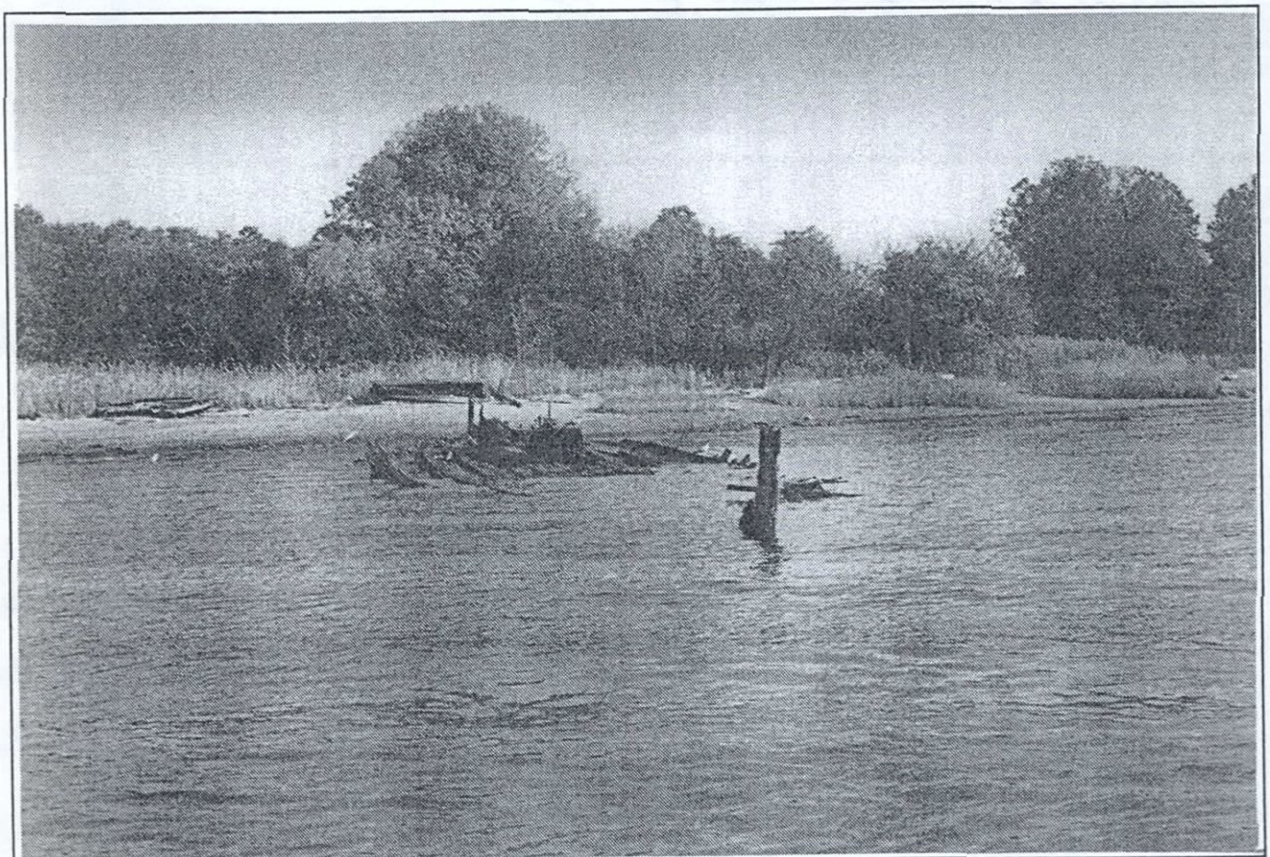


Figure 23. Site location of Vessel No. 58, *Westfield*, facing east.

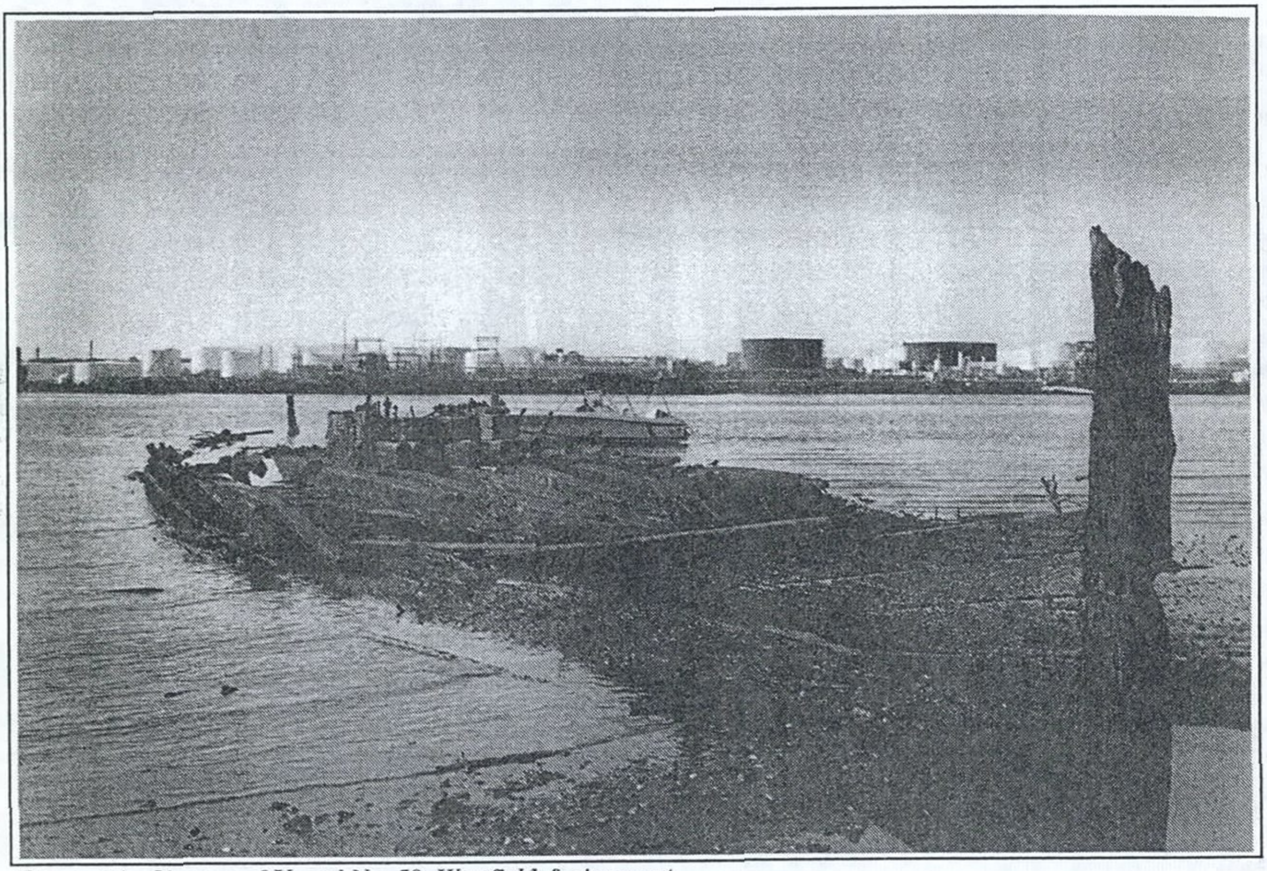


Figure 24. Closeup of Vessel No. 58, *Westfield*, facing west.

Kill Van Kull, New York Reach

Vessel No. 5 (Figures 25-27)
Vessel Type: Wooden beam engine double-ended ferry
General Location: Kill Van Kull, New York Reach near Pointin/Forsyth/National Dry Dock
Date of Abandonment: 1945 (Raber et al. 1995b)
Description: Portions of the vessel's lower hull remains are present but disarticulated. The wreck's beam engine A-frame still stands.
Recommendation: Based on Criterion D, the lower hull remains may provide data on construction and design, particularly details on engine support. Vertical beam engine ferry details, particularly A-frame supports extant on-site are rare. Information gathered from this site (complete photographic and site plan recordation) should be compared to data derived from Vessel No. 58.

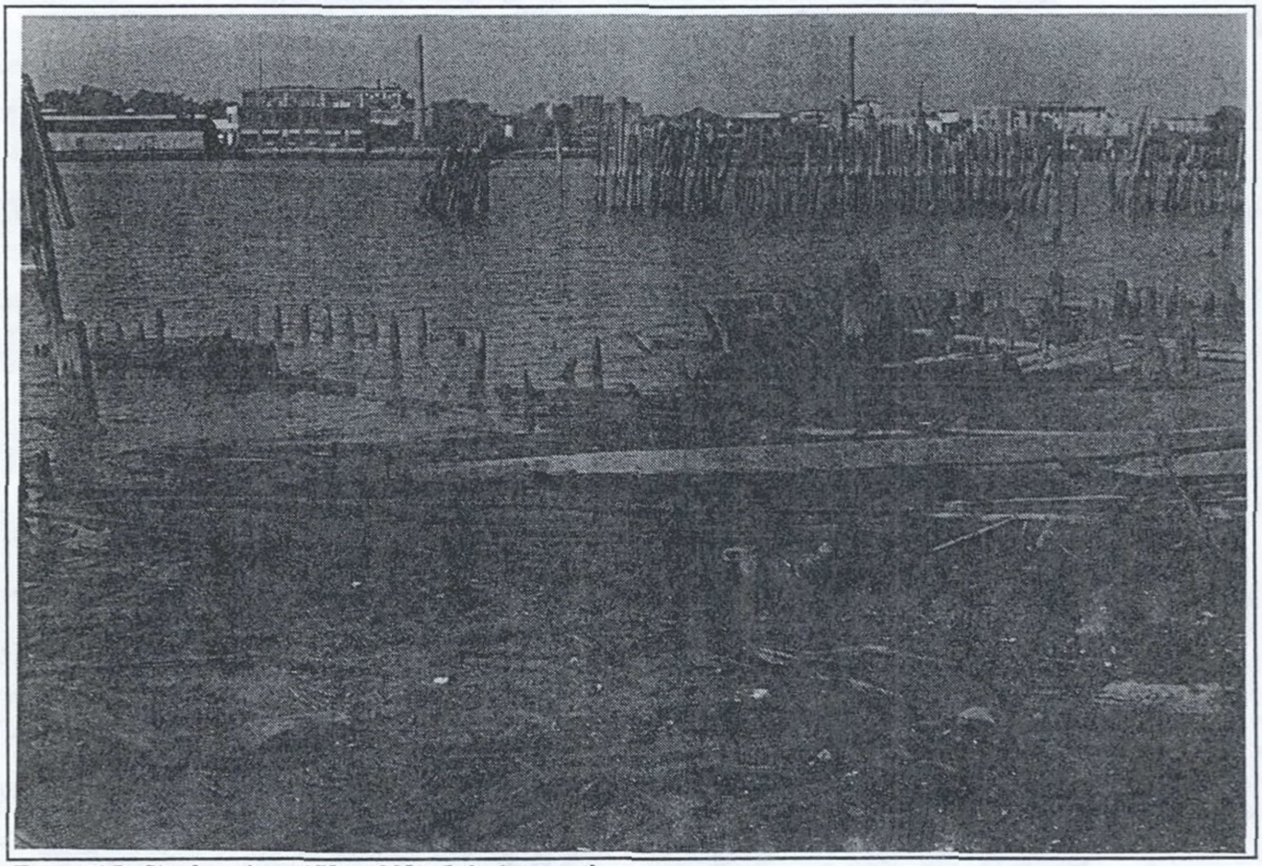


Figure 25. Site location of Vessel No. 5, facing northwest.

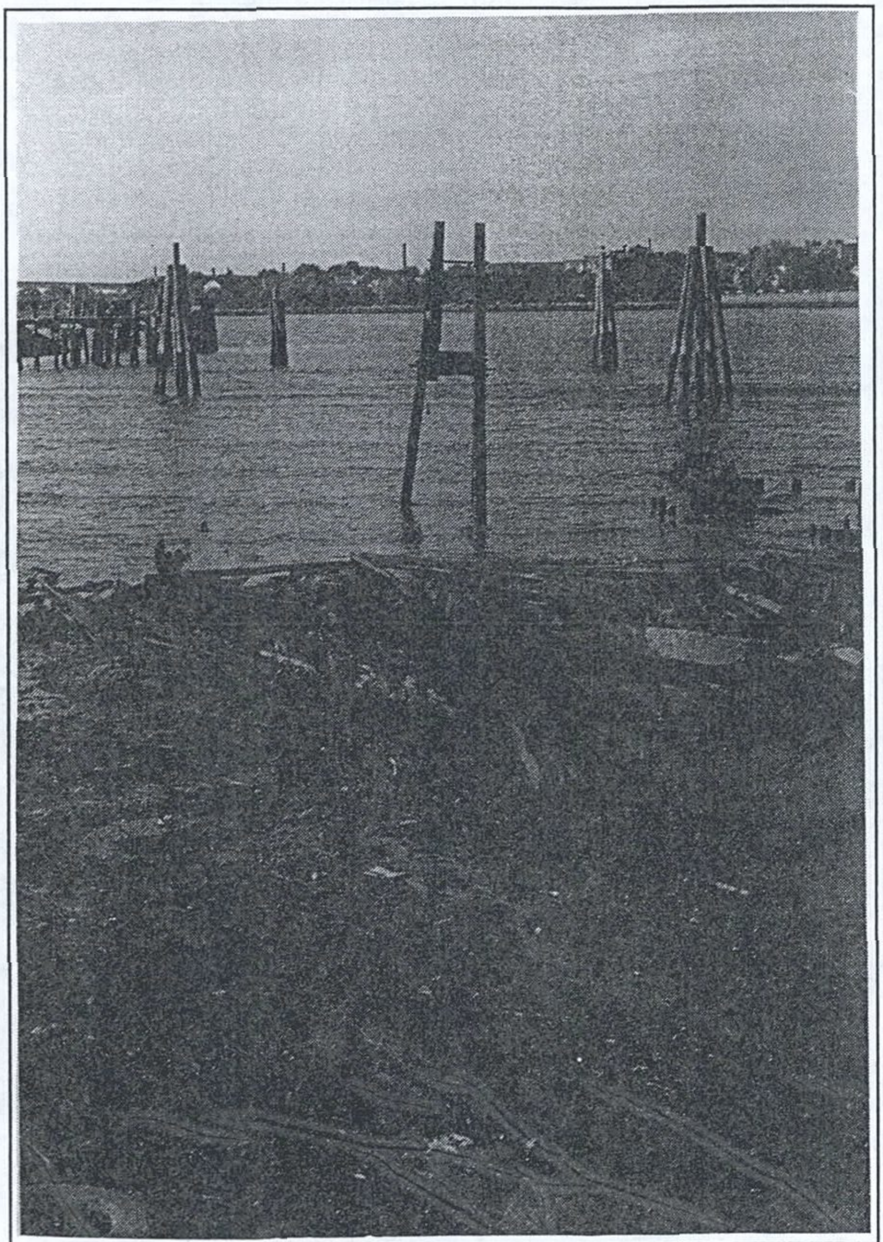


Figure 26. Western view of Vessel No. 5. The vessel's A-frame is in fair condition.

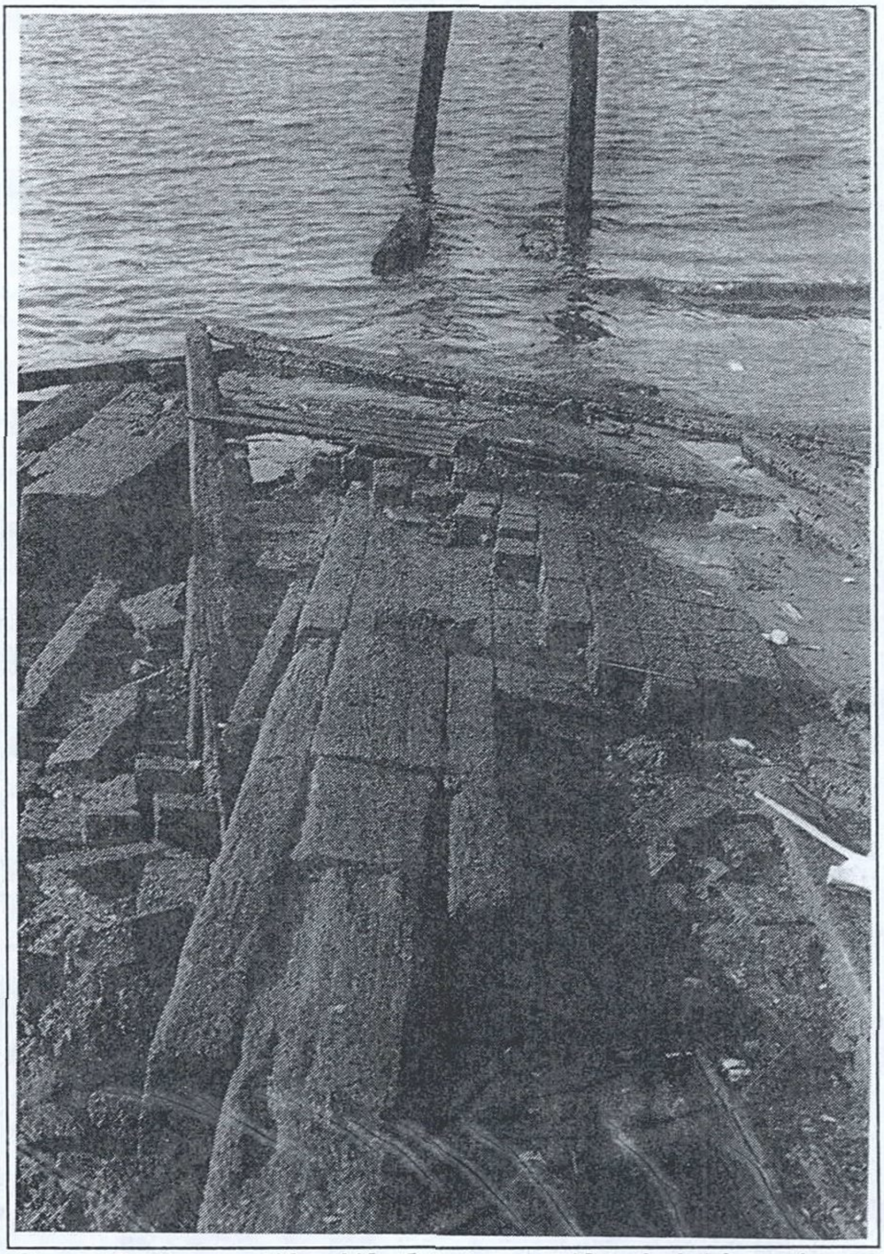


Figure 27. Closeup of Vessel No. 5, facing west. Note the bricks resting on the vessel ceiling.

STEEL SCREW DOUBLE-ENDED FERRIES

Steam screw or propeller ferries superseded sidewheel ferries beginning in the late 1880s. By 1905, New York City ferry management in the East River and the Upper Bay employed the steel screw ferry exclusively until 1950. The South Street Seaport Museum has several building drawings of all ferry classes. A few examples of this class exist today, including *Binghamton* (1905), built by the Hoboken Ferry Company. The ferry is now a restaurant in Edgewater, N.J. Table 4 includes steel screw double-ended ferries.

Vessel No. 62 (Figures 28-30)
Vessel Type: Steel screw double-ended municipal ferry
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Identified as *Astoria* (ex.-*William C. Collins*), most of the steel-hulled vessel is afloat and in good condition. Built by the Staten Island Shipbuilding Company in 1925, *Astoria*'s sister ship, *Major General William H. Hart*, is partially grounded at Bridgeport, Connecticut (Raber et al. 1995a). The hull plan features a strut-braced elliptical sponson similar to overhanging deck guards on paddlewheel steamers. The decking is a composite wood/steel construction.
Recommendation: The *Astoria* does not meet necessary criteria for significance. The history of New York Harbor's steel screw double-ended ferryboat is well documented. No further work is recommended.

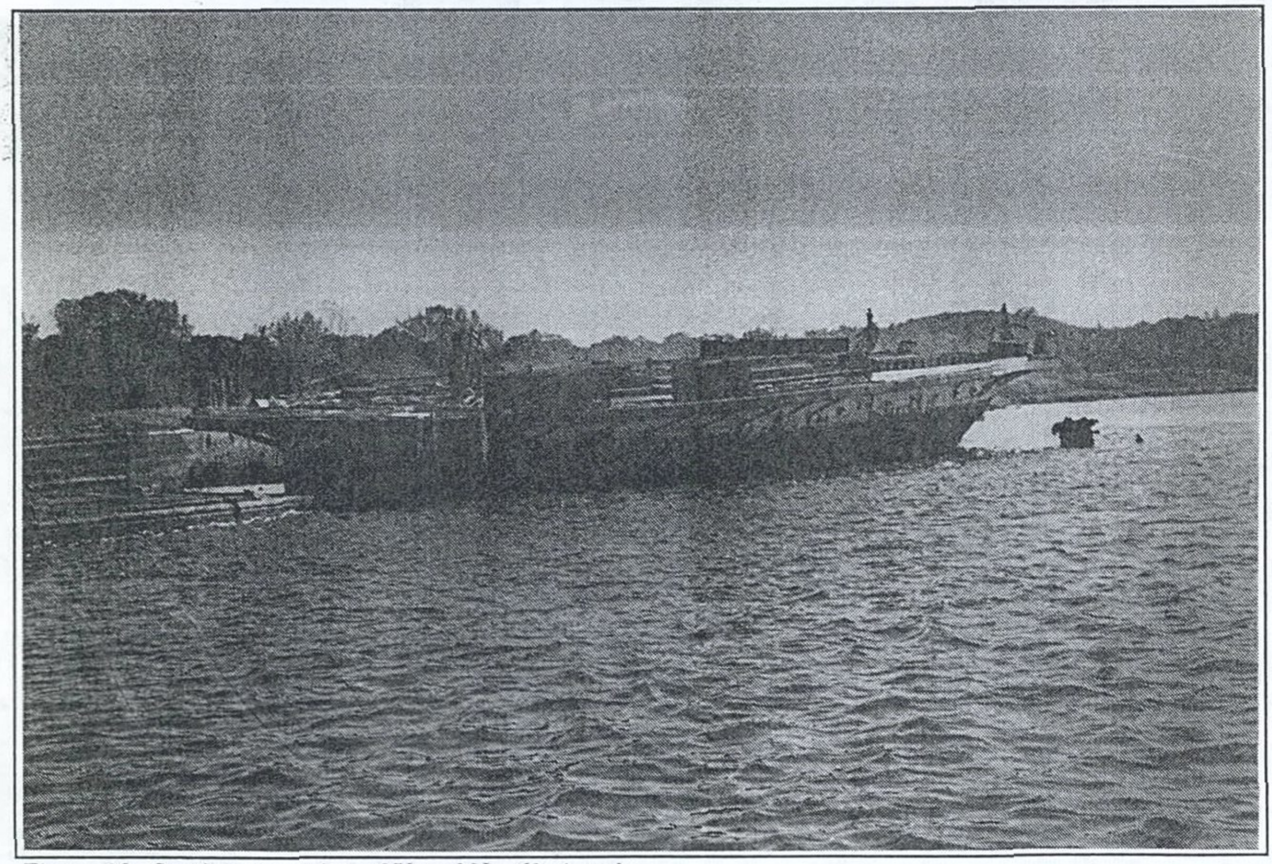


Figure 28. Southeastern view of Vessel No. 62, *Astoria*.

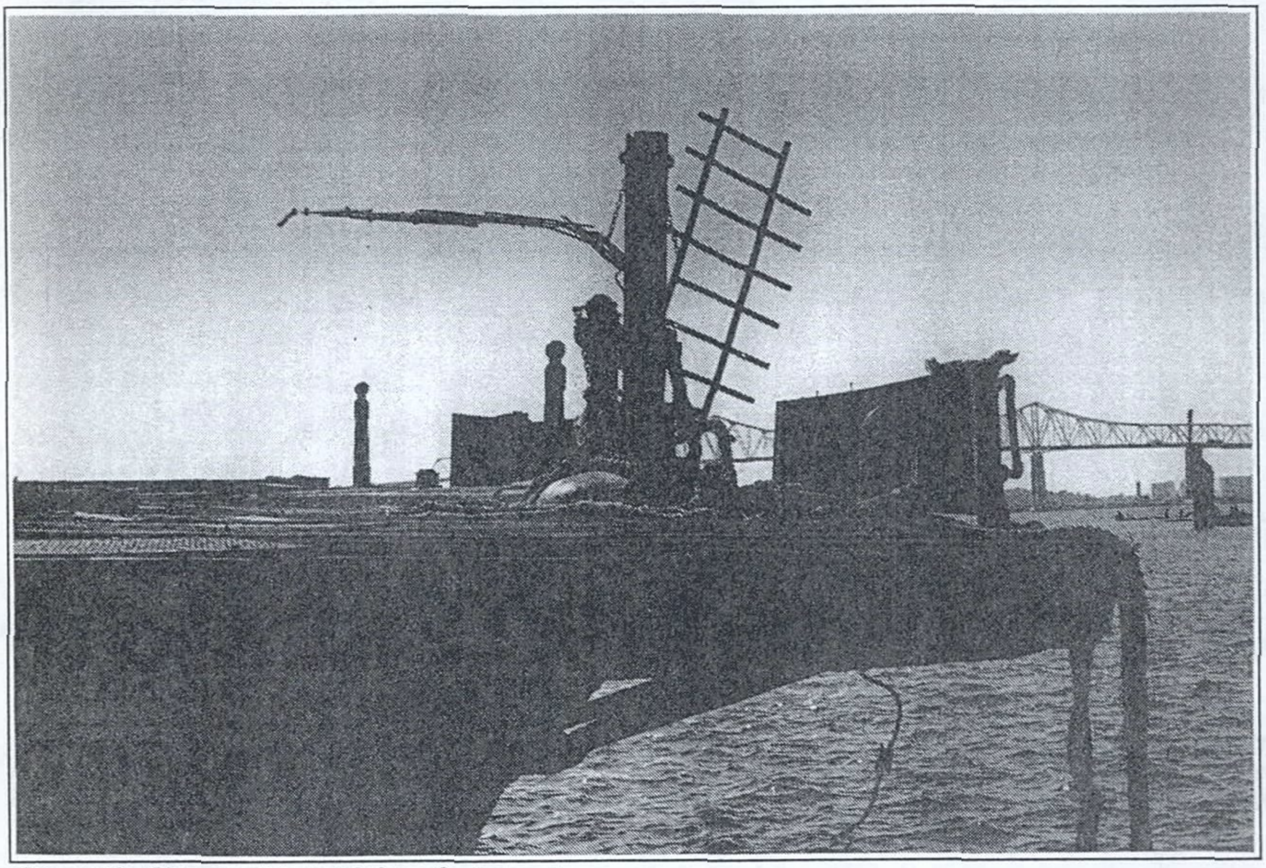


Figure 29. Closeup of *Astoria*'s bow, facing west.

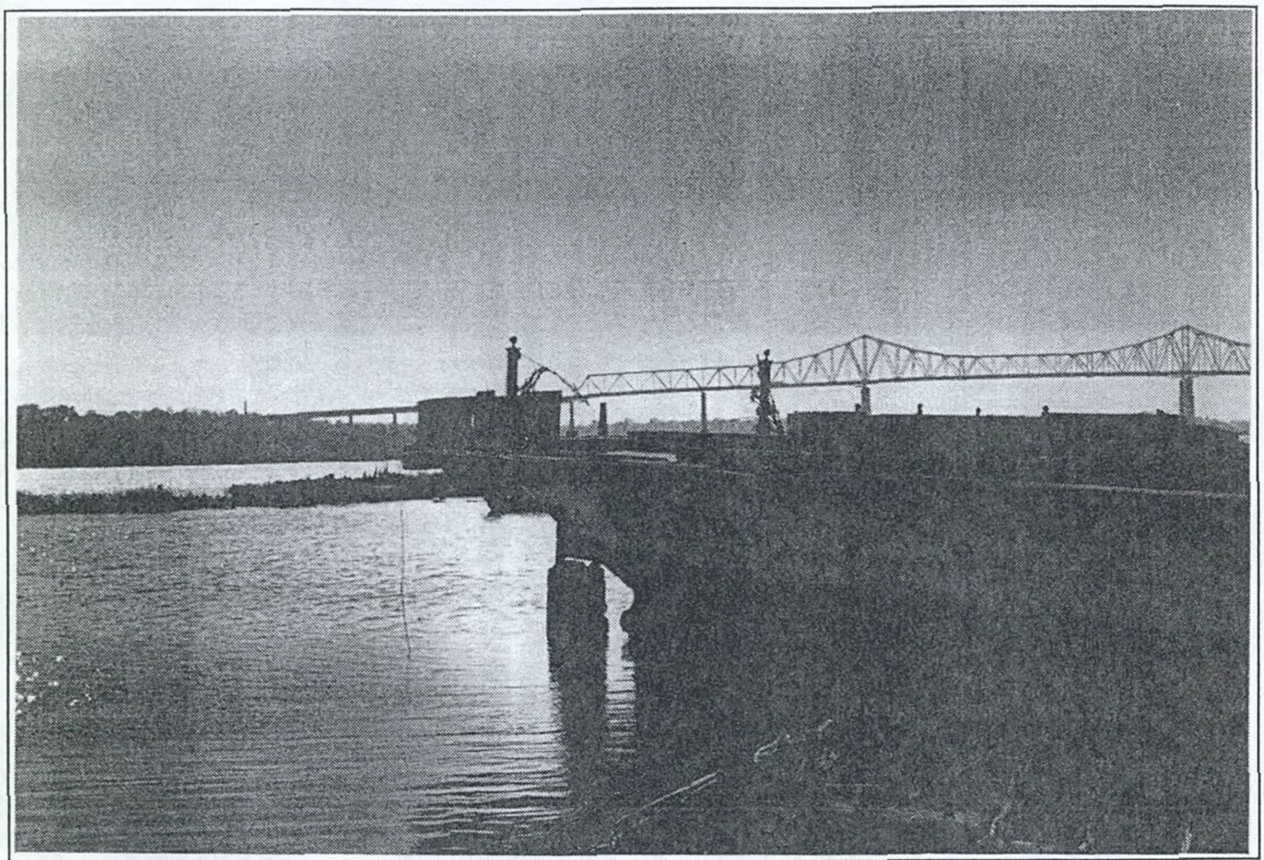


Figure 30. Closeup of *Astoria*'s stern, facing southeast. Note the rudder assemblage.

Vessel No. 234
Vessel Type: Steel screw double-ended municipal ferry
General Location: Arthur Kill, New York Reach near O'Boyle/Townsend Shipyard
Date of Abandonment: 1978 (Raber et al. 1995a)
Description: The vessel no longer exists. According to local information, foreign investors bought and removed the ferry for scrap.

SIDEWHEELER CONVERSION

Only one vessel in the project represents a converted sidewheeled steamer.

Vessel No. 53 (Figure 31)
Vessel Type: (Sidewheeler) barge conversion (steam)
General Location: Arthur Kill, New York Reach near Smoking Point
Date of Abandonment :1932 (Raber et al. 1995a)
Description: Brouwer (1996) identifies this vessel as *Hatteras*, built in Brooklyn in 1865. A converted steam-powered sidewheeler, the vessel's hull remains are partially submerged at low tide and covered with sediment. The upper portion of a large rudder and stern post assemblage is visible. The rudder itself is plated with metal (outboard end). Large centerline stanchions (possibly for deck beams) are oriented somewhat in pairs. The ceiling is extant starboard. Treenails fasten the outer planking, otherwise metal fasteners are used. Bricks are

evident in the forward section, probably ballast. The is a possible fore-mast, slightly raked, approximately 30 ft. aft of the stem.

Recommendation: The vessel is eligible for the NRHP under Criterion D (yielding data on construction methods). Archaeological information derived from the site offers comparative data on sidewheeled steamers and provides data on methods of functional ship conversion. Complete photographic documentation is recommended, as are length, beam, and scantling measurements.

Figure 31. Site view of Vessel No. 53, *Hatteras*, facing north.

CANAL BOATS

The Erie Canal (1817), 4 ft. deep by 40 ft. wide, with locks measuring 15 ft. deep by 40 ft. wide, ran from Albany to Buffalo. Sister canals ran from the Hudson River to Lake Champlain, Montezuma to Cayuga and Seneca Lakes, and Syracuse to Oswego. Federal money shortcoming, New York State built and maintained the canal system. In 1836, the state widened the canal to 7 x 70 ft. and the locks to 18 x 110 ft. "This permitted boats of much greater size on the Erie, Champlain, Cayuga-Seneca, and Oswego canals, and further diminished the importance of the smaller lateral canals" (Canal Museum 1981:5). Dimensions given for New York's State Repair Scows in the 1880s measure 98 ft. long, 17 2/3 ft. wide, and 9 to 10 ft. draft (Canal Museum 1981). The 1908 Barge Canal Bulletin for the State of New York gives the following dimensions: 18 ft. wide, 98 ft. long, and 6 ft. draft. Figure 32 shows an accident involving a canal

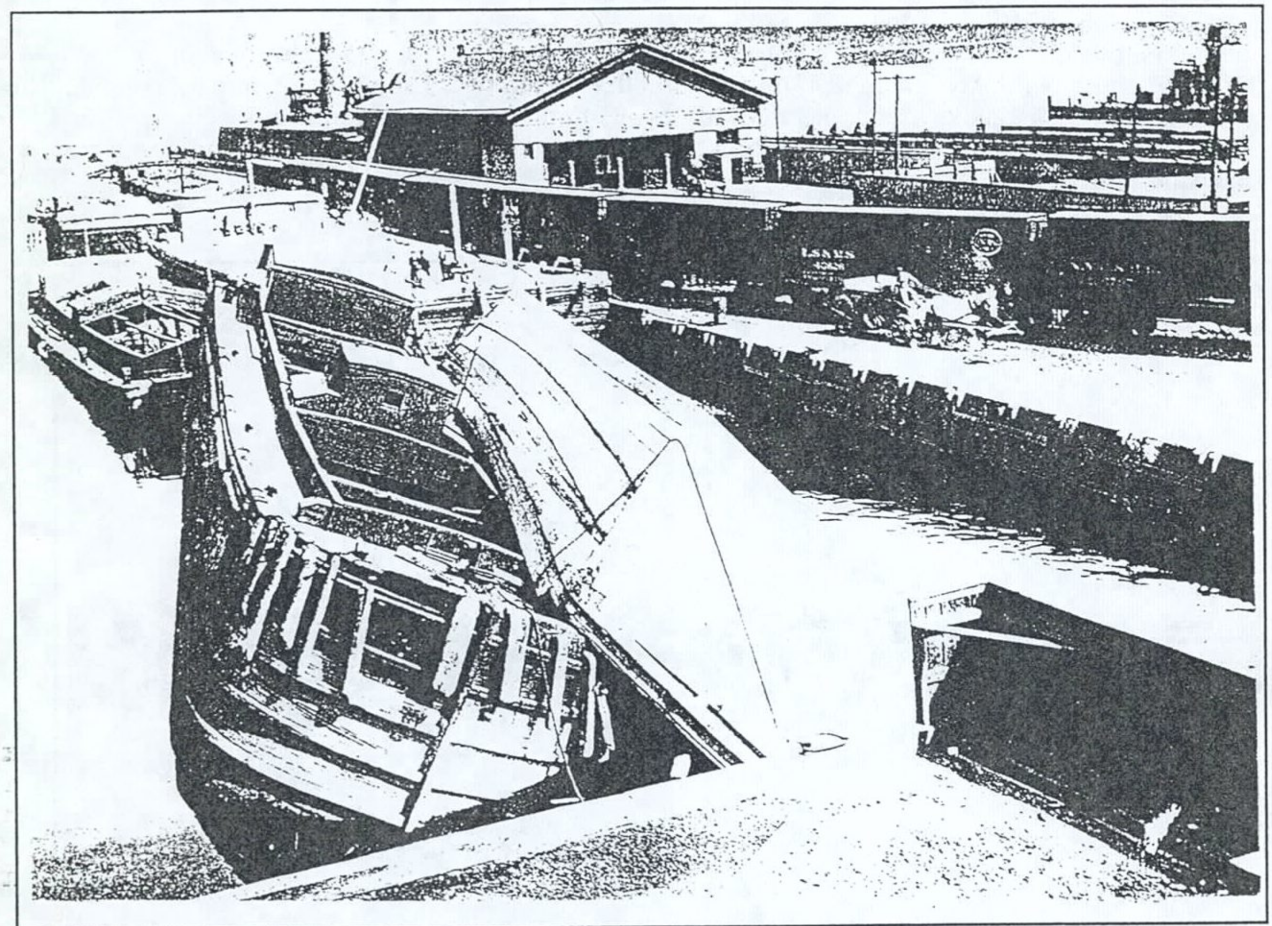


Figure 32. Canal boat and scow stacked on top of one another after a 1912 storm in Weehawken, New Jersey (Morris and Quinn 1989).

barge and a scow at Weehawken, New Jersey in 1912. A contract giving the dimensions for a state scow for the Erie Canal (1875) states:

> The Scow to be seventy feet long; fourteen and one half feet wide on top, and thirteen and one half feet wide on bottom, eleven feet top breadth of ends, four and one half feet height of sides; six feet rake, flooring to be one foot below top of sides; Stern deck to be six feet in length, and raise of bow and stern to be six inches. The cabin is to be twelve feet long and four and one half feet running above running board. The sides are to be seasoned white Pine, four inches in thickness and well jointed and doweled with 5/8 inch bolts to be placed not exceeding ten inches apart in each course. Floor timbers are to be well seasoned white oak three inches thick and eight inches deep. The long bow and stern timbers also the bow and stern Ricks are to be well seasoned white oak. The latter two inches in thickness. The Scow to be thoroughly caulked with the best quality oakum and the bottom to be well pitched. The Cabins to be made of thoroughly seasoned matched white pine, and to be painted with two coats of best Brooklyn lead and boiled linseed oil. All the bolts, fastenings and necessary iron to be of the best American iron [New York State Archives, Comptroller's Records. Canals. Collection 13. Package 2777].

In describing specifications for building a state scow, the contractor's model is based on a new state scow used on Section No. 1 of the Oswego Canal (Canal Museum 1981). The scow has nine white oak floor timbers 3 in. wide and 8 in. deep. The bow and stern timbers are doubled, 1, 2, and 3 in. thick and the same depth as the floor timbers. The bottom strakes are white oak 8 in. wide and 8 in. deep with only one splice.

Bottom planks are made of seasoned soft maple, free from checks and cracks, well jointed and secured by wrought boat spikes 6 in. long, caulked throughout. The sunken deck is good quality seasoned pine, resting on seven 3-x-12-in. joints. Stanchions under the deck are 2 ft. apart. Brace clamps are seasoned white oak 3 in. thick and12 in. wide, extending the entire length of the scow. Clamps are bolted with 1/2-in. bolts every two ft. Grub beams and deck beams kneed off, secured with 5/8-in. bolts. Five mud sills, 6 x 8 in., over the floor timbers are bolted to each floor timber. Top strakes are white oak, 5 x 7 in. (Canal Museum 1981).

Growth in steam power and steel boat production led to the Barge Canal System, a state-funded project featuring cast concrete construction and electronic locks. The System opened in 1918 and utilized canalized waterways and sections of the Old Erie Canal. Still in use are the Champlain, Erie, Oswego, and Cayuga-Seneca routes (Canal Museum 1981).

Two major changes in New York boat-building occurred in the 1860s. Bigger boats and increased traffic provoked the state in 1862 to mandate rounded bows on the system. The law prohibited square-bow boats. In a collision, a square-ended barge could shear off an entire section of boat "dumping a whole cargo and making a major blockage in the canal" (Canal Museum 1981:13). The mandate required better boat-building skills, but exploitation depleted local timber supplies. The boat-building industry developed along timber supply routes in Buffalo, Tonawanda, and Lockport. Canadian and northern New York timberlands supplied yards in Rochester, along the Oswego Canal to Phoenix and Fulton.

Boatyards in Ithaca, supplied by southern timbermen, developed the slab side scow in the 1860s. The design made use of pine and hemlock 6-x-12-in. side timbers. The timbers were mounted edge to edge by steel drift pin. The use of cheap softwoods minimized framing and planking, reducing the cost and labor of production (Canal Museum 1981).

Previous research by Raber et al. (1994) identified canal boats as those boats suitable for use on the New York State Barge Canal, built between 1905 and 1918. The Chittenango Landing Canal Boat Museum has plans and details of 13 types of canal boats; some of those plans are presented here. No known plans exist for boats built for the early state canal system.

The Underwater Archaeology Association of Elmira, New York located 28 canalboat sites in Seneca and Keuka Lakes. They also mapped several planked boat bottoms in the Old Erie Canal waters. These drawings are available at the Canal Museum Library in Syracuse, New York.

TYPOLOGICAL ISSUES. As stated in Raber et al. (1995b:98), "boats used on regional canals or contiguous waterways pose several identification problems." Boats used for canal service sometimes worked in a non-canal capacity, as in service on the Arthur Kill channel. Other times, these boat types served strictly in a non-canal capacity. These non-canal services included harbor freight traffic via creek and stream systems (including the Hudson River), and the movement of Woodbridge/Perth Amboy clay products.

The criteria adopted by Raber et al. (1995b) for canal boat typology is based on width and form. Boats identified in the project area are long enough for offshore/coastal service, but are narrow (20-30 ft.), with pointed or rounded bows, occasionally featuring rounded sterns. Raber et al. (1995b:98) state these boats are transitional types "between traditional moulded hulls with curved floors and frames requiring bent or curved fabricated members, and barge forms with few if any members." All boats identified as canal boats by Raber et al. (1995b) feature measurements applicable for the New York State Barge Canal (1905-1918). The boat measurements (20-25; 30-35 ft.) presented by Raber et al. (1995b) are not precise. However, the authors state that the examples previously investigated exceed maximum 17.5-foot widths necessary for use on nineteenth-century New York State Canals and the 10.5- to 14-ft. boat widths witnessed on the Delaware and Hudson, Morris, and Delaware and Raritan canals. During Phase III investigation, research should require precise measurements of boats identified as canal boats.

Raber et al. (1995b) also categorized project-area canal boats into two types: (1) large wooden barge canal or harbor hold barges, and (2) probable transitional/smaller barge canal boats. The large harbor hold barges, according to Raber et al. (1995b), apparently correspond to twentieth-century vessels some 22-34 ft. wide and 108 ft. long (barge, barge canal boats, canal box, lake work barge, Box O'Donnell type (Volume II Figures 1, 2, and 3), big grain boat/box, and deep barge). These boats are wider, though they retain pre-barge canal boat features, i.e., low set cabins. Raber et al. (1995b) state that these boats may represent a redesign of earlier barge canal forms after 1915-1920. The probable transitional/smaller barge canal boats are apparently bigger versions of nineteenth-century forms, built 1905-1915.

The Feeney Collection from the Hudson River Maritime Museum, Kingston, New York has deck and side plans for an O'Donnell type canal boat (Volume II, Figures 1, 2, and 3). The undated plan features a vessel measuring 104 ft. 4 in. x 31 in. Figure 1 indicate frames, deadwood, deckbeam, and hanging knee patterns. Figure 2 shows stanchions and outer planking. Figure 3 show the vessel's outer hull fastening pattern. Comparison of these figures with vessel remains will provide relevant data on size and construction features particular to project vessel types. Table 5 lists vessels that are identified as canal boats or transitional barge/canal boats located in the project area.

Table 5. Summary of Canal Boats Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 214	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 219	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 30	Arthur Kill, NJ	Yes	Basic measurements for comparison
Vessel 32	Arthur Kill, NJ	Yes	Basic measurements for comparison
Vessel 34	Arthur Kill, NJ	Yes	Basic measurements for comparison
Vessel 98	Arthur Kill, NJ	Yes	Basic measurements for comparison
Vessel 99	Arthur Kill, NJ	Yes	Basic measurements for comparison
Vessel 103	Arthur Kill, NJ	Yes	Basic measurements for comparison
Vessel 43	Arthur Kill, NJ	Yes	Basic measurements for comparison
Vessel 46	Arthur Kill, NJ	No	Inaccessible, no further work
Vessel 47	Arthur Kill, NJ	No	Inaccessible, no further work
Vessel 57	Arthur Kill, NJ	Yes	Basic measurements for comparison
Vessel 58	Arthur Kill, NJ	Yes	Basic measurements for comparison
Vessel 59	Arthur Kill, NJ	Yes	Basic measurements for comparison

Arthur Kill, New York Reach

Vessel No. 214 (Figure 33)
Vessel Type: Possible transitional/smaller barge canal boat
General Location: Arthur Kill, New York Reach near O'Boyle/Townsend Shipyard (Raber et al. 1995a)
Description: One end of the vessel is vertical, the other end scowed. The scow end is raked with seven support timbers. The sides of the vessel are vertical. Wooden diagonal and vertical bracing runs transversely amidship. Fasteners appear to be all metal. The site is littered with rocks, bricks, and debris. Many of the bricks are stamped "*Bellwood.*"
Recommendation: This site meets significant criteria as outlined in Sections A and D, NRHP Bulletin #20. Criterion A includes recommendations based on engineering designs. This vessel may provide data on technological developments in canal boat hull form and design. It may also provide additional data on ship construction methods and designs as outlined in Criterion D. Complete photographic documentation and site plan recordation is recommended as a best representation type.

Figure 33. *Closeup* of Vessel No. 214, facing north. The vessel's interior is littered with rock, brick, and debris.

Vessel No. 219 (Figure 34)
Vessel Type: Possible transitional/smaller barge canal boat
General Location: Arthur Kill, New York Reach near O'Boyle/Townsend Shipyard
Date of Abandonment: 1971 (Raber et al. 1995a)
Description: The boat is identified by Norman Brouwer as *Marion Melvin*, apparently abandoned between 1961-1971. The upper portions of the boat are burned and disarticulated. The vessel is narrow and has the typical curved bow of a barrel bow canal boat. Centerline stanchions are attached to deck beams with metal strapping. Vertical bow planking is spiked into breast timbers. Along outer planking are etched the Roman numerals VIII and VI. Lower hull features are submerged during low tide.
Recommendation: Under Criterion A, this vessel should reveal data pertinent to agriculture or commerce associated with the region. Under Criterion D, this site provides construction details on a typical barrel bow canal boat. The data derived from the site should be compared to known archaeological data associated with New York Harbor and canal boats. Much of this information is available at the Canal Boat Museum in Syracuse and the Hudson River Maritime Museum in Kingston, New York. The investigation should include, but not be limited to, complete photographic and site recordation.

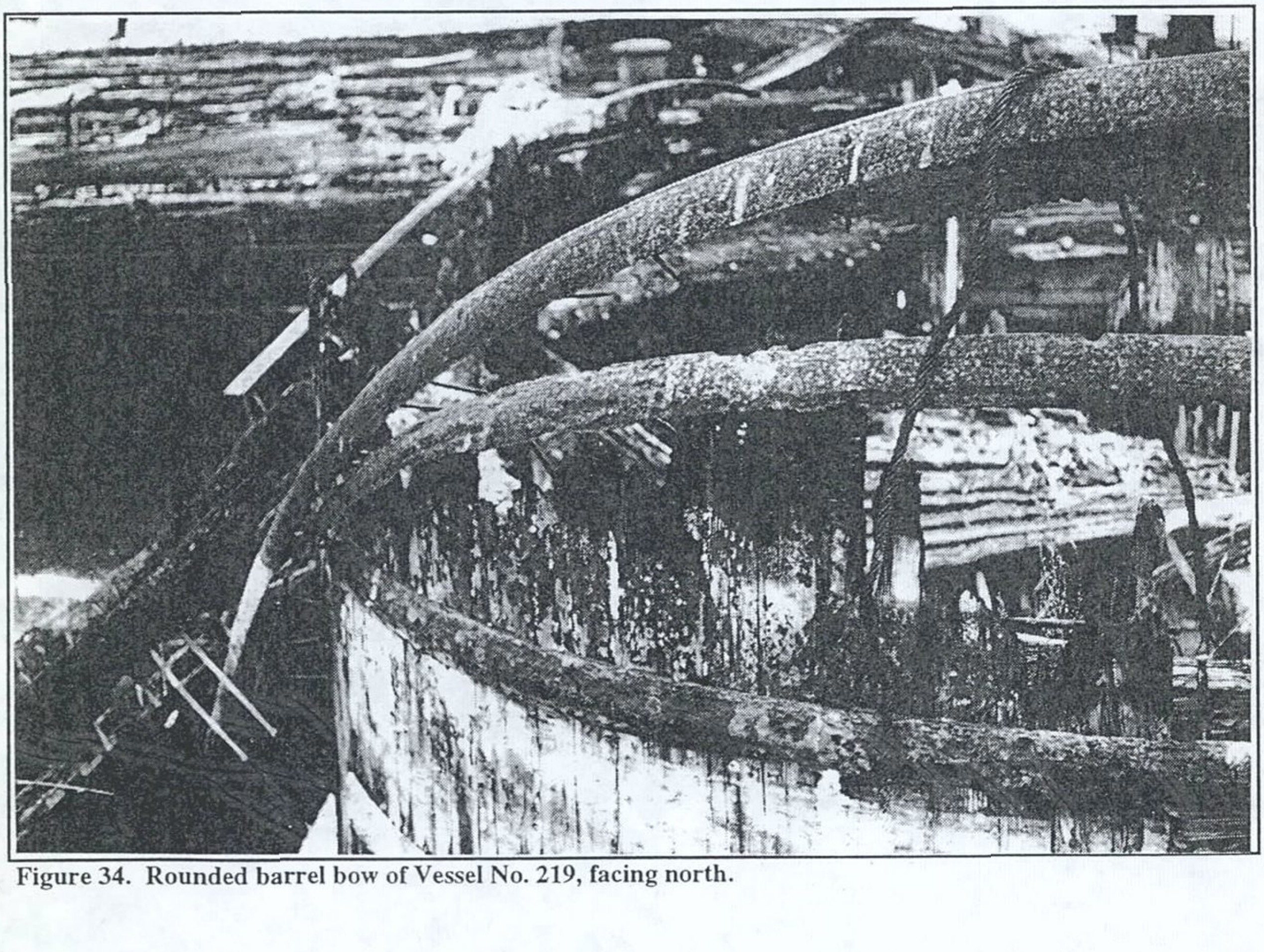


Figure 34. Rounded barrel bow of Vessel No. 219, facing north.

Arthur Kill, New Jersey Reach

Vessel No. 30 (Figure 35)
Vessel Type: Probable transitional/small barge canal boat
General Location: Arthur Kill, New Jersey Reach near Lehigh Valley RR
Date Abandoned: 1940 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: Some timbers from the pier side are visible at low tide. The scow timbers are visible. They are fastened with transverse timbers that are notched at the top (probably for missing sheer timber). Extant are two wooden hanging knees for deck beams.
Recommendation: Under Criterion D, this vessel may yield information regarding its use and construction. It is recommended that length and beam measurements be taken and compared with other similar sites in the project area.

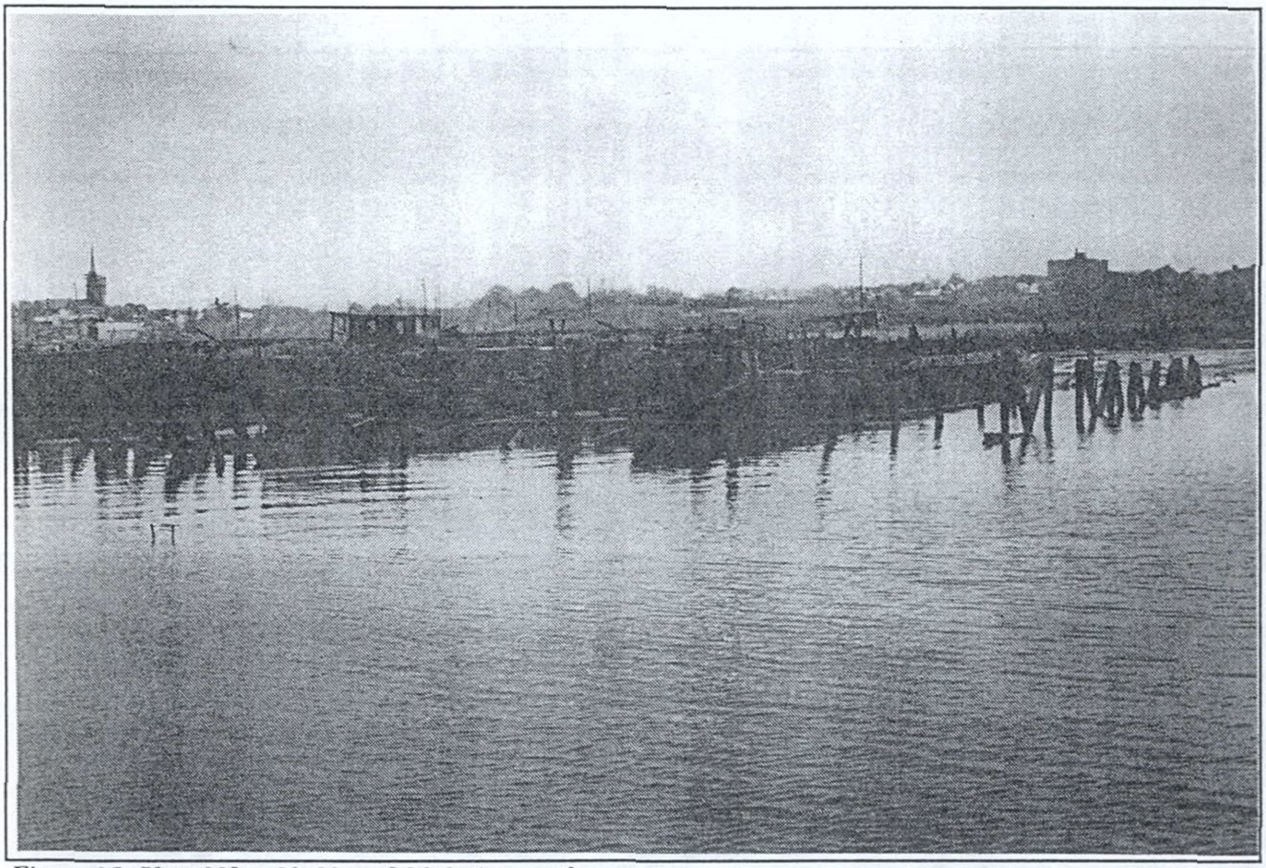


Figure 35. Vessel Nos. 30, 32, and 34, facing north.

Vessel No. 32 and 34 (Figure 35)
Vessel Type: Probable transitional/smaller barge canal boat
Date Abandoned: 1940 (Raber, Flagg, Wiegand, and Weinstein 1995)
General Location: Arthur Kill, New Jersey Reach near the Lehigh Valley RR
Description: In similar condition as Vessel No. 30, these boats have scow ends. Both boats have supporting outside walls, side crossing bracing (trusses), and centerline stanchions.
Recommendation: Under Criterion D, this vessel may yield information regarding its use and construction. The data derived from this research provides comparative data for other project

canal boat types. It is recommended that length and beam measurements be taken and compared with other similar sites in the project area.

Vessel No. 43 (Figure 36)
Vessel Type: Large wooden barge, canal/harbor hold barge
General Location: Arthur Kill, New Jersey Reach near Segrave Transportation/LVRR
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: Only outer hulling remains are visible. The vessel is rectangular with vertical sides. Partial remains of vertical stanchions and deck beams are present.
Recommendation: Under Criterion D, this vessel may yield information regarding its use and construction. The data should be compared to other similar boat types in the project area. It is recommended that length and beam measurements be taken and compared with other similar sites in the project area.

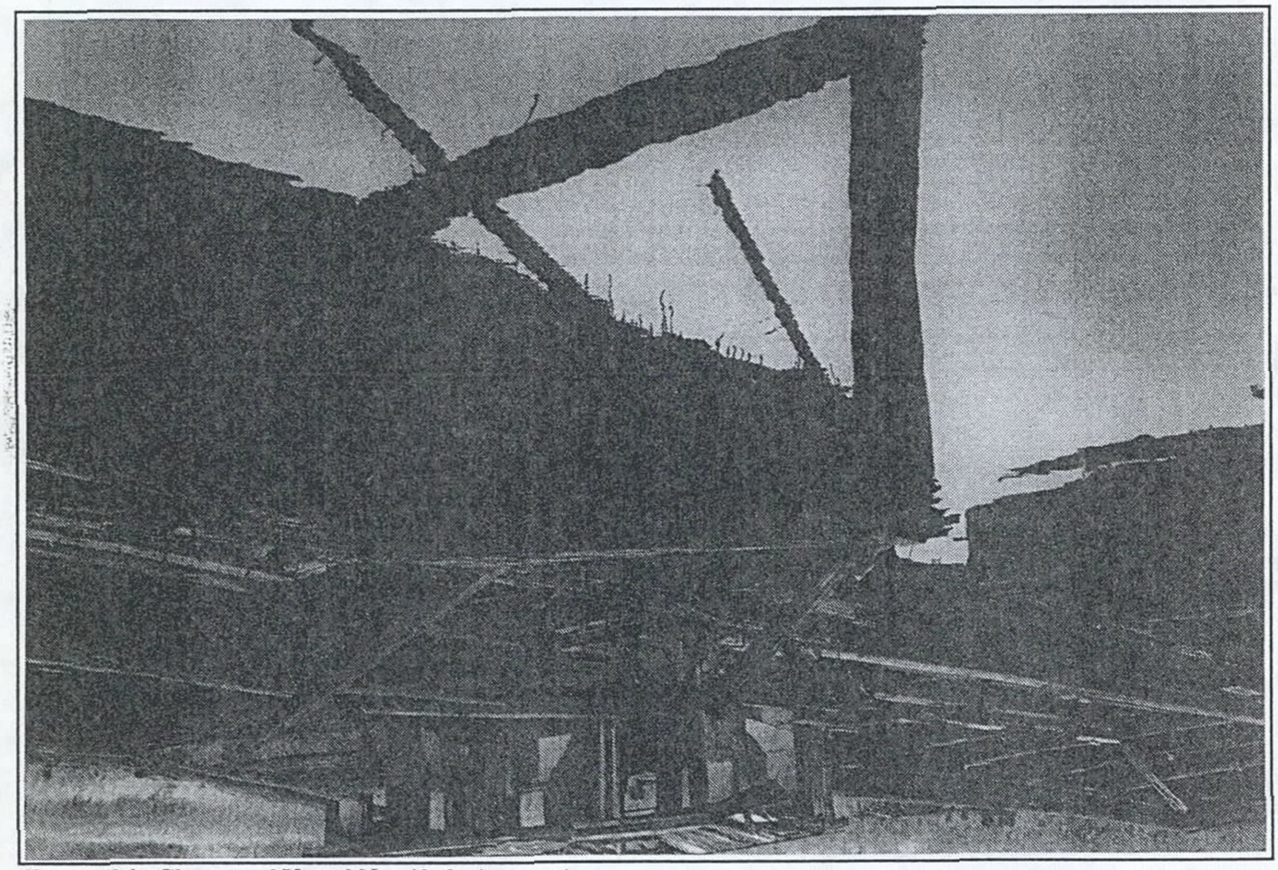


Figure 36. Closeup of Vessel No. 43, facing west.

Vessel No. 46
Vessel Type: Wooden barge, canal/harbor hold barge
General Location: Arthur Kill, New Jersey Reach near Lehigh Valley RR
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: This vessel and No. 47 are inaccessible. Very little remains are visible at low tide.
Recommendation: Because of limited accessibility, no further work is recommended.

Vessel No. 47
Vessel Type: Wooden barge canal/harbor hold barge
General Location: Arthur Kill, New Jersey Reach near the Lehigh Valley RR
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: see Vessel No. 46
Recommendation: Because of limited accessibility, no further work is recommended.

Vessel No. 57 (Figure 37)
Vessel Type: Wooden barge canal/harbor hold barge
General Location: Arthur Kill, New Jersey Reach near the Lehigh Valley RR
Date of Abandonment: 1940 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: One side of the planking exists, leaning against Vessel No. 58. Both ends of the vessel are scowed. Rake timbers are notched at either end, presumably for transverse end planks. Centerline stanchions are present at one end.
Recommendation: Under Criterion D, this vessel may yield use and construction information. The derived data would provide comparison research for canal boat types. Length and beam measurements are recommended for comparison with similar sites in the project area.

Figure 37. Scow end of Vessel No. 57, facing east.

Vessel No. 58 (Figure 38)
Vessel Type: Wooden barge canal/harbor hold barge
General Location: Arthur Kill, New Jersey Reach near the Lehigh Valley RR
Date of Abandonment: 1940 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: One side of the vessel's planking is visible, leaning against Vessel No. 57. The planking is hook-scarfed along the length. Vertical framing timbers are extant, as are five centerline stanchions. Most of the vessel is submerged at low tide.
Recommendation: Under Criterion D, this vessel may yield information regarding its use and construction. It is recommended that length and beam measurements be taken and compared with other similar sites in the project area.

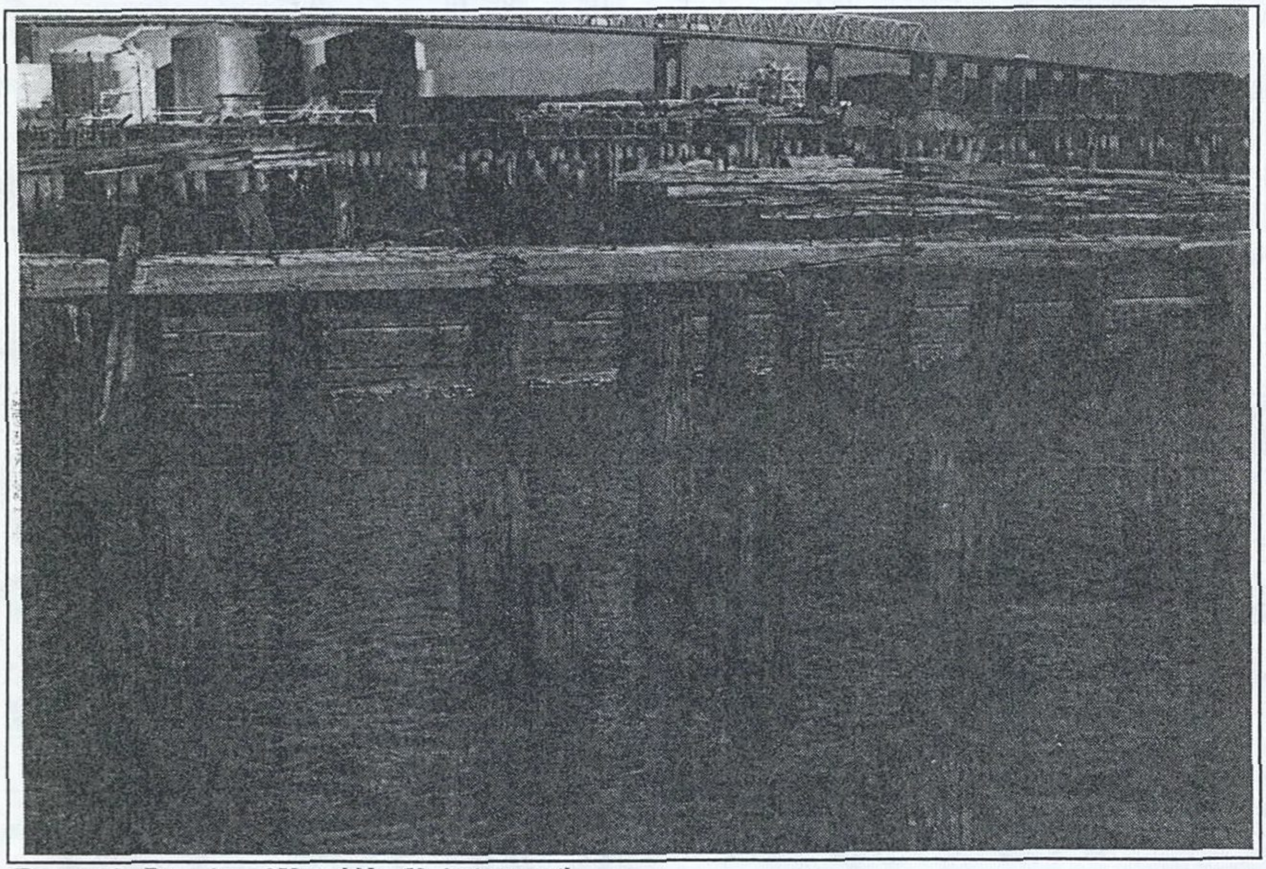


Figure 38. Remains of Vessel No. 58, facing north.

Vessel No. 59 (Figure 39)
Vessel Type: Smaller barge/canal boat
General Location: Arthur Kill, New Jersey near the Lehigh Valley RR
Date Abandoned: 1940 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: In similar environmental condition as Vessel Nos. 57 and 58, very little vessel remains are observable at low tide. There is evidence of vertical framing timbers and eight centerline stanchions, but there is no visible decking or planking.
Recommendation: Under Criterion D, this vessel may yield information regarding its use and construction. It is recommended that length and beam measurements be taken and compared with other similar sites in the project area.

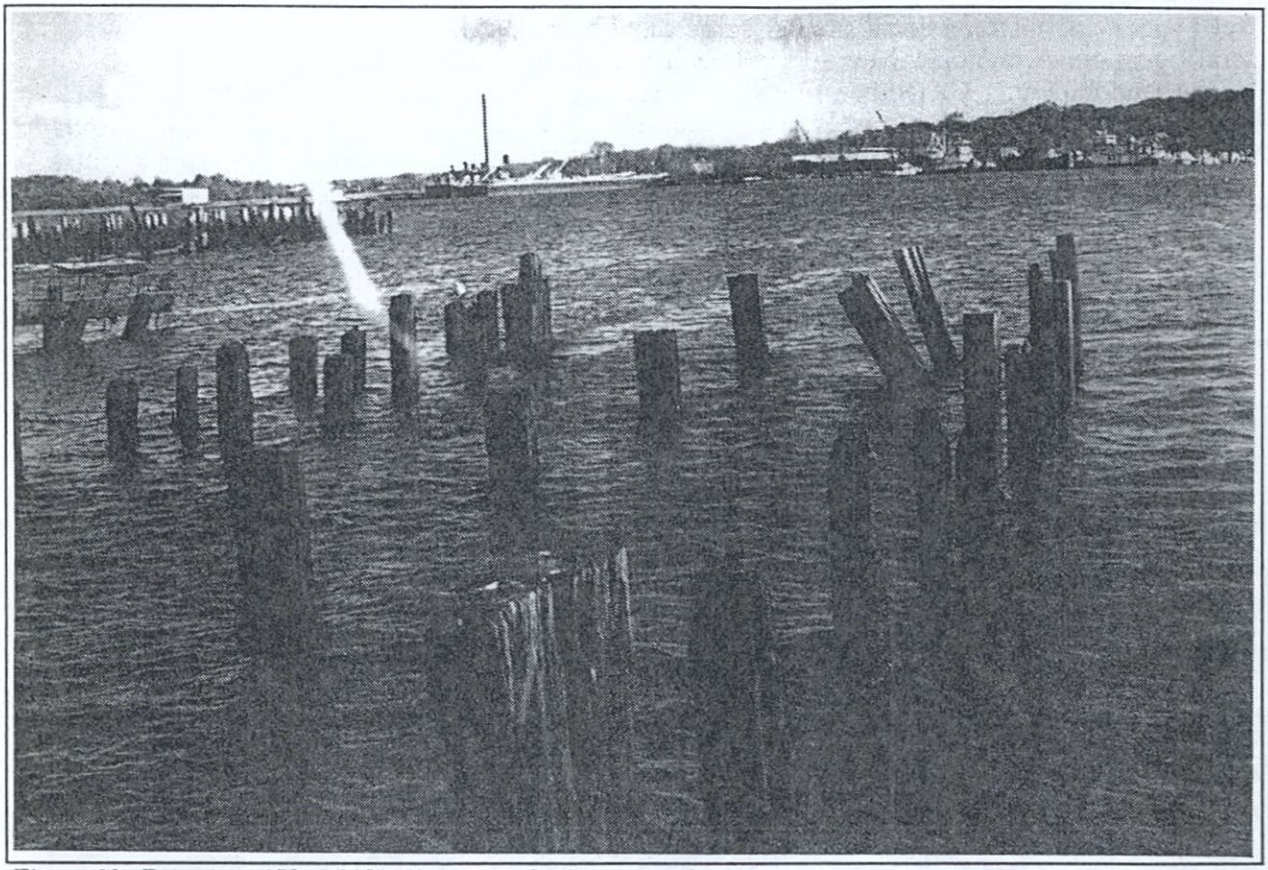


Figure 39. Remains of Vessel No. 59 at low tide, facing northeast.

Vessel No. 98
Vessel Type: Possible transitional smaller barge canal boat
General Location: Arthur Kill, New Jersey Reach near the New York and Long Branch RR
Date of Abandonment: 1961 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The vessel is barely visible at low tide. There is apparent siltation of the site since Raber's initial investigation. The vessel has a rectangular floor plan with transverse floor timbers. One end, apparently the bow, is bluffed and rounded.
Recommendation: Under Criterion D, this vessel may yield use and construction information. Length and beam measurements are recommended for comparison with similar sites in the area.

Vessel No. 99
Vessel Type: Possible transitional smaller barge canal boat
General Location: Arthur Kill, New Jersey Reach near the New York and Long Branch RR
Date of Abandonment: 1961? (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: This vessel is in a similar physical and environmental condition as Vessel No. 98. A rectangular vessel, 90 percent of it is submerged at low tide. Visible are longitudinal floor timbers and one piece of planking at one end.
Recommendation: Under Criterion D, this vessel may yield use and construction information. Length and beam measurements are recommended for comparison with similar sites in the project area. However, site accessibility may make such activity impossible.

Vessel No. 103 (Figures 40 and 41)
Vessel Type: Possible transitional smaller barge canal boat
General Location: Arthur Kill, New Jersey Reach near Chesebrough
Date of Abandonment: 1932 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: At low tide, the vessels rests in some 6 to 8 in. of water. The vessel is approximately 100 ft. long, very narrow throughout, and has rounded ends. The frame ends are just visible at low tide. The vessel's stem and sternpost are vertical. The rudder is extant.
Recommendation: Under Criterion D, it is recommended that this site receive complete photographic documentation and site plan recordation. This site features possible lower-hull configuration, as compared to Vessel No. 219, which has extant upper-hull features. The data revealed from these two sites should be analyzed and compared for similarities and distinctions.

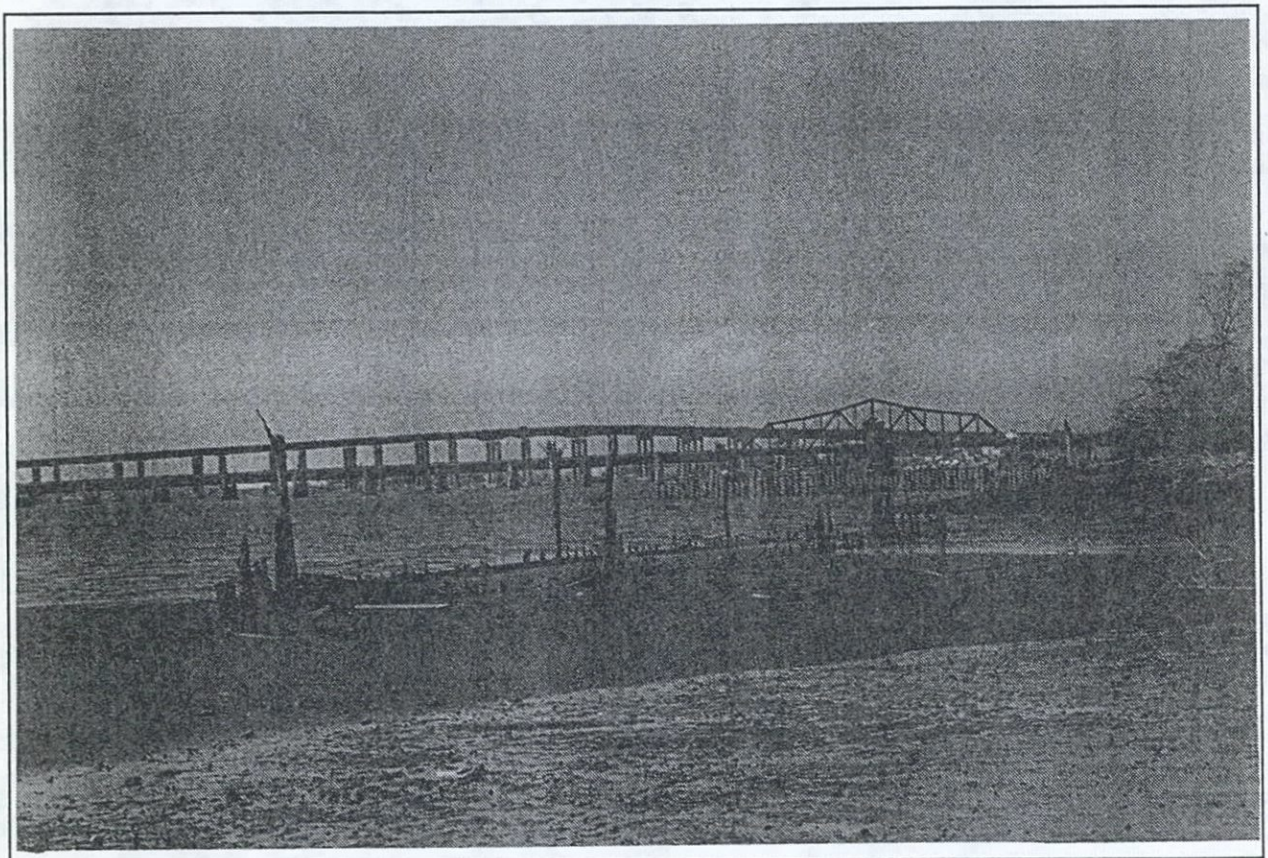


Figure 40. Site view of Vessel No. 103, facing southeast.

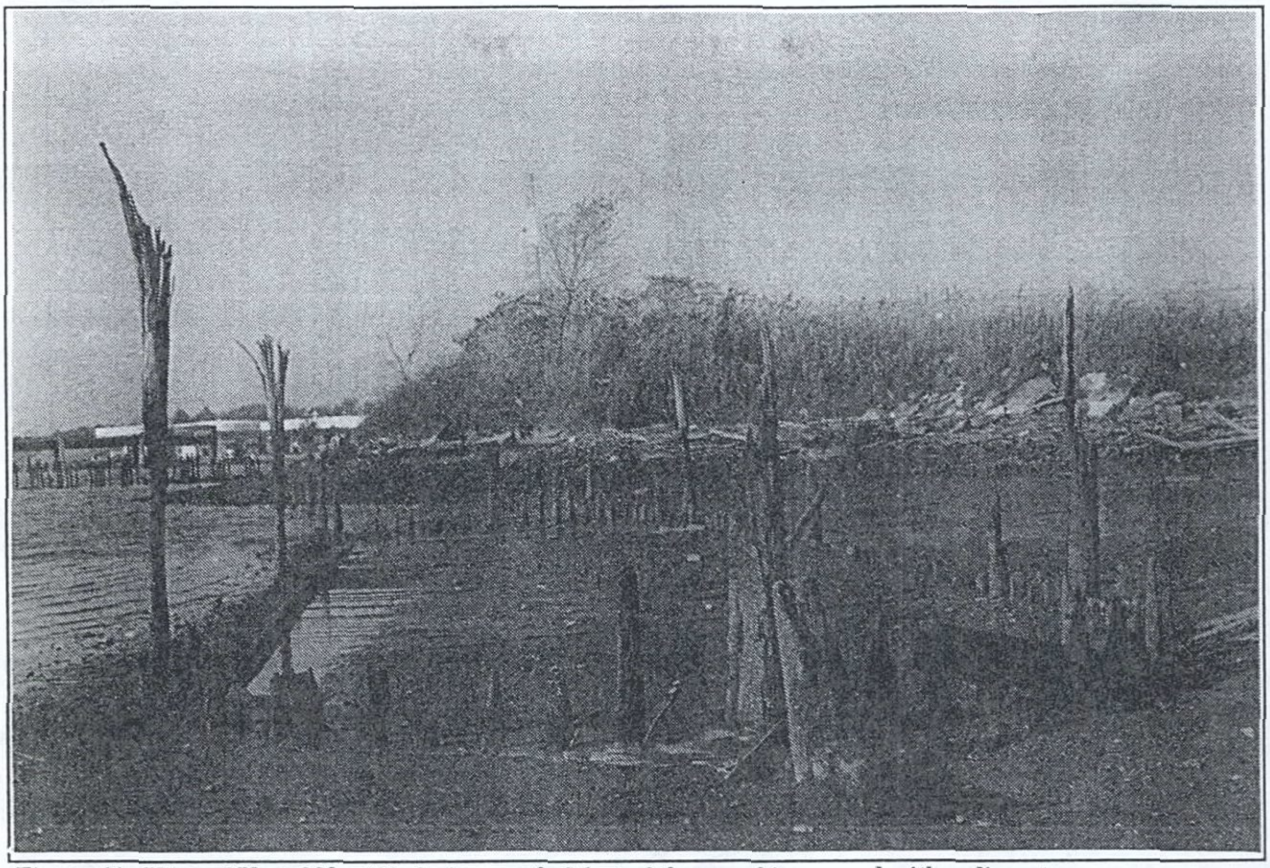


Figure 41. View of Vessel No. 103, facing south. Most of the vessel is covered with sediment.

SAILING LIGHTERS

Fashioned from periague boat/Hudson River packet designs, early self-propelled lighters possessed lines similar to ships. Hand-operated, gasoline, or steam winches, used for loading and unloading, distinguished the lighter from other non-self-propelled craft (Squire 1918). In 1864, inventor Edward Stern's hand wrench became "one of the first and best improvements for...handling...freight to and from lighters" (Douglas 1904:). Built to carry cargo, these craft featured boxy lines, with a beam half their length (Figures 42 and 43).

There are two types, covered or open-decked. The open-decked lighters, single- or double-ended boats, featured a single or double mast. Single-ended boats used a single mast with the wheelhouse aft and a large, open deck for stowing cargo forward. The mast had a decided rake, the mast head positioned over the center of the hatch. Double-ended or two-masted boats had their wheelhouses closer amidships, with an open deck forward and aft.

George Douglas (1904) cites the following dimensions for a New York harbor sailing lighter (Figure 42): 96 ft. long, 41 ft. in beam, 9 ft. draft when unloaded, and 103 ft. from the mast, deck to head. In later years, owners converted these boats into derrick lighters, the sailing rig replaced by cargo booms. Covered steam lighters had single-story deckhouses (with sliding doors) running bow to stern. The wheelhouse mounted at the forward end of the upper deck.

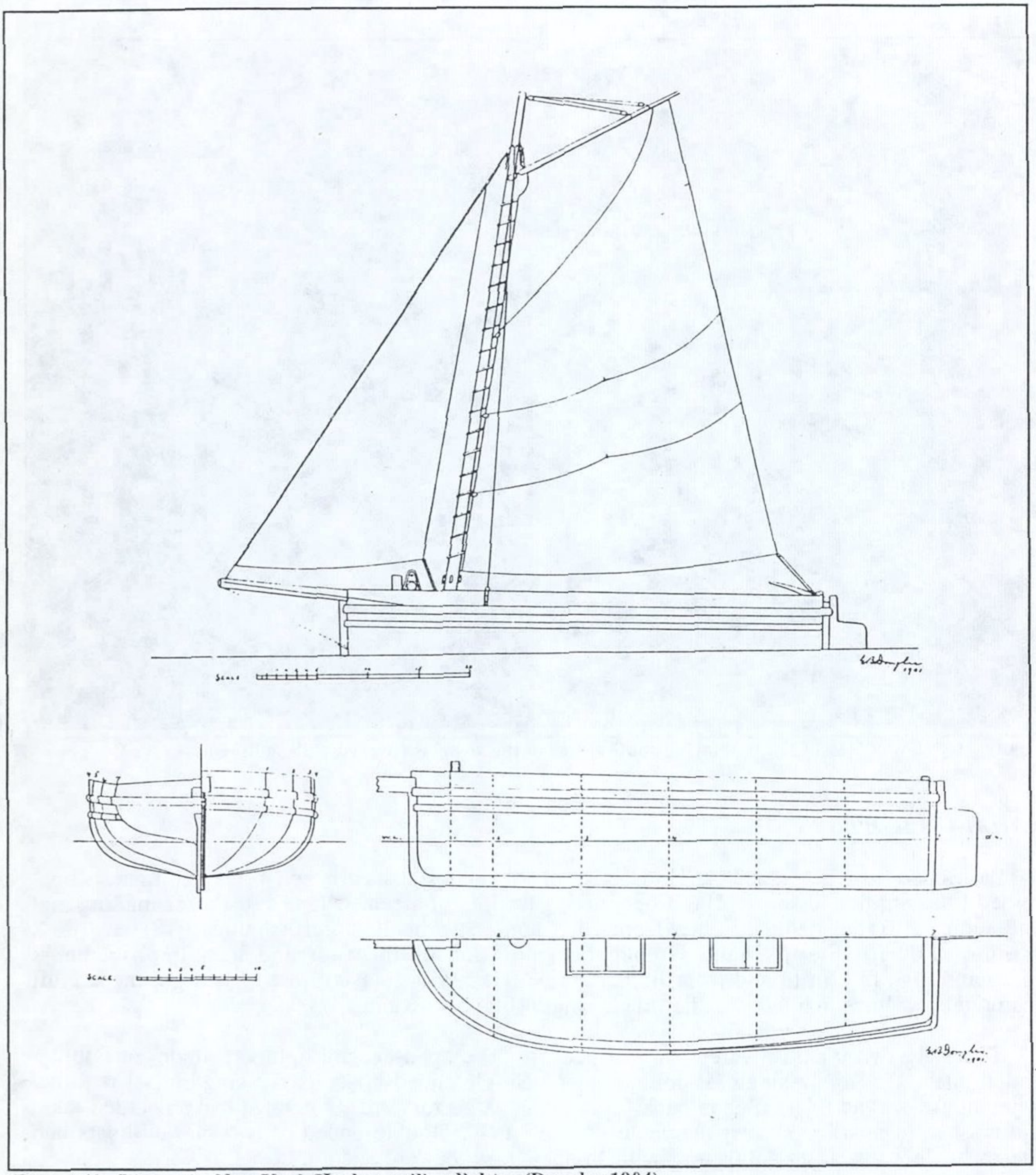


Figure 42. Lines of a New York Harbor sailing lighter (Douglas 1904).

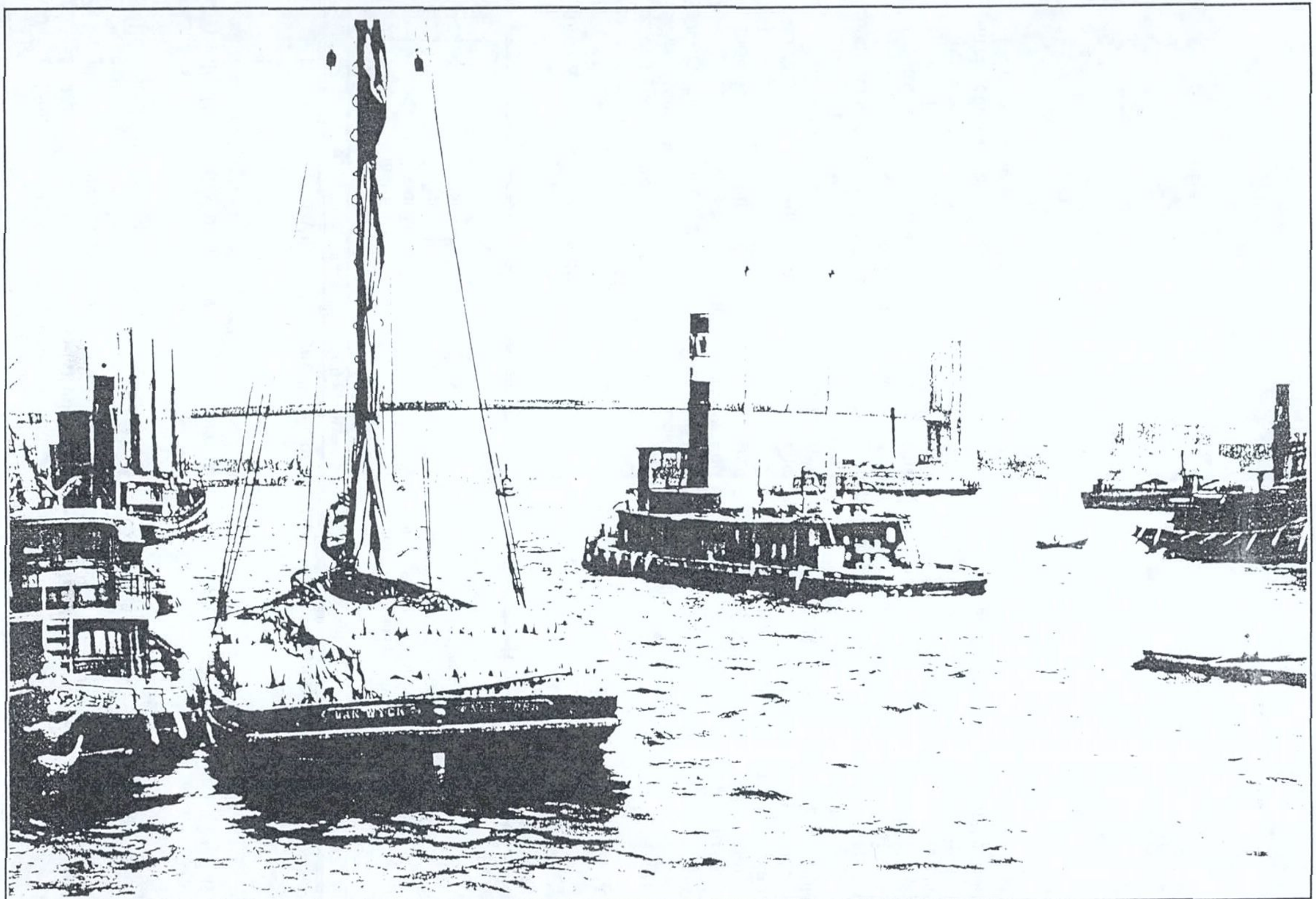


Figure 43. Photograph of a sailing lighter tied to tug in the East River. The lighter is loaded with barrels (South Street Seaport Museum Collection, n.d.).

The single-ended lighter *Manzanillo*, built in 1906 in Tomkins Cove, New York, measured 100 ft. in length, 28 ft. in breadth, with a depth of hold of 9 ft. Open-decked amidships forward, a hatched cargo space amidship provides additional room. The only enclosed space on the main deck housed the upper engine room and boiler space. Most lighters had small crew cabins aft of the wheelhouse. The *Manzanillo* apparently took out excursion parties on Sundays or holidays, as illustrated by the lighter's extra large cabin, featuring built-in seats inside and out (Brouwer 1996).

Table 6 identifies those vessels identified as sailing lighters. One boat is included in the group that is not part of the original survey.

Table 6. Summary of Sailing Lighters Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 77	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 9	Kill Van Kull, NY	No	Inaccessible, no further work
Vessel 15	Kill Van Kull, NY	No	Inaccessible, no further work
Vessel 83	Kill Van Kull, NY	Yes	Photo and site documentation
Vessel 84	Kill Van Kull, NY	Yes	Photo and site documentation

Arthur Kill, New York Reach

Vessel No. 77 (Figures 44 and 45)
Vessel Type: Possible wooden sailing lighter
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: The vessel's forward quarter is well preserved. Visible interior hull configuration includes a breasthook (with deadwood), lodging and hanging knees, frames, deck beams, and planking. The vertical stem is well preserved and includes hawser holes. The outer planking is fastened by 1-in. wedged treenails. The deck is capped with nails countersunk with wooden plugs. Some 25 ft. aft of the stem, a notch in the deck beam suggests a possible location for masting. Lower hull configuration is not visible.
Recommendation: Under NRHP recommendations for Criterion D, this site should receive complete photo documentation and site plan recordation. Any archaeological information on sailing ships is valuable, considering the limited database. The research should include, but not be limited to, a historical description of the vessel type and an archaeological site description, which should include a discussion of all exposed and identifiable features, artifacts, and architectural components. The data derived here should be contrasted and compared with similar vessel types in the project area.

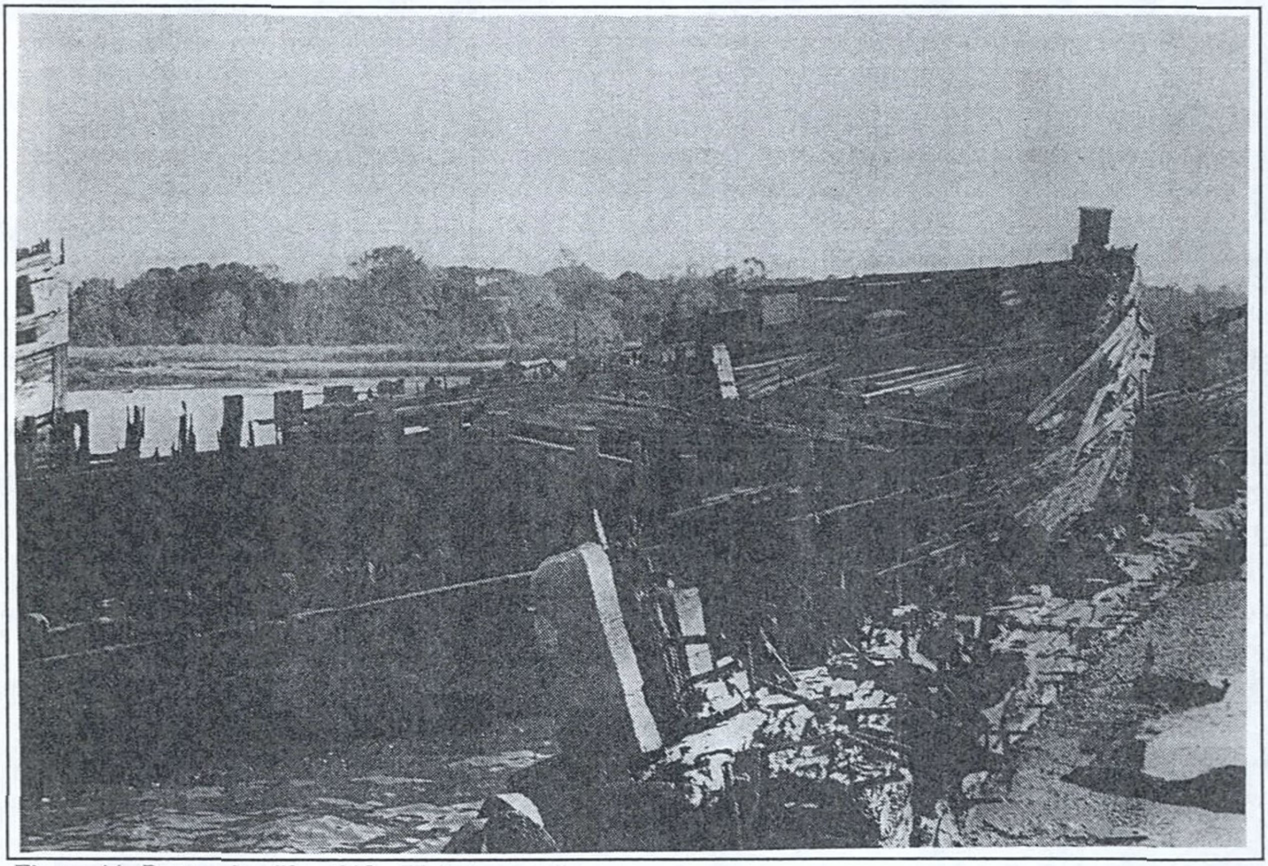


Figure 44. Bow end of Vessel No. 77, facing west.

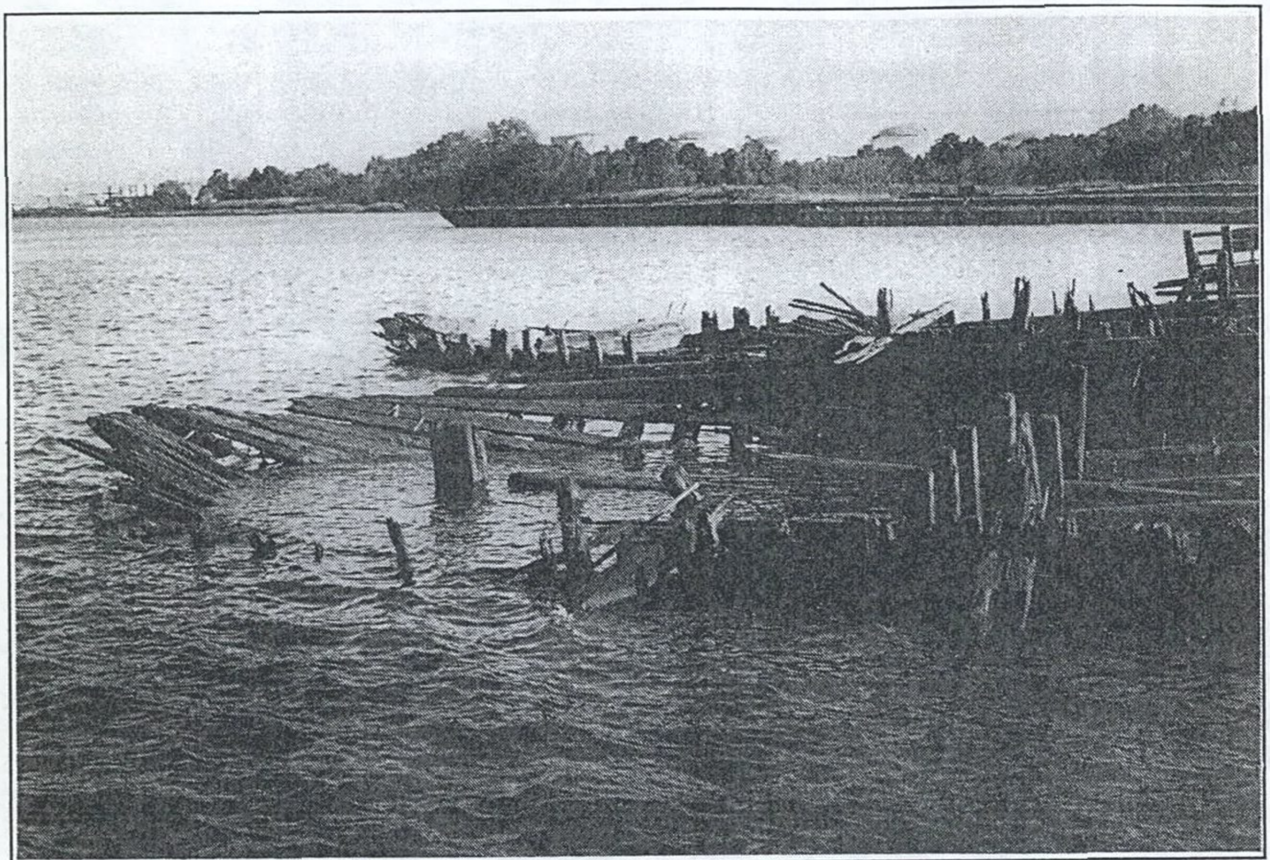


Figure 45. Stern end of Vessel No. 77, facing north.

Kill Van Kull, New York Reach

Vessel No. 9 (Figure 46)
Vessel Type: Possible wooden sailing lighter
General Location: Kill Van Kull, New York Reach near Pointin/Forsyth/National Dry Dock (Raber et al. 1995b)
Description: Very little vessel remains are visible at low tide, possibly futtocks and stern post.
Recommendation: Because of limited access, no further work is recommended.

Vessel No. 15 (Figure 47)
Vessel Type: Possible wooden sailing lighter
General Location: Kill Van Kull Reach, New York near Pointin/Forsyth/National Dry Dock
Date of Abandonment: 1945 (Raber et al. 1995b)
Description: The vessel is barely visible at low tide.
Recommendation: Because of limited access, no further work is recommended.

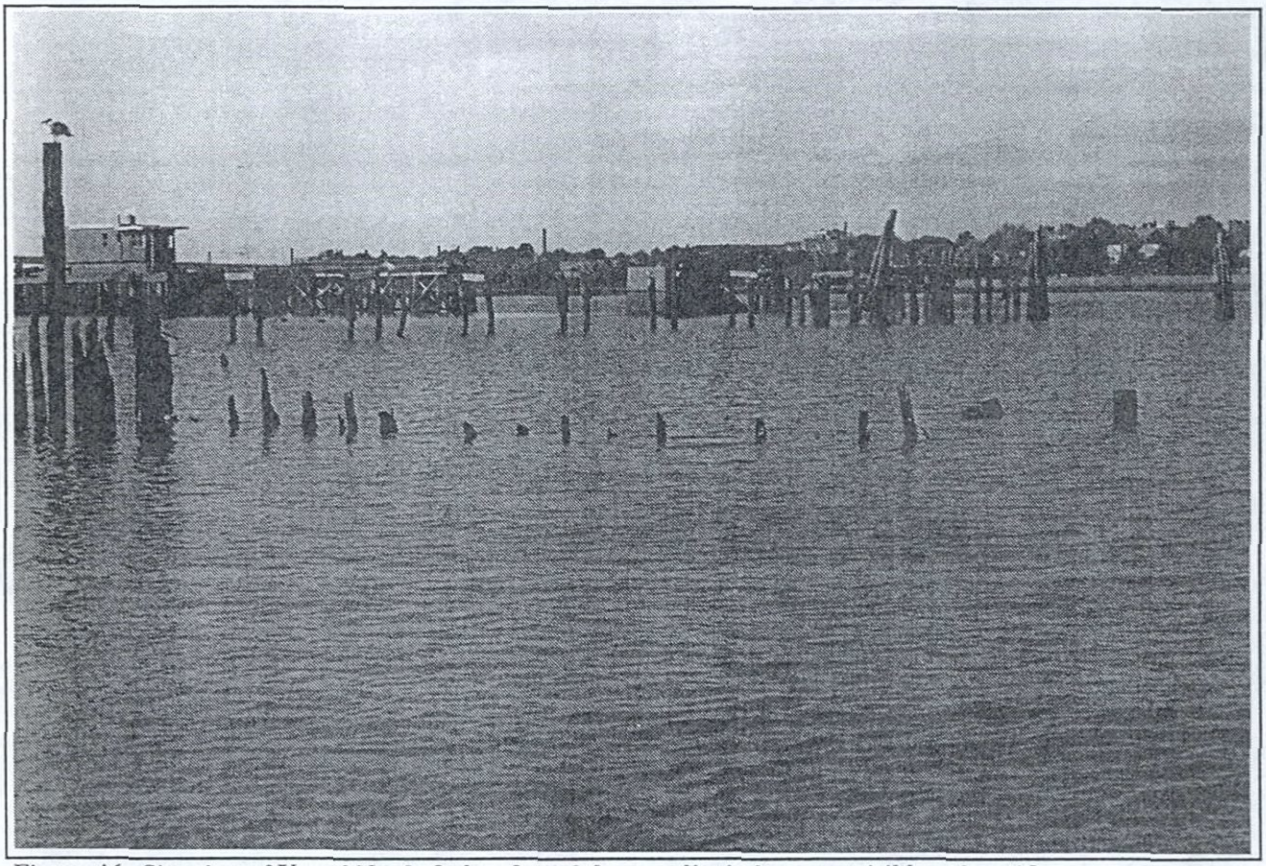


Figure 46. Site view of Vessel No. 9. Only a few of the vessel's timbers are visible at low tide.

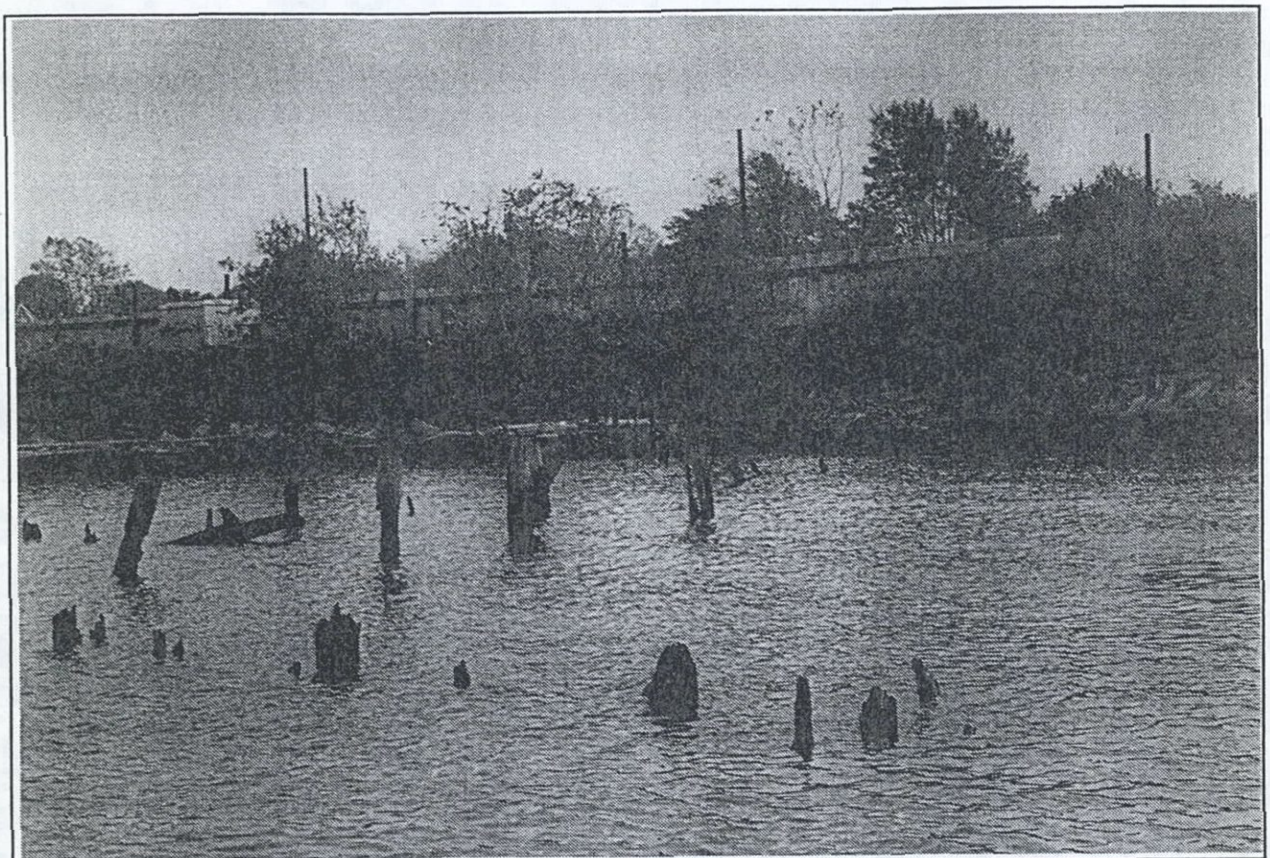


Figure 47. Vessel No. 15. Most of the vessel is submerged at low tide.

Vessel No. 83 (Figures 48 and 49)
Vessel Type: Possible wooden sailing lighter
General Location: Kill Van Kull, New York Reach near GLD&D/George Rogers site
Date Abandoned: 1935 (Raber et al. 1995a)
Description: The vessel rests in shallow water about 60 ft. from shore. Due to its physical location, crew members could not obtain close-up observation. The small boat measured ca. 60 ft. long. It is lightly built with slender paired framing. Both stem and stern posts are vertical.
Recommendation: Under NRHP recommendations for Criterion D, this site should receive complete photo documentation and site plan recordation. Any archaeological information on sailing ships is valuable, considering the limited database. The research should include, but not be limited to, a historical description of the vessel type and an archaeological site description, including a discussion of all exposed and identifiable features, artifacts, and architectural components. The data derived here should be contrasted and compared with similar vessel types in the project area.

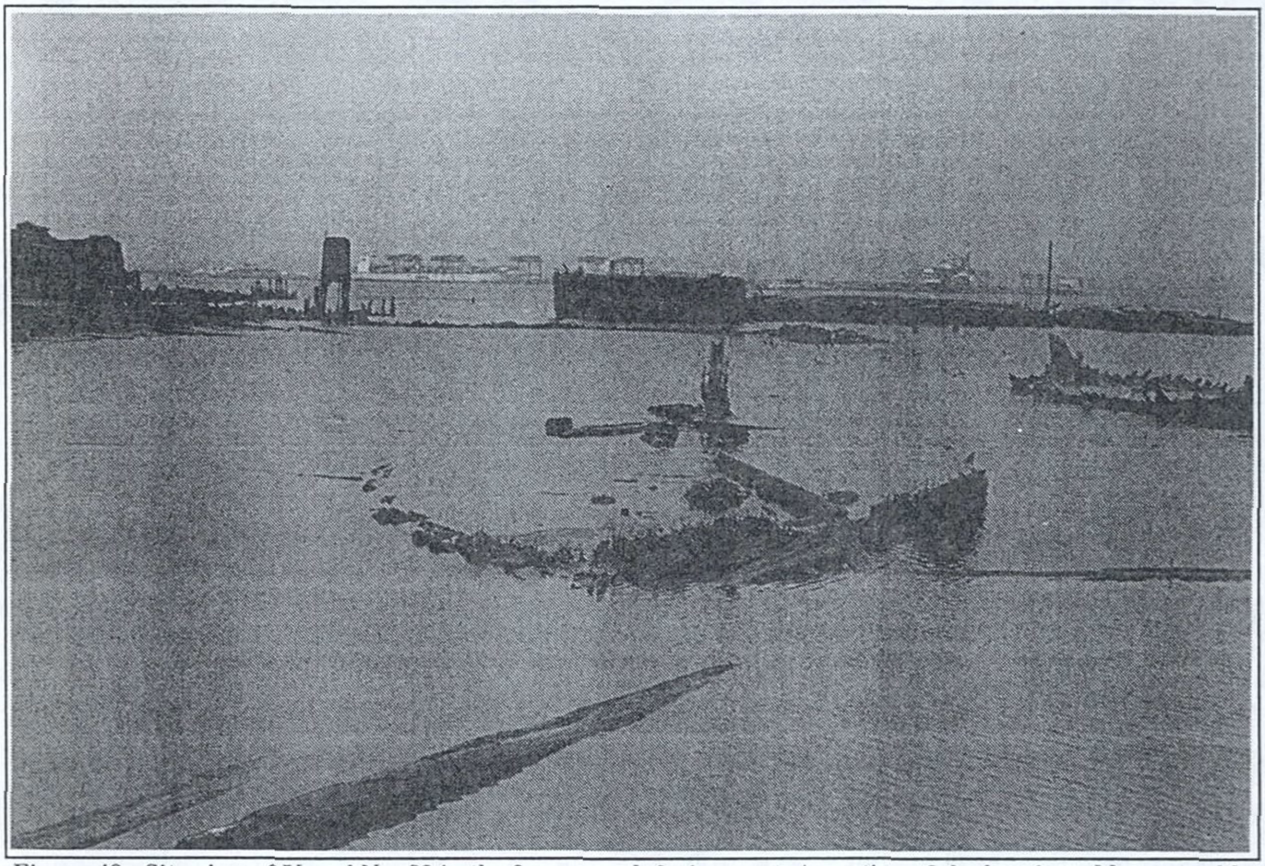


Figure 48. Site view of Vessel No. 83 in the foreground, facing west. A portion of the boat's rudder assembly is just visible.

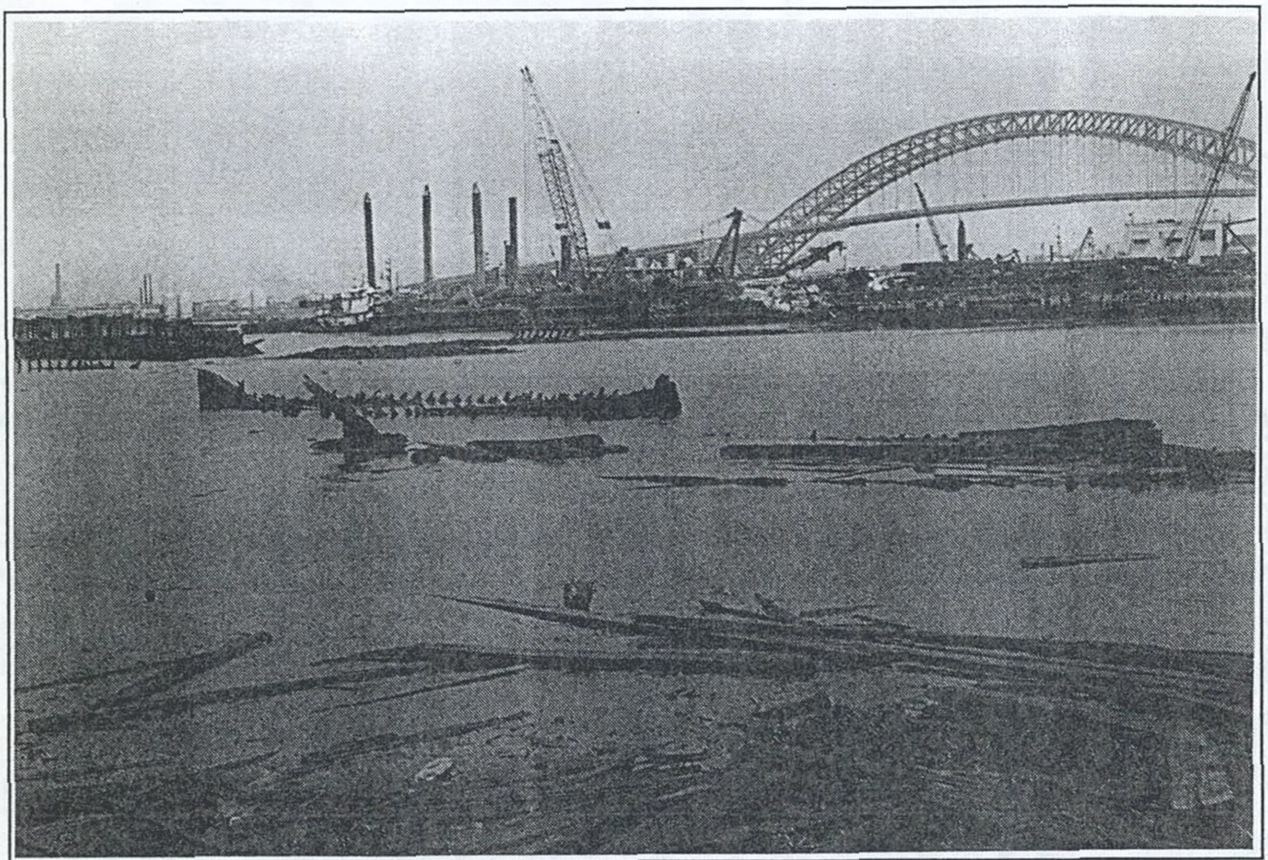


Figure 49. Site view of Vessel Nos. 83 (foreground) and 84 (background), facing north.

Vessel No. 84 (Figure 50)
Vessel Type: Possible lighter/small boat
General Location: Kill Van Kull, New York Reach near GLD&D/George Rogers site
Date Abandoned: No date
Description: Though not included in the original inventory, this vessel is similar to No. 83 and warrants recordation.
Recommendation: Under NRHP recommendations for Criterion D, this site should receive complete photo documentation and site plan recordation. Any archaeological information on sailing ships or small boats is valuable, considering the limited database. The research should include, but not be limited to, a historical description of the vessel type and an archaeological site description, including a discussion of all exposed and identifiable features, artifacts, and architectural components. The data derived here should be contrasted and compared with similar vessel types in the project area.

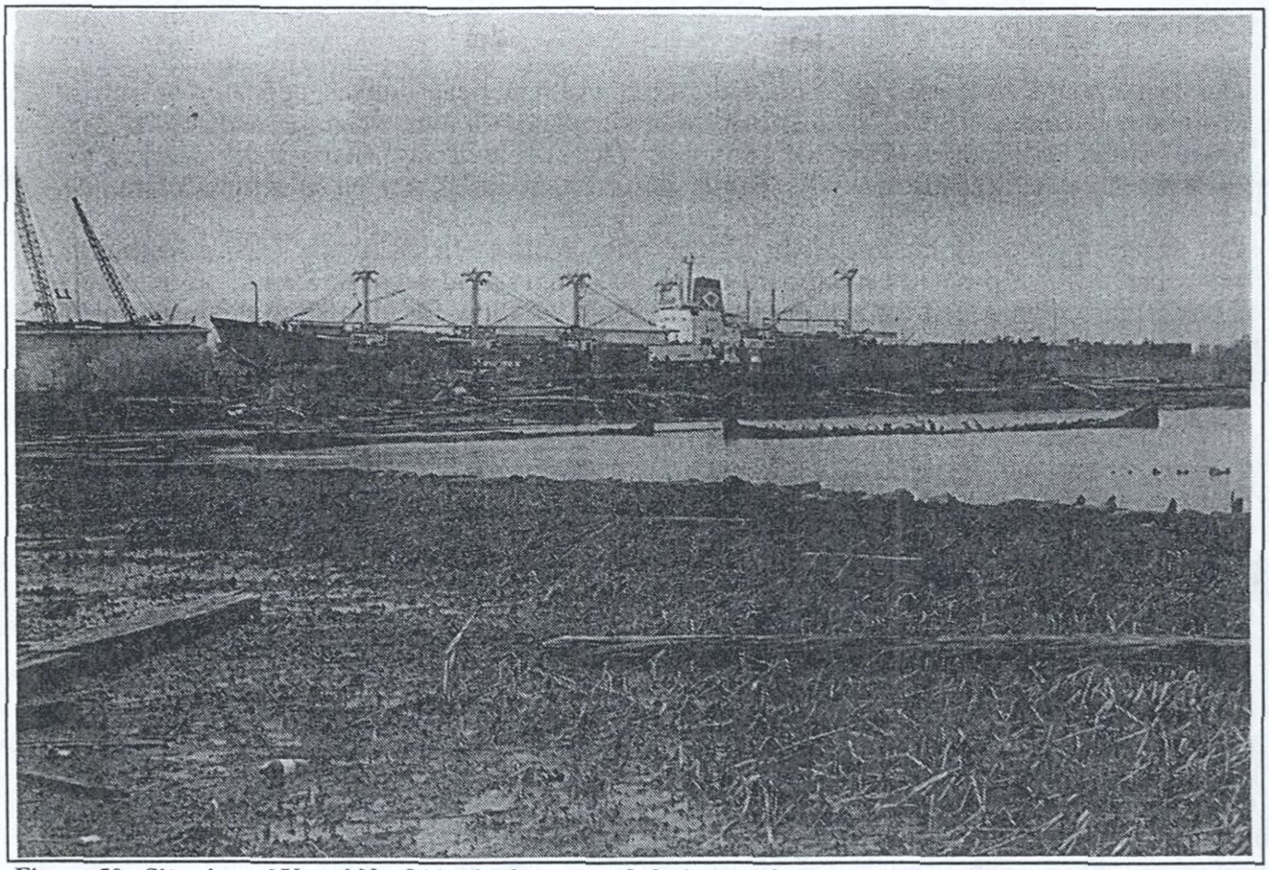


Figure 50. Site view of Vessel No. 84 in the foreground, facing south.

CENTERBOARD SCHOONERS

For years shipwrights struggled to prevent leeway in shoal-draft hulls. European designers approached the problem in two ways (1) using an external keel as a fin, or (2) employing lee-boards (Chapelle 1951). The first design required a keel with some depth, eliminating its shoal-draft qualities. Leeboards are paddle-shaped extensions pivoted at the gunwale port and starboard.

First associated with Dutch sailors, leeboard sailors could tack close-hauled without slipping to leeward. A description of Dutch leeboards in 1702 states:

> The lee-board is made of three boards laid over one another, and cut in the shape of the sole of a shoe, or of a half oval. Bylanders and hookers use them for sailing close-hauled, and generally these vessels have two lee-boards hanging on either of their sides. If one wishes to sail close-hauled, the lee-board which is on the lee side, is lowered into the water, and this prevents the vessel from falling off; the other lee-board remains hanging against the weather side [Barkhausen 1990].

The origin of the centerboard is vague. Arthur H. Clark, in *History of Yachting 1600-1815*, suggests Peruvian origins. Howard Chapelle (1951) theorizes centerboard construction origi nated in China, Formosa, or possibly South America. The Chinese used leeboards and another keel extension, the daggerboard.

The daggerboard, long used by Formosans and South American Indians, appeared in Europe in the eighteenth century. In 1774, a British soldier designed "a long, shallow, rectangular dagger board" called a drop keel (Chapelle 1951:40). The keel measured nearly three-quarters the length of the vessel (Barkhausen 1990). The design, later modified, proved so successful that the Royal Navy used the drop keel in schooners, brigs, and ship-sloops.

The design eventually made its way to the New World. In 1811, the U.S. government granted a patent for a pivoted centerboard to Joshua, Henry, and Jacocks Swain. Evidently a small craft, the design called for a wider keel amidships to allow for mortising; this was necessary for the centerboard to enter the trunk (Barkhausen 1990). By 1825, the centerboard appeared on "quite large craft, sloops and schooners" (Chapelle 1951:40).

The centerboard schooner became a local fixture in the Chesapeake Bay, particularly after 1840 (Snediker and Jensen 1992). Runoff and mass wasting associated with urban and industrial development silted up the Chesapeake Bay's waterways, creating the need for a shallow-drafted vessel. Increased commerce along the Bay created the demand for a larger boat. By the 1840s, the Chesapeake Bay centerboard schooner featured a full, tubby midsection, sharp in the bow and stern (Watts 1990).

Centerboard trunk configuration and its spatial relationship to the keel and floors are "indicative of the period of construction and possibly...geographical affiliation" (Watts 1994:87). In an *Underwater Archaeological Excavation and Data Recovery at the Hilton Wreck, Northeast Cape Fear River, Wilmington, North Carolina,* Watts (1994) compared centerboard configurations among surveyed North Carolina wrecks and found most North Carolina centerboards offset to starboard. The Hilton Wreck, located in the Cape Fear River near Wilmington, North Carolina, featured a centerboard cut into the keel and keelson, with port and starboard pocket pieces. This configuration is similar to the vessels found in the project area (Figures 51 and 52).

The tradition of offset starboard centerboards is apparently unique to the Chesapeake Bay in the nineteenth century (Chapelle 1935; Griffith 1874). The Great Lake Underwriters (Board of Lake Underwriters) in 1866 specified a centerline centerboard configuration for schooner construction (Watts 1994). Specifications called for a pocket piece designed to fit between the keel and keelson. Half floors are mortised into the pocket piece. This configuration is evident in the remains of the Sheboygan, Wisconsin schooner wreck *Lottie Cooper* (Tidewater Atlantic Research 1993). The design, evident in the wrecks of the project area, is more closely associated with the Great Lakes.

Table 7 identifies two vessels in the project area categorized as centerboard schooners.

Table 7. Summary of Centerboard Schooners Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 37	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 10	Kill Van Kull, NY	Yes	Photo and site documentation

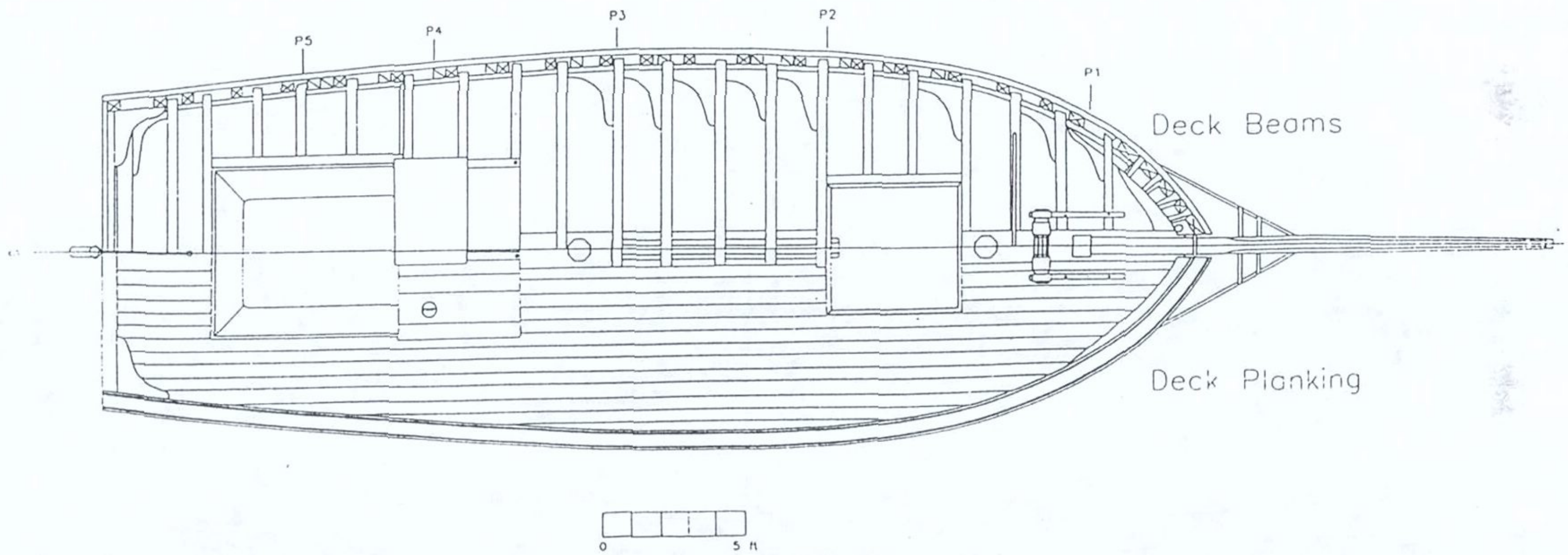


Figure 51. East Coast (North Carolina) centerboard schooner plan view (Watts 1994).

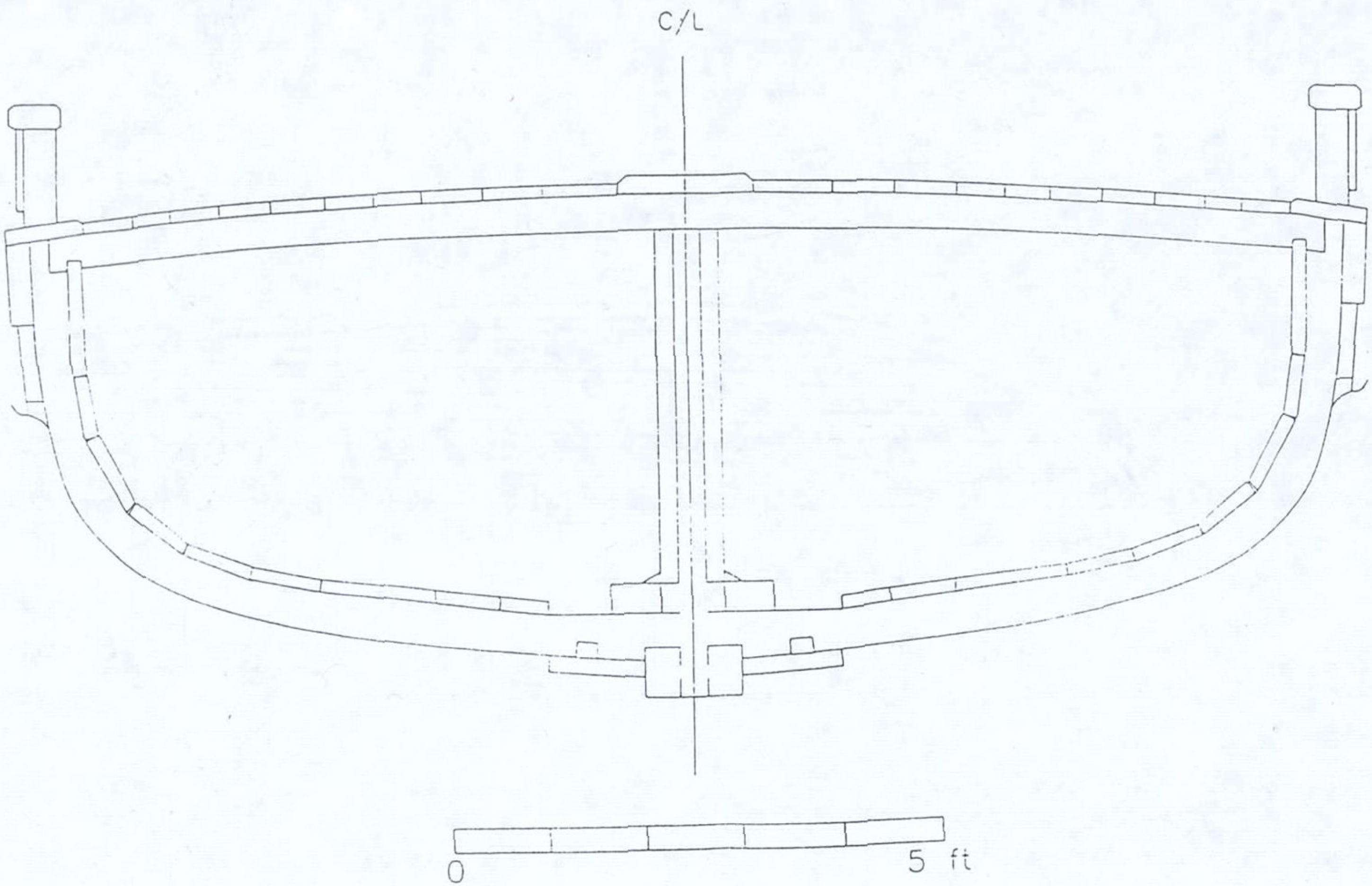


Figure 52. East Coast (North Carolina) centerboard schooner midship profile (Watts 1994).

Arthur Kill, New York Reach

Vessel No. 57 (Figures 53 and 54)
Vessel Type: Wooden centerboard schooner
General Location: Arthur Kill, New York Reach near Port Mobile
Date of Abandonment: Unknown
Description: The vessel's lower hull is exposed during low tide. Hull consists of keelson, riders, floors, first and second futtocks, ceiling, and planking. The keelson is extant some two-thirds the length of the keel. A centerboard trunk is notched over the frame. The top side of the keelson is mortised (3). Stringers run flush along the sister keelsons. Floors are fastened transversely to the first futtocks by wooden trunnels. There is evidence of metal fasteners.
Recommendation: Under NRHP recommendations for Criterion D, this site should receive complete photo documentation and site plan recordation. Any archaeological information on sailing ships is valuable, considering the limited database. The research should include, but not be limited to, a historical description of the vessel type and an archaeological site description, including a discussion of all exposed and identifiable features, artifacts, and architectural components. The data derived here should be contrasted and compared with similar vessel types in the project area.

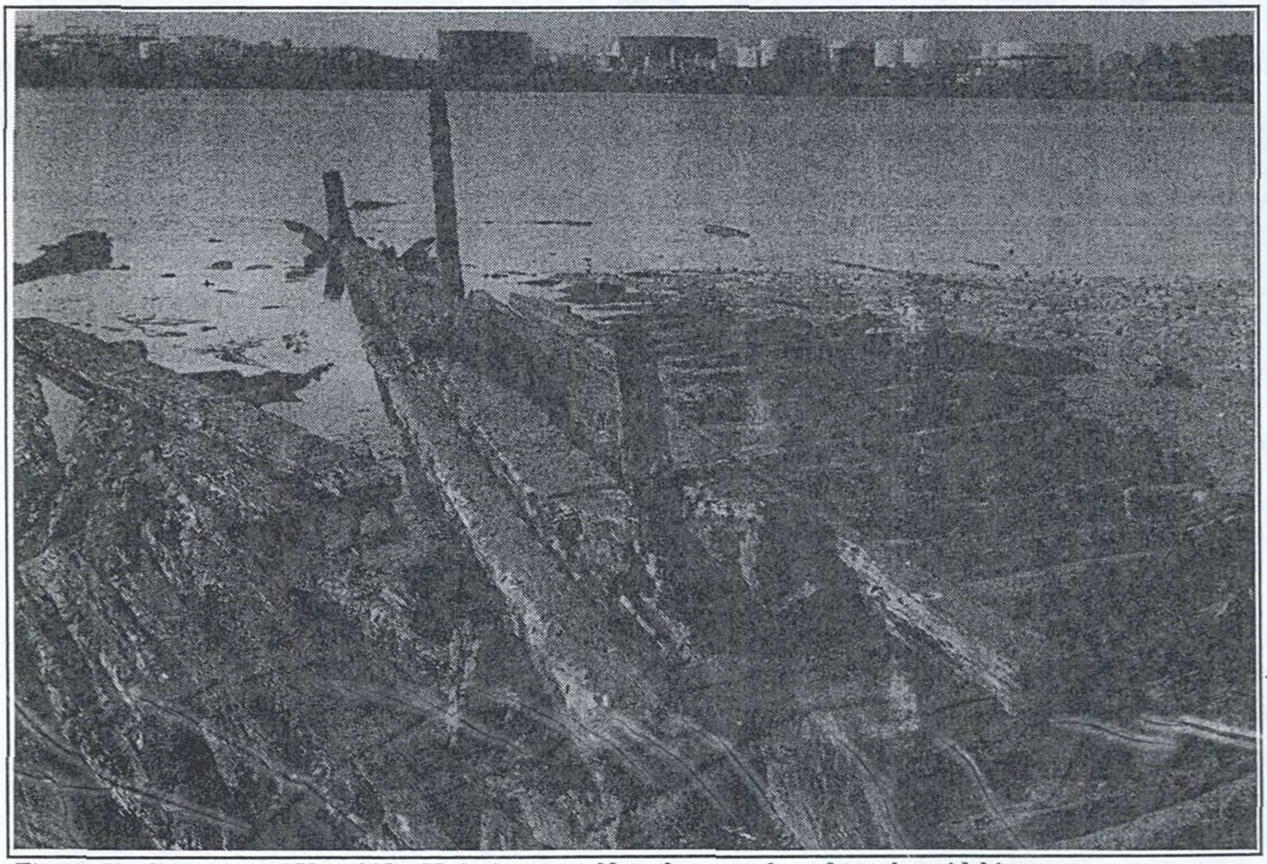


Figure 53. Stem view of Vessel No. 57, facing west. Note the centerboard trunk amidships.

Figure 54. Closeup of Vessel No. 57's keelsons and centerboard trunk, facing west.

Kill Van Kull, New York Reach

Vessel No. 10 (Figures 55 and 56)
Vessel Type: Wooden centerboard schooner
General Location: Kill Van Kull, New York Reach near Pointin/Forsyth/National Dry Dock
Date Abandoned: 1945 (Raber et al. 1995a)
Description: The small boat is fully exposed at low tide. It measures 60 x 20 ft. amidships. The keel, keelson, centerboard trunk, stem and stern post, garboard, and floor portions are extant. The keelson is mortised on both moulded sides.
Recommendation: Under NRHP recommendations for Criterion D, this site should receive complete photo documentation and site plan recordation. Any archaeological information on sailing ships is valuable, considering the limited database. The research should include, but not be limited to, a historical description of the vessel type and an archaeological site description, including a discussion of all exposed and identifiable features, artifacts, and architectural components. The data derived here should be contrasted and compared with similar vessel types in the project area.

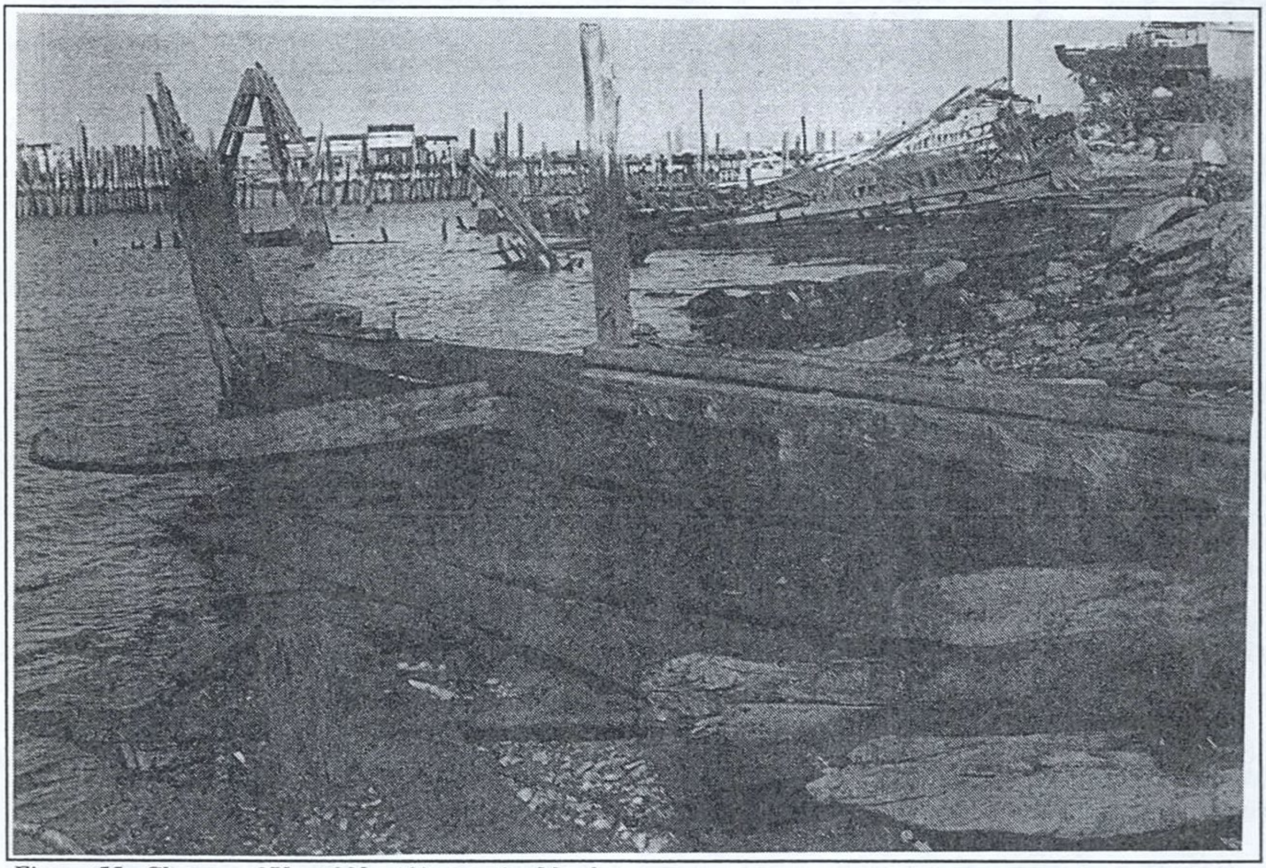


Figure 55. Closeup of Vessel No. 10's mortised keelson.

Figure 56. Site view of Vessel No. 10, facing northwest.

STEAM LIGHTERS

As previously discussed, lighter construction featured different shapes and sizes. Some are square at both ends, others have a bow like a sailing vessel, as witnessed in the sailing lighter. Some are wooden, others steel. Lighters with square ends are "considered the better, as more easily towed and having greater carrying capacity" (Harding 1912:15).

The *New York Central No. 29* is an example of a double-ended steam railroad lighter. A steel-built vessel built at Mariner's Harbor, Staten Island in 1912, it measures 99.3 ft. long, 35.5 ft. in breadth, with a depth of hold measuring 11.9 ft. Sold to a Brooklyn company, owners removed the masts and installed large water tanks in the hold and deck. Laid out like the *Manzanillo* forward, the cabin, aft of the wheelhouse, is much smaller (Brouwer 1996).

Table 8 indicates the vessels identified in the project area as steam lighters. Steam lighters presented here are built of steel or wood.

Table 8. Summary of Steam Lighters Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 28	Kill Van Kull, NY	Yes	Photo and site documentation
Vessel 179	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 260	Arthur Kill, NY	Yes	Photo and site documentation

Kill Van Kull, New York Reach

Vessel No. 28 (Figures 57-59)
Vessel Type: Steel steam lighter
General Location: Kill Van Kull, New York Reach near Pointin/National Dry Dock
Date of Abandonment: 1970 (Raber et al. 1995b)
Description: Most of the vessel is submerged at low tide. It is composite constructed, with steel frames and wooden wearing strakes bolted to steel plates. A steel frame is mounted amidships, probably used for hoisting. No steam or engine machinery is visible. The vessel is identified as *Blairstown*, painted on the bow.
Recommendation: Because typologies offered by Raber et al. (1995b) are tentative, this vessel is considered significant under Criteria A and D. Considerations under Criterion A include engineering and commerce. The vessel may reveal new information on hull form and propulsion installation. Under Criterion D, the vessel should reveal information on steel lighter construction methods and engineering installation. Complete photographic recordation is recommended and, if the vessel is accessible, limited site measurements and drawings.

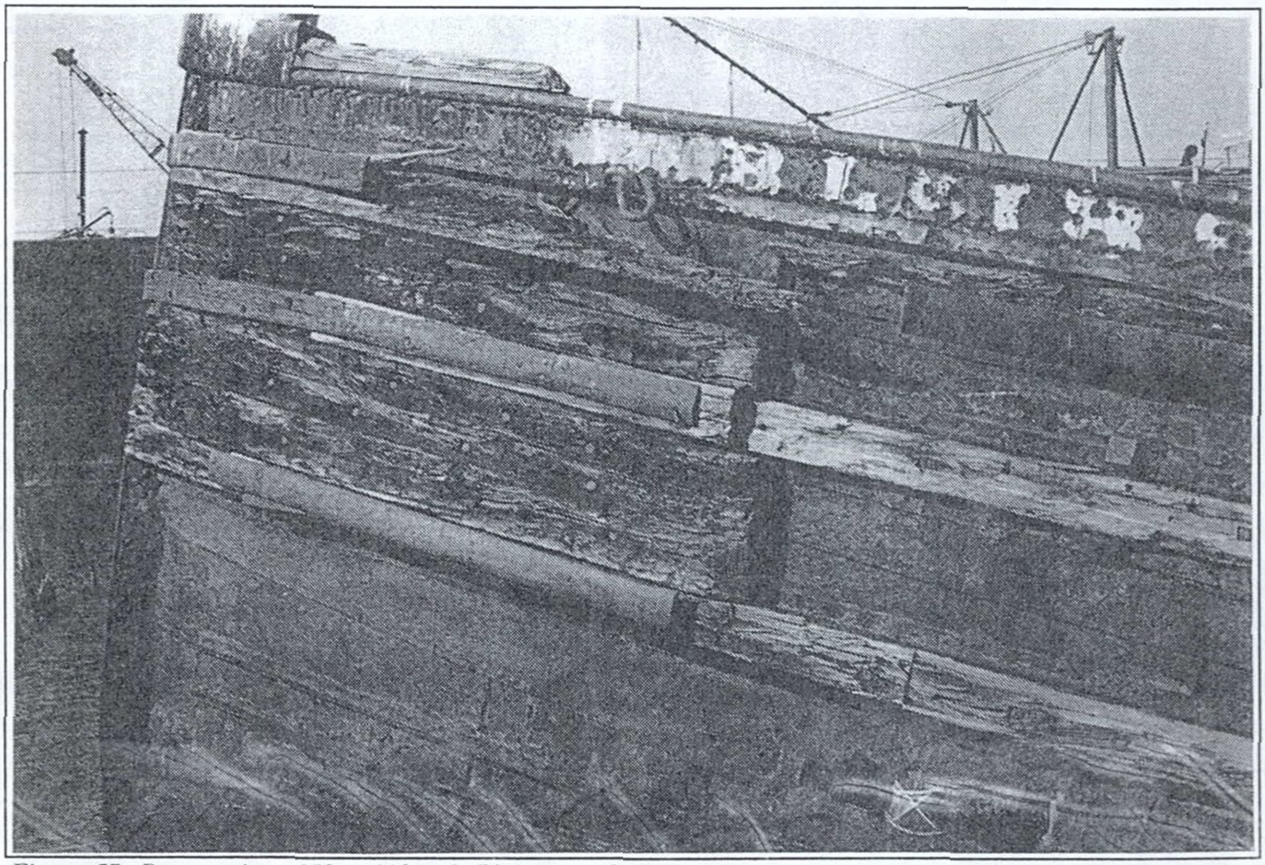


Figure 57. Bow section of Vessel No. 28, *Blairstown*, facing southeast.

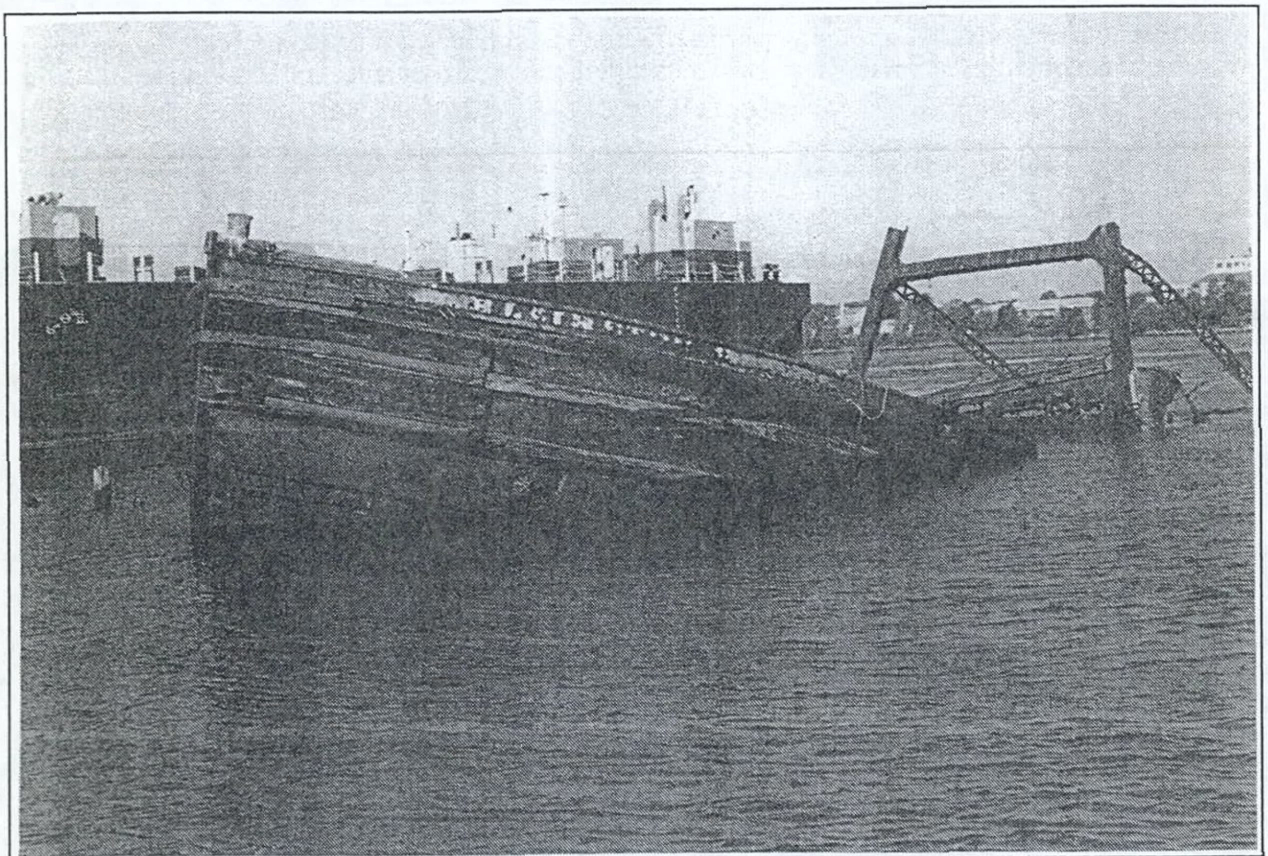


Figure 58. Site view of extant bow section of *Blairstown*, Vessel No. 28, facing southeast.

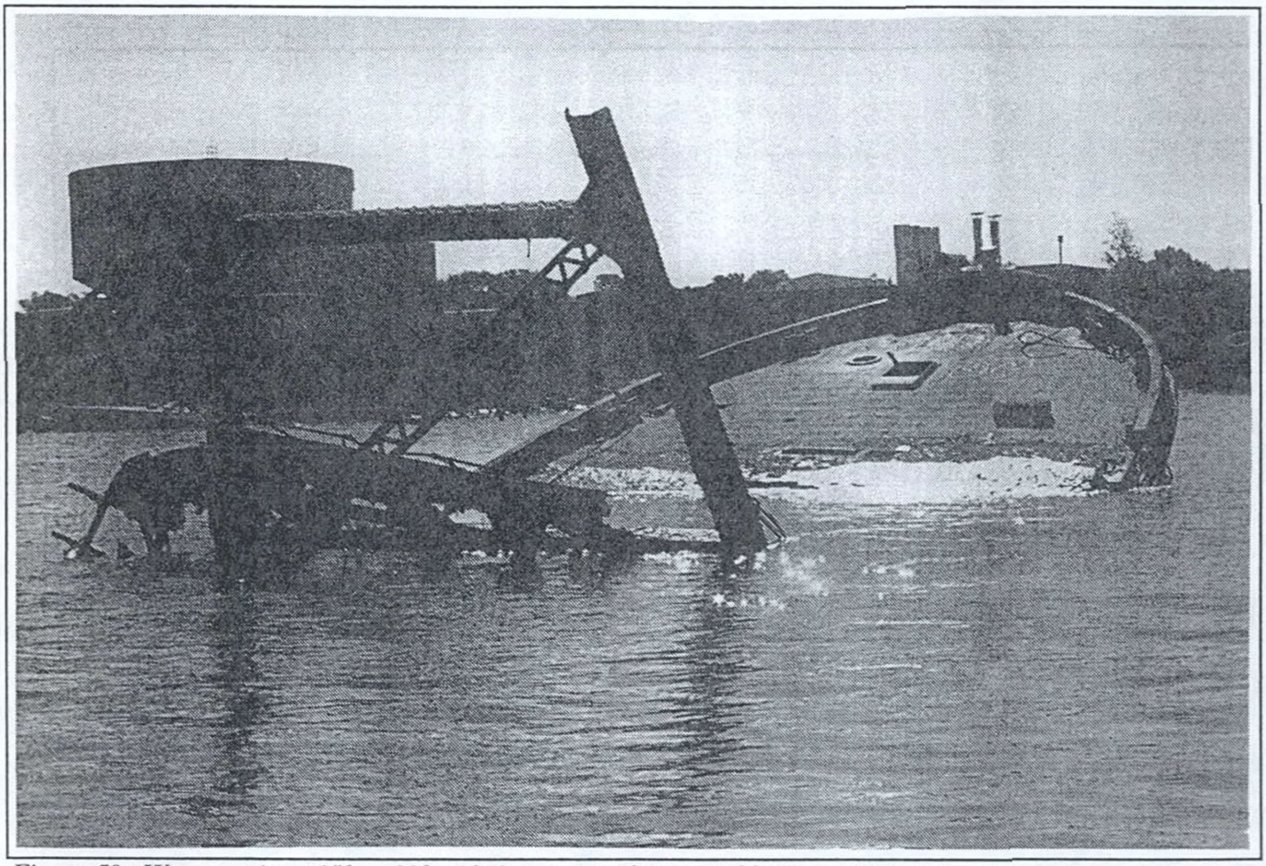


Figure 59. Western view of Vessel No. 28 showing steel-mounted hoisting (?) frame.

Arthur Kill, New York Reach

Vessel No. 179 (Figure 60)
Vessel Type: Wooden steam lighter
General Location: Arthur Kill, New York Reach north of Outerbridge
Date of Abandonment: 1932? (Raber et al. 1995a)
Description: Very little structure is visible, even at low tide, during which time the upper section of a small compound engine is exposed.
Recommendation: Because of limited site accessibility, it is recommended that research include complete photographic recordation under Criteria A and D. Criterion A includes potential data for engineering/propulsion systems. Under Criterion D, the boat will provide data on construction methods associated with steam propulsion.

Figure 60. Remains of Vessel No. 179, facing northeast. A portion a small engine frame is visible at low tide.

Vessel No. 260 (Figures 61-63)
Vessel Type: Possible wooden steam lighter
General Location: Arthur Kill, New York Reach near A.C. Brown Shipyard
Date of Abandonment: 1932 (Raber et al. 1995a)
Description: Outer hull, frames, futtocks, ceiling, and bulwarks are visible during low tide. The ceiling is doubled amidships. Also visible are three sets of stanchions, one amidships, two to either side, probably on the inwales. The stem is extant, but in fair condition. Also visible (during low tide) is an iron rudder and rudder post. Unique to the site is an A-frame supported vertical cylinder associated with the engine/propulsion mechanism.
Recommendation: Under Criteria A and D, investigation should include complete photographic documentation. Under Criterion A, the vessel's extant A-frame supported vertical cylinder offers data on engine propulsion. Under Criterion D, construction designs associated with the vessel's stern section offers relevant data on both steam-propulsion design (sail verses steam) and general lighter construction. Photographs should also feature documentation of the stern section. This data should also be compared and contrasted with information from Vessel No. 179.

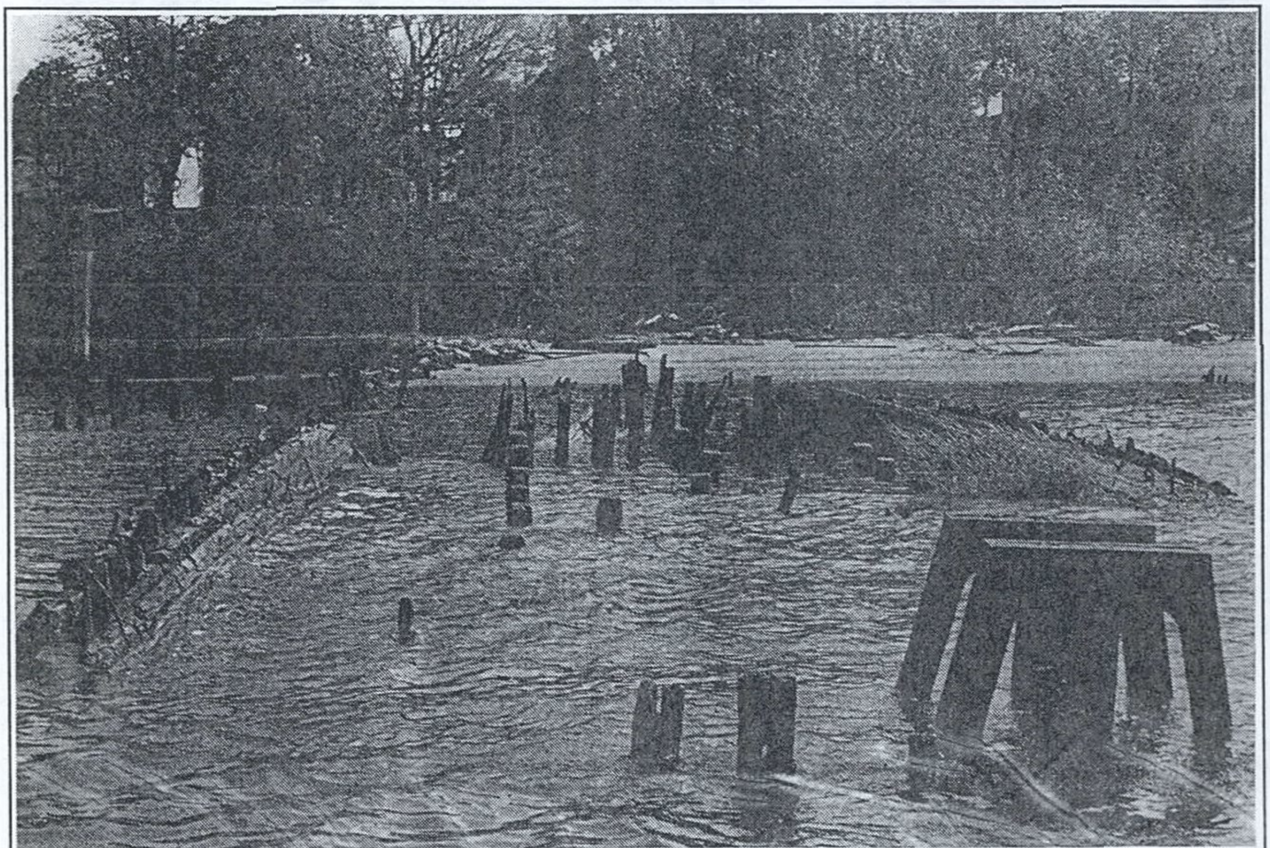


Figure 61. Forward section of Vessel No. 260, facing east. Amidship is an A-frame supported vertical cylinder.

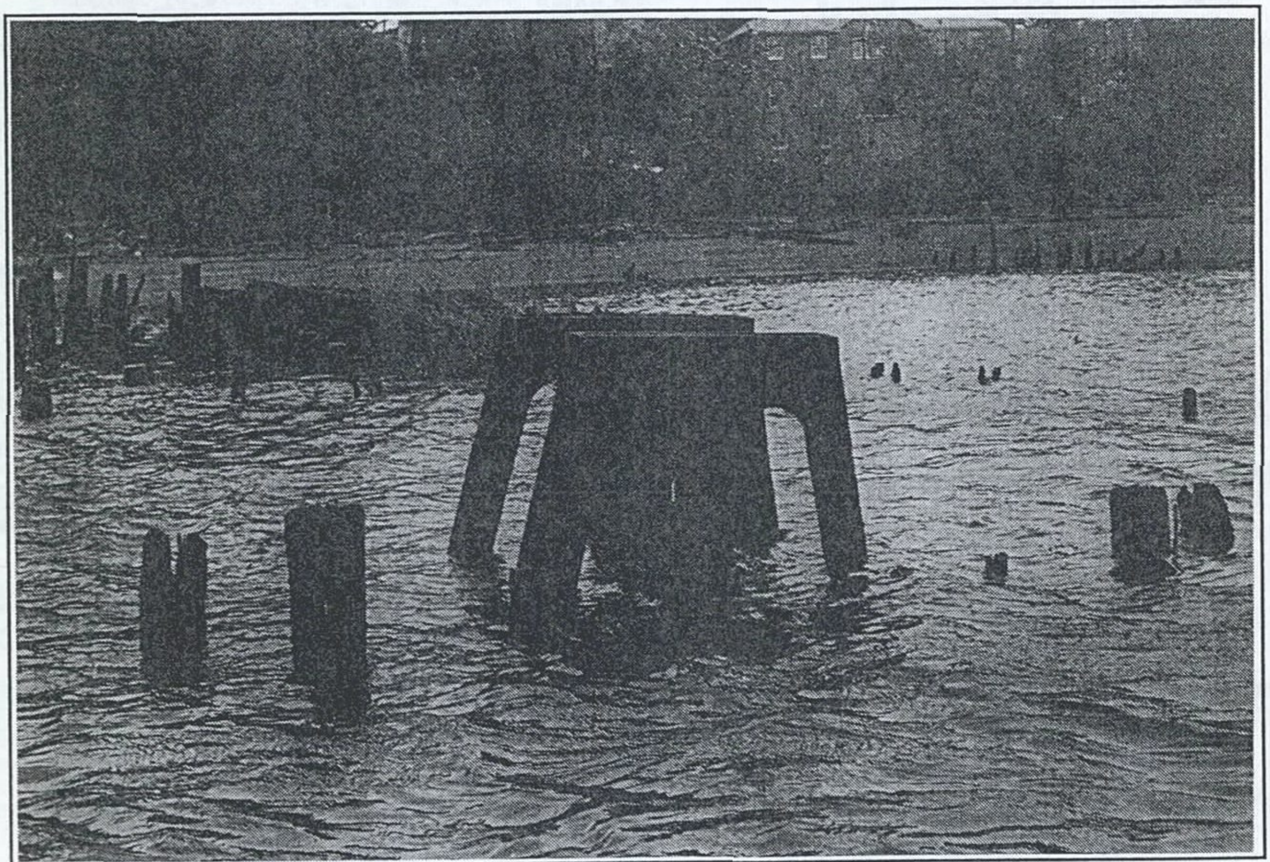


Figure 62. Closeup of Vessel No. 260's vertical cylinder, facing east.

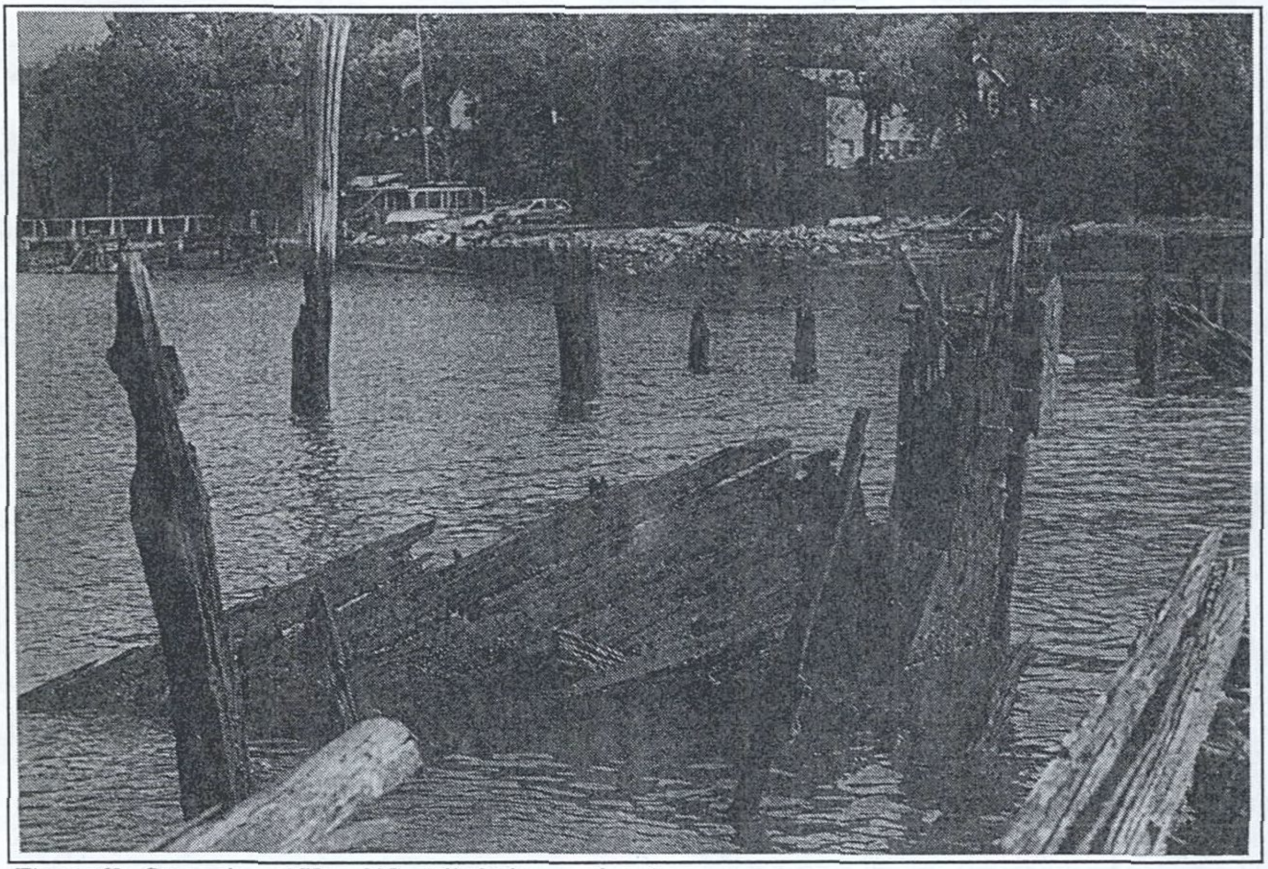


Figure 63. Stern view of Vessel No. 260, facing northeast.

DERRICK OR STICK LIGHTER

Open-decked derrick lighters operating in New York Harbor became popularly known as "stick lighters" because of prominent timber masts and cargo booms. Some of these boats had boat-shaped hulls, pointed bows, and elliptical sterns (Brouwer 1996). There is uncertainty regarding an association between this configuration and lighters or sailing craft.

Photographic records indicate that by the 1890s, most derrick lighters featured scow hulls, square at both ends, straight at both sides, with bow and stern planking at a 45-degree angle. The single sturdy timber mast might be stepped in one of two locations, either in the center of the deck or at the stern just in from of a small crew cabin. In the former case, there would be two cargo booms, one pointing forward and one pointing aft. If the mast rest aft, only one cargo boom pointed forward.

In the central mast configuration, the cargo booms usually rigged like a sailing ship's fixed gaff. Positioned around three-quarters of the way up the mast and fitted with wooden jaws to allow lateral swinging, they were held at a constant angle by fixed wire topping lifts. The masts measured around 50 ft. in height. In the central mast arrangement, the boat had two lighter masts at the bow and stern just forward of the cabin. Three masts around 20 ft. high had sheaves mounted near their tops for lines used in hoisting the ends of a tarpaulin used in the protection of cargo.

If the cargo mast sat aft, usually one of the smaller masts at the bow served the same purpose. When cargo was being loaded, the tarpaulin hung loosely furled between these masts. Once the cargo was loaded, crew members draped the tarpaulin over it, secured it at the sides to a lower deck rail.

In 1985 Norman Brouwer recorded the intact derrick lighter, L.V.R.R. No. 462, grounded at Edgewater, New Jersey. The boat, built at Mariner's Harbor, Staten Island, 1926, measured 104.5 ft. in length, 32 ft. in breadth, with a depth of hull measuring 7.8 ft. A large winch house stood on deck aft, with mast and boom positioned directly in front of the house. The largest openings in the deck, small rectangular hatches, provided access and ventilation. A system of longitudinal bulkheads and timber pillars linked by crossed diagonal timber braces supported the deck. The derrick barge had more diagonal braces at the side rather than natural knees. A continuous row of windows spanned the front of the deck house. The cabin measured 6 ft. 2 in. across the windows, 14 ft. 9 in. at the side of the deckhouse. Interior cabin construction featured tongue-and-groove details.

The winch, built by the Domestic Pump and Engine Company of Harrisburg, Pennsylvania, had an oil-burning single-cylinder engine. Topping lift wires led to the mast through guides in the roof. Other lines led to the base of the mast through a hatch beneath the center window. These included vangs used to swing the boom which led to drums on the winch. Excess line fed through holes in the deck.

Some of the later derrick lighters had steel A-frames and a steel box-girder instead of timber masts and booms. Steel-hulled derrick lighters built in this century featured this rig. The last wooden derricks had winch controls in a small shelter on the roof of the winch house. Steel derrick lighters featured two-storied deckhouses.

The Feeney Collection at the Hudson River Maritime Museum in Kingston, New York has several types of wooden stick lighters cataloged. Figures 4, 5, and 6, Volume II, shows three undated views of an Erie Railroad Company, New Jersey derrick lighter. The plan view (Figure 4, Volume II) shows the overall length of the vessel (90 ft.) over the bumper logs. The plans of the 30-ft.-wide vessel show deck beam spacing, frame size and location, hatch coamings, mast location, and the overall layout of the cabin. Figure 5 (side view) indicates the length on bottom, breadth on bottom, depth of side, and sheer. Figure 6 provides rigging plan schematics. This data is useful for (1) comparison of construction literature data for an Erie Railroad derrick lighter cited below and (2) project-area Vessel Nos. 113 and 120, particularly overall dimensions and interior construction features.

Construction details for an Erie Railroad derrick lighter, built in 1924, called for seven yellow and/or Southern longleaf pine keelsons; the center keelson measuring 12 x 12 in., the two bulkhead keelsons measuring 10 x 12 in. Four intermediate keelsons (8 x 12 in.) are in two or three pieces. This to give "a good shift of butts with 6 inch plain scarfs fastened (the) same as bilge logs" (Erie Railroad Company 1924:Sheet No. 1). The end keelsons or rake timbers are one pieced and sided the same size. These are joined to the keelson with anchor stocks of the same siding and depth. All the keelsons and rake timbers are rounded at the bottom ends, the same as the bilge logs.

The athwartship keelsons, made of yellow pine, Southern longleaf pine, are placed inside every third member, fastened by two 7/8-in. headed bolts, one at each end and crossing. The bolts are driven through and clinched over rings at the bottom of the keelson (Erie Railroad Company 1924). The side timbers, also pine, consists of 8-x-8-in. and 8-x-12-in. timbers, are mortised 6.5

in. into the outside of the bilge log and 7.5 in. down into the bilge log with 1.5-in. dovetail, also mortised down into the bilge log. The two bulkheads (yellow/southern longleaf pine) are spaced 7 ft. 6 in. each side of center, running the entire length of the boat. The bulkheads are fastened with 1-x-30-in. blunt bolts spaced 30 in. The strakes are long lengths with 6-in. scarfs and a good shift of butts. The scarfs are fastened with an 8-in. spike (Erie Railroad Company 1924).

The apron, also pine, placed inside the bumper log on each end, is one piece. It is mortised down over the rake timbers, crowned the same as bumpers, and fastened with 1-x-26-in. headed bolts, spaced 30 in. apart (Erie Railroad Company 1924). Deck beams are also made of yellow pine/Southern longleaf pine. The beams, one piece, measured 8 x 12 in. with a 4-in. crown. Every third beam running over athwartship keelsons measured 12 x 12 in. Beams under house coamings, running each side of the mast, or each side of the main hatch measure 12 x 12 in. All the beams are fitted to the inside of the side timbers, down to the clamp strakes and bulkhead stringers, fastened by two 7/8-x-24-in. headed bolts at each end, are driven into the clamps.

Stanchions, 12 x 12 in. (pine), are placed at every 12-in. beam between the center deck stringer and athwartship keelson, fastened with two 3/4-in. bolts in the lower end. The knees are made of 80 lbs. standard steel rail. One standing knee is fitted against fillers on each athwartship keelson on each side of the boat. The knees lap each other not less than 3 ft. side by side. They are secured with 7/8-in. countersunk galvanized screw bolts.

In 1985 Norman Brouwer surveyed and recorded the Lehigh Valley Railroad Derrick Lighter No. 462. Built in 1926 at Mariner's Harbor, the boat measured 104.5 in. long, with a breadth of 32 in. The hull is very similar to covered barges recorded in the vicinity, with only minor variations (Brouwer 1985). Table 9 indicates derrick lighter vessels located in the project area.

Table 9. Summary of Derrick Lighters Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 120	Arthur Kill, NY	No	Inaccessible, no further work
Vessel 155	Arthur Kill, NY	No	Inaccessible, no further work
Vessel 14	Arthur Kill, NJ	No	Inaccessible, no further work
Vessel 113	Kill Van Kull, NY	Yes	Photo and site documentation
Vessel 120	Kill Van Kull, NY	Yes	Photo and site documentation

Arthur Kill, New York Reach

Vessel No. 120 (Figure 64)
Vessel Type: Wooden derrick lighter
General Location: Arthur Kill, New York Reach near Kreisher Brick Works
Date of Abandonment: 1971 (Raber et al. 1996)
Description: Rectangular hull plan, the upper decking and superstructure are visible at low tide. The vessel is apparently part of the Blue Line, Vessel No. 101. The captain's cabin and hoist room are present and in fair condition. Visible equipment features include boom and machinery aft. The machinery includes four reduction gears. Metal (iron) vertical straps are attached to the outside hull. The vessel features all metal strapping. Minimal lower construction features are visible, although at least four longitudinal bulkheads support the deck.
Recommendation: Based on project data, this vessel is not a best representative type. No further work is recommended.

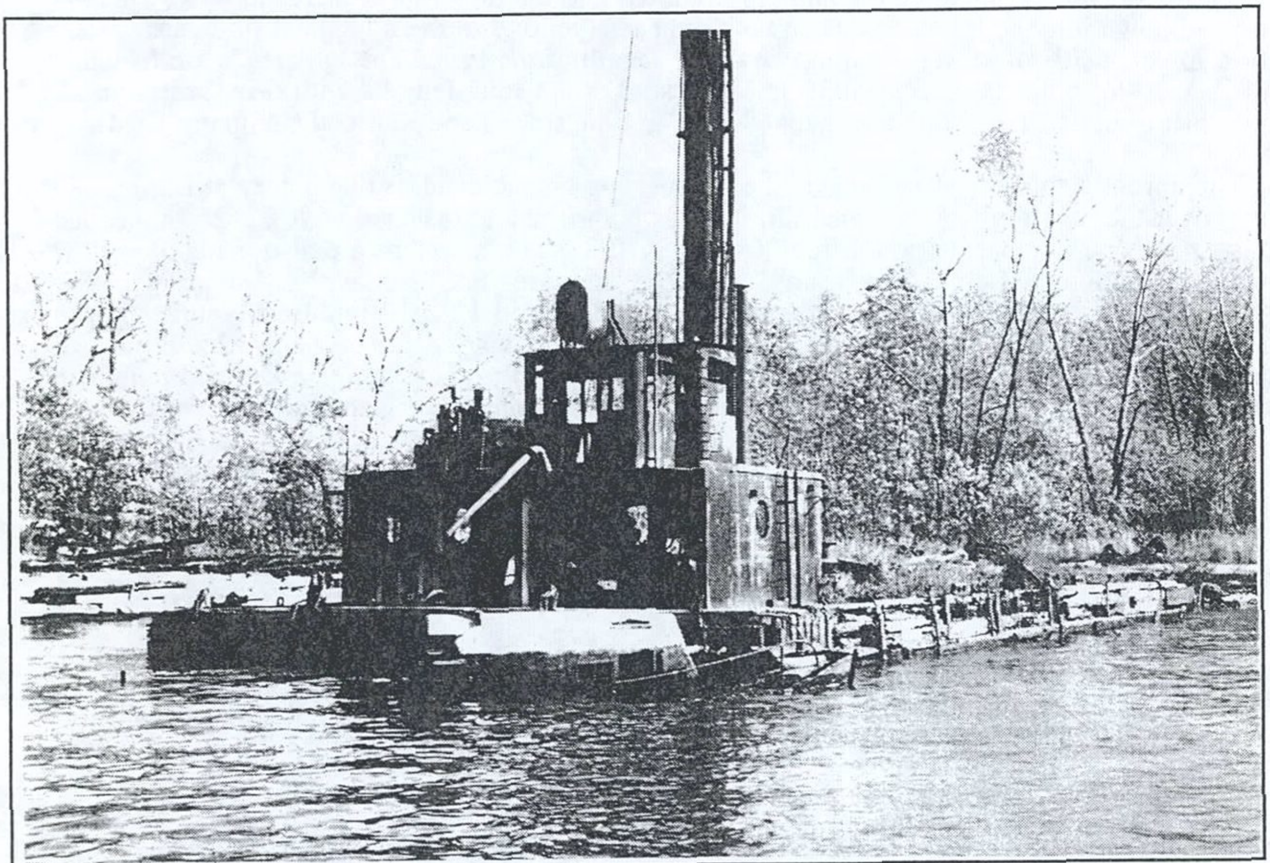


Figure 64. Vessel No. 120's cabin and machinery, viewed from the southeast.

Vessel No. 155 (Figure 65)
Vessel Type: Wooden derrick lighter
General Location: Arthur Kill, New York Reach north of the Outerbridge
Date of Abandonment: 1961 (Raber et al.)
Description: The vessel is disarticulated, resting partially submerged along the Staten Island shoreline. The aft section of the vessel is visible, with a single forward cabin bulkhead standing. The vessel is in poor condition.
Recommendation: Based on project data, this vessel is not a best representative type. No further work is recommended.

Arthur Kill, New Jersey Reach

Vessel No. 14 (Figure 66)
Vessel Type: Wooden derrick lighter
Date Abandoned: 1971 (Raber et al. 1995b)
General Location: Arthur Kill, New Jersey Reach near the Port Reading creosote plant
Description: The vessel is barge-like, double-ended, with some planking extant. The deck has collapsed. Three bollards and one bit are visible. The boat is not easily accessible.
Recommendation: Based on project data, this vessel is not a best representative type. No further work is recommended.

Figure 65. Site view of Vessel No. 155, facing southeast.

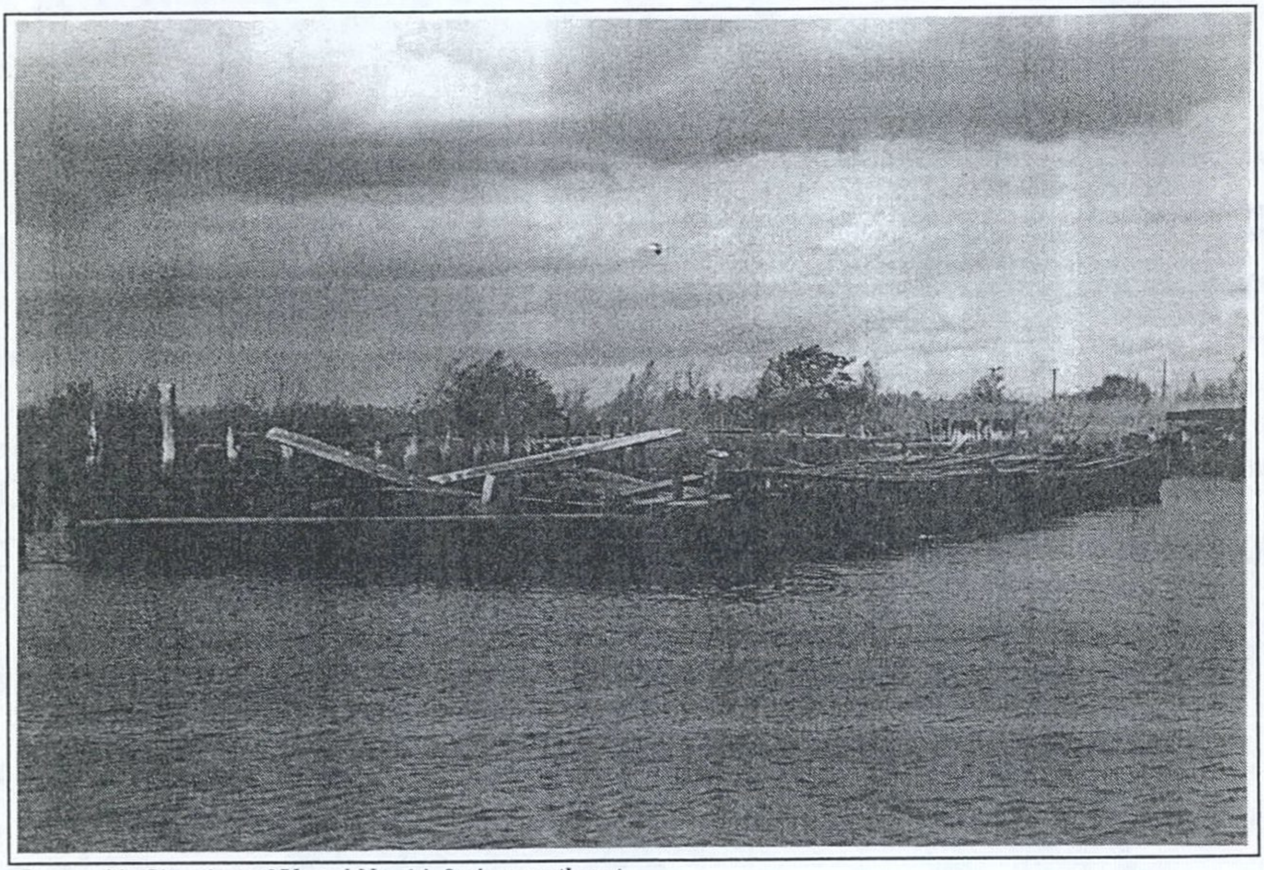


Figure 66. Site view of Vessel No. 14, facing southeast.

Vessel No. 113 (Figures 67 and 68)
Vessel Type: Wooden derrick lighter
General Location: Kill Van Kull, New York Reach near SP&B
Date of Abandonment: 1970 (Raber et al. 1995b)
Description: A rectangular hull plan with vertical sides and sharply raked ends, the vessel's lower hull plan is not visible. The barge is in fair condition.
Recommendation: Based on Criterion D, this vessel is the best representative type in the project area. It provides potentially relevant construction data on wooden derrick construction, a database otherwise ignored in the archaeological record. Research should include complete photographic documentation. This work should then be compared and contrasted against derrick plans presented in Volume II.

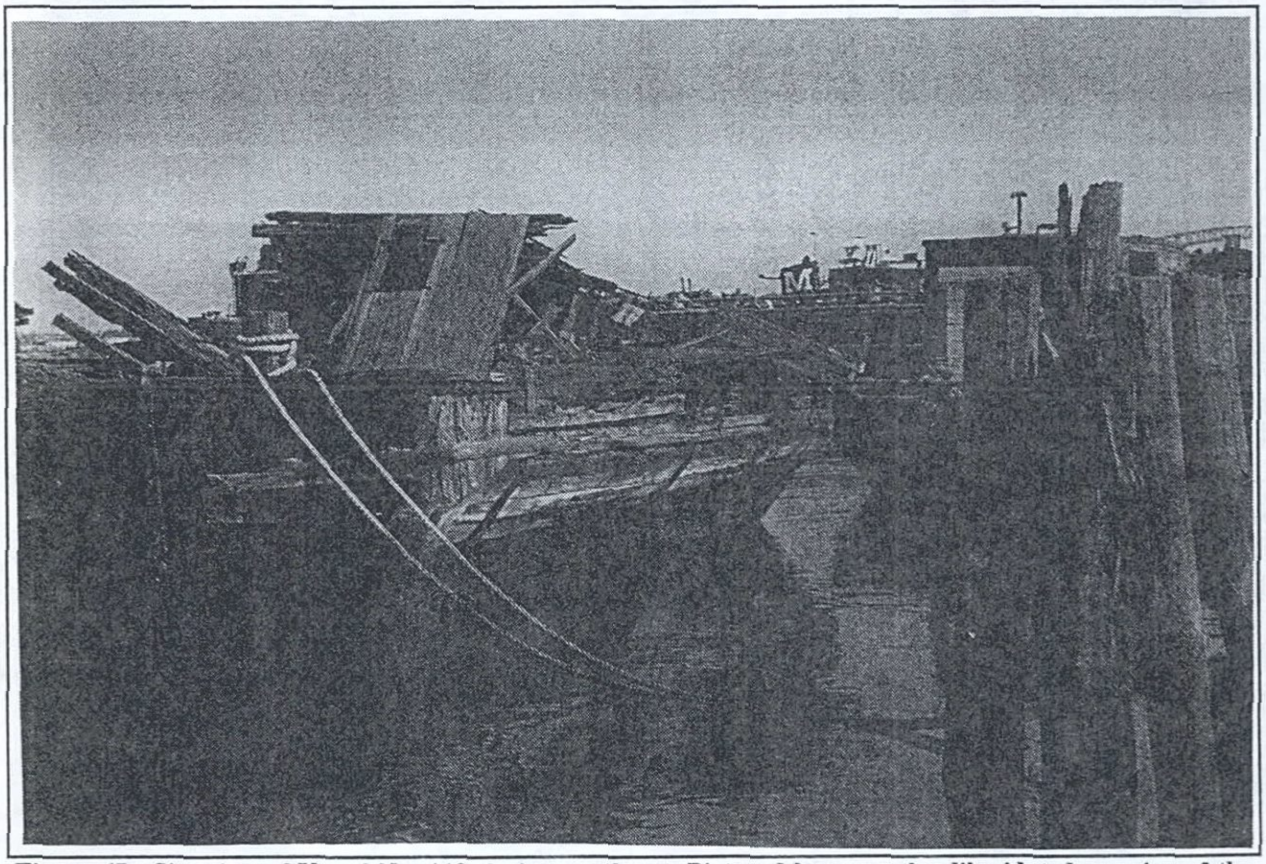


Figure 67. Site view of Vessel No. 113, facing northeast. Pictured here are the dilapidated remains of the cabin structure.

Figure 68. Site view of Vessel No. 113, facing south.

Vessel No. 120 (Figures 69 and 70)
Vessel Type: Wooden derrick lighter
General Location: Kill Van Kull, New York Reach near SP&B
Date of Abandonment: 1970 (Raber et al. 1995b)
Description: A wooden barge measuring 100 x 32 x 9 ft., the vessel is constructed with heavy-duty timbers. The lower portion of the vessel is submerged. What is visible is a winch, ballards, cleats, chain, and cable. An articulated cabin stands aft. Fasteners are wooden and iron.
Recommendation: Under Criterion D, investigation should include complete photographic documentation of machinery housing and vessel superstructure. Derrick lighters are unique harbor vessels with little archaeological data available. This data should then be compared and contrasted with derrick plans in Volume II and available data from Vessel No. 113.

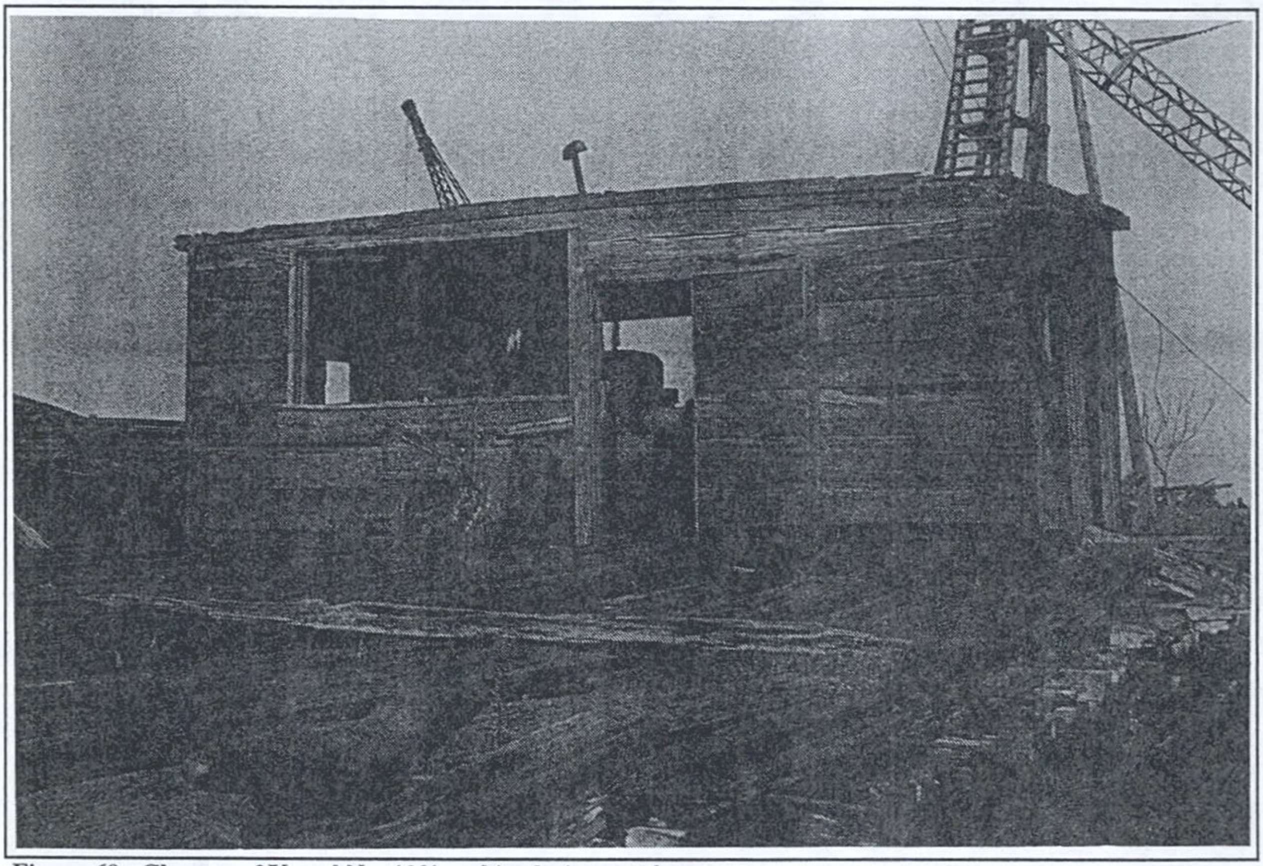


Figure 69. Closeup of Vessel No. 120's cabin, facing southwest.

Figure 70. Site view of Vessel No. 120, facing southeast.

THE RAILROAD CARFLOAT

In a 1909 obituary, the *New York Times* credits John H. Starin with inventing the car float in 1866. According to the *Times*:

> He was among the transportation contractors whom the United States Government picked out to assemble and ship troops, food, and clothing during th e [sic] civil war. Commodore Vanderbilt appointed him to solicit freight for the Hudson River Railroad.
>
> In time he built up so large a freight and lighterage business of his own that, some years ago, he controlled practically all the freight lighterage business of the New York Central & Hudson River Railroad, the Morris & Essex Railroad, the Delaware, Lackawanna & Western, and the Central Railroad of New Jersey, and was also probably the largest individual owner of steamboats, tugs, and barges in this country. He originated the idea of transporting freight cars on floats, and was always very proud of this achievement [*NYT*, 23 March 1909].

Carfloats are basically extra-long scows fitted with railway tracks. The early wooden ones measured 240 ft. in length. Steel carfloats built in this century, of which a few are still in use today, measure over 300 ft. The latter, which could carry as many as 23 freight cars on modern dimensions, were called "Broadway car floats." Two types of carfloats developed: transfer car floats, which discharged the cars themselves at their destination, and the station or terminal car floats, on which the cargo was discharged from the cars while they were still on board (Dibner 1994).

The transfer carfloat usually had three tracks running from bow to stern. The terminal car floats substituted a long, narrow platform for the center track. This platform was raised to the height of the floors of the cars, and usually had a sheltering roof. Some car floats had small crew cabins sunk into the deck at one end. Others carried no permanent crew.

Workmen loaded railcars on the carfloats over adjustable ramps called "float bridges." Some of the float bridges had pontoons under their outer ends to adjust their height to the rise and fall of the tide. Others had superstructures built over their outer ends and were winched up and down by hand to match the height of the car float. The transfer carfloats ran their cars ashore on the other side over similar float bridges. The cars were then shunted into warehouses in small, self-contained terminals owned by the same railroad on the shore of Manhattan, Brooklyn, Queens, or the Bronx (Brouwer 1996).

At their destination, the terminal carfloats moored on to a shoreside warehouse. The carfloat end platform lined up with a door in the warehouse by a portable gangway rigged between them. Longshoremen hand-trucked goods from the freight cars into the warehouse. With all the cars empty, the carfloat returned to the west side of Hudson River. This type of carfloat also loaded cargo aboard ship. An empty flat car, placed in the string of cars, would be next to the ship's side. The goods could then be wheeled onto the flat car and hoisted up to the deck of the ship (Brouwer 1996).

The South Street Seaport Museum has numerous detailed plans of steel car floats of both types built in the Bethlehem Shipyard in Mariner's Harbor, Staten Island. A few plans of wooden carfloats also exist. Construction details for a converted New York car float to passage barge provided by the South Street Seaport Museum, New York (Figure 7, Volume II) show an overall plan view of the vessel's deckhouse and vessel amidships view. This view indicates the size and location of horizontal trusses, vertical stations, and lower hull features. The plan, compared with overall data generated from Vessel No. 258 and 155 recommendations, can distinguish changes, if any, in interior structural layout. Table 10 shows the vessels (number, location, recommendation) located in the project area designated as wooden car floats.

Table 10. Summary of Wooden Car Floats Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 3	Arthur Kill, NY	No	Not best representative, no further work
Vessel 33	Arthur Kill, NY	No	Not best representative, no further work
Vessel 196	Arthur Kill, NY	No	Not best representative, no further work
Vessel 208	Arthur Kill, NY	No	Not best representative, no further work
Vessel 258	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 78	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 155	Kill Van Kull, NY	Yes	Photo and site documentation

Arthur Kill, New York Reach

Vessel No. 3 (Figure 71)
Vessel Type: Wooden car float
General Location: Arthur Kill, New York Reach near Chelsea

Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Rectangular scow-style hull plan, the barge has at least seven longitudinal bulkheads of piled-up scarfed timbers. The timbers are stagger bolted. Visibly evident are transverse deck beams with longitudinal planking, internal ceiling, and external planking. The float is reinforced with steel strapping and a metal I-beam. According to an informant (John Decker, personal communication 1995), Roeters owned the barge and used it as an A-frame barge.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

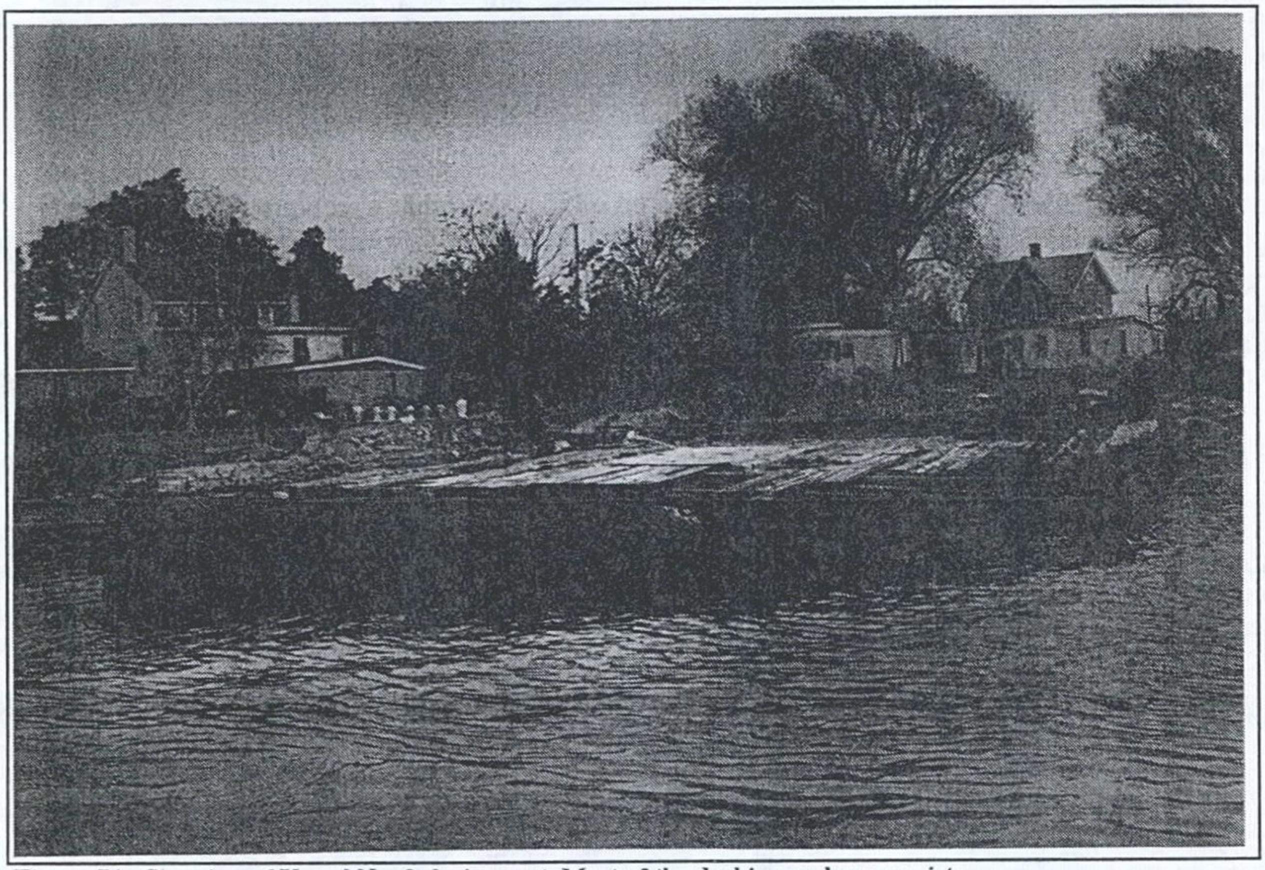


Figure 71. Site view of Vessel No. 3, facing east. Most of the decking no longer exists.

Structure No. 33 (Figure 72)
Structure Type: Wooden car float
General Location: Arthur Kill, New York Reach near Chelsea
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: This structure in now a transformed pier. Five longitudinal bulkheads are visible. Metal railing is visible topside.
Recommendation: Based on comparative data, this structure is not a best representative type. No further work is recommended.

Figure 72. Site view of Structure No. 33. Debris covers most of the deck.

Vessel No. 196 (Figure 73)
Vessel Type: Wooden car float
General Location: Arthur Kill, New York Reach north of Atlantic Terra Cotta
Date of Abandonment: 1951 (Raber et al. 1995a)
Description: The lower hull structure is present. Construction features include raked bow, longitudinal bulkheads, scarfed timbers, and diagonal side bracing. The beached section of the vessel is severely burned. No transverse bulkheads are present.
Recommendation: Based on comparative data, this structure is not a best representative type. No further work is recommended.

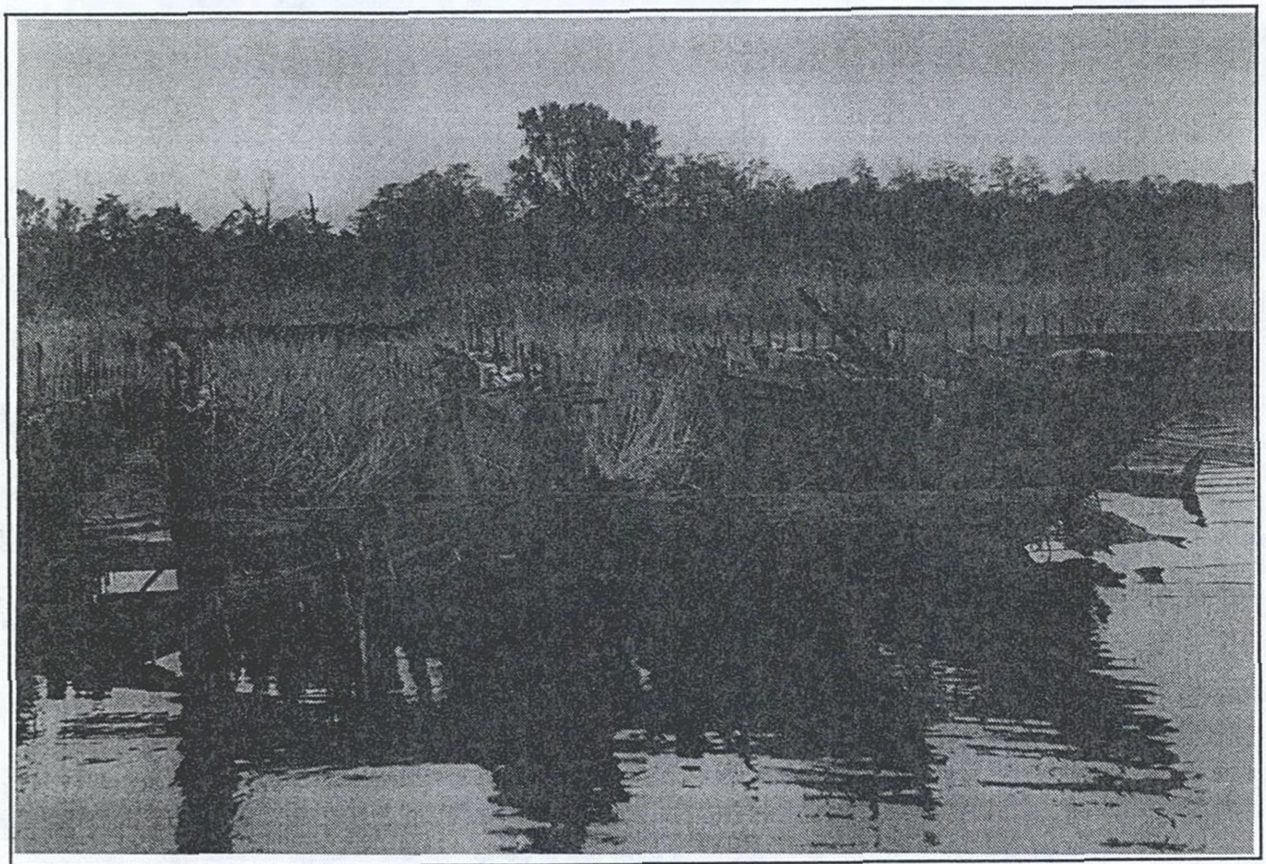


Figure 73. Remains of Vessel No. 196, facing west. Extant are the vessel's longitudinal bulkheads and bottom hull planking.

Vessel No. 208 (Figures 74 and 75)
Vessel Type: Wooden car float
General Location: Arthur Kill, New York Reach near O'Boyle/Townsend Shipyard (Raber et al. 1995a)
Description: Half of this beached vessel is fairly preserved. Of the upper works, only one-third of the vessel is visible, and this portion is disarticulated. Evident are longitudinal beams supported by transverse cross-bracing. Cross-bracing consists of a center metal triangle chock and tie rod.
Recommendation: Based of the condition of the vessel and comparative project-area data, this structure is not a best representative type. No further work is recommended.

Figure 74. Disarticulated remains of Vessel No. 208, facing northwest.

Figure 75. Site view of Vessel No. 208, facing northwest.

Vessel No. 258 (Figure 76)
Vessel Type: Wooden car float
General Location: Arthur Kill, New York Reach near Tottenville Marina Basin
Date of Abandonment: 1951 (Raber et al. 1995a)
Description: The vessel is partially submerged, resting along the Staten Island shoreline. Rectangular and scow-like in design, the float has apparent longitudinal camber (arch) fore and aft, though it is difficult to determine the degree of camber due to gravity. Five longitudinal bulkheads, timbered by stagger bolting, rest on enlarged keelsons. Bulkheads are diagonally braced. Side planking is visible, along with evidence of sheathing. The vessel is probably double-ended. Due to shallow water depth and construction instability, investigation did not include hull construction features.
Recommendation: Under Criteria C and D, the vessel warrants investigation. Under Criterion C, a vessel possesses significance if it embodies a distinctive type or method of construction. Wooden car floats are unique in this regard. Also, Criterion D states that a vessel is significant if it yields data on its use and construction methods. Because these vessels were designed to suit the needs of rail freight and transportation, the investigation should include complete photographic documentation of upper works and length, beam, general scantling measurements (including limited drawing). Further research should include data comparison with vessel plans (Figure 7, Volume II).

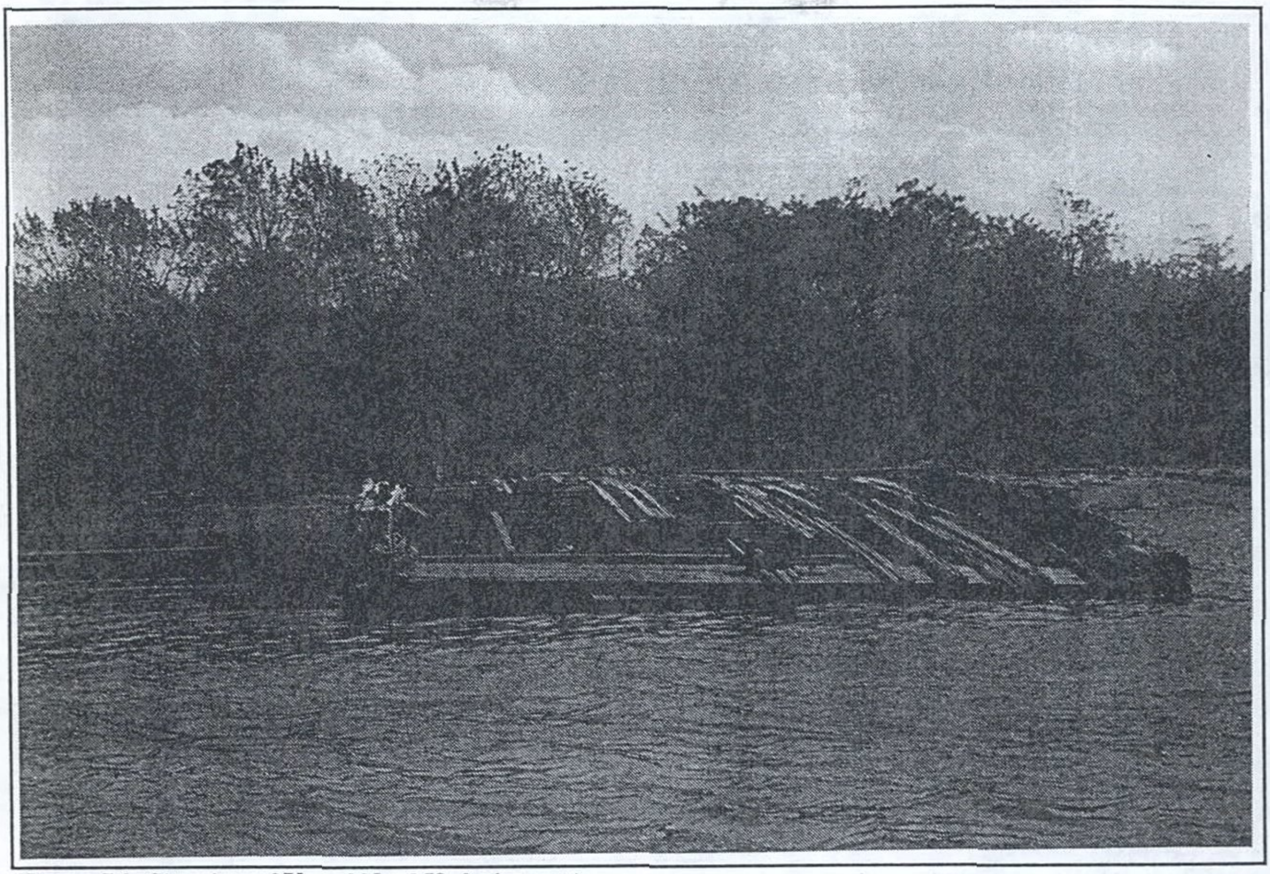


Figure 76. Site view of Vessel No. 258, facing east.

Kill Van Kull, New York Reach

Vessel No. 78 (Figure 77)
Vessel Type: Wooden car float
General Location: Kill Van Kull Reach near the GLD&D/George Rogers site
Date Abandoned: 1945 (Raber et al. 1995b)
Description: There are remnant longitudinal inwales, cribbing, and deck clamps. At least eight sister keelsons appear amidships. Cross stringers run transversely
Recommendation: Based on comparative project-area data, this vessel does not embody characteristics of a best representative type. No further work is recommended.

Figure 77. Vessel No. 78, facing southeast.

Vessel No. 155 (Figure 78)
Vessel Type: Wooden car float
General Location: Kill Van Kull Reach near Milliken/Downey Shipyard
Date Abandoned: 1947 (Raber et al. 1995b)
Description: Paired frames are fastened together by metal spikes. The exterior planking is fastened, butt-jointed with treenails. Interior planking is held together with iron fasteners. Five longitudinal bulkheads, consisting of piled-up scarfed timbers, are treenail fastened. Diagonal turnbuckles are used for cribbing. Chine knees are apparent between bottom and side interior planking.
Recommendation: Under Criterion C, the vessel possesses distinctive characteristics of a type, period, and method of construction, i.e., railroad freight and transportation. Under Criterion D, the vessel construction is unique to history. Recommendations include complete photographic documentation and site recordation of the vessel's lower hull works. This data should, in turn, be compared with data revealed from Vessel No. 258. Further research should include data comparison with vessel plans (Figure 7, Volume II).

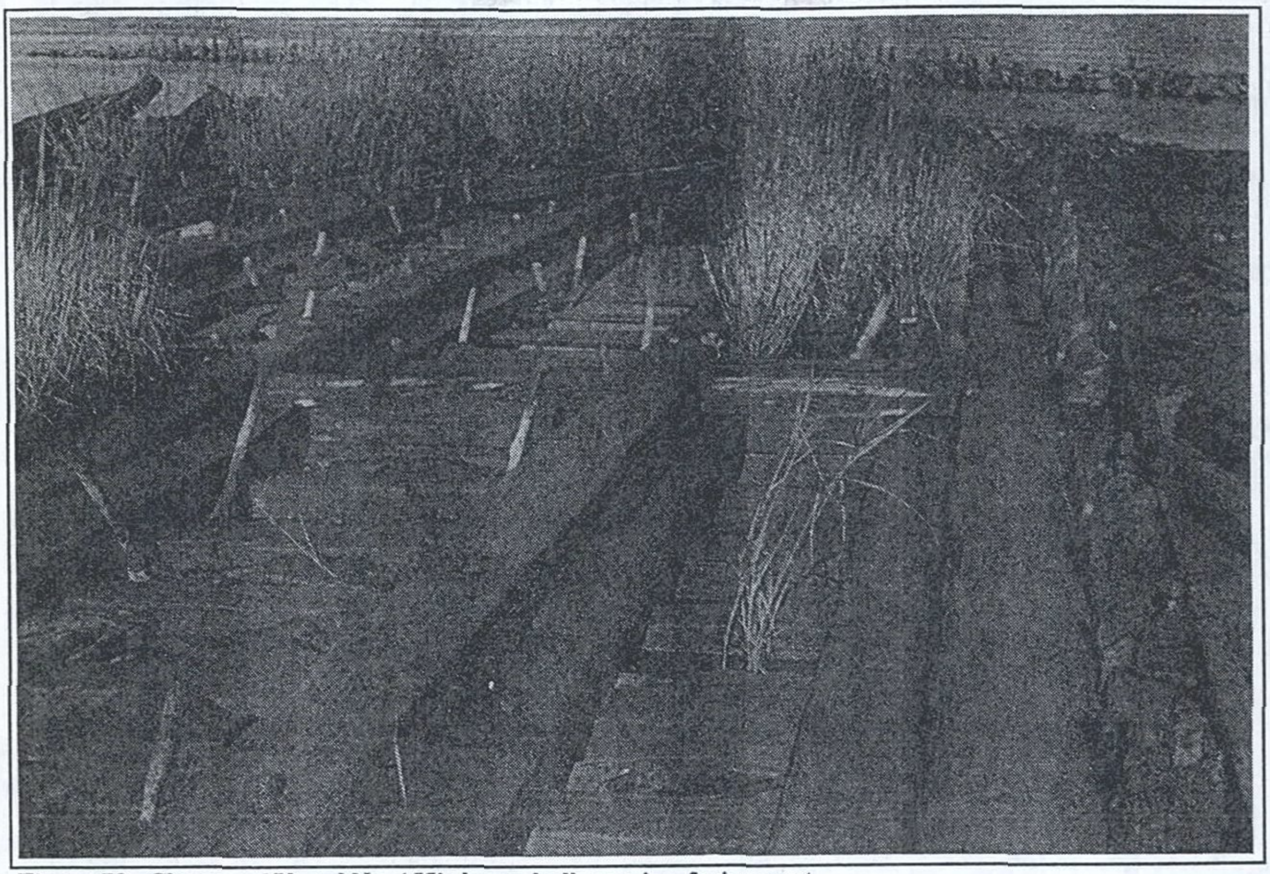


Figure 78. Closeup of Vessel No. 155's lower hull remains, facing west.

FERRIS VESSELS

Following the Civil War, America's merchant fleet took a passive role in sea-faring commerce, permitting foreign fleets, particularly British, to ship most of its commerce. The United Kingdom launched 1,683, 553 gross tons in 1914, compared to 200,762 by the United States.

The United States' decision to enter WWI prompted widespread mobilization of marine manpower and machinery. The decision to build wooden ships rested on (1) the inability to mass-produce steel-hulled vessels quickly, (2) the availability of North Atlantic Coast labor, (3) natural resources in the Southern Atlantic Gulf and North Pacific coasts, and (4) the shipbuilding tradition in Maine (McKellar 1959).

In 1916, Congress adopted the United States Shipping Act, then approved the Emergency Shipping Fund Provision of the Urgent Deficiencies Appropriations Act. Appropriations totaled $150,000,000 for purchasing and requisitioning (ships, materials, charters, etc.) and $5,000,000 for ship operations. The appropriated money caused a boom in U.S. shipbuilding (Hoyt and Schmidt 1995).

Initial war efforts by the United States Shipping Board Emergency Fleet Corporation (USSB) focused on existing wooden ship plans. The USSB built wooden ships to "compensate for the shortage of existing steel shipyards and thereby bridge the war-time emergency" (Hoyt and

Schmidt 1995:17). Organized under the laws of the District of Columbia, the corporation's capital stock eventually grew from $50,000,000 to $3,000,000,000. The corporation could "purchase, construct, equip, lease, charter, maintain, and operate merchant vessels in the United States" (Webb ca. 1980s:275). Timber for the fleet originated from Maine's White pine forests, Southern longleaf yellow pine, and Pacific coast Douglas fir.

The USSB planned to build some 1,000 vessels. According to Thomas (1994), orders included 521 cargo ships, 141 barges, 161 tugs, 10 sailing ships, 119 finished hulls without propulsion plants, 64 barges converted from cargo ships, and one tanker, a total of 1,017 vessels. There is disagreement on the actual numbers, but the difference is slight.

The Wood Ship Division of the USSB operated 51 shipyards by November 1917, the number increasing to 130 by September 1918. Of these 130 yards, 78 yards built cargo-carrying wood vessels, 4 constructed composite cargo vessels, 28 built barges, and 20 shipyards built tugs (Hoyt and Schmidt 1995). In November 1917, the USSB contracted 314 wooden-hulled vessels, 61 completed. By August 1918, contracts totaled 469 vessels, 163 completed.

The USSB first approved the Hough design based on two vessels, *C.A. Smith* and *Johanna Smith*, built by Kruse and Banks for the C.A. Smith Lumber Company (McKellar 1959). After design alterations, Theodore Ferris received a commission to design a boat later identified as the Ferris type wooden steamship (Figures 79 and 80). C.A. Smith Company built the first wooden ship for the USSB in 1918.

Pine mills on the Atlantic and Gulf coasts could not deliver the quantities required by the Ferris model. Specifications for some timbers measured 16 in. x 24 in. x 40 ft. Several thousand carloads of Douglas fir shipped to Gulf and Atlantic shipyards lessened the shortage to some degree, but project delays and difficulties plagued the Emergency Fleet. A number of yards had timber for hulls, but had no contact with machinery suppliers. Yards sometimes possessed a surplus of timber for beams, keelsons, etc., but no timber for planking. This shortage slowed contract allocations. Labor shortages also plagued the project, so much so that the USSB investigated additional labor pools: men in cantonments, army personnel, and men in munitions and war factories (Hoyt and Schmidt 1995).

Engine allocation proved problematic. The USSB and private firms converted a number of the hulls to barges. By the Armistice signing, it became apparent that wooden ships would not provide expected results. Widespread contract re-negotiation or cancellation followed. The USSB initiated disposal and salvage procedures. Private companies bought a number of vessels. Some steamed under U.S. and foreign registers, while schooner/barge conversion prolonged the lives of others. Despite program cutbacks, the last launching occurred in 1920. After 1920, the Nacirema Steamship Company ("American" spelled backwards) of New York apparently purchased 35 cargo ships, but these vessels ended up property of the Shipping Board (Thomas 1994). By the beginning of WWII, the Ferris vessel apparently disappeared from active service.

The cargo freighter's massive wood construction apparently made it prone to fire. The freighter proved difficult to sell as well. A glutted market and a poor service record made the boat a white elephant. Three attempts by the USSB to sell the vessels failed in 1922. A plan to raft them together as a pontoon highway bridge between Manhattan and New Jersey never materialized. No longer able to maintain the fleet, the USSB began salvage operations.

G.D. Perry won salvage rights to the freighters, but, beset with logistical problems, quit in 1926. Henry Ford bought salvage rights for some 200 freighters, but the operation fail to generate profit. Most of the fleet ended up in graveyards in Mallows Bay, Maryland. Some derelicts ended up in the Kill Van Kull and Arthur Kill.

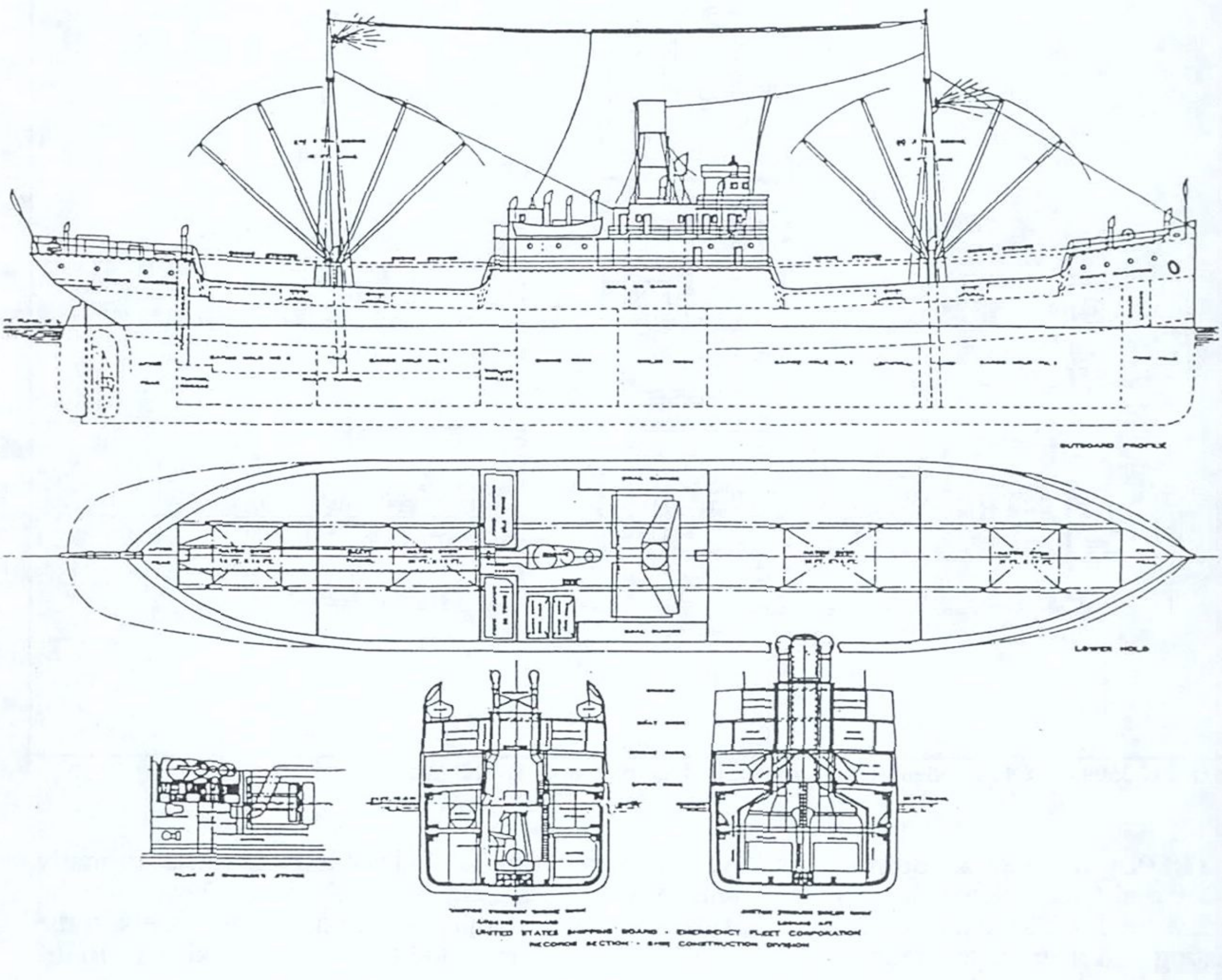


Figure 79. 3500 D.W.T. wooden Ferris cargo ship outboard profile (USSB-PSS, n.d.)

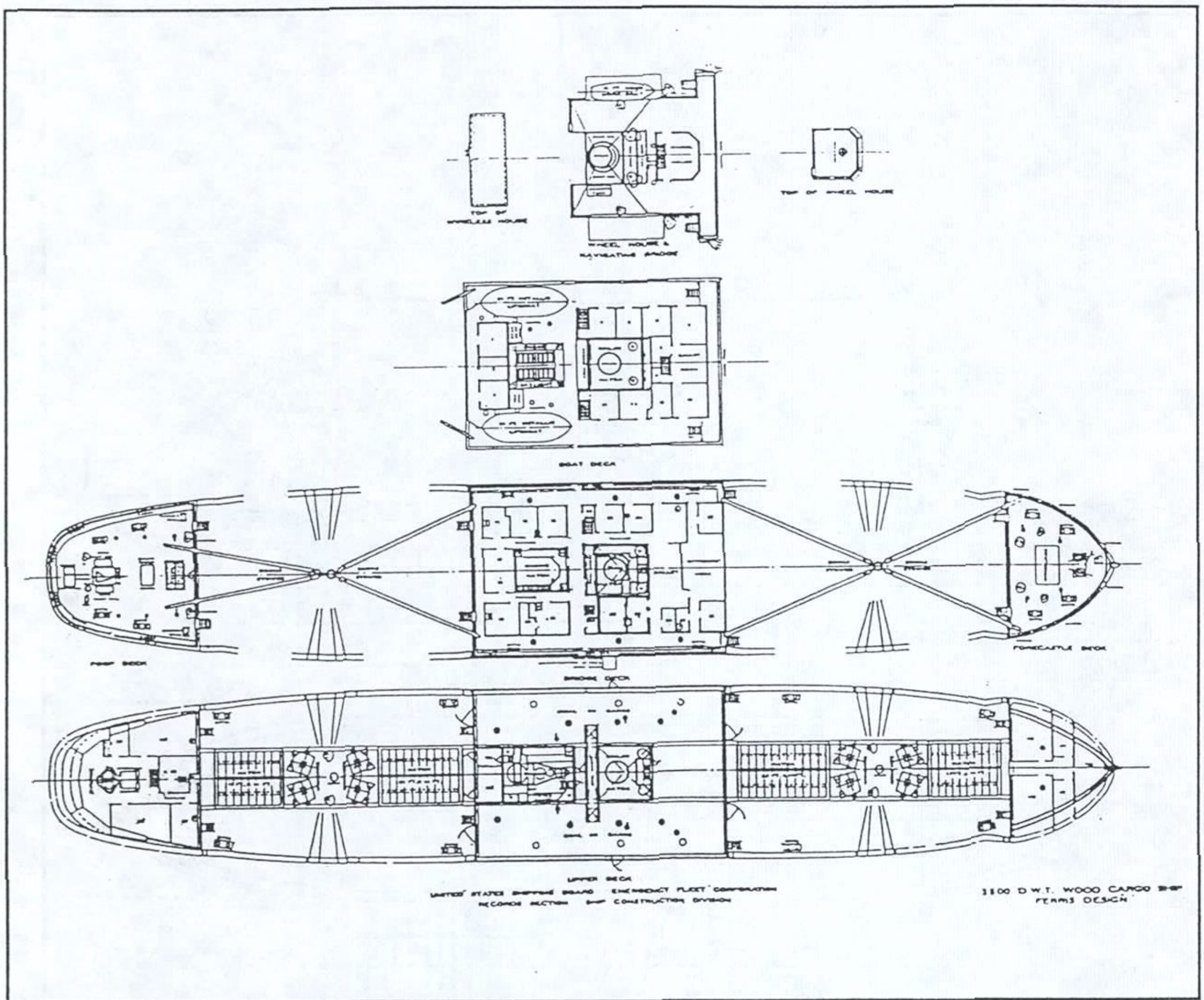


Figure 80. 3500 D.W.T. wooden Ferris cargo ship deck plan (USSB-PSS, n.d.).

THEODORE FERRIS. Born in Stamford, Connecticut in 1872, Theodore E. Ferris, formally educated at Greenwich Academy, first went to work in a Long Island shipyard. From here he worked for John Roach in Chester, Pennsylvania as a draftsmen and designer of vessels in the coasting and deep-water trade (Allen 1922). He later gained additional design skills in Baltimore, Philadelphia and the Great Lakes.

At age 18, Ferris worked for renowned American architect C.A. Smith. He studied under Smith for six years, developing an understanding of Long Island Sound and riverine steamboat traffic. In 1898 Ferris became chief constructor for the Townsend and Downey Shipbuilding Company at Shooter's Island of New York (later the Standard Shipping Company). When called into U.S. military service, Ferris had 30 freight and/or freight/passenger ships under construction at a value of approximately $20,000,000 (Allen 1922).

As chief architect for the USSB during 1917, Ferris designed a single-screw, single-deck, three-island type vessel with one triple-expansion coal-burning engine. Two single-ended Scotch boilers or water tube boilers provided auxiliary power for twin screws and turbine steam-propelling machinery (Webb ca. 1980s). The vessel's preliminary length measured 281.5 ft., length of beam over planking 46 ft., depth molded at side of upper deck 26 ft., with a total estimated deadweight of 3,500 long tons and loaded sea speed of 10 knots. Other vessels had similar configurations, but ranged to 5,000 tons (Webb ca. 1980s).

Ferris tackled problems associated with wooden ship stability and strengthening by using a system of diagonal steel strapping. The straps measured 1/2 x 4 in. in cross section and extended around and under the bilge. Riveted at the top to 3/4-x-8-in. steel cord, the straps formed a diagonal lattice riveted where they met. This strapping is extant on several of the project-area sites.

STEAM TO SAIL CONVERSION. Costly modifications necessary for adapting a sailing ship hull to a full-powered steamship hull, apart from small fishing schooners, negated such conversions. Economical operation gave the sailing ship great advantage. Installing engines, boilers, and fuel tanks was not only costly, but also took away paying cargo space. Owners also had to consider the added expense of hiring additional crew members. The conversion from steamship to coastwise barge, however, proved sensible. Larger ships, wooden and metal, could spend their last days along the coastline as deepwater or coastwise barges. The wooden *Armstead*, built in 1919, is a good example. Built as a cargo vessel, the ship is now grounded at Cornwall Landing on the Hudson River. *Armstead* is one of over 800 wooden cargo ships built as part of the USSB war effort. Several more of these ships now lie in the shallows along Staten Island's shoreline just north of the Outerbridge Crossing. Diagonal steel strapping let into the frames underneath the planking, a characteristic of the WWI steamers, is clearly evident..

Two vessels in the project area are identified specifically as "Ferris" type vessels and are presented here (Table 11). Two other vessels, No. 72 (AKNY) and No. 78 (AKNY) are "Ferris" vessels but are listed as converted barges.

PREVIOUS ARCHAEOLOGICAL RESEARCH. Research on some 30 Ferris type vessels in Orange County, Texas (1995) and an undetermined number of similar vessels (Nueces County, Texas; Rockport, Texas) suggest that the Ferris vessel type is well documented archaeologically. Some of the 30 vessels in Orange County have at least 10 ft. of vertical hull extant. Internal bulkheads and iron outer-hull strapping is also present. According to Hoyt and Schmidt (1994:76), these boats are "extremely well preserved." The vessels within the project area are in very good condition. Most of the vessels' hull remains are extant. Because of the intact condition of the vessel lower hull remains, recommendations include photographic and limited site documentation. The derived information offers comparative data for future research.

Table 11. Summary of Ferris Ocean Freighters Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 184	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 195	Arthur Kill, NY	Yes	Photo and site documentation

Arthur Kill, New York Reach

Vessel No. 184 (Figures 81 and 82)
Vessel Type: Ferris ocean freighter, tentatively identified as *Neal O'Boyle*, ex.-*Weequaic*?
General Location: Arthur Kill, New York Reach, north of the Outerbridge
Date of Abandonment: 1932? (Raber et al. 1995a)

Description: The massive freighter shows obvious signs of burning and salvage. The vessel rests in shallow water. The rudder assemblage (rudder, prop, prop housing) is clearly visible, though deteriorated. Three large holds are sectioned off by bulkheads. Mortised timbers, associated with walkways, are visible between holds. Site features include the charred remains of (center keelson?) vertical stanchions, transverse deck beams, and knees, both hanging and standing. Fasteners are made of wood and iron.

Recommendation: Eligible for investigation under Criteria C and D, further research should include the location of ship plans and further research into the Ferris design. Field documentation should include photographic recordation of the entire vessel and limited scantling measurements. Photographic documentation should focus on the stern, rudder, and propeller housing, etc.

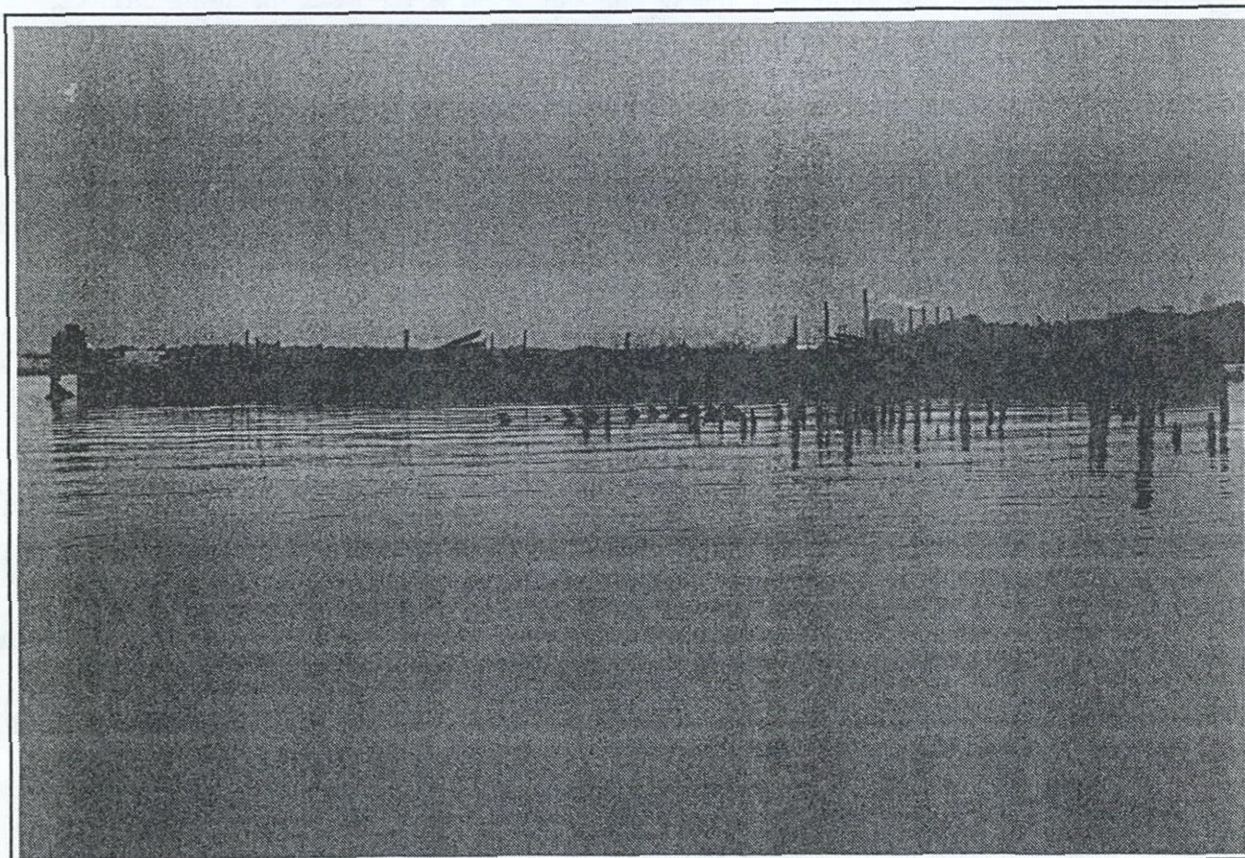


Figure 81. Site view of Vessel No. 184, *Neal O'Boyle*, facing north.

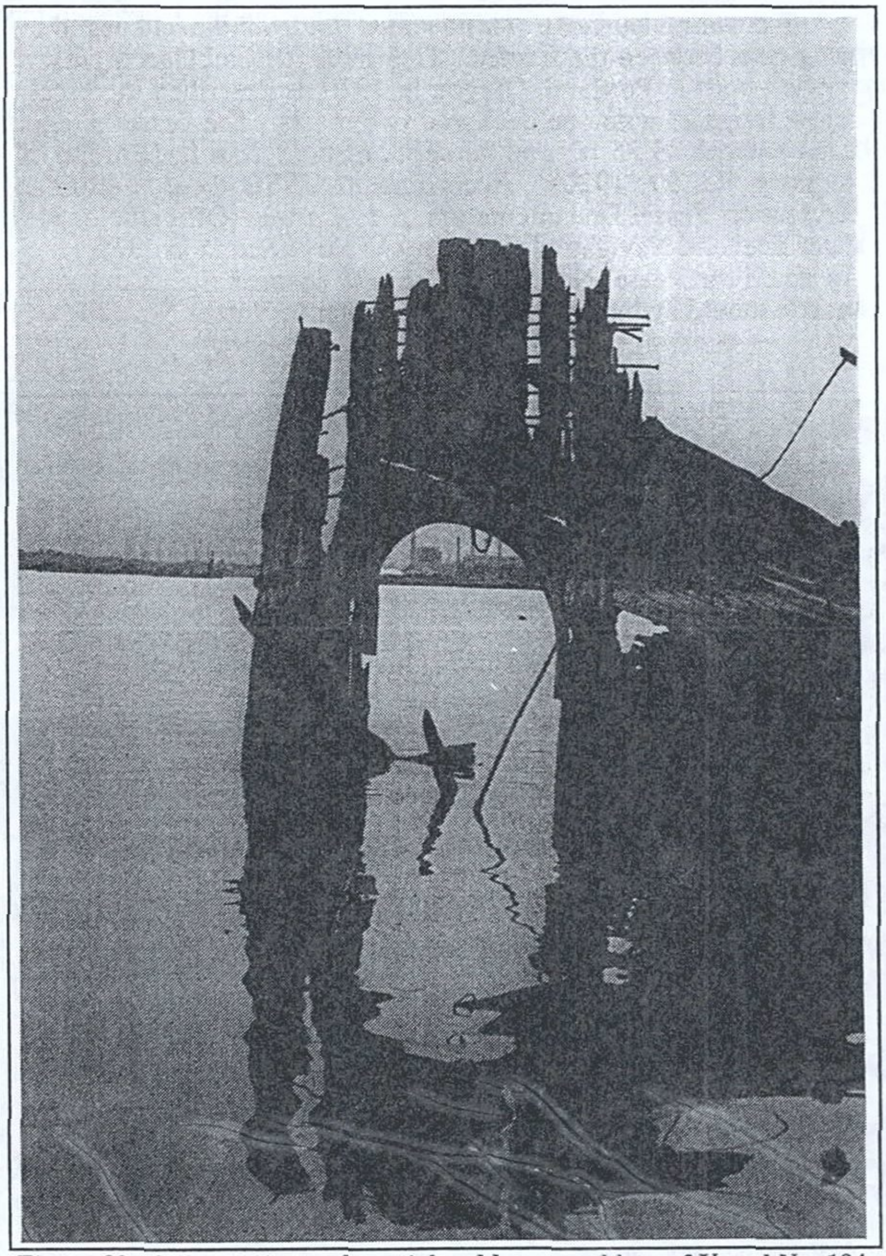


Figure 82. Stern section and partial rudder assemblage of Vessel No. 184, facing northwest. Note the extant prop.

Vessel No. 195 (Figures 83-85)
Vessel Type: Ferris ocean freighter, tentatively identified as *Corone* (Raber et al. 1995a)
General Location: Arthur Kill, New York Reach north of the Outerbridge
Date of Abandonment: 1932? (Raber et al. 1995a)
Description: The massively built vessel shows obvious signs of salvage and burning, but initial observation suggests an intact lower hull, though it is not visible. Much of the deck is intact (beams, knees, and decking). Deck planking measures 4 x 4 in. The wooden freighter has four large holds (with coaming hatches). Turnbuckles run from the hatches to the inner hull. Iron cross-strapping runs between the frames. The rudder assemblage is present and in fair condition. The vessel, built in Portland, Oregon in 1920, is described in vessel records as a wooden steam screw freighter with one deck and two masts. The vessel's registered length totaled 267.8 ft., its breadth 49.85 ft., and its depth of hold 25.6 ft. (Bureau of Navigation Certificate of Registry No. 97, 1920). According to USSB records (Bureau of Marine Inspection and Navigation Vessel Documentation, n.d.) *Corone* (Official No. 219661) sold to the Tidewater Water Fuel and Navigation Company of Nova Scotia in 1928.
Recommendation: As stated for Vessel No. 184, the ship is deemed significant under Criteria C and D. Field research should include data retrieval similar to Vessel No. 184.

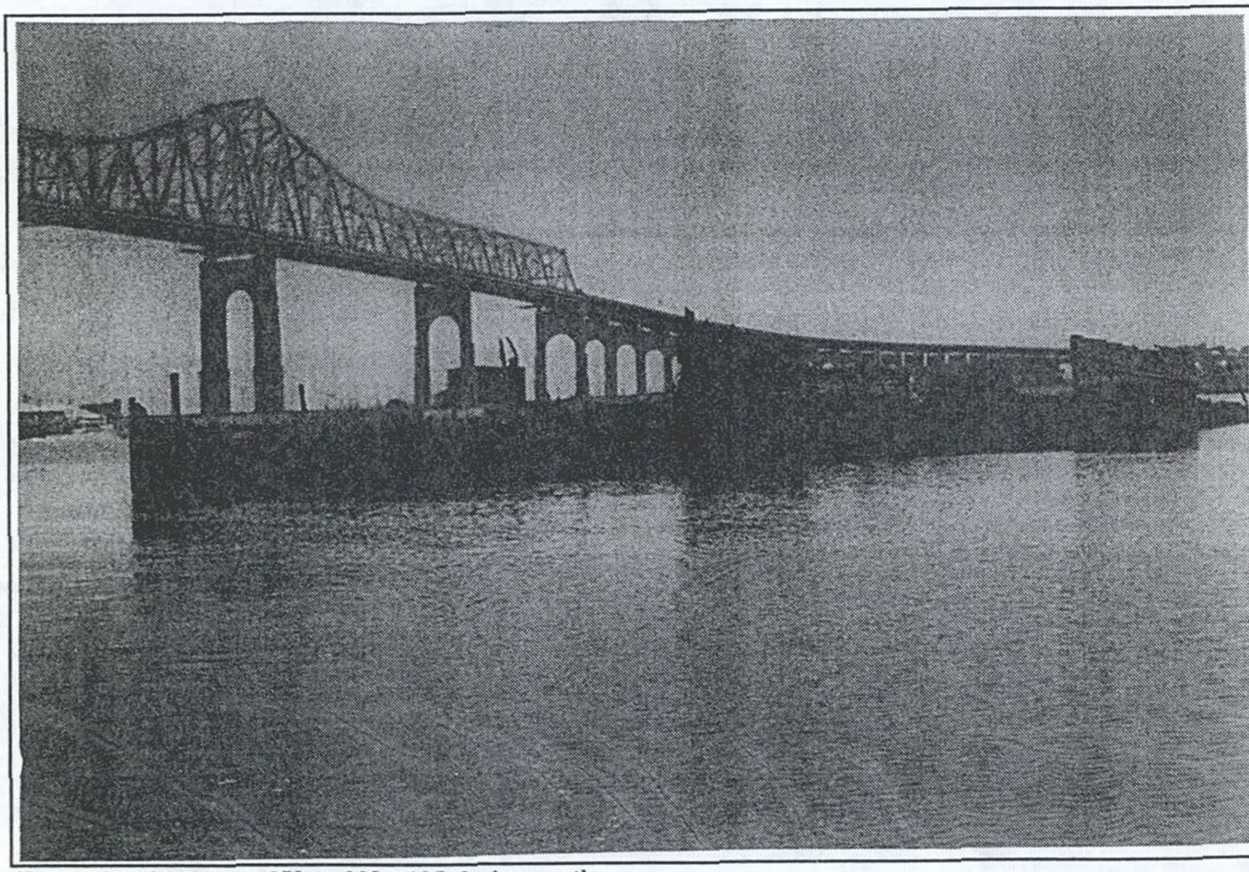


Figure 83. Site view of Vessel No. 195, facing south.

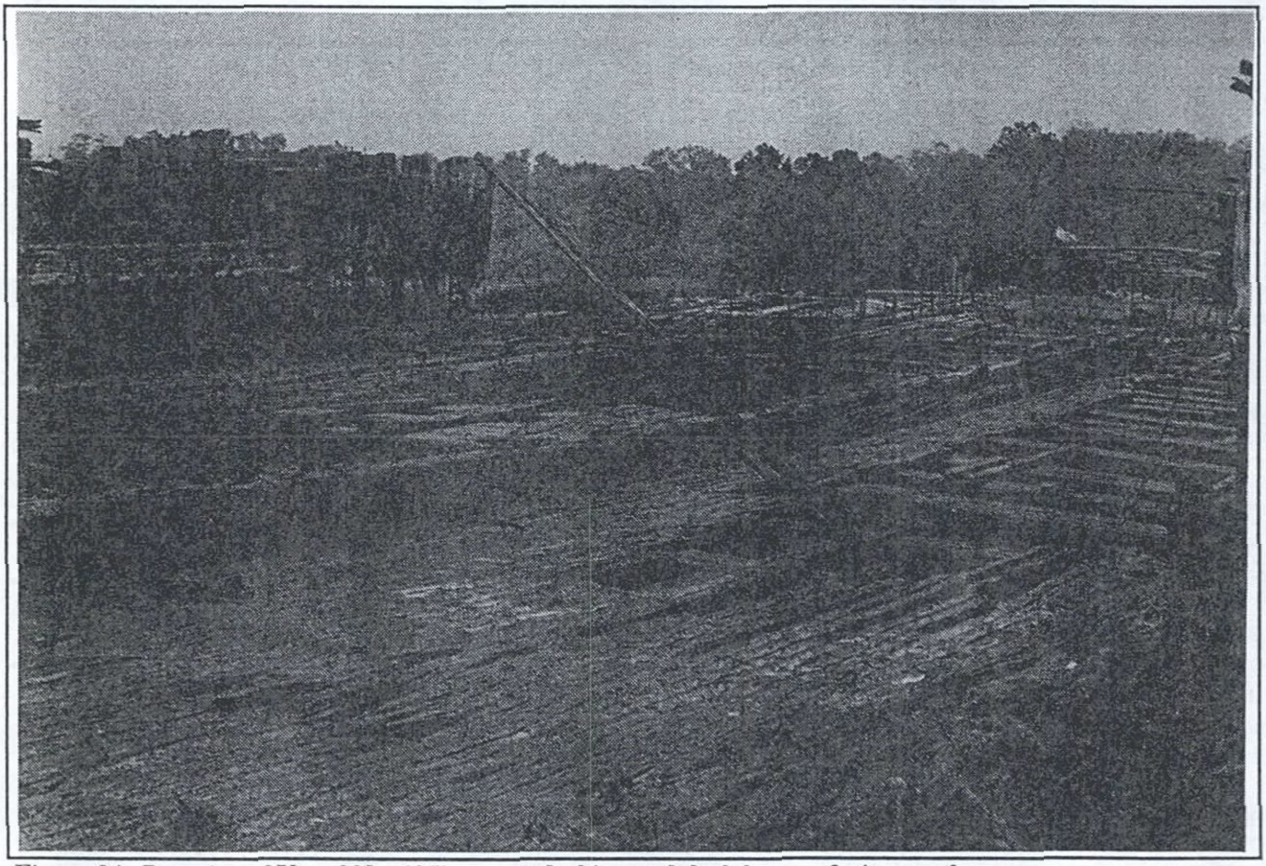


Figure 84. Remains of Vessel No. 195's upper decking and deck beams, facing southwest.

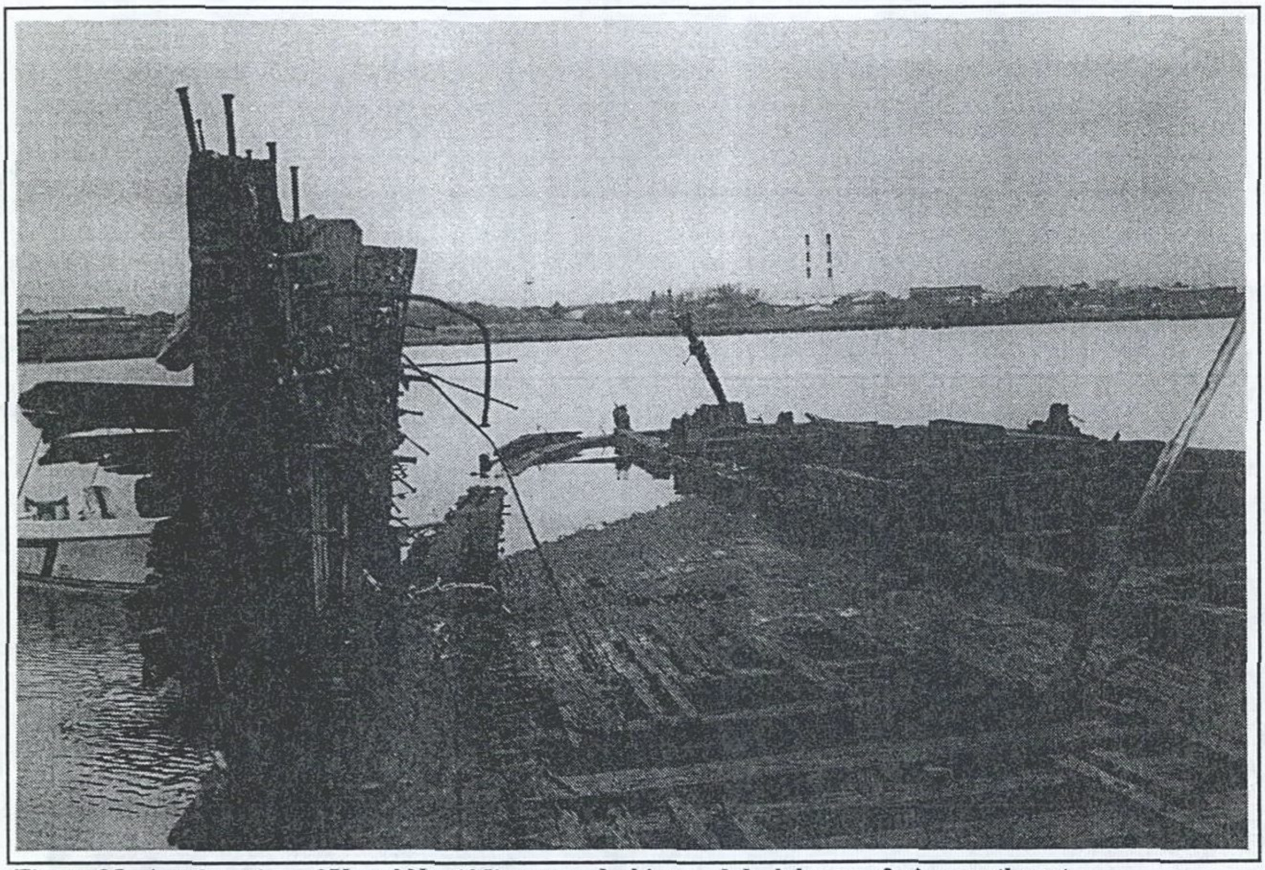


Figure 85. Another view of Vessel No. 195's upper decking and deck beams, facing northwest.

BARGE TYPES OF THE ARTHUR KILL/KILL VAN KULL REACH

EARLY BARGE EVOLUTION. The modern use of simple boxlike water vessels, similar in design to barges of the project area, can be traced historically to sixteenth- and seventeenth-century Europe. Here the lines of the Thames sailing barge are remarkably similar to barge designs associated with the project area.

The lines of an English chalk barge, published in Chapman's *Architectura Navalis* (1768), indicate a boxlike hull 56 ft. in length, 15 ft. in beam, with a depth of hold 5 ft. amidships (Carr 1989). The boat has lines very similar to the Thames punt, a small pleasure craft. The barge described by Chapman has no external keel and a flat bottom, and was steered by a large rudder and wooden tiller. In that regard, the barge design is very similar to the river flatboat.

Barges associated with the project area all of similar design. External and internal construction distinctions are made based on the type of commodity carried. In the case of site remains, most observable distinctions surround (1) the use/quantity of longitudinal verses transverse bulkheads, (2) truss and stanchion use and placement, and (3) the use and placement of knees.

AMERICAN BARGE DESIGN. A forerunner of the modern American barge, the gondola, used during the American Revolution for harbor defense, featured a flat bottom and double ends. This boat measured 40 to 60 ft. and featured long, cutter, sloop, or hoy rigging. As a rule, gondolas had no deadrise or rocker in the bottom and "sometimes had flat sides in sections; at other times the sides had a little curvature" (Chapalle 1935:54). The Revolutionary War era "radeau," basically a square-ended scow, represents another box-shaped vessel similar in design to the barges in the study area (Figure 86).

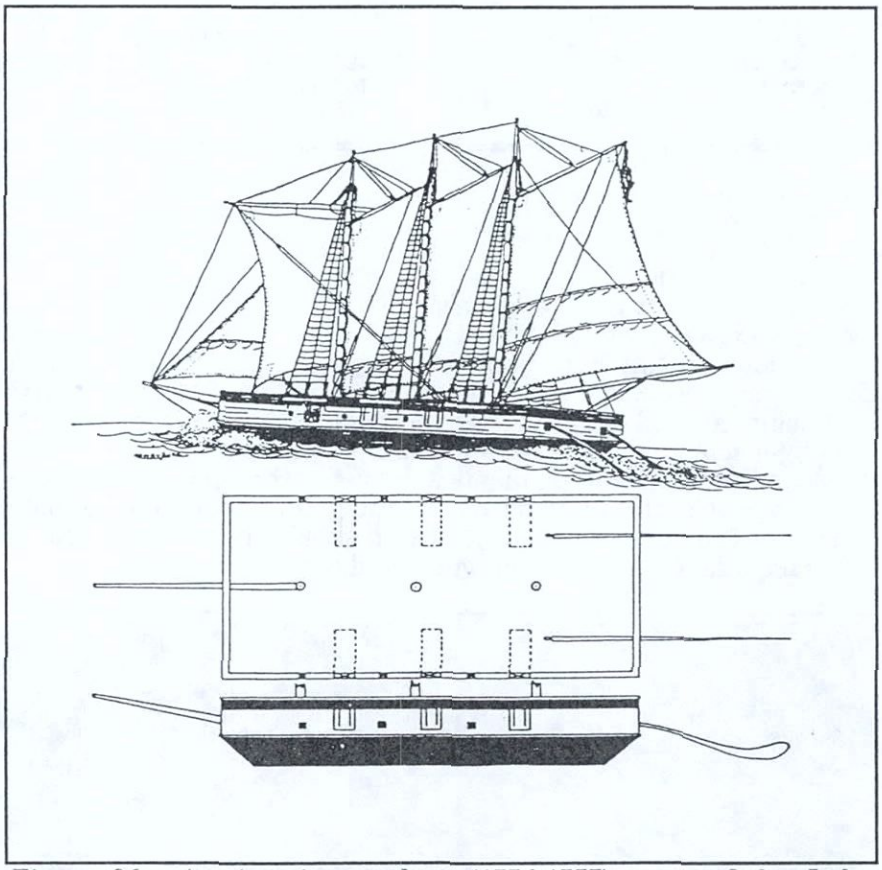


Figure 86. An American radeau (1776-1777) proposed for Lake Champlain, New York (Chapalle 1935).

A barge is best described as a non-self-propelled boat used for hauling commodities. Most barges deployed on the Hudson River, or within New York's harbor, are categorized into four types: (1) hold barges, (2) deck scows, (3) covered barges, and (4) schooner barges. The first three types are described in literature as "lighter barges" or "lighters," though the term "lighter" also refers to various types of smaller self-propelled craft. Referencing barges, a lighter is "a flat open boat with either gasoline or steam hoist, and generally used for handling open top freight" (Cleary 1956:45). There is no agreed-upon definition of a lighter or barge, and no accepted authority to rely upon (Harding 1912).

WORK BARGE. In the last hundred years ,these barge designs have remained the same. Used during harbor construction or as platforms for pile drivers, cranes, hoists, or steam plants, there exist no known studies or plans.

Table 12 shows those vessels identified as work barges. Vessels included in this category are various-sized A-frame crane barges, work barges, a concrete plant, and an unidentified vessel tentatively identified as a work barge.

Table 12. Summary of Work Barges Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 4	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 111	Arthur Kill, NY	No	No further work
Vessel 193	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 15	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 91	Arthur Kill, NJ	Yes	Photo and site documentation
Vessel 95	Arthur Kill, NJ	No	No further work
Vessel 105	Kill Van Kull, NY	Yes	Photo documentation only
Vessel 119	Kill Van Kull, NY	No	No further work
Vessel 169	Kill Van Kull, NY	No	No further work
Vessel 193	Kill Van Kull, NY	No	Not best representative, no further work

Arthur Kill, New York Reach

Vessel No. 4 (Figures 87 and 88)
Vessel Type: Medium A-frame crane barge
General Location: Arthur Kill, New York Reach near Chelsea
Date of Abandonment: 1985 (Raber et al. 1995a)
Description: Bulldozed debris incorporates most of the barge into the bank. Visible structural remains include a single longitudinal bulkhead amidship and one inside the portside pontoon. The A-frame and cabin, as well as supporting turnbuckles and stays, are extant but in poor condition. Winching machinery and operating levers are present.
Recommendation: Under Criteria C and D, this is a unique vessel type. It embodies distinctive characteristics of a type (Criterion C) and is likely to yield important information about its use, operation, and construction methods. Research should include complete photographic documentation and recordation of the upper works to the extent possible.

Figure 87. Steel frame of Vessel No. 4, facing northwest.

Figure 88. Disarticulated remains of Vessel No. 4's machinery, facing northwest.

Vessel No. 111 (Figure 89)
Vessel Type: A-frame crane barge
General Location: Kriescher Brick Works
Date of Abandonment: 1961
Description: Similar in construction to Vessel No. 193, the decking runs longitudinally above transverse beams and hanging knees. The barge is scow ended and has at least two longitudinal bulwarks. The barge has a vertical 2-x-2-ft. metal box or chute (spud box?) fastened to the deck beam. All fasteners are metal.
Recommendation: The vessel is not a best representative type within the project area. No further work is recommended.

Figure 89. Site view of Vessel No. 111, facing east.

Vessel No. 193 (Figures 90 and 91)
Vessel Type: Wooden heavy-lift A-frame crane barge
General Location: Arthur Kill, New York Reach north of Outerbridge
Date of Abandonment: 1940 (Raber et al. 1995a)
Description: Typical scow end construction, four bulkheads run longitudinally stem to stern. These bulkheads are notched at the end to receive a transverse beam, . Small blocks are inserted between bulkhead timbers. Hanging knees support the deck beams, as do vertical turnbuckles. Some wooden cross-bracing runs between the bulkheads. Apparently all fasteners are metal.

Recommendation: Based on Criterion C, the vessel possesses distinctive characteristics of a particular type. A-frame crane barges are unique harbor/work craft. The vessel type played a crucial role in harbor development. Regarding this type, archaeological and historical data are lacking (Criterion D), and complete photographic documentation and site plan recordation is recommended.

Figure 90. Site view of Vessel No. 193, facing north.

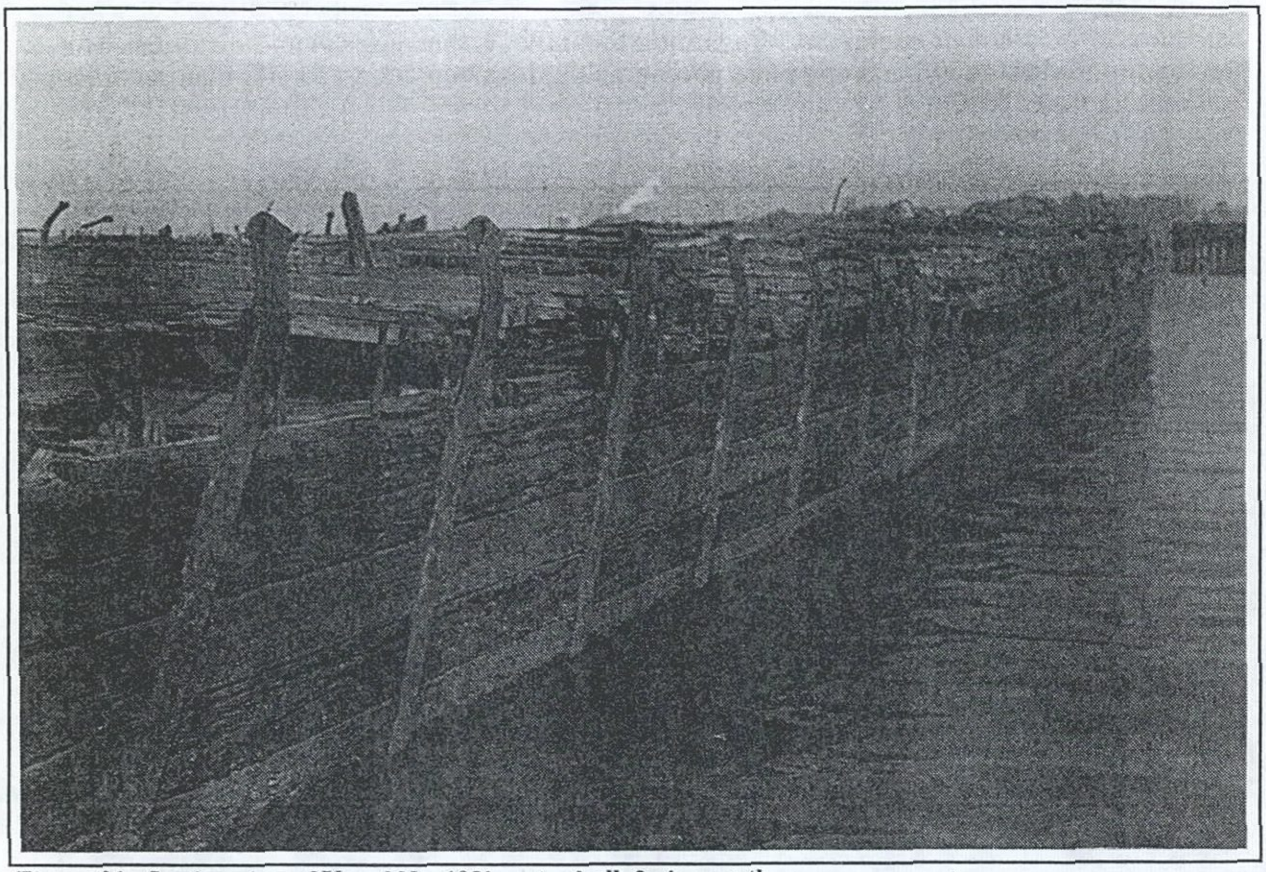


Figure 91. Section view of Vessel No. 193's outer hull, facing south.

Arthur Kill, New Jersey Reach

Vessel No. 15 (Figure 92)
Vessel Type: Work barge
General Location: Arthur Kill, New Jersey Reach near Port Reading creosote plant
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The vessel is unique because of the mortised keelsons running longitudinally. There are two sets of longitudinal bulwarks, consisting of vertically scarfed stacked timbers. Vertical stanchions are fastened flush against the bulkheads. Wooden cross-bracing runs transversely.
Recommendation: This vessel possess certain features (typological and constructional) best representing a project-area type under Criteria C and D. It is recommended that the vessel receive complete photographic documentation and site plan recordation, as feasible. This data, in turn, should be compared to data derived from other similar barge types in the project area.

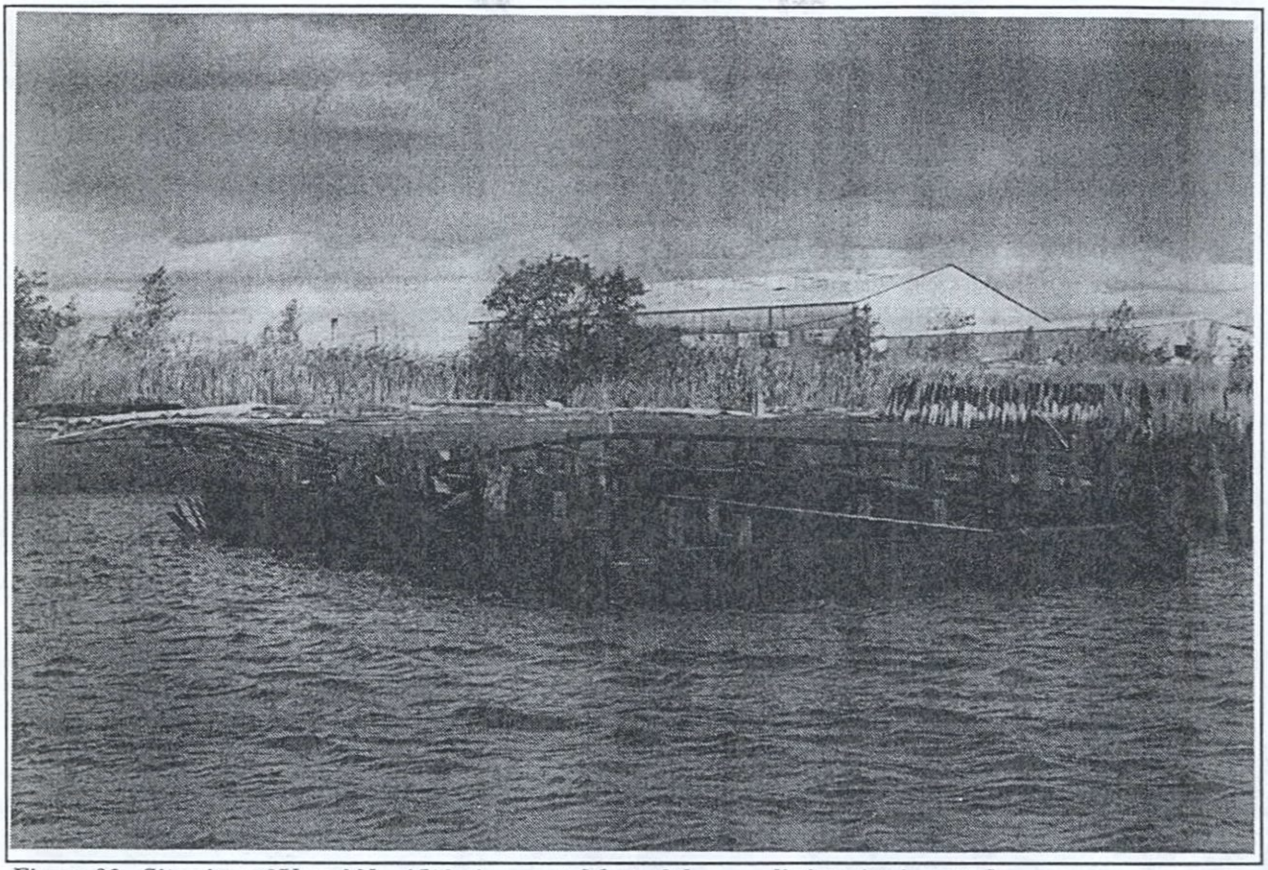


Figure 92. Site view of Vessel No. 15, facing west. Most of the vessel's interior is gutted.

Vessel No. 91
Vessel Type: Work barge
General Location: Arthur Kill, New Jersey Reach (Edward O. Wickberg)
Date Abandoned: 1978 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: Removed by Perth Amboy Dry Dock between 1994 and 1995.

Vessel No. 95
Vessel Type: Unidentified (possible work barge)
General Location: Arthur Kill, New Jersey Reach (Edward O. Wickberg)
Date Abandoned: Unknown
Description: The vessel is apparently a work barge, raked and metal strapped at one end. The vessel is filled with debris. There is also evidence of concrete construction. Very little vessel remains are visible.
Recommendation: Based on comparative project-area data, this vessel is not a best representative type. No further work is recommended.

Kill Van Kull, New York Reach

Vessel No. 119 (Figure 93)
Vessel Type: Concrete plant
General Location: Kill Van Kull, New York Reach near SP&B
Date of Abandonment: 1970 (Raber et al. 1995b)
Description: A basic barge design, the vessel measures approximately 330 x 40 ft. The lower hull is submerged. Rails run longitudinally on top of steel and asphalt decking. Most of the concrete mixing machinery rests disarticulated on the deck.
Recommendation: Though the only concrete plant barge in the project area, the vessel does not possess distinctive construction features to warrant significance. No further research is recommended.

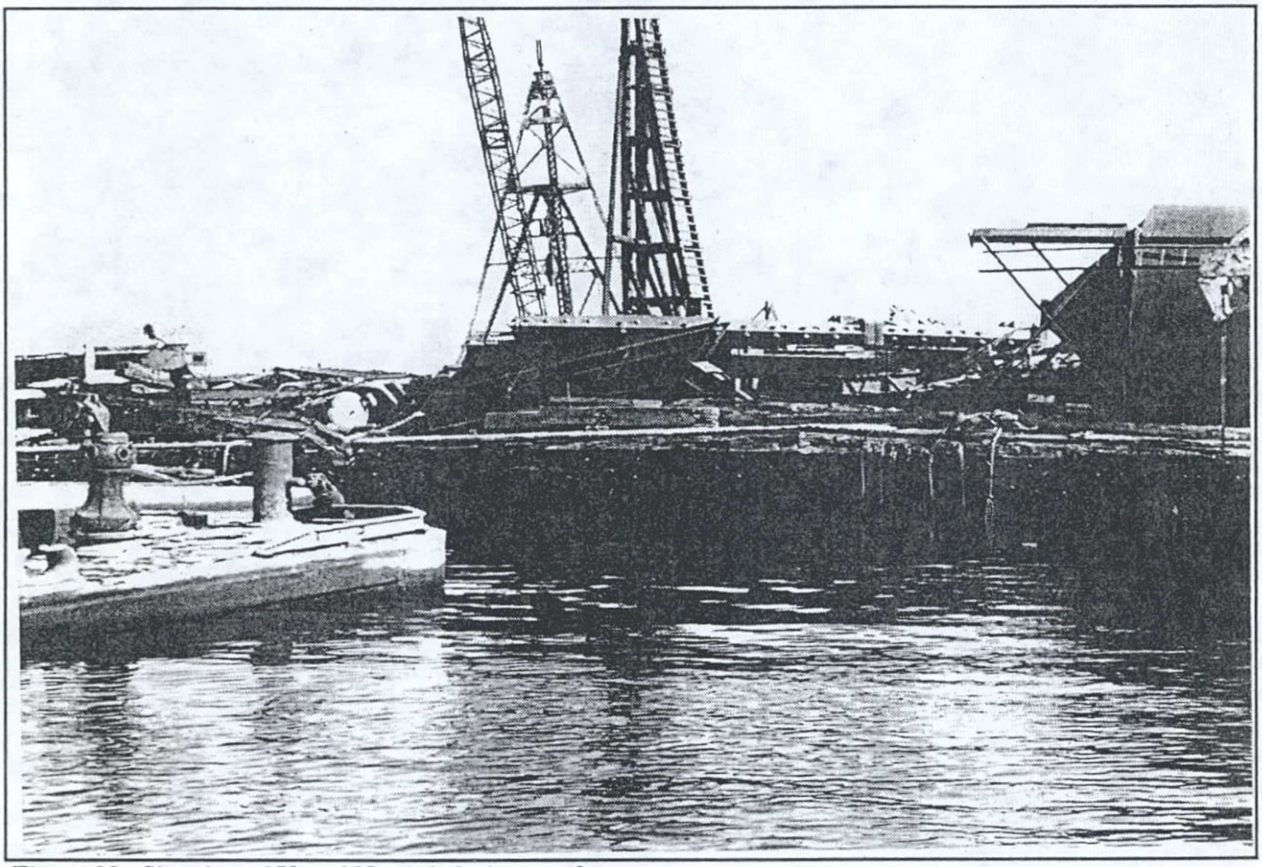


Figure 93. Site view of Vessel No. 119, facing north.

Vessel No. 105 (Figures 94)
Vessel Type: Medium-sized wooden A-frame crane barge
General Location: Kill Van Kull, New York Reach near Spearin, Preston, and Burrows (SP&B)
Date of Abandonment: 1985 (Raber et al. 1995b)
Description: The steel A-frame is standing, though in disrepair. Extant are a wooden cabin, a work station, and engine room machinery. The barge is almost completely submerged.
Recommendation: Although the vessel possesses constructional features unique to crane barges (Criterion D), safety concerns should limit recordation to photographic documentation only.

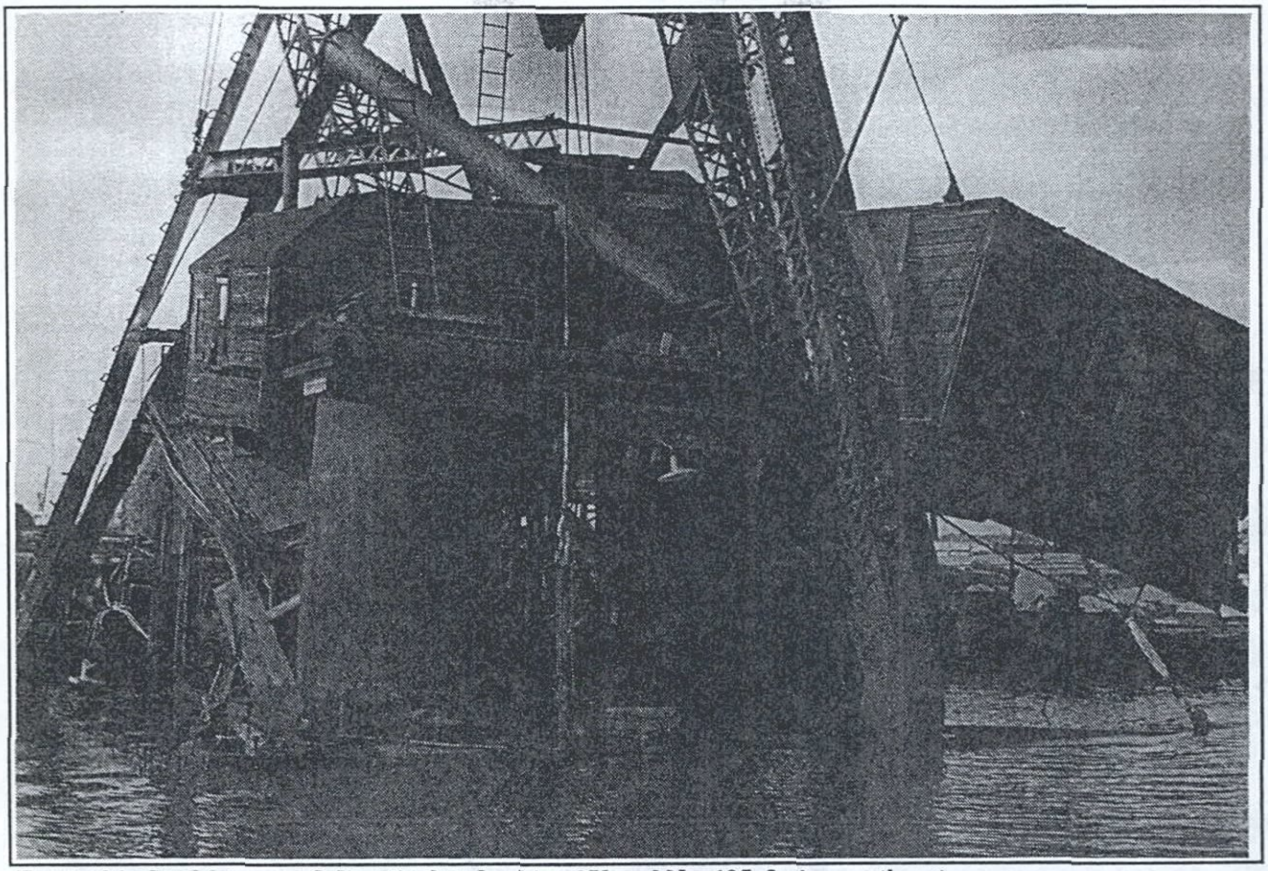


Figure 94. Steel frame and disarticulated cabin of Vessel No. 105, facing southeast.

Vessel No. 169 (Figures 95 and 96)
Vessel Type: Medium wooden A-frame crane barge
General Location: Kill Van Kull, New York Reach near Milliken/Downey Shipyard
Date Abandoned: 1955 (Raber et al. 1995b)
Description: The vessel is in poor shape. The A-frame is collapsed on deck. One end is scow bowed with vertical metal strapping. Planking is fastened with vertical rebar.
Recommendation: The vessel's poor condition removes it from further consideration. No work is recommended.

Figure 95. Deck remains of Vessel No. 169 showing longitudinal deck beams, facing west.

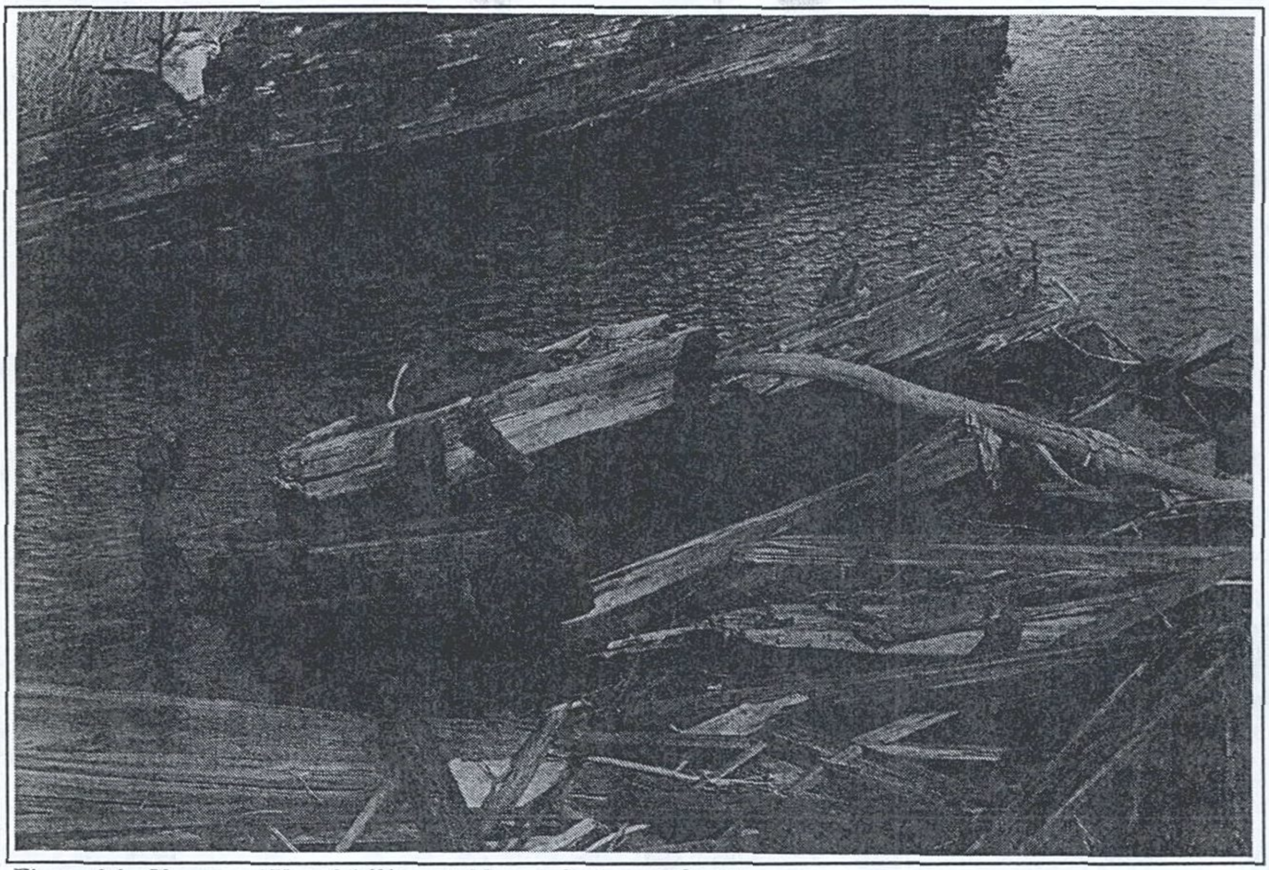


Figure 96. Closeup of Vessel 169's metal knees, facing southeast.

HOLD BARGES. Hold barges moved bulk commodities, especially grain and coal. These boats featured construction designs similar to canal boats, i.e., large, accessible deck hatches with deep holds. Not restricted by canal or lock dimensions, these boats measured between 25 and 35 ft. in breadth, 90 to 100 ft. in length. Box designs (except for a short upturn of the bottom) led to the vernacular box barge (Figure 97). Sometimes known as a coal or grain box, the boat usually featured a cabin, hatch boards, or a canvas tarpaulin covering cargo, particularly grain (Brouwer 1996).

Dimensions for the hold barge *Quincy Adams*, built in 1917 at South Rondout, New York, provides data typical for project-area hold barges. The vessel measured 122.7 ft. long, 28.4 ft. in breadth, with a depth of hold measuring 13.4 ft. (GPO 1937). The depth is almost double that of a scow hull. As with scows, there is usually a crew cabin at the stern, either built on deck or sunk into it about 4 ft. A large, open hatch (with low coamings) took up most open main deck space. For transverse strength, the hatch opening usually featured three or more permanent beams.

When a cargo required protection from the elements, fitted longitudinal strongbacks (installed on the centerline) formed a peaked roof. The side planking consisted of single timbers laid over vertical frames. The frames joined to the underside of the deck on either side of the hatch and to the floors with natural hanging or standard knees. The frame and knees are exposed at the sides of the hold, but the floors running across the bottom of the hold are protected by planked decking (Brouwer 1996).

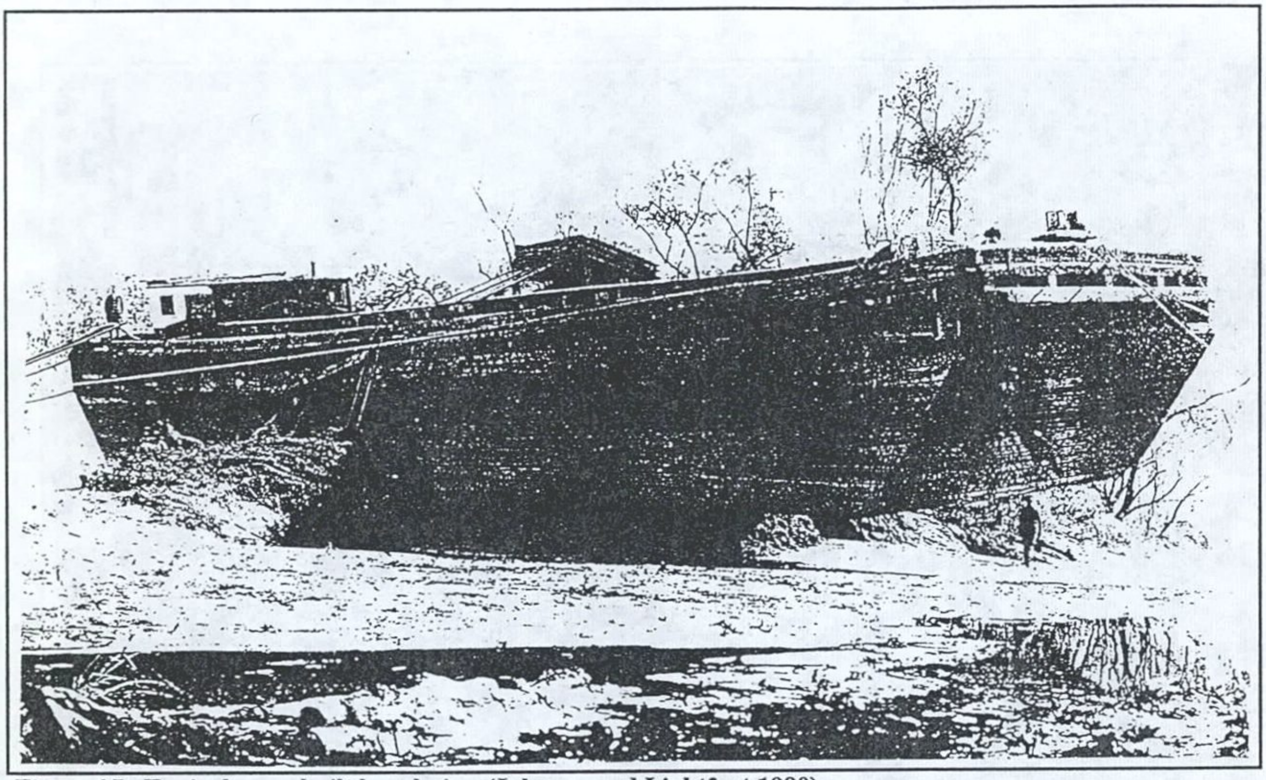


Figure 97. Typical scow-built box design (Johnson and Lightfoot 1980)

WF & R Boatbuilder plans for a large grain box (barge) (Figures 8, 9, and 10, Volume II) from the Feeney Collection (1920-1922) show two amidship (cross-section) and side views of a typical peaked-roof hold barge. Figure 8 (Volume II) provides an overall length (31 ft.) and outerhull height (15 ft.) and shows the location, size, and spacing of keelsons, kingposts, hanging knees, deck beams, and strongback. Figure 9 (Volume II) provides general data on the vessel's bow and stern configuration, stanchion location, and scarfing patterns. Figure 10 indicates general fastening location and types. The information provided by the Feeney plans, compared with similar vessel types within the project area, will provide functional and construction similarities and differences. Barge designs are basically the same. However, depending on barge use, each type displays constructional nuances.

WOODEN COASTWISE HOLD BARGE. Figures 98 and 99 display plans of a 1903 coastwise hold barge. According to the *Nautical Gazette* (8 October 1903), the barge is of average size, about 100 ft. long by 26 ft. beam. Longitudinal logs form the bottom framing. The planked sides serve as heavy girders. Heavy beams are connected by wooden knees. The transverse connections on the bottom are comparatively light, consisting of the outside transverse planks 3 x 12 in. The center keel and keelson is a single log 12 x 12. in. The corner keelsons are the same dimensions; the intermediate sister keelsons are 8 x 12 in. The side planks are 6 x 12 in., while the garboards are 8 x 12. in. The wales are composed of two pieces, each 8 x 12 in.

The deck planking measures 6 x 3 in. The plank sheer is 3 x 12 in. with a rail 5 x 7 in. running along the sides of the barge lifted off from the deck by distance pieces. The heavy hatch coaming is composed of a lower strake 8 x 12 in. and an upper strake 6 x 12 in., all around the hatch. The deck beams are 12 x 6 in., having a crown of 4 in. in their length with a spacing of 10 ft. At the center each beam is a strong stanchion, 12 x 12 in., connected by an iron strap 6 x 1/2 in. The knees that connect the deck beams to the sides are 7 in. thick by 3 ft. long on the beam

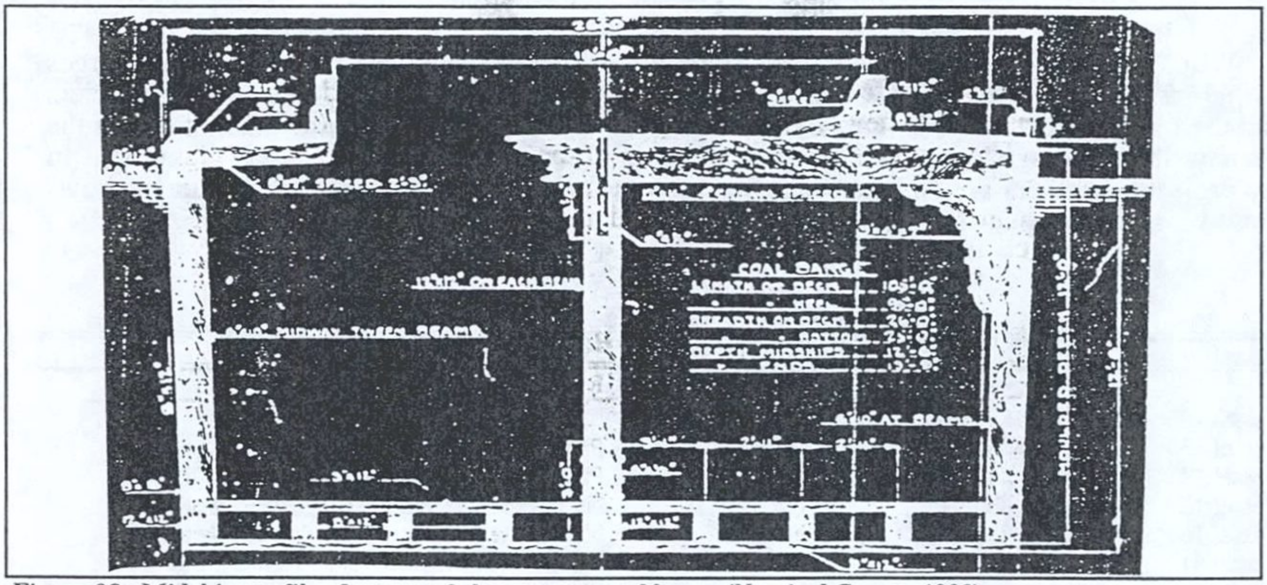


Figure 98. Midship profile of a turn-of-the-century coal barge (*Nautical Gazette* 1903).

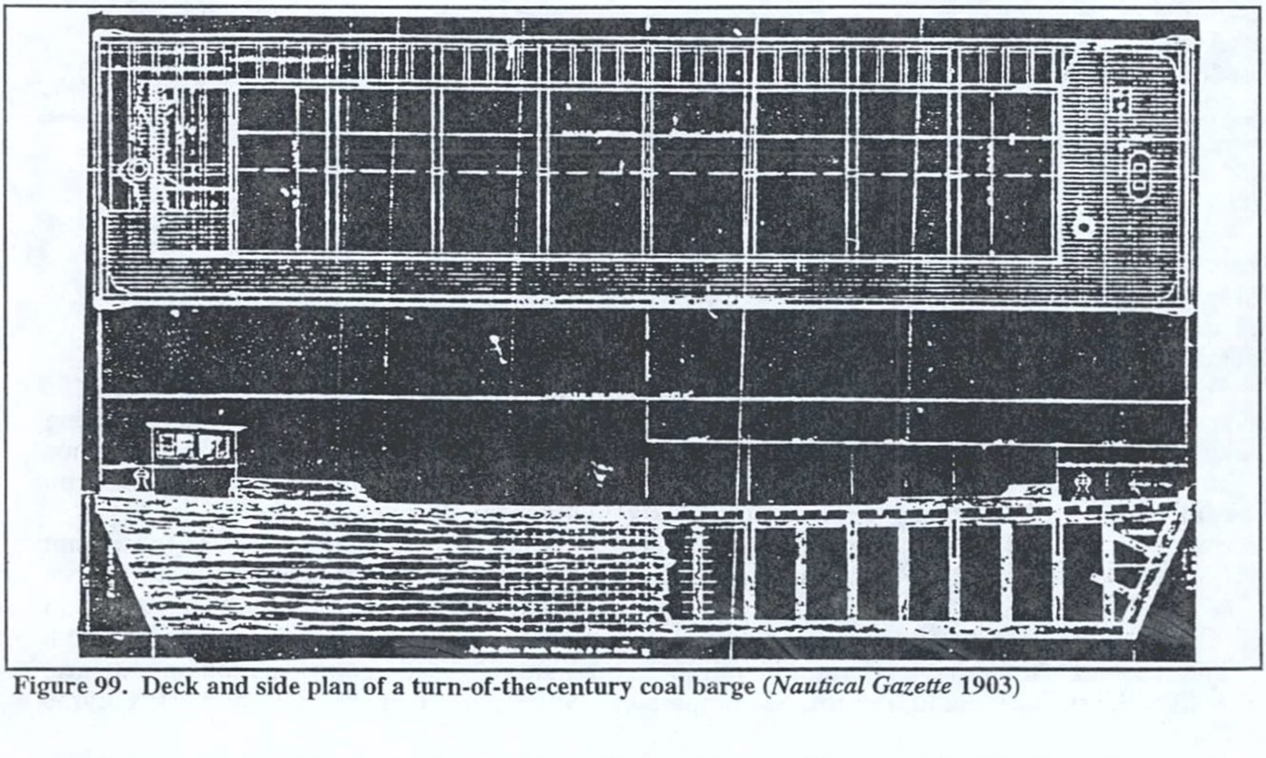


Figure 99. Deck and side plan of a turn-of-the-century coal barge (*Nautical Gazette* 1903)

and 4 ft. long on the side vertical stanchion. These side stanchions are 6 x 10 ft. with a spacing of 5 ft. Additional half beams, 5 x 7 in., are placed between the main beam at a spacing of 2 ft. 3 in. for more efficient support of the deck planking (*Nautical Gazette* 1903).

The fastenings are particularly strong in the side planking, where heavy bolting unites all the members into one rigid girder. Galvanized iron rods 7/8 in. in diameter are driven edgewise through the planks at a spacing of 2 in. The knees also show the demand of strong fastenings at this junction. The center stanchions are connected with strong bolts to the iron straps that form the tie to the beams on top and for the main keelson on the bottom (*Nautical Gazette* 1903).

Wooden coastwise hold barges (coal, grain, box barges) are similar in design to canal barges but larger for coastwise use. They often carried grain or coal between railroad-owned coal piers and their customers. There is limited documentation of the design. Available drawings from the Feeney Shipbuilding Company show general design features (Figures 8, 9, 10, Volume II). In the project area, there are 10 sites identified as wooden coastwise hold barges. Table 13 shows those vessels identified as wooden coastwise barges.

Table 13. Summary of Hold Barges Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 106	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 134	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 135	Arthur Kill, NY	No	Not best representative, no further work
Vessel 160	Arthur Kill, NY	No	Not best representative, no further work
Vessel 169	Arthur Kill, NY	No	Not best representative, no further work
Vessel 41	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 42	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 44	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 52	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 106	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 157	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 166	Kill Van Kull, NY	No	Not best representative, no further work

Arthur Kill, New York Reach

Vessel No. 106 (Figure 100)
Vessel Type: Wooden coastwise hold barge
General Location: Arthur Kill, New York Reach near the Kreisher Brick Works
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Raked at both ends, an iron cross beam runs transversely amidship. The vessel is scantily built, but physically in good shape. On both ends are large boxes. Wooden hanging knees, along with iron lodging knees, are present at both box corners. Metal bracing straps attach at the corners. Vertical stanchions, with metal straps over transverse deck beams, run centerline. Built in typical barge fashion, it is a good representative type.
Recommendation: Based on Criteria A and D, this vessel possess distinctive features to warrant further investigation. Considerations include vessels involved in maritime commerce (Criterion A) and research yielding information on its use and methods of construction (Criterion D). Complete photographic documentation and site recordation are recommended. The research should include, but not be limited to, materials used in construction and historic design. This data should, in turn, be compared to vessel plans (Figures 8, 9, and 10, Volume II).

Figure 100. Midship view of Vessel No. 106, facing east. Most of the vessel's lower hull appears intact.

Vessel No. 134 (Figure 101)
Vessel Type: Wooden coastwise hold barge
General Location: Arthur Kill, New York Reach, north of the Outer Bridge
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Typical rectangular barge with a slight rake. Lower hull includes a center keelson and 10 intermediate keelsons. Vertical centerline stanchions are attached to the center keelson. It is unclear whether these stanchions are notched or mortised. Both port and starboard frames are supported by vertical stanchions mortised or notched into the bilge log. The superstructure exhibits fire damage.
Recommendation: As in Vessel No. 134, it is recommended this vessel receive complete photographic documentation and site plan recordation. This data should, in turn, be compared and contrasted with Vessel. No. 134.

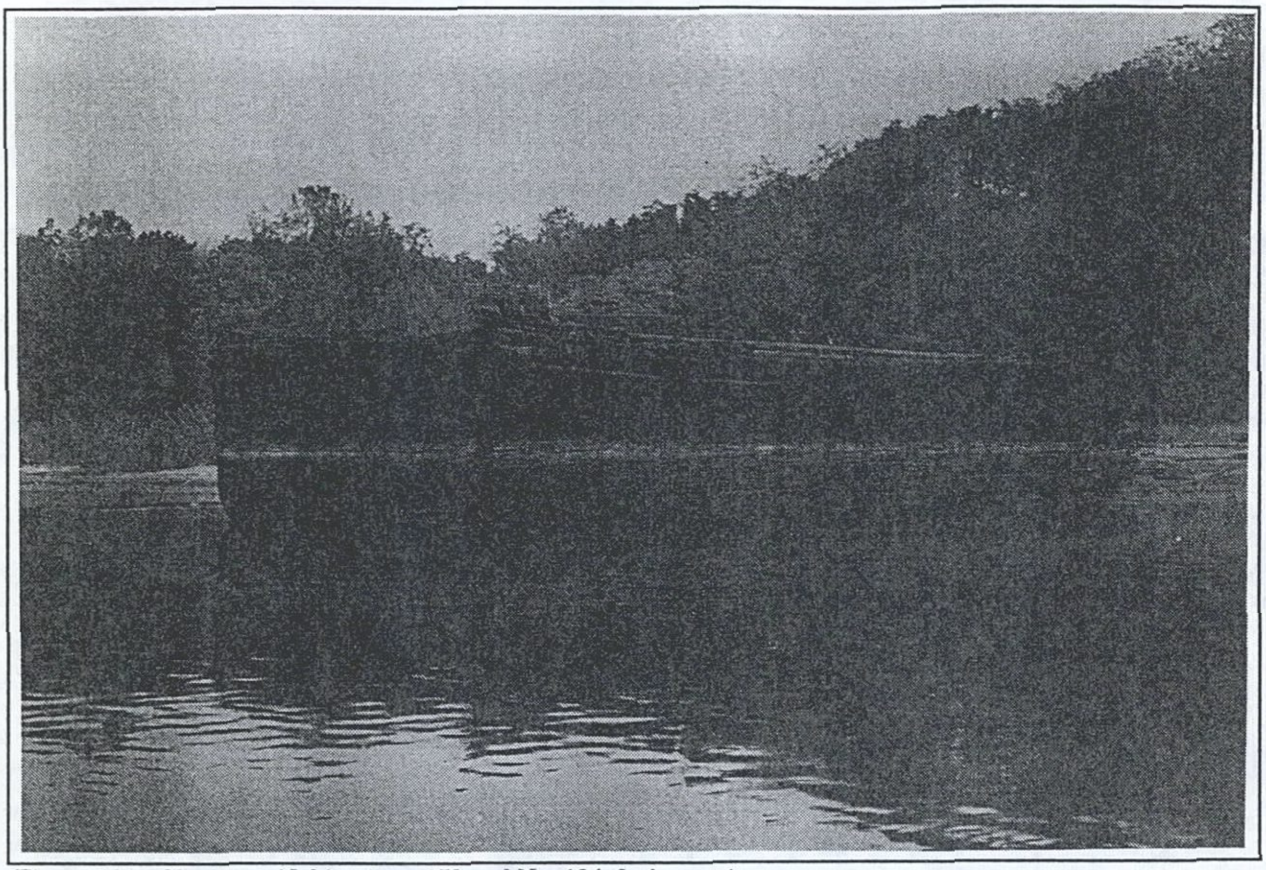


Figure 101. Closeup midship view of Vessel No. 134, facing east.

Vessel No. 135 (Figure 102)
Vessel Type: Wooden coastwise hold barge
General Location: Arthur Kill, New York Reach, north of the Outerbridge
Date of Abandonment:1961 (Raber et al. 1995a)
Description: Similar in design to Vessel No. 134, the barge rests on the bank of Staten Island. It is dilapidated and in poor condition.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

Vessel No. 160 and No. 169
Vessel Type: Wooden coastwise hold barge
General Location: Arthur Kill, New York Reach, north of the Outerbridge
Date of Abandonment 1932(?) (Raber et al. 1995a)
Description: The vessels sit far out on a mud flat and are difficult to access at low tide. Remains (sides, stanchions, decks) appear collapsed.
Recommendation: The vessels are not a best representative type for the project area. No further work is recommended.

Figure 102. Site view of Vessel No. 135, facing southeast.

Arthur Kill, New Jersey Reach

Vessel No. 41 (Figure 103)
Vessel Type: Wooden coastwise hold barge
General Location: Arthur Kill, New Jersey Reach, near Segrave Transportation/LVRR
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The vessel's cabin is extant, as is the forward outerhull. Rub rails are attached at each end corner.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

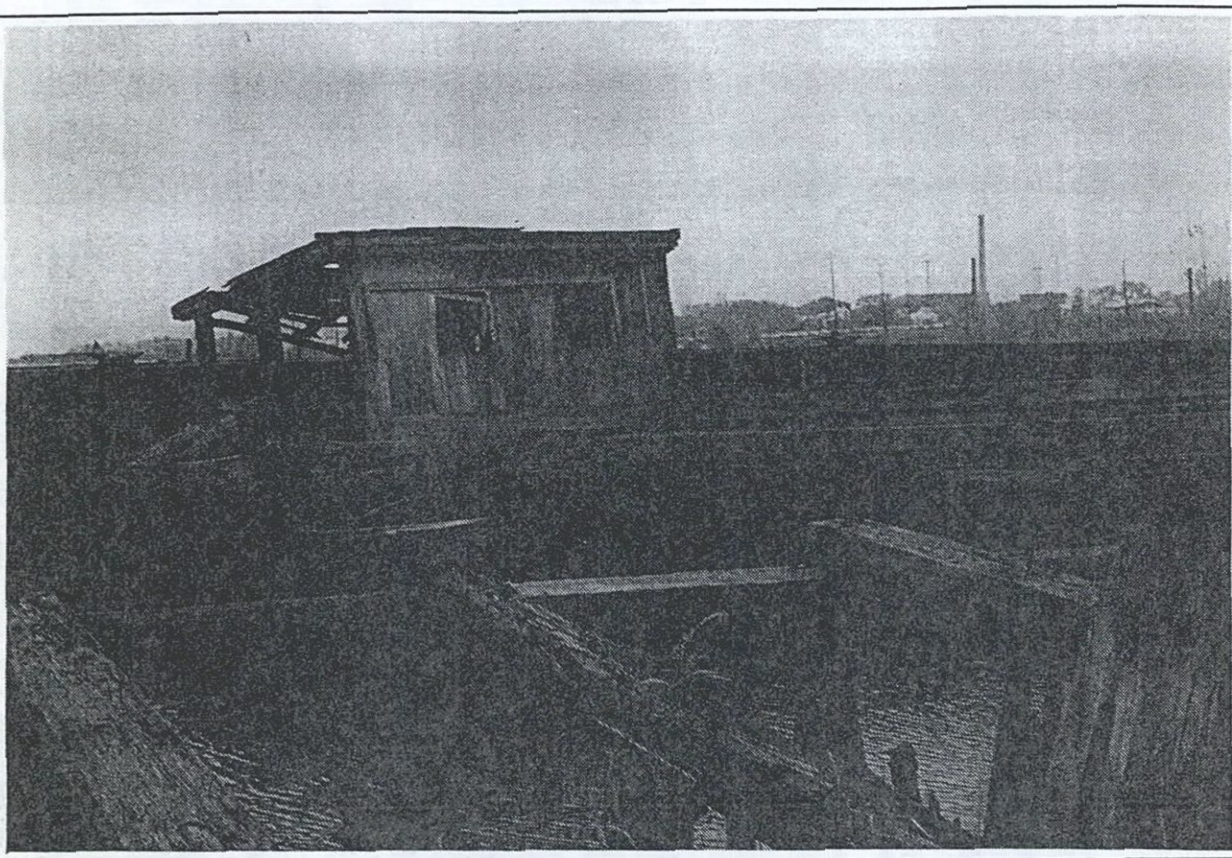


Figure 103. Extant cabin structure of Vessel No. 41, facing northeast.

Vessel No. 42 (Figure 104)
Vessel Type: Wooden coastwise hold barge
General Location: Arthur Kill, New Jersey Reach, near Segrave Transportation/LVRR
Date Abandoned: 1951 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The vessel is rectangular, and the sides are vertical. The lower hull section is submerged at low tide. There are no interior full height longitudinal bulkheads. Five vertical stanchions run longitudinally centerline. Deck beams are present. Fasteners are wooden and iron.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

Vessel No. 44 (Figure 105)
Vessel Type: Wooden coastwise hold barge
General Location: Arthur Kill, New Jersey Reach, near Segrave Transportation/LVRR
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: A rectangular hull plan, narrow beamed, with marginally curved sides, the barge's lower hull features are submerged at low tide. Vertical stanchions run centerline. On deck is a "box" hold, with vertical sides and trapezoidal ends. The "box" is secured by wooden knees. One end is painted "*Trans Co. Inc.*"
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

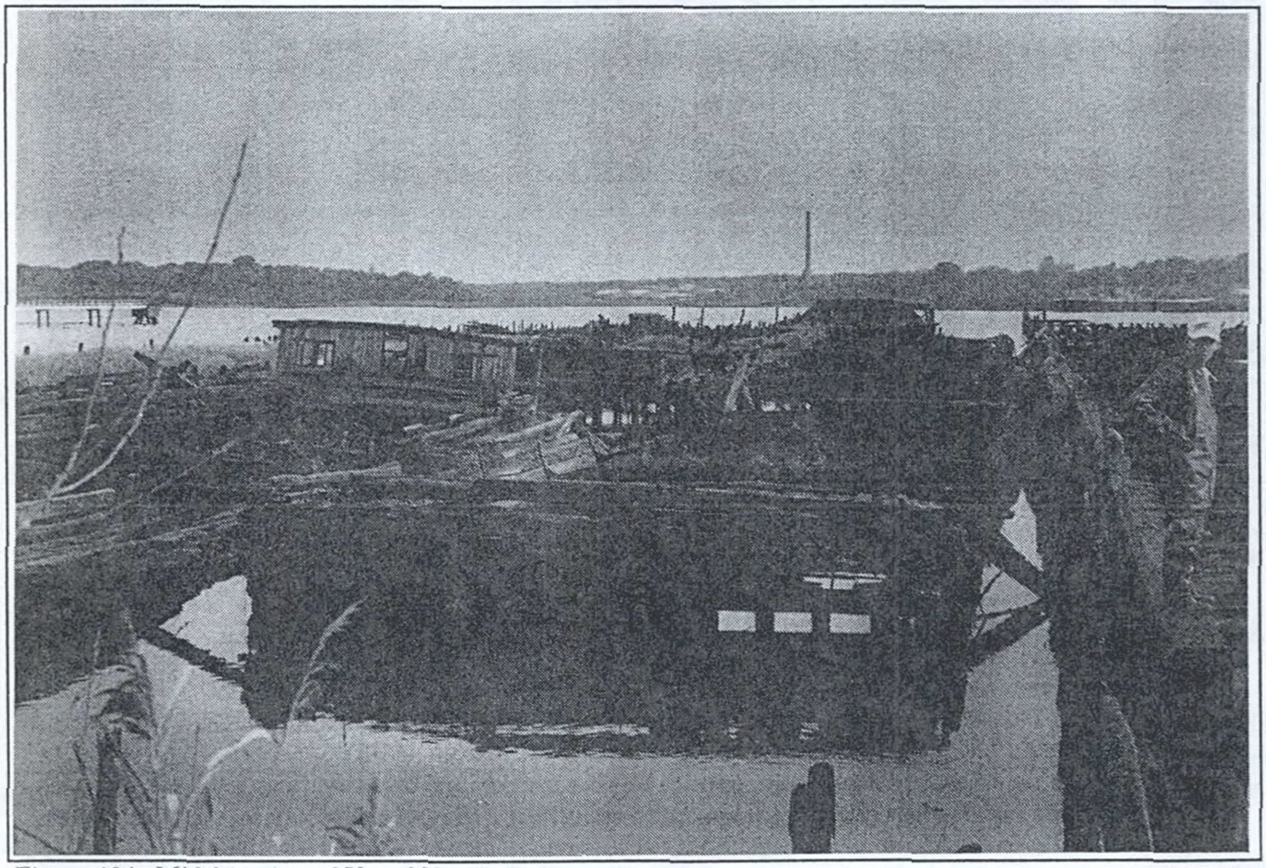


Figure 104. Midship view of Vessel No. 42, facing west.

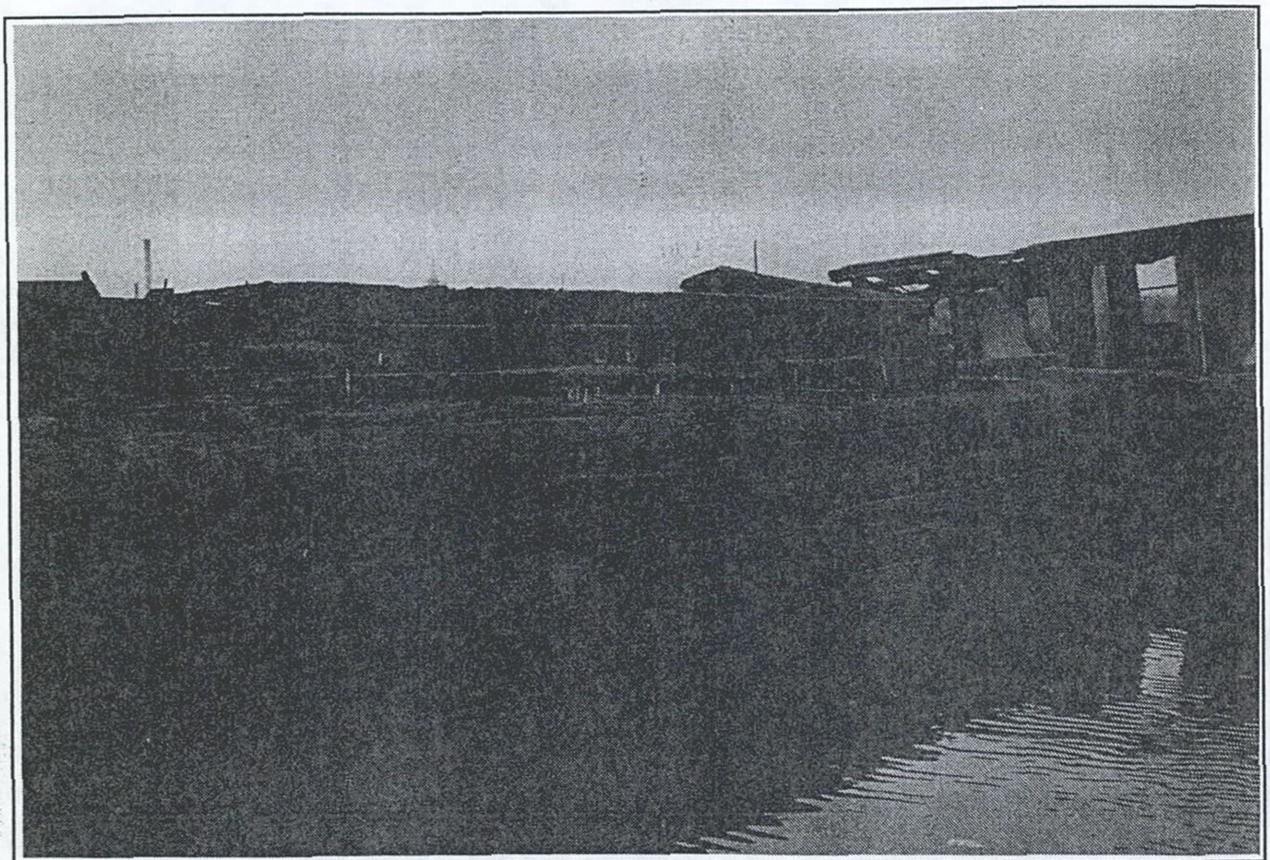


Figure 105. Outer side planking of Vessel No. 44, facing south.

Vessel No. 52 (Figure 106)
Vessel Type: Wooden coastwise hold barge
General Location: Arthur Kill, New Jersey Reach, near Segrave Transportation/LVRR
Date of Abandonment: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The remains of the vessel are minimal. Both ends are slightly raked. Six charred center stanchions (with metal straps) are located where deck beams would run. A few remnants of hanging knees are present, but most are burned. The vessel also has metal rubbing rails.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

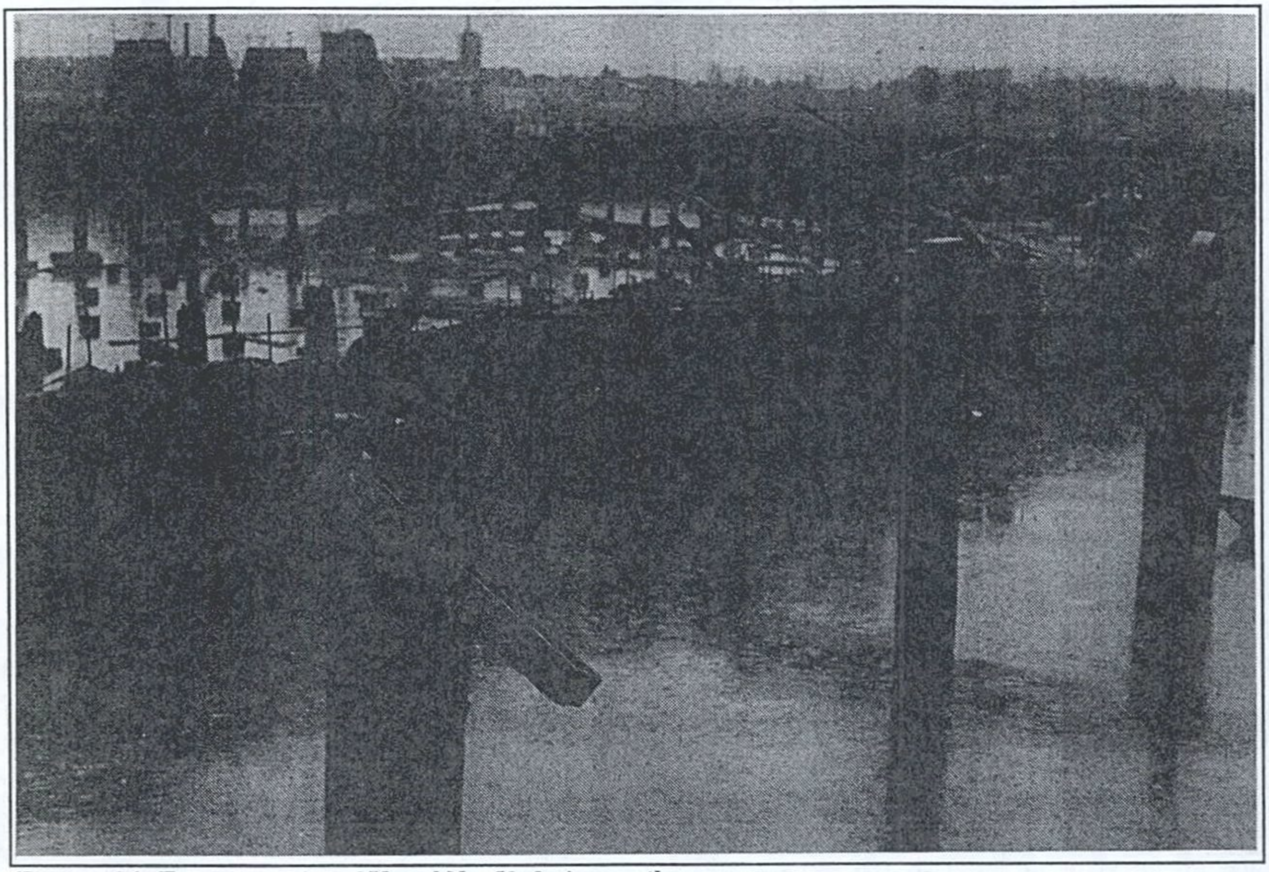


Figure 106. Extant remains of Vessel No. 52, facing south.

Kill Van Kull Reach

Vessel No. 166 (Figure 107)
Vessel Type: Wooden coastwise hold barge
General Location: Kill Van Kull, New York Reach, near Milliken/Downey Shipyard
Date Abandoned: 1955 (Raber et al. 1995b)
Description: The vessel's outer hull is extant, though most of the vessel is disarticulated. The barge has square, vertical ends; the stern end is heavily framed. Seven centerline stanchions with iron clamps are visible. Three deck beams are partially extant. Some planking is evident. Planking is fastened with vertical reinforced turnbuckles.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

SCOWS. The scow, a non-self-propelled open boat, is flat bottomed without mast or derrick. Generally used for non-bulk, non-perishable commodities requiring little or no protection, the main deck provided storage. To support the weight of the cargo, the hull contained an elaborate system of bulkheads, pillars, trusses, or braces, each designed or adapted for a particular type of cargo. To avoid dramatic cargo shift, the boat featured low coamings port and starboard, bulkheads forward and aft. Hudson River brick scows lacked these bulkheads. Cranes or derricks unloaded the cargo. If the ship lacked hoisting machinery, scows equipped with a steam-powered winch maneuvered alongside (Brouwer 1996).

Figure 107. Remains of Vessel No. 166, facing south.

Figure 11, Volume II contains barge plans for a standard scow design built by W.E. & R Boatbuilders, Inc. (Feeney Collection, n.d.). Figure 11 indicates cross sections of a stanchion-type scow (upper) and bulkhead scow (lower). The figure provides location and size of stringers, cross sills, keelsons, stanchions, side planking, and decking for the stanchion-type scow. Measurements and location of bulkheads for a bulkhead scow are also listed in Figure 11.

Figure 12, Volume II, shows deck frame stringer details for a deck scow. The deck plan for the 115-x-36-ft. vessel includes a timber list demarcating timber location, number, size, and length. Figures 13 and 14 offer detailed measurements on the vessel's cabin structure. The information presented in these plans offers comparative data for Vessel No. 92's recommended photographic and site documentation. Table 14 indicates vessels in the project area identified as scows. The typology includes harbor and open-decked scows.

Table 14. Summary of Scows Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 104	Arthur Kill, NY	No	Not best representative, no further work
Vessel 92	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 16	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 92	Arthur Kill, NJ	Yes	Photo and site documentation
Vessel 157	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 158	Kill Van Kull, NY	No	Not best representative, no further work

Arthur Kill, New York Reach

Vessel No. 104 (Figure 108)
Vessel Type: Wooden harbor open-decked scow
General Location: Arthur Kill, New York Reach near Kreisher Brick Works
Date of Abandonment: 1971 (Raber et al. 1995a)
Description: The vessel is submerged to the waterline. Typical scow bowed, the stern is raked. The boat appears double-ended. Four longitudinal beams support the deck by the use of wooden cross framing. Resting on top of the deck sits a large 360-degree crane (on tracks).
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

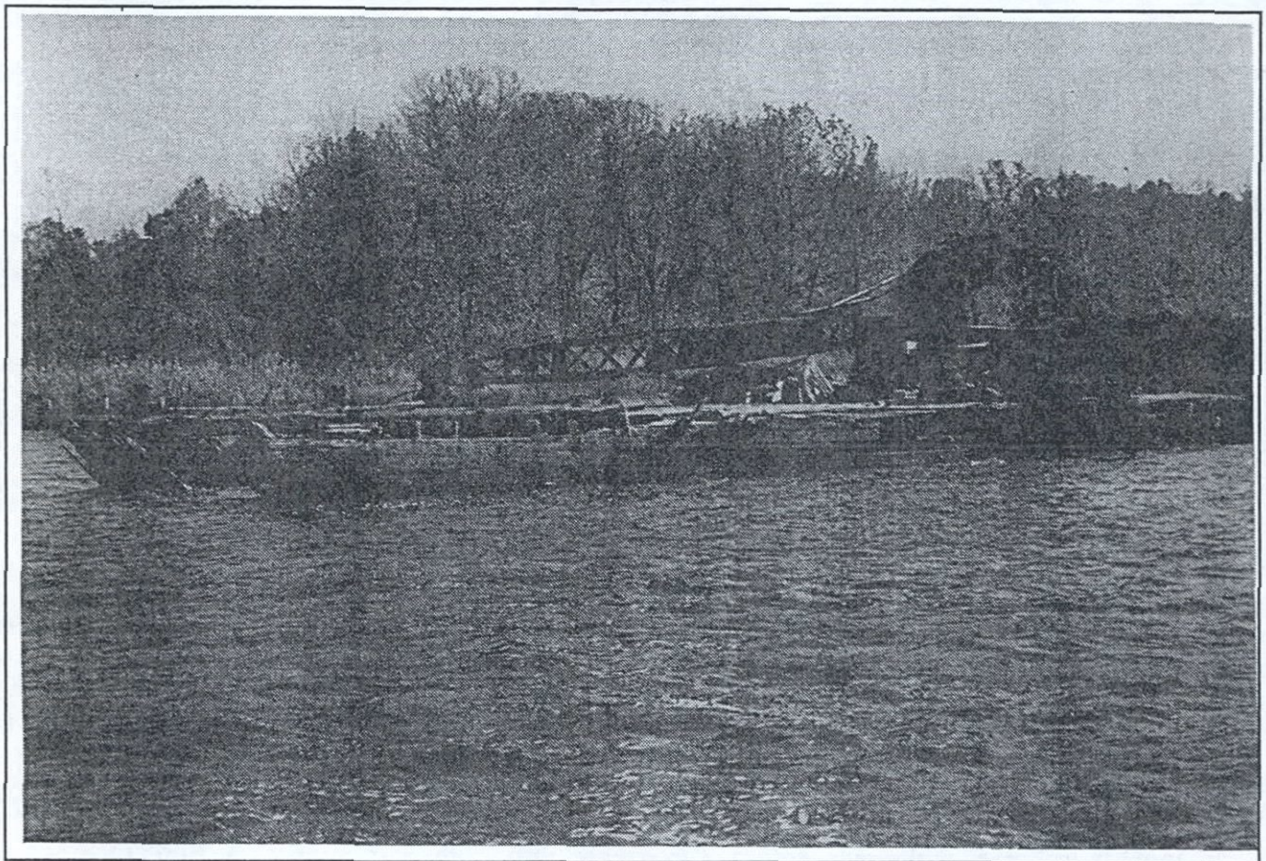


Figure 108. Site view of Vessel No. 104, facing northeast.

Arthur Kill, New Jersey Reach

Vessel No. 16 (Figure 109)
Vessel Type: Wooden harbor open-decked scow
General Location: Arthur Kill, New Jersey Reach near the Port Reading terminal area
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: Decking is partially extant. The scow is squared ended. Most of its side planking and framing are gone. At one end stands a single bollard.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.


Figure 109. Site view of Vessel No. 16, facing west. Most of the vessel is submerged.

Vessel No. 92 (Figures 110 and 111)
Vessel Type: Wooden harbor deck scow
General Location: Arthur Kill, New Jersey Reach (Edward O. Wickberg)
Date Abandoned: 1978 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The vessel is raked in scow fashion. Most of the vessel is covered with debris on deck. However, the vessel's internal structure is visible. These features include double-planked decking, longitudinal frame members, and vertical stanchions.
Recommendation: This vessel should receive research attention based on Criterion D, since its interior hull features are intact and in good shape. The harbor deck scow's history as a "channel workhorse" make recordation of the vessel important, particularly since this type of boat is usually ignored in historical/archaeological research. Photographic documentation and scantling measurements compared with other relevant data associated with similar project-area types should reveal the general nature of construction methods.

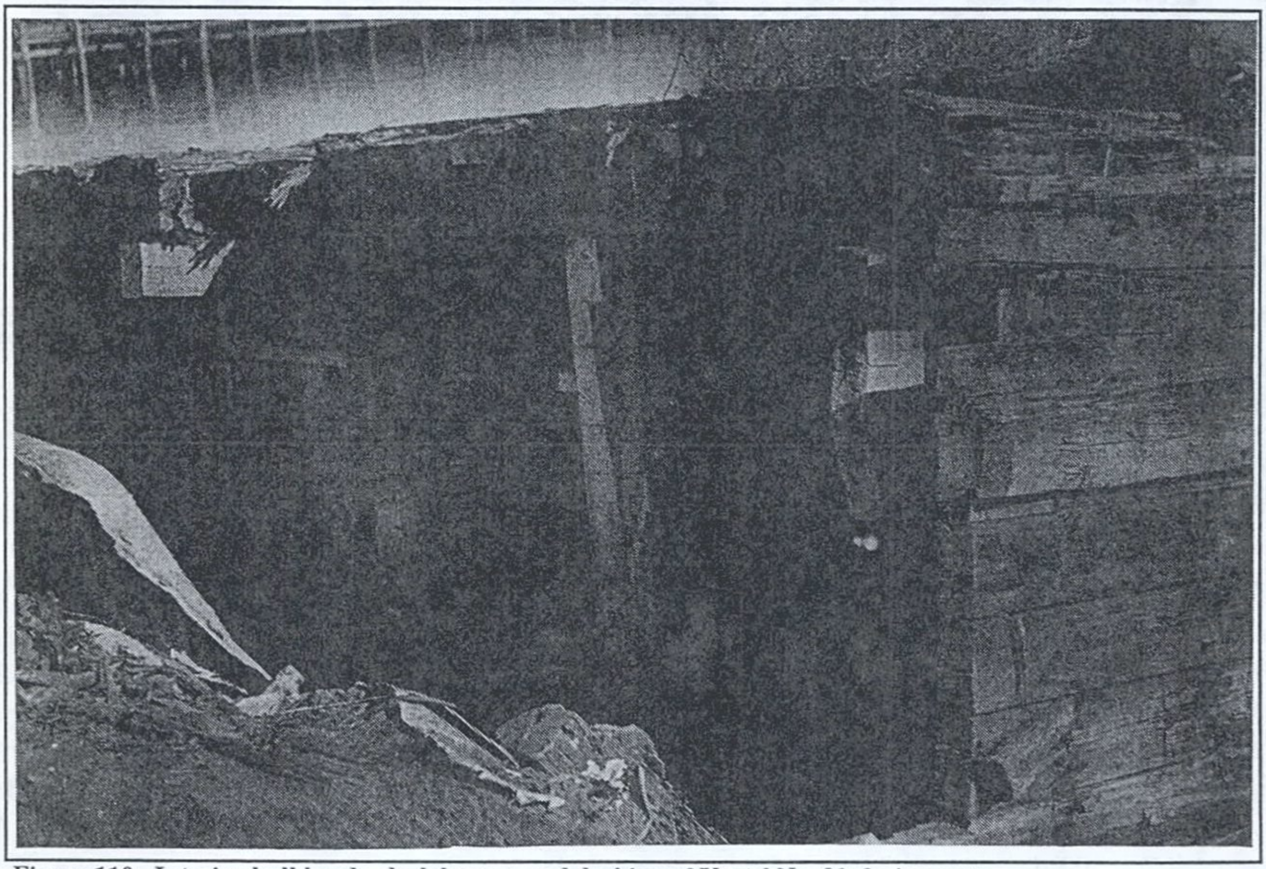


Figure 110. Interior bulkheads, deck beams, and decking of Vessel No. 92, facing east.

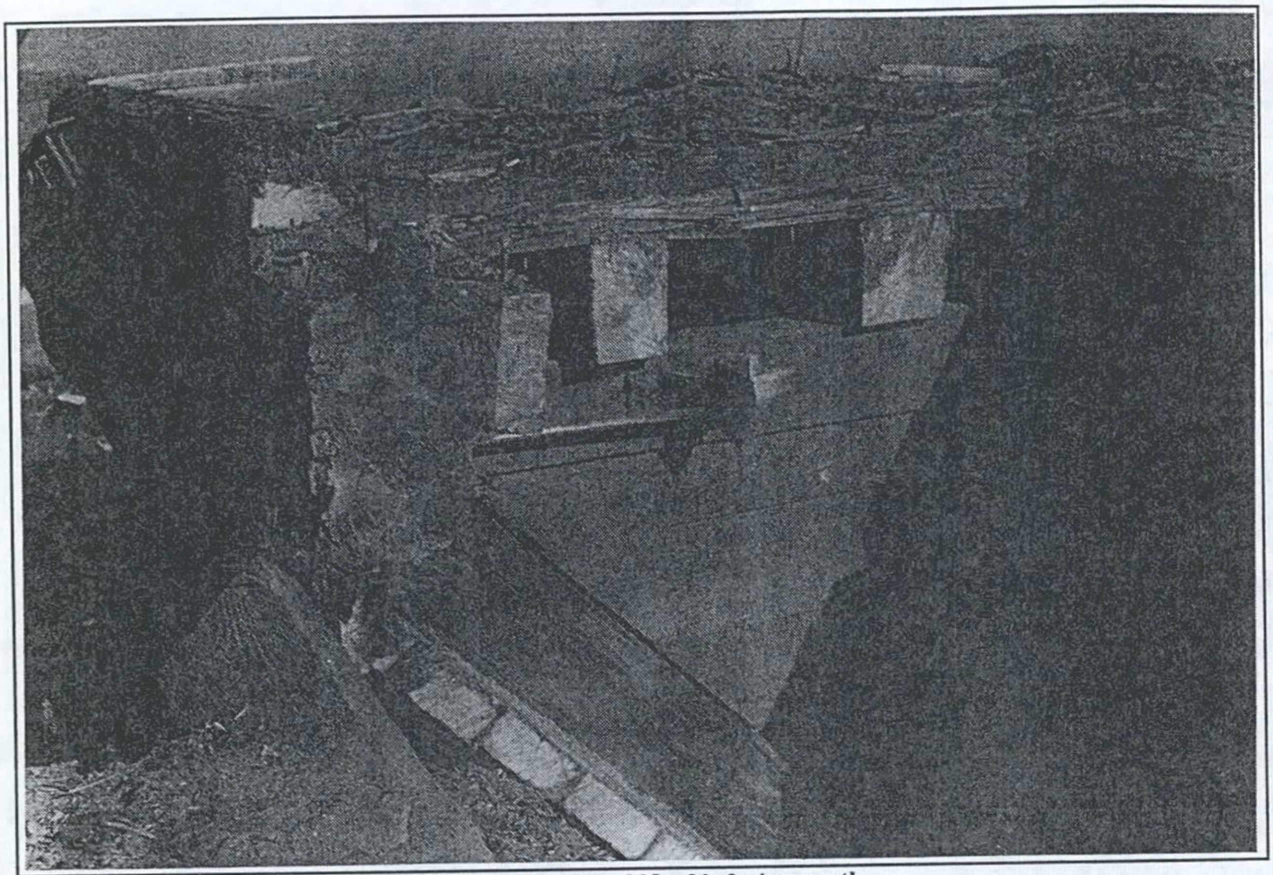


Figure 111. Scow end and interior bulkhead of Vessel No. 92, facing north.

Kill Van Kull Reach

Vessel No. 157 (Figure 112)
Vessel Type: Wooden harbor open-decked scow
General Location: Kill Van Kull, New York Reach near the Milliken/Downey Shipyard
Date Abandoned: 1955 (Raber et al. 1995b)
Description: The vessel, severely burned, features two disarticulated scow ends. All fasteners are metal, some of which are diamond headed. Anchor stocks are evident at both ends.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

Vessel No. 158 (Figure 113)
Vessel Type: Wooden open-decked scow
General Location: Kill Van Kull, New York Reach near Milliken/Downey Shipyard
Date Abandoned: 1955 (Raber et al. 1995b)
Description: The barge is wooden, scow bowed, with a concrete covered deck. Side planking is fastened with vertical rebar and iron spikes. Most of the inner hull construction is not observable. Longitudinal bulkheads provide support for the upper deck.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

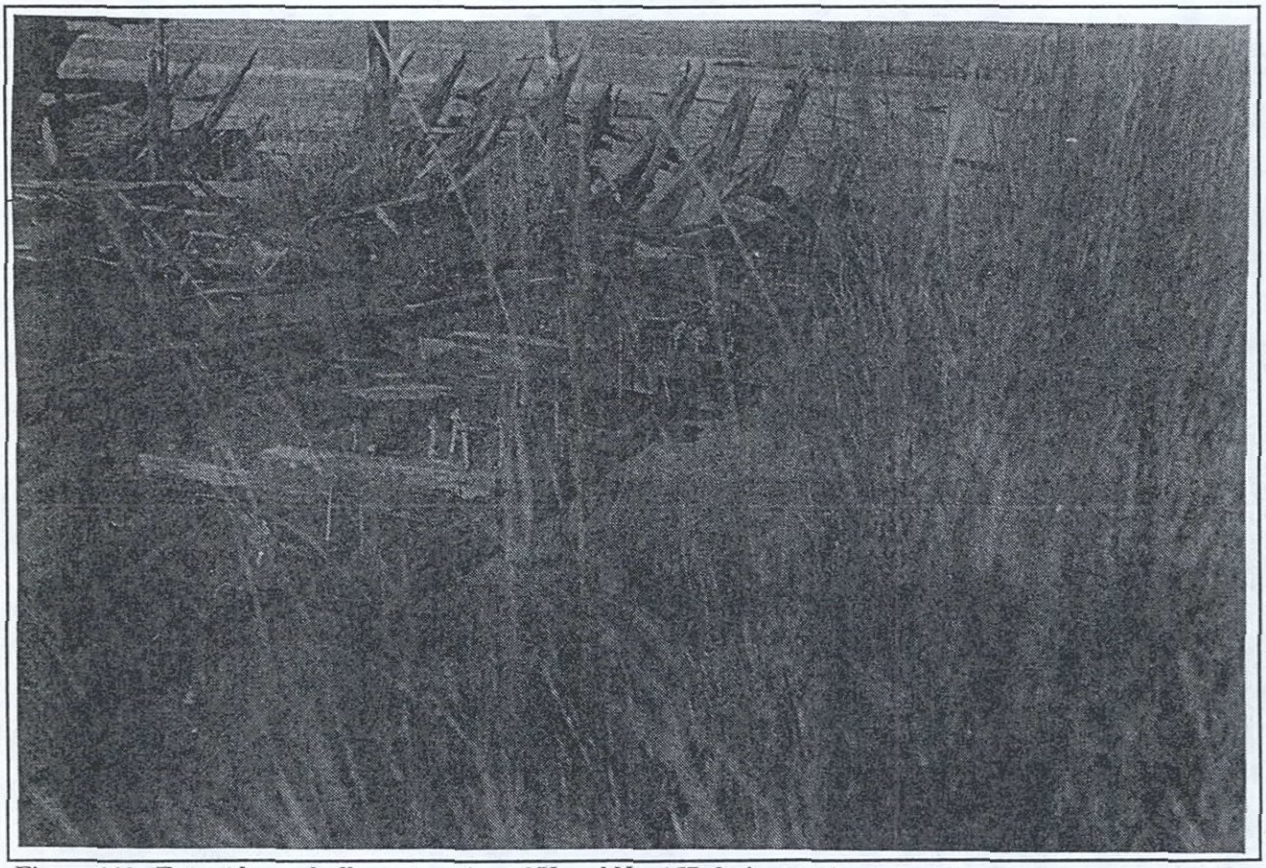


Figure 112. Extant lower hull construction of Vessel No. 157, facing west.

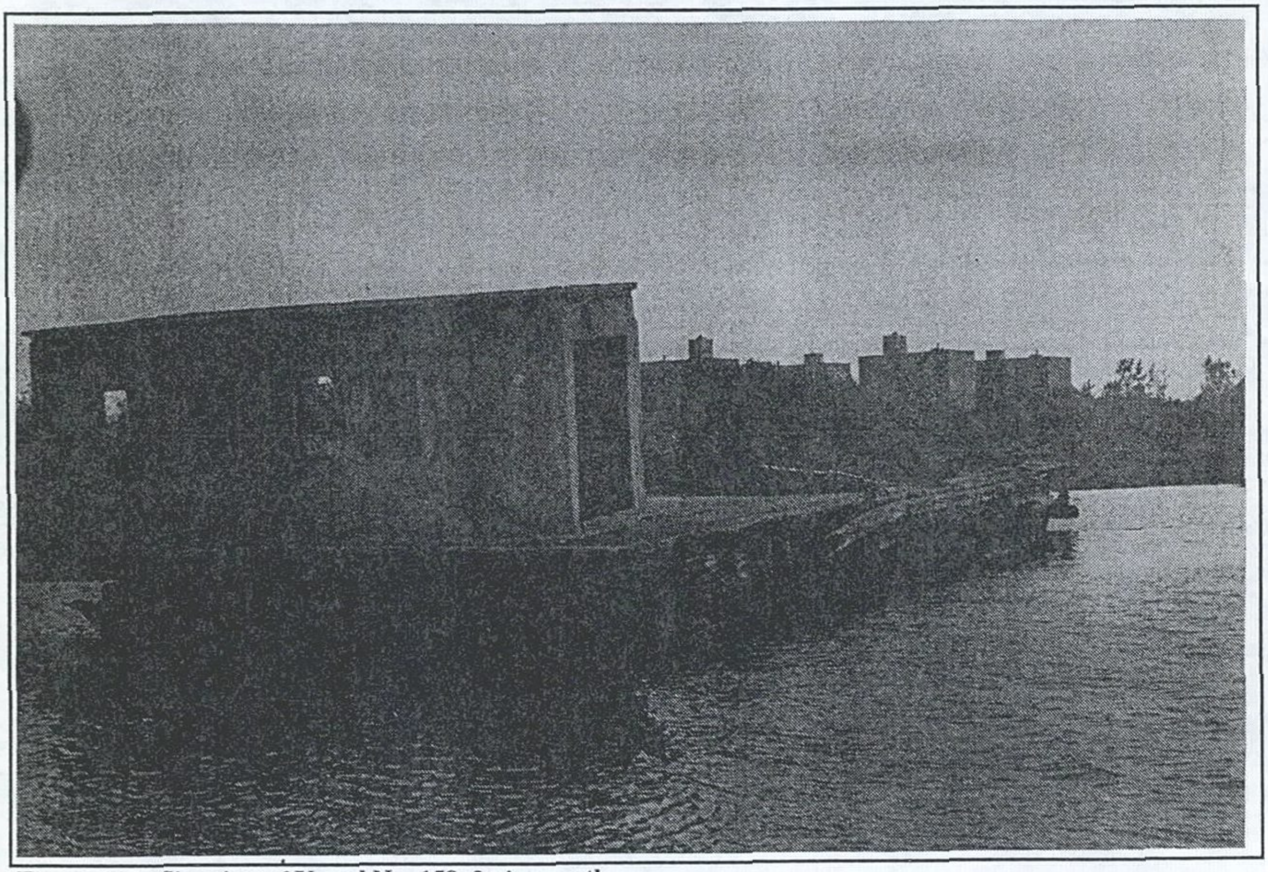


Figure 113. Site view of Vessel No. 158, facing south.

DUMP AND HOPPER BARGES. Builders designed several types of scows capable of dumping cargo at sea. This technology led to the development of the dump scow, a vessel used for dumping garbage, dredge spoil, or breakwater/shoreline extension fill. The hopper barge featured a common arrangement. The following dimensions are for a 1927 hopper barge. Instead of a raked bow and stern, the barge has curved ends forming one-quarter of a circle from the keel to deck. The pockets measure 28 ft. from side to side at the top and 16 ft. 5 in. fore and aft. There is a 3-ft.-4-in. coaming rising above the deck. At deck level, the sides of the pockets begin sloping inward. The sides ending at the hatch in the bottom measure 9 ft. 6 in. wide. The hatch is closed by a pair of timber doors (Brouwer 1996).

The doors are closed by chain bridles attached to single chains passing over sheaves on forward and aft bulkheads. These chains are, in turn, attached to cables on moving sheaves. The cables are taken in or released by turning a continuous shaft running along the top of the hatch coaming on one side. The shaft, probably operated by hand, closed the doors once the contents of the hopper had been dumped. In the middle of the barge is a seventh bay some 8 to 9 in. in the fore and aft dimension. This is apparently the crew cabin (Brouwer 1996).

Figure 15, Volume II is a plan view of a side-dumping scow. The plan shows the general interior layout of the vessel (deck beams, hanging knees, keelsons, longitudinal bulkheads, and so-called cross keelsons). The data, compared with information generated from Vessel No. 75 recommendations, will provide cross-referencing data for future research. Table 15 provides data (number, type, location, recommendation) on vessels identified in the project area as hopper barges.

Table 15. Summary of Hopper Barges Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 50	Arthur Kill, NY	No	Not best representative, no further work
Vessel 169	Arthur Kill, NY	No	Not located
Vessel 238	Arthur Kill, NY	No	Inaccessible, no further work
Vessel 242	Arthur Kill, NY	No	Inaccessible, no further work
Vessel 64	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 65	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 75	Kill Van Kull, NY	Yes	Photo and site documentation

Arthur Kill, New York Reach

Vessel No. 50 (Figure 114)
Vessel Type: Hopper barge
General Location: Arthur Kill, New York Reach near Smoking Point
Date of Abandonment:1940 (Raber et al. 1995a)
Description: As in the other vessels sunk near Smoking Point, the vessel's hull remains are partially exposed but filled with sediment. The vessel is rectangular (vertical sides), scow hulled, and end raked. Initial observation suggests the presence of longitudinal and transverse bulkheads. Mortises for longitudinal timbers are cut into the bulwarks. Two chain transverse supports are visible at low tide, as is evidence for vertical metal turnbuckles. Bulwarks are held together by vertical spikes. The vessel's outer hull remains are in good shape. Outer hull planking is hook-scarfed.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

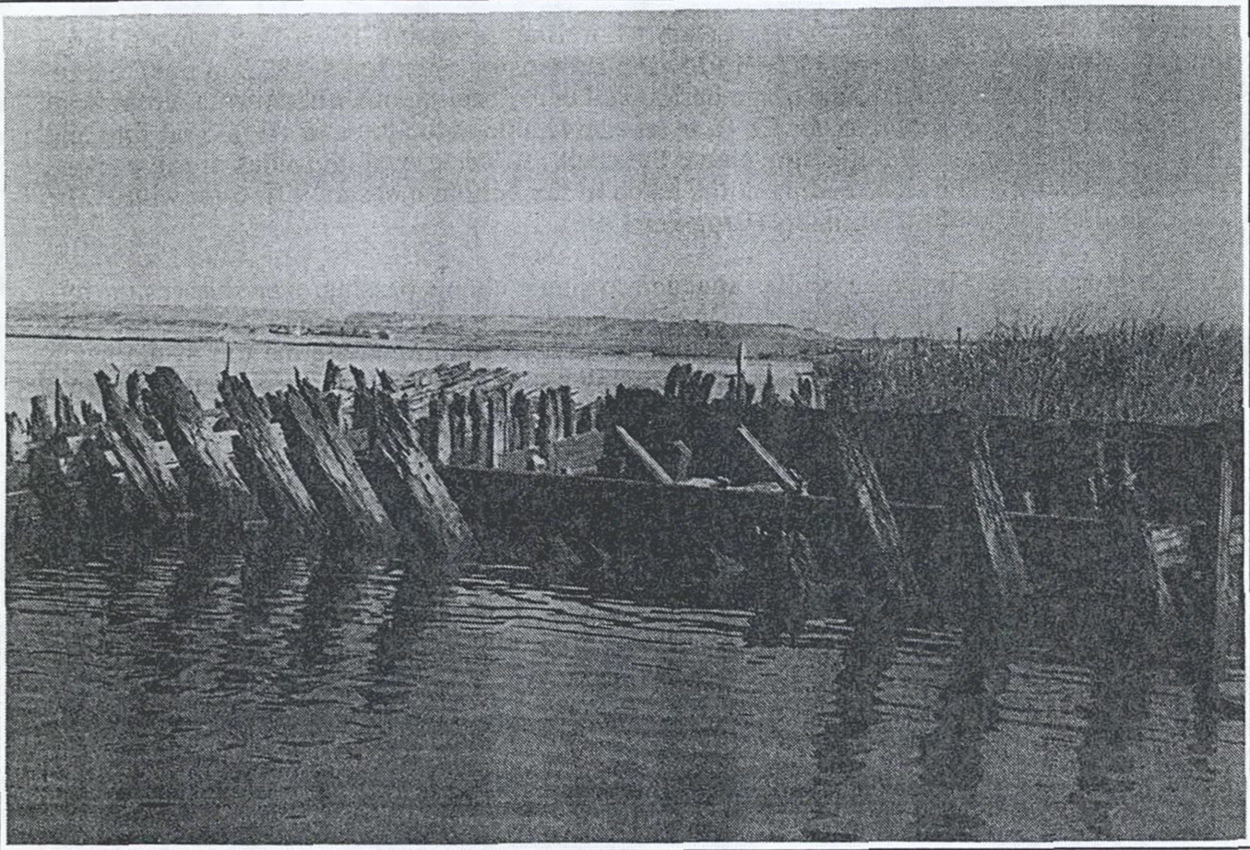


Figure 114. Extant remains of Vessel No. 50 at low tide, facing west.

Vessel No. 169
Vessel Type: Hopper barge
General Location: Arthur Kill, New York Reach north of Outerbridge
Description: Vessel No. 169 could not be located

Vessel No. 238
Vessel Type: Hopper barge
General Location: Arthur Kill, New York Reach near O'Boyle/Townsend Shipyard
Date of Abandonment : 1961 (Raber et al. 1995a)
Description: Very little vessel remains are visible at low tide.
Recommendation: Because of site inaccessibility, no further work is recommended.

Vessel No. 242 (Figure 115)
Vessel Type: Hopper Barge
General Location: Arthur Kill, New York Reach near O'Boyle/Townsend Shipyard
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Only a small section of the barge is visible. Scrap lumber covers most the vessel.
Recommendation: Because of site inaccessibility, no further work is recommended.

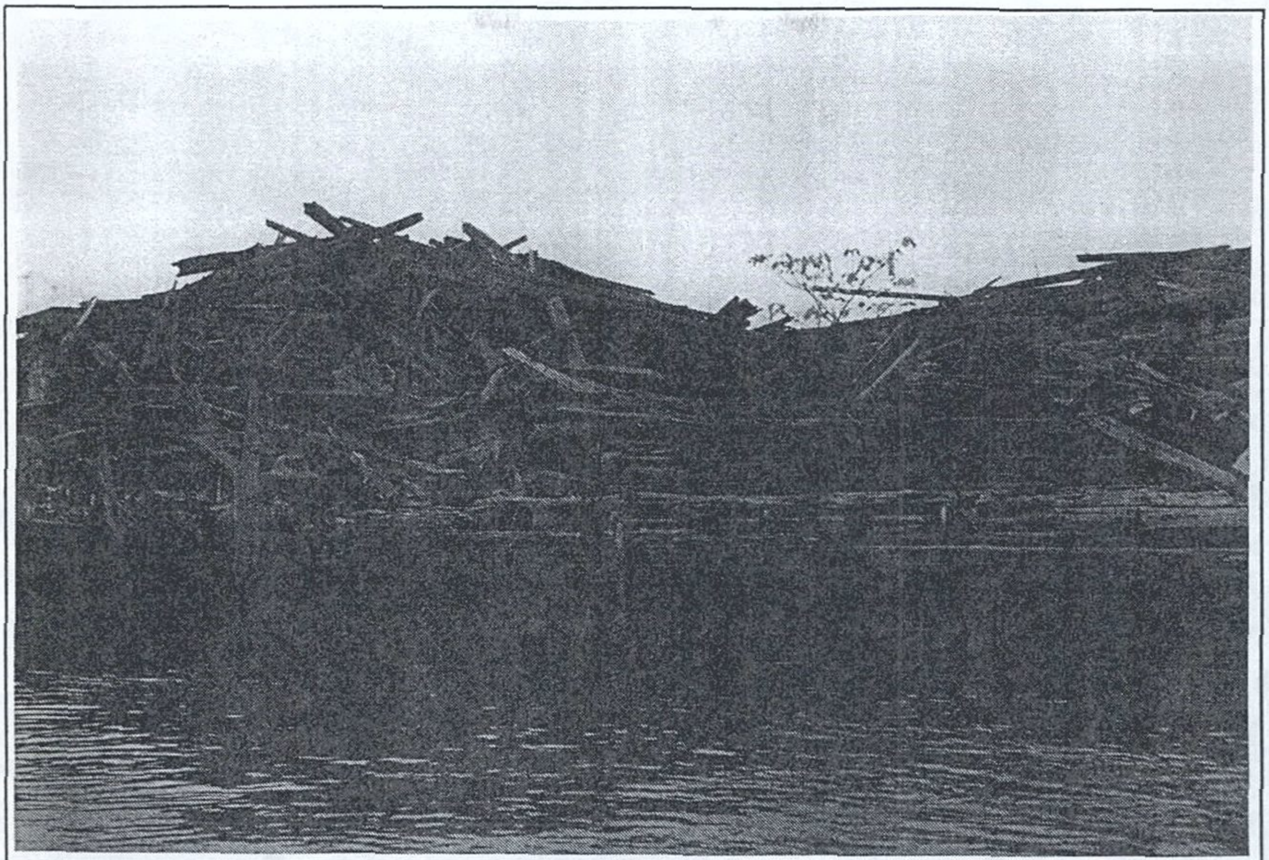


Figure 115. Site view of Vessel No. 242, facing northeast.

Kill Van Kull, New York Reach

Vessel No. 64 (Figure 116)
Vessel Type: Hopper barge
General Location: Kill Van Kull, New York Reach near GLD&D
Date of Abandonment: 1935 (Raber et al. 1995b)
Description: Bow framing timbers are visible. Heavy bulkheads run transversely.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

No. 65 (Figure 117)
Vessel Type: Hopper barge
General Location: Kill Van Kull, New York Reach, near GLD&D
Date of Abandonment: 1935 (Raber et al. 1995b)
Description: Bow framing is extant. Four longitudinal beams cut into heavy timbered bulkheads (8 in. x 12 ft.). Lower hull features are submerged.
Recommendation: The vessel is not a best representative type for the project area. No further work is recommended.

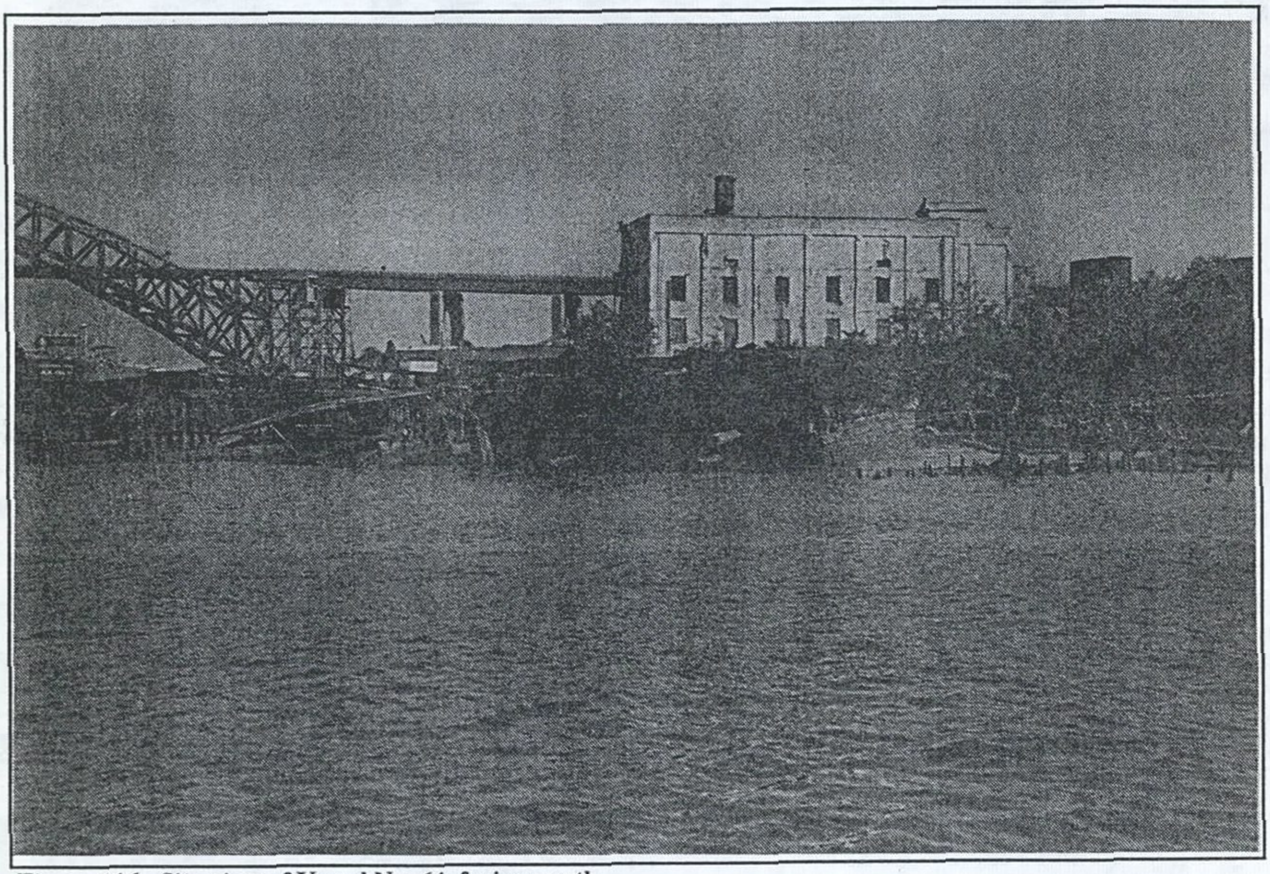


Figure 116. Site view of Vessel No. 64, facing north.

Figure 117. Extant remains of Vessel No. 65 at low tide, facing south.

Vessel No. 75 (Figure 118)
Vessel Type: Hopper barge
General Location: Kill Van Kull, New York Reach, near GLD&D/George Rogers site.
Date Abandoned: 1945 (Raber et al. 1995b)
Description: Composite constructed, a series of keelsons run longitudinally. Vertical side timbers attach to vertical stanchions. These stanchions, in turn, are supported by braced longitudinal wooden trusses. Iron I-beams serve as deck beams. The hopper is extant. Wooden trusses with cribbing run longitudinally. The cribbing fastens to metal chocked trusses.
Recommendation: Based on Criteria C and D, this vessel represents a best type. Under Criterion C, a vessel is deemed significant if it embodies distinctive characteristics of a type. Hopper barges certainly meet this criterion. Under Criterion D, this barge will likely reveal data concerning construction methods. Complete photographic documentation is recommended, as are scantling measurements. These measurements should then by compared to plans presented in Figure 15 (Volume II) of this report.

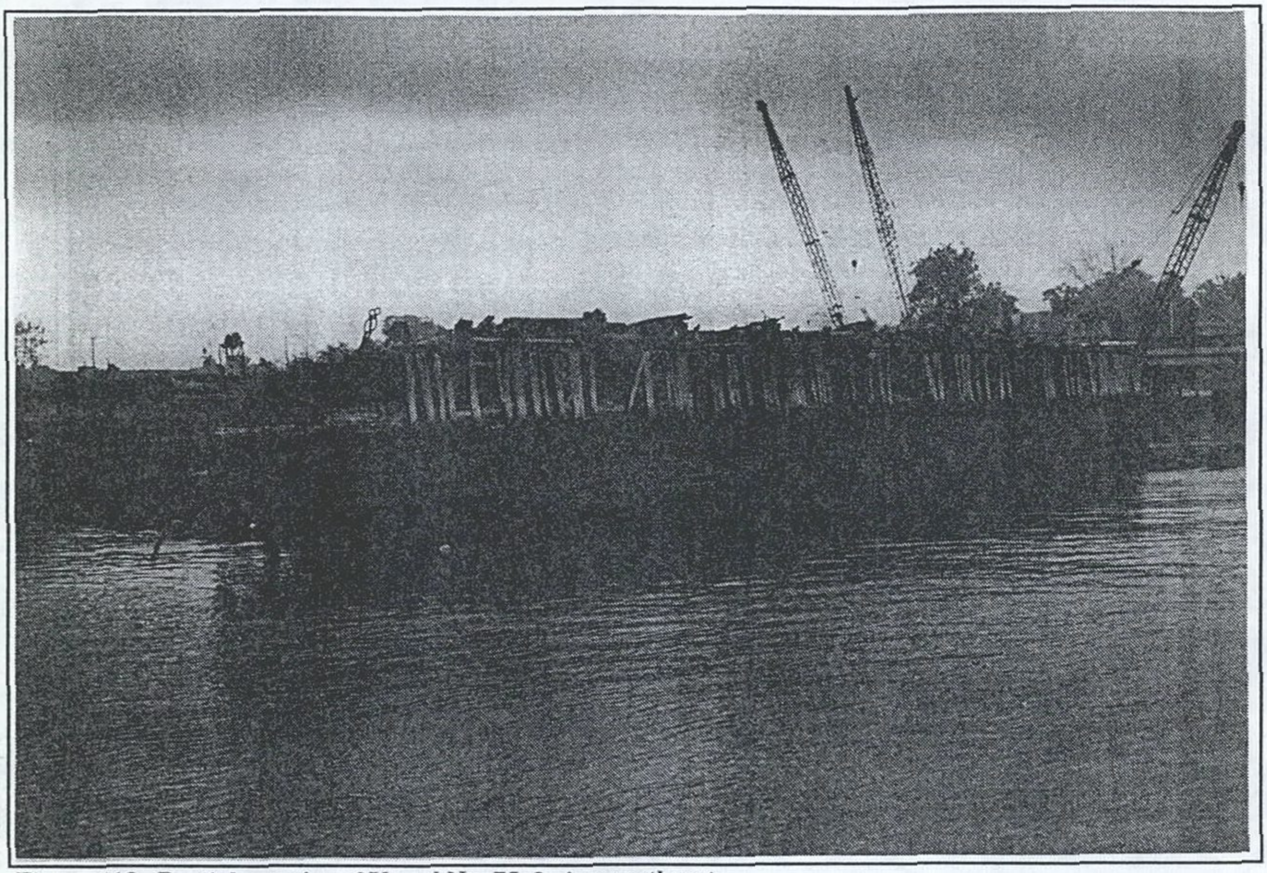


Figure 118. Partial remains of Vessel No. 75, facing northeast.

SCOW CONSTRUCTION. The New York City Department of Street Cleaning plans for a side-dumping scow date to 1922 (Figure 119). The plans show a standard scow hull with raked bow and stern. The dimensions for the barge measures 134 ft. length, breadth 37 ft., and depth of hull 13 ft. 8 in. The cabin crew, 7 x 12 ft., is on deck, aft. Figure 16, Volume II shows a side view of a flat scow with similar cross-bracing as in Figure 119 (Volume I).

The internal construction is similar to that of deck scows and lighter barges. There are three longitudinal bulkheads located at the one-quarter, one-half, and three-quarter points of width. Instead of a level deck, stowed cargo sat on a deck sloped downward 45 degrees on either side of the centerline. The bottom of the slope at the side is only 3 ft. above the bottom of the barge. There are four 27-ft. bays separated by bulkheads, creating eight pockets, four on each side. Dumping occurred by opening the sides of the bay, though the mechanism is not shown (Brouwer 1996).

TRAP ROCK SCOW. In the late nineteenth century, quarries along the lower Hudson produced large quantities of crushed stone for construction use. Companies delivered the stone in a scow similar in shape and construction to the brick scow. The difference included the addition of timber bulkheads for the retention of cargo. The bulkheads at the bow and forward of the deckhouse at the stern measured some 10 ft. high in the center but angled 45 degrees at either side. Since the cargo peaked in a mound, the retaining bulkheads could measure as low as 2 ft.

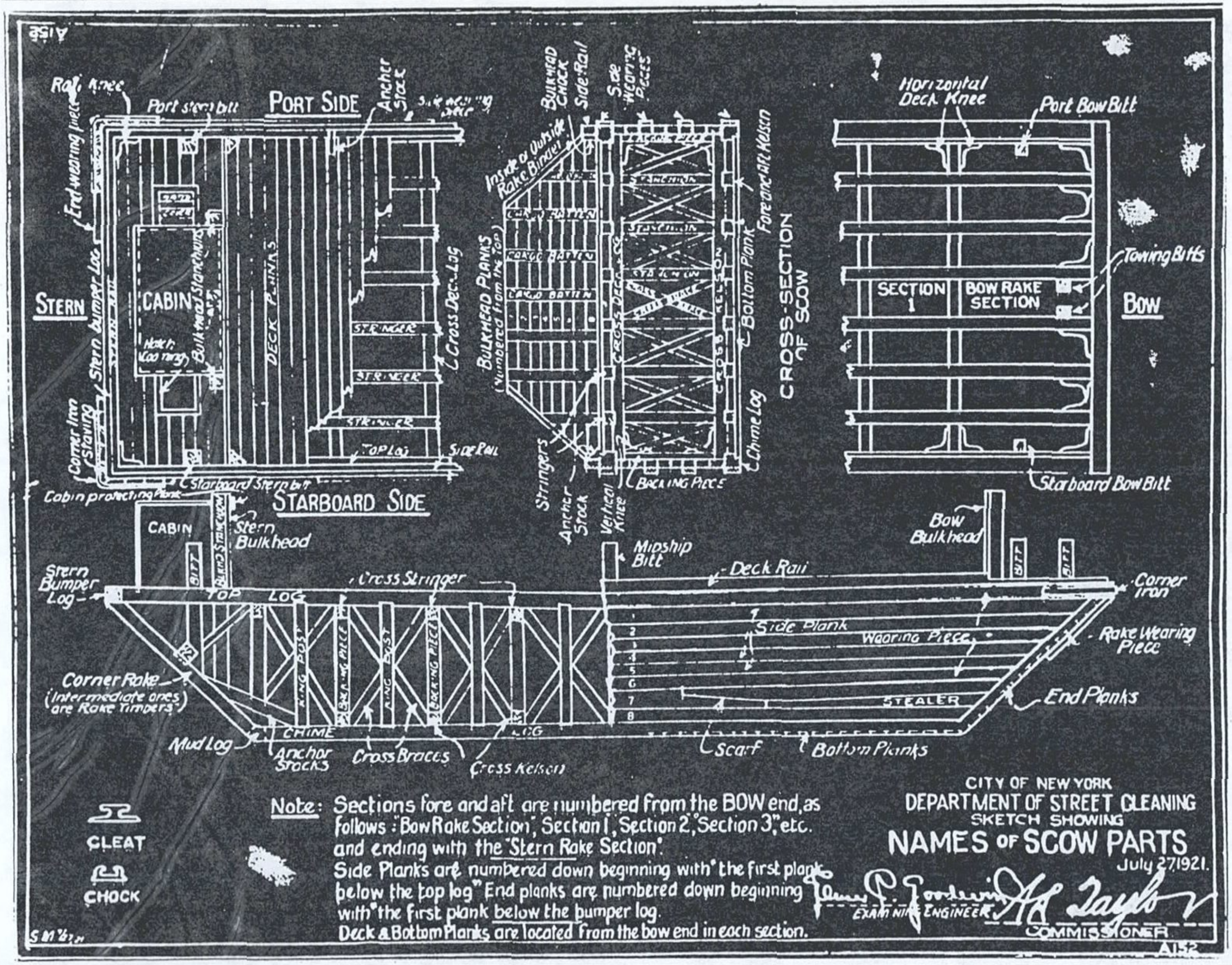


Figure 119. Names of scow parts (NYC Department of Street Cleaning 1921)

Vertical timbers support the bulkheads, horizontally planked and smooth on the side facing the cargo (Brouwer 1996).

Companies still transported crushed stone on the Hudson River. The scows are generally of the same configuration as earlier scows, but are steel built. The loading deck is usually sunk into the hull and not part of the main deck. Newer scows do not have steel cabins (Brouwer 1996).

The South Street Seaport Museum had a complete set of plans for a New York Trap Rock Corporation scow, dated 1951. The 1950s were the last decade in which companies built wooden barges and scows. Table 16 provides information on the vessels in the project area categorized as trap rock scows.

Table 16. Summary of Rock Scows Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 244	Arthur Kill, NY	No	No longer exists
Vessel 244A	Arthur Kill, NY	No	No longer exists
Vessel 244B	Arthur Kill, NY	No	No longer exists
Vessel 50	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 51	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 53	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 54	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 55	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 56	Arthur Kill, NJ	No	Not best representative, no further work
Vessel 173	Kill Van Kull, NY	Yes	Photo and site documentation

Arthur Kill, New York Reach

Vessel No. 244, 244A, 244B
Vessel Type: Wooden trap rock scow
General Location: O'Boyle/Townsend Shipyard
Description: Based on available data (physical and ethnographic), these vessels no longer exist.
Date Recorded: 11/13/95

Arthur Kill, New Jersey Reach

Vessel No. 50 (Figure 120)
Vessel Type: Wooden trap rock scow
General Location: Arthur Kill, New Jersey Reach near Segrave Transportation/LVRR
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: Typical scow construction, four longitudinal beams underneath transverse deck planking. Metal railing is strung atop the gunwale.
Recommendation: Based on comparative project-area data, this site is not a best representative type. No further work is required.

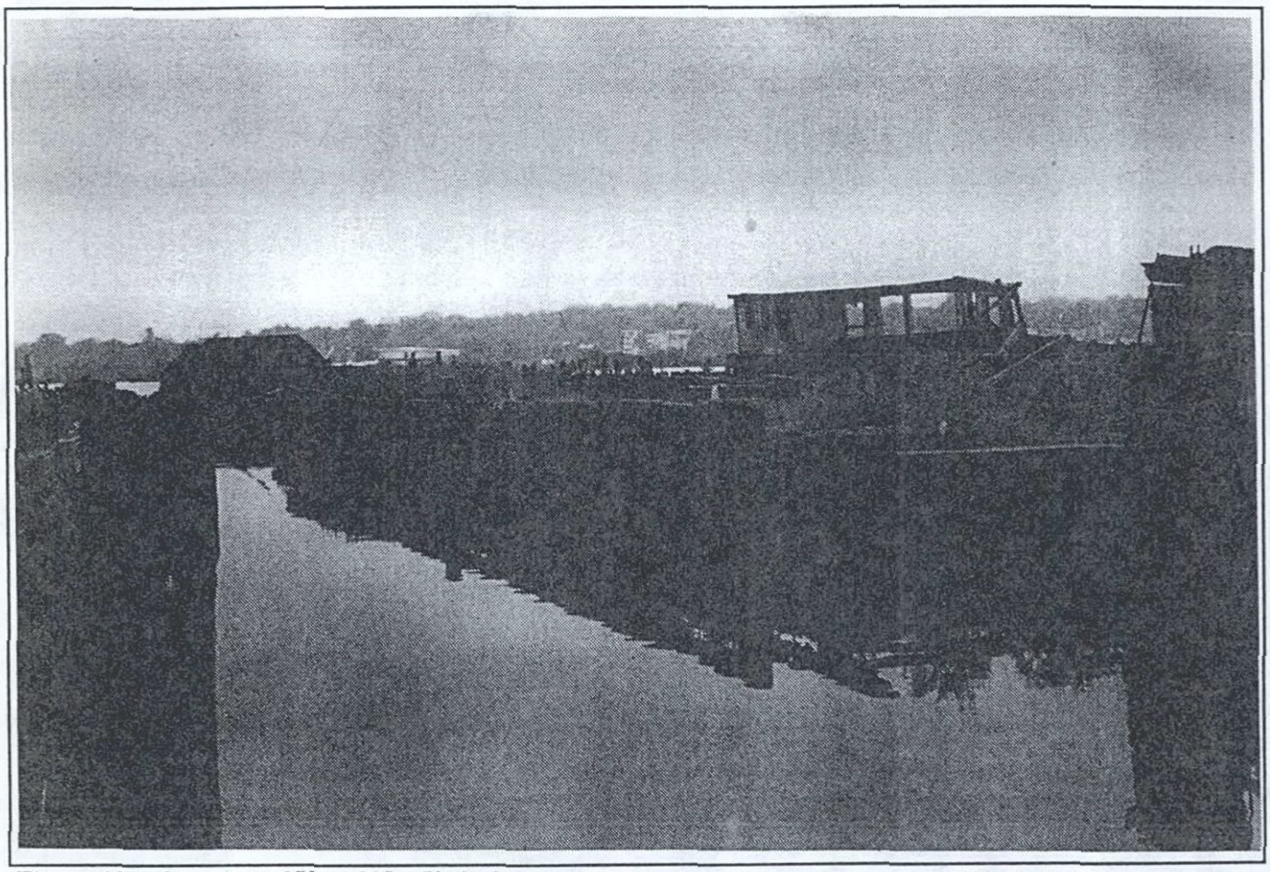


Figure 120. Site view of Vessel No. 50, facing east.

Vessel No. 51 (Figure 121)
Vessel Type: Wooden trap rock scow
General Location: Arthur Kill, New Jersey Reach near Segrave Transportation/LVRR
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: Both ends are raked. Two longitudinal bulkheads run stem to stern. The decking runs longitudinally (iron fastened) atop transverse deck beams. There is slight camber. Knees are not present.
Recommendation: Based on comparative project-area data, this site is not a best representative type. No further work is required.

Vessel No. 53 (Figure 122)
Vessel Type: Wooden Trap scow
General Location: Arthur Kill, New Jersey Reach, near Segrave Transportation/LVRR.
Date Abandoned: 1971 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: There are minimal remains of the vessel. Both ends are slightly raked. Six charred center stanchions (with metal straps) are located where the deck beams would run. A few remnant hanging knees are present, but most are burned. The vessel also has rubbing rails.
Recommendation: Based on comparative project-area data, this site is not a best representative type. No further work is required.

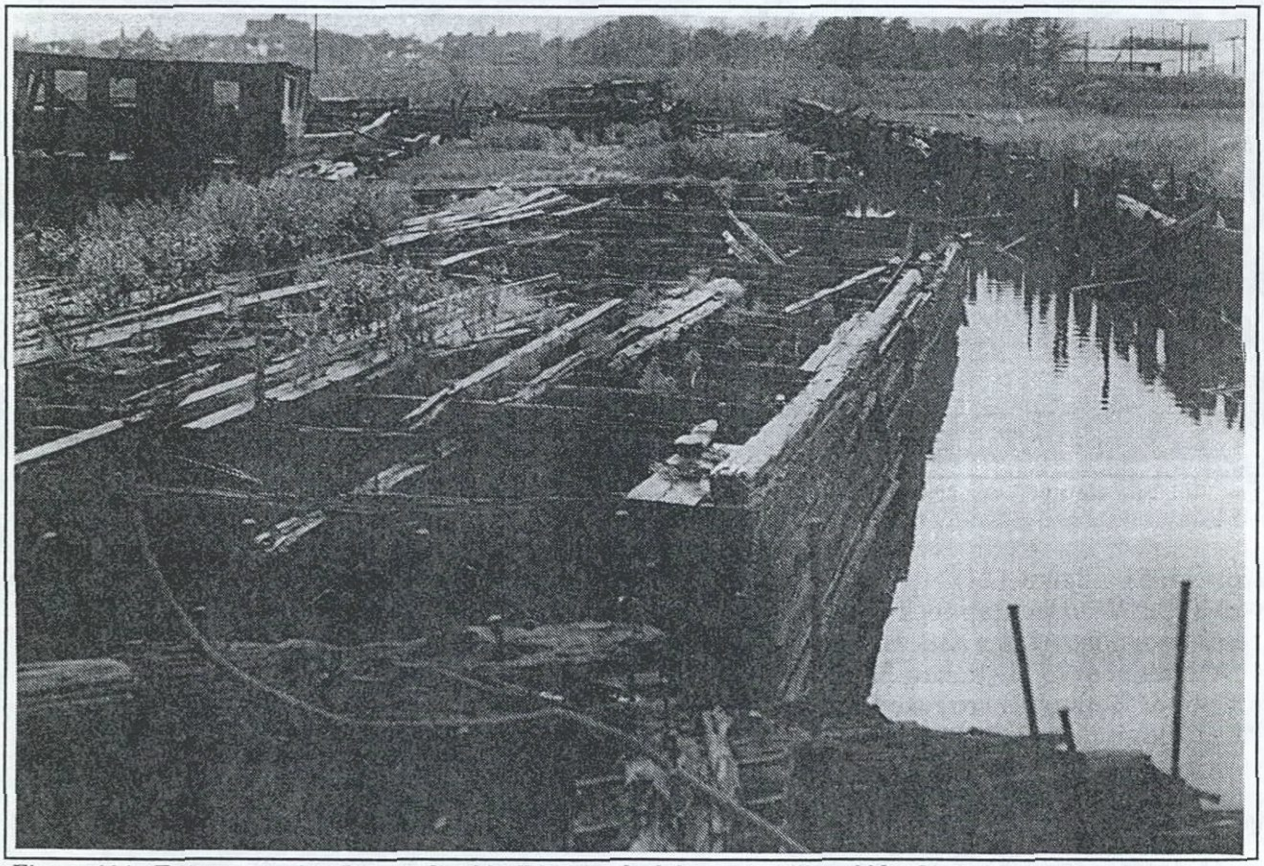


Figure 121. Extant remains (longitudinal bulkheads, deck beams) of Vessel No. 51, facing west.

Figure 122. Site view of Vessel No. 53, facing west.

Vessel No. 54 (Figure 123)
Vessel Type: Wooden trap rock scow
General Location: Arthur Kill, New Jersey Reach near Segrave Transportation/LVRR
Date of Abandonment: 1978 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: Planks are only 10 ft. long. Ends are butt-joined. The outside planking is 12 x 6 x 30 in. Planking is mostly hook-scarfed. One longitudinal truss runs down the center of the vessel. Longitudinal planking is supported by transverse cross-bracing. Vertical tie-rods, made of metal, are visible. Fasteners for the decking are wooden. Lodging knees are present at the ends of the vessel, as are interior hanging and standing knees. Metal knees hold the upper railing. The vessel has two 4-x-4-ft. hatches (with coaming). On deck are two trapezoidal partitions fore and aft. Lower hull features are not visible at low tide.
Recommendation: Based on comparative project-area data, this site is not a best representative type. No further work is required.

Figure 123. Decking and bulkhead of a trap rock scow, Vessel No. 54, facing east.

Vessel No. 55 (Figure 124)
Vessel Type: Wooden trap rock scow
General Location: Arthur Kill, New Jersey Reach near the Segrave Transportation/LVRR
Date of Abandonment: Unknown
Description: Similar in design to Vessel No. 54, the vessel has a small cabin aft. There is triple-thick exterior planking in some areas; the inwale is triple thick at sheer level. Inner structural remains include vertical turnbuckles and wooden diagonal bracing.
Recommendation: Based on comparative project-area data, this site is not a best representative type. No further work is required.

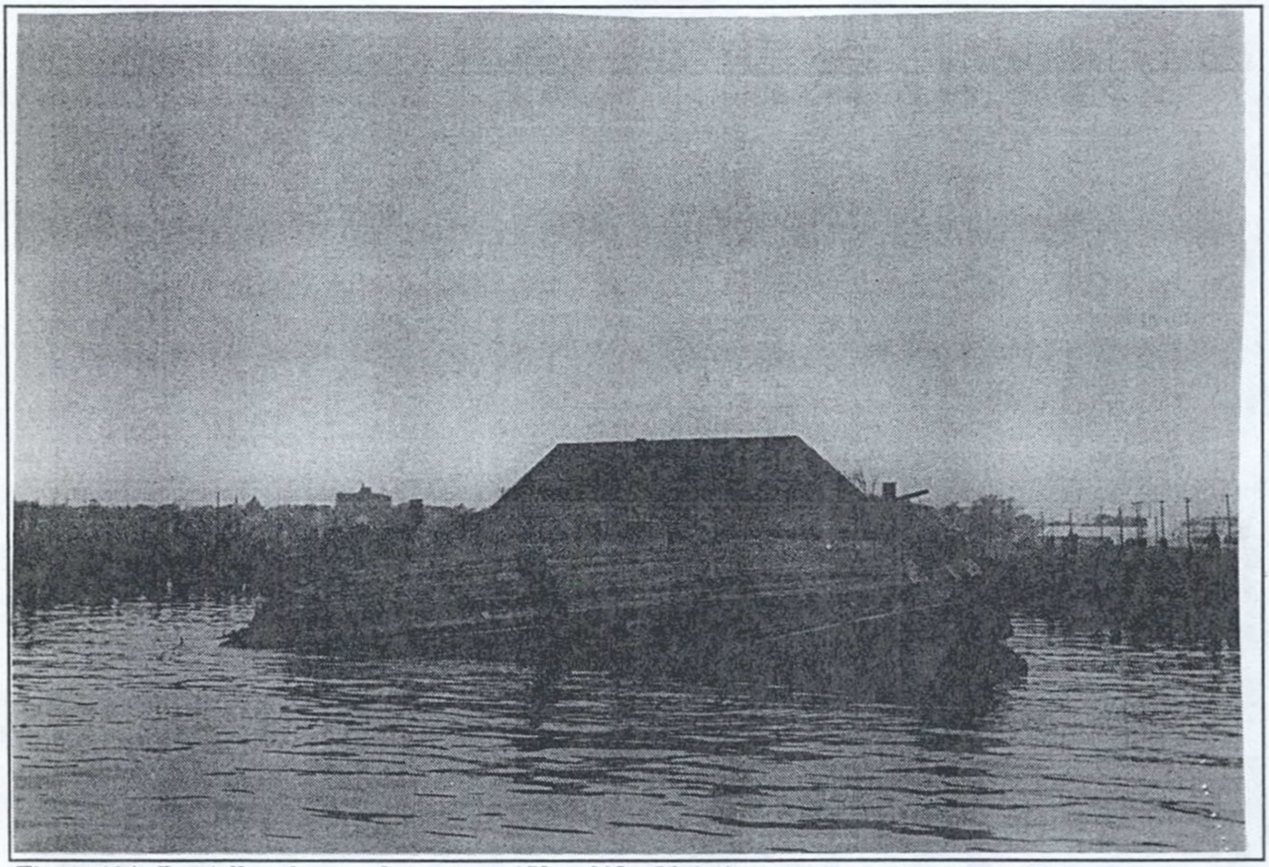


Figure 124. Partially submerged site view of Vessel No. 55, facing west.

Vessel No. 56 (Figure 125)
Vessel Type: Trap rock scow
General Location: Arthur Kill, New Jersey Reach near the Lehigh Valley RR
Date of Abandonment: 1971 (Raber et al. 1996b)
Description: Most of the vessel is underwater. Typical scow built, the vessel has seven longitudinal bulkheads. Transverse planking is visible, though most of the site is covered with ruderal material. Visible are a metal bit, a metal caprail at the sheer, and a wooden bollard. There is evidence of a deck bulkhead at one end. Behind the bulkhead are entrance hatches (with coaming).
Recommendation: Based on comparative project-area data, this site is not a best representative type. No further work is required.

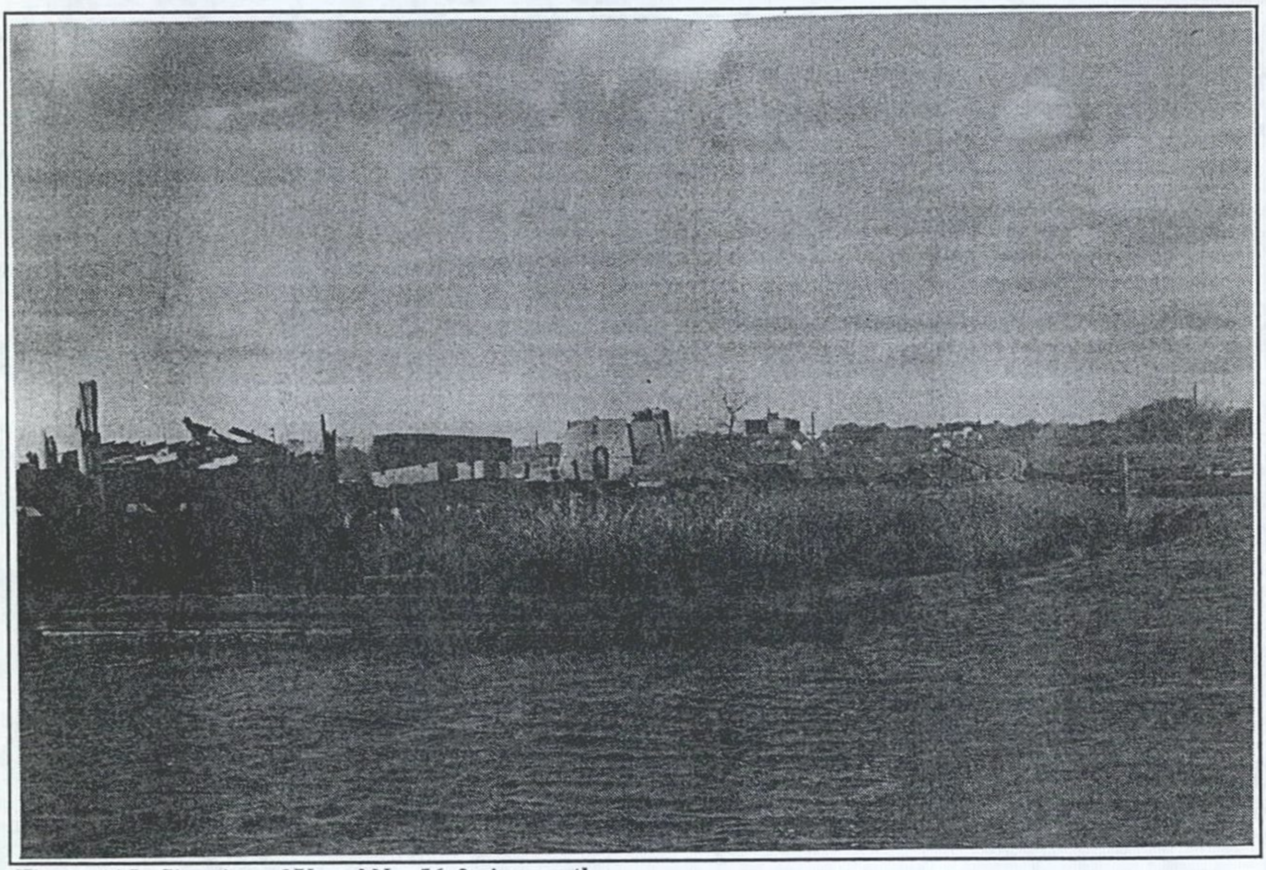


Figure 125. Site view of Vessel No. 56, facing north.

Kill Van Kull , New York Reach

Vessel No. 173 (Figures 126-128)
Vessel Type: Wooden trap rock scow
General Location: Kill Van Kull, New York Reach near the Milliken/Downey Shipyard
Date Abandoned: 1955 (Raber et al. 1995b)
Description: The vessel is heavily constructed. Typical barge features include a rectangular shape and raked bow and stern. Heavy planking, laid transversely, measures 5 x 12 in. It is fastened to longitudinal beams by square-shanked spikes and iron knees. These beams are notched over transverse beams. Both beams are supported by cross cribbing.
Recommendation: Based on comparative data, this site is the best representative type in the project area. Eligible for further investigation under Criteria C and D, the trap rock scow displays unique construction features based on its association with a particular maritime commerce and its necessary heavy design for rock transportation. Photographic documentation is recommended. This data should be compared and contrasted with standard scow plans presented in Volume II.

COVERED LIGHTER BARGES. Covered lighter barges carried non-bulk perishable commodities. The early fully enclosed covered barges evolved from early hay and produce canal barges, having one or two decks sheltered by a roof, usually open at the sides (Brouwer 1985).

Basically scow built, the barge featured a one-story structure or shed covering most of the deck. Often barn-sided, two large sliding doors opened port and starboard when cargo was handled over the gangway. A hatch at the margin of the roof allowed for vertical hoisting of goods when moored to the high side of an oceangoing vessel.

The earliest covered barges conformed to a steamboat shape, with a pointed bow and a round counter stern. The deckhouses filled most of this area, squared off well forward, usually following the curve of the counter aft. Their hulls, lightly constructed, featured a system of hogging chains, supported on several masts (Brouwer 1985).

The final generation of wooden covered barges appeared by the late 1880s and went into general use in the early years of this century. The last ones built of wood were launched in the 1950s. Steel covered barges built in later years were simply wooden covered barges built from a different material.

Vents positioned at each end of the shed (attached to large ice bins) provided refrigeration for perishable items Filled through hatches in the roof, the vents circulated cool air top and bottom. When necessary, a stove, installed in the center of the shed, circulated warm, dry air (Brouwer 1996).

Some companies preferred centered penthouse cabins over the usual stern counterpart. The higher elevation permitted a 360-degree view of surroundings and, perhaps more importantly, wasted no cargo space. Some covered barges featured a hoisting gear. A single mast with booms rose above the center of the deck house. Part of the rooftop cabin accommodated a steam-, or later, oil- or gasoline-powered winch. Tugs usually towed schooner barges from port to port, but these vessels differed considerably from other barges in that they featured masted sails. The sails expedited the progress of tow or aided the barge in reaching port in case of emergency.

CABINS AND SHEDS. All non-self-propelled harbor boats featured cabins (Squire 1918). The size of the cabin varied from a shed to a family's permanent residence. The standard insurance policy of the Atlantic Inland Association, which many companies used, required a man on board. Many captains lived on board with their families. Besides providing extra security, night-time operations (towing, moving, loading, etc.) required the captain's presence.

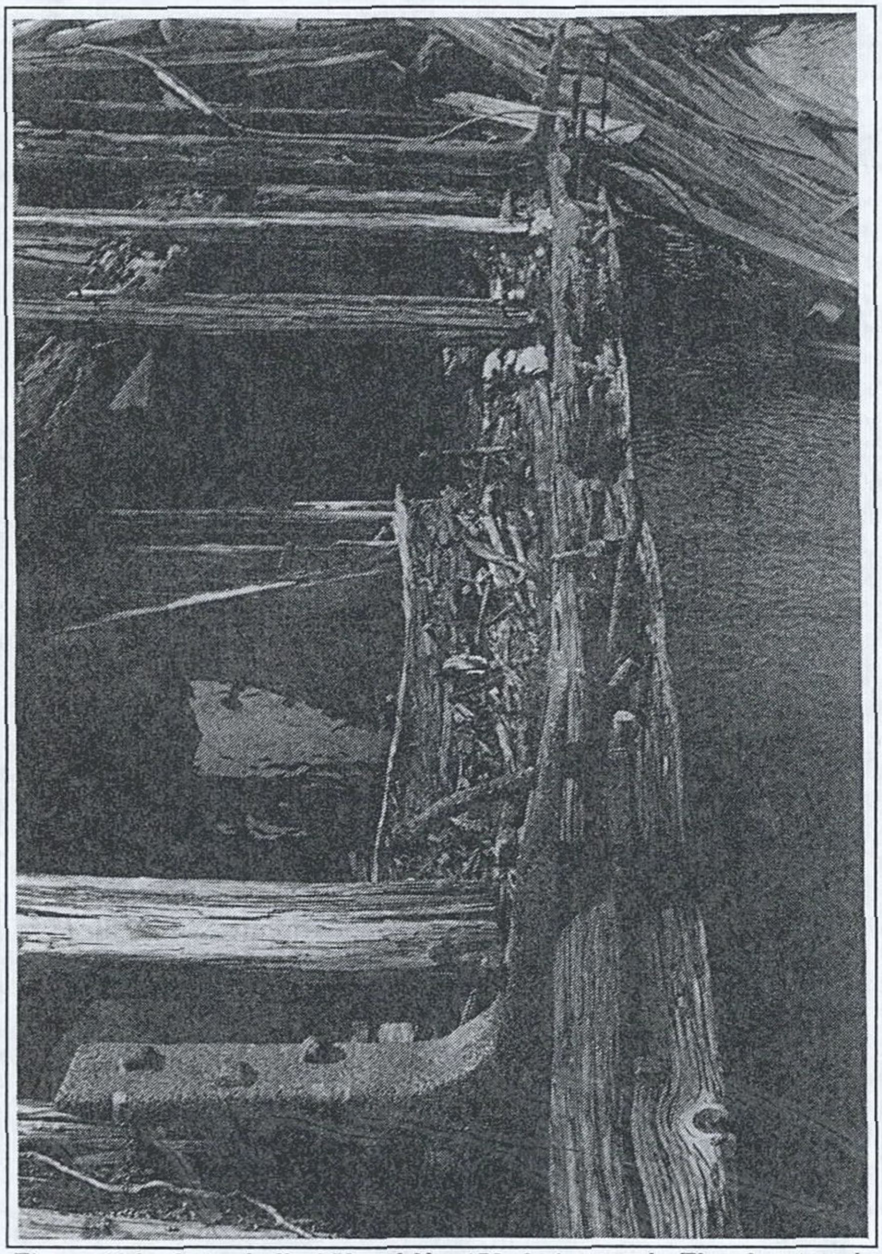


Figure 126. Outer hull of Vessel No. 173, facing south. The photograph shows deck beams and a metal knee.

Figure 127. Site view of Vessel No. 173, facing south.

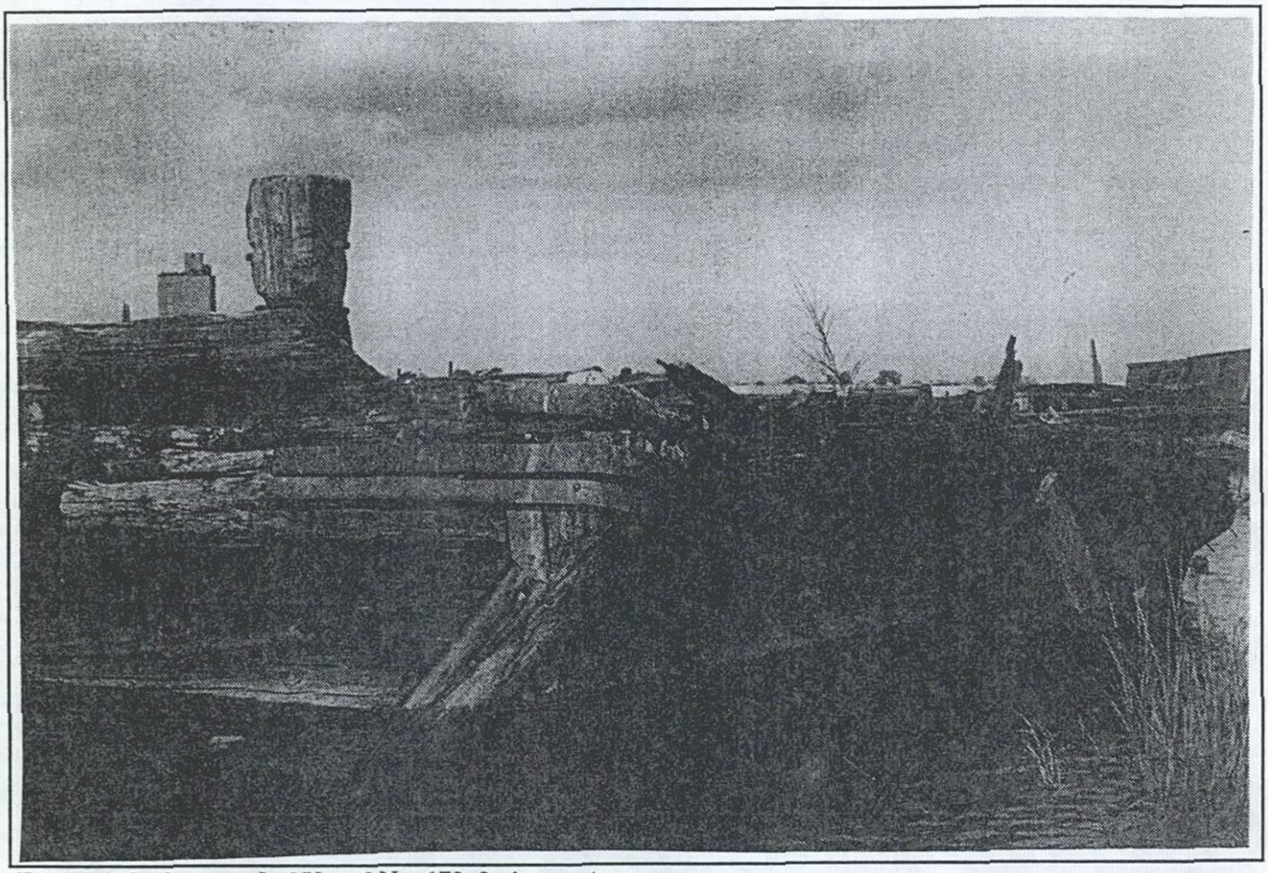


Figure 128. Scow end of Vessel No. 173, facing east.

Of 208 unrigged boats owned by one company, 89 housed families with children ages 1 through 10, 71 had captains and wives, and 48 had captains living alone on the boat (Squire 1918). Living conditions on board no doubt varied, but general descriptions mention crowded, damp, foul-smelling rooms. "The general impression given is that of dirt and disorder" (Squire 1918:16). Some companies tried to accommodate their employees if possible, providing stoves, furniture, etc., while others provided nothing at all. One company (200 unrigged boats) provided nothing for its employees (Squire 1918).

Figures 17, 18, and 19 (Volume II) provide detailed views of a barge cabin designs. Figure 19 (Volume II) provides a cross-sectional view of a barge built for the Southern Pacific Company in 1922.

Wooden Covered Harbor Barges (Refrigerator, Covered Cement). Used primarily as carriers of boxed, bagged, or barreled commodities, the wooden covered barge provided a means of transporting goods, ship to ship or ship to shore. The Hudson River Waterfront Museum, located at various New York Harbor slips, is a restored wooden covered harbor barge. The barge's physical condition is in stark contrast to the physical remains of the covered barges in the project area, which are all deteriorated. The project area also includes three converted covered barges.

Figures 20 and 21 (Volume II) provide a plan and cross-sectional view of a covered barge cabin (South Street Seaport Museum). Table 17 lists vessels typed as wooden covered barges.

Table 17. Summary of Covered Barges Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 189	Arthur Kill, NY	No	Not best representative, no further work
Vessel 252	Arthur Kill, NY	No	Not best representative, no further work
Vessel 144	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 144A	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 162	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 167	Kill Van Kull, NY	No	Not best representative, no further work

Arthur Kill, New York Reach

Vessel No. 189 (Figure 129)
Vessel Type: Wooden covered barge
General Location: Arthur Kill, New York Reach north of the Outer Bridge
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: The vessel offers a reasonable sheer plan, with the starboard outer hull removed. The visible end section is sharply raked. Major hull construction features include lower decking, transverse girders, vertical stanchions and knees, upper deck beams, and decking.
Recommendation: Based on the existence of the Hudson River Waterfront Museum (at various New York Harbor slips), a restored wooden covered harbor barge, no further work is recommended.

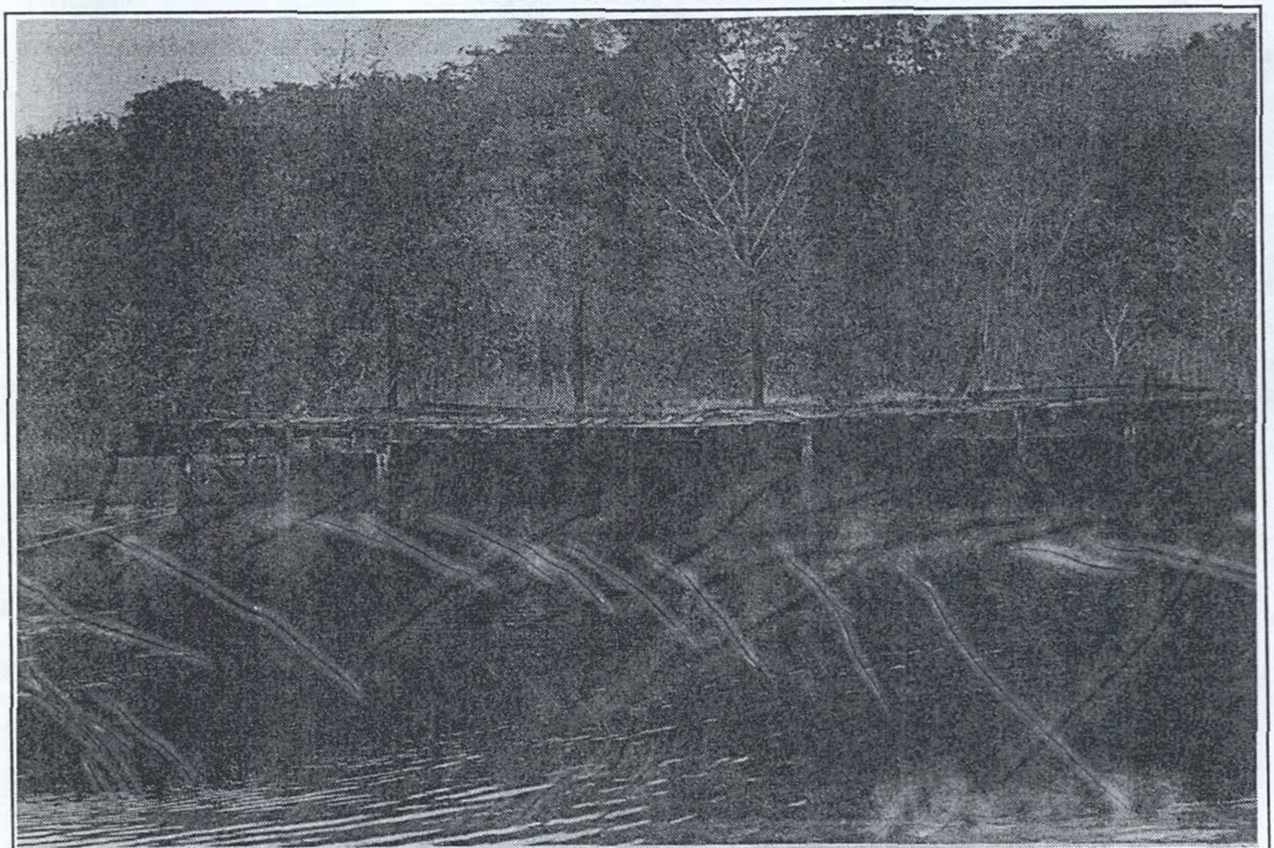


Figure 129. Side view of Vessel No. 189, facing east. The lower keelsons and bottom planking are evident.

Vessel No. 252 (Figure 130)
Vessel Type: Wooden covered barge
General Location: Arthur Kill, New York Reach near O'Boyle/Townsend Shipyard
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: The partially articulated vessel includes skeleton superstructure. The remains are charred, though portions of the lower hull section are visible. The vessel's bow and stern are raked in typical barge fashion. The hull is best described as a series of intersecting longitudinal and transverse girders; the longitudinal beams are much heavier in construction. Longitudinal decking rests atop transverse deck beams.
Recommendation: Based on the existence of the Hudson River Waterfront Museum (located at various New York Harbor slips), a restored wooden covered harbor barge, no further work is recommended.

Figure 130. Charred, disarticulated remains of Vessel No. 252, facing southwest.

Kill Van Kull Reach

Vessel No. 144 (Figure 131)
Vessel Type: Wooden covered barge
Date of Abandonment: 1955 (Raber et al. 1995b)
General Location: Kill Van Kull, New York Reach near Milliken/Downey Shipyard
Description: Very little of the vessel is visible at low tide. Specifically, portions of the floor, standing knees, and disarticulated timbers are extant. A winch is visible just below the water line.
Recommendation: Based on the existence of the Hudson River Waterfront Museum (located at various New York Harbor slips), a restored wooden covered harbor barge, no further work is recommended.

Figure 131. Side view of Vessel No. 144, facing south.

Vessel No. 144A (Figure 132)
Vessel Type: Wooden covered harbor barge
General Location: Kill Van Kull, New York Reach near Milliken/Downey Shipyard
Date of Abandonment: 1993 (Raber et al. 1995b)
Description: One end of the vessel is scowed. Multiple transverse stringers, spaced approximately 2 ft. apart, rest on three sets of longitudinal deck beams (top logs). The lower set of stringers are edge-notched into the top log. These logs, in turn, rest on a series of multiple transverse bulkheads. All timbers are butt-joined. Three vertical timbers, forward, amidships, and after, rise above the deck. These stanchions, no doubt used for cover, are transversely fastened by a single timber is cross fashion. The vessel is severely burned.
Recommendation: Based on the existence of the Hudson River Waterfront Museum (located at various New York Harbor slips), a restored wooden covered harbor barge, no further work is recommended.

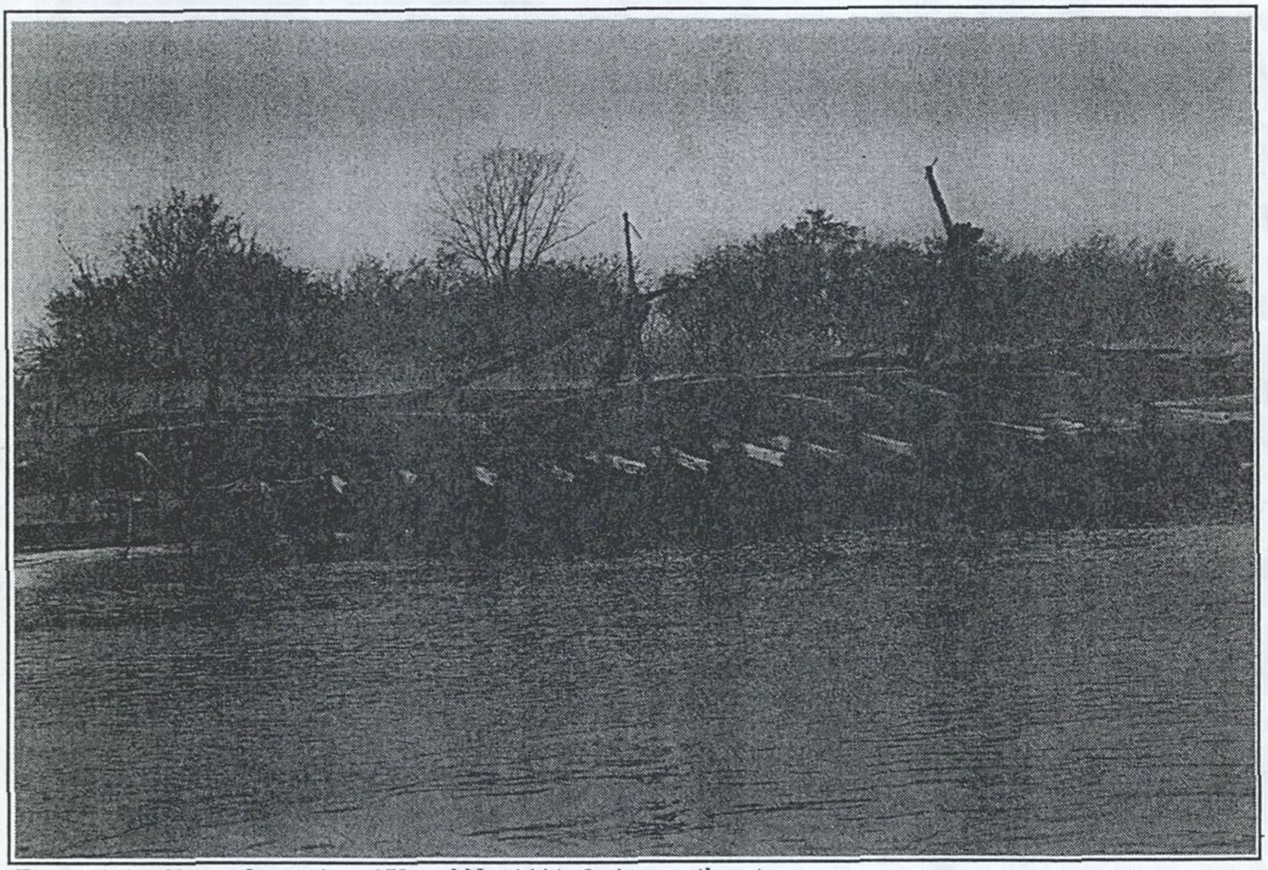


Figure 132. Charred remains of Vessel No. 144A, facing southeast.

Vessel No. 162 (Figure 133)
Vessel Type: Wooden covered barge
General Location: Kill Van Kull, New York Reach near Milliken/Downey Shipyard
Date Abandoned: 1955 (Raber et al. 1996b)
Description: Most of the vessel's lower hull remains are submerged. Extant structural remains are disarticulated decking timbers and a dilapidated cabin, though it is difficult to determine whether the cabin is associated with Vessel No. 162 or another vessel. The decking runs longitudinally and is covered in asphalt shingles. Visible fasteners are made of iron.
Recommendation: Based on the existence of the Hudson River Waterfront Museum (located at various New York Harbor slips), a restored wooden covered harbor barge, no further work is recommended.

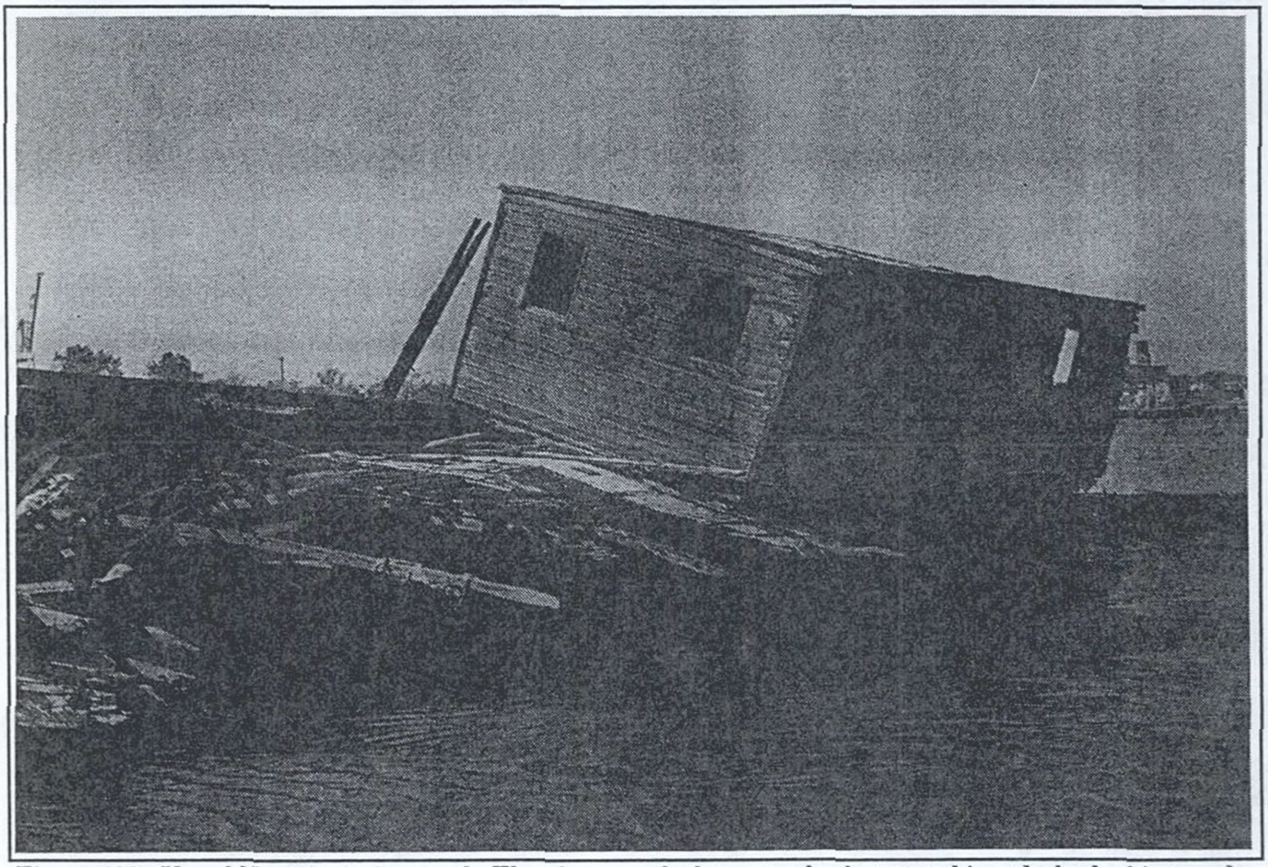


Figure 133. Vessel No. 162, facing south. The photograph shows one broken stanchion, deck planking, and a cabin.

Vessel No. 167 (Figure 134)
Vessel Type: Wooden covered barge
General Location: Kill Van Kull, New York Reach near Milliken/Downey Shipyard
Date Abandoned: 1955 (Raber et al. 1995b)
Description: About half the superstructure remains. The after end cabin still stands. Behind the cabin is a bollard and capstan. Decking runs longitudinally. None of the lower remains are visible.
Recommendation: Based on the existence of the Hudson River Waterfront Museum (located at various New York Harbor slips), a restored wooden covered harbor barge, no further work is recommended.

Figure 134. Site view of Vessel No. 167, facing southeast. The vessel's interior cabin is extant, as is the covering framework.

CONVERTED COVERED BARGES. Converted covered barges received a separate typology. Table 18 indicates those vessels within the project area typed as such. Figures 22 and 23 (Volume II) provide amidship (cross section) and side view plans of a W.F. & R Boatbuilders covered cement scow built in 1927. Figures 22 and 23 show the location and measurements of the vessel's keelsons, deck beams, hanging knees, and cross-bracing. The data presented here sufficiently documents basic cement covered scow designs.

Table 18. Summary of Covered Converted Barges Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 13	Arthur Kill, NY	No	Not best representative, no further work
Vessel 48	Arthur Kill, NY	No	Not best representative, no further work
Vessel 121	Kill Van Kull, NY	No	Not best representative, no further work

Arthur Kill Reach

Vessel No. 13 (Figure 135)
Vessel Type: Converted covered barge
Date Abandoned: 1971 (Raber et al. 1995a)
General Location: Arthur Kill, New Jersey Reach near Port Reading creosote plant
Description: The vessel rests in shallow water near shore, but is not easily accessible. The boat displays typical barge-like features (i.e., rectangular, vertical outer planking, etc.). Most of the side planking is gone.
Recommendation: Based on the existence of the Hudson River Waterfront Museum (located at various New York Harbor slips), a restored wooden covered harbor barge, no further work is recommended.

Vessel No. 48 (Figure 136)
Vessel Type: Converted covered barge
General Location: Arthur Kill, New Jersey Reach near the Lehigh Valley RR
Date Abandoned: 1971 (Raber et al. 1995a)
Description: Only the upper deck is visible at low tide. Closely spaced deck beams run transversely, while decking runs longitudinally.
Recommendation: Based on the existence of the Hudson River Waterfront Museum (located at various New York Harbor slips), a restored wooden covered harbor barge, no further work is recommended.

Kill Van Kull Reach

Vessel No. 121 (Figure 137)
Vessel Type: Converted covered barge
General Location: Kill Van Kull, New York Reach SP&B
Date Abandoned: 1970 (Raber et al. 1995b)
Description: Typical barge construction, the vessel is fully articulated and in good shape.
Recommendation: Based on the existence of the Hudson River Waterfront Museum (located at various New York Harbor slips), a restored wooden covered harbor barge, no further work is recommended.

Figure 135. Vessel No. 13, facing east.

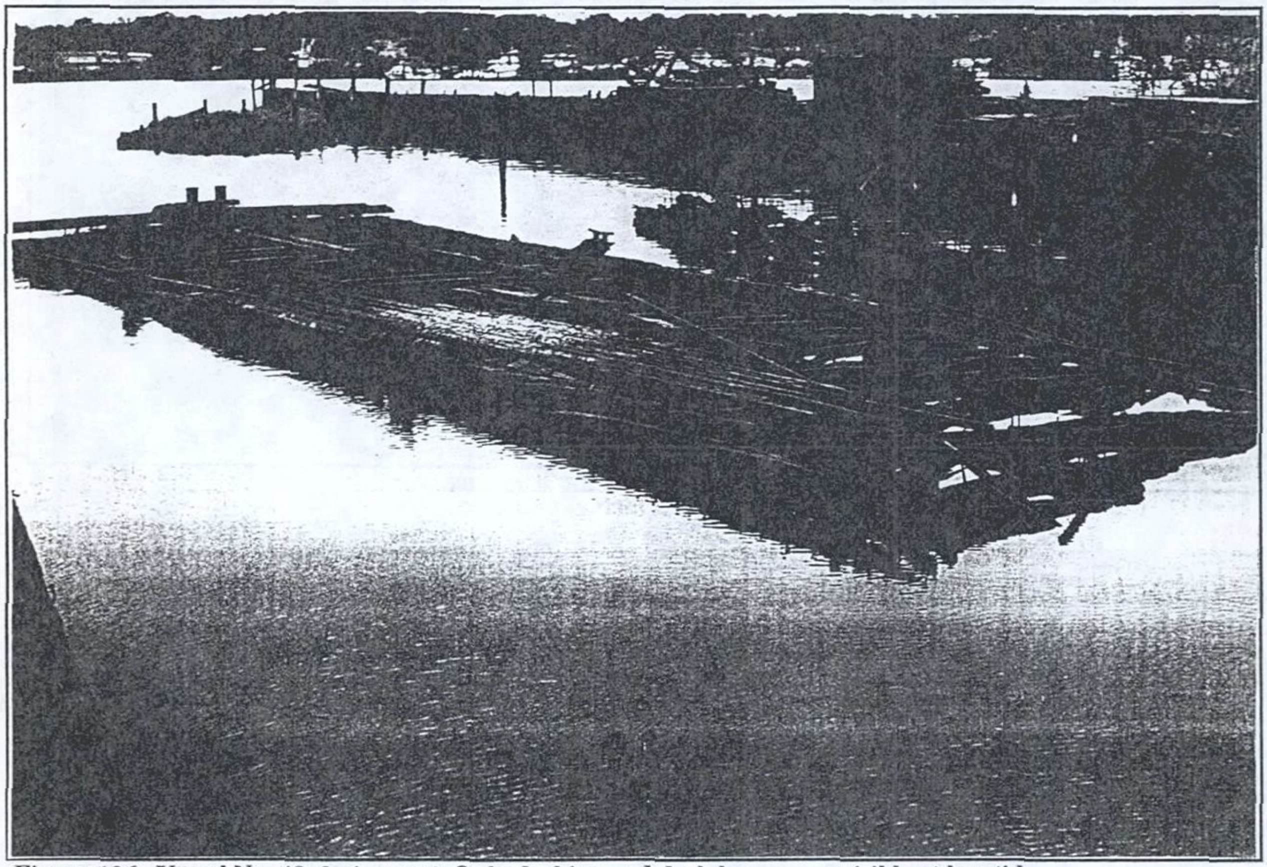


Figure 136. Vessel No. 48, facing east. Only decking and deck beams are visible at low tide.

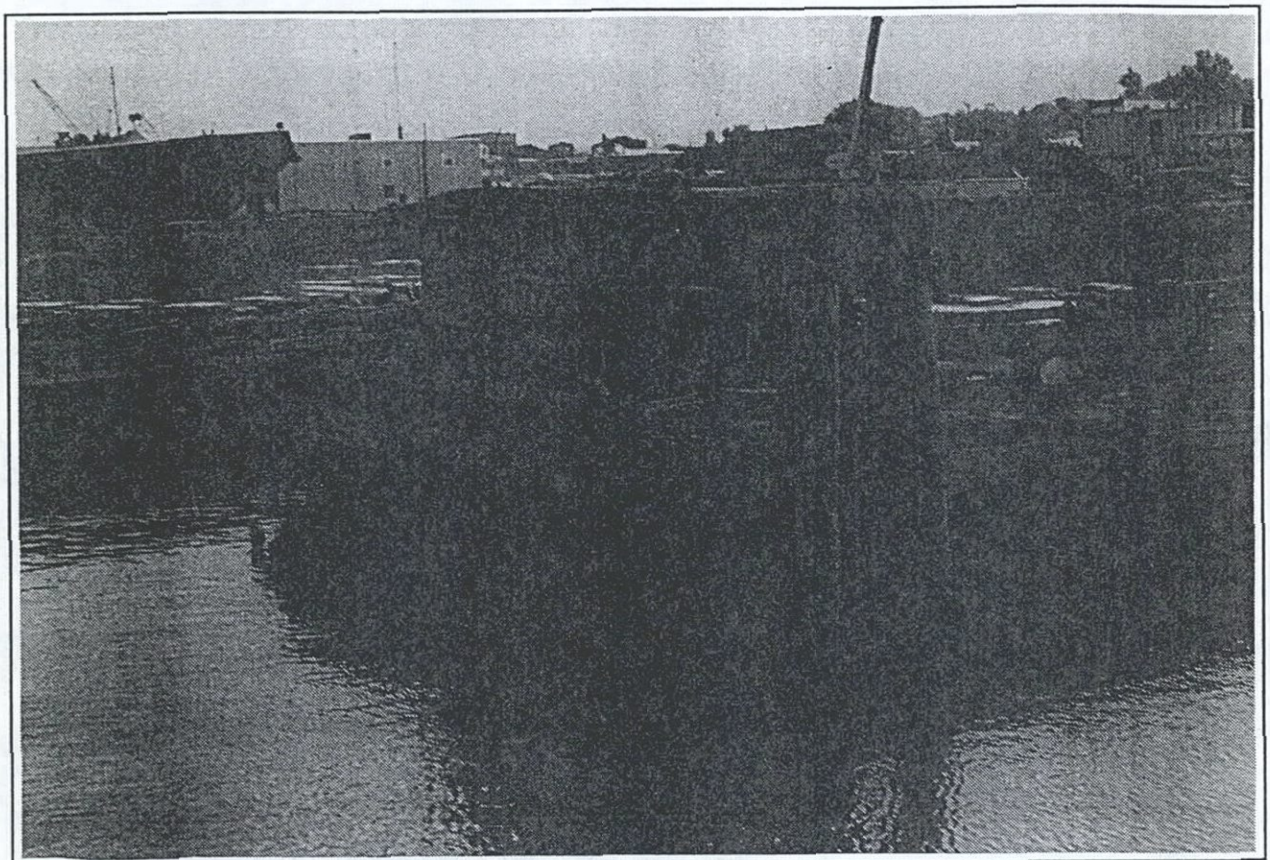


Figure 137. Fully articulated site view of Vessel No. 121, facing southeast.

IRON/STEEL BARGES. Shipbuilders eventually developed all-welded designs (1928) as illustrated by the steel sand and gravel barge in Figure 138. The Federal Shipbuilding & Dry Dock Company, Kearny, New Jersey, built a barge 116 ft. long, 34 ft. in breadth, 10 ft. 3 in. deep with a gross weight of 172 tons (Marine Engineering and Shipping Age 1928). The design, according to the author, applied to scows, lighters, covered barges, and tank barges. The Federal Shipbuilding Company believed, correctly so, that "the change from wood to steel construction for such craft is inevitable" (Marine Engineering and Shipping Age 1928:595). Grounds for such belief depended on lower maintenance and insurance costs and increased carrying capacity. Obviously, this type of construction provided greater longevity as opposed to wood. What is of interest here is the internal construction. The use of longitudinal truss designs is similar to designs seen in earlier wooden barges.

The Delaware, Lackawanna and Western Railroad Company, and the New York Central Railroad Company accepted the standard scow design set forth by the Standardization Committee of the General Manager's Association of New York (Bethlehem Steel Company 1951). These companies placed orders with the Staten Island Yard of the Bethlehem Steel Company, Shipbuilding Division for 80 scows in 1951. Ten featured freight houses, the design allowing a house addition to the hull of a standard scow. "The development of a standard design, its acceptance by a number of railroads...marks an important step in barge building" (Bethlehem Steel Company 1951:2). Table 19 indicated vessels in the project area defined as transitional wooden/steel barges.

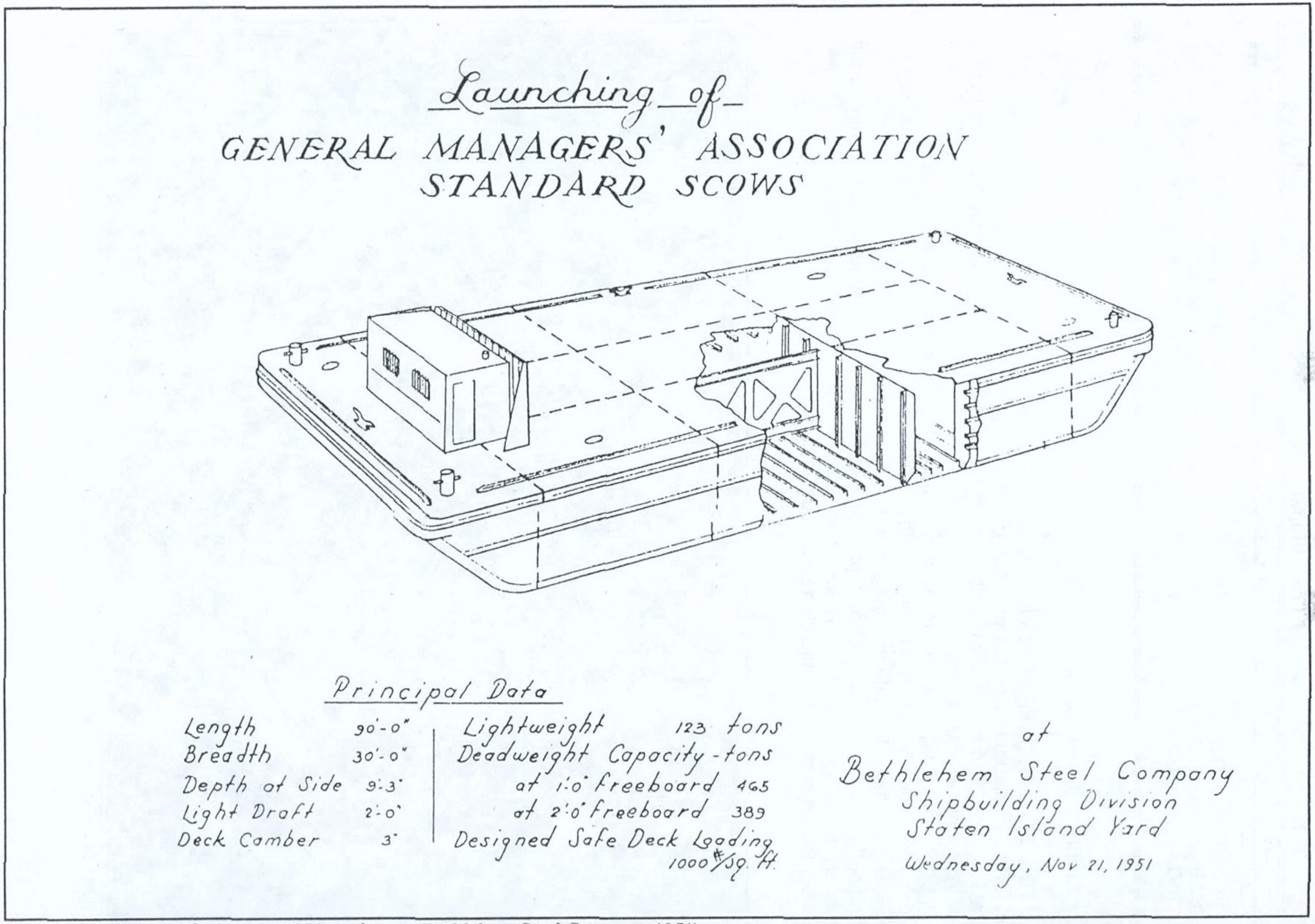


Figure 138. General design of a 1951 steel scow (Bethlehem Steel Company 1951).

Table 19. Summary of Transitional Wooden/Steel barges Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 105A	Arthur Kill, NJ	No	No further work is recommended
Vessel 105B	Arthur Kill, NJ	No	No further work is recommended
Vessel 105C	Arthur Kill, NJ	No	No further work is recommended

Arthur Kill, New Jersey Reach

Vessel Nos. 105A, B, C (Figures 139-141)
Vessel Type: Transitional wooden/steel barge
General Location: Arthur Kill, New Jersey near National Fireproofing (Raritan, New Jersey)
Date of Abandonment: Unknown
Description: Both Vessels A and B are wooden-sided, steel-ended barges. Standard bitts run along each side. Vessel A's deck is welded plate metal measuring 38 x 130 ft. Vessel B's deck is riveted plate metal measuring 38 x 120 ft. Vessel C is a modern metal barge.
Recommendation: These barges, though possessing iron and wood characteristics, are not unique in construction. Vessels A and B are wooden barges retrofitted with riveted plates. They are not composite constructed and do not warrant further investigation.

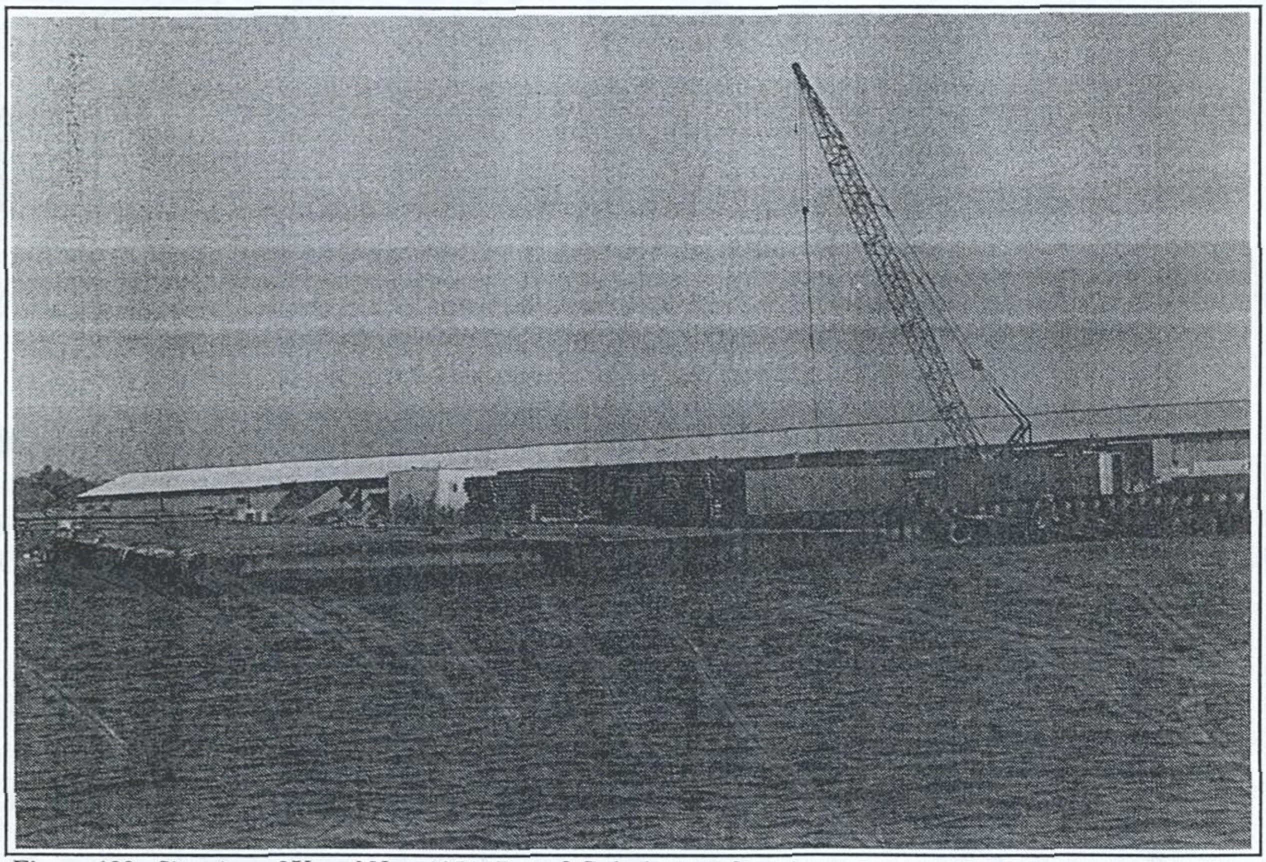


Figure 139. Site view of Vessel Nos. 105A, B, and C, facing northwest.

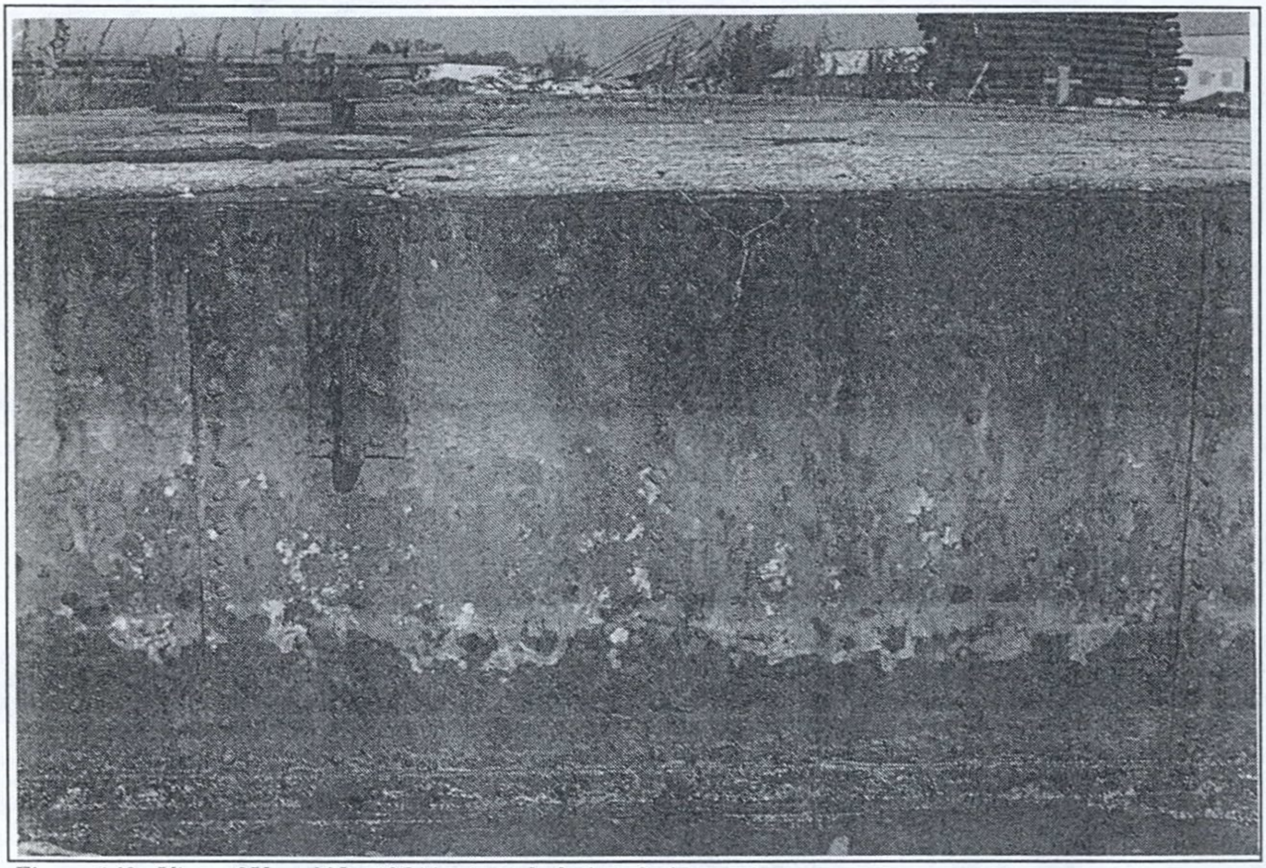


Figure 140. View of Vessel No. 105A's riveted plating, facing west.

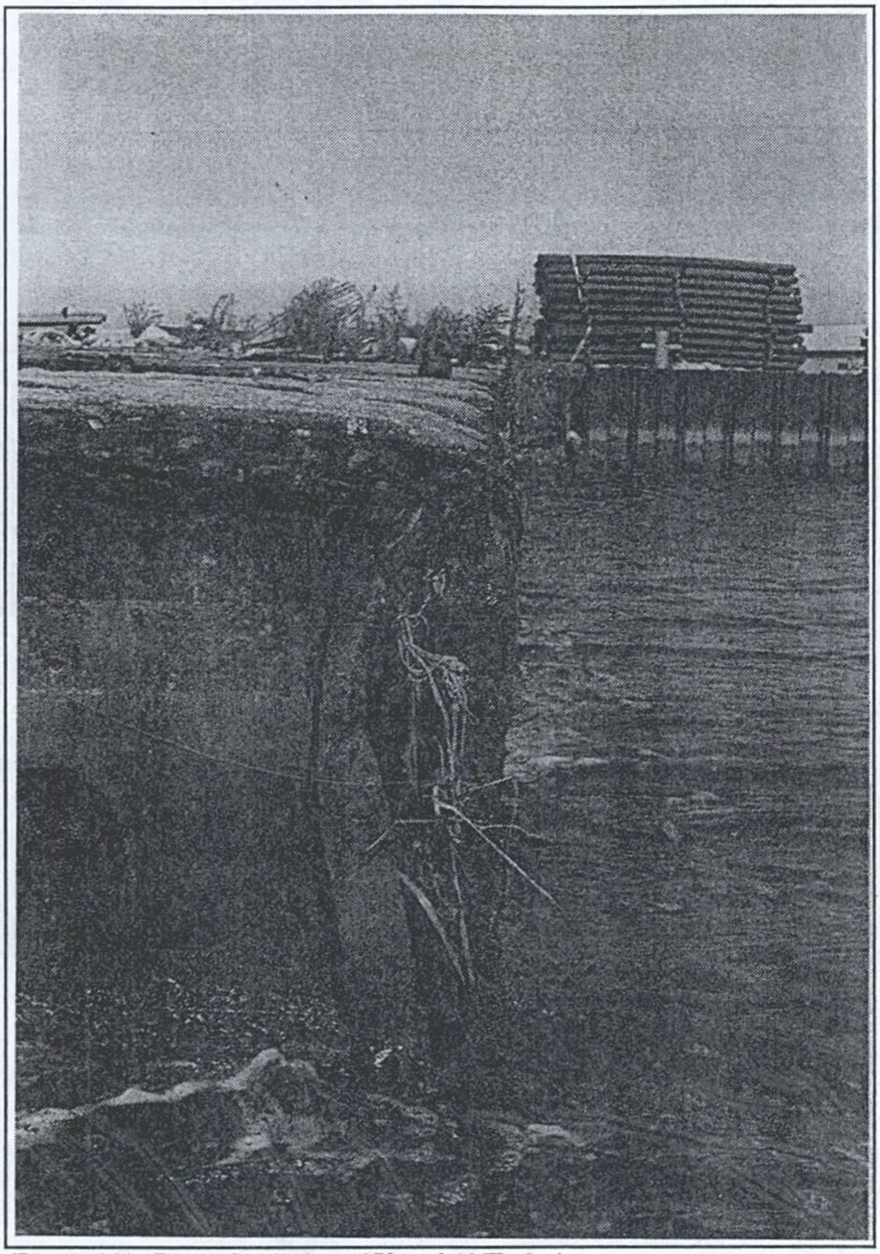


Figure 141. Riveted refitting of Vessel 105B, facing west.

TOWBOATS AND TUGBOATS

Tug boats are truly "harbor tractors," capable of performing a wide variety of tasks. Modern tug designs are basically the same, most differences based on function. In 1818, the Staten Island ferry *Nautilus* towed sailing vessels through the Narrows. In 1825, the woodburning sidewheeler *Henry Eckford* towed Hudson River barges from New York to Waterfront, the eastern terminus of the Erie Canal (Cleary 1956:44). In port, *Henry Eckford*'s crew docked and undocked sailing vessels. The New York Harbor Dry Dock Company built the sidewheeler *Rufus B. King* in 1828, the first boat designed solely for towing in the Port of New York (Cleary 1956).

Sidewheelers mobilized the towage service almost exclusively until 1848 when the propeller-driven *Samson* appeared. A forerunner to today's tug, the workhorse vessel marks an evolution in steamboat design that significantly contributed to New York's lighterage system. The big sidewheelers guided windbound whaling vessels, produce barges, and canal boat rafts into the Harbor. Because of their size, they were not suitable for moving barges in the more constricted areas of the port. The propeller-driven reciprocating-engined towboat provided the appropriate technology. By the late 1800s, propeller boats replaced the big Hudson River sidewheel towboats.

The unwieldy paddleboxes disappeared, the hulls becoming shorter and narrower. A standard tugboat profile developed. The boats featured a long, narrow, one-story deckhouse. The wheelhouse appeared at the forward end, raised a few steps above the deck, or stacked on top of the deckhouse on smaller boats. Main decks developed a noticeable sheer, rising higher at the bow than the stern. Heavy moulding ran along the sides at deck level to withstand the constant buffeting by barges or car floats.

Records suggest that the iron tug *R.B. Forbes*, of Ericisson design, appeared as early as 1845 (Hall 1884). The tug, twin-screwed, registered about 300 tons, its size apparently adapted for rough water work. Screw-type tugs later appeared in Philadelphia in 1849 (Hall 1884). Apparently an owner of two old paddlewheel towboats in the city saw the advantage of propeller tugs in the harbor. William Cramp of Philadelphia built the first propeller-type tug, *Samson*, on the Delaware River. The wooden-hulled vessel measure 80 ft. in length, 17 ft. in breadth, with a draft of 8 ft.

The success of the boat *Samson* drew a great deal of attention. Cramp departed from the idea of a screw entirely submerged, instead outfitting *Samson* with a 6-ft. wheel, half of which remained below the hull, a 3-ft. keel protecting the screw (Hall 1884). A number of boats featured this configuration. The need for a light-draft vessel led to the removal of the broad keel, the wheel placed entirely above the bottom of the vessel. "This boat proving to be as efficient as its predecessors and much more handy, a revolution was effected in the form of tugs" (Hall 1884:149). Writing in 1884, Hall stated that this vessel now superseded the sidewheel towboat, and at that time there were "more than 1,800 of these...boats in. the United States" (Hall 1884:149).

The size of the tug and its horsepower determined the number of barges the pilot could tow. Bigger tugs, with a pulling capacity in excess of 400 hp, could tow three or more loaded schooner barges. Increased pulling power, larger loads, and stress on the bitts required a greater towing distance between barges. The greater the distance, the greater the probability for problems, particularly during bad weather.

Tugs typically sit low in the water, the deck 2 or 3 ft. higher than the load line. The bulwarks are always low. According to Hall (1884:149), the tugboat is "simply framed and easily built and...is a favorite boat for a rising master carpenter to undertake as his first effort at ship-building." Tugs are generally divided into two categories, harbor or short-haul tugs and oceangoing or long-haul tugs. The following typologies are tugs associated with the project area.

CARFLOAT TUGS. Among the larger propeller-driven harbor tugs are those specifically designed for moving car floats across the Hudson River and the Upper Bay. The upper deck wheelhouse, elevated 3 or 4 ft. by an additional crawl space underneath, gave pilots greater visibility over a car float loaded with standard freight cars. The *New York Central No. 27*, built in 1910, was a typical example, measuring 97.5 ft. in length and 25.6 ft. in breadth, with a depth of hold measuring 12.2 ft. (Brouwer 1996).

The *Newark* (Figures 142 and 143), built at Elizabethport, New Jersey in ca. 1916, served as a carfloat for the Central Railroad of New Jersey. The steel-hulled vessel measured 110 ft. overall, with a molded beam of 26 ft. and a depth of hold measuring 14 ft., 6 and 1/2 in. The lower and narrower after part of the deck house provided an unobstructed view of the stern from the pilot house.

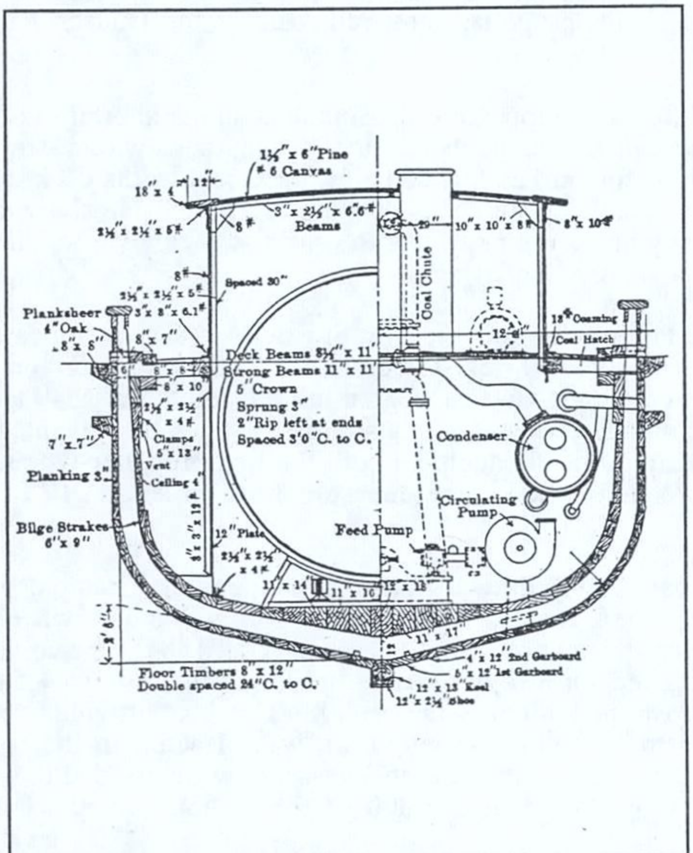


Figure 142. Midship section of the tug *Newark* (International Marine Engineering 1916)

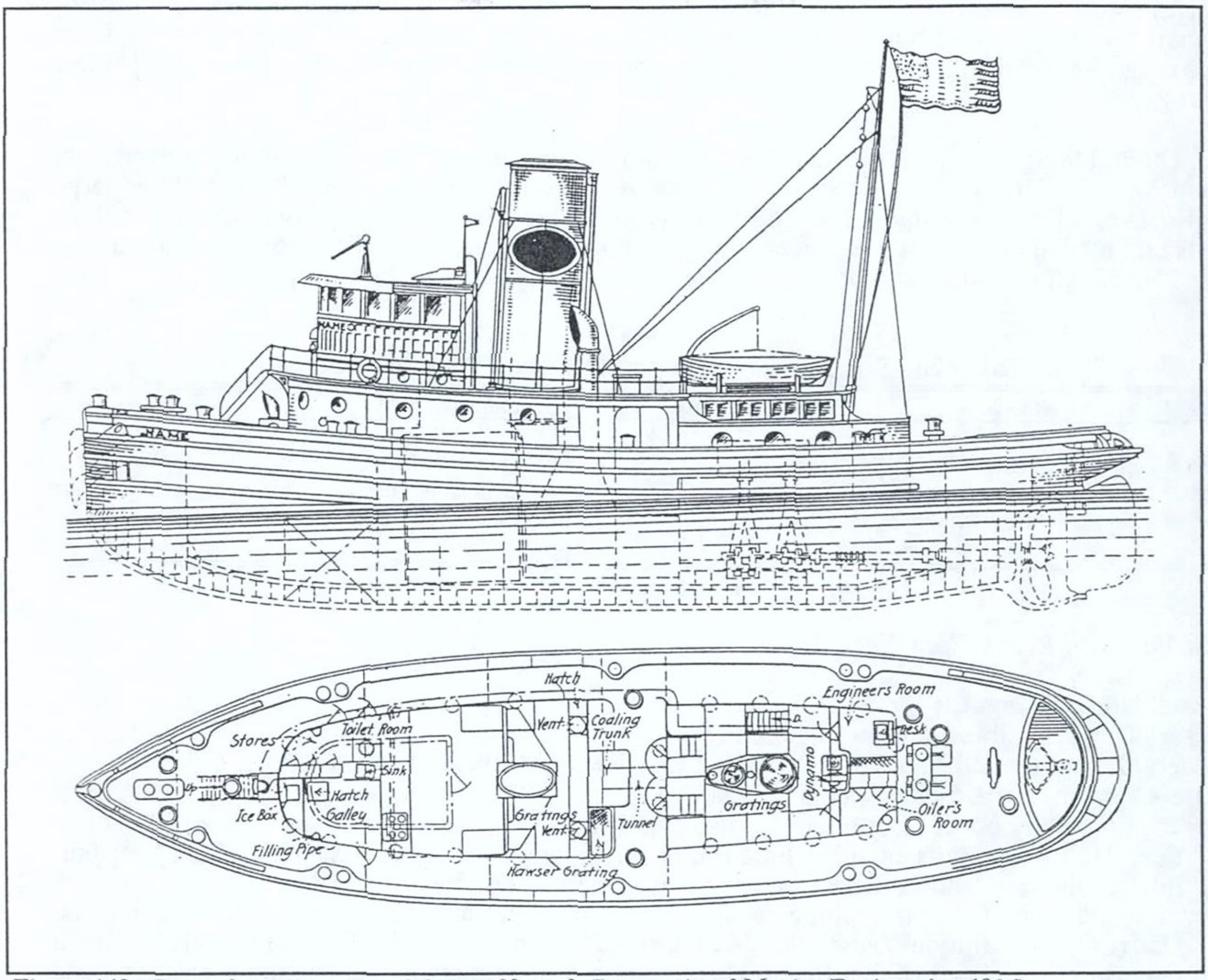


Figure 143. General arrangement of the tug *Newark* (International Marine Engineering 1916)

DRILL TUGS. Small tugs shifted barges within a terminal. They averaged around 75 ft. long and 250 horsepower. To eliminate the need to turn around in a constricted slip, the Pennsylvania Railroad in 1926 experimented with double-ended drill tugs. Because they were powered with diesel engines turning electric motors, the stack disappeared. Propellers appeared at both ends, each end a combined bow and stern. The centered wheelhouse faced fore and aft. The company built two double-enders.

CANAL TUGS. After the completion of the New York State Barge Canal in 1921, goods were brought to the Port of New York from as far away as Buffalo in barges towed behind tugs. Because of height restrictions, the tugs used were long enough to accommodate the powerful engines required. They also had a very low profile. Wheelhouses were again lowered to the main deck at the forward end of the deckhouse. Many canal tugs featured hydraulic systems for raising their pilothouse where heights were not restricted.

SEAGOING TUGS. The largest class of tugs moved coastwise barges, particularly the long strings of schooner barges that transported coal from New York and points south, ports in New England. Characteristics of the type are a series of steel-hulled boats built for the Reading Railroad around the turn of the century. One of these, *Catawissa* (1896), survives as a steam-cleaning plant based in Mariner's Harbor, Staten Island. The boat measures 158 ft. by 29 ft. breadth, with a depth of holding measuring 18 ft. Engines rated at 1,000 hp powered the boat. The seagoing tug featured a profile typical of tugs, but with two masts forward and aft (Brouwer 1996).

The lighterage tug had long, narrow lines, a long deckhouse, and a wheelhouse covered by windows. The largest tug, the transfer tug, measured 110 ft. in length. These boats handled large carfloats and featured a stacked wheelhouse for visibility. The smallest vessel type, the drill or shift tug, moved barges between piers or slips within a terminal. Table 20 provides data on vessels identified previously as wooden offshore tugs.

Table 20. Summary of Wooden Offshore Tugs Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 149	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 151	Arthur Kill, NY	No	Inaccessible, no further work
Vessel 152	Arthur Kill, NY	No	Inaccessible, no further work

Kill Van Kull Reach, New York Reach

Vessel No. 149 (Figures 144 and 145)
Vessel Type: Possible wooden offshore tug
General Location: Kill Van Kull, New York Reach near Milliken/Downey Shipyard
Date Abandoned: 1955 (Raber et al. 1995a)
Description: Only portions of the upper outer hull (frames and outer planking) are visible at low tide. Hull planking is ca. 4 in. thick and is butt-jointed with metal fasteners. The upper portions of the stem and sternpost are extant, as is the vessel's steel screw.
Recommendation: Tugs are typologically unique, built specifically for towing and harbor work. Under this description Vessel No. 149 is deemed significant under Criteria C and D. Under Criterion C, a vessel is significant when it embodies distinctive characteristics of a type and method of construction. Criterion D deems vessels significant if they yield information important to history, i.e., vessel use and construction methods. Recommended is complete photographic documentation and scantling pattern measurements. This data should be contrasted and compared with harbor tug plans presented in Volume II.

Vessel No. 151 (Figure 146)
Vessel Type: Possible wooden offshore tug
General Location: Kill Van Kull, New York Reach near Milliken/Downey Shipyard
Date Abandoned: 1947 (Raber et al. 1995b)
Description: Little visual remains of the vessel exist at low tide. Framing pairs are distinguishable, but little else.
Recommendation: Based on site inaccessibility and comparative project data, this site does not fit the best representative type category. No further work is needed.

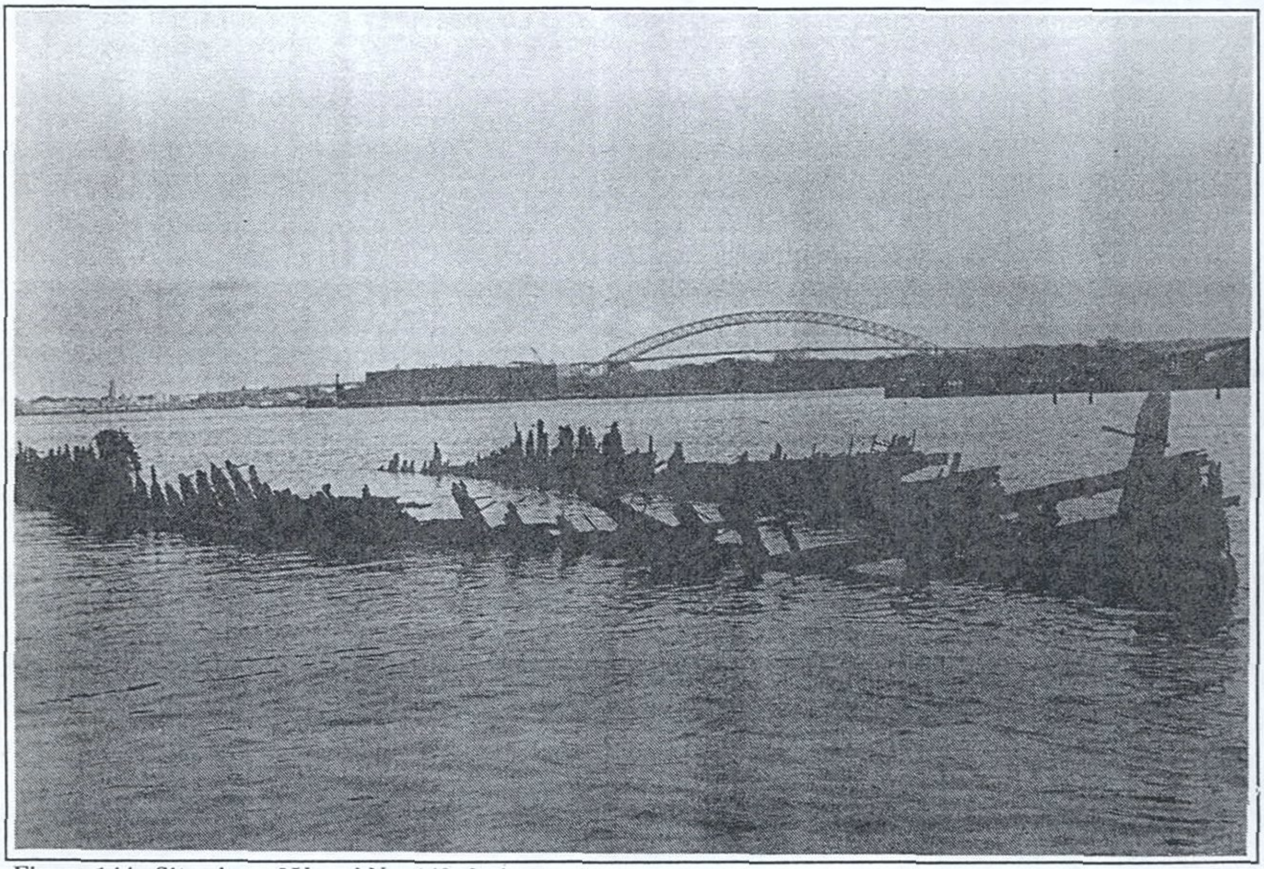


Figure 144. Site view of Vessel No. 149, facing east.

Figure 145. View of bow remains, Vessel No. 149, facing northwest.

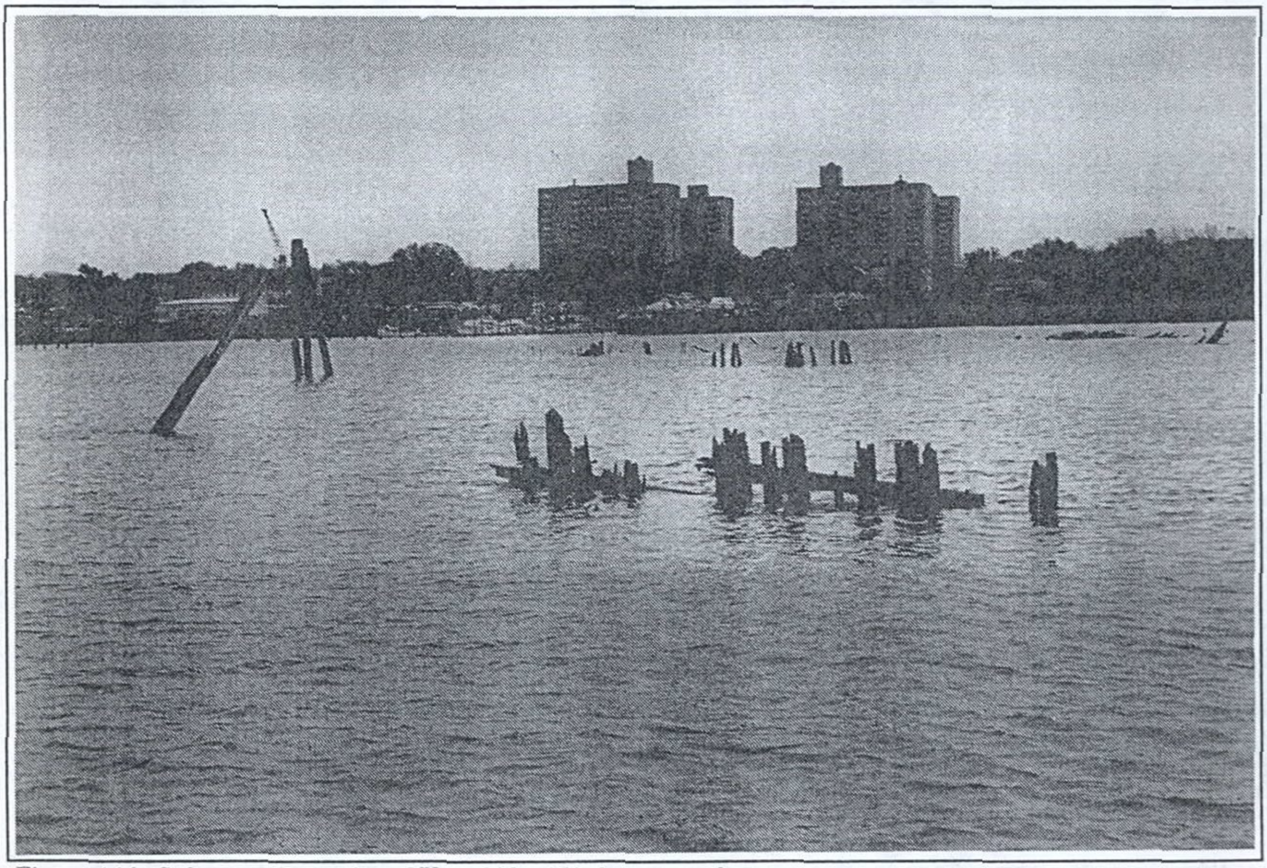


Figure 146. Submerged remains of Vessel No. 151, facing southeast.

Vessel No. 152 (Figure 147)
Vessel Type: Possible wooden offshore tug
General Location: Kill Van Kull, New York Reach near Milliken/Downey Shipyard
Date Abandoned: 1947 (Raber et al. 1995b)
Description: Very little vessel remains are visible at low tide. One side of upper outer and inner hull (port or starboard?) is visible. This portion includes paired frames and butt-jointed outer/inner hull planking.
Recommendation: Based on site inaccessibility and comparative project data, this site does not fit the best representative type category. No further work is needed.

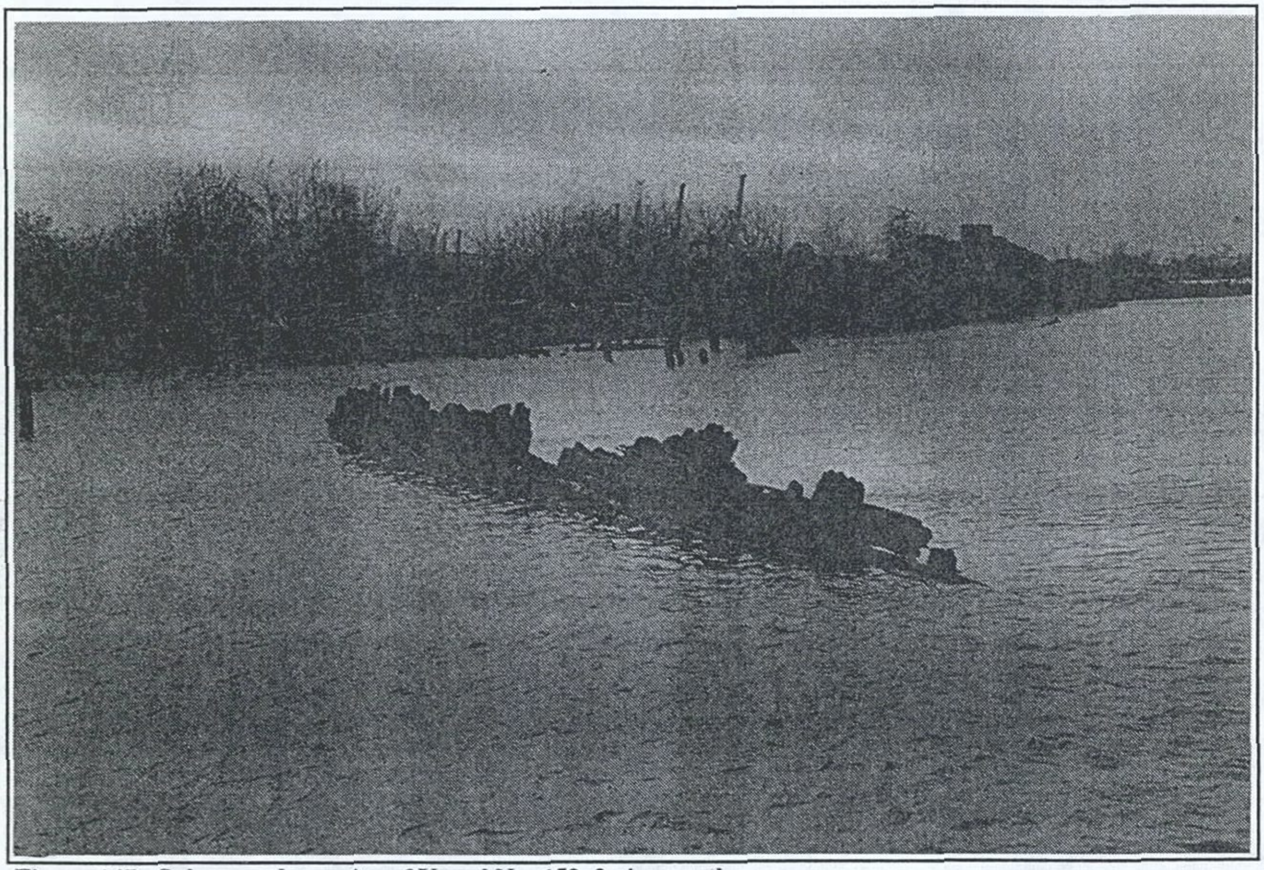


Figure 147. Submerged remains of Vessel No. 152, facing south.

WOODEN HARBOR TUGS. The Emergency Fleet Corporation and the Consolidated Shipbuilding Corporation, formerly the Gas Engine & Power Company, built four 100-ft. wooden harbor tugs for the USSB. J. Murray Watts, naval architect, Philadelphia, Pennsylvania, designed the boats. With lines similar to usual harbor tugs (100 ft.), the American Bureau of Shipping rules for wooden tugs presented the following specifications (International Marine Engineer 1912):

Keel: white oak , sided 12 in. and molded 13 in.
Stem: white oak , sided 11 in. and molded 14 in.
Stern post: white oak, sided 11 in. and molded 14 in.
Frames: white oak, sided 6 in. double.

Keelson: 12-x-12-in. yellow pine in long lengths with scarfs not less than 6 ft. long.
Shaft log: white oak in halves, 10 x 24 in.
Deadwoods: white oak, sided 18 in. and molded back to receive the frames.
Bottom ceiling: yellow pine 3 in. thick.
Side ceiling: ceiling between the bilge strakes and the clamps 3 1/4-in. yellow pine.
Clamps: yellow pine 6 x 10 in., three strakes on each side in long lengths, scarfed.
Shelf: yellow pine, two strakes 5 x 9 in., lock strake 5 x 10 in., in beam 1 in.
Deck beams: main beams yellow pine sided 11 in. and regular beams sided 8 1/2 in.
Knees: white oak or hackmatack
Outside planking: side and bilge planking 3 1/4-x-8-in. yellow pine.
Sheer strakes: Three sheer strakes 4-x-10-in. yellow pine, fastened with 7/16-x-8in. galvanized spikes.
Deck planking: 3-x-3-in. Douglas fir or yellow pine.
Plank sheer: white oak 4 x 14 in., let down over the stanchions and fastened with 7/16-x-8-in. galvanized spikes.
Rudder: the rudder stock and main piece to be of the best steel casting; blade and balance made of oak
Shoe: cast steel shoe for rudder
Water tanks: either stock steel tanks or independent wooden tanks
Steel bunker bulkheads: non-watertight steel bunker bulkheads; steel bulkhead forward of the boiler
Outboard joiner work: the entire hull, decks, and rails well planed off smooth and fair
Wood deck house: yellow pine; the top of the deck house made of Oregon pine, felted and covered with No. 6 canvas.
Pilot house: yellow pine.

By 1920, 42 of these tugs were built according to Murray's design. Figures 148 and 149 show midship section and general arrangement plans of a typical 100-ft. tug (Marine Engineering 1920). The boats are wooden built with oak frames (8 x 12 in.) and hard pine planking. The keel is oak, measuring 12 x 15 in. The overall length of the tug was 100 ft. 8 in. The keelsons are built up of 11-x-12-in. hard pine. Figure 150 is the tug *Energy*, built by Northwest Engineering Works. Table 21 identifies those vessels previously typed as wooden screw harbor tugs.

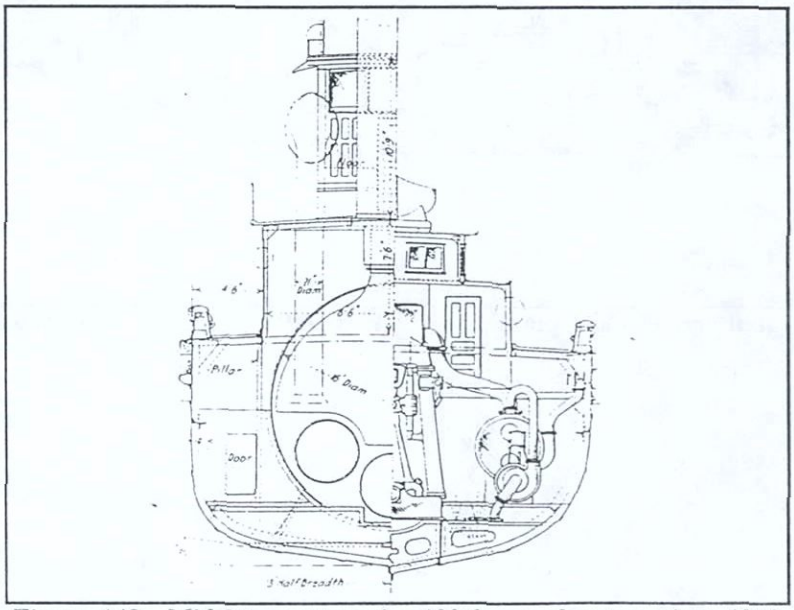


Figure 148. Midship section of a 100-ft. wooden tug, circa 1920 (International Marine Engineering 1920).

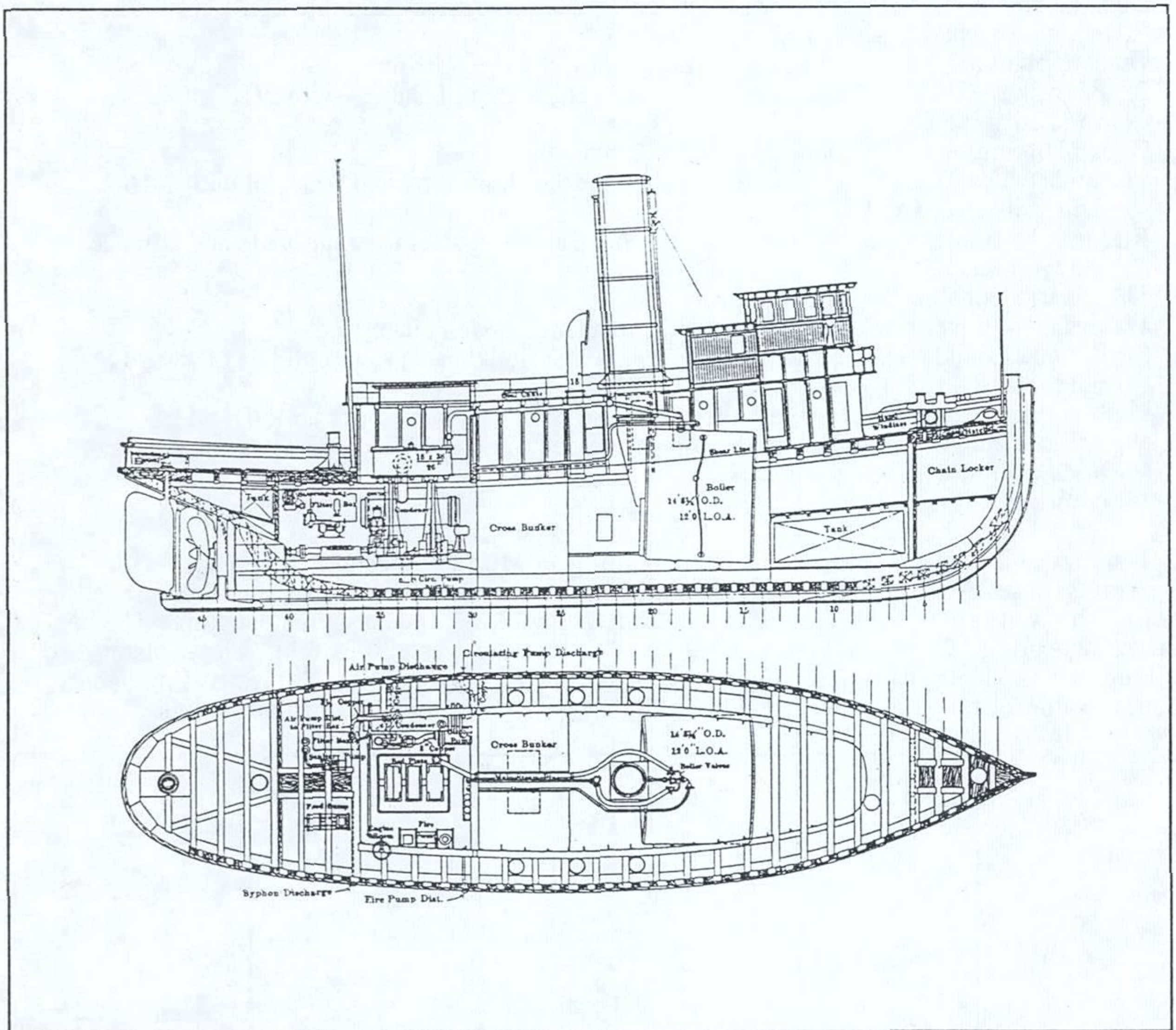


Figure 149. General plan arrangement plans of a 100-ft. wooden tug, circa 1920 (International Marine Engineering 1920).

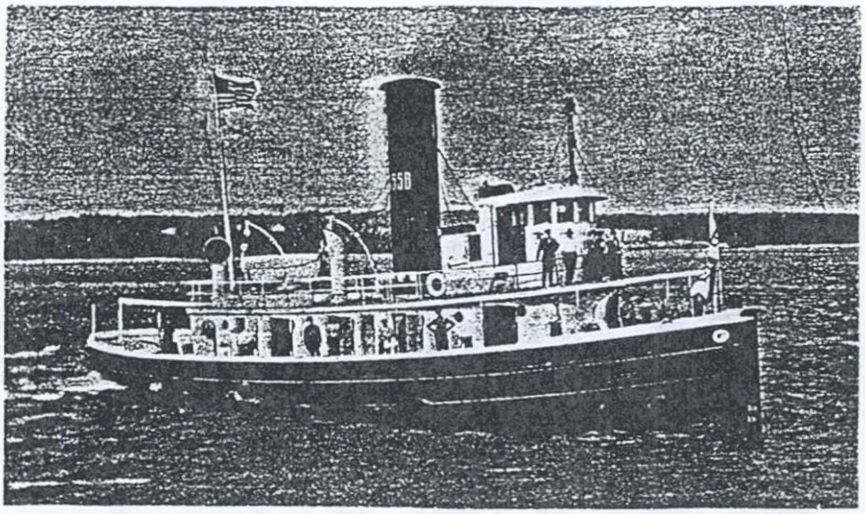


Figure 150. Photograph of the tug *Energy* (International Marine Engineering, 1920).

Table 21. Summary of Wooden Screw Harbor Tugs Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 9	Arthur Kill, NY	No	Not best representative, no further work
Vessel 41	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 75	Arthur Kill, NY	No	Not best representative, no further work
Vessel 76	Arthur Kill, NY	No	Not best representative, no further work
Vessel 84	Arthur Kill, NY	No	Not best representative, no further work
Vessel 100	Arthur Kill, NY	No	Not best representative, no further work
Vessel 102	Arthur Kill, NY	No	Not best representative, no further work
Vessel 97	Arthur Kill, NY	No	Not best representative, no further work

Arthur Kill, New York Reach

Vessel No. 9 (Figure 151)
Vessel Type: Wooden screw harbor tug
General Location: Arthur Kill, New York Reach north of Witte's Scrapyard
Date of Abandonment: 1978 (Raber et al. 1995a)
Description: Only the upper after body is afloat and visible at low tide. The superstructure is absent. Vertical stanchions arise through mortised waterway timber port and starboard. The vessel is heavily fastened by iron. Extant railing spikes are exposed on the starboard side aft. Vertical bumper strakes are visible above the rudder area. Deck planking runs longitudinally.
Recommendation: Based on limited accessibility and comparative project data, this site does not fit the best representative type category. No further work is needed.

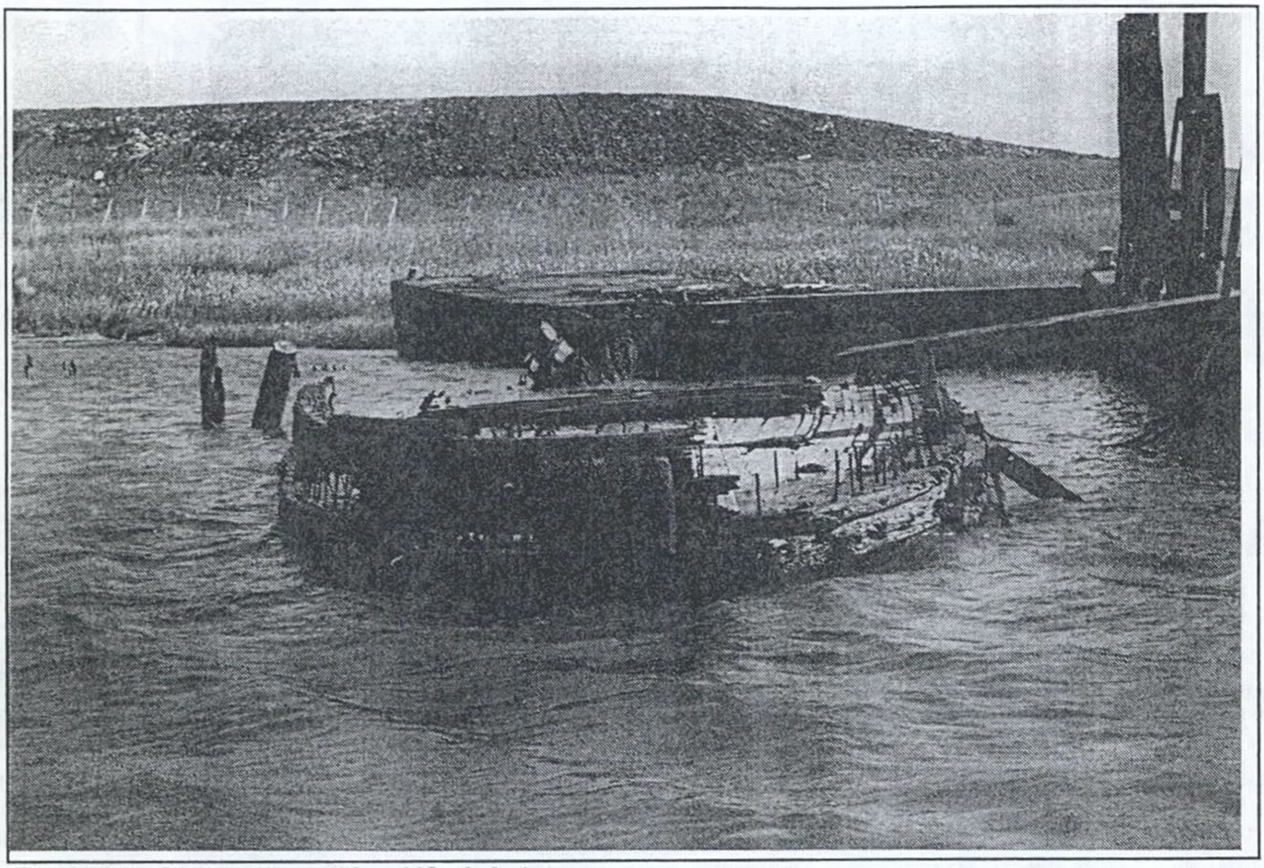


Figure 151. Stern section of Vessel No. 9, facing east.

Vessel No. 41 (Figure 152)
Vessel Type: Wooden screw harbor tug
General Location: Arthur Kill, New York Reach north of Witte's Scrapyard
Date of Abandonment: 1978 (Raber et al. 1995a)
Description: The vessel is afloat but devoid of superstructure. Vessel access is limited due to its association with other wrecks. The vessel is straight bowed. Hawser holes, scuppers, metal bits, and cleats are extant, as are remnants of hoist bracing and pumping equipment. The sheer wale is steel sheathed. The vessel has the typical rounded stern of a tug. All outer planking is butt-joined. The decking is longitudinal.
Recommendation: This vessel represents the best representative type within the project area. It is eligible for the NRHP under Criterion C (distinctive type or method of construction) and Criterion D (yielding information about use and construction). Though the vessel's superstructure is absent, its lower hull remains are intact. Complete photographic documentation and site plan recordation are recommended. The research should include, but not be limited to, an examination of any available deck plans, profiles, engine/boiler plans, scantlings, or models.

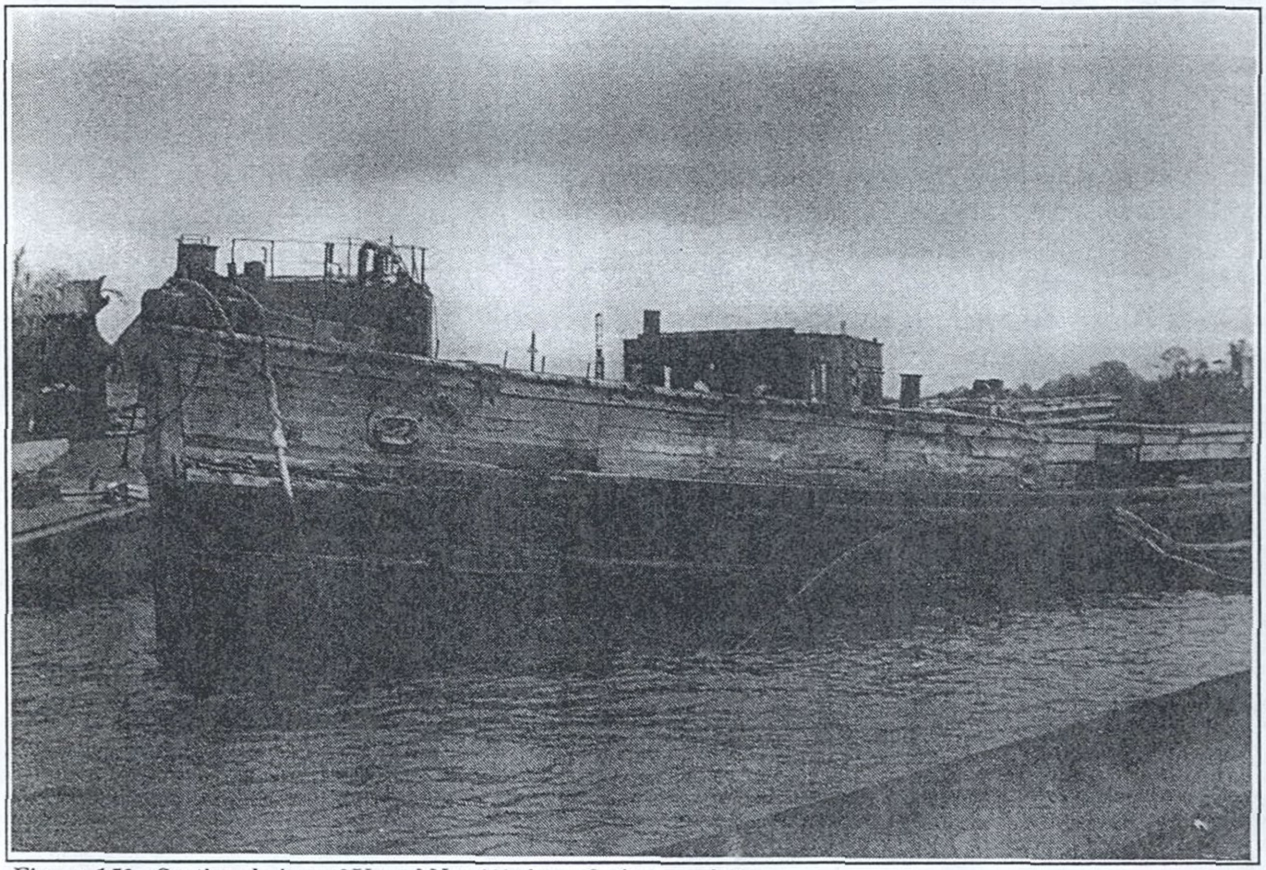


Figure 152. Sectional view of Vessel No. 41's bow, facing northeast.

Vessel No. 75 (Figure 153)
Vessel Type: Wooden screw harbor tug
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: This tug is in similar condition and position as Vessel Nos. 84 and 76. With a submerged stern and exposed bow, the stem section is in good physical condition. Visible construction features include vertical stanchions and knees, deck beams, decking, and iron railing. The tug exhibits similar construction features as Nos. 84 and 76, but has substantially more metal workings (i.e., metal railing, chocks, and strapping), including a metal bulkhead forward. The tug has substantial wooden wales and bumpers. The scuppers are intact. In the bow section, tack holes are present near the waterline, suggesting previous sheathing.
Recommendation: Based on comparative project data, this site does not fit the best representative type category. No further work is needed.

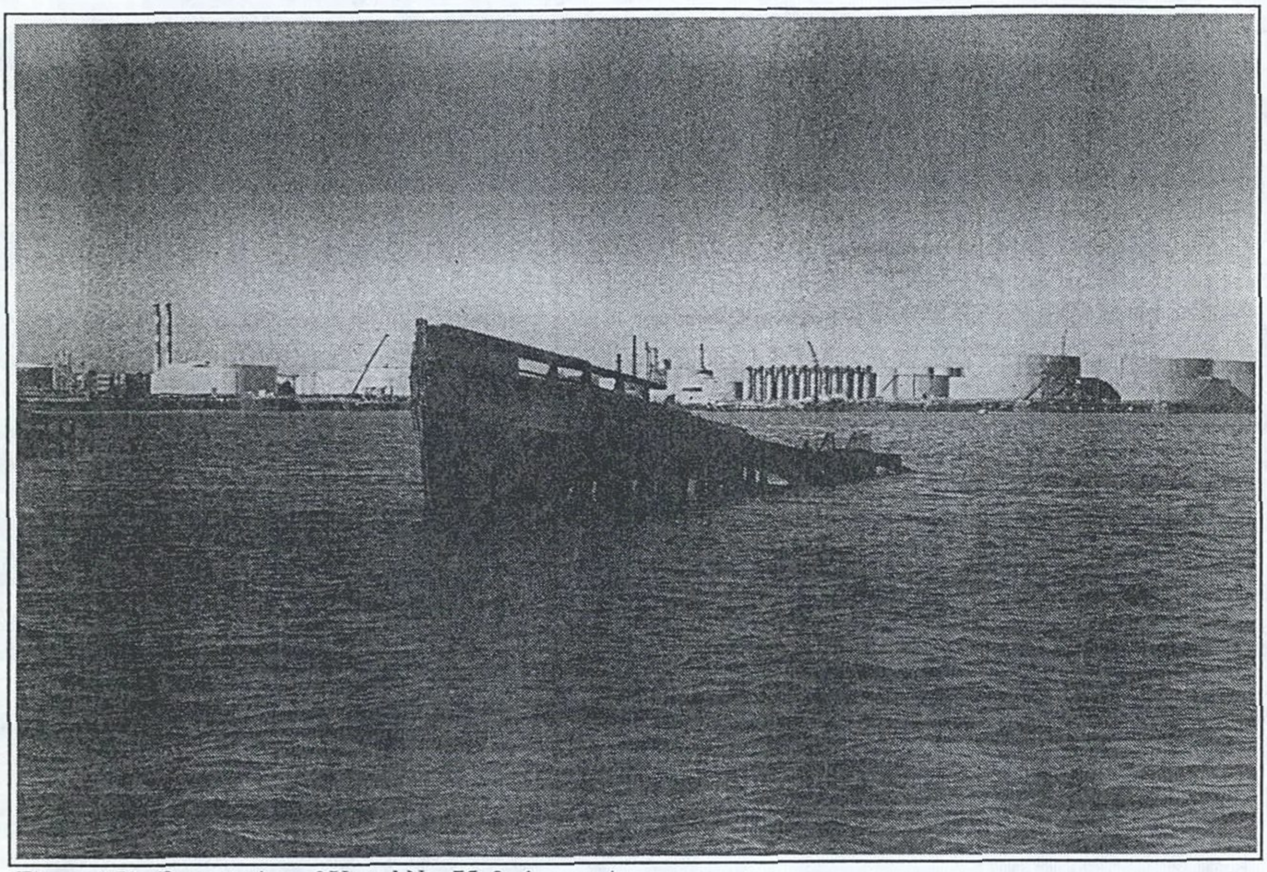


Figure 153. Bow section of Vessel No. 75, facing west.

Vessel No. 76 (Figure 154)
Vessel Type: Wooden screw harbor tug
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Part of a "tug cluster," the vessel is in similar condition and position to Vessel No. 84. The bow extends upward out of the water, with the stern section partially submerged at low tide. The tug apparently sits on top of another vessel. The superstructure is absent, but more forward deck planking is present than Vessel No. 84. Vertical stanchions are mortised through the waterway. Frames are occasionally paired. Forward portions of longitudinal planking and a transverse deck beam exist. Outer planking is butt-joined and treenail fastened. Lower hull configuration is not visible.
Recommendation: Based on comparative project data, this site does not fit the best representative type category. No further work is needed.

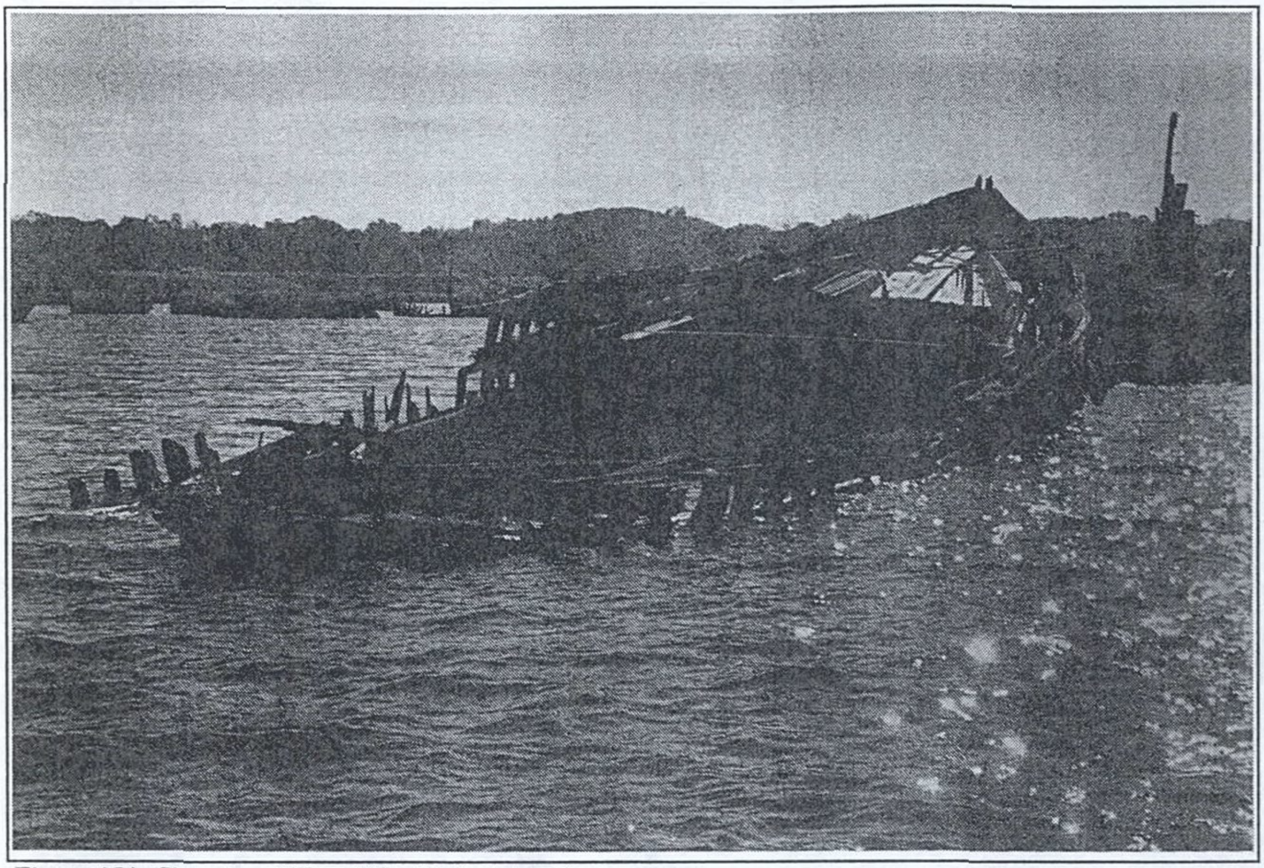


Figure 154. Site view of Vessel No. 76, facing east.

Vessel No. 84 (Figures 155 and 156)
Vessel Type: Wooden screw harbor tug
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Part of a "tug cluster," the vessel's internal framing is gutted. The bow extends upward out of the water. The stern section is partially submerged and rests against another vessel. The bow section is intact but deteriorating. Visible stem section includes hawser holes and a forward ladder leading to the bilges. The stempost is iron capped. A bulkhead in the forward section is viewable. Fasteners are wooden and iron. Deck planking is visible in the upper bow section, but obstructions hampered further investigation.
Recommendation: Based on site inaccessibility and comparative project data, this site does not fit the best representative type category. No further work is needed.

Vessel No. 100 (Figures 157 and 158)
Vessel Type: Wooden screw harbor tug
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Only the vessel's outer hull section is visible. The vessel rests in shallow water. The hull acts as a sediment reservoir for ruderal plant species. The stern post assemblage is partially visible at low tide.
Recommendation: Based on site inaccessibility and comparative project data, this site does not fit the best representative type category. No further work is needed.

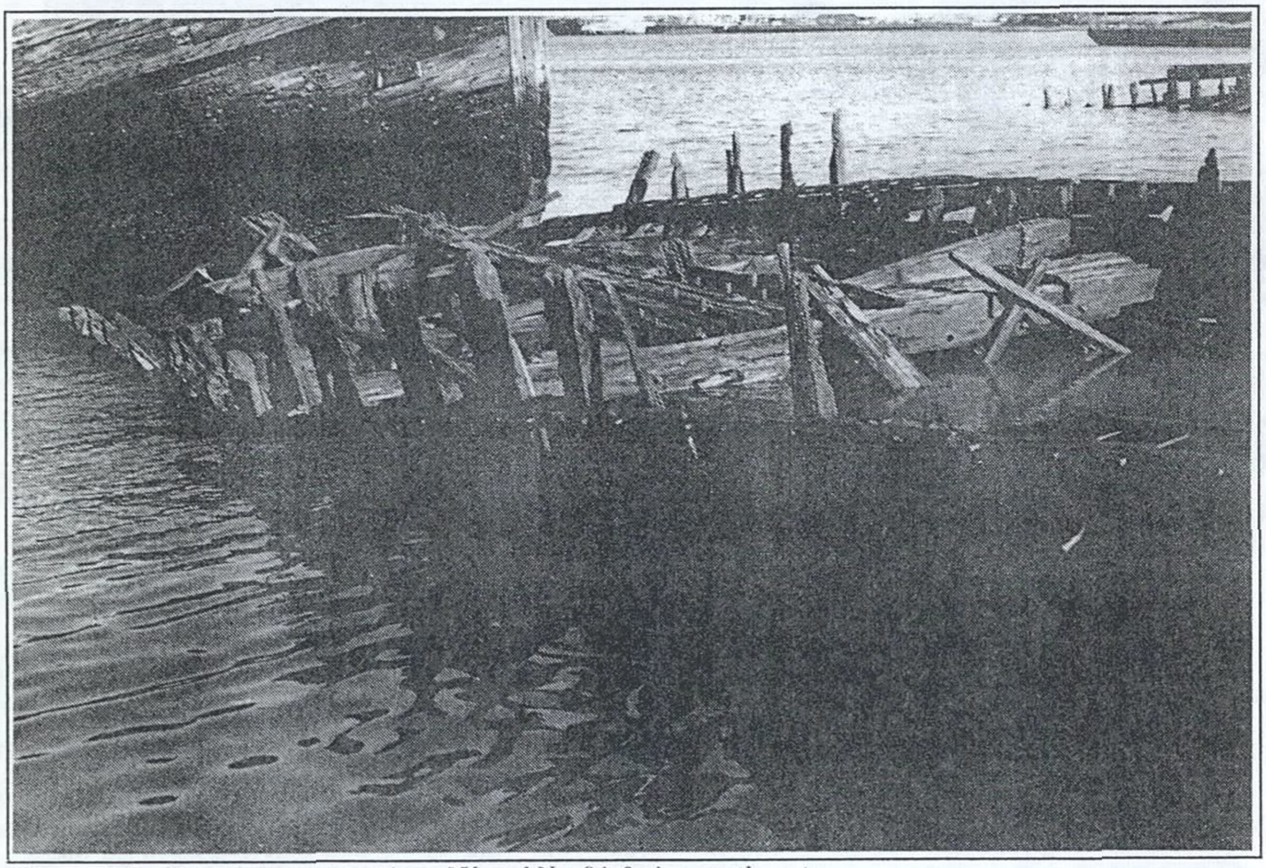


Figure 155. Outer hull stern section of Vessel No. 84, facing northwest.

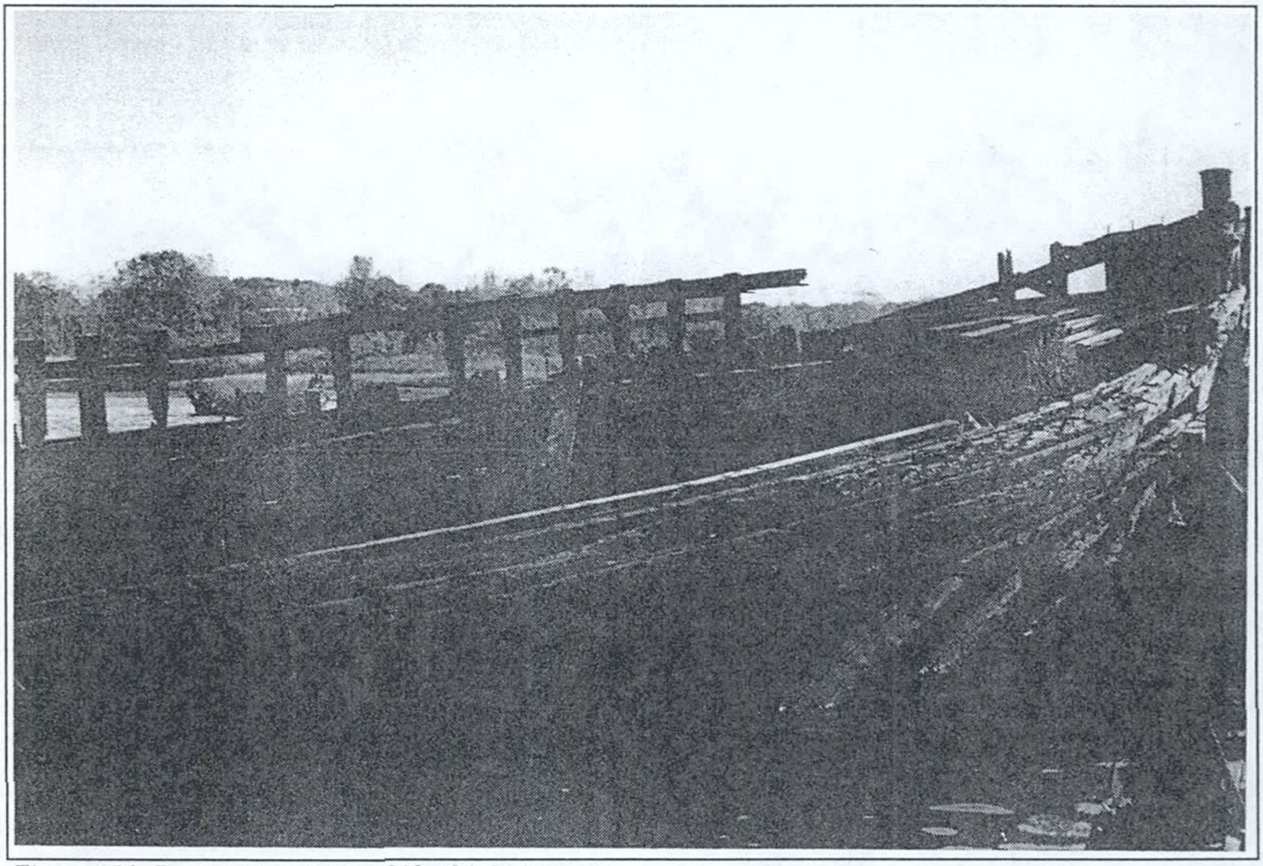


Figure 156. Bow section of Vessel No. 84, facing east.

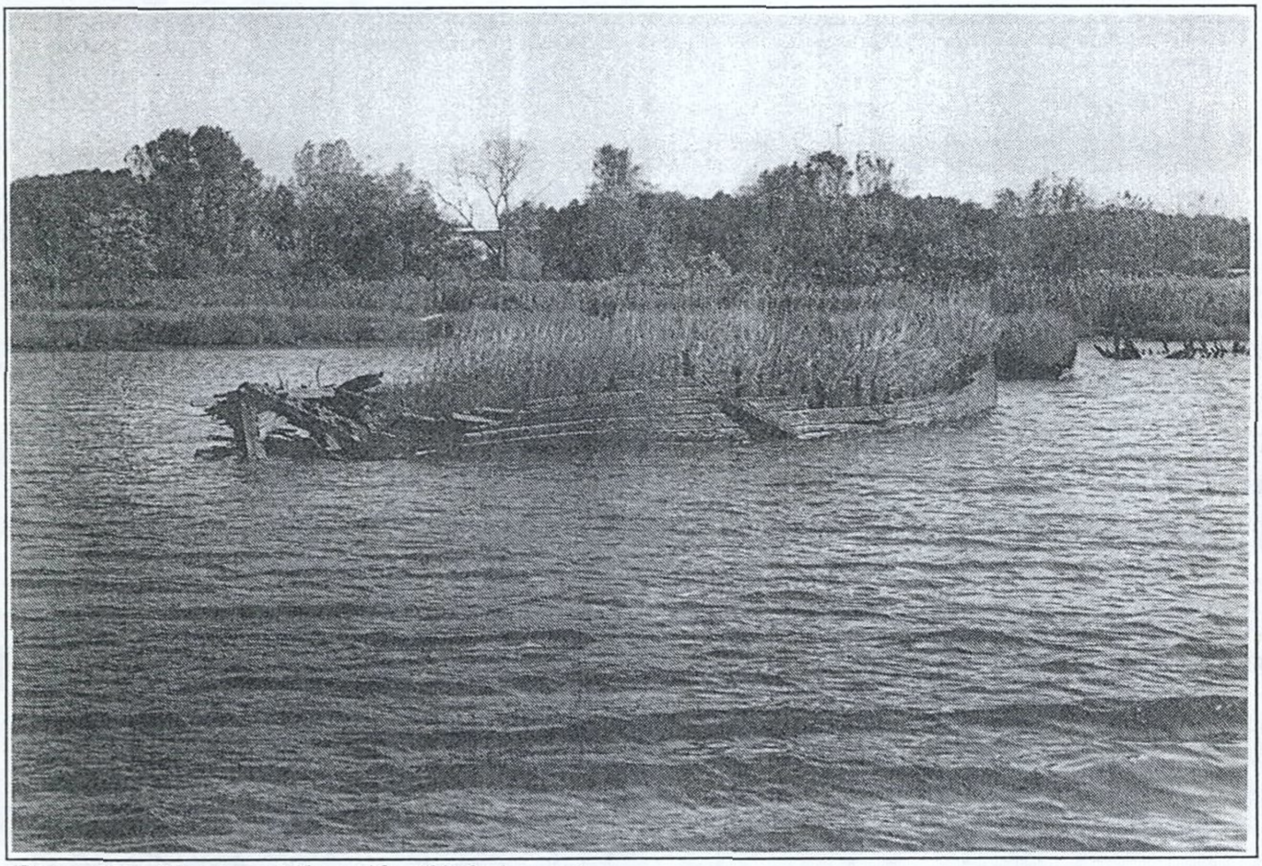


Figure 157. Site view of Vessel No. 100, facing east.

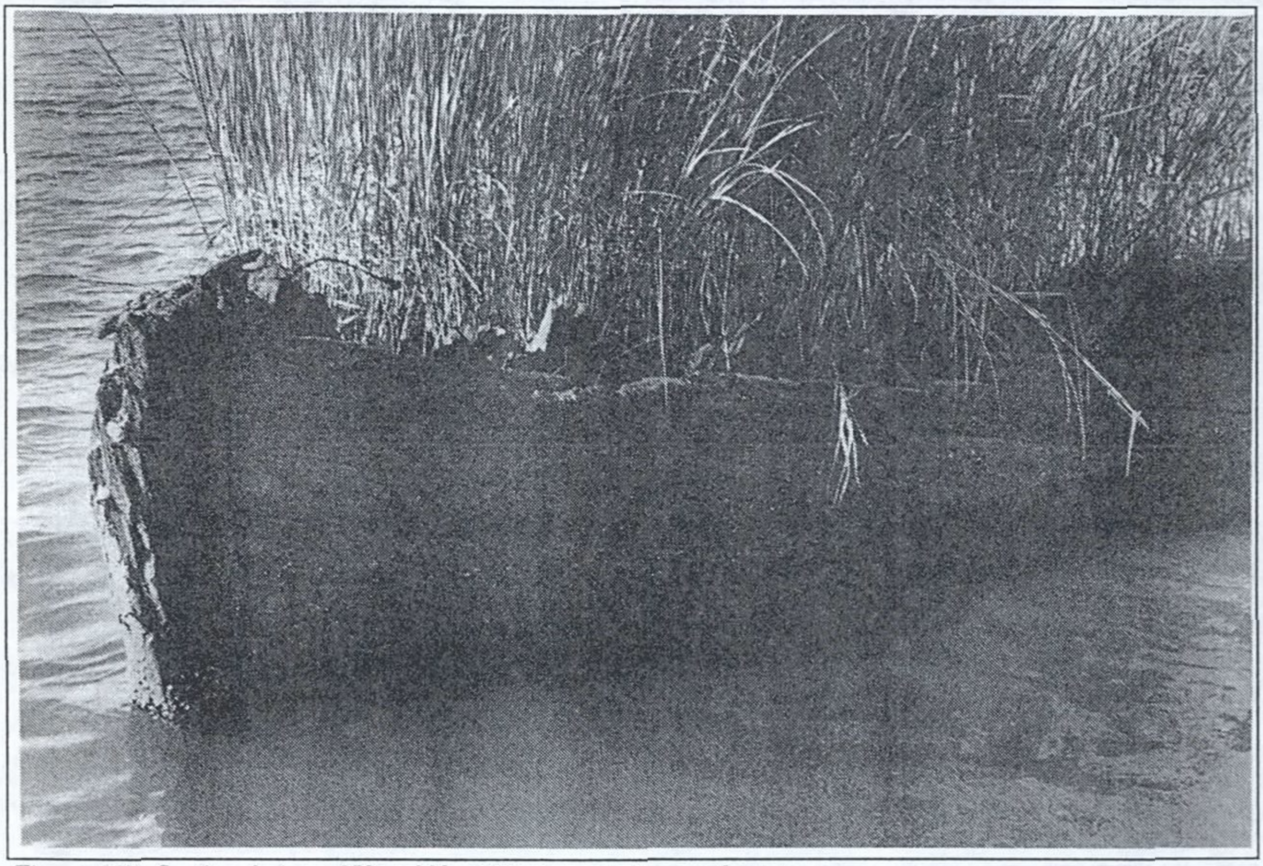


Figure 158. Sectional view of Vessel No. 100's bow, facing southwest.

Vessel No. 102 (Figure 159)
Vessel Type: Wooden screw harbor tug
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: The vessel's physical condition is similar to Vessel No. 100; it is in poor condition.
Recommendation: Based on site inaccessibility and comparative project data, this site does not fit the best representative type category. No further work is needed.

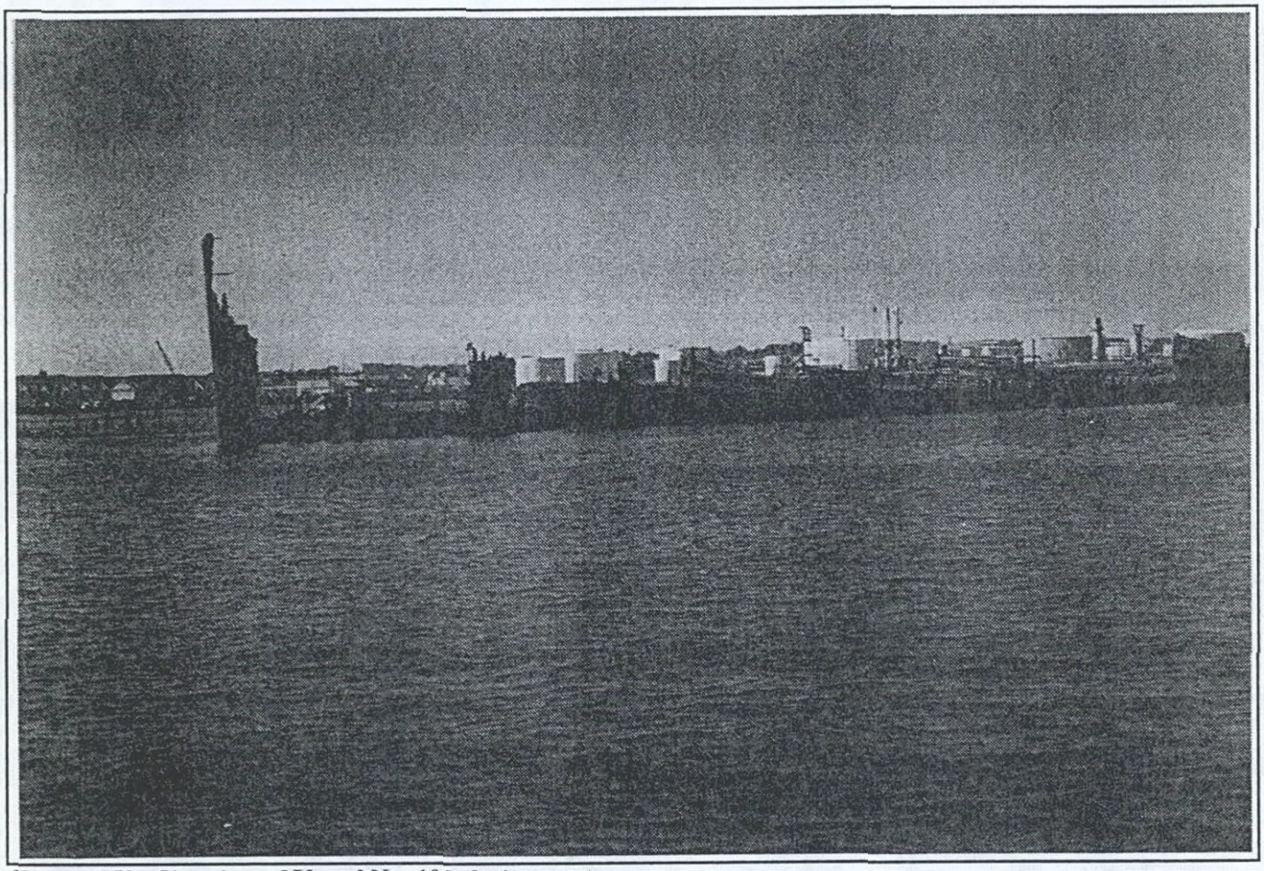


Figure 159. Site view of Vessel No. 102, facing west.

Arthur Kill, New Jersey Reach

Vessel No. 97 (Figures 160 and 161)
Vessel Type: Wooden screw harbor tug
General Location: Arthur Kill, New Jersey Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The vessel is approximately 70 ft. in length and 30 ft. in breadth. No superstructure or deck machinery exists, leaving only extant hull remains. The visible remains include outer planking, futtocks, and deck beams. Lower hull features are underwater. Portions of the stern post are copper sheathed. The stern post rises through timbers probably meant to support the transom. Also visible is the ceiling, doubled in some sections. The outer planking is 6 in. wide and 4 in. thick. It is attached by treenails externally and metal fasteners internally.

During low tide, the tug's hull acts as a water reservoir, eliminating further structural observation.

Recommendation: Based on site inaccessibility and comparative project data, this site does not fit the best representative type category. No further work is needed.

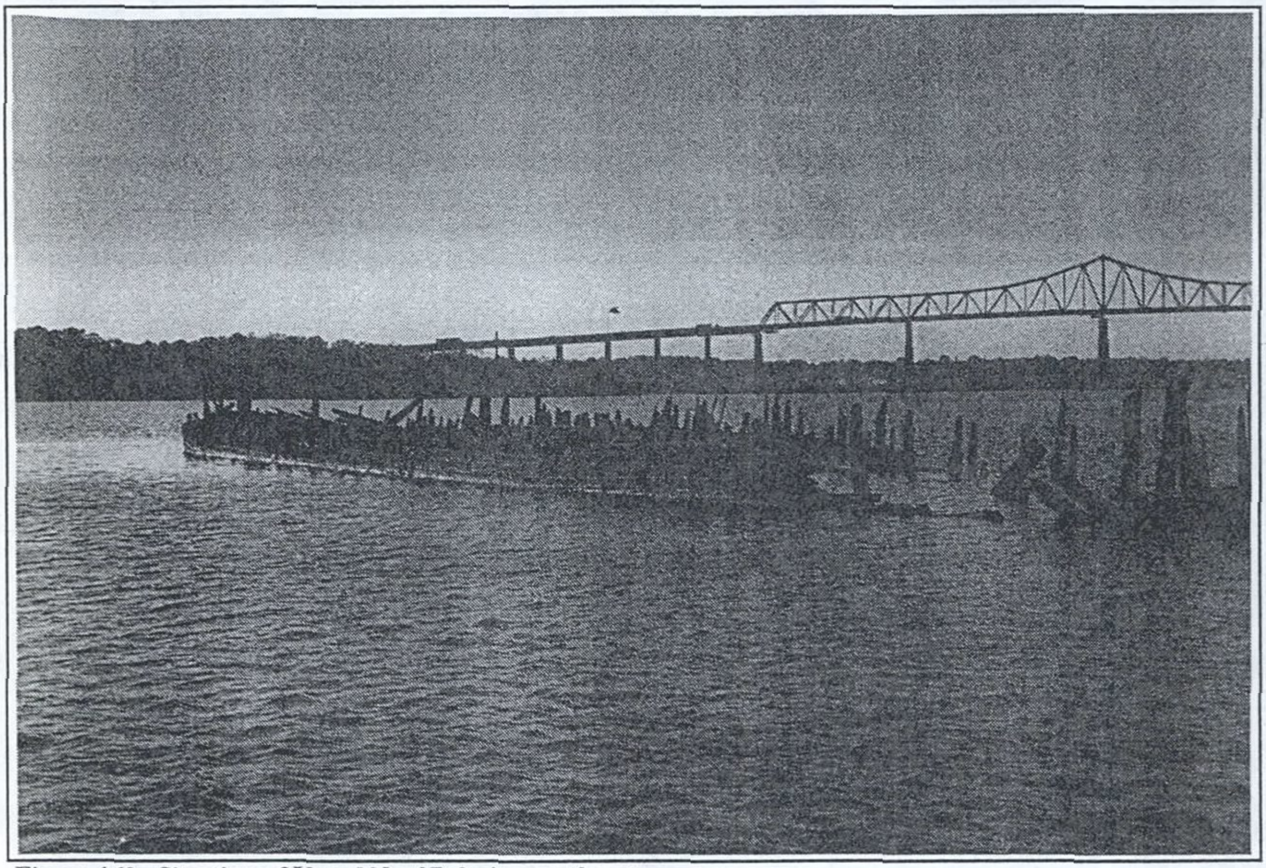


Figure 160. Site view of Vessel No. 97, facing southeast.

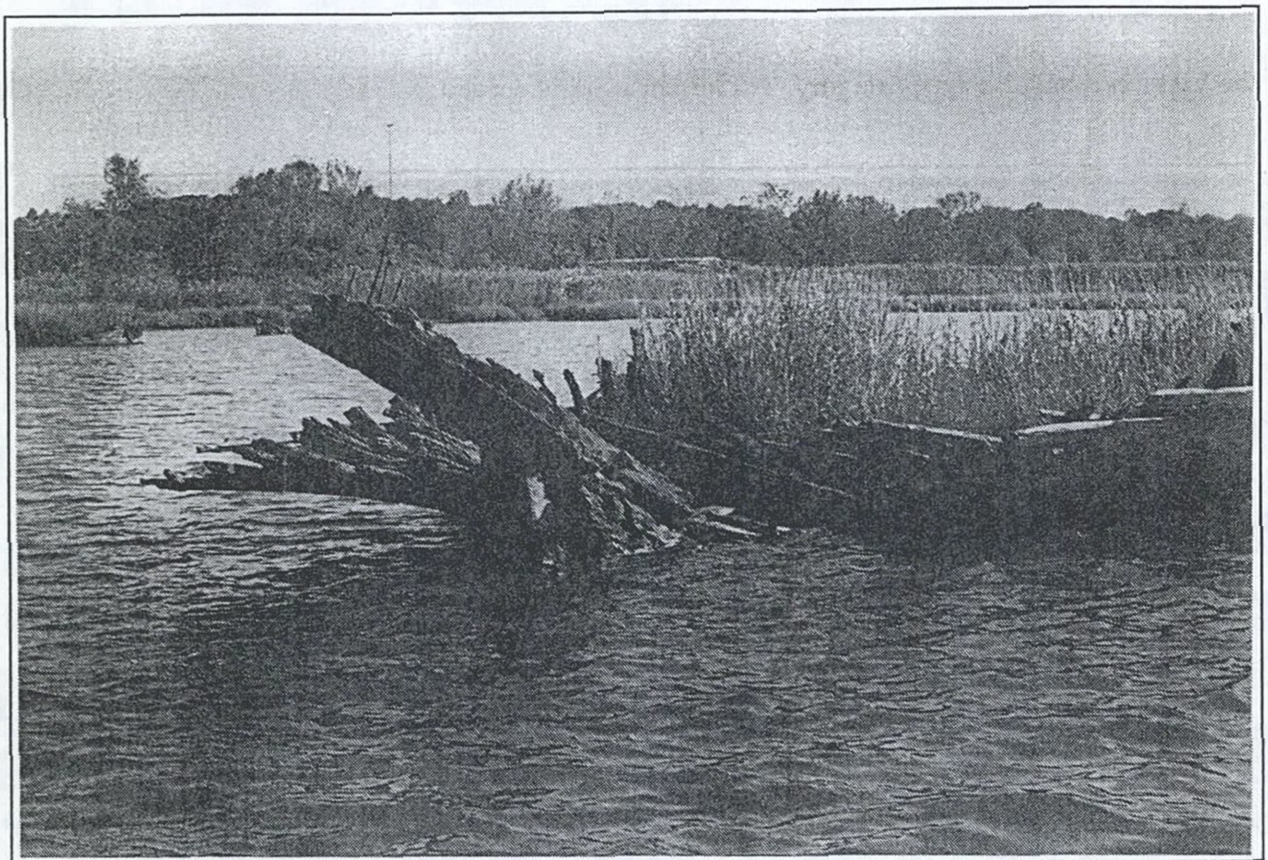


Figure 161. Sectional view of Vessel No. 97's stern, facing southeast.

STEEL-HULLED TUGS. The Central Railroad of New Jersey had two tugs built "which embody new features and improvements which have been brought about through experience with former tugs..." (Norton 1916:56). The *Bethlehem*, built by Staten Island Shipbuilding Company for lighterage service. Norton (1916:56) provides the following principal dimensions for the tug:

Length of deck	98 ft. 0 in.
Beam, molded	24 ft. 0 in.
Depth, molded	12 ft. 7 in.
Draft, loaded	11 ft. 0 in.
Displacement	about 320 tons

Except for size, the general arrangement of the other tug, the steel-hulled *Newark*, remained the same (see Figures 142 and 143). Used for the carfloat service, Newark's dimensions measured as follows:

Length overall	110 ft. o in.
Length between perpendiculars	97 ft. 9 in.
Beam, molded	26 ft. 0 in.
Depth, molded	14 ft. 6.5 in.

In designing the tug, builders made sure of interior accessibility, primarily for painting and scraping. As witnessed in the following profile, the forefoot and deadwood aft is cut away, enabling the tug to turn full circle within a short radius. The tug is fitted with a side-plate balanced rudder. Reverse frames, continuous athwartship, follow the top of the floor plates only. They are doubled in the engine room (Norton 1916).

The fitted keelson extends from the collision bulkhead to the after-end of the engine room. Longitudinal strength is provided by side keelsons and stringers, "the side stringer being deep and formed of intercoastal plates and clips, between frames, with a continuous angle along the outside of the frames" (Norton 1916:57).

The bulwark section aft is set in, cast steel protecting three fitted chocks. This sequence minimized the breaking of bulwarks. The space between the first and second fender guards is filled with solid wood from the stem to amidships, reducing damage to the hanging fenders. The deck is steel, covered with "litosilo" (Norton 1916:57). The after part of the deck house is narrowed and lowered to allow an unobstructed view of the stern from the pilot house.

WORLD WAR II TUGS. The Army operated several thousand tugs during WWII. The tugs fit into four broad categories: (1) seagoing or large tugs designated as LTs (usually 92 ft. or longer); (2) harbor or small tugs, designated STs (about 52 to 92 ft. in length); (3) motor towing launches, known as MTLs (40 to 54 foot length); and (4) motor towboats or marine tractors, designated MTs, (less than 40 ft.) (Grover 1987). The measurements presented here are general. Several older vessels designated STs by the Army measured longer than 100 ft., while the MTL size often received ST designation.

Oceanic military operation and transportation during and after the Spanish-American War increased the need for tugs and towboats. By the turn of the century, Army tugs fell under the jurisdiction of the Quartermaster Corps. In 1909 the Army built four ship class 98-ft. tugs. Towboat construction preceded this class (Grover 1987). Early tugs featured War Department designations "Passenger, Auxiliary or Artillery, and Freight" vessels. These boats served in various capacities.

The Army operated a number of tugs in WWI (Grover 1987). These boats, built to various size specifications, included the oceangoing tug, which towed barges to Europe. During peacetime, the Army's tug fleet remained stagnant. However, the Second World War in Europe expedited U.S. naval construction. The pre-WWII buildup included tugboat construction, particularly harbor tugs. These workhorses assisted in the movement of ships and lighters at embarkation ports. The Army tried several designs, building one or two tugs in each class, finally deciding on the previously mentioned basic types in 1943 (Grover 1987).

As plans for European invasion and amphibious Pacific landings materialized, the Army ordered hundreds of tugs in each size. By the end of the war the Transportation Corps determined that 746 tugs operated under the designation LT or ST, 1,065 tow launches were designated MTL, and 1,113 were designated marine tractors or MTs. One hundred sixty-seven LTs or STs, 287 MTLs, and 295 MTs served in the European Theater. In the Southwest Pacific, 171 STs and LTs, 260 MTLs, and 180 MTs served.

The Harbor Boat Branch of the Transportation Corps usually operated the tugs, though late in the war some fell under jurisdiction of other departments, particularly oceangoing tugs. The Coast Guard provided crews for most of the live-aboard LTs. Civilians generally operated the STs. Both civilian and military personnel crewed smaller harbor boats, usually day boats (Grover 1987).

Table 22. Summary of Army Tug Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 43	Arthur Kill, NY	Yes	Photographic documentation

Arthur Kill, New York Reach

Vessel No. 43 (Figures 162 and 163)
Vessel Type: Army steam tug
General Location: Arthur Kill, New York Reach north of Witte's Scrapyard
Date of Abandonment: 1978 (Raber et al. 1995a)
Description: Part of Witte's tug cluster, the vessel is tentatively identified as *Bloxom* (Raber et al. 1995a). Constructed in 1944 on the Ohio River, the tug has an LT designation. The Pennsylvania Railroad later used the tug for transporting carfloats in the Chesapeake. Witte apparently placed the vessel in his collection in the 1970s (Raber et al. 1996). The superstructure is intact, as is most of the deck gear, propulsion mechanisms, and power plant.
Recommendation: The tug is eligible for the NRHP under Criteria A, C, and D. Under Criterion A, it is significant as a government/military vessel. Under Criterion C, it is significant because of its distinctive typological characteristics, i.e., military harbor vessel. Under D, the tug will yield information on tugboat construction methods. Historic documentation is recommended, as is complete photographic documentation and identification.

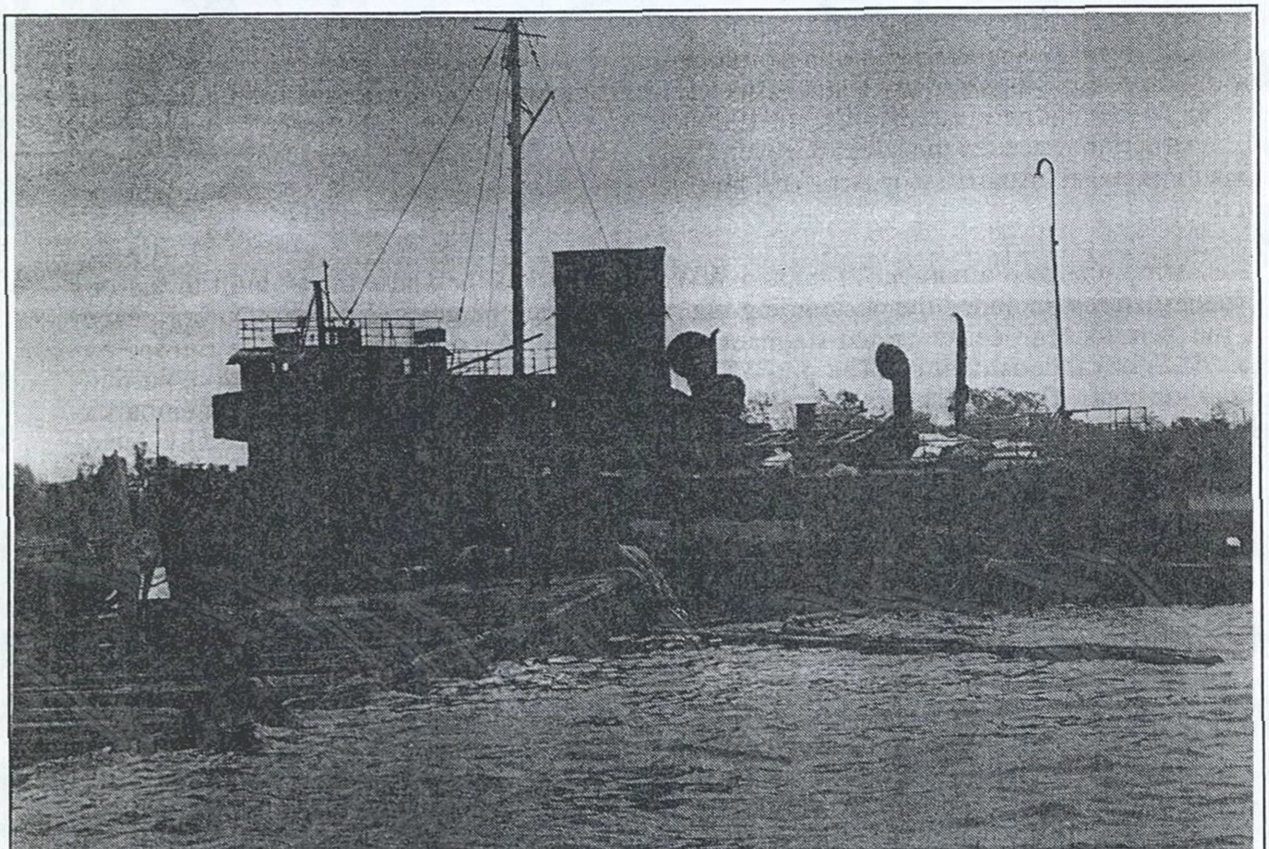


Figure 162. Site view of Vessel No. 43, the WWII tug *Bloxom*, facing east.

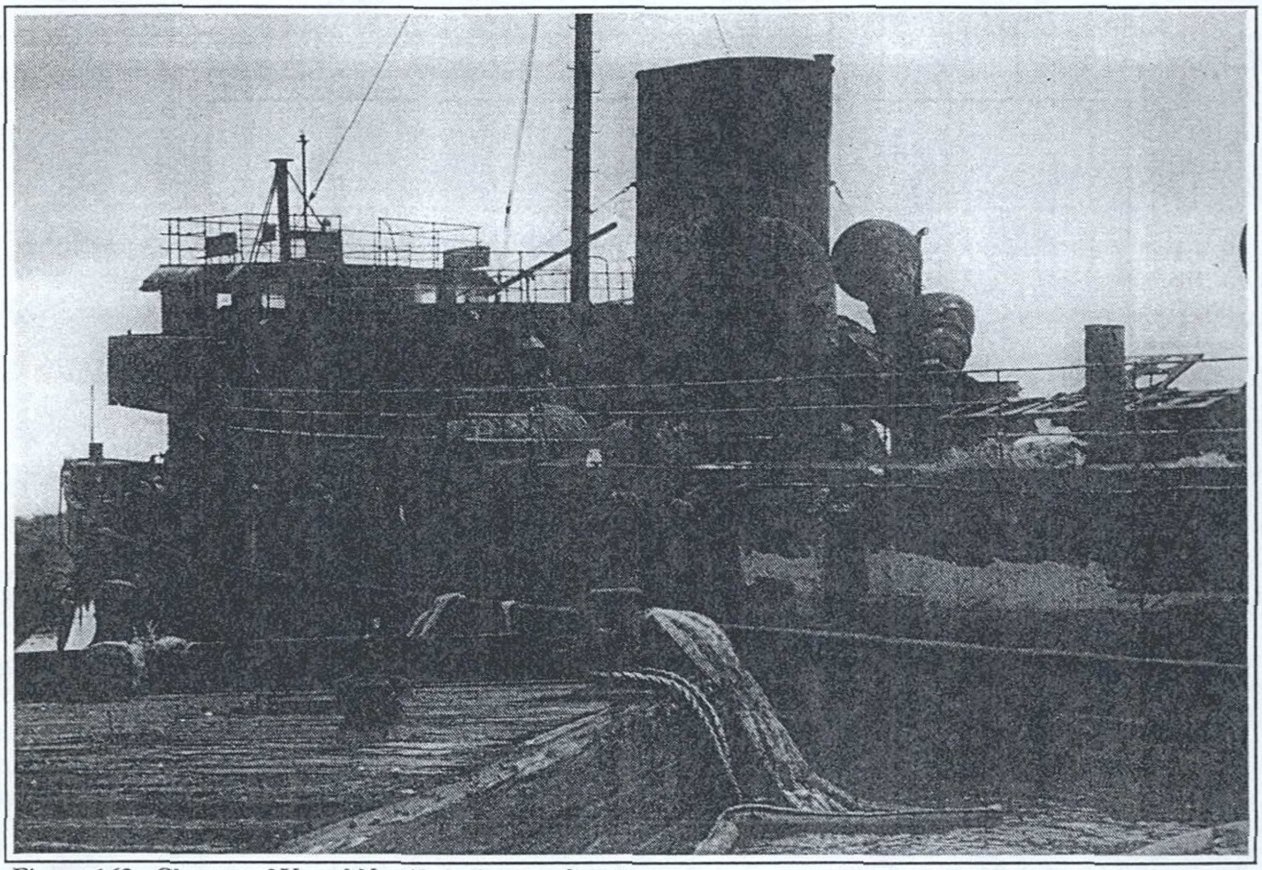


Figure 163. Closeup of Vessel No. 43, facing northeast.

FLOATING DRYDOCKS

The floating dry dock is generally considered an American invention. It is basically a large floating structure, "so large that it can not only float itself, but the largest vessel for which it is designed" (Donnelly 1905:312). The United States issued a floating dry dock patent to J. Adamson in 1816. Donnelly (1905:316) suggests that the design (Figure 164) originated from "the wreck of an old hull laying on some slope beach, which was used by cutting out the stern and making gates to close the opening...similar to...a canal lock." In 1849, Abraham Lincoln invented a hollow structure designed to provide extra buoyancy for vessels in shallow water (Figure 165). The United States government issued a patent for the design, but apparently nothing ever came from it.

The Brooklyn Erie Basin dry dock, built 1845-1850, was in 1905 the oldest and largest known wooden dry dock (Donnelly 1905). Known as the Old Balanced or Box Dock, the structure (Figure 166) measured 330 ft. long by 100 ft. wide. Managing the combined weight of dock and vessel proved difficult. To compensate, builders connected smaller sectional docks together with locking logs.

The next development of dry dock construction, the sectional dry dock (Figure 167), provided alignment stability while restricting the amount of motion between sections. The sway between sections required some means of flexible power from one section to another. For this

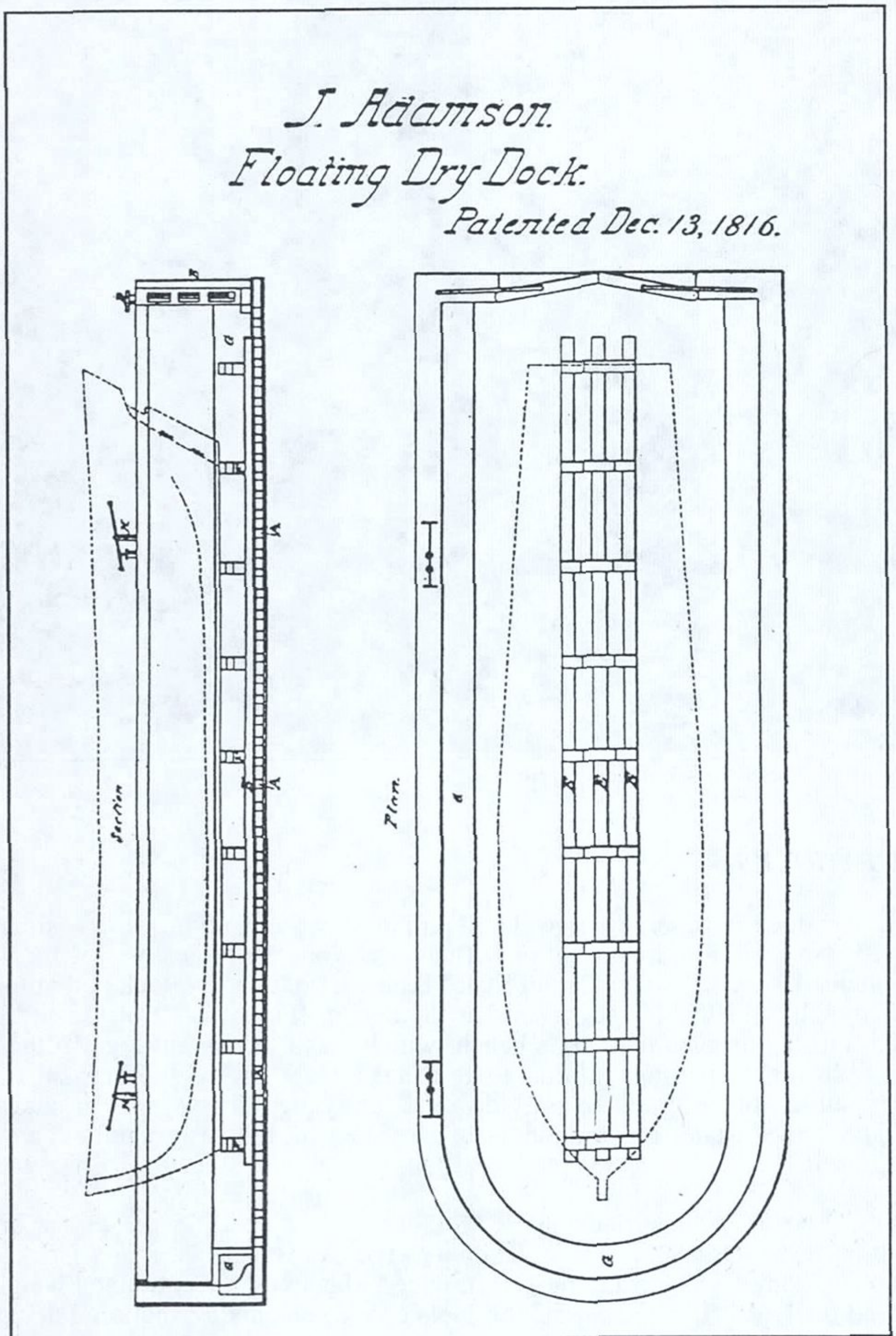


Figure 164. First patent issued for a U.S. floating dry dock issued in 1816 (Donnelly 1905).

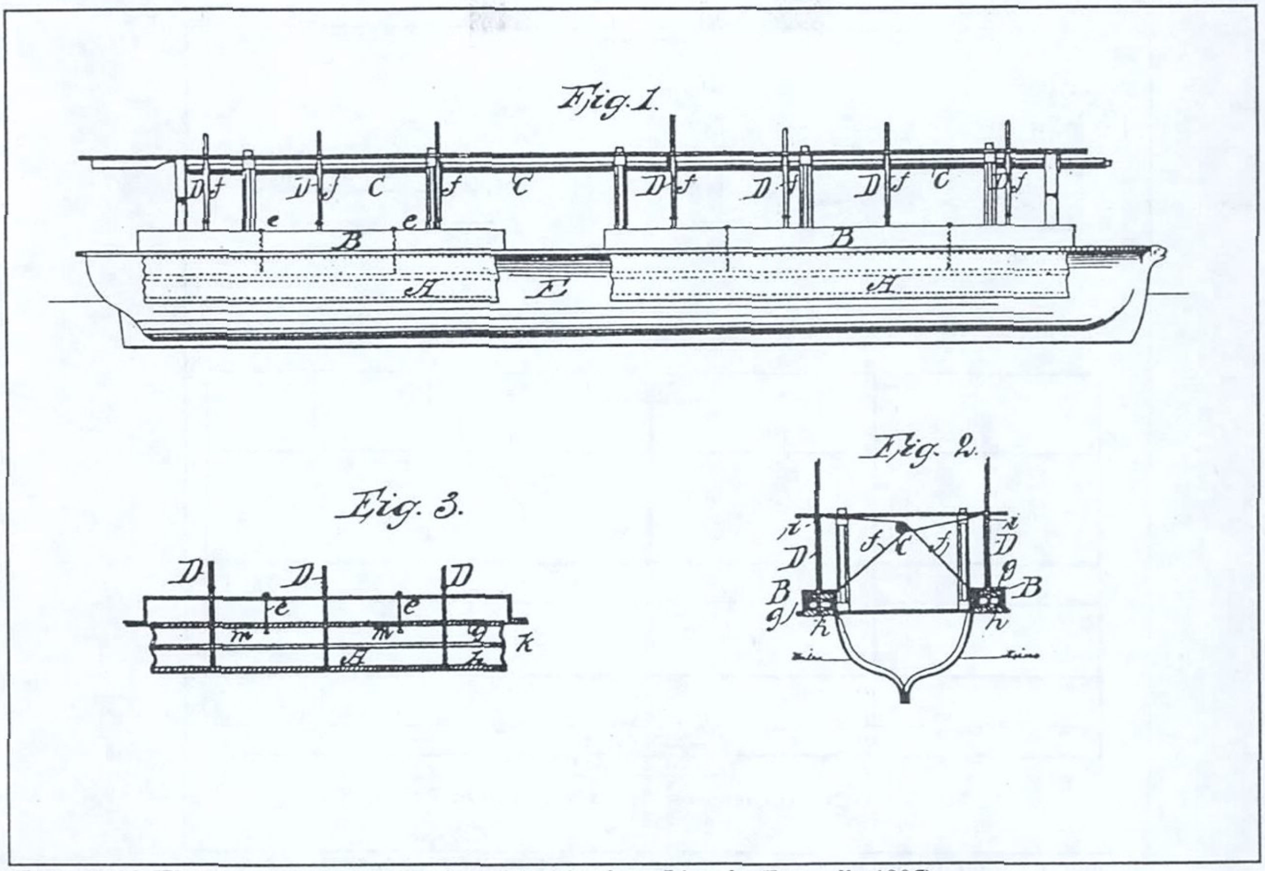


Figure 165. Floating dry dock patent issued to Abraham Lincoln (Donnelly 1905).

purpose, designers invented a double universal joint, with a slip or extension joint between. The design, wrought with complications, proved popular. Built with three to seven 25-ft. sections, the structure measures 200 ft. in length.

The Dodge-Burgess Sectional Floating Dock (Figure 168), patented in 1841, generally featured 10 pontoons. Connected by a locking log, the dock lost the wings typical of the earlier sectional dry docks. The framework's roof housed pumping machinery. The framework fastened to the central pontoon, lifting or lowering. Power is distributed along the top by a shaft with flexible couplings, in the same manner described for the sectional dock.

Built in one piece, the box or balanced dock (Figure 169) represents the next phase in dry dock construction. To limit the flow of water from one end of the interior to another, builders added watertight bulkheads. These cross-bulkheads, "together with the center longitudinal bulkhead, divide the dock into...independent watertight compartments" (Donnelly 1905:322). Gates controlled the flow of water from compartments to the pumps, balancing dock and vessel. Box dock design appeared near the end of the Civil War, the smaller sizes more prevalent. Experiments in composite construction proved expensive.

The balanced sectional floating dry dock possessed all the advantages of a box dock (cross and longitudinal bulkheads, separate gates, and independent means of admitting and removing water). The sectional dock needed no internal longitudinal strains or self docking. Two steam engines on each side of the dock turned a flexible shaft. The line operated through two gearing

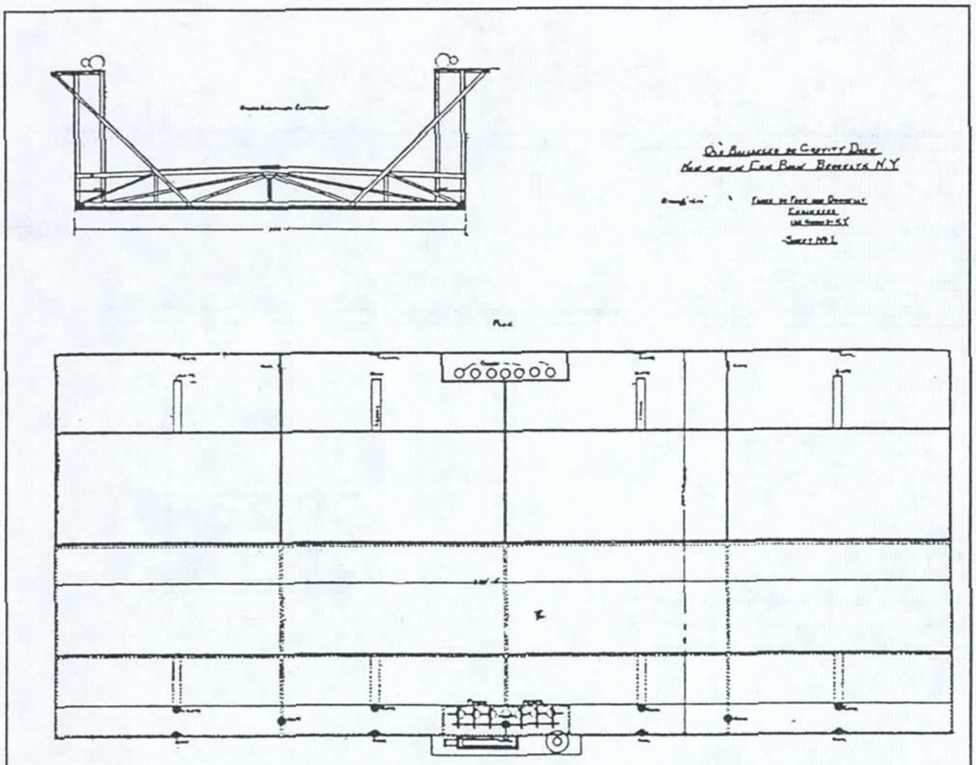


Fig. 4.—Old Balanced or Gravity Floating Drydock.

Figure 166. Old balanced or gravity floating dry dock (Donnelly 1905)

pumps in watertight compartments of each section. Each section was divided into six compartments. There were five sections and sixty pumps.

It is phenomenal that from the building of the two Dodge-Burgess Sectional Docks, between 1850-1860, to the building of the dock described above in 1899, no large floating docks were built in the United States.

Some of the dry docks associated with the project area are adaptations of the "box or balanced dock" (Figure 170). Table 23 identifies wooden dry docks present in the project area.

Table 23. Summary of Dry Docks Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 215	Arthur Kill, NY	No	Not best representative, no further work
Vessel 254	Arthur Kill, NY	No	Not best representative, no further work
Vessel 68	Kill Van Kull, NY	Yes	Photo and site documentation
Vessel 79	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 88	Kill Van Kull, NY	Yes	Photo and site documentation
Vessel 89	Kill Van Kull, NY	Yes	Photo and site documentation
Vessel 90	Kill Van Kull, NY	Yes	Photo and site documentation
Vessel 99	Kill Van Kull, NY	No	Not best representation, no further work
Vessel 100	Kill Van Kull, NY	No	Not best representation, no further work

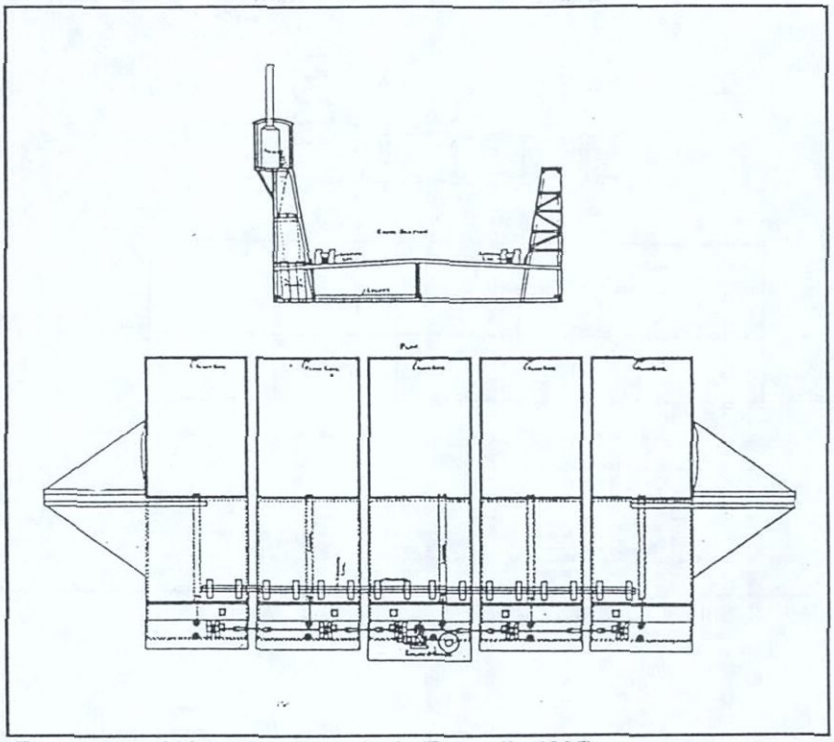


Figure 167. Old sectional dry dock (Donnelly 1905).

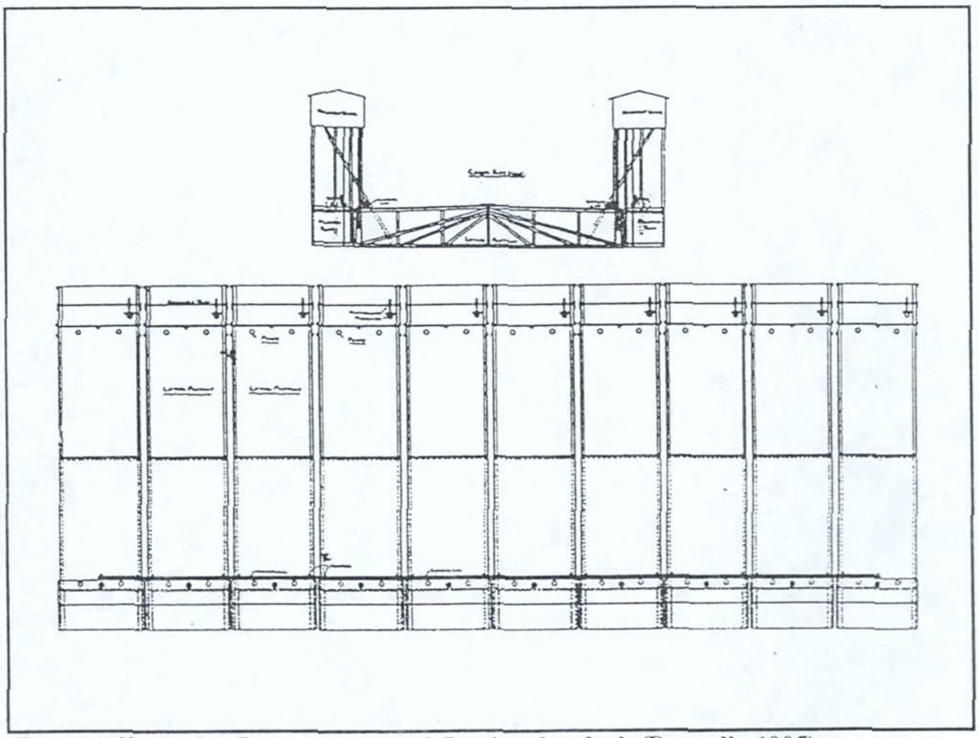


Figure 168. Dodge-Burgess sectional floating dry dock (Donnelly 1905).

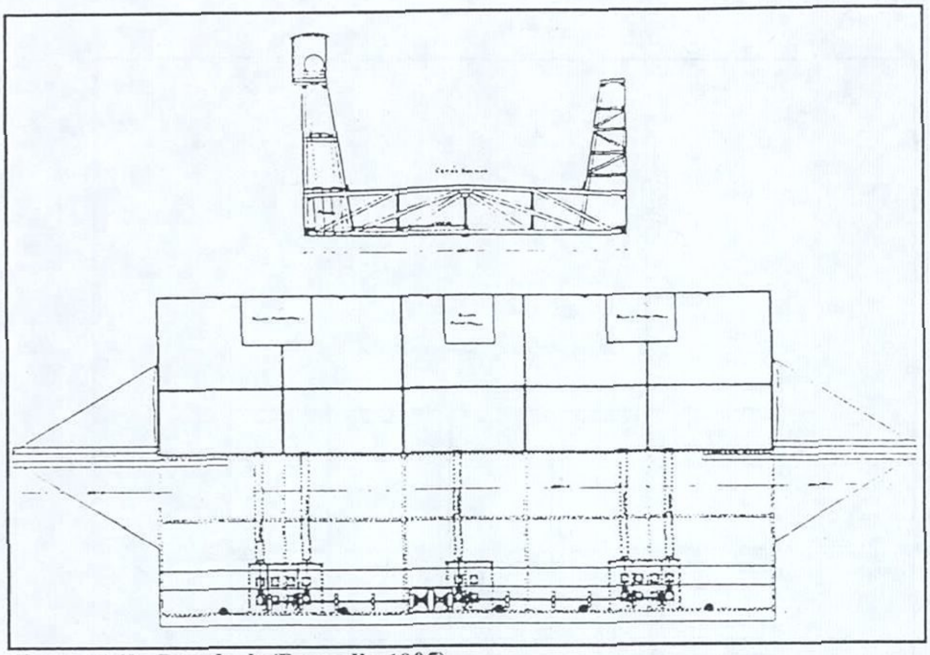


Figure 169. Box dock (Donnelly 1905).

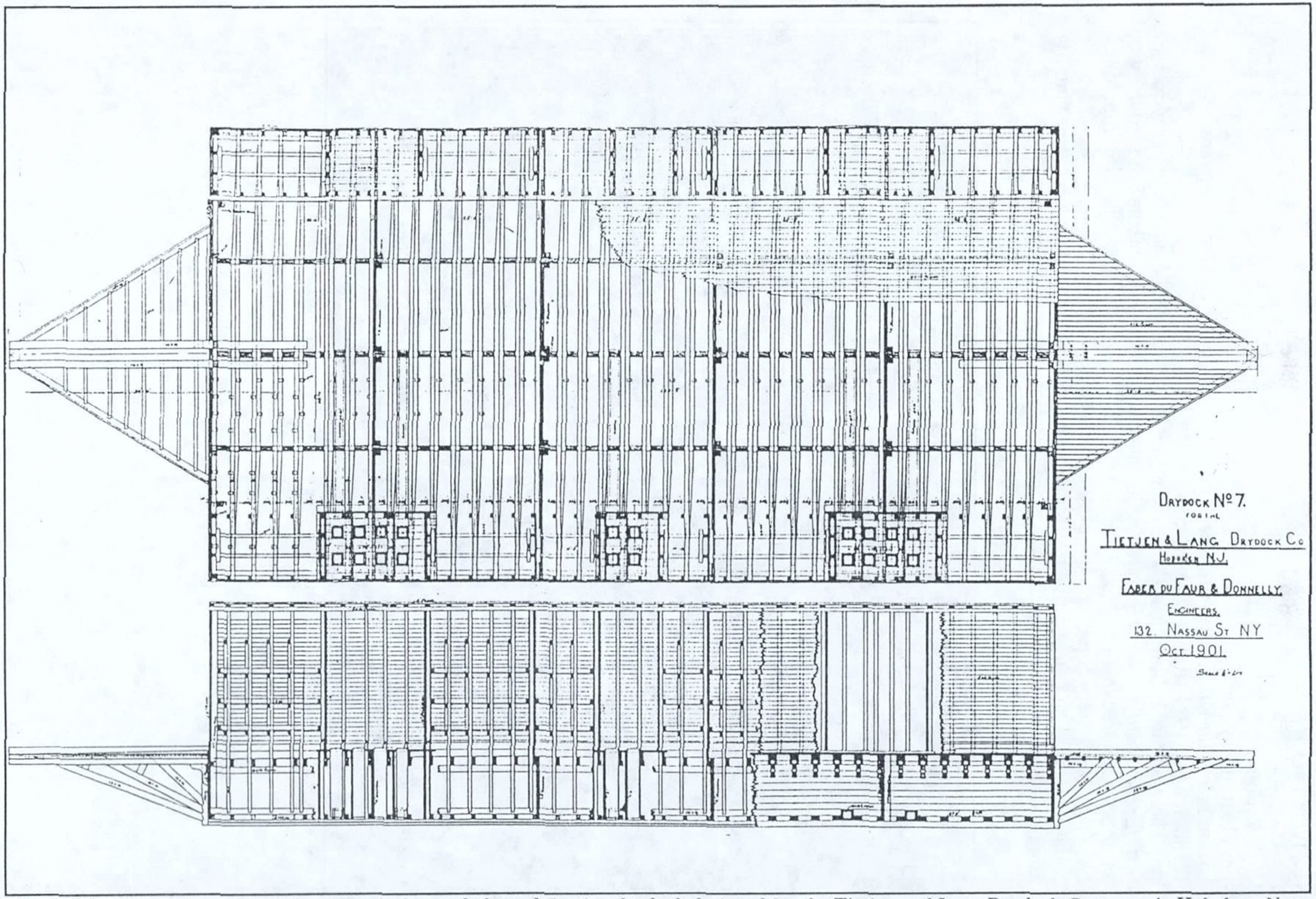


Figure 170. Plan and structural elevation of a box or balanced floating drydock designed for the Tietjen and Lang Drydock Company in Hoboken, New Jersey, 1901 (Donnelly 1905).

Arthur Kill, New York Reach

Vessel No. 215 (Figure 171)
Vessel type: Floating dry dock
General Location: Arthur Kill, New York Reach near the O'Boyle/Townsend Shipyard
Date of Abandonment: 1971 (Raber et al. 1995a)
Description: The structure is burnt just above the waterline. Because the dock's upper works are removed, the structure's lower hull remains are accessible. Cross members are visible every 6 ft. on deck. Cross beams run inside the water ballast. Wooden cross-bracing runs transversely. Some machinery is present, but in poor condition.
Recommendation: Based on comparative project data, this site does not fit the best representative type category. No further work is needed.

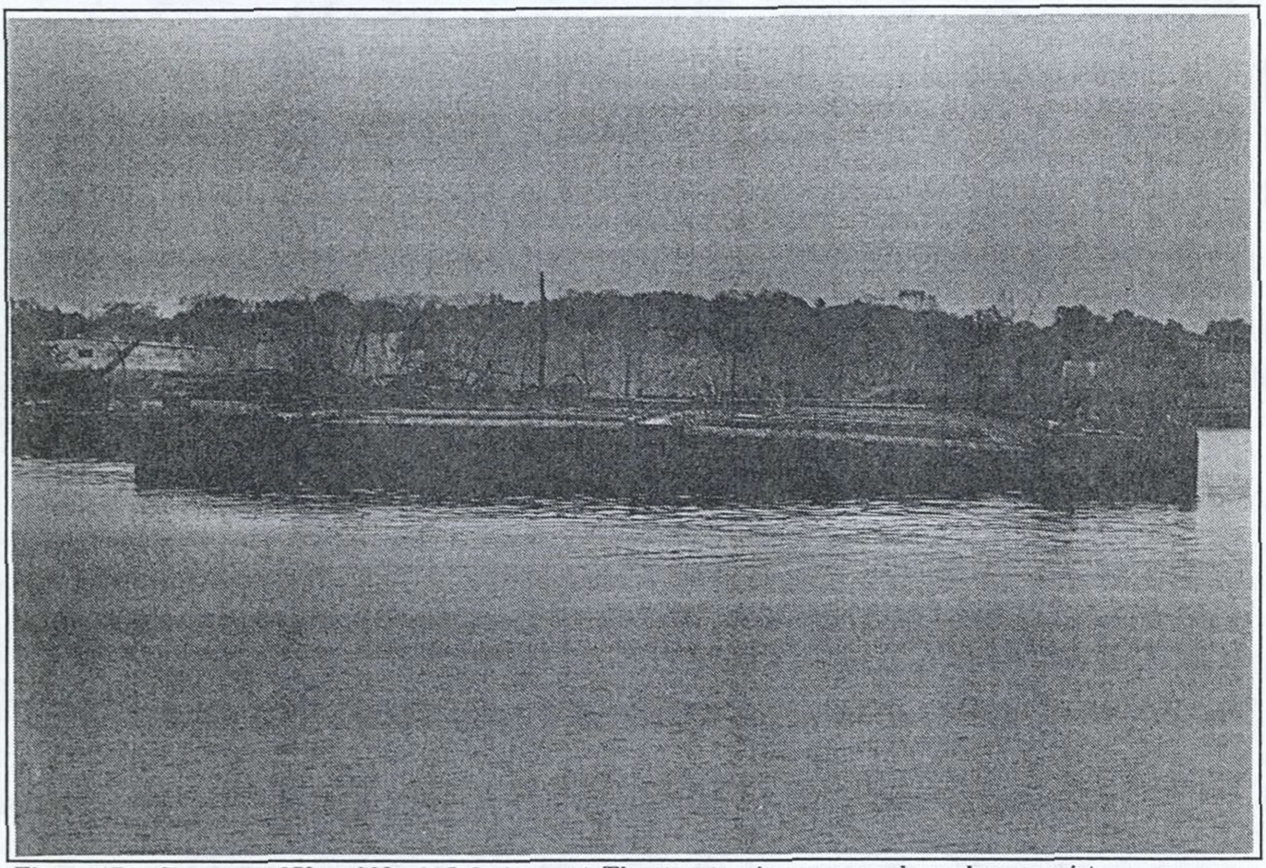


Figure 171. Site view of Vessel No. 215, facing east. The structure's upper works no longer exist.

Vessel No. 254 (Figure 172)
Vessel Type: Wooden floating dry dock
General Location: Arthur Kill, New York Reach near Tottenville Marina Basin
Date of Abandonment: 1971 (Raber et al. 1995a)
Description: Approximately one-third of the structure is accessible during low tide. A large pile of wood rests against the center bulkhead. This is a rectangular pontoon-type structure with vertical wing walls; the walls increase in width toward the base. The walls are fastened to a series of double stanchions with horizontal side planking. Approximately one-third of the planking remains. Ladders are fastened to the inside walls. Probable pump gearing is visible topside starboard. The northernmost wall is collapsed.
Recommendation: Based on safety considerations and comparative project data, this site does not fit the best representative type category. No further work is needed.

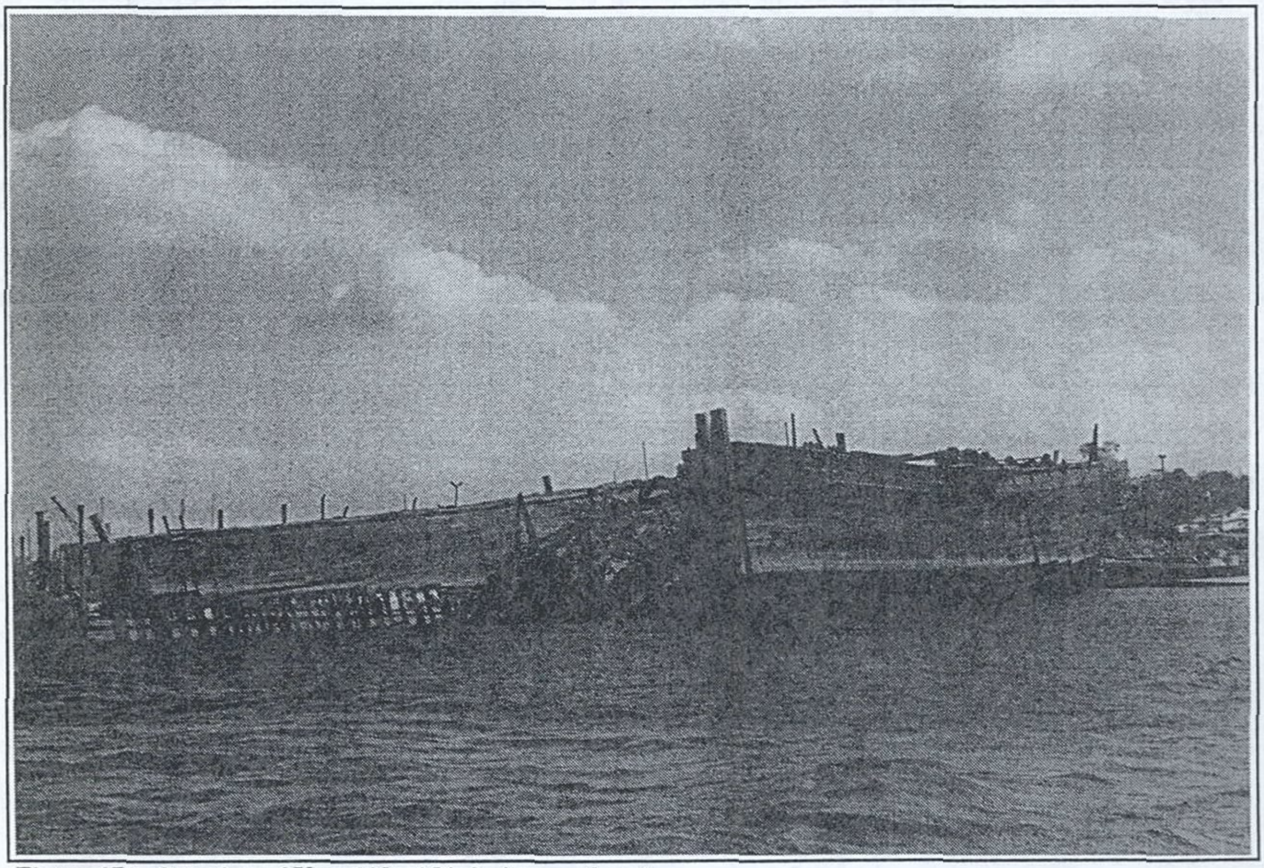


Figure 172. Site view of Vessel No. 254, facing southeast.

Kill Van Kull Reach

Vessel No. 68 (Figures 173-175)
Vessel Type: Floating dry dock
General Location: Kill Van Kull, New York Reach near GLD&D
Date Abandoned: 1945 (Raber et al. 1995b)
Description: The structure has changed somewhat since Raber's assessment. It appears that salvage work has occurred on the dock. A raked truss protrudes from the front of the dock. Shims are visible between planking. There is obvious deck camber. Drainage ports are visible.
Recommendation: The vessel is considered significant under the NRHP Criteria C and D. Floating dry docks display distinctive typological characteristics and possess a significant and distinguishable entity whose components lack individual distinction. Under Criterion D, the structure/vessel will yield archaeological data pertinent to dry dock construction, information that now is lacking. Complete photographic and site plan documentation of the structure are recommended. This data, compared and contrasted with existing plans, will reveal consistencies and nuances in construction.

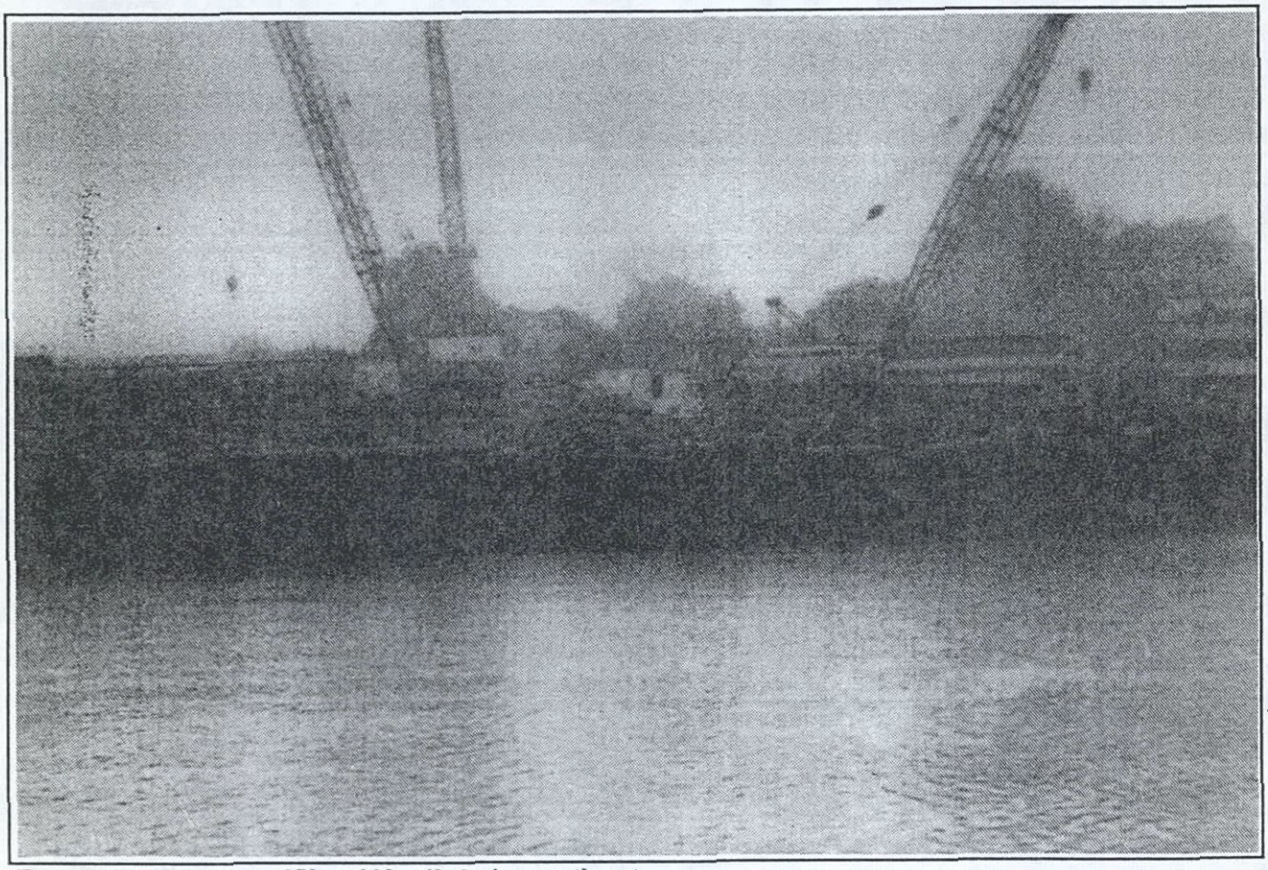


Figure 173. Site view of Vessel No. 68, facing southeast.

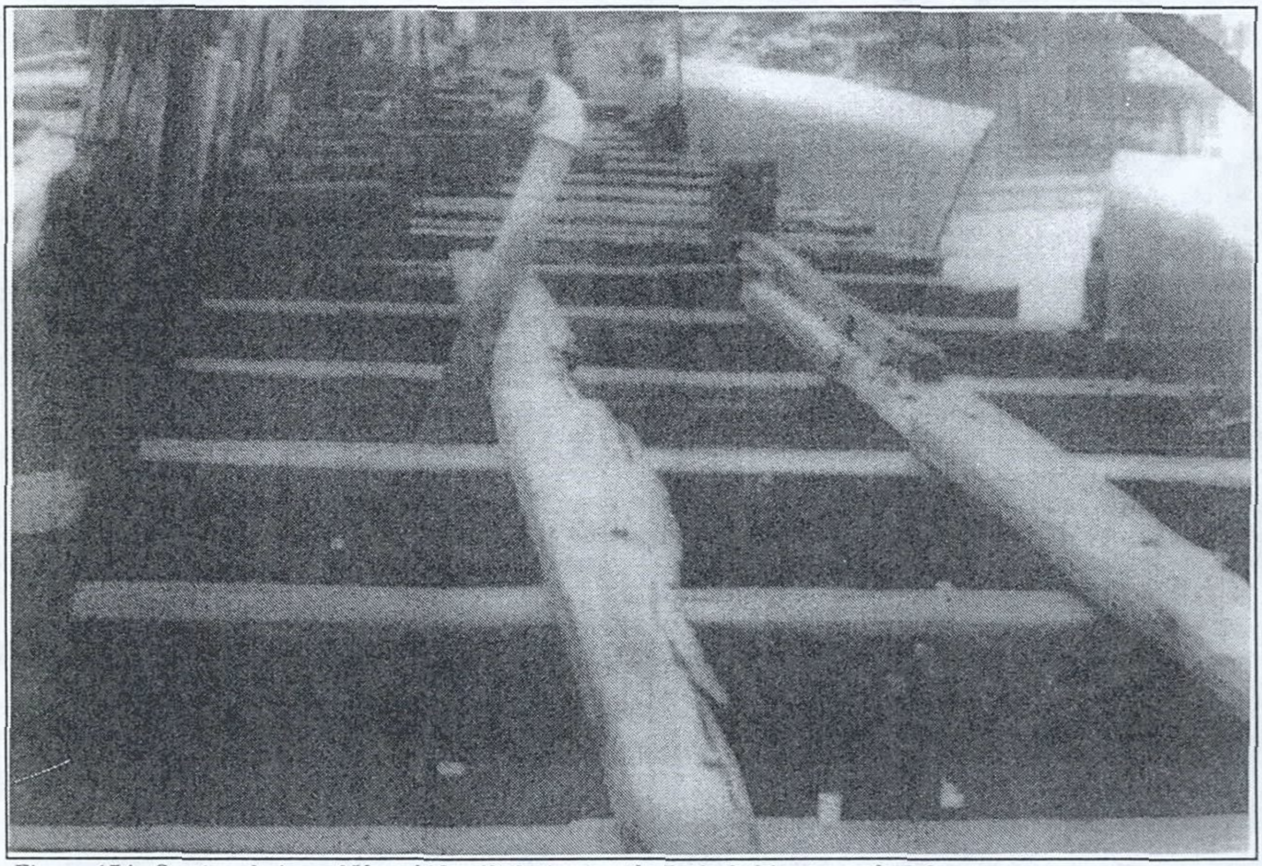


Figure 174. Sectional view of Vessel No. 68, facing south. Included here are deck beams.

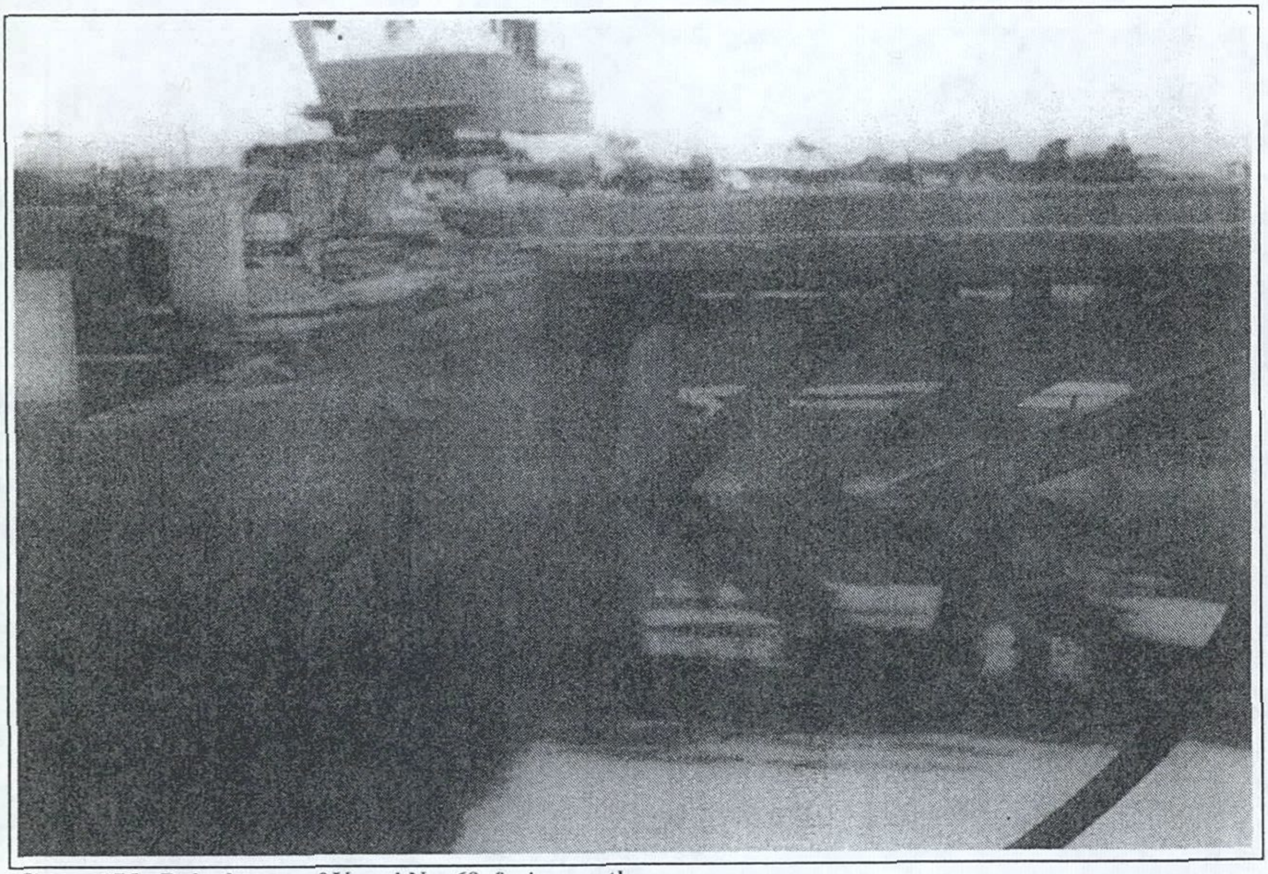


Figure 175. Raked truss of Vessel No. 68, facing south.

Vessel No. 79 (Figure 176)
Vessel Type: Wooden floating dry dock
General Location: Kill Van Kull Reach near GLD&D/George Rogers site
Date Abandoned: 1945 (Raber et al. 1995b)
Description: The sides of the dock are gone. There is evidence of a prow (similar to Vessel No. 68). Transverse decking beams are notched over stanchions. There is evidence of stone ballasts.
Recommendation: Based on limited site data and comparative project data, this site does not fit the best representative type category. No further work is needed.

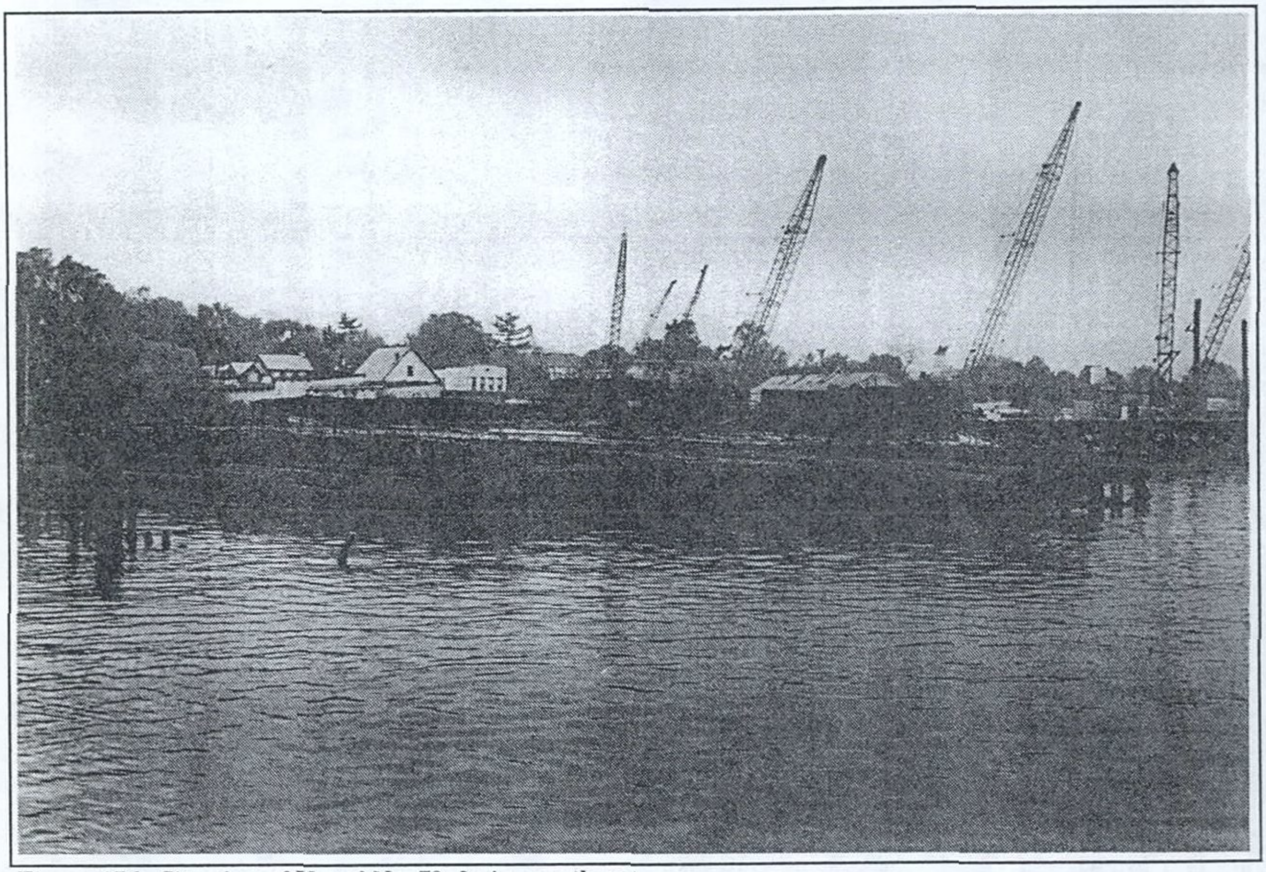


Figure 176. Site view of Vessel No. 79, facing southeast.

Vessel Nos. 88 (Figure 177), 89, 90
Vessel Type: Wooden floating dry dock
General Location: Kill Van Kull Reach near GLD&D/George Rogers site
Date Abandoned: 1945 (Raber et al. 1995b)
Description: All three dry docks are in similar shape, though both sides of No. 89 are extant. Longitudinal bulkheads are evident.
Recommendation: These structures, as a group, may provide comparative construction data as outlined in Criteria C and D. Photographic documentation of the structures is recommended and, where safe, measurements and limited drawing of the structures.

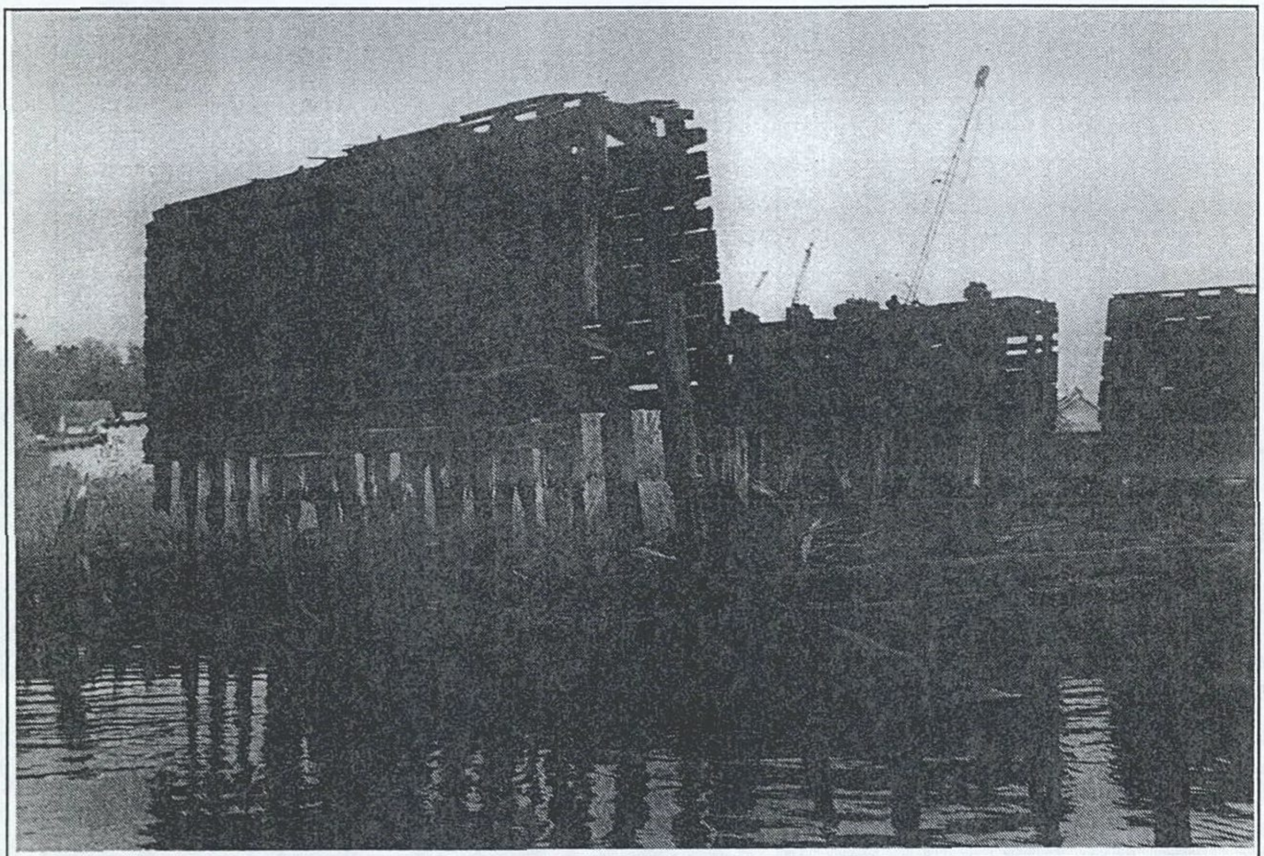


Figure 177. Site view of Vessel No. 88, facing southeast.

Vessel No. 99 (Figure 178)
Vessel Type: Wooden dry dock
General Location: Kill Van Kull Reach near the Brewer Dry Dock (east)
Date Abandoned: 1960 (Raber et al. 1995b)
Description: The port side of the structure is burnt to the waterline. The starboard side is intact, with ladders and repair hatches visible. Fasteners include drift pins (with washers). *Naragansett SFB Co. N-4* is clearly painted.
Recommendation: Based on limited site data and comparative project data, this site does not fit the best representative type category. No further work is needed.

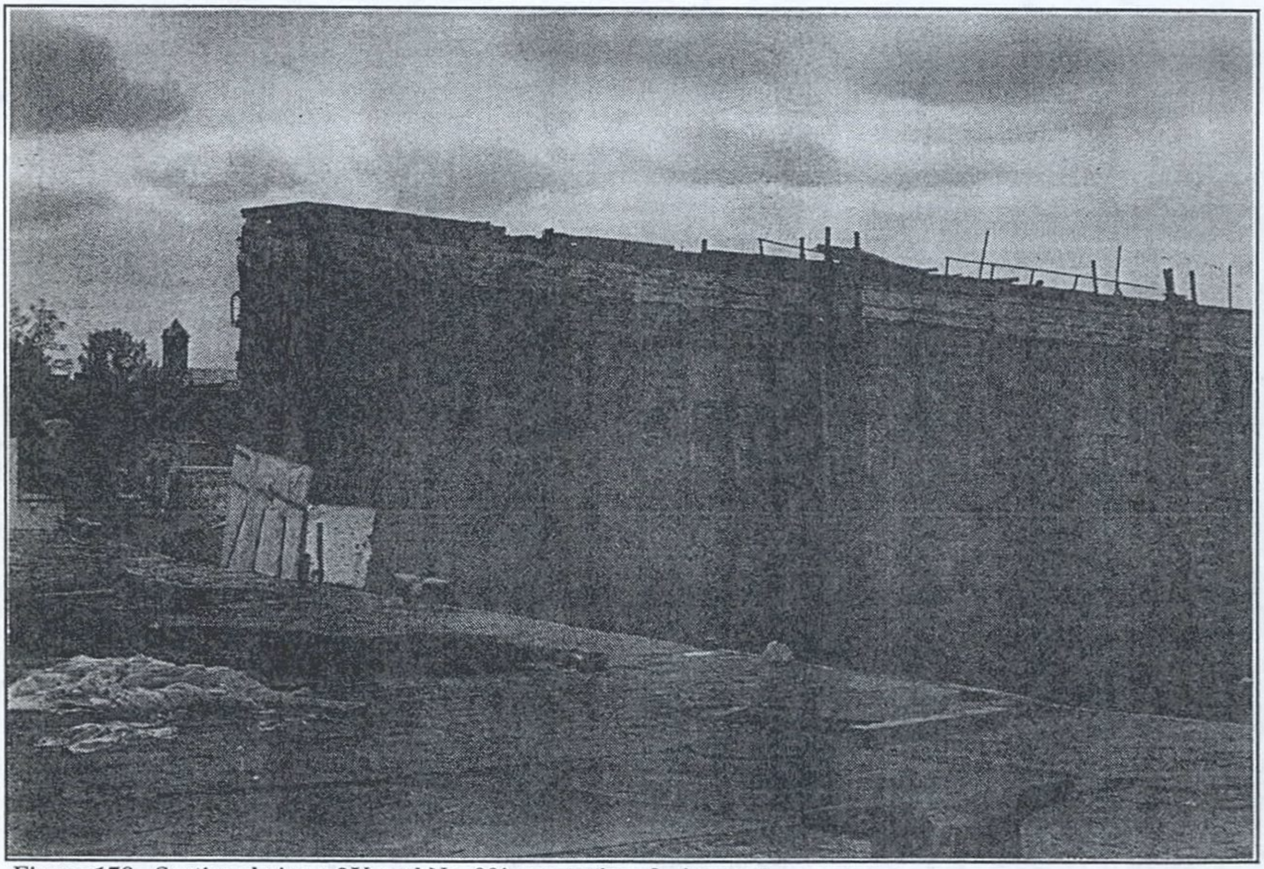


Figure 178. Sectional view of Vessel No. 99's port wing, facing east.

Vessel 100 (Figure 179)
Vessel Type: Wooden dry dock
General Location: Kill Van Kull Reach near the Brewer Dry Dock (east)
Date of Abandonment: 1960 (Raber et al. 1995b)
Description: Port side of the structure is partially burnt. Two steel spuds are evident. On the starboard side is pumping equipment. The dock has the company name *W.H. Gahagan Inc. G-4*.
Recommendation: Based on limited site data and comparative project data, this site does not fit the best representative type category. No further work is needed.

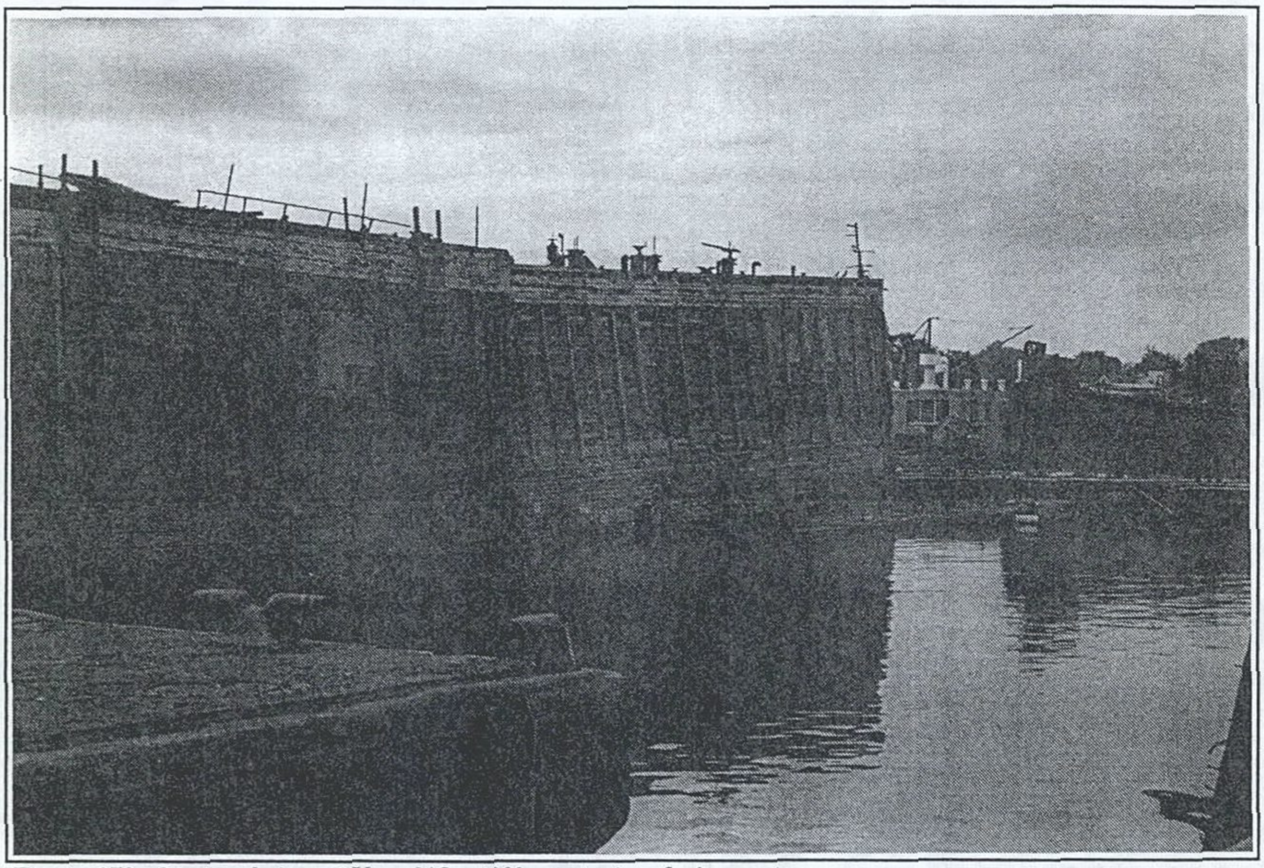


Figure 179. Sectional view of Vessel No. 100's port wing, facing east.

PILE DRIVERS

The City of New York currently owns one or two wooden-hulled steam pile drivers. Steam is still used for driving piles in the maintenance of the slips for the Staten Island and Governors Island ferries (Figure 180).

The design of steam pile drivers remains virtually unchanged since the latter half of the nineteenth century (Brouwer 1996). The hulls are basically rectangular scows. The guides for the weight used to drive the piles are supported on a tall timber framework. The steam winch and the boiler are located in a wooden shed. The boiler is the vertical type, using oil for fuel. In the nineteenth century, coal probably fueled the driver.

There is little wasted space on the scow. The open decks around the house are wide enough for the walkways and handling mooring lines. There are winch heads on the outside of the house used by the pile driver to winch itself into position.

Table 24 summarizes the pile drivers examined for this project. Figures 24 and 25 (Volume II) show various views of an undated steam pile driver (South Street Seaport Museum). Most of the data provide information on the vessel's frame.

Table 24. Summary of Wooden Steam Pile Drivers Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 44	Kill Van Kull, NY	No	No further work is recommended
Vessel 112	Kill Van Kull, NY	No	No further work is recommended

Kill Van Kull Reach

Vessel No. 44 (Figure 181)
Vessel Type: Wooden steam pile driver
General Location: Kill Van Kull, New York Reach near GLD&D
Date Abandoned: 1935 (Raber et al. 1996b)
Description: The vessel is generally disarticulated. Several turnkeys and turnbuckles are visible. The vertical wooden hoisting tower is partially extant.
Recommendation: Based on limited site data and comparative project data, this site does not fit the best representative type category. No further work is needed.

Vessel No. 112 (Figure 182)
Vessel Type: Wooden steam pile driver
General Location: Kill Van Kull Reach near SP&B
Date Abandoned: 1970 (Raber et al. 1995b)
Description: A wooden tower still stands, but the barge cabin is in disrepair. The machinery is extant, including the boiler. The barge is completely submerged.
Recommendation: This site does not fit the best representative type category. No further work is needed.

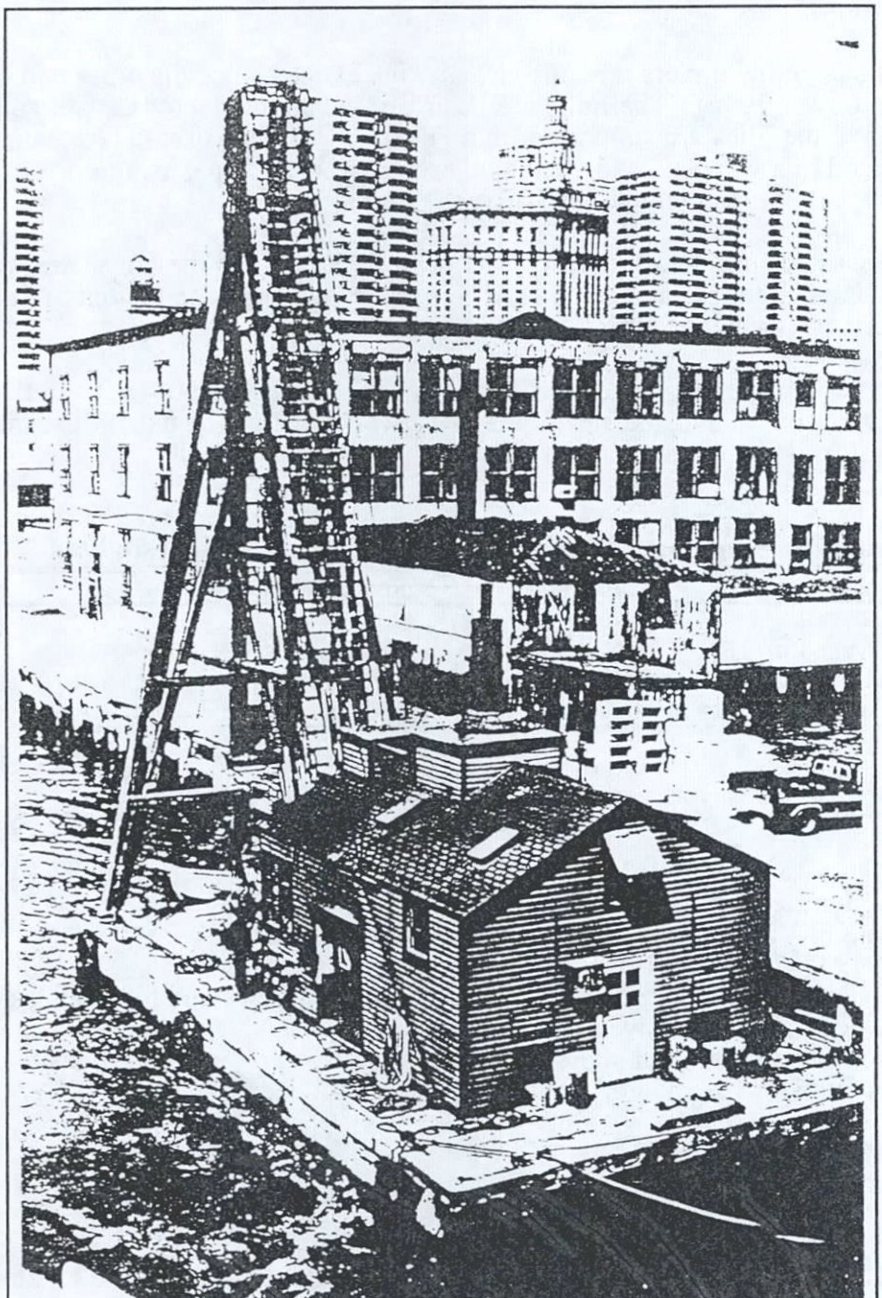


Figure 180. Wooden steam-driven pile driver (South Street Seaport Museum, n.d.).

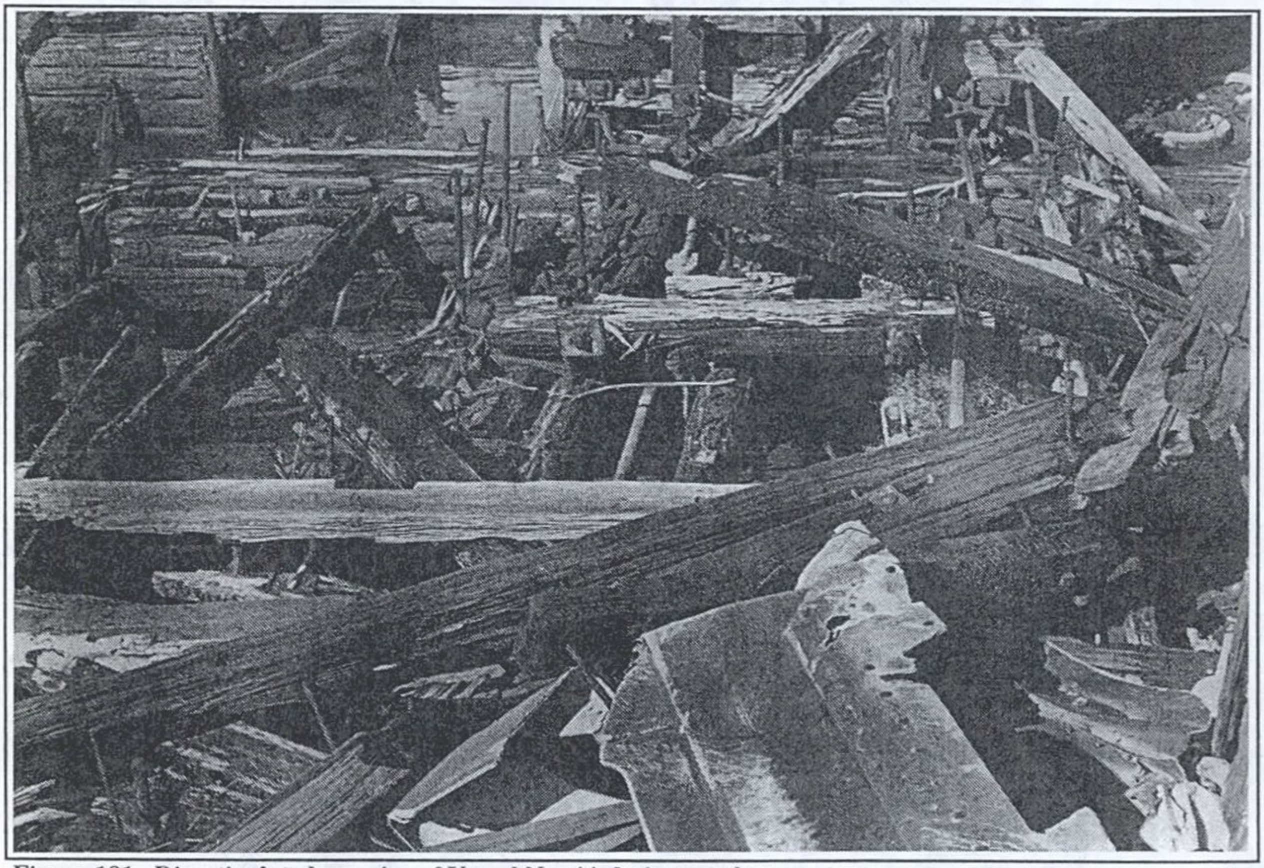


Figure 181. Disarticulated remains of Vessel No. 44, facing north.

Figure 182. Disarticulated remains of Vessel No. 112, facing south.

STEAM WINCH SCOWS

Sailing ships that called the Port of New York home in the nineteenth century frequently had no steam power for use in loading and discharging cargo. To provide such power, workers used portable steam boilers and winches on the piers and in the water. The steam winches on the piers mounted on timber skids for transfer from one location to another. The steam winches in the water mounted on small wooden scows. In both cases, sheds protected the winches from inclement weather. The sheds had little in the way of windows. Doors could open up for ventilation, and a hatch through which the cargo runner led up to a block hung in the ship's rigging above the discharge hatch (Brouwer 1996).

WATER BOAT

The water boat supplied fresh and potable water to steamships and other facilities in the harbor. Very little is known about its history, though water boats, converted from steel steam lighters, served the port into the 1980s (Raber et al. 1996b). Some limited data are available on the waterboat *Aqua I* at the South Street Seaport Museum in New York. Initial investigation collaborates Raber et al. (1996b) in that the vessel exhibits similar design features of a converted steam lighter. The is no known construction details or historic documentation on wooden/steel water boats.

Table 25. Summary of Water Boats Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 43	Kill Van Kull, NY	No	No further work is recommended

Arthur Kill, New York Reach

Vessel No. 43 (Figure 183)
Vessel Type: Probable wooden steam water boat
General Location: Kill Van Kull, New York Reach near GLD&D
Date Abandoned: 1935 (Raber et al. 1995a)
Description: The small boat is burned and disarticulated. However, it appears most of the lower hull is intact but not visible. The boat is loaded with iron fasteners, i.e., long bolts, drifts, and nails. Two transverse bulkheads are extant, as are transverse deck beams and longitudinal planking.
Recommendation: Based on Criteria A, C, and D, this vessel, if indeed a water boat, is eligible for NRHP consideration. However, this eligibility must be tempered by the fact that the remains of the vessel are in poor condition. Because the vessel is in poor shape, only photographic documentation is recommended.

Figure 183. Structural remains of Vessel No. 43, facing north. Most of the vessel's upper works are covered with wooden debris.

SEAGOING VESSEL TYPES

Unlike the torched South, industrialization in the Northeast flourished after the Civil War. New England shipbuilders thrived, building larger, bulkier seagoing vessels. In the early 1850s, New England shipwrights built a few sailing ships with three masts, the first sail square-rigged. Early newspaper accounts identify the vessel as a three-masted brig (Brouwer 1996). Before the end of the decade, "barkentine" became the standardized term.

The barkentine rig "grew out of the ship and three masted fore-topsail schooner" (Chapelle 1935:290). The rig combined the advantages of three- or four-masted schooner and the square-rigger. In model, large schooners and barkentines hulls are the same; many three- or four-masted schooners were re-rigged as barkentines. The changes involved re-stepping the fore mast farther aft and the construction of new upper masts and yards (Chapelle 1935).

David McGregor, in *Merchant Sailing Ships 1815-1850,* (1984:79), writes that *Bonanza* (Figure 184) is a barkentine, not a three-masted schooner "so described in the yard book...and makes one wonder...what other barquentines (sic) (were) disguised under the pseudonym...three-masted schooner." *Bonanza*, built in 1830, is apparently the earliest known example of a conventional barkentine rig (McGregor 1984). A 1845 engraving from the *Illustrated London News* (Figure 185) shows the American screw steamer *Marmora* with a conventional barkentine rig.

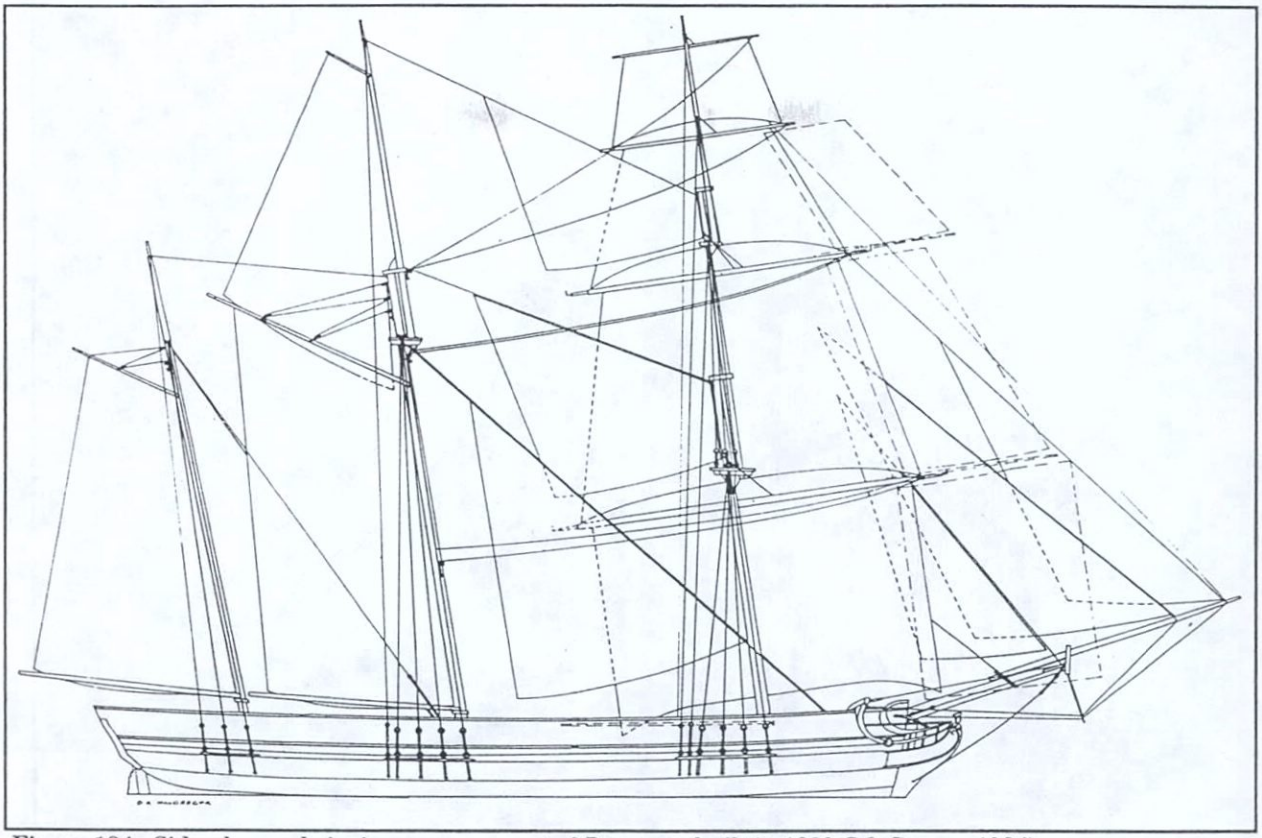


Figure 184. Side plan and rigging arrangement of *Bonanza*, built in 1830 (McGregor 1984).

The barkentine rig had the benefits of a fore-and-aft rig when sailing into prevailing winds, and the power of a square-rig when sailing with the wind. Economical to operate, barkentines became popular on the East Coast with the South American coffee, sugar, hides, and tobacco trades. Pacific builders paid particular attention to the barkentine (Chapelle 1935). On the West Coast, the rig became popular in the Australian lumber trades.

Around 1890, four-masted barkentine construction appeared on both coasts. The *Herbert Fuller*, built in Maine in 1890, operated out of the Port of New York. The ship measured 158.3 ft. in length and 35.5 ft. in breadth, with a depth of hold of 18 ft. (Brouwer 1996). Not as numerous as the three-masted configuration, one of the last East Coast four-masters is abandoned on the mud flats at Smoking Point south of Rossville, Staten Island. Built at Chelsea, Massachusetts in 1917 and abandoned in the 1920s, the ships measures 199.8 ft. by 42.3 ft. breadth (Brouwer 1996).

TURN-OF-THE-CENTURY SCHOONERS. After the Civil War, the booming industries of New England created a rapidly expanding market for coal mined in the Pennsylvania mountains. The Hudson River limited railroad connections. To meet transportation needs, New England shipwrights produced the largest fore-and-aft rigged vessels in the world (Brouwer 1996).

Vessels in the trade sailing between the Virginia Capes and New England had to make at least one leg of each voyage heading into prevailing winds. These conditions made the fore-and-aft rig particularly suitable. In operation, the rig had an economical advantage, particularly after the development of efficient steam, and later gasoline, sail setting hoisting engines.

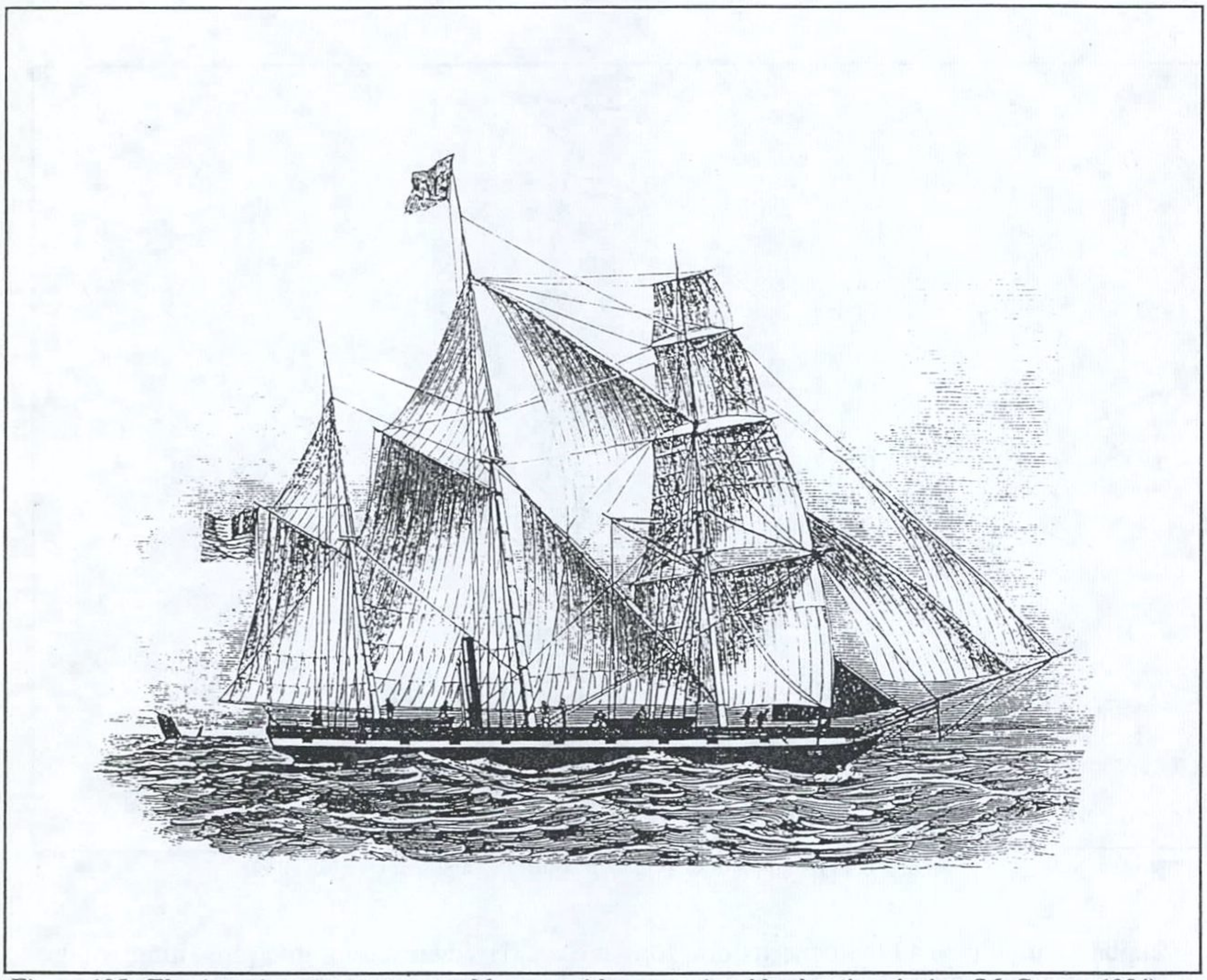


Figure 185. The American screw steamer *Mamora* with conventional barkentine rigging (McGregor 1984).

The first four-masted schooner built as such, George *W. Adams*, launched on the Great Lakes in 1875. The 190-ft. William *L. White*, launched at Bath, Maine in 1880, represents the first four-masted schooner built on the East Coast (Brouwer 1996). The remains of the four-masted schooner *Paul E. Thurlow*, built at Rockland, Maine in 1918, is located within the project area at the east end of Mariners Harbor, Staten Island on the Kill Van Kull.

John A. Noble, an artist renowned for maritime subjects on the Arthur Kill, drew the lithograph in Figure 186 entitled *Soul of Sail* (1961) from drawings made of four-masted East Coast schooner holds from 1928 on. He also considered vessels built from 1900 and even Maine barks and ships from the 1870s. The lithograph is an attempt by the artist to portray the massive timbering of a schooner hull.

The *Soul of Sail* point of view is from slightly forward of the foremast looking aft toward the transom. The measurements of the schooner range about 230 ft. (John Noble Collection Essays 1967). Under the hatches, the keelson is sheathed and iron strapped, providing protection against heavy cargo or the dropping of steel coal buckets. Hatch-coamings and stanchions are also iron strapped and battened.

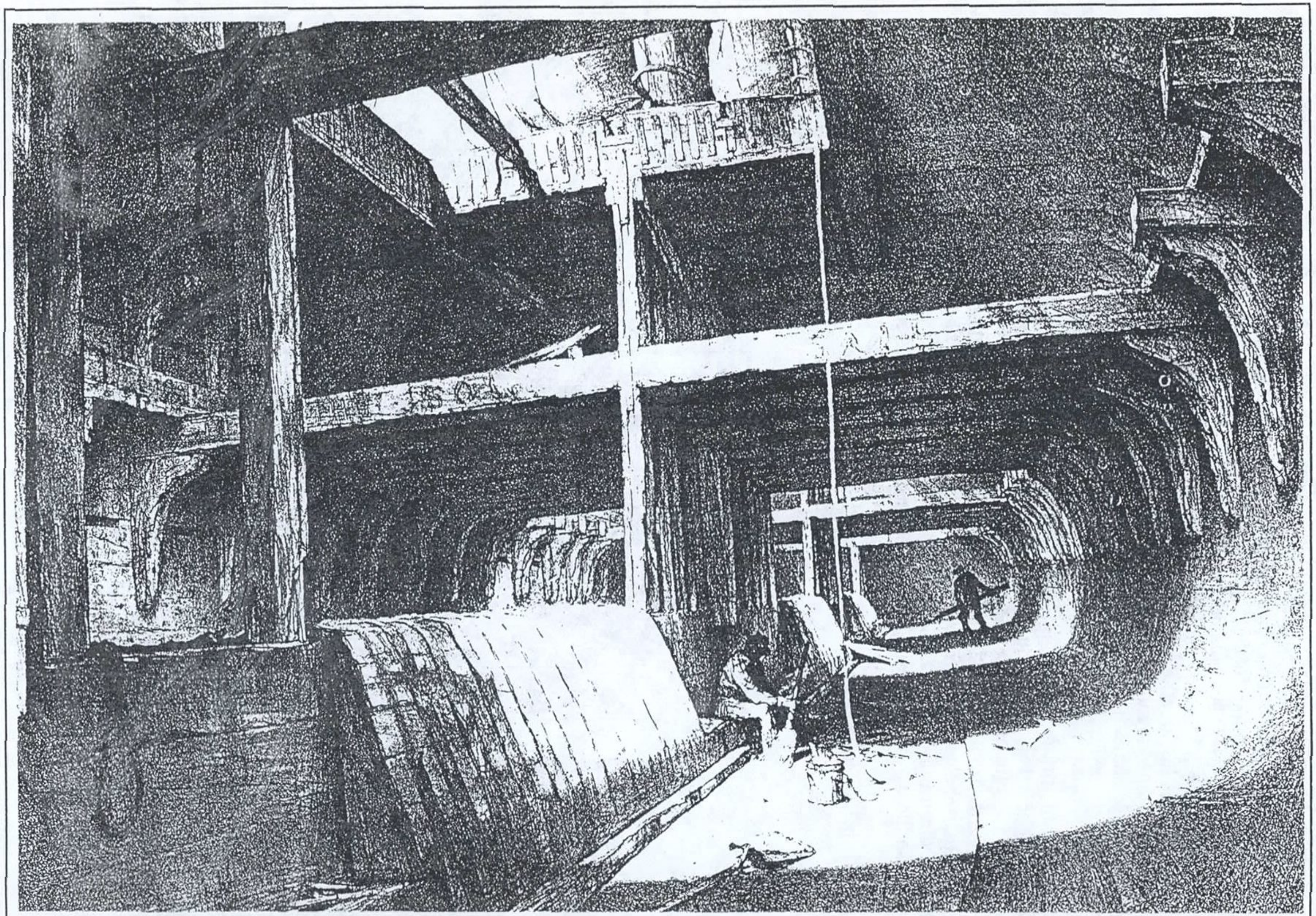


Figure 186. "Soul of Sail," lithograph by John A. Noble (Noble 1961).

Some vessels had timbering instead of knees pictured here under deck beams. Some apparently had no beams at all (John Noble Collection Essays 1967). The lithograph represents a pre-WWI vessel. The combination of beams and laminated planks, like a 'tween deck waterway, is sometimes called a ribbon. In the foreground is the lower extremity of heavy ceiling planks curved toward the bow. These planks, 10 in., are on frames about the same thickness. The outside planks measure 5 in. Amidship near the hatch coaming is a massive turnbuckle, used to bind the vessel's sides together. From inside out, the entire hull measures some 5 ft. of solid wood. Artistic license included the foremast and curve of the ceiling too far aft;. three missing stanchions; the fore hatch too long, and the 'tween-deck frames slightly diminished (John Noble Collection Essays 1967).

Another Noble lithograph (Figure 187) portrays the construction of the four-masted schooner *Tomila* (1920) near Linoleumville, on the west end of Victory Boulevard in Staten Island. The vessel is described by Noble as the last great sailing vessel ever built in the City of New York (John Noble Collection 1973). *Tomila*, the largest of the three schooners depicted, had a 'tween deck. The square holes in the bow facilitated loading of timber. The hawser holes are not yet cut through. In the foreground is Douglas fir, sawn octagonally, adzed round for schooner masts. Carpenters on the ways are pulling up garboard planks weighing some 300 pounds.

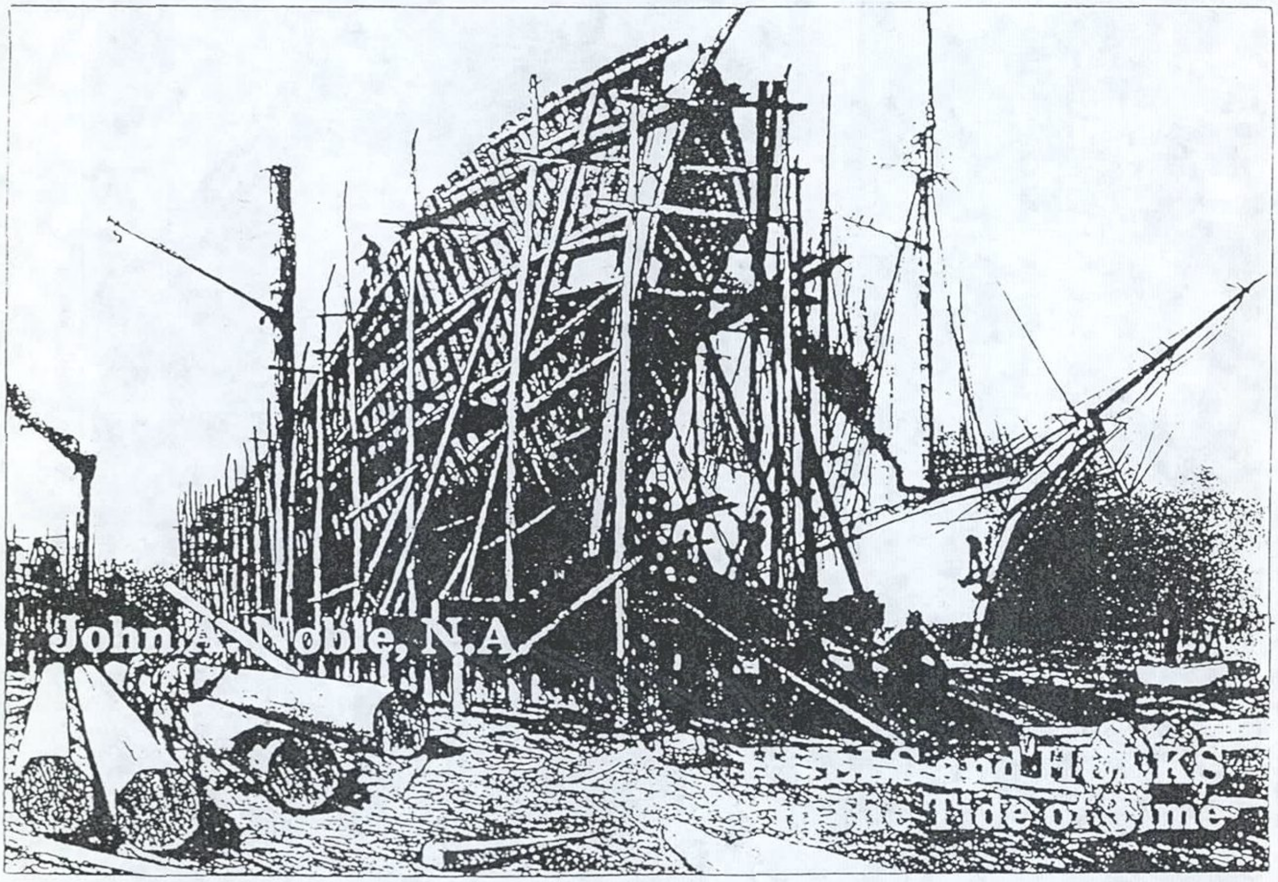


Figure 187. John A. Noble lithograph of the shipyard near Linoleumville, Staten Island (Noble 1961).

Again Noble admitted artistic license. He noted all these activities usually do not occur at the same time. The *Govin*, pictured on the right, is tied up sideways to the current. Gasoline powered the ship, not steam as portrayed here. There were two ways in this yard, not just the one pictured here. A shed and a waiting room for the ferry are also missing (John Noble Collection 1967). Noble's artistic license in no way diminishes his contribution to construction features.

The first five-masted schooner on the East Coast, *Governor Ames*, built in 1888, measured 245.6 ft. by 49.6 ft. in breadth. Over the next 30 years builders constructed over 50 vessels of this rig on the East Coast. Between 1900 and 1909, the East Coast launched eight wooden six-masted schooners. In 1900, the six-masted *George W. Wells* set sail. At Quincy, Massachusetts in 1902, the steel-built, seven-masted *Thomas W. Lawson* careened down the slipways (Morris 1984). The massive vessel, though impressive in size, proved disappointing at sea.

Table 26. Summary of Barkentine Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 49	Arthur Kill, NY	Yes	Photographic/site plan recommended

Arthur Kill, New York Reach

Vessel No. 49 (Figures 188 and 189)
Vessel Type: Possibly the four-masted barkentine *Herdis*
General Location: Arthur Kill, New York Reach near Smoking Point
Date of Abandonment: 1932 (Raber et al. 1995a)
Description: The vessel rests in shallow water and is just visible at low tide. Frame pairs are attached transversely. The planking fasten to frames with wedged trunnels. The exposed stem section suggests a bluff bow. Center line stanchions are visible amidships. According to enrollment records (Bureau of Marine Inspection and Navigation Vessel Documentation, n.d.), the wooden coastal trade schooner *Herdis* (Official No. 214685), built in Chelsea, Massachusetts in 1917, had two decks, four masts, a billet head, and a square stern. The vessel's registered length measured 199.8 ft., its breadth measured 42.33 ft., and it had a depth of hold measuring 19.67 ft. The vessel's gross tonnage totaled just over 1,220 tons.
Recommendation: The schooner may be one of the last four-masted east coast vessels built. It is the only known four-masted vessel left in New York Port. The remaining hull features should provide new data on construction (Criterion D) as one of the last New England wooden sailing ships built. Recommendations include complete photo documentation and site plan recordation. Because the vessel is almost entirely submerged and filled with sediment, the proposed work will require health and safety considerations. These considerations are presented in the chapter "Recommendations and Interpretations."

SCHOONER BARGES

In the late nineteenth century, coal transported from New York Harbor, Chesapeake Bay, and the Delaware River to ports in New England provided work for a large fleet of multi-masted schooners, and a large fleet of towed barges (Brouwer 1996). Railroad, coal, and towing companies, independent tug owners, and the like competed against the increasingly larger coastal schooner. The schooner barge had few of the problems associated with larger schooners. The schooner barge, "a vessel that was normally towed from port to port by a tug...differed from other barges in that it carried some sails on masts (smaller than) those found on a normal schooner" (Morris 1984:2).

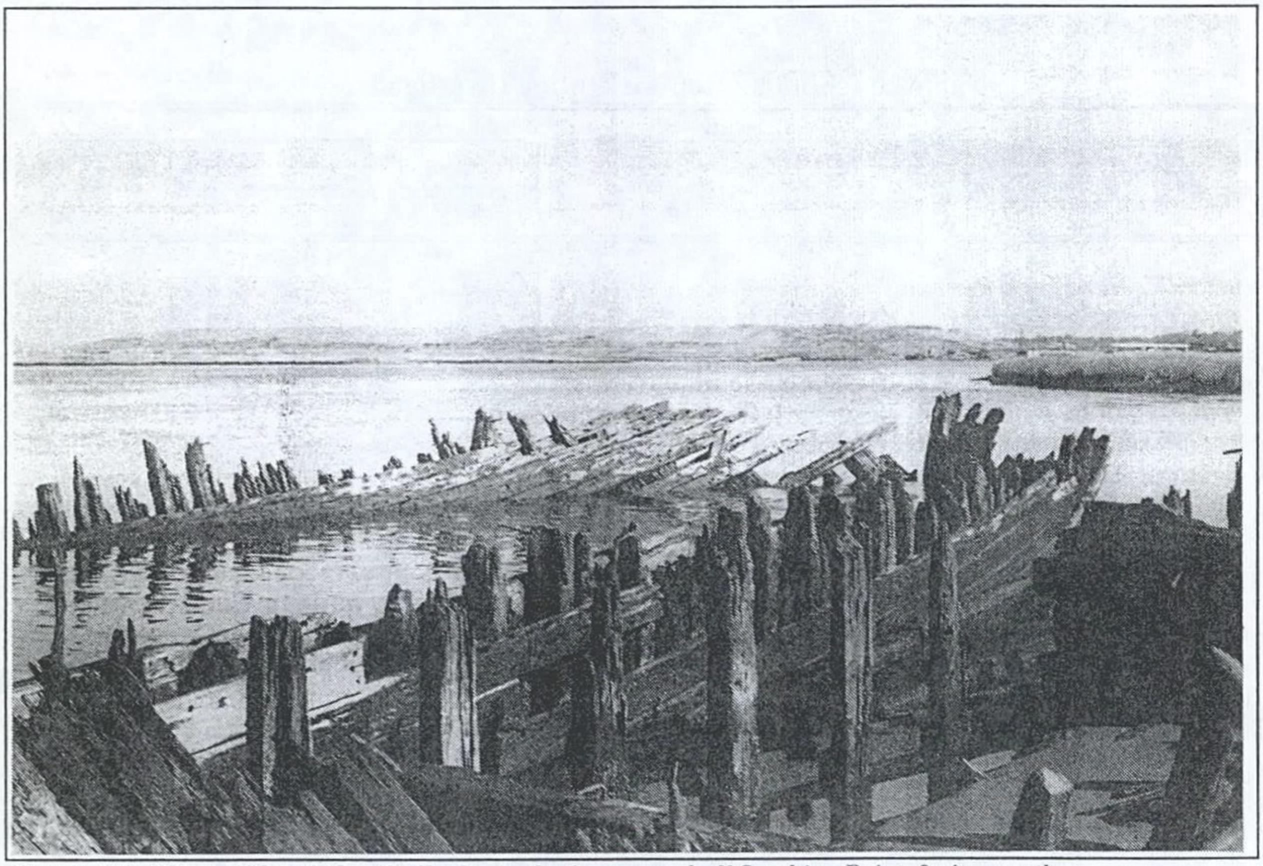


Figure 188. View of Vessel No. 49, *Herdis*, in the foreground off Smoking Point, facing north.

Figure 189. Site view of Vessel No. 49, facing north.

Not a sailing vessel per se, the sails "expedited the progress of the tow when the wind was abaft the beam" (Morris 1984). Because of the short rig associated with small sails, crews of three, four, or five manned the vessel. The small crew sized obviously cost less to operate than traditional schooner crews. The barges also cost less to build, whether as a schooner barge or reconstructed from old sailing vessels (Brouwer 1996). They proved more reliable than conventional schooners, both in delivery and speed. Tugboat pilots could tow four to six barges at a time (Morris 1984).

The typical schooner barge built as such looked like a no-frills sailing ship (Figure 190). The barge had little sheer, and a straight stem with some rake. Early sterns had an overhanging counter with no transom. Later sterns simply came to a point above the rudder (Brouwer 1996). Reduced rigging, usually two or three lowermasts, had booms for setting triangular fore-and-aft sails. These small sails provided stability in heavy seas, but added little speed even under ideal conditions.

The method for sail-to-barge conversion eventually became standardized. Laborers cut down the rigging to the lower sections of the mast, the bowsprit cut flush with the stem. After removing the forward deckhouse, laborers added a series of hatches along the entire length of the main or well deck. They sometimes built a pilot house on top of the afterhouse, providing a view of the barge or tug ahead. Below, workers installed steam hoisting engines, pumps, sails, etc. (Morris 1984).

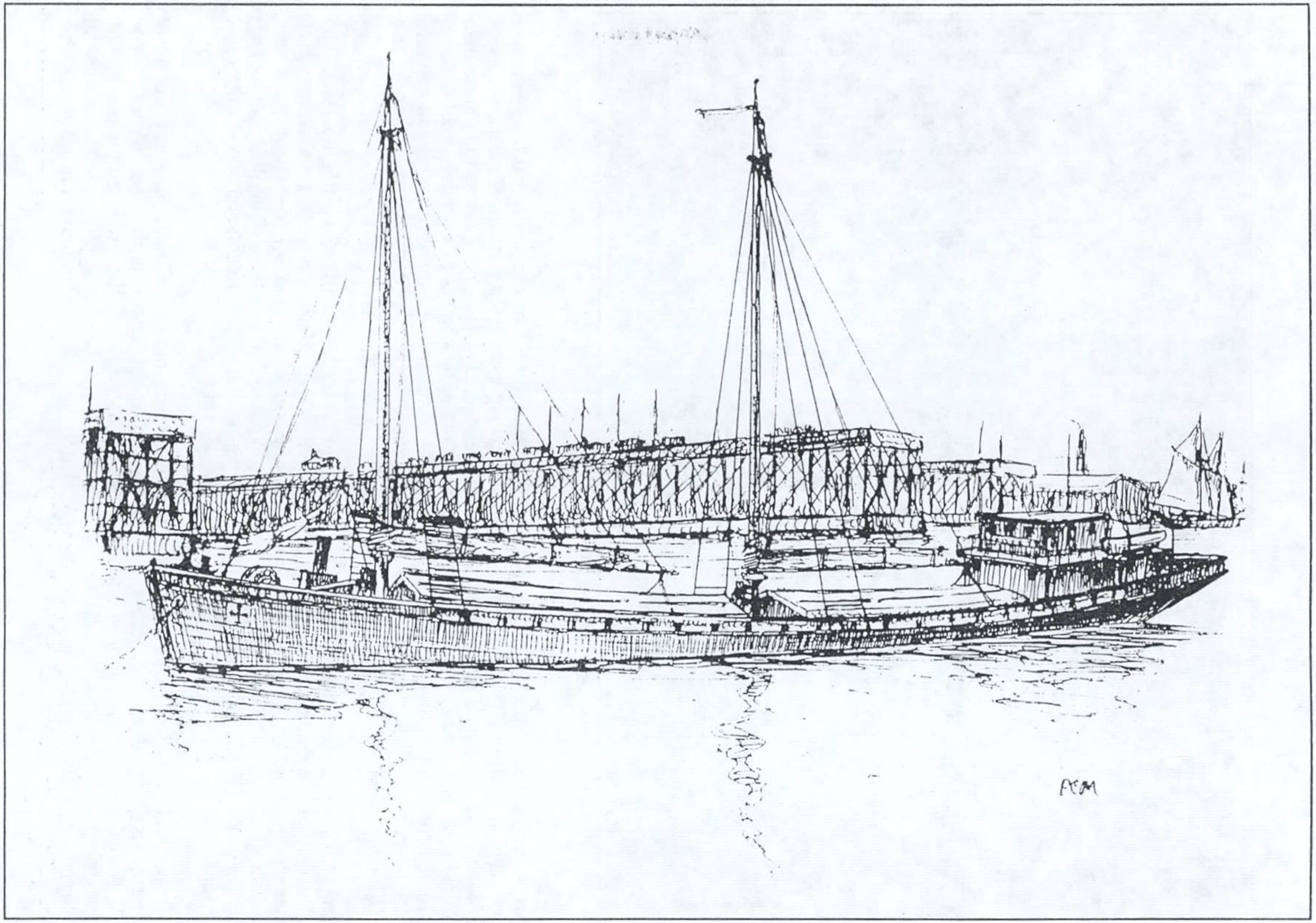


Figure 190. Lithograph of schooner barge (Morris 1984).

Table 27. Summary of Schooner Barges Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 52	Arthur Kill, NY	Yes	Photo and site documentation
Vessel 54	Arthur Kill, NY	No	Not best representative, no further work
Vessel 194	Arthur Kill, NY	No	Not best representative, no further work

Arthur Kill, New York Reach

Vessel No. 52 (Figures 191 and 192)
Vessel Type: As built, schooner barge
General Location: Arthur Kill, New York Reach near Smoking Point
Date of Abandonment: 1932 (Raber et al. 1995a)
Description: According to Brouwer, this is the vessel *Devon* (1895) built in Bath, Maine. The vessel's upper hull configuration is partially exposed at low tide, but overburden covers most of the remains. Initial observation suggests that the hull is intact and articulated beneath the sediment. Visible vessel remains include a vertical stern post, centerline stanchions, hanging knees, paired frames and futtocks, ceiling, and planking. The outside planking is butted, not scarfed. Outside planking is trunneled; otherwise, fasteners are metal. Scuppers are intact. The Morecraft Transportation Company probably abandoned the vessel at Smoking Point between 1927-1932 (Raber et al. 1996)
Recommendation: The site fits the best type category. Photographic documentation and scantling measurements are necessary under Criterion D (the site may provide relevant data on ship construction methods). Investigative safety considerations are outlined in the section entitled "Recommendations and Interpretations."

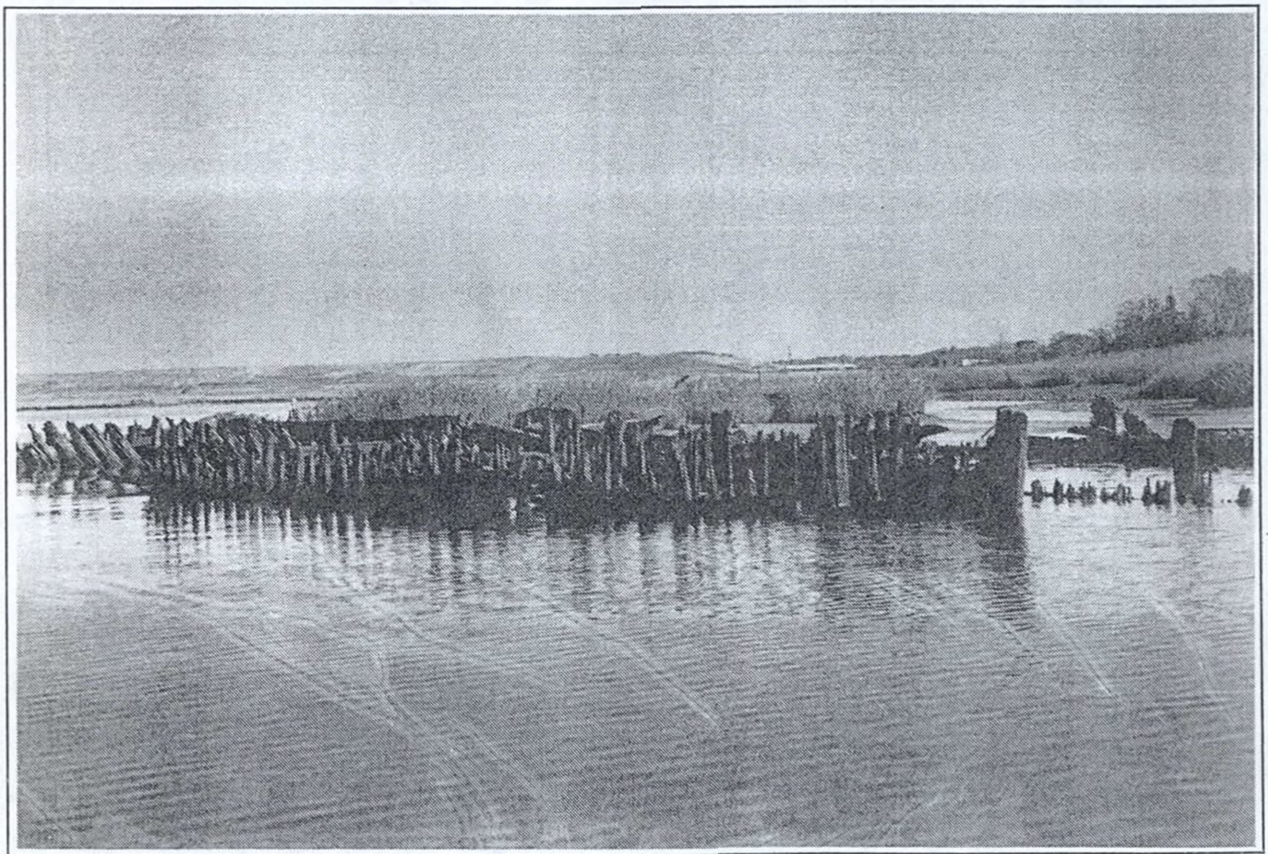


Figure 191. Site view of Vessel No. 52, identified as *Devon* (1895), facing north.

Figure 192. Closeup of Vessel No. 52, facing south. The vessel's rudder assemblage appears intact.

Vessel No. 54 (Figure 193)
Vessel Type: Possible schooner barge conversion (sail)
General Location: Arthur Kill, New York Reach near Smoking Point
Date of Abandonment: 1932 (Raber et al. 1995a)
Description: This vessel, according to Brouwer, is Camden (Official No. 125027), built in Cleveland, Ohio in 1872. Built as a Great Lakes grain and lumber schooner, the boat moved to the Atlantic Coast in 1893, rebuilt as a schooner-barge in 1916 (Raber et al. 1996). The vessel's registered length measured 190.2 ft., its breadth measured 33.5 ft., its depth of hold 14.5 ft. Its gross tonnage totaled almost 697 tons (Bureau of Marine Inspection and Navigation Vessel Documentation, n.d.). The vessel is nearly submerged and rests in shallow water. Minimal structural remains are visible at low tide. There exist at least nine centerline stanchions. A possible bulwark is exposed forward. The vessel's rudder is well preserved, though most of it is buried in sediment.
Recommendation: Extant examples of lumber and grain schooners exist in the archeological record (Carroll 1985; James 1992). No future research is needed.

Figure 193. Site remains of Vessel No. 54, facing north.

Vessel No. 194 (Figure 194)
Vessel Type: Schooner barge
General Location: Arthur Kill, New York Reach north of Outerbridge
Date of Abandonment: 1932 (Raber et al. 1995a)
Description: Raber et al. (1996) tentatively identified this vessel as Atlantic Queen, a schooner-barge conversion. The vessel has metal cross-bracing outboard of frames. At the stern is a composite rudder, complete with a large metal stern post. At the centerline deck level is a large coaming. Several hatches (approximately eight) are visible. From the coamings, one can see interior deck beams, framing pairs, and wooden/iron lodging knees. The stem is vertical.
Recommendation: Based on comparative project-area data, this vessel is not a best representative type. No further research is needed.

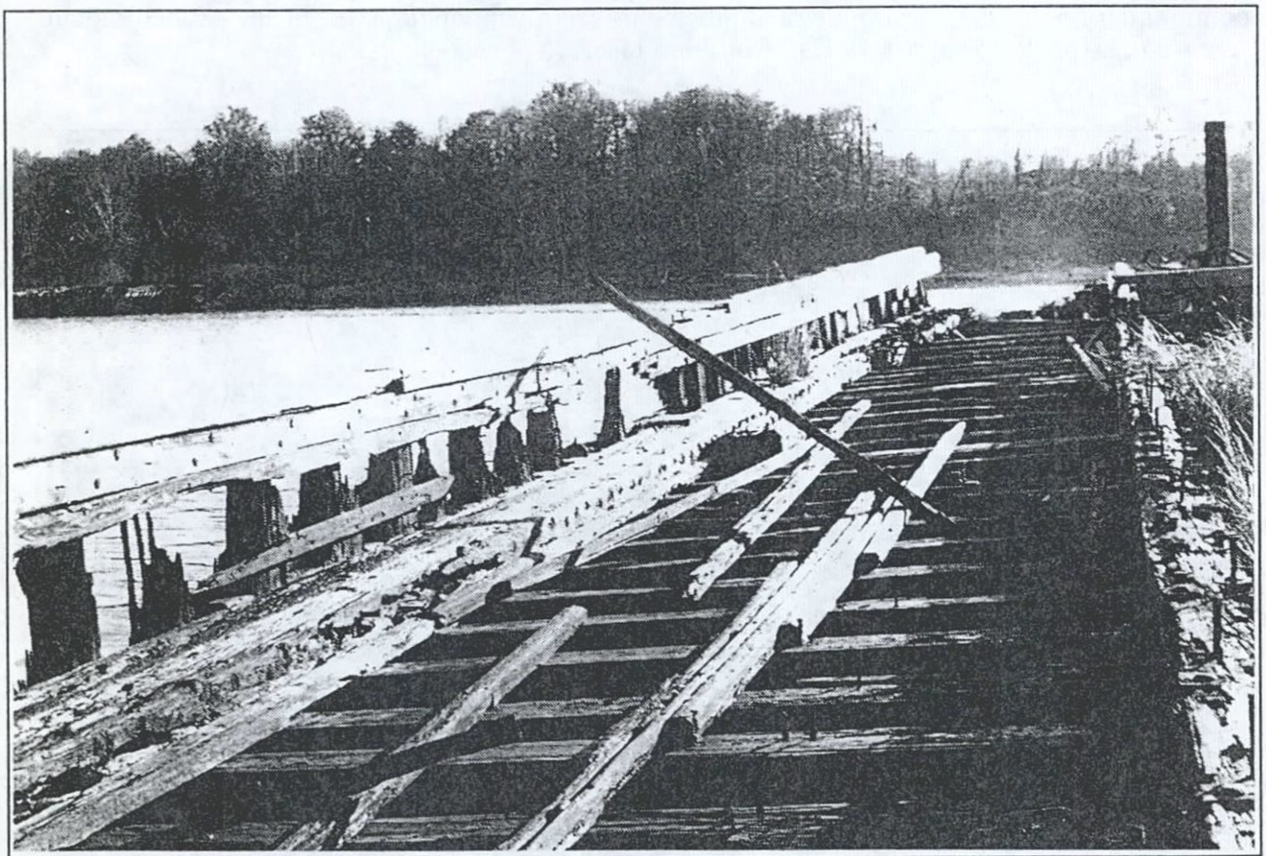


Figure 194. Site view of Vessel No. 194, identified as *Atlantic Queen*, facing north.

SCHOONER BARGE RIGGING AND TOWING. Early rigging featured short topmasts. Later gaff-rigged courses or sometimes small, triangular courses appeared on each mast. A fore staysail ran between the stemhead and foremast. For towing, the barge had installed tow bitts fore and aft, with a bow chock placed over the stem head. Construction sometimes required a reduction of freeboard, but the carrying capacity remained the same as the old vessel (Morris 1984).

Table 28. Summary of Converted Schooner Barges Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 72	Arthur Kill, NY	Yes	Photo and site documentations
Vessel 78	Arthur Kill, NY	No	Not best representative, no further work
Vessel 82	Arthur Kill, NY	No	Not best representative, no further work
Vessel 83	Arthur Kill, NY	No	Not best representative, no further work
Vessel 37	Kill Van Kull, NY	No	Not best representative, no further work
Vessel 76	Kill Van Kull, NY	No	Not best representative, no further work

Arthur Kill New York Reach

Vessel No. 72 (Figures 195 and 196)
Vessel Type: Ferris conversion to barge
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Although there are obvious signs of salvage and burning, the vessel's upper works are well preserved . The vessel's construction is massive, i.e., a distance of some 6 ft. exists from the outer hull to the inboard hatch area. Two large holds are visible, measuring some 40 ft. long by 30 ft. wide. At least three bulkheads are present, these supported by large knees. An intact water tube boiler rests on the upper decking. The aft section contains concrete decking, along with pumping gear. Metal cross-strapping runs between the outboard side of the frames and outer hull planking. Lower hull assembly is not visible. End-butted external planking is attached by treenails. The rudder assembly is fully articulated.
Recommendation: Though Raber et al. (1995) presents no bibliographic evidence for a schooner barge typology, the vessel should be inspected for schooner/barge conversion methods (Criterion D). Photographic documentation should include machinery and boiler systems.

Vessel No. 78 (Figure 197)
Vessel Type: Ferris conversion to barge, tentatively identified as *Winapie* (Raber et al. 1995a)
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1961 (Raber et al. 1995a)
Description: Approximately half the outer hull rests afloat in shallow water. Gutted and in degreed states of deterioration, observable features are confined to outer hull remains. The vessel is bulky and heavily constructed. The gunwale is partially intact. Metal cross-strappings are fastened between the outboard frames and outer planks. In the bow section, two areas (port and starboard ca. 50 ft. aft from the stem) are reinforced with concrete. Some concrete reinforcement exists in the stern area as well. The stern post has attached metal sheathing and water marks. Lower hull features are submerged during low tide. The vessel (Official No. 220588), built in New York in 1919 and later rebuilt in Bath, Maine in 1920, is listed as a two-masted wooden schooner. Its registered length measured 268 ft., its breadth measured 46 ft., and its depth totaled 23 ft. 6 in. The vessel's gross tonnage totaled almost 2,412 tons (Bureau of Marine Inspection and Navigation Vessel Documentation, 1920).
Recommendation: Based on comparative project data, this vessel is not a best representative type. No further work is needed.

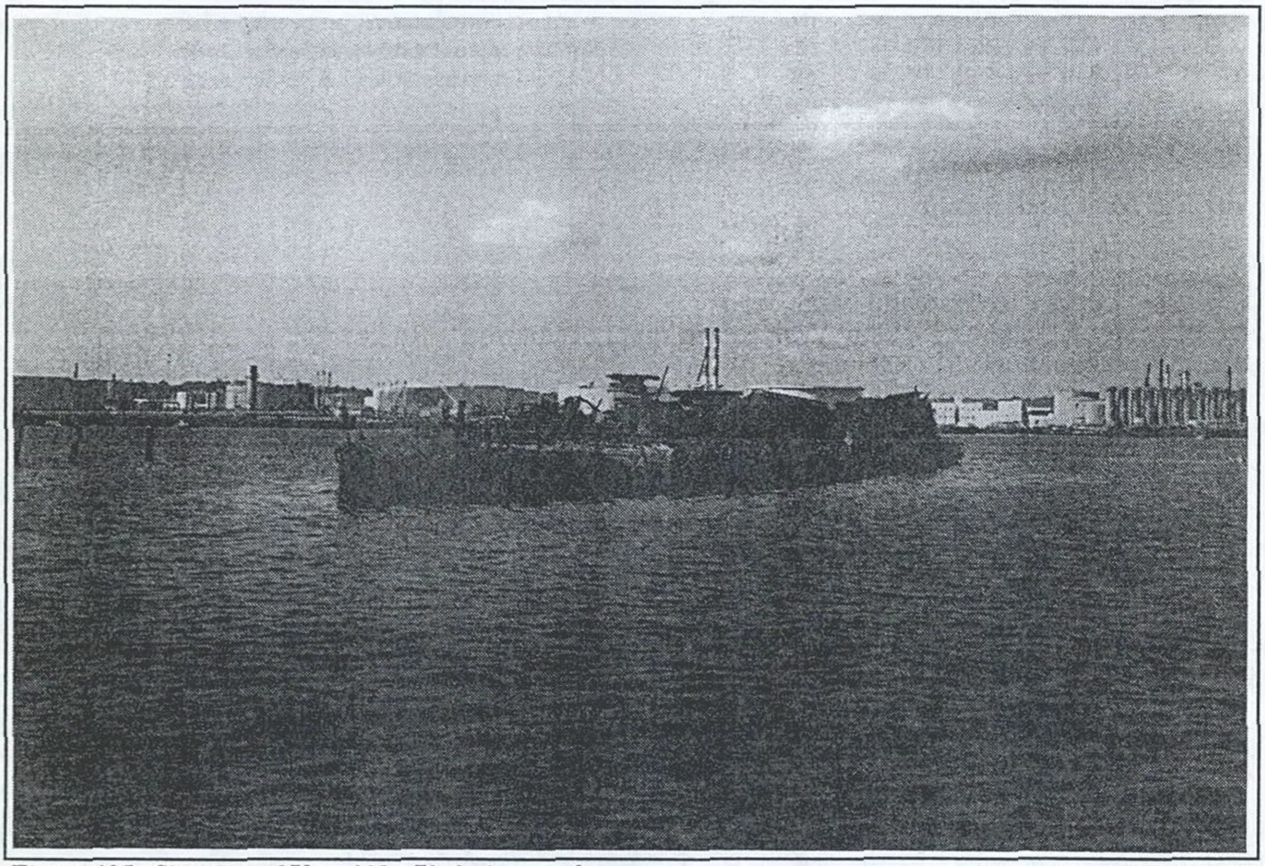


Figure 195. Site view of Vessel No. 72, facing south.

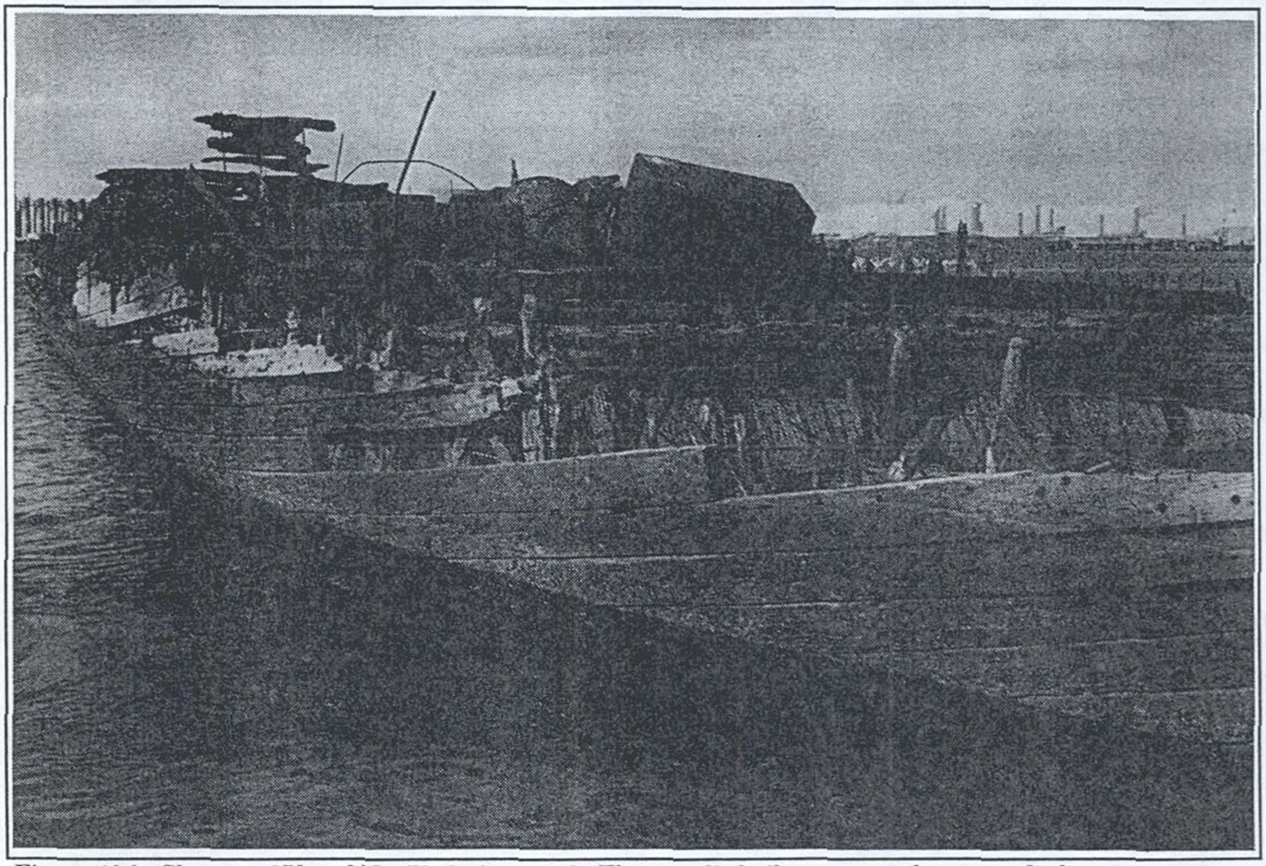


Figure 196. Closeup of Vessel No. 72, facing north. The vessel's boiler rests on the upper deck.

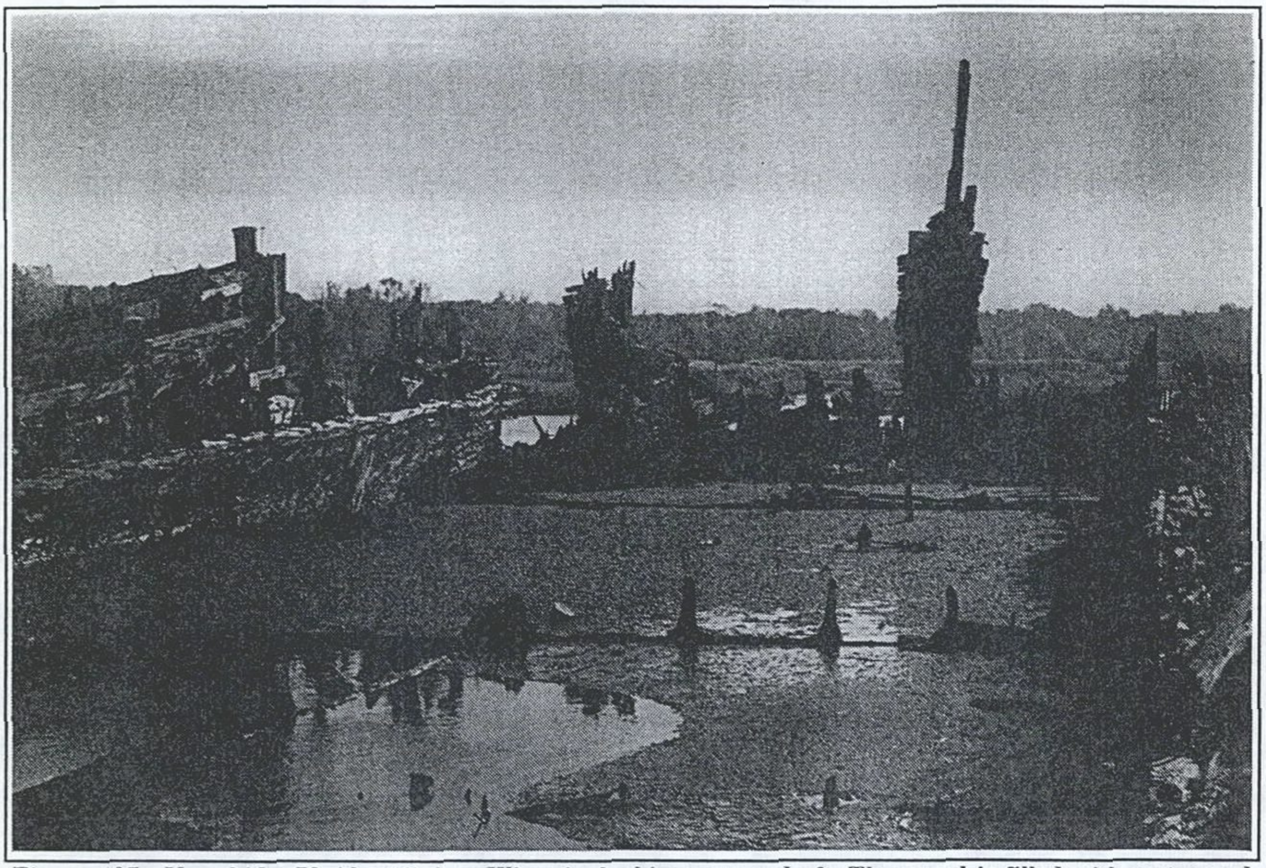


Figure 197. Vessel No. 78, identified as *Winapie*, looking east and aft. The vessel is filled with water and sediment at low tide.

Vessel No. 82
Vessel Type: Schooner barge
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1940 (Raber et al. 1995a)
Description: At low tide, the only visible feature of the vessel is the top of the rudder post.
Recommendation: Based on comparative project data, this vessel is not a best representative type. No further work is needed.

Vessel No. 83 (Figures 198 and 199)
Vessel Type: Schooner barge
General Location: Arthur Kill, New York Reach south of Sharrott's Road
Date of Abandonment: 1940 (Raber et al. 1995a)
Description: At low tide, the vessel's lower hull features are submerged. What is evident are the top of frames, stem, outer planking, iron cross-strapping, and stern post.
Recommendation: Based on comparative project data, this vessel is not a best representative type. No further work is needed.

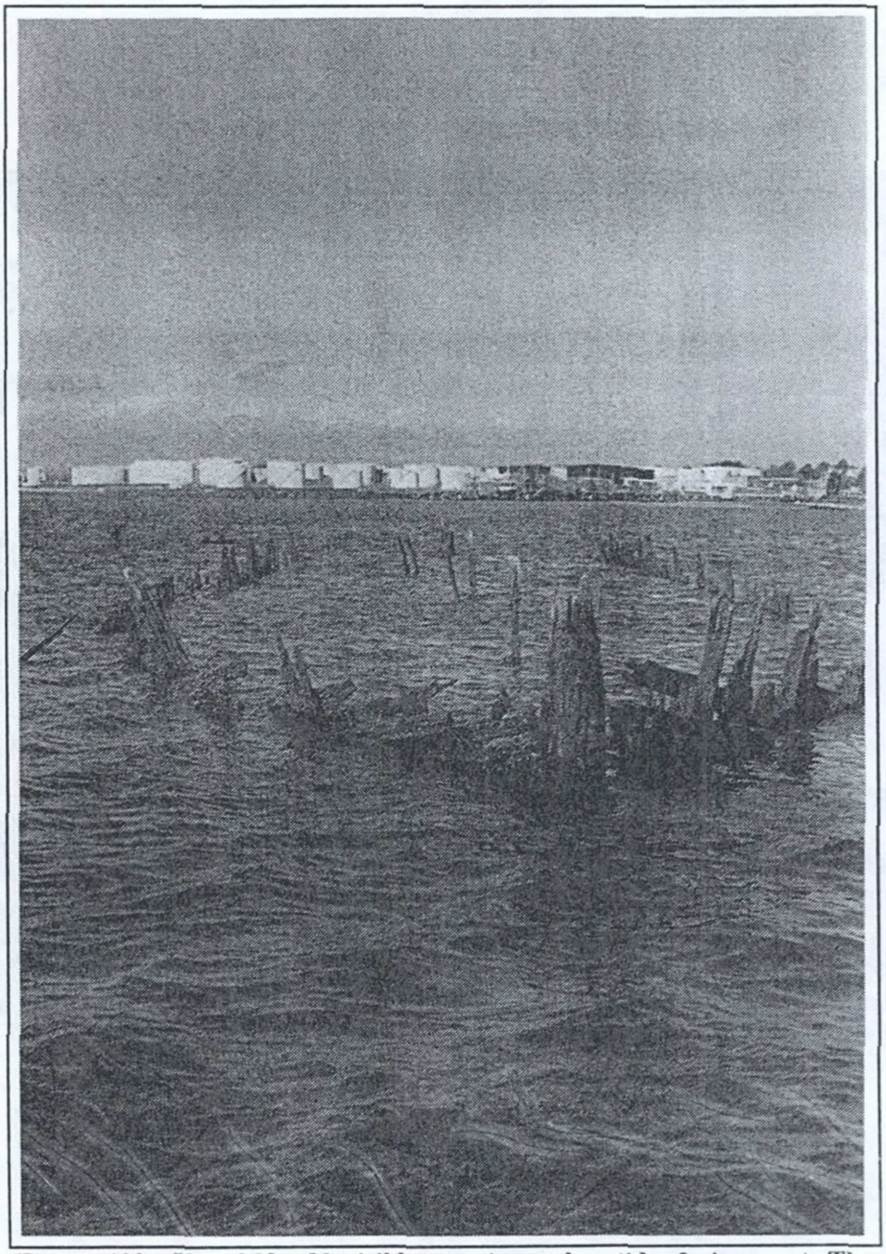


Figure 198. Vessel No. 83 visible remains at low tide, facing west. The vessel's stern post is extant.


Figure 199. Vessel No. 83, facing southeast.

Kill Van Kull Reach

Vessel No. 37 (Figure 200)
Vessel Type: Schooner barge
General Location: Kill Van Kull, New York near the GLD&D
Date Abandoned: 1947 (Raber et al. 1995b)
Description: The vessel is almost submerged at low tide. Exposed remains are severely deteriorated. Minimal deck planking exists, but several deck beams and stanchions are visible. Portions of ceiling and outer planking are present. Visible fasteners are iron. Fire damage is evident. Rudder post and counter timbers are partially exposed.
Recommendation: Based on comparative project data, this vessel is not a best representative type. No further work is needed.

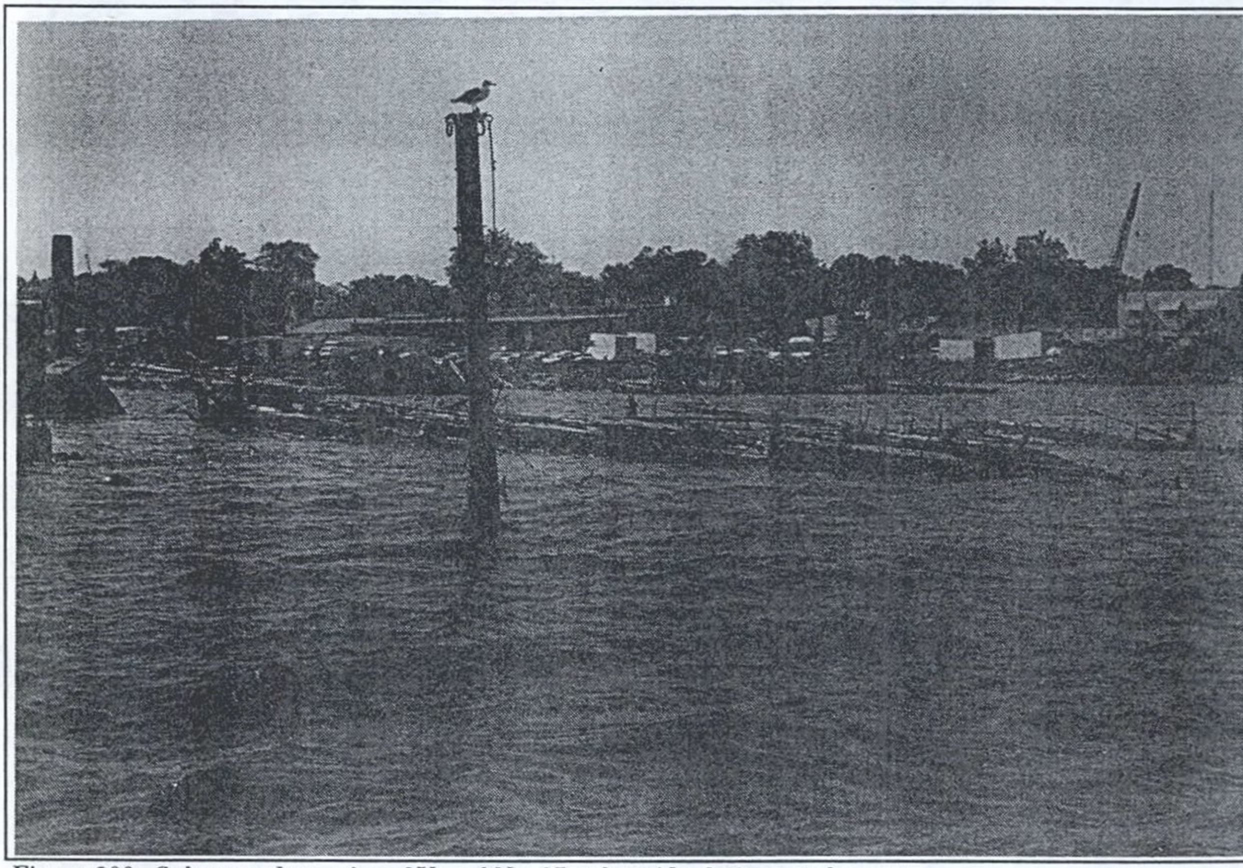


Figure 200. Submerged remains of Vessel No. 37 at low tide, facing north.

Vessel No. 76 (Figures 201 and 202)
Vessel Type: Schooner barge
General Location: Kill Van Kull, New York Reach near the GLD&D/George Rogers site
Date Abandoned: 1935 (Raber et al. 1995b)
Description: Vertical stem and stern posts are visible at low tide. Frames are spaced 2 ft. apart, center to center, between ceiling and floor. Outer planking is bolted butt-jointed. Metal cross-strapping runs on the outboard side of the frames. There is evidence of sheathing. The port side of the vessel is collapsed into the hull.
Recommendation: Based on comparative project data, this vessel is not a best representative type. No further work is needed.

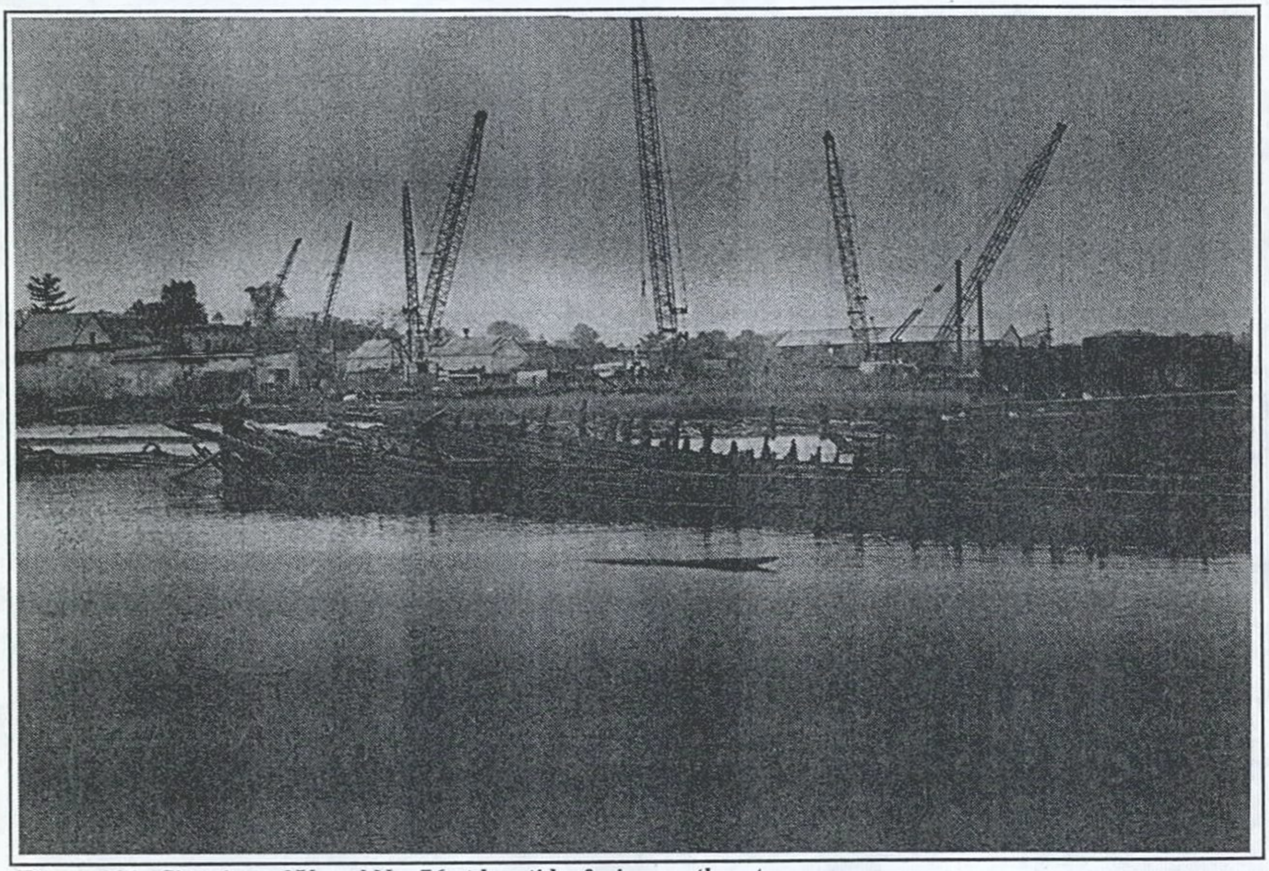


Figure 201. Site view of Vessel No. 76 at low tide, facing southeast.

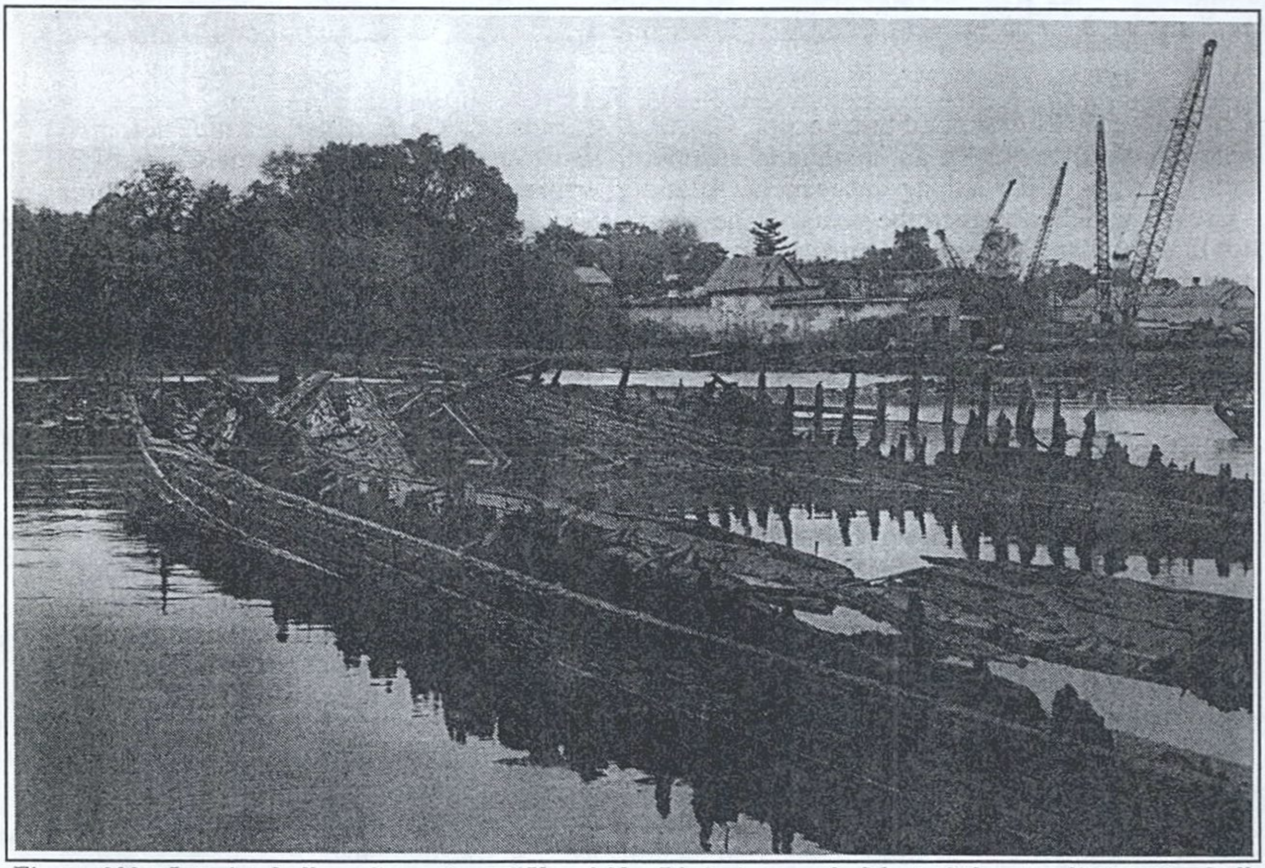


Figure 202. Interior hull configuration of Vessel No. 76, facing south. Most of the vessel's interior hull appears intact.

MENHADEN TRAWLERS

At the turn of the century, menhaden fish, or pogie, swam in large schools all along the Atlantic seaboard. Menhaden fishing in the Port of New York, as a profitable industry, began in the 1860s (Erismann 1912). Initial efforts to develop menhaden as food failed because of its oiliness. Instead, processors derived profits from tanning, paint production, or fertilizer. The first steam-operated oil extraction plants occurred on Shelter Island around 1850 (Brouwer 1996)

The fish traveled at the surface in large schools. Lookouts, posted on the mast, sighted the schools. In describing trawling methods, Martin C. Erismann stated "a purse seine is shot overboard from a seine boat, two usually carried, one on each quarter; the seine is brought alongside...the fish dipped out and transferred to the fish hold" (Erismann 1912:71). When full, the trawler made speed to the processing factory, where laborers extracted the oil. Once extracted, the remains of the fish became fertilizer. It became a substitute for German potash and bone phosphate.

Erismann (1912) described three boats, *Martin J. Marran*, *Rollan E. Mason*, and *Herbert N. Edwards*, built specifically as menhaden steamers. Built under the direction of Capt. N.B. Church, manager of the fishing department, Atlantic Fertilizer & Oil Company, the Boston firm B.B. Crowninshield designed the boats. "The boats are of the usual type of vessel for this trade, except that they are larger and better equipped..." (Erismann 1912:71). The dimensions measured as follows:

Length overall	165 ft.
Breadth	23 ft.
Draft (loaded)	12 ft. 9 in.
Depth	13 ft.
Indicated horsepower	600
Speed	13 knots
Capacity of fish hold	4,000 barrels

The hulls are wooden, the keel, stern, sternpost, and deadwood made of oak. The framing is white oak, the planking and ceiling made of hard pine some 4 in. thick. Bilge strakes are made of hard pine. A steel beam (with large gusset plates) tied the boat together near the boiler. The builders intended to strengthen the top member of the structure with a steel stringer, but "these were omitted owing to possible delay in the date of delivery" (Erismann 1912:71).

A two-story deck house sits forward, and a house is located aft on a raised poop (Figure 203). Part of the after house rests over the engine and boilers (Figure 204). A winch room is located in the forward end. Two large hatches "in the waist" provided access to the fish holds (Erismann 1912:71). Twenty-eight crewmen bunked in the forecastle below the main deck.

The early steamers had a wheelhouse on the main deck forward, with a tall mast for the lookout fitted high up with a boom for net handling. Crewman kept the central area of the deck open for loading fish. The forward end of the afterhouse housed dipping scoops, used to get fish from the seine to the fish hold (Erismann 1912). These boats usually had a sheer line rising to a fairly high bow (Brouwer 1996).

The menhaden steamer's basic design survived until quite recently. A plant handling menhaden active on the New Jersey shore of Lower New York Bay operated through the 1970s. Boats in this century used diesel engines, and had two-storied deckhouses forward. There is a fairly intact hull of what is apparently a wooden menhaden boat along the shore of Mariner's Harbor, Staten Island (Table 29).

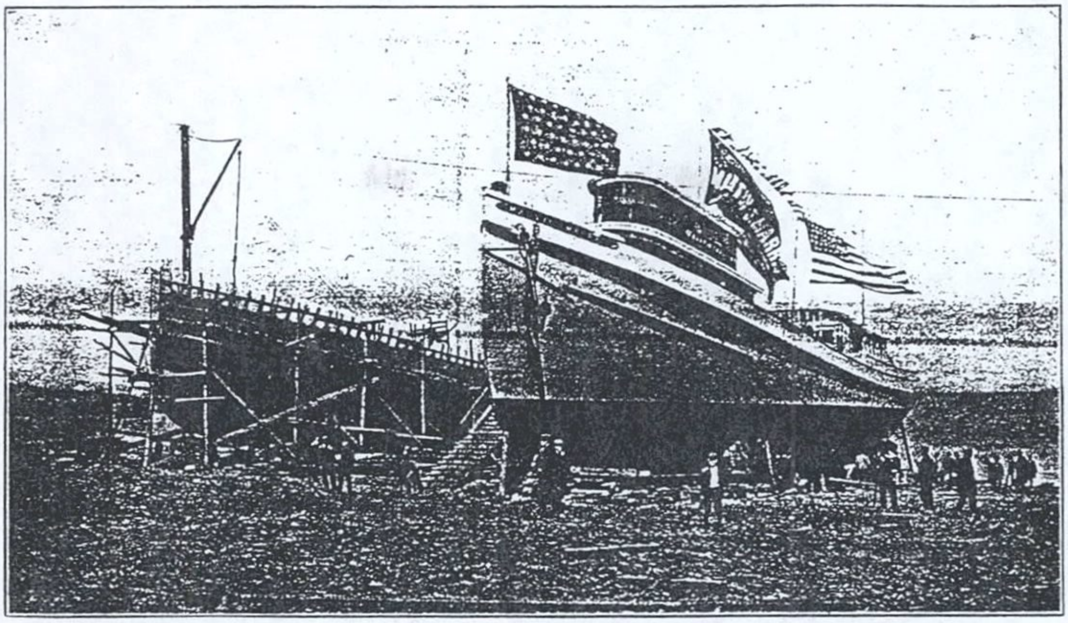


Figure 203. Menhaden steamer in the stocks (International Marine Engineering 1912).

Table 29. Summary of Menhaden Trawlers Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 33	Kill Van Kull, NY	Yes	Photo and site documentations

Kill Van Kull, New York Reach

Vessel No. 33 (Figures 205 and 206)
Vessel Type: Wooden steam (?) menhaden fishing boat
General Location: Kill Van Kull, New York Reach near Great Lakes Dredge and Dock Company (GLD&D)
Date of Abandonment: 1960 (Raber et al. 1995b)
Description: The large trawler is listing to port, three-quarters submerged. Visible upper structural remains include a steel-cased wooden stem post, bow ballards port and starboard, and two metal stacks amidships. The vessel has 4-in. deck planking. Fastening patterns on deck run longitudinally. The wooden stem and stern posts are steel sheathed.
Recommendation: The vessel is eligible under Criteria A, C, and D. Under A, vessel considerations include commerce and industry. Under C, the vessel possesses distinctive characteristics of type. Under D, the vessel will yield data on construction methods. Because site investigation is unsafe, it is recommended that only photographic documentation take place. This information can be compared and contrasted with existing plans.

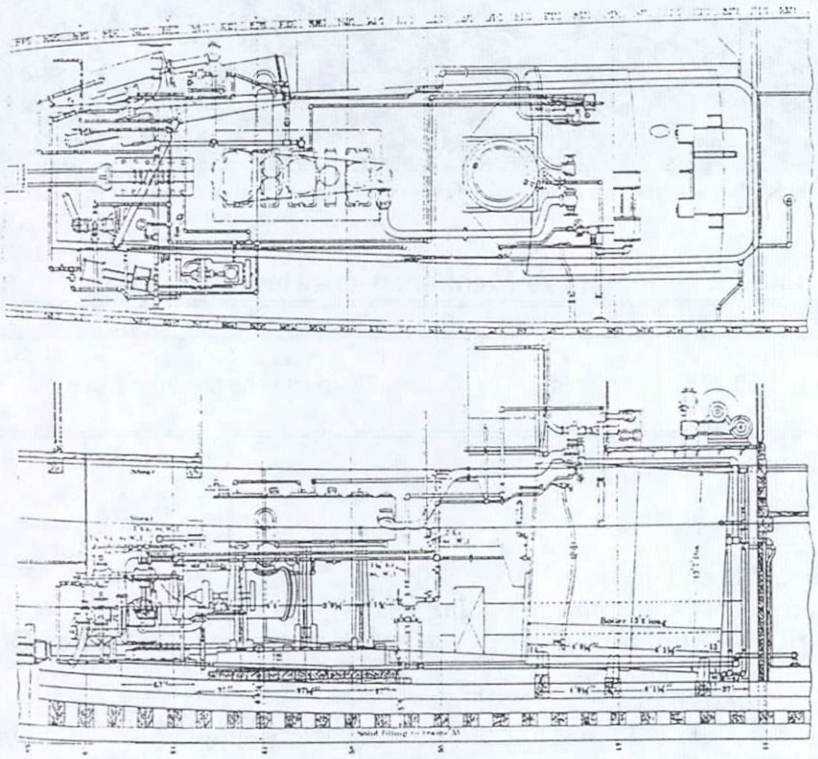


Figure 204. Machinery arrangement of the Menhaden steamer (International Marine Engineering 1912).

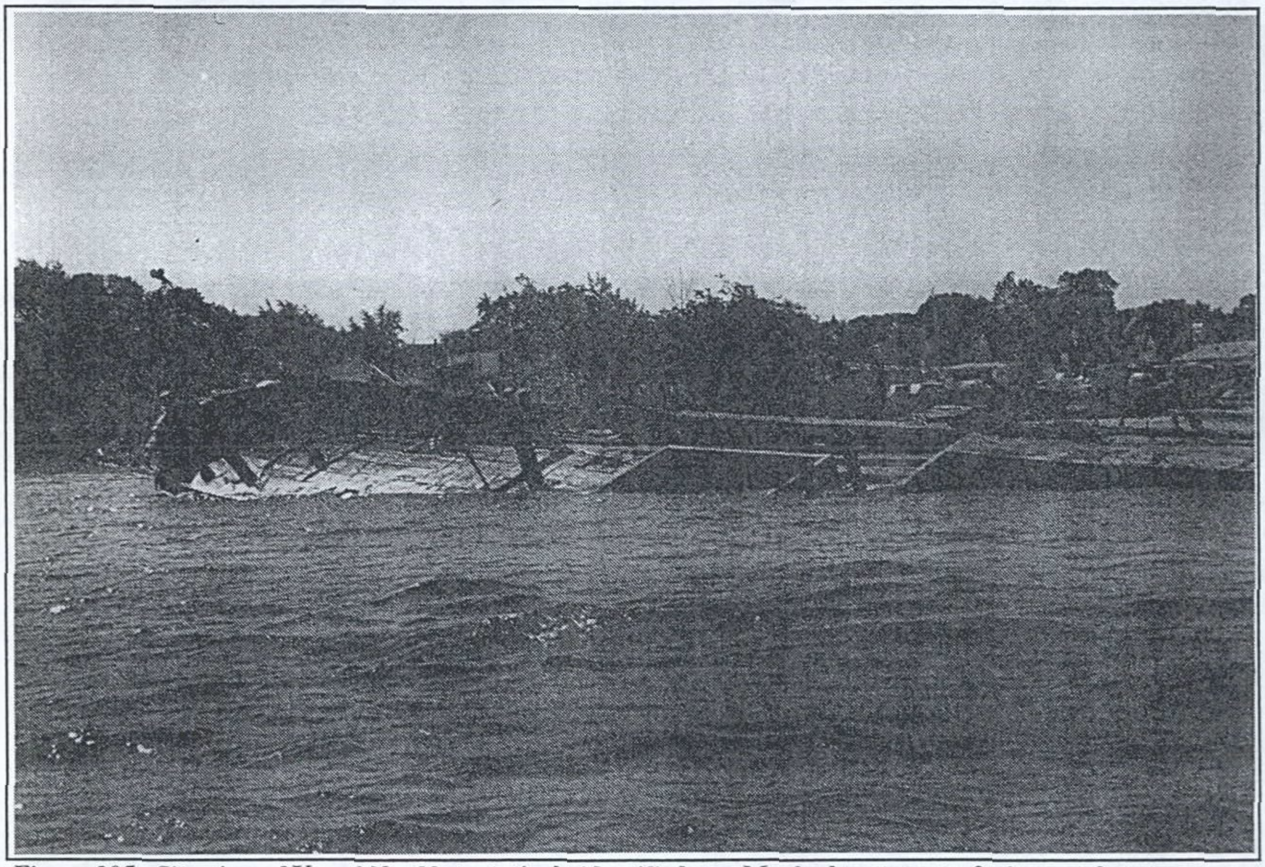


Figure 205. Site view of Vessel No. 33, tentatively identified as a Menhaden steamer, facing southeast.

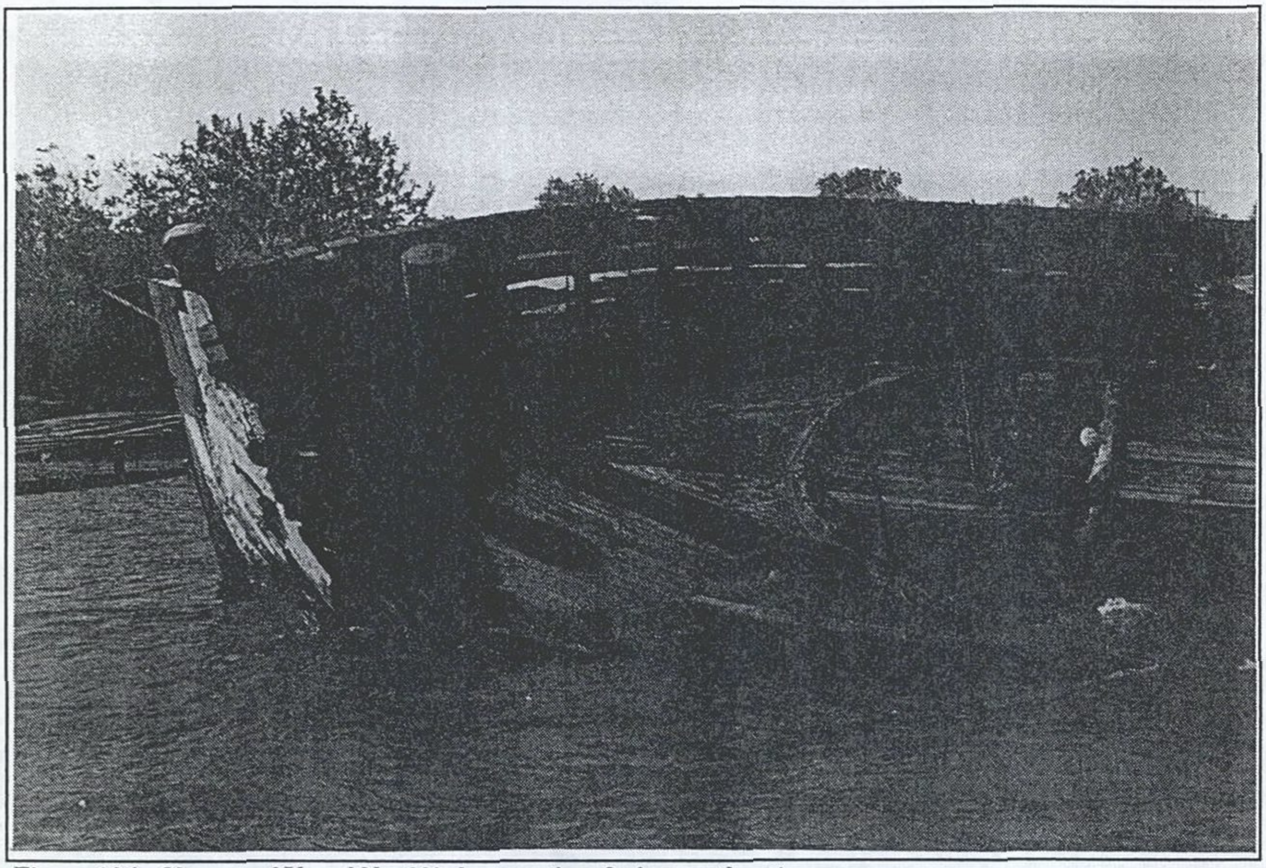


Figure 206. Closeup of Vessel No. 33's bow section, facing southeast.

DREDGES

BUCKET DREDGE. The bucket dredge, historically related to the spoon dredge, a simple scoop design, typically has a boom extending from its bow (Table 30; Figure 207). The boom is supported by an A-frame or mast. Another boom, equipped with a large bucket at its pivot end, rests near the midpoint of the first boom. The first boom has a cable running through a sheaf at the head of the first boom. At the head of this boom is a bucket used as a scoop. In 1990, the Great Lakes Dredging Corporation used a bucket dredge in the channel at Newark Bay, off Staten Island, New York (Brouwer 1990).

Table 30. Summary of Bucket Dredge Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 3	Kill Van Kull, NY	Yes	Photo/limited site documentation

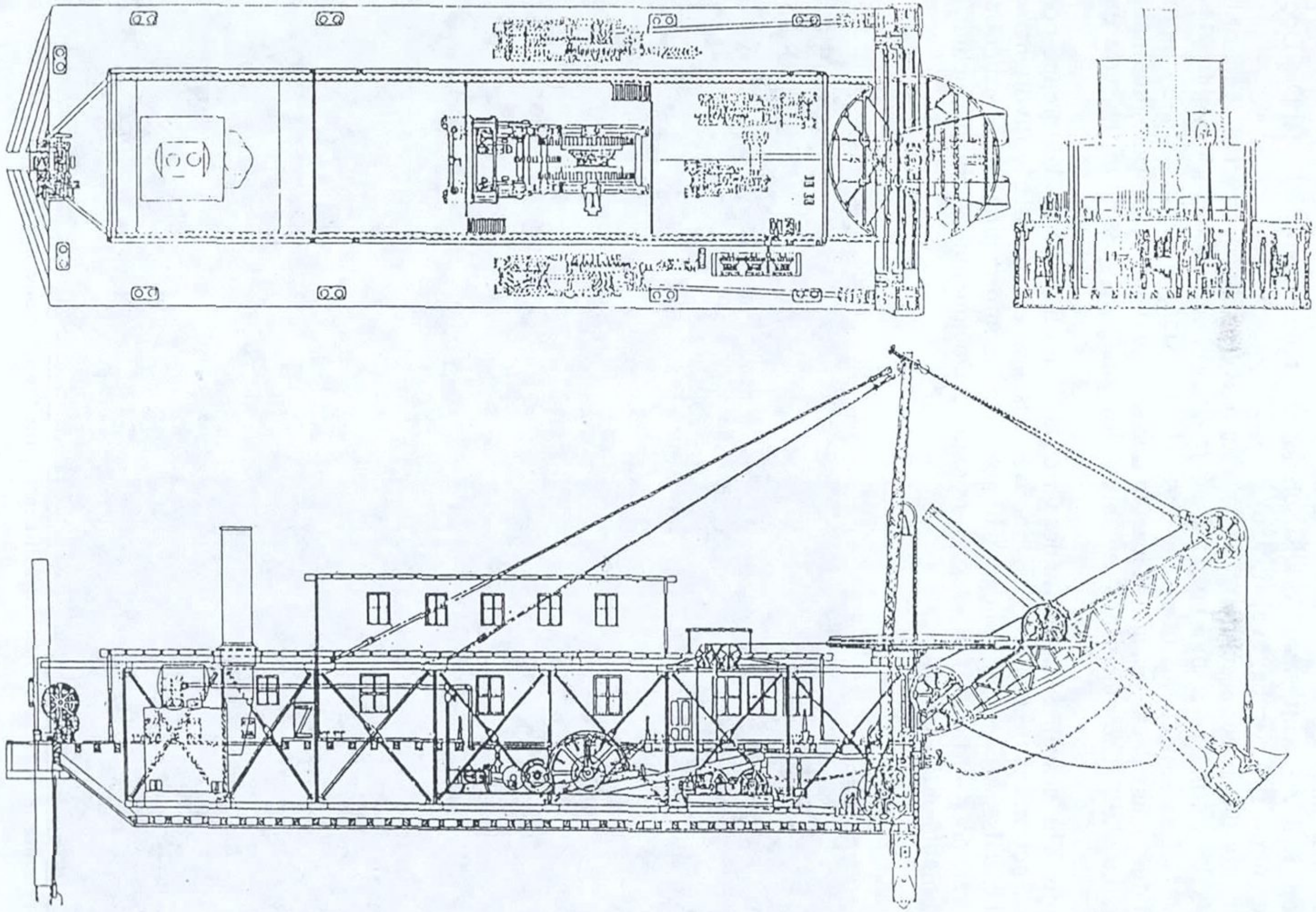


Figure 207. Inboard profile, deck plan, and cross section of *Toledo*, a wooden-hulled bucket dredge (International Marine Engineering 1910).

Vessel No. 3 (Figure 208)
Vessel Type: Wooden bucket dredge (a.k.a. spud barge)
General Location: Kill Van Kull, New York Reach near Pointin/Forsyth/National Dry Dock
Date of Abandonment: 1945 (Raber et al. 1995b)
Description: Most of the vessel is submerged. The barge is heavily constructed. Outer planking measures 6 x 12 x 4 in. Two spud boxes, 3 x 3 ft. square, are visible at low tide. The stern end of the vessel is scowed, the other end vertical. The sides of the vessel are supported by vertical and diagonal stanchions, and at least in one section, knees are set longitudinally flush against the side wall. The rudder post, visible at low tide, sets outside of the scow end timbers.
Recommendation: The vessel is eligible under Criteria C and D. The bucket dredge possesses unique construction features and is a distinctive vessel type, particularly involving work in harbors and canals. Archaeological data will also provide information on construction methods. However, only portions of the vessel are extant. Documentation should include photos and measurements of the spud box.

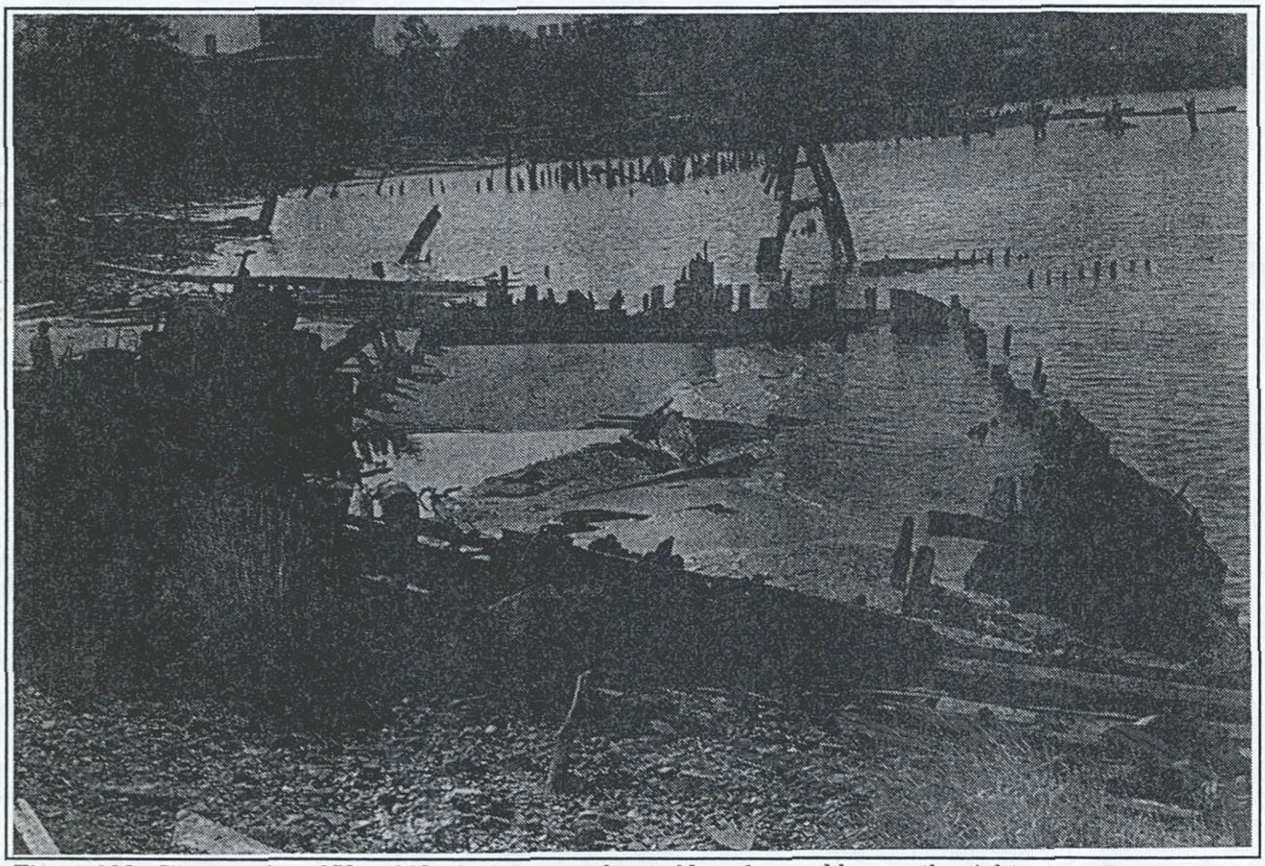


Figure 208. Site remains of Vessel No. 3, facing southeast. Note the spud box on the right.

SUCTION DREDGE. International Marine Engineering (May 1912) published data on a 20-in. Morris suction dredge owned by the American Pipe and Construction Company used on the New York State Canal Barge system. The hull is wooden with two heavy steel girders running fore and aft. The dredge shown here measured 138 x 42 ft. The main dredge pump, steel constructed, had a 20-in. suction/discharge. The pump connects to a triple-expansion Morris engine (750 hp. @ 225 revolutions/minute). The power plant had two batteries, two 180 hp boilers connected to each battery. The plants utilized a surface condenser, with vertical air pumps and centrifugal circulating pumps, boiler feed pumps, and service pumps. The cutter shaft measured 8.5 in. in diameter. The cutter-drive engine (12-x-12-in. double-cylinder horizontal engine) sat on deck.

HYDRAULIC OR CUTTER HEAD DREDGE. The cutter head dredge has one boom at the vessel end. The boom is usually lowered by lift rig supported by an A-frame. The hollow boom contains a pipe leading to a large suction pump. A rotating cutter head, complete with a series of blades, is attached to the end of the boom. The cutter head loosened bottom material which was subsequently sucked into the pipe. The bottom sediment was then discharged into a barge or floating pipeline (Brouwer 1990).

Hydraulic dredges, used early this century, worked extensively during construction of the New York State Barge Canal System. Stationary vessels, dredges had no propulsion systems; they reached their destinations by tug. During close shore work, workmen secured the vessel by cables attached to deadmen posts (Brouwer 1990).

Table 31. Summary of Suction/Cutter Head Dredges Investigated

Vessel	Reach	Eligibility	Recommendations
Vessel 3	Kill Van Kull, NY	Yes	Photo/limited site documentation
Vessel 36	Kill Van Kull, NY	No	No further work is recommended
Vessel 45	Kill Van Kull, NY	No	No further work is recommended

Kill Van Kull, New York Reach

Vessel No. 36 (Figures 209-211)
Vessel Type: Wooden hydraulic (suction/cutter head) dredge
General Location: Kill Van Kull Reach near GLD&D
Date Abandoned: 1935 (Raber et al. 1995b)
Description: Most of the vessel is disarticulated. There is obvious fire damage. Two large stanchions, probably built to accommodate dredge pulleys and framework, are extant. Also identifiable are two metal boxes, probably used as depositing buckets. Visible barge remains include a section of decking, which reveals heavily constructed transverse and longitudinal deck beams.
Recommendation: Lack of structural integrity and above-surface articulation impedes site documentation. No further work is recommended.

Figure 209. Framework of Vessel No. 36, facing west.

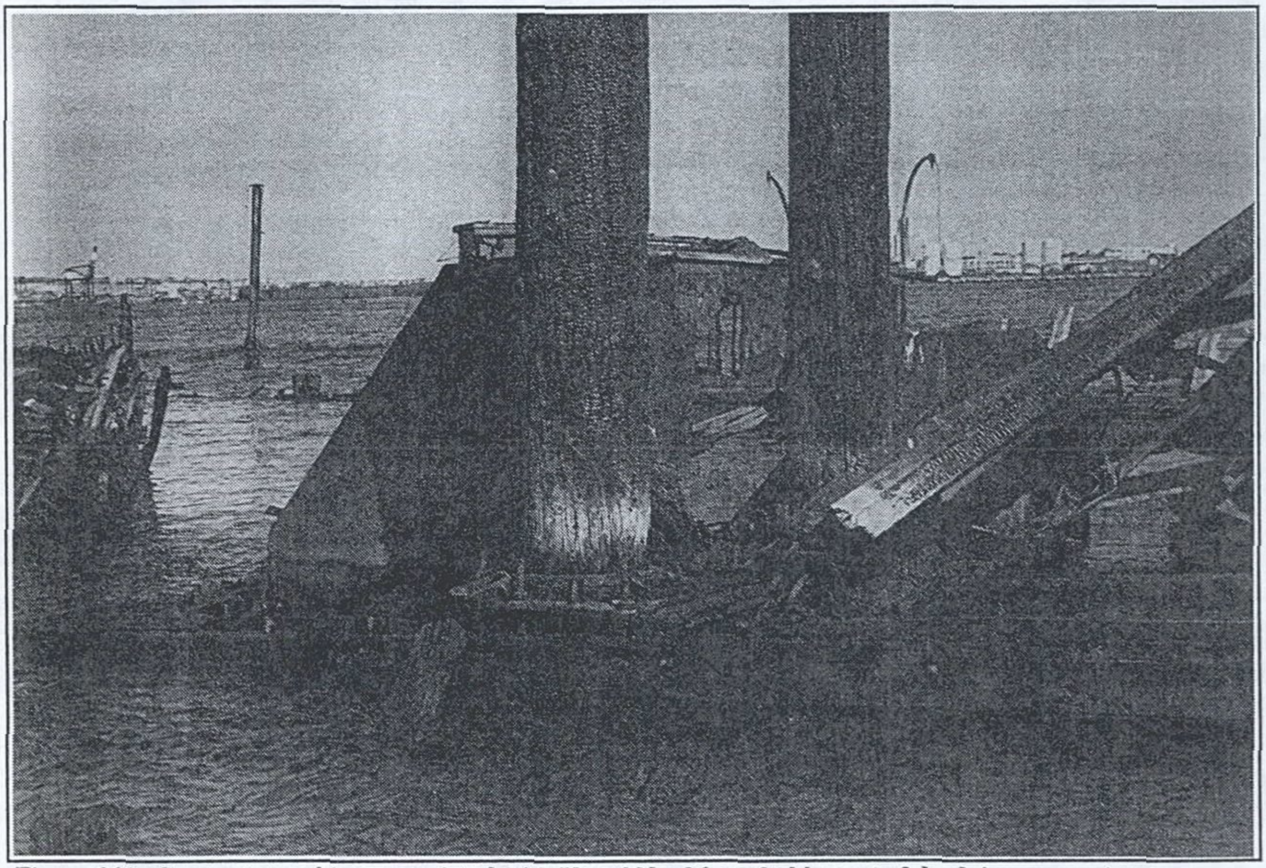


Figure 210. Support stanchions associated with Vessel No. 36, probably part of dredging apparatus.

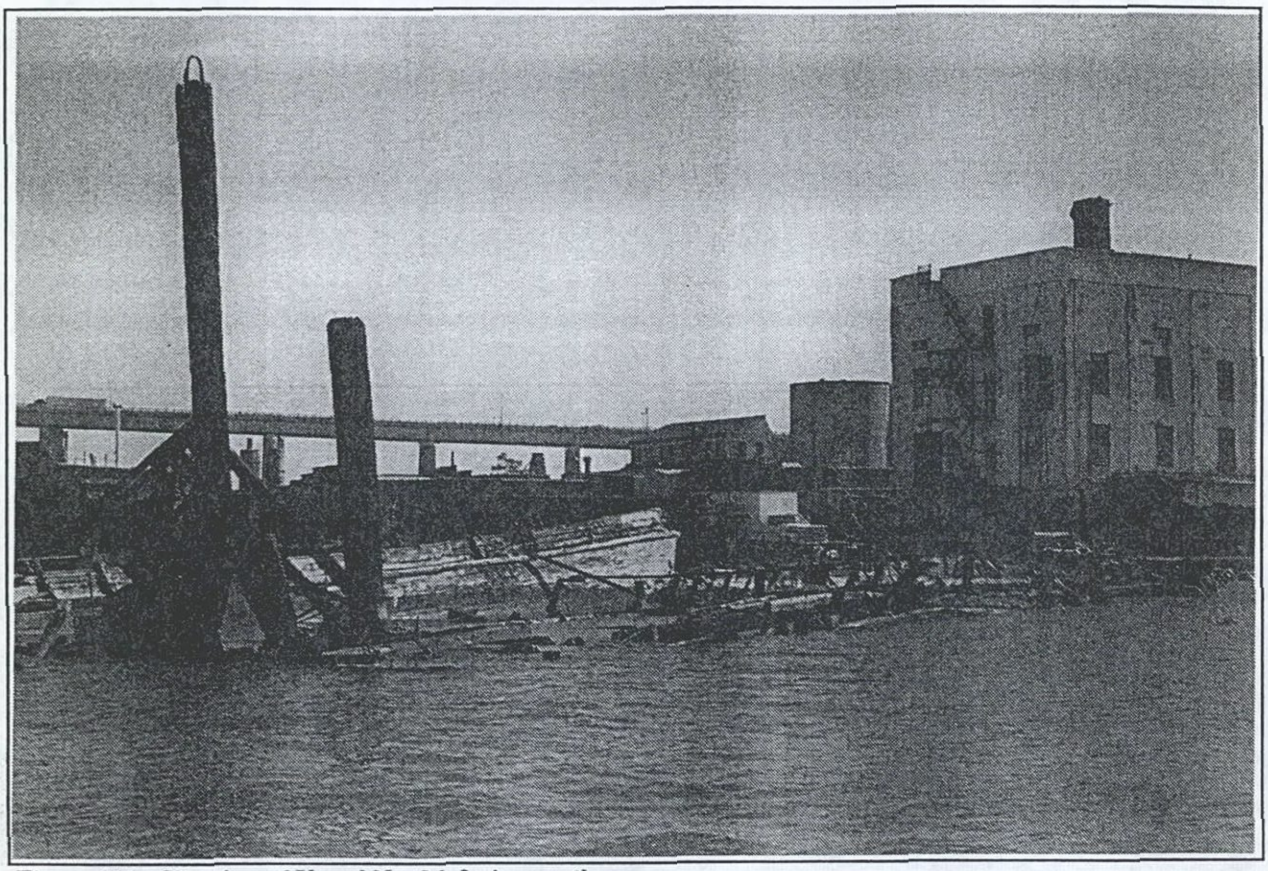


Figure 211. Site view of Vessel No. 36, facing south.

Vessel No. 45 (Figures 212 and 213)
Vessel Type: Wooden hydraulic (suction/cutter head) dredge
General Location: Kill Van Kull, New York Reach near GLD&D
Date Abandoned: 1935 (Raber et al. 1995b)
Description: This scow-ended platform, barge-like in construction, is disarticulated and gutted by fire. Exterior planking is still visible on one side. Lower hull features are still present, but water covered. A portion of an intake/discharge pipe exists.
Recommendation: The vessel's poor condition makes further work unnecessary.

Figure 212. Structural remains of Vessel No. 45, facing northwest.

Figure 213. Pipeline of Vessel No. 45, probably associated with the vessel's suction or discharge apparatus.

FLOATING GRAIN ELEVATOR

Floating grain elevators are original to New York. Without the influence of naval architects, elevator construction slowly evolved over the last century. Called "skyscrapers on tugboats," or a "naval architect's nightmare," these vessels proved quite stable in the protected waters of New York Harbor (Fuerst 1978:131).

In the 1840s, gangs of men unloaded hundreds of bushel grain baskets by hand. Backbreaking, the labor process proved time consuming and inefficient. Then in 1848, the nation's first grain elevator, known as "Pagan's Patent," appeared on the waterfront. The elevator resembled its Kansas cousin (Baab 1953). The elevator, basically a converted sailing ship equipped with a grain elevator, had an extendible leg and a conveyor belt with buckets. A loaded canal boat floated alongside the elevator, the extendible leg lowered into the hold, then the conveyor belt, set in motion, scooped up the grain, which was gravity-fed into the hold of a waiting vessel. The process could load up to 2,500 bushels per hour. Stevedores, keen to the situation, apparently destroyed the machine in 1852 (Fuerst 1978).

Early elevators, so-called single leggers, sat on the gutted hull of old scows, brigs, barks, or schooners (Noble Collection 1951) (Figure 214). Eventually, builders constructed vessels from the keel up. In the 1880s, Phillip H. Gill and Edward G. Burgess received a patent on "two elevators adapted to elevate grain simultaneously from two boats, suitable devices for weighing the

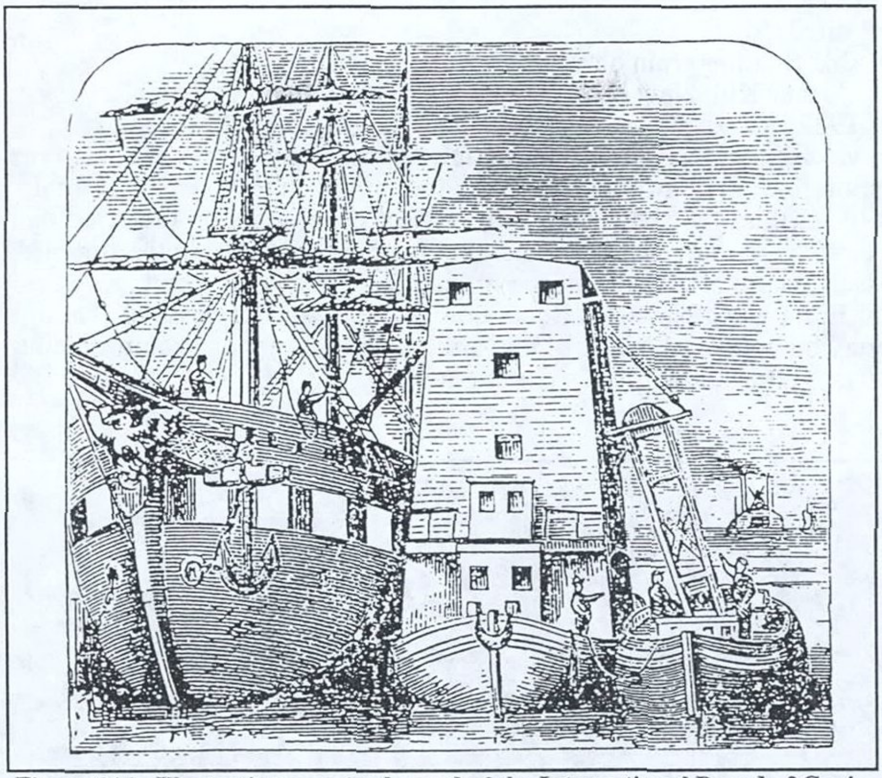


Figure 214. Illustration on a trade card of the International Board of Grain Measurers and Elevating Association, circa 1856 (Fuerst 1978).

grain elevated from each boat separately..." (Fuerst 1978:133-134). As larger steamers replaced sailing vessels in the grain trade in the 1880s, the length of the elevator increased proportionally (Baab 1953). In the twentieth century, grain elevators featured two marine legs.

Initially, New York Harbor's free lighterage system provided companies with an incentive to use New York as their primary export port. However, under sanctions issued from the Interstate Commerce Commission in 1905, railroads serving the Atlantic seaboard planned to use other seaboard cities. By establishing "a freight rate differential for inland goods coming to the East Coast for export," goods shipped to Philadelphia or Baltimore cost less (Baab 1953:2). Grain transported to Buffalo east from the Great Lakes also featured a rate differential. Granaries on the Lakes also competed with iron ore suppliers for cargo space. Grain rates eventually increased. Finally, Canada stopped shipping grain to New York in 1932 when it issued a 6-cent-per-bushel tax on all exported grain (Baab 1953). New York Harbor's subsequent decline as a primary grain port in turn precipitated the decline of the grain elevator. Its unofficial demise occurred in the early 1960s (Fuerst 1978).

Apparently, no known hull details or construction features associated with the Harbor's floating grain elevator exist. No intact examples exist in New York. According to Raber et al. (1996b), a hull in the Bayonne Reach may be a floating grain elevator. Only one possible floating grain elevator is identified in the project area.

Arthur Kill, New Jersey Reach

Vessel No. 79 (Figure 215)
Vessel Type: Possible floating grain elevator
General Location: Arthur Kill, New Jersey Reach near the Lehigh Valley RR
Date Abandoned: 1932 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The vessel's starboard side is partially submerged at low tide and rests along the New Jersey shoreline. The framing timbers are spaced quite closely (roughly 1 ft. apart). Heavy wales (6 in. thick) are attached to the top of the frames by metal bolts. The rudder, large and massive, is partially visible. Hanging knees are present in the forward or landward end of the vessel. There is some evidence of beams in the forward end.
Recommendation: Early grain elevators floated on several types of vessels. Though Vessel No. 79's history may be unique, the lack of elevator superstructure or extant remains negates significance status. No further work is recommended.

Figure 215. Site view of Vessel No. 79, possibly a former floating grain elevator, facing northwest.

BALTIMORE AND OHIO STATEN ISLAND RAPID TRANSIT (SIRT)

The railroad on Staten Island originally ran as an independent local line. Tracks ran 13 miles from the main ferry terminal at Vanderbilt's Landing (later named Clifton) on the east shore down to Tottenville. Work on the railroad began in 1851, ending in 1863 (Clute 1877). The line remained a country railroad until the 1880s (Flagg 1996).

In 1884, the Baltimore and Ohio Railroad (B&O) acquired freight facilities at New York Harbor. The B&O had in the works a Baltimore-to-Philadelphia rail connection, while its partner, Reading Railroad, had the Delaware and Bound Brook line as far as Bound Brook, New Jersey (located on the main line of the New Jersey Central). The arrangement suited passenger service, but the B&O, to serve New York Harbor, wanted its own waterfront freight terminal facilities.

Other railroads in Manhattan and New Jersey had already acquired good sites along the New Jersey waterfront. The north shore of Staten Island offered property ideal for terminal facilities. However, such facilities required a bridge over the Arthur Kill. A prominent Staten Island resident, Erasmus Wiman, persuaded B&O officials to attempt the project (Flagg 1996). The railroad first bought the Staten Island Railroad Company and in 1886 extended rail connections north to St. George. There B&O built a new ferry terminal, consolidating all ferry service to the rest of the city. B&O then built a new line, the Staten Island Rapid Transit (SIRT), from Crawford Junction, New Jersey, where it connected with the main line of the Central RR of New Jersey across the Arthur Kill to Staten Island, then on to St. George (Flagg 1996).

In 1888, the B&O completed a waterfront freight terminal at St. George. The facility had one covered pier, two open piers, a transfer bridge, and a freight yard. Completion of the Arthur Kill Swing Bridge occurred in 1889 (the longest draw span in the world—500 ft.—at the time). The new line began service in 1890 (Flagg 1996).

Until 1934, the St. George site handled all of B&O's New York freight. The same year B&O operations moved from St. George to the CNJ Jersey City terminal (Flagg 1996). The move probably resulted from declining traffic associated with the Great Depression. During WWII, however, the St. George site witnessed extensive lighterage traffic.

PASSENGER SERVICE. Apparently, the B&O expected to use the St. George site as a passenger terminal, ferrying passengers from St. George to Manhattan, but the plans never fully materialized. Instead, through passenger trains continued using the CNJ station at Jersey City (Cornell 1914). Local ferry service operated from the ferry terminal at St. George to all points on the line, more like a rapid transit operation than a regular passenger train (Flagg 1996). Electricity came to the passenger service in 1925.

In 1948, the City of New York Board of Transportation took over competing bus lines on Staten Island, then instituted a transfer system in which a rider could go anywhere on Staten Island for 5 cents, a nickel cheaper than previous costs. Passengers deserted SIRT for city buses. SIRT cut its service in half, but the operation still lost money. B&O offered to sell the line to the Board of Transportation, to no avail. In 1953, SIRT dropped all passenger service on the North Shore line, maintaining the ferry service to Tottenville only (Glucksman 1972). In 1971, the Staten Island Rapid Transit Operating Authority took over the B&O line to avoid complete abandonment. B&O retained trackage rights to Tottenville (for freight service) and kept the North Shore line, renamed Staten Island Railroad Corporation (Glucksman 1972).

During the 1950s and 1960s, rail freight in New York declined. Highway traffic, piggyback operations, and a general shift of industry away from the city caused the decline. By the 1970s containerized shipping replaced lighterage, while shipping business moved to Newark Bay, traffic formally handled at waterfront terminals. In 1991, SIRT service for the Island ended (Flagg 1996).

STRUCTURES

TRANSFER BRIDGE. A transfer bridge connects railroad tracks on land with those on a carfloat described earlier. Because the Hudson River obstructed Manhattan's western commercial rail connections, owners loaded freight cars on barges (carfloats) in New Jersey, then using float bridges, "transferred" the cars between tracks on land and the carfloats. Also known as float bridges, these bridges provided an essential transportation link to Manhattan, moving freight from the island's industries to mainland railroads.

The carfloats crossing the river to smaller Manhattan freight yards (ca. 1880-1900) eventually unloaded at traditional railroad freight stations. Yards in the Bronx, Brooklyn, and Queens connected carfloats and transfer bridges to the railroad system. The transfer system provided a fundamental transportation link to Manhattan in the nineteenth century, without which industries and shipping would have moved to the New Jersey side of the harbor. The system ended in the 1960s, but only after most industry and shipping left the city (Raber et al. 1985).

The bridge is basically a pair of railroad tracks resting on a short, sturdy bridge, 80 to 100 ft. long. Its designs are similar to standard railroad bridges, but shifting loads required a greater degree of flexibility. Because conventional bridges are not subject to such lateral stress, transfer bridge construction counteracted structural stress in one of two ways: (1) heavy bulk, rigid construction, or (2) designs allowing twisting movement at the outshore end while remaining unchanged at the inshore end (Flagg and Raber 1990).

Many transfer bridges featured the obsolete timber Howe truss design. The design employed a series of cross-form timbers connected by vertical iron tension rods. The design provided desired flexibility, plus resisted salt air and water spray corrosion common to steel. Steel supplanted wood construction, as the cost of wood was prohibitive, particularly after 1950 (Flagg and Raber 1990).

Patented in 1840 by William Howe, the use of the Howe truss in the twentieth century is somewhat anachronistic, since wood, not steel, provided its flexibility. By the twentieth century, the disadvantage of wood compared to steel (rot, lack of strength, cost) was evident, yet in 1954, the B&O railroad "found this design so advantageous that it replaced its steel transfer bridge at West 26th Street with a wooden Howe truss when the former wore out" (Flagg and Raber 1990:n.p.).

The bridge at West 26th Street in Manhattan is one of two examples of a wooden Howe truss in New York, the other at the former B&O waterfront yard in St. George, Staten Island. At the St. George site, the B&O originally built pontoon-type transfer bridges when the yard opened in 1890. In 1912 the railroad built an electric transfer bridge, a type that suspended the outer end of the bridge, rather than floating it on a pontoon. In 1942 B&O removed the electric transfer bridge, leaving a primitive but economically efficient pontoon-type bridge. In 1949 a Department of Marine and Aviation permit states that transfer bridge #2 burned and in the same year was replaced. Work began on a similar bridge in 1949 (Flagg 1996).

Structure No. 13 (Figures 216 and 217)
Structure Type: Wooden transfer bridge
General Location: B&O Terminal site, St. George, Staten Island, New York
Date of Abandonment: 1945
Description: This structure, identified as the rebuilt B&O Transfer Bridge #2, St. George, Staten Island site (built 1949), features wooden Howe trusses, compression members, iron tension rods, cast-iron fittings, and a rocker log. The bridge, both wood and iron sections, is in good physical condition.
Recommendation: The structure is eligible for the NRHP under criteria A, C, and D. Its uniqueness is derived from its association with commerce, transportation, and construction. Recommendations include complete historic and photographic documentation. Bridge schematics may exist, but the archives at the B&O Railroad Museum in Maryland are not well organized. If drawings of the bridge are not located, then a complete site plan is recommended. Because of its physical condition and the limited survival of other similar bridge types, the site should be protected.

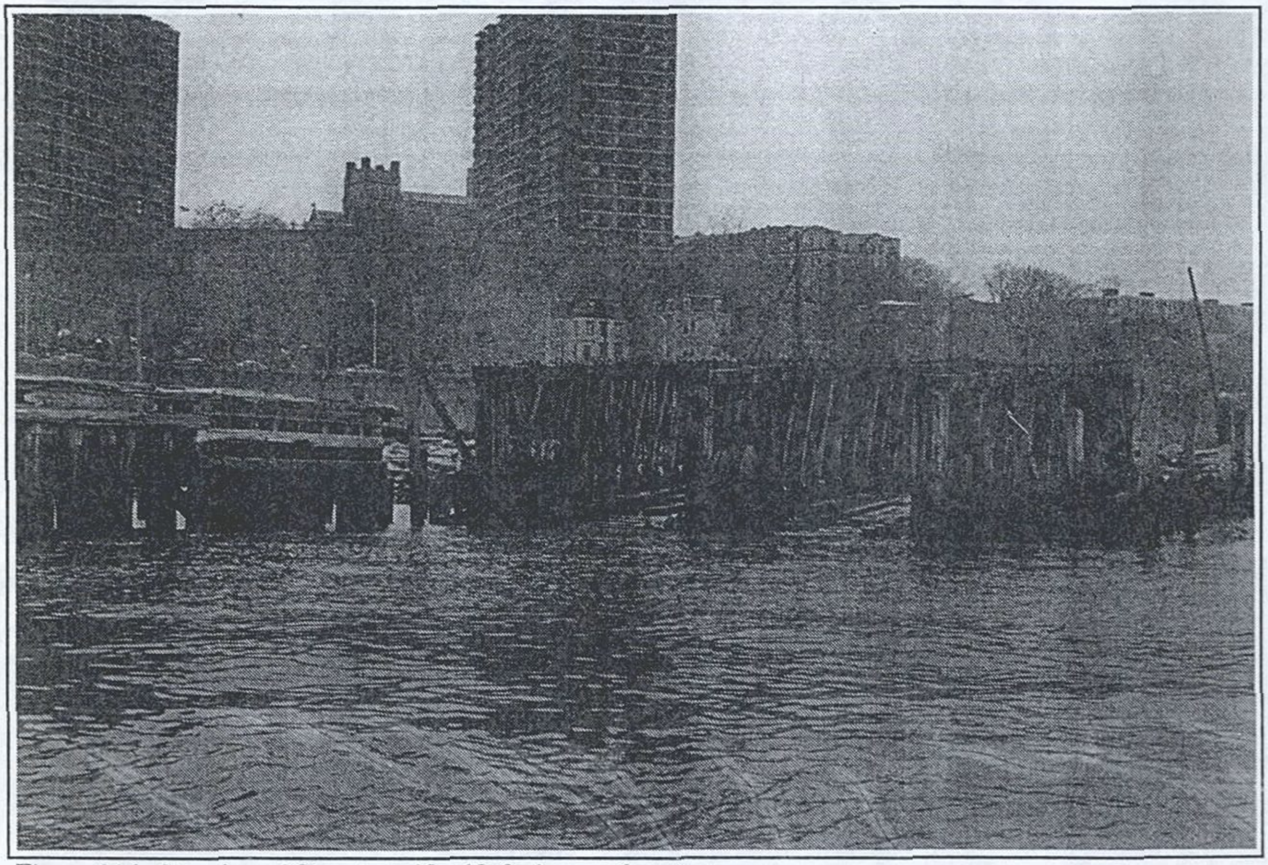


Figure 216. Site view of Structure No. 13, facing southeast.

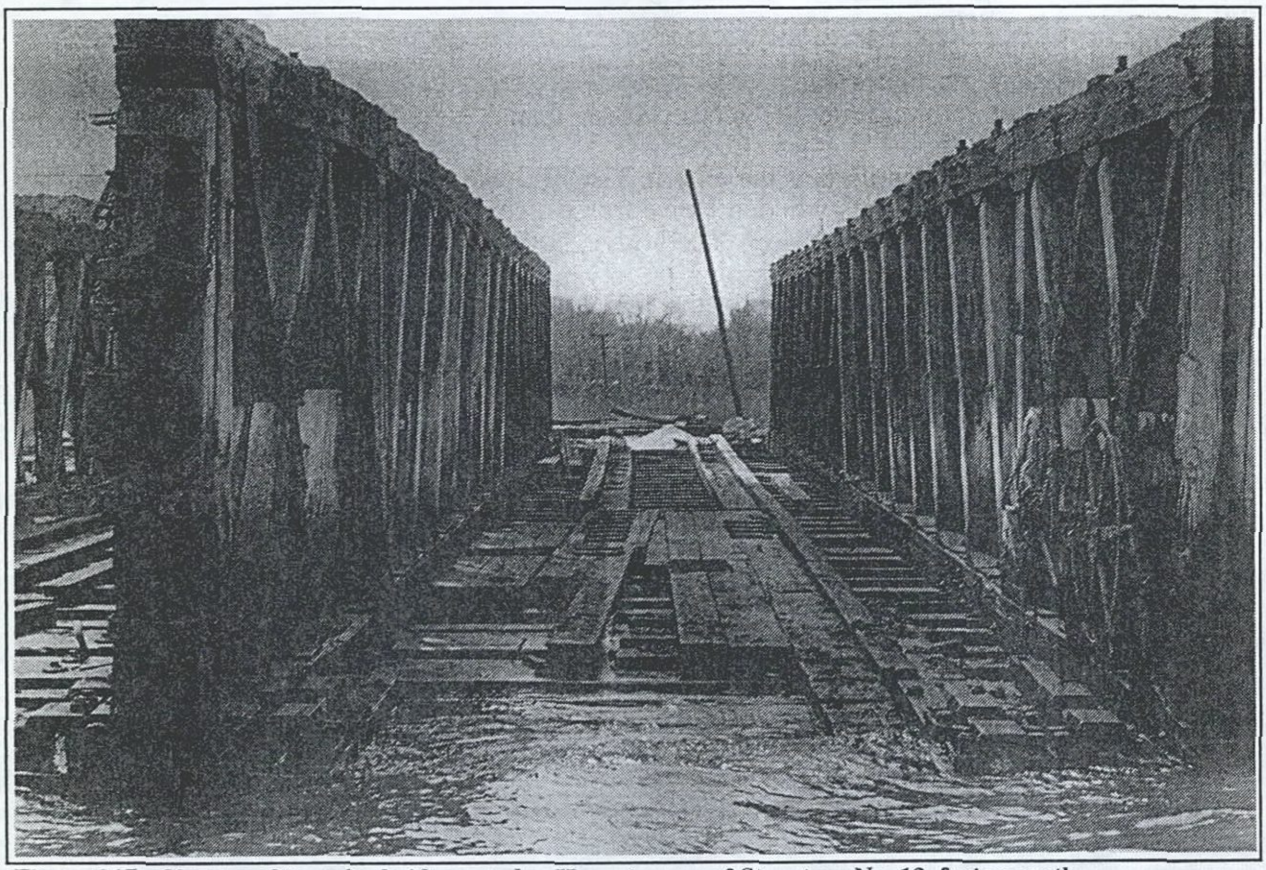


Figure 217. Closeup of transfer bridge wooden Howe trusses of Structure No. 13, facing south.

ELECTROLYTIC COPPER SMELTING AND THE AMERICAN SMELTING AND REFINING COMPANY. Depending on its composition, early copper ore processing might have produced brass, bronze, or other alloys, tin, zinc, iron, gold, silver, palladium, or platinum. Considered impurities, these byproducts are also highly valued. The expanding use of electricity in the U.S., particularly near the turn of the century, increased the demand for pure copper. Impurities in copper wiring reduces its electrical conductivity. Electrolytic copper refining (1) produced a high-quality conductive metal and (2) made it possible to recover silver and gold (Marcosson 1949).

When copper entered a turn-of-the-century refinery like the American Smelting and Refinery Company plant at Perth Amboy, laborers melted the ore in reverberating furnaces, a furnace where heat "reverberated" from the furnace roof to the charge. The copper was cast into anodes, ready for electrolysis (Davies 1924).

Electrolysis is a process whereby a direct current is fed to impure copper positive plates, called anodes. The current creates dissolution in the copper sulfate electrolyte and sulfuric acid, then depositing them on the other negative or cathode plate. At large refineries like American Smelting and Refining Company, Perth Amboy, thousands of lead-lined wooden tanks contained the two sets of copper plates (Davies 1924).

The cathodes, thin sheets of copper, fill up at the expense of the impure anodes. The impurities do not couple with copper on the cathode. Nickel, cobalt, zinc, manganese, tin, and iron are positive to copper, thus dissolving at the anode, concentrating in the liquid. The precious metals, gold, silver, platinum, selenium, and tellurium, are negative. They do not dissolve but sink to the bottom of the tank and form "anode slime" with other impurities. Arsenic, antimony, and bismuth, similar to copper in electrochemical reaction, partially dissolved, may wind up at the cathode (Davies 1924).

The process required about a month for a 500-pound anode to dissolve before it could go to the anode casting furnace. A constant flow of low-voltage heavy amperage built up three sets of cathodes weighing some 135 pounds. The copper sulfate electrolyte was purified periodically, and metallic salt build-up crystallized and refined. The slime was refined, the gold and silver sent to mint. The cathodes, now almost pure copper (99.98 percent), were melted into ingots for handling (Davies 1924).

Meyer Guggenhiem began construction on the Perth Amboy plant in 1894, the first refinery in the family empire. The story of the Guggenheims "is one of the most diverting in all the history of American metals" (Marcosson 1957:197). The American Smelting and Refining Company, incorporated in New Jersey in 1899, included most American smelting companies. The Guggenheims refused to join the corporation initially due to disagreements concerning the amount of stocks allotted to them. In 1901, however, Guggenhiem joined the company, but retained their other mining properties and interests under the firm Guggenheim and Sons. By 1907 Guggenhiem became the largest individual stockholder in the company (Williams and Heath 1954).

From the Guggenheim's Perth Amboy plant, the family started a string of refining plants from Tacoma, Washington to San Luis Potosi. Mexican copper production led to the construction of the Perth Amboy plant. The plant, located on the Arthur Kill, provided freighters from Mexico easy port access. Construction of the plant, however, proved difficult.

Meyer preferred building on the Perth Amboy site (drained swampland), not only because of its strategic location, but because of the swamp's cheap price tag. The plant's inaugural brick building is still visible from the shoreline. A copper casting plant, a lead refinery, a boiler room, a tank house, anode furnaces, wire bar furnaces, and the like soon followed. Smelting operations (copper and lead) began in 1894 with the arrival of lead bullion from Guggenheim's plants in Mexico (Marcosson 1957).

The ore arrived at the Perth Amboy plant in the form of bullion, called blister, already smelted in the form of pigs or bullion ingots. The blister and bullion (lead) arrived in the Port of New York by freighter and was later shipped to the plant via lighter. Truck and rail (Lehigh Valley Railroad) lines also served the plant (Marcosson 1957).

The American Smelting and Refining Company at Perth Amboy engaged in all types of metal processing except the treatment of ores and concentrates. Its uniqueness derived from its ability to handle and produce a wide variety of non-ferrous metals. Most refineries at the time could handle only a few major metals. The Perth Amboy site produced copper, lead, gold, silver, platinum, palladium, antimonial lead alloys and oxide, bismuth, lead sheet, pipes, rods, and tubes (Marcosson 1957). The plant also produced magnesium and brasses. The facility is the site of the first tin plant (1915) in the U.S. Tin production ended shortly thereafter (1920) due to stiff English competition.

In its heyday, the plant covered 75 acres (Figure 218). It also owned 80 adjoining acres. The electrolytic copper refining plant had a capacity of some 132,000 tons of blister per year, 90,000 tons of lead bullion (Marcosson 1957). The plant, rebuilt in 1922, operated until 1975, when the site became a freight terminal. Much of the waterfront, pier and bulkheads, are intact. For a detailed look at New York Harbor pier and bulkhead history, see *Cultural Resources Reconnais-*

sance, Edgewater, New Jersey Reach: New York Harbor Collection and Removal of Drift Project (Raber et al. 1984).

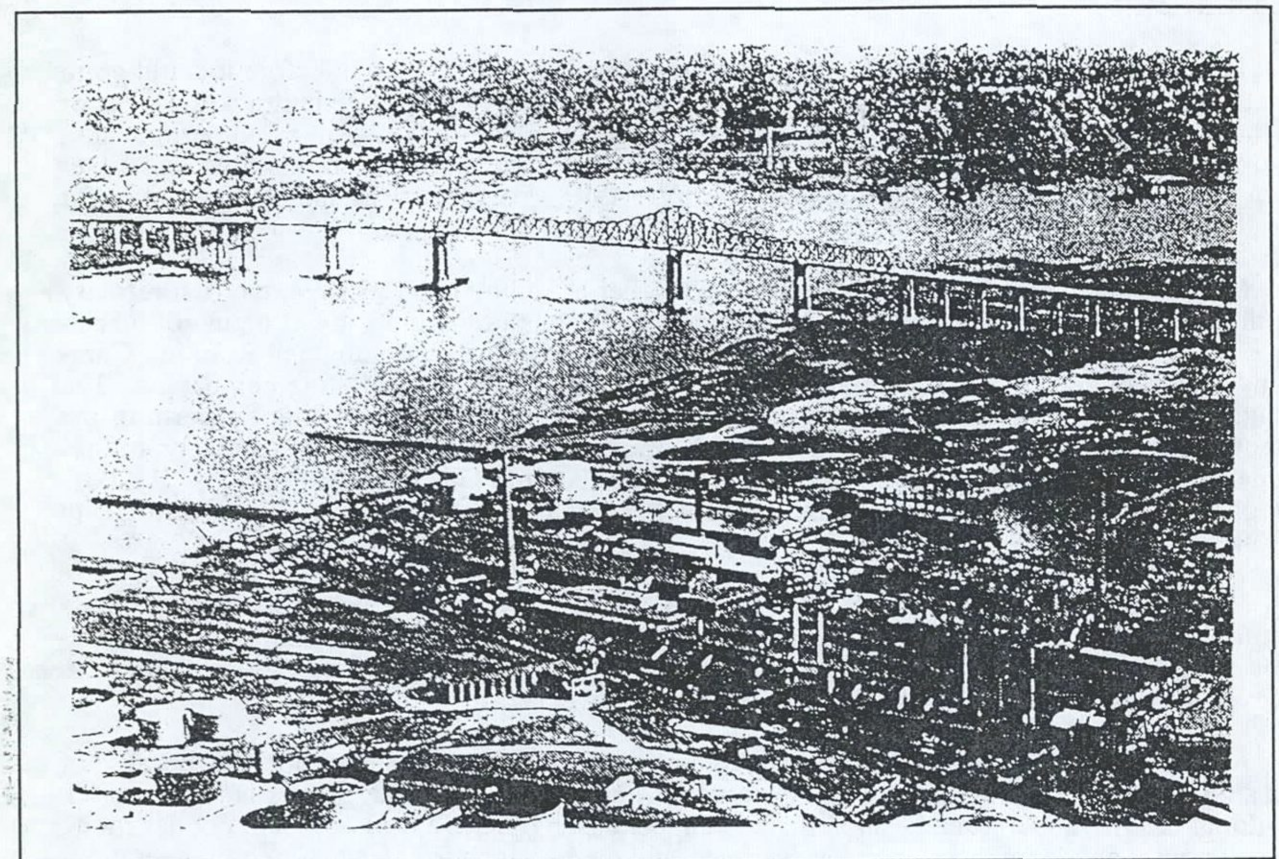


Figure 218. American Smelting and Copper Refining plant in Perth Amboy, New Jersey (Marcosson 1957).

TIMBER PILE PIERS. In New York, the wooden pile pier became commonplace during the late nineteenth and early twentieth century. The structure, economically superior to masonry-built structures, provided enough stability for ships yet offered flexibility. This flexibility proved less damaging to tie-up vessels. Wood proved durable as well. Wet wood does not decay, meaning wood under the waterline proved more or less permanent, since pollution decimated the local marine borer population (Raber et al. 1984).

Above-water wood did not last as long. However, the dramatic evolution of New York's maritime industry required an adaptable waterfront. Piers needed lengthening as ship size increased. Designs changed with industry needs. Wooden piles could be reused, even with another type of pier design built on top of it. This durability allowed wooden piers to succeed their commercial use, usually about 30 years (Raber et al. 1984).

Arthur Kill, New Jersey

Structure No. 132 (Figures 219 and 220)
Structure location: Perth Amboy adjacent to the old American Smelting and Refining Company (Maurer Refinery)
Date Abandoned: 1965 (Raber, Flagg, Wiegand, and Weinstein 1995)
Description: The pier is a timber pile type with a timber deck, measuring 33 x 440 ft. Its deck is a modern addition. The pier provided access for freighters carrying blister, bullion, lead products, and fuel oil. A 12-in. pipeline running along the waterline is extant. The pier featured two standard gauge rails (846 ft.) which connected to the plant's LVRR spur line. The pier apparently featured two electrically operated derricks in 1921 and 1924, though later locomotive cranes operated on the tracks. In 1953 and 1965, three locomotive cranes (one diesel and two electric) loaded and unloaded goods. By 1965, use of the pier consisted of the inner 200 ft. of pier and tracks (Flagg 1996).
Recommendation: The pier's upper works are obviously reworked. The lower section is apparently original, in fair condition. The pier is considered significant because of its association with the American Smelting and Refining Company factory and waterfront. Recommendations include visual and photographic documentation. Sectional drawings may provide addition data not evident in photographs.

Figure 219. Closeup of Structure No. 132, facing west.

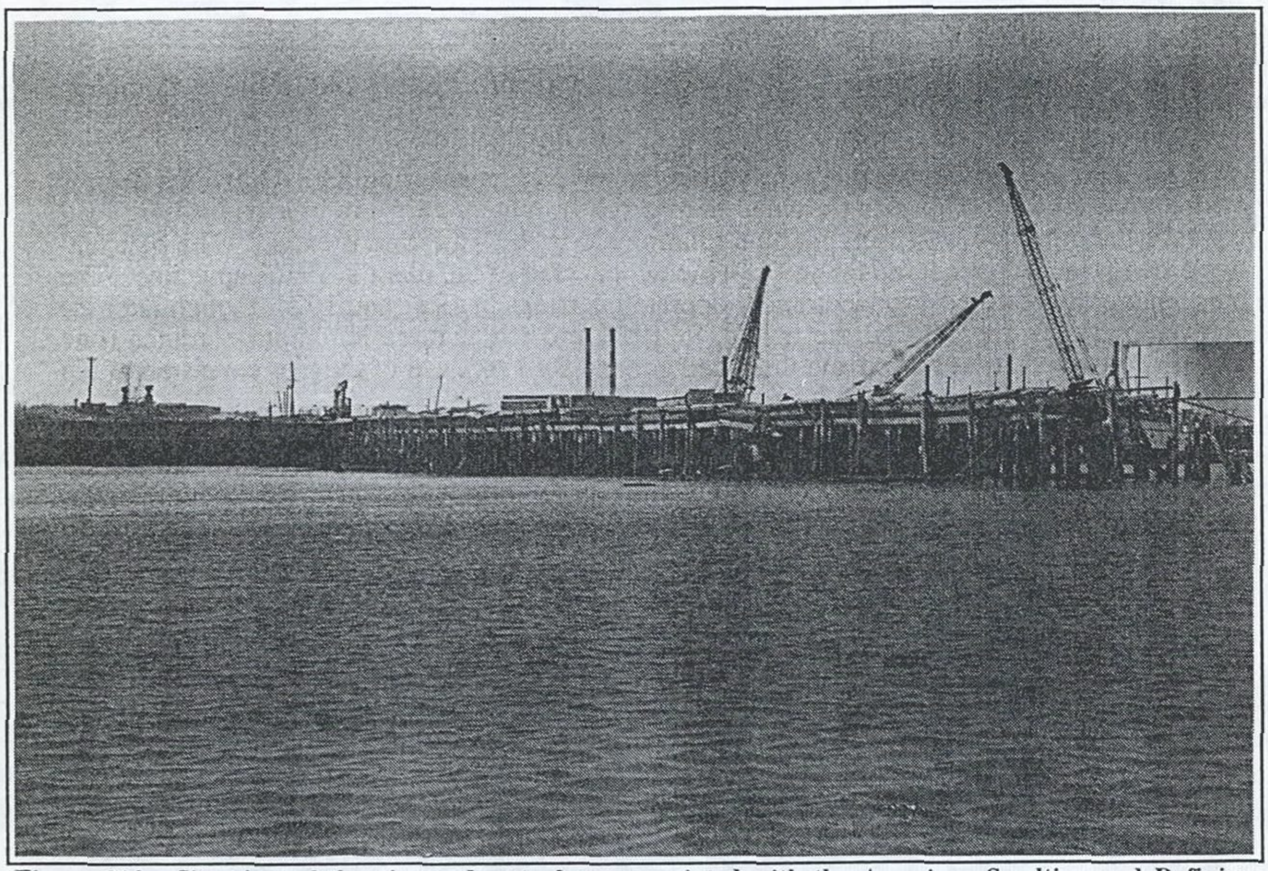


Figure 220. Site view of the pier and waterfront associated with the American Smelting and Refining Company, Perth Amboy.

VESSEL CLUSTERS

PREVIOUS INVESTIGATIONS. Previous research into vessel clusters or "graveyards" associated with New York Harbor suggests that (1) the vessels often served as clubhouses, residences, breakwaters, bulkheads, piers, or landings (Raber, Flagg, Wiegand, and Weinstein 1995; Raber et al. 1995a, 1995b; Raber et al. 1986; Kardas and Larrabee 1985a); (2) vessels were abandoned after anticipated re-use (Kardas and Larrabee 1985a); (3) vessels were collected for scrapping (Flagg et al. 1992); or (4) vessels clustered as a result of random drift.

It seems unlikely that any of these boats ended up in a cluster due to random drift. As outlined earlier, terrestrial collection of garbage or scrap often occurs in public, isolated areas, such as backroads or dead ends. The isolated and polluted nature of the project area provides a well-suited environment for dumping.

Research into the vessel clusters provided little information. Investigators attributed this to (1) the clandestine nature of "dumping activity;" (2) suspicion and reluctance on the part of local residents to reveal data to the government, particularly the Corps of Engineers; and (3) the unknown nature of the clusters themselves. Most individuals we interviewed had no idea who or what firm owned or created the clusters. However, some met us with suspicion, unfortunately a recurring situation in the field. Many times over the last few years, our association with the

Corps of Engineers proved a liability regarding informant willingness to share information. The problem does not seem inherent with the Corps itself, but is rather a general suspicion of government in general.

Previous harbor research suggests that area clusters are generally associated with local marine yards, canal boat basins, rail marine terminals, or waterfront industries. As stated by Raber et al. (1995), very little information on these clusters is available. Most of the local marine yards or waterfront industries no longer operate on the Island.

Based on available data, it is believed these vessel clusters are not unique or significant, based on NRHP criteria. Vessels determined significant within the clusters are included in the survey database. Data revealing an association with a particular yard may provide unique local histories, but none of the previously identified firms associated with the project area are historically significant. Regarding grouping patterns associated with the late history of traditional Port of New York transportation firms (Raber, Flagg, Wiegand, and Weinstein 1995), future research is not dependent on the physical presence of the project-area clusters.

For investigative purposes, the clusters are identified chronologically using aerial photographs dating from the 1930s. This information (1) geographically locates the clusters and (2) determines cluster growth over a period of years. Beginning in the 1970s, government regulations curbed or prohibited illegal ocean/water dumping. The information provided here should determine the timing or the rate of most cluster dumping.

Water Index maps from the New York State Bureau of Land Management provide waterfront property determination for a given year (dating from the turn of the century). The information also included waterfront access delineations. This material, discovered late in the project schedule, offers a potential means of tracing property and title records. However, time and logistical limitations prohibited exhaustive title searches. Using these maps and existing aerial photographs, further research may narrow ownership of the clusters for a specific year. Future investigation, if warranted, should focus on data derived from Water Index maps, Sanborn Insurance maps, photographic archives, and local informants.

ARTHUR KILL NEW YORK/STATEN ISLAND CLUSTERS. Six clusters are included in the investigation:

Cluster 2: Vessel Nos. S33, 3-4
Cluster 3: Vessel Nos. 7-19, 28, S74A, 34-35; 40-47
Cluster 4: Vessel Nos. 49-55
Cluster 6: Vessel Nos. 59-103, S96;
Cluster 8: Vessel Nos. 130A, 131, 134-195
Cluster 11: Vessel Nos. 208-247, 249-252

These vessel clusters represent the greatest number of vessels abandoned in New York Harbor's shoreline. The shallow-watered, isolated, and undeveloped nature of Staten Island made it an attractive "dumping site," much like the phenomenon witnessed near isolated "dead-end" terrestrial sites. Clusters 2 and 11 are apparently associated with repair yards from the 1960s or 1970s.

Only limited aerial photographs are available for this section of AKNY area at this time. Clusters 2, 4, 5, 8, and 11 are included in historical aerial photography. Aerial histories for Cluster 2 include 1930s (Figure 221), 1940 (Figure 222), 1951 (Figure 223), 1960 (Figure 224), 1974 (Figure 225), 1984 (Figure 226), and 1994 (Figure 227). Cluster 6 is included in one recent (1994) photograph (see Figure 242). Additional aerial photography for the reach will be presented in the final report.

Figure 221. 1930s aerial photograph of Cluster 2 (AeroGraphic Corporation 1996).

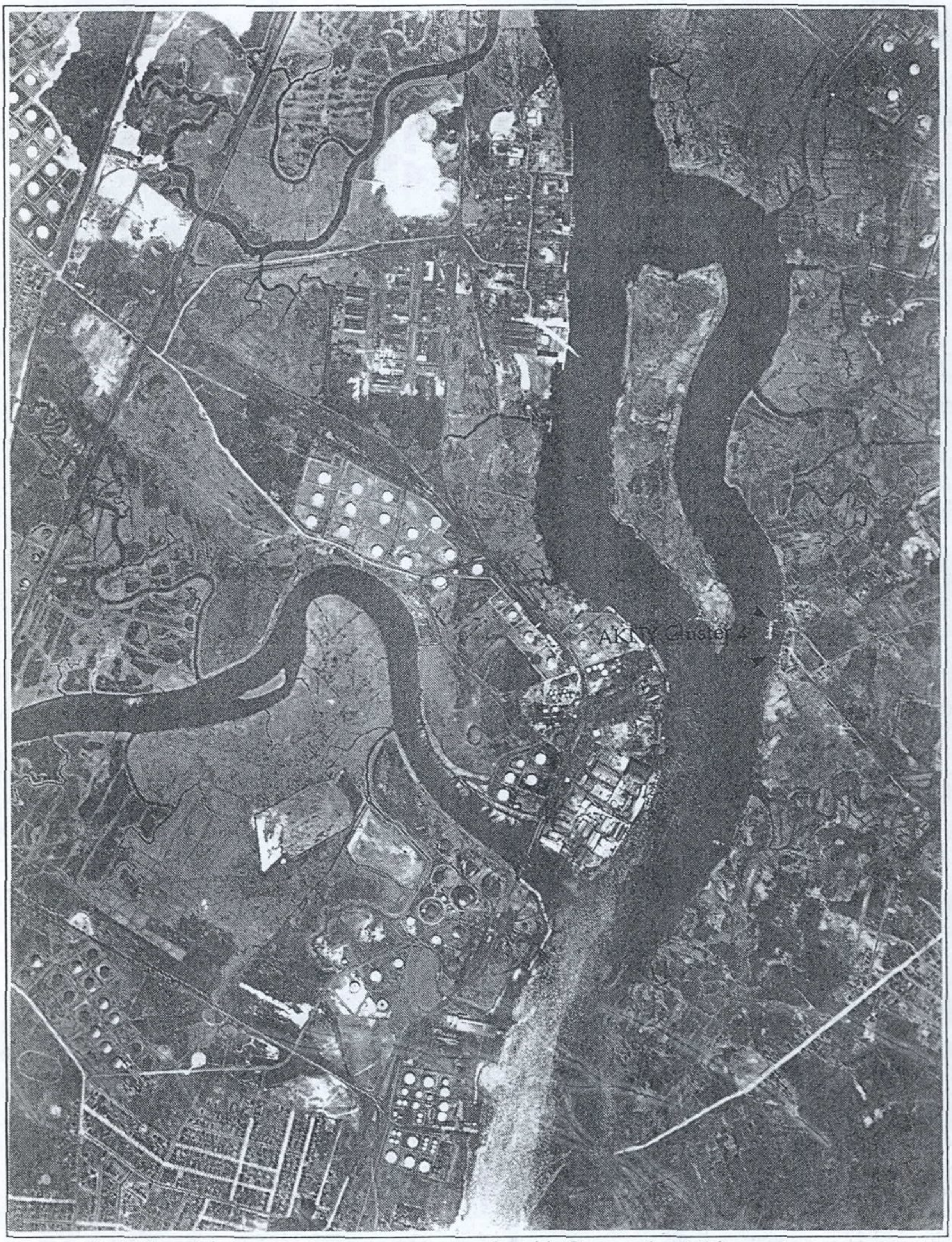


Figure 222. 1940 aerial photograph of Cluster 2 (AeroGraphic Corporation 1996).

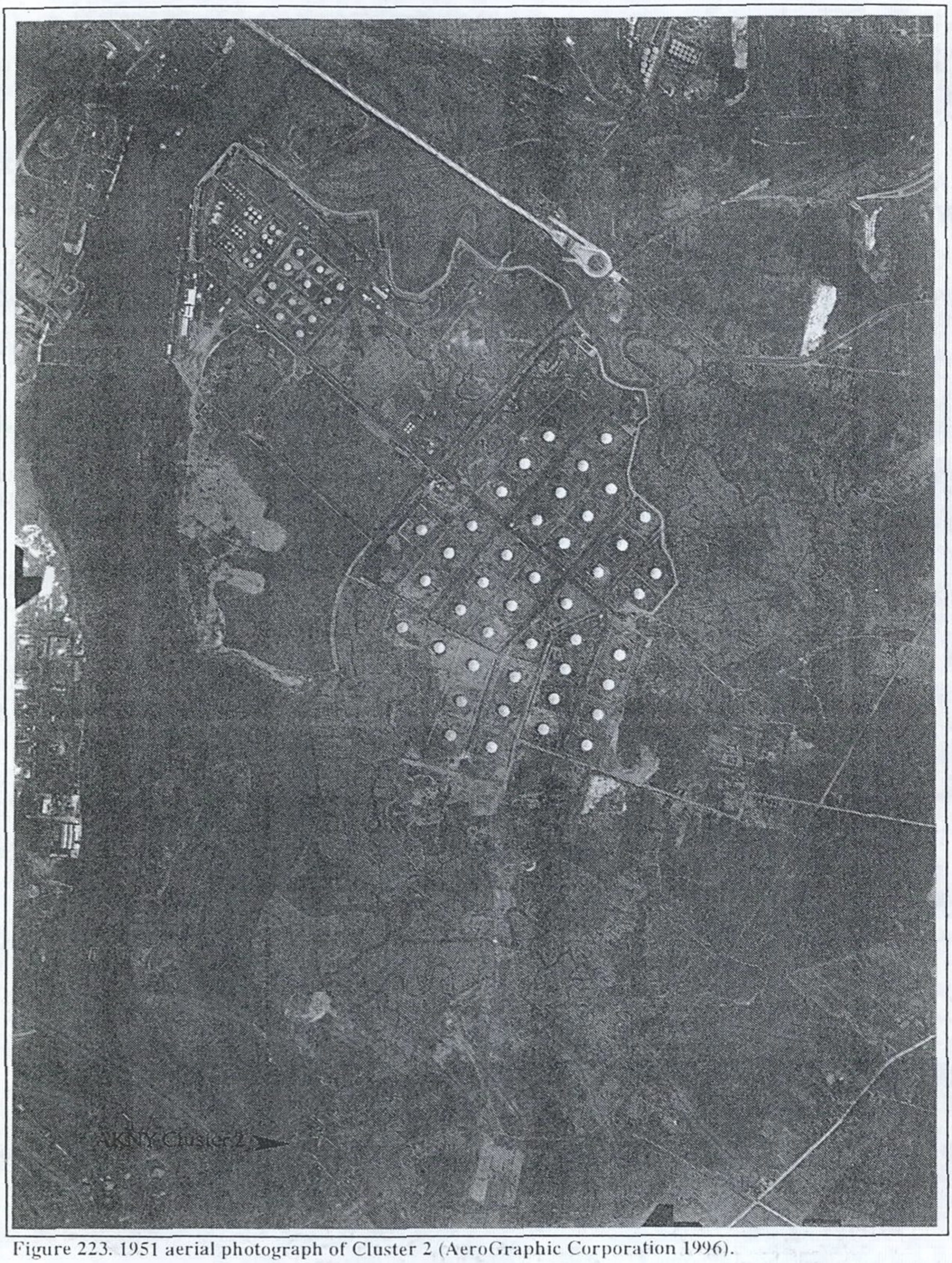


Figure 223. 1951 aerial photograph of Cluster 2 (AeroGraphic Corporation 1996).

Figure 224. 1960 aerial photograph of Cluster 2 (AeroGraphic Corporation 1996).

Figure 225. 1974 aerial photograph of Cluster 2 (AeroGraphic Corporation 1996).

Figure 226. 1984 aerial photograph of Cluster 2 (AeroGraphic Corporation 1996).

Figure 227. 1994 aerial photograph of Cluster 2 (AeroGraphic Corporation 1996).

Aerial photographs for Clusters 8 and 11 in the AKNY and for Clusters 4 and 5 in the AKNJ include 1930s (Figure 228), 1940 (Figure 229), 1951 (Figure 230), 1960 (Figure 231), 1974 (Figures 232 and 233), 1984 (Figure 234), and 1994 (Figures 235 and 236). Aerial photographs of the KVK project area for Clusters 4, 5, 6, 7, 8, and 9 are dated 1940 (Figure 237), 1951(Figure 238), 1960 (Figure 239), 1974 (Figure 240), 1984 (Figure 241) and 1994 (Figure 242).

Cluster 2. Cluster 2 is historically and geographically associated with the mothball fleet of World Wars I and II. The Prall's Island anchorage in the Arthur Kill near Chelsea had for years been the dumping site of surplus army craft (tugs, freight and cargo vessels, utility boats, tenders, towboats, powered lighters, self-propelled and non-propelled barges, motor launches, inland tankers, and aircraft rescue boats).

After WWI, Prall's Island became the site of abandoned freighters under the charge of the Shipping Board (Staten Island *Advance*, 24 December 1946). In 1946 the site contained over 200 vessels. A boom in Liberty and Victory ship construction during WWII resulted in a merchant fleet too large for full peacetime employment. The Maritime Commission offered many of the vessels for sale.

It is unknown whether the vessels in this cluster are associated with government surplus dumping activity. The vessels in the cluster are not typed according to military or government surplus vessels. The large Prall's Island cluster is gone by 1940 (Figure 222). The current Chelsea cluster does not appear on aerial photographs until the 1950s (Figure 223). The cluster size increases in the 1960s (Figure 224). Between 1960 and 1994 (Figures 224 through 227), the cluster remains relatively the same, though decreasing in size. The nature of the Prall's Island site illustrates how "dumping patterns" can occur in the area. Like terrestrial dump sites, once dumping patterns are established, the behavior tends to continue over time.

The cluster includes two wooden carfloats and an A-frame crane barge. The carfloats appear in the 1950s, "probably as tie-up piers from small under-documented marine repair yards" (Raber, Flagg, Wiegand, and Weinstein 1995:100). Local interviews regarding cluster origin or ownership did not reveal specific data for the site. Future historical research, if warranted, does not depend on the cluster's physical remains. No further work is recommended.

Clusters 3 and 6. The Witte yard, known locally as Witte's Marine Salvage, has a collection of some 200 barges, tugs, ferries, hulks, and various and sundry vessel types. John J. Witte began doing business on the Island in 1931 (Serig 1986). He founded a variety of marine businesses, many still operated by family members. Mr. Witte began collecting the vessels at the Rossville site for scrap machinery and fittings. Over the years he amassed the current collection (200 is a best-guess estimate), but no records of vessel purchase exist.

The collection, viewed from the Arthur Kill channel, provides a glimpse of the transitional phases of modern ship construction. "The construction of vessels changes from wood to steel, propulsion plants go from steam to diesel, and cargo-handling gear passes from labor- to capital-intensive" (Serig 1986:90). The collection features turn-of-the-century stick lighters, lower hull features of a turn-of-the-century sidewheeled passenger steamer, a New England passenger steamer, a Hudson River ferry, sailing vessels, workboats, and tugs. Witte's tugboat collection ranks as one of the nation's best. The collection features steam tugboats from the 1900s, railroad tugs, and several U.S. Army tugs.

Work on clearing the collection began in the late 1980s, though due to its immense size, will take several years. Joe Coyne, Witte's son-in-law who managed the yard in 1986, stated in an interview, "We know some of it (the collection) is valuable" (Serig 1986:94). To date, many of the vessels are still there (Figure 236). Several artifacts from the collection now belong to various New York institutions or collectors.

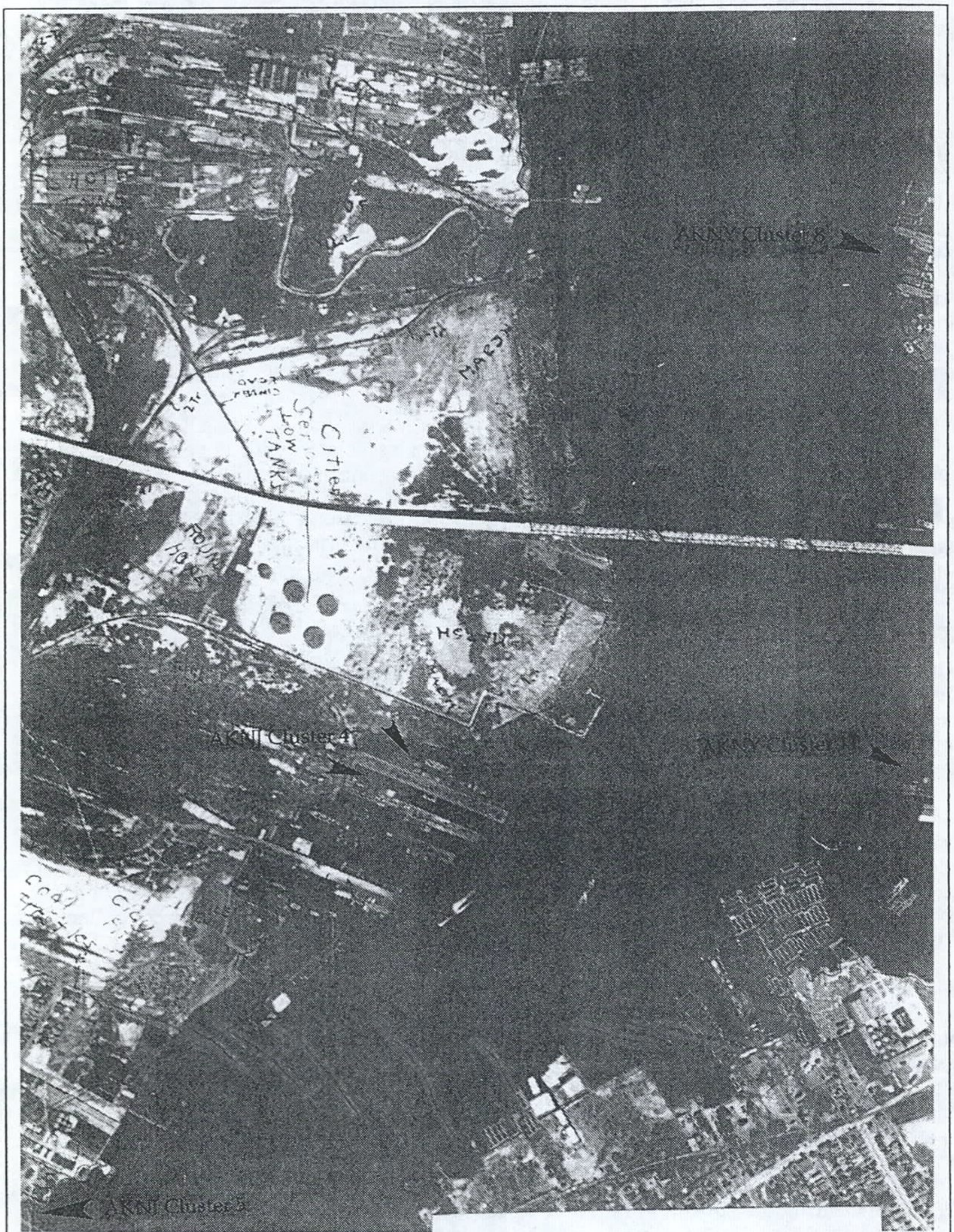


Figure 228. 1930s aerial photograph of Clusters 8 and 11, AKNY; and Clusters 4 and 5, AKNJ (AeroGraphic Corporation 1996).

Figure 229. 1940 aerial photograph of Clusters 8 and 11, AKNY; and Clusters 4 and 5, AKNJ (AeroGraphic Corporation 1996).

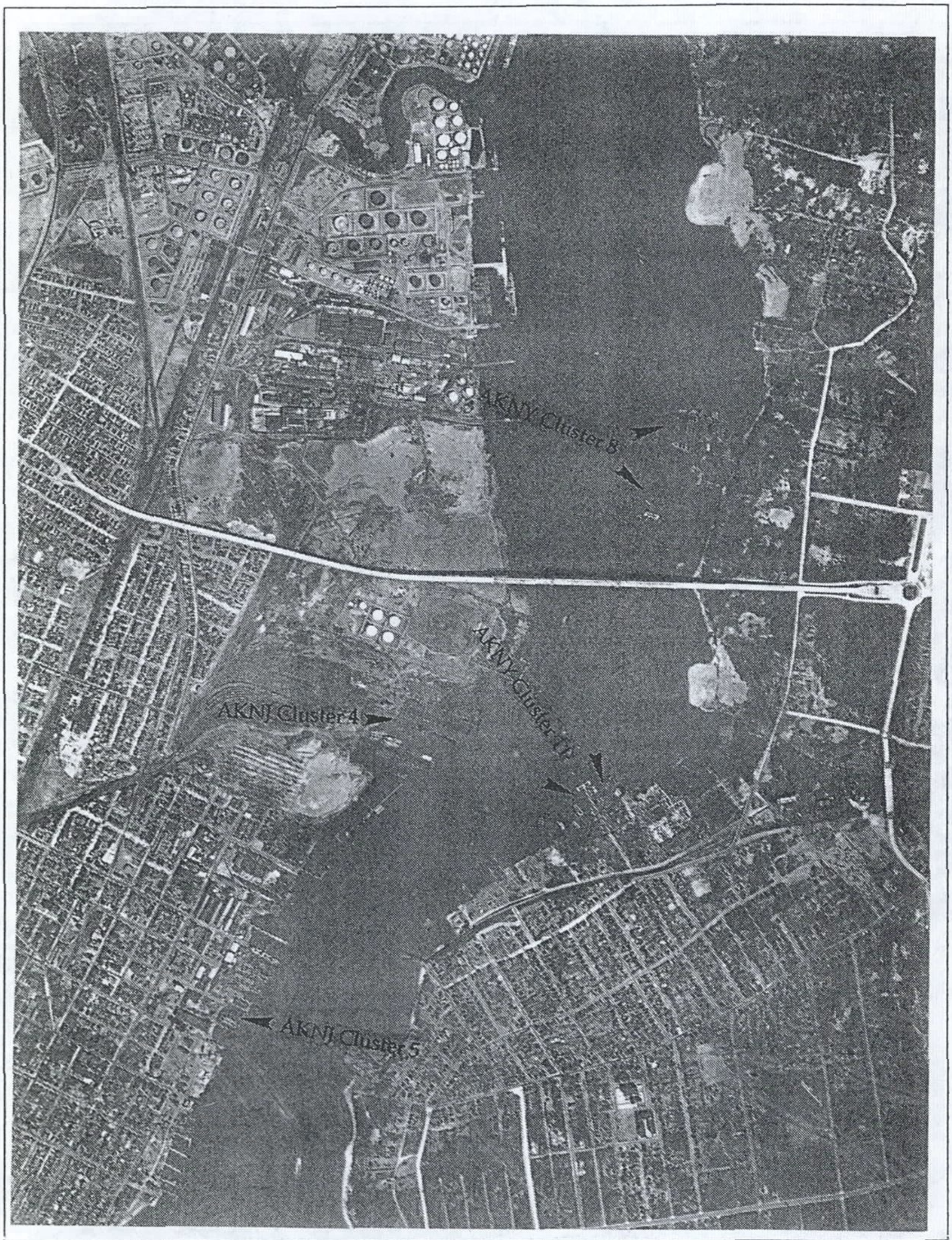


Figure 230. 1951 aerial photograph of Clusters 8 and 11, AKNY; and Clusters 4 and 5, AKNJ (AeroGraphic Corporation 1996).

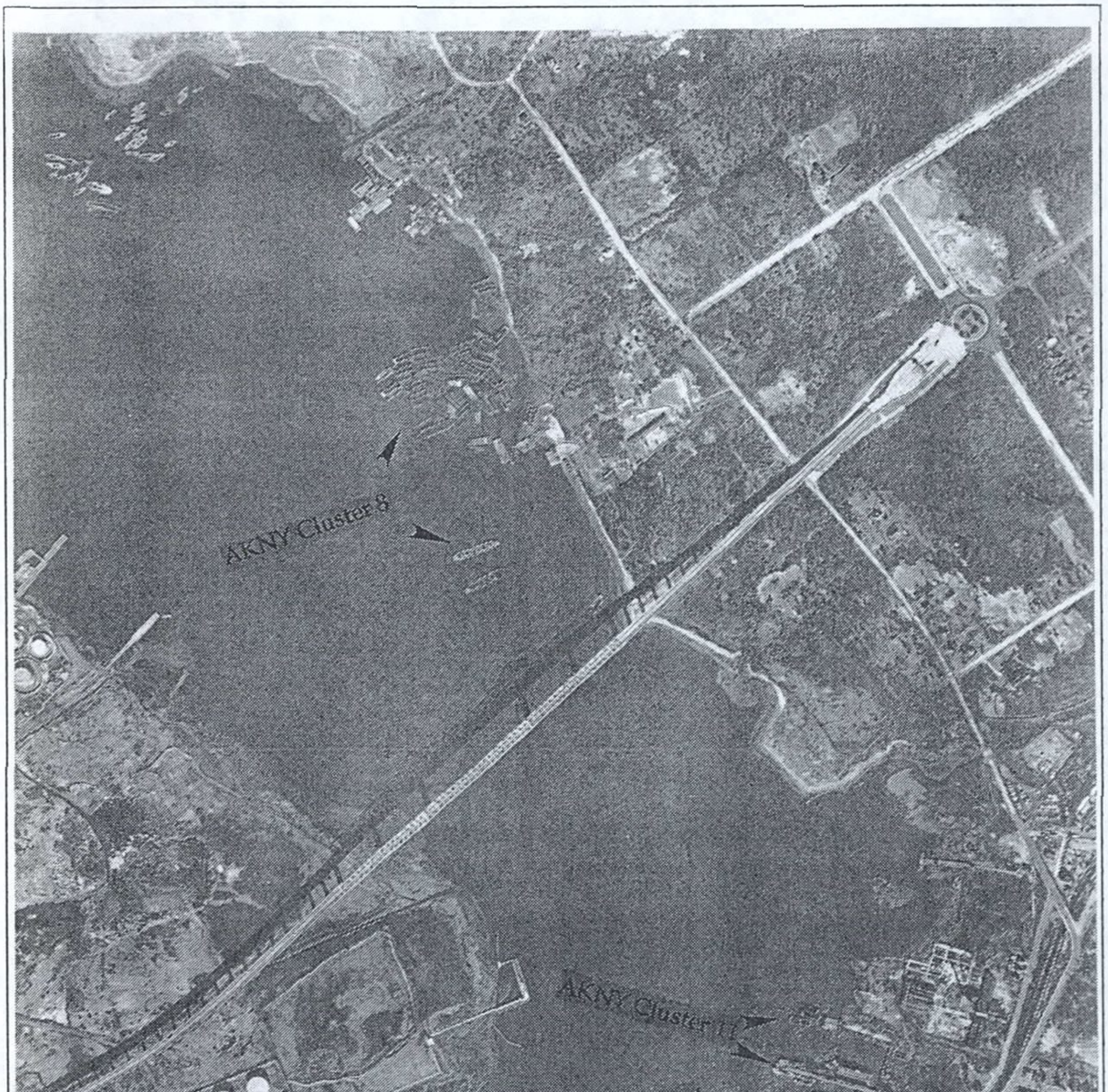


Figure 231. 1960 aerial photograph of Clusters 8 and 11, AKNY; and Cluster 4, AKNJ (AeroGraphic Corporation 1996).

Figure 232. 1974 aerial photograph of Clusters 4 and 5, AKNJ (AeroGraphic Corporation 1996).

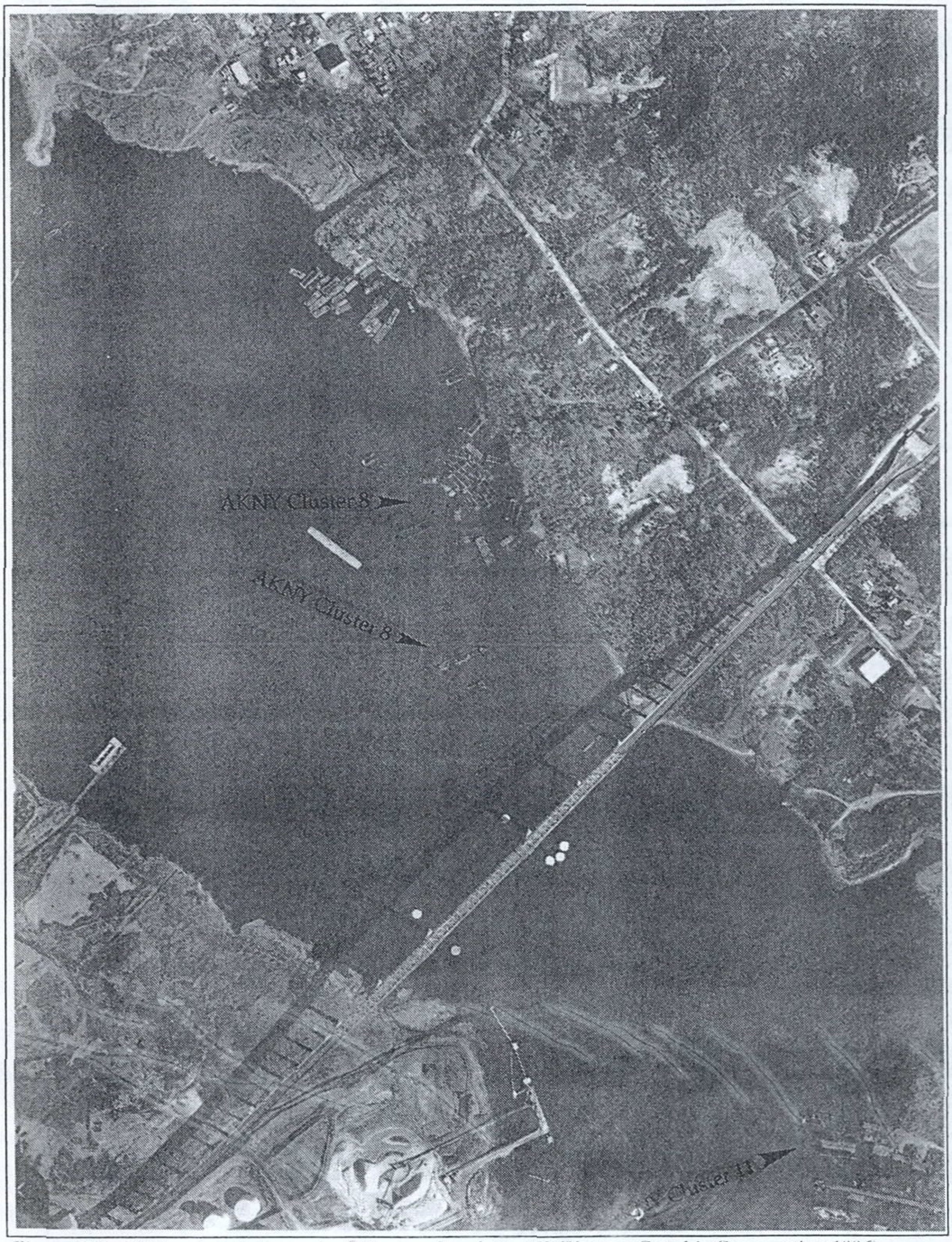


Figure 233. 1974 aerial photograph of Clusters 8 and 11, AKNY (AeroGraphic Corporation 1996).

Figure 234. 1984 aerial photograph of Clusters 8 and 11, AKNY; and Clusters 4 and 5, AKNJ (AeroGraphic Corporation 1996).

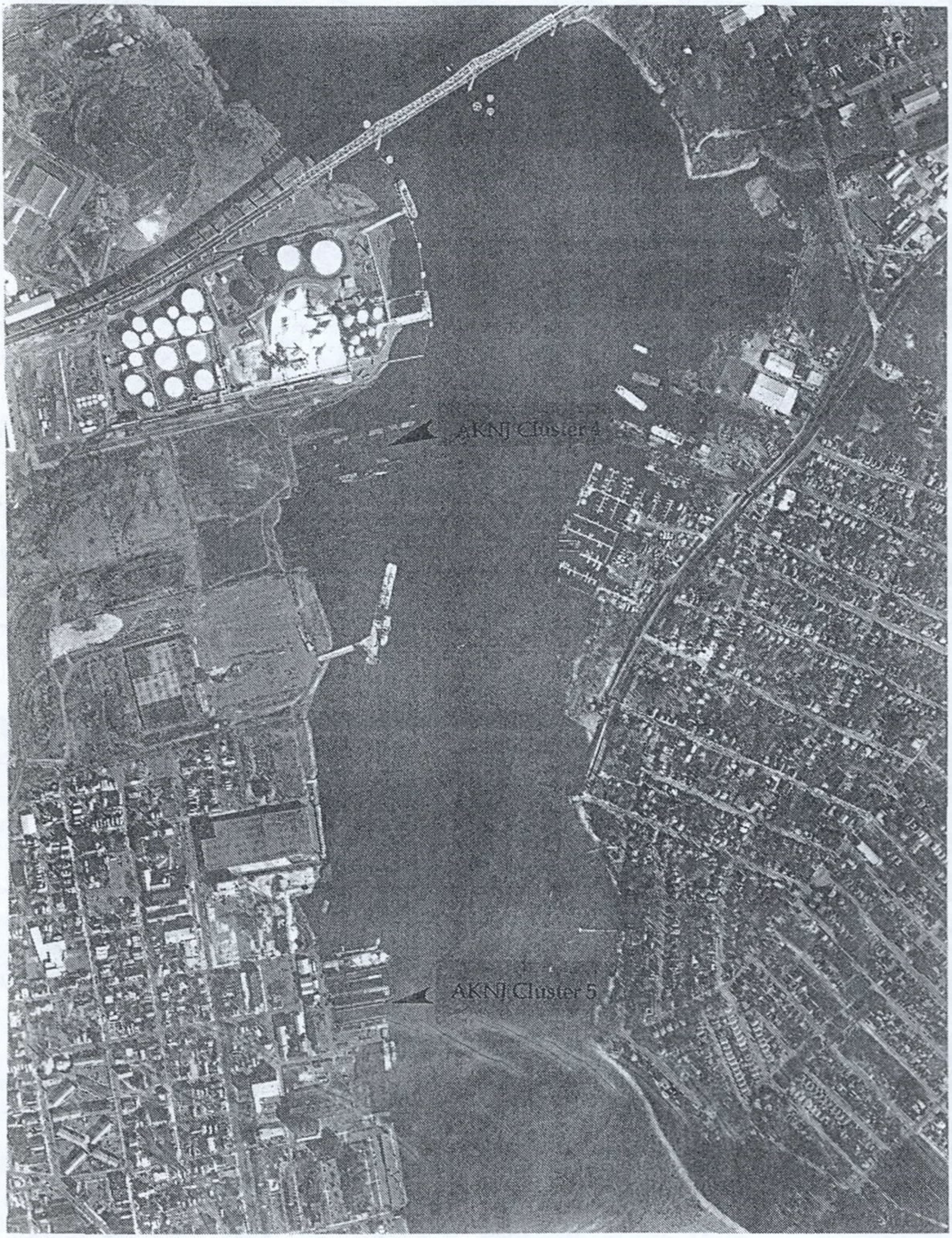


Figure 235. 1994 aerial photograph of Clusters 8 and 11, AKNY; and Clusters 4 and 5, AKNJ (AeroGraphic Corporation 1996).

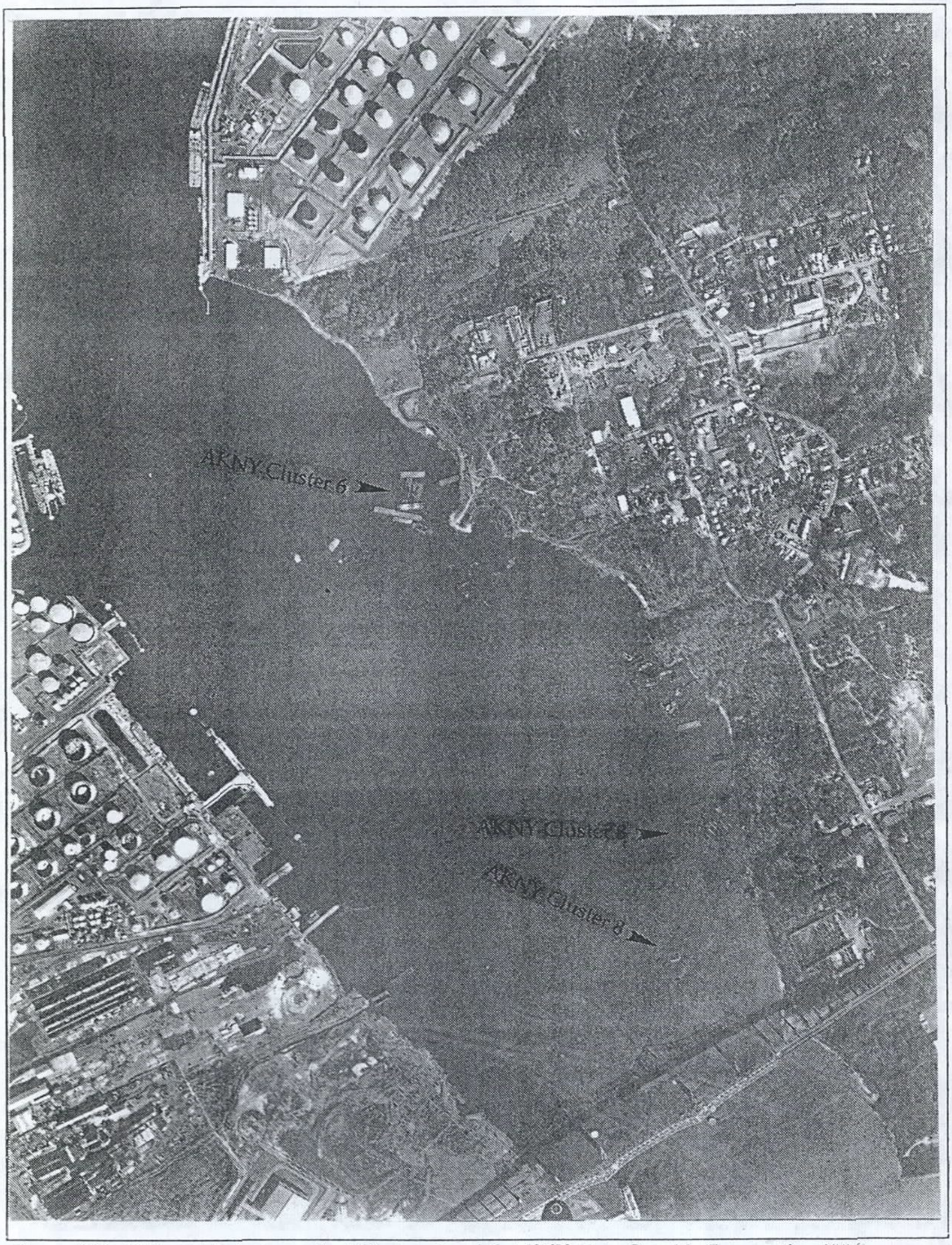


Figure 236. 1994 aerial photograph of Clusters 8 and 6, AKNY (AeroGraphic Corporation 1996).

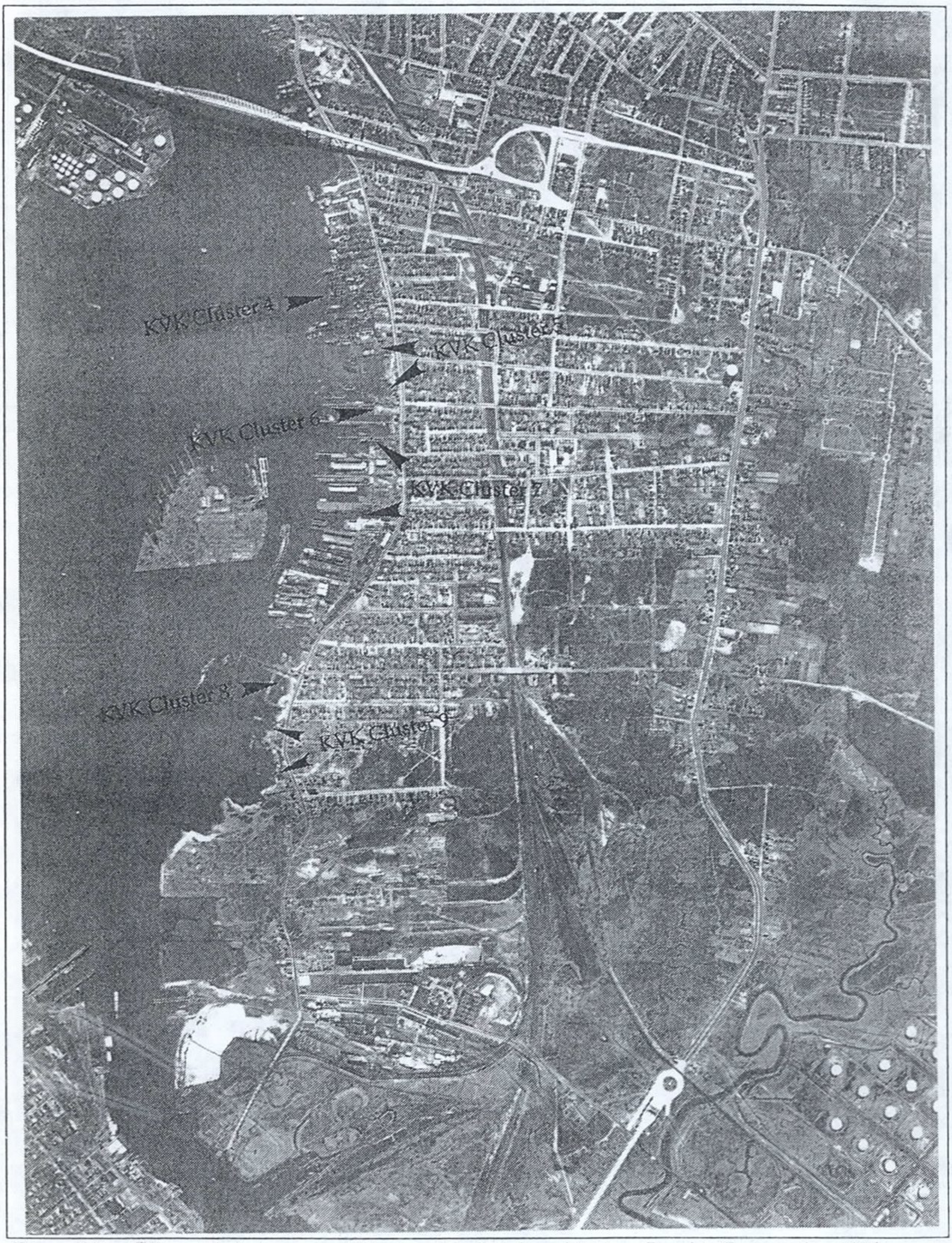


Figure 237. 1940 aerial photograph of Clusters 4, 5, 6, 7, 8, and 9 (AeroGraphic Corporation 1996).

Figure 238. 1951 aerial photograph of Clusters 4, 5, 6, 7, 8, and 9 (AeroGraphic Corporation 1996).

Figure 239. 1960 aerial photograph of Clusters 4, 5, 6, 7, 8, and 9 (AeroGraphic Corporation 1996).

Figure 240. 1974 aerial photograph of Clusters 4, 5, 6, 7, 8, and 9 (AeroGraphic Corporation 1996).

Figure 241. 1984 aerial photograph of Clusters 4, 5, 6, 7, 8, and 9 (AeroGraphic Corporation 1996).

Figure 242. 1994 aerial photograph of Clusters 4, 5, 6, 7, 8, and 9 (AeroGraphic Corporation 1996).

Clusters 3 (Figures 243 through 245) and 6 (Figures 246 through 247) are tentatively associated with Witte Marine Shipyard (1932-1960). Research of the Witte yard might produce "more precise chronologies on the abandonment or replacement of specific vessel types...and the shifting fortunes of...public or private marine operations" (Raber et al. 1995a). Unfortunately, the Witte yard is renowned for its secrecy. The company does not allow visitors to the site. It seems reasonable to assume that the clusters belong to Witte's salvage efforts, given their geographic association with the yard. However, the assumption is not verified. Future historical investigation may provide "salvage and dumping pattern data," but such research is not dependent on the physical presence of the clusters. No further work is recommended.

Clusters 4 and 8. Clusters 4 and 8 are associated with the abandonment of coal trade vessels between 1925-1940 (Raber, Flagg, Wiegand, and Weinstein 1995). The vessels abandoned at Port Johnson are apparently associated with this coal trade pattern. Informant data gathered from these clusters could possibly reveal information on coal handling firms and New York Harbor graveyards.

According to Raber et al. (1995a:105), "the fact that some of the events in question may be less than 50 years old...must be tempered by two considerations." Raber et al. (1995a) state that: (1) the cluster's history may have started as much as 50 years ago, and (2) informant data is "critical" for this type of research. The rationale here is that unless ethnographic data is cataloged soon, it may not be available at a later date.

Cluster 4 (Figures 243 through 245) includes seven vessels abandoned before 1940. These include three schooner barges owned by the Durham Navigation Company, a schooner owned by the Maryland Transportation Company, a hopper barge, and a wooden screw harbor tug (Raber, Flagg, Wiegand, and Weinstein 1995).

Sixty-seven wooden vessels are associated with Cluster 8. According to Raber et al. (1995a), over half these vessels are associated with the coal trade. Aerial photographs show a large vessel mass in the early 1930s (Figure 228). The size of the cluster diminishes in 1940 (Figure 229). Many of the larger vessels (Ferris freighters?) are gone. This pattern (based on aerial photographs from 1951, 1960, 1974, 1989, and 1994; Figures 230 through 236) continues until the present The cluster features an array of vessel types, including coastwise barges, a schooner barge, Ferris freighters, barge/canal boats, covered lighters, a possible wooden steam lighter, and an A-frame crane barge.

Local investigation did not reveal specific data for either cluster. Information regarding the New York Harbor's coal trade is presented in the text. Future historical research may reveal relevant data on local coal trade patterns, but such research is not dependent on the physical remains of the clusters. No further work is recommended.

Cluster 11. The cluster features some 52 wooden or steel vessels, and includes a wooden floating dry dock. The vessels are tentatively associated with the M.J. Tracy marine repair yard, the James O'Boyle Shipyard, Townsend Transportation Company, and the Tottenville Shipyard Company. Chronologically, abandonment patterns occur between 1920 and 1970 during repair yard operations (Raber, Flagg, Wiegand, and Weinstein 1995). The cluster includes covered harbor barges, trap rock scows, canal barges, coastwise hold barges, hopper barges, a carfloat, a derrick lighter, and the steel ferry *Dongan Hills*.

Aerial photographs reveal a large cluster of vessels, approximately 80 barges, in the early 1930s (Figure 228). By 1940 most of these vessel are gone (Figure 229). The cluster remains virtually the same since the 1940s.

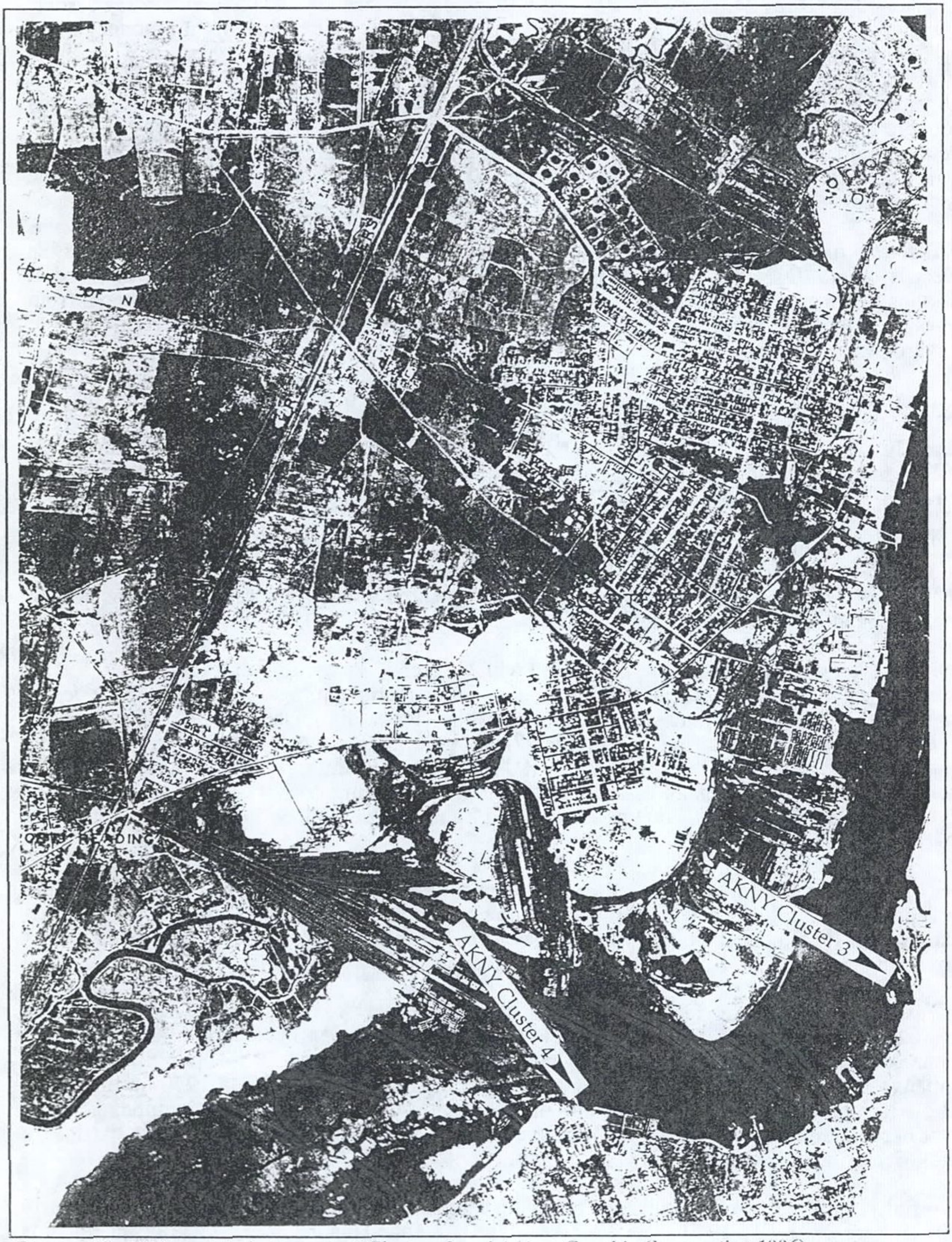


Figure 243. 1930s aerial photograph of Clusters 3 and 4 (AeroGraphic Corporation 1996).

Figure 244. 1960 aerial photograph of Clusters 3 and 4 (AeroGraphic Corporation 1996).

Figure 245. 1984 aerial photograph of Clusters 3 and 4 (AeroGraphic Corporation 1996).

Figure 246. 1960 aerial photograph of Cluster 6 (AeroGraphic Corporation 1996).

Figure 247. 1984 aerial photograph of Cluster 6 (AeroGraphic Corporation 1996).

Investigation did not uncover specific data regarding cluster origin or ownership. Based on previous research and existing vessel data, the cluster itself is not NRHP significant, though specific vessels within the cluster are significant. Future historical research, if determined necessary, is not dependent on physical cluster remains. No further work is recommended.

KILL VAN KULL CLUSTERS. The following six clusters are apparently associated with marine contractors:

Cluster 4: Vessel Nos. 32-60, 63-66, U2-5
Cluster 5: Vessel Nos. 68-90, U6
Cluster 6: Vessel Nos. 97-98
Cluster 7: Vessel Nos. 99-102
Cluster 8: Vessel Nos. 103-104, U8
Cluster 9: Vessel Nos. 105-129, 129A, 130-142, U9

Raber et al. (1995b:109) state that these might produce information concerning "the use, repair, conversion, and abandonment of many (vessel) types over the last 50-75 years." Information presented here is based on field investigation and aerial photographs from 1940, 1951, 1960, 1974, 1984, 1994 (Figures 237 through 242).

Clusters 4 and 5. Clusters 4 and 5 are attributed to the Great Lakes Dredge and Dock Company. The company, as the name implies, has its corporate headquarters in Chicago, Illinois. The company maintains offices in Union, New Jersey; Staten Island; Towson, Maryland; Tampa, Florida; New Orleans and Morgan City, Louisiana; Oakland, California; and Cleveland, Ohio. Primarily a dredging contractor, it is involved in many types of marine contracts (rock blasting, breakwaters, docks, piers, etc.). Its Staten Island operation began in the early 1920s.

Fifty-seven vessels and five wooden floating dry docks are attributed to the clusters. Cluster 5 is geographically adjacent to Cluster 6, attributed to George W. Rodgers Construction Company. The cluster site may contain vessels from either firm. Photographs for 1940 indicate the largest number of vessels (Figure 237). Photographs for 1951 and 1961 indicate a large numbers of vessels for both sites, though the size of the cluster is diminished somewhat (Figures 238 and 239). By 1974, the number of vessels for both clusters is reduced significantly (Figure 240).

Water Index Map #15 indicates that the Great Lake Dredge and Dock Company acquired waterfront rights to an area between Bay Avenue and Simonson Avenue on December 23, 1975. Officials at the Staten Island office and at the firm's corporate headquarters in Illinois had no knowledge of the cluster's history. Fear of future legal liability tempered the firm's willingness to share information. Current research is ongoing. Any pertinent data applicable to the site will be presented in the final report.

Cluster 6. In 1869, George W. Rodgers convinced his father that a small company in New York Harbor could profit by building piers and docks. The growth of the Harbor's steam-powered passenger and freight service convinced his grandfather, Henry M. Rodgers, to finance the venture. The company specialized in surveying, appraising, designing, and constructing New York waterfront piers, docks, and pile foundations (George Rodgers Construction Company 1944). The company became a major player in harbor construction, building an 840-x-39-ft. steel and concrete outfitting pier (No. 10) for the Bethlehem Steel Company Shipbuilding Division, Staten Island; the Lehigh Warehouse deepwater terminal in Bayonne, New Jersey; a half-million-dollar New York City Department of Sanitation Dumping Platform in Flushing, New York; and piling bulkheads for the New York Yacht, Glen Cove Shore Station. The company operated pile drivers, derrick boats, whirley cranes, concrete mixers, auxiliary steamers, and the like (George W. Rodgers 1954). Figure 248 shows the work yard in 1944. Located in the photograph are several derrick lighters, deck scows, tugs, and covered barges.

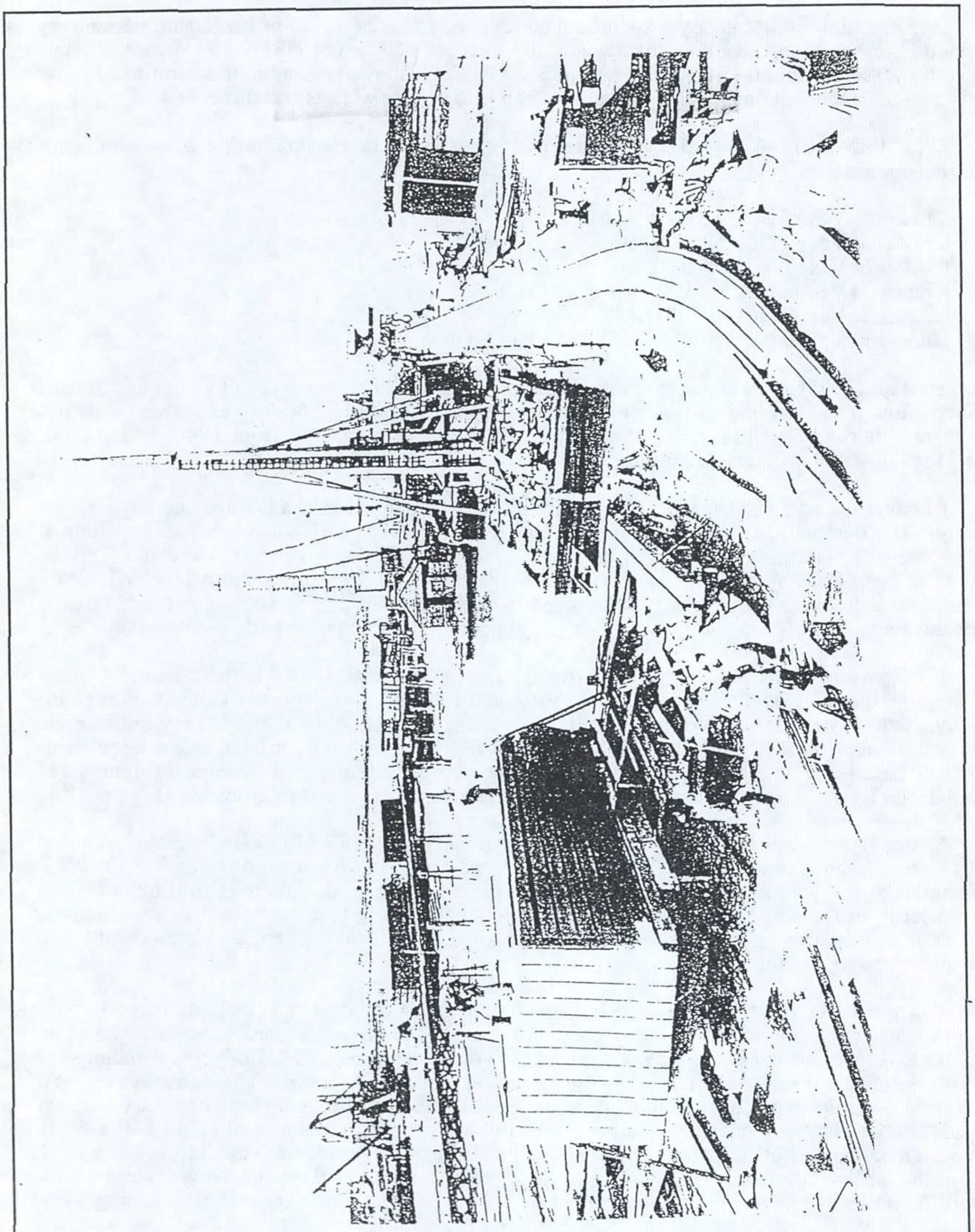


Figure 248. George W. Rodgers work yard in 1944 (George W. Rodgers 1944).

Cluster 6 is tentatively associated with the George W. Rodgers Construction Company. This identification is based on geographic location only. The Water Index Map (Figure 249) indicates that George W. Rodgers retained waterfront access to the site on November 25, 1902. Aerial photographs show only a few vessels at the site in 1940, but by 1951 numerous vessels are present (Figures 237 and 238). Vessel numbers increase dramatically by 1960 (Figure 239). Interviews with local informants did not verify the cluster's ownership. Based on observational and research data, Cluster 6 is does not meet significant criteria under NRHP evaluation. No further work is recommended unless further historical documentation is deemed necessary. In any case, future research can occur without the physical presence of the cluster.

Cluster 7. The Brewer Dry Dock Company, founded by Everard C. Brewer around the turn of the century, provided many of New York Harbor's dredges, barges, tugs, and scows. Brewer, a Maine native, came from an old-time shipbuilding family. A well-traveled seaman, Brewer worked for the shipbuilding industry in Providence, Maine during the 1890s. He later joined the New Jersey Dry Dock and Transportation Company (Elizabeth, New Jersey) where he acted as superintendent. In 1899 he established the Brewer Dry Dock Company, Inc. at Elm Park, Staten Island. After operating a plant at the foot of Harbor Road, Mariner's Harbor, Brewer moved operations in 1918 to the Kill Van Kull waterfront along Richmond Terrace. During this period, the company actively built and repaired all types of harbor craft involved in the war effort (Leng and Davis 1930).

In 1918, Brewer joined with Arthur J. Grymes, president of Grymes Engineering Company and Vulcan Iron Works in Jersey City. Experienced in marine engineering and railroad marine management, Grymes remained partners with Brewer until his death in 1925 (*Maritime Reporter,* 15 February 1975). The company specialized in dry dock construction and steel vessel repair (Leng and Davis 1930). The company witnessed "tremendous" activity during WWII, employing three shifts of men and women employees around the clock (Staten Island *Advance*, 25 May 1980). In the 1960s, Staten Island's largest shipyard, Bethlehem Steel, Mariner's Harbor, closed their doors. The Brewer Company took over Bethlehem and the Brighton Marine Repair Yard, making it the largest yard on the Island. Industry declines eventually dropped Brewer's employee roster from 1,100 workers in its heyday to 12 to 15 workers in late 1970s (Staten Island *Advance*, 21 May 1980)

Jackson Engineering Company acquired the Brewer property in 1979. The firm's president, convicted of conspiracy to commit bribery, faced a maximum 10-year prison term. Investigation did not involve the outcome of the trial. The company folded in 1983. Research failed to locate anyone from the Brewer or Jackson firms.

Aerial photographs from 1940 show four dry docks associated with the site geographically (Figure 237). Photos as late as 1974 show repair activity relative to the dry dock locations (Figures 238-240). The nature of cluster changes somewhat between 1984 and 1994 (Figures 241 and 242)

Cluster 7's association with Brewer Dry Dock company is tentative, based on geographic location and assumption. However, in a description of property from the *63rd Annual Report, Department of Dry Docks*, New York City 1934, Brewer Dry Dock Company received an unspecified amount of money for a "sinking fund." Within the cluster are two wooden dry docks, a covered barge, and a trap rock scow. Archival research did not reveal any further information on the nature of the fund. It is assumed here that the money involved the salvaging and sinking of derelict vessels, hence the name.

Interviews with local informants failed to verify or confirm the above assumption or actual ownership of the cluster. Curiously, Water Index Map #16 indicates a small strip of waterfront access located adjacent to Cluster 7 (between Summerfield Avenue and Union Avenue) granted if warranted, is not dependent on the cluster's physical remains. No further work is recommended.

Cluster 5. Cluster 5, abandoned in the 1970s, represents a specific chronology associated with the decline of small, undocumented marine contract firms of New York Harbor. This cluster is of recent origin. Aerial photographs from the early 1930s do not include the cluster (Figure 228). A few vessels appear in 1940 (Figure 229). By 1951, the vessel cluster includes approximately six vessel, three barges and three larger non-barge type vessels (Figure236). Between 1974 and 1984, the clusters change in size and character (Figures 232 and 234). The post-1970 cluster is attributed to Edward O. Wickberg and Company, a marine contractor operating on the New Jersey shoreline during the 1970s (Raber, Flagg, Wiegand, and Weinstein 1995). Research did not yield relevant data on the firm. As is the case with the other clusters in the project area, further historical research may reveal specific data on the cluster, but such research is not dependent on the cluster's physical presence. No further work is recommended.

INTERPRETATIONS AND RECOMMENDATIONS

BACKGROUND CULTURAL CONTEXTS

The project area contains a large percentage of unpowered wooden boats, barges, and boats/vessels associated with towing, i.e., tugs. These vessel types represent artifacts associated with New York, Arthur Kill, Kill Van Kull, and Raritan River commerce. Towing began in the project area no later than 1830 (Raber et al. 1995b). As New York Harbor developed commercially, particularly rail and industry, the Arthur Kill, Kill Van Kull channels witnessed extensive barge and boat traffic. By WWI, 55,000 barges and boats plied the project area waters (U.S. Congress 1920).

The decline of the clay industry (mid-1930s), coupled with improvements of the Arthur Kill channel, witnessed a general decline in barge/towboat traffic. The introduction of the modern oceangoing vessels generally ended the wooden barge era in the 1960s. The last wooden barges, built in the 1950s, became obsolete with the advent of modern steel barge construction. By the early 1980s, the tractor-trailer/container industry supplanted the barge as a primary means of moving goods in the harbor.

The vessel types represented in the project area contain construction and design features directly associated with the emerging commercial and industrial complex of Manhattan and surrounding areas. Some of these vessel types will provide clues to evolutionary or transitional constructional forms, i.e., the transitional harbor/canal barge. Other types, particularly barge types, provide data on vessels otherwise ignored by researchers. Project-area barges represent artifacts of the urban commercial/industrial vernacular. Though lacking "historical glamour," they nonetheless provide artifactual information on a commercial system central to New York's development as the world's chief port and harbor.

The vessels and structures associated with the rail and lighterage system, i.e., carfloats, transfer bridges, etc., provide a glimpse of a bygone era. The relationship between rail and water transport cannot be understated; it is uniquely urban. Recognition of these vessel types acknowledges the influence railroad freight and transportation had on the emergence and development of New York Harbor.

Coupled with the aforementioned types of commercial vessels are vessels associated with the movement of local populations, i.e., ferries. There is great interest in early steam-propulsion designs and features in nautical archaeology. The interest derives from previous discoveries such as *Southfield*, a Union-converted Staten Island ferry sunk by a rebel torpedo during the Civil War in North Carolina, and the limited availability of extant constructional data. The potential information present in the project area will expand a limited database.

Boats associated with harbor work, i.e., steam winches, derricks, pile drivers, etc., provide potential data on subjects otherwise ignored. Like barges, these boats/vessels lack broad appeal; however, these vessels, similar to modern-day tractor-trailers, trucks, etc., were essential in the production and development of the harbor. Again, investigation into these types can provide information on how work was accomplished and the economic factors affecting such work. Finally, the small boats and lighters known in the project area, wooden sailing lighters, centerboard schooners, etc., are poorly represented in the archaeological record. These finds are unique.

The importance of the barges and other vessels known in the project area is not understated here, but rather tempered with known constructional data, i.e., plans, descriptions, etc. Naturally, constructional plans and written descriptions are not blanket standardizations. Using a modern analogy, trucks are different in specific size, shape, and use, but the basic design remains the same. The same is true for barges. Their distinctions are noted here.

The data gathered for this study will provide a database for future study. Because these vessels are typically viewed as nuisances, they are often destroyed without documentation. The information presented here, along with previous project-area investigations, ensures a complete maritime recordation of vernacular vessels associated with New York Harbor commerce and transportation. Its value, if not apparent now, will become evident later.

RECOMMENDATIONS

The results of this investigation indicate that 50 vessels and the two structures require varying degrees of mitigation in the form of photographic documentation and/or partial or complete HABS/HAER (Historic American Building Survey/Historic American Engineering Record) recordation (if avoidance by adverse drift removal activities is not feasible).

Each vessel and structure presented here received recommendations based on the integrity of the site, its archaeological and historical value, and comparative data gathered from similar sites in the project area. Table 32 presents each vessel investigated according to vessel number, type, location, and recommendation. Vessels recommended should be avoided if possible.

Table 32. Summary of Vessels Eligible for NRHP Nomination

Vessel Type	Vessel No.	Reach	Recommendations
Steam boat	Vessel 53	Arthur Kill, NY	Photo and site documentation
Double-ended Ferry	Vessel 81	Arthur Kill, NY	Photo and site documentation
	Vessel 58	Arthur Kill, NY	Photo and site documentation
	Vessel 5	Kill Van Kull, NY	Photo and site documentation
Canal Boat	Vessel 214	Arthur Kill, NY	Photo and site documentation
	Vessel 219	Arthur Kill, NY	Photo and site documentation
	Vessel 30	Arthur Kill, NJ	Basic measurements for comparison
	Vessel 34	Arthur Kill, NJ	Basic measurements for comparison
	Vessel 98	Arthur Kill, NJ	Basic measurements for comparison
	Vessel 99	Arthur Kill, NJ	Basic measurements for comparison
	Vessel 103	Arthur Kill, NJ	Basic measurements for comparison
Barge	Vessel 43	Arthur Kill, NJ	Basic measurements for comparison
	Vessel 57	Arthur Kill, NJ	Basic measurements for comparison
	Vessel 58	Arthur Kill, NJ	Basic measurements for comparison
	Vessel 59	Arthur Kill, NJ	Basic measurements for comparison
Lighters (sail)	Vessel 77	Arthur Kill, NY	Photo and site documentation
	Vessel 83	Kill Van Kull, NY	Photo and site documentation
	Vessel 84	Kill Van Kull, NY	Photo and site documentation
Centerboard	Vessel 37	Arthur Kill, NY	Photo and site documentation
Schooners	Vessel 10	Arthur Kill, NY	Photo and site documentation
Lighters(Steam)	Vessel 179	Arthur Kill, NY	Photo and site documentation
	Vessel 260	Arthur Kill, NY P	hoto and site documentation
	Vessel 28	Kill Van Kull, NY	Photo and site documentation

Table 32, continued

Vessel Type	Vessel No.	Reach	Recommendations
Derrick Lighters	Vessel 113	Kill Van Kull, NY	Photo and site documentation
	Vessel 120	Kill Van Kull, NY	Photo and site documentation
Car Float	Vessel 258	Arthur Kill, NY	Photo and site documentation
	Vessel 155	Kill Van Kull, NY	Photo and site documentation
Ocean Freighter	Vessel 184	Arthur Kill, NY	Photo and site documentation
	Vessel 195	Arthur Kill, NY	Photo and site documentation
Crane Barge	Vessel 4	Arthur Kill, NY P	hoto and site documentation
	Vessel 193	Arthur Kill, NY P	hoto and site documentation
	Vessel 105	Kill Van Kull, NY	Photo documentation only
Work Barge	Vessel 15	Arthur Kill, NJ	Photo and site documentation
Hold Barge	Vessel 106	Arthur Kill, NY	Photo and site documentation
	Vessel 134	Arthur Kill, NY	Photo and site documentation
Deck Scows	Vessel 92	Arthur Kill, NJ	Photo and site documentation
Hopper Barge	Vessel 75	Kill Van Kull, NY	Photo and site documentation
Rock Scow	Vessel 173	Kill Van Kull, NY	Photo and site documentation
Wooden Tug	Vessel 149	Arthur Kill, NY	Photo and site documentation
Screw Tug	Vessel 41	Arthur Kill, NY	Photo and site documentation
Steam Tug	Vessel 43	Arthur Kill, NY	Photo and site documentation
Floating Dry Dock	Vessel 68	Kill Van Kull, NY	Photo and site documentation
	Vessel 88	Kill Van Kull, NY	Photo and site documentation
	Vessel 89	Kill Van Kull, NY	Photo and site documentation
	Vessel 90	Kill Van Kull, NY	Photo and site documentation
Steam Water Boat	Vessel 43	Arthur Kill, NY	Photo documentation only
Barkentine *Hedris*	Vessel 49	Arthur Kill, NY	Photo and site documentation
Fishing Boat	Vessel 33	Kill Van Kull, NY	Photo documentation only
Converted Schooner Barge	Vessel 72	Arthur Kill, NY	Photo and site documentation
Transfer Barge	Vessel 13	Arthur Kill, NY	Photo and site documentation
Bucket Dredge	Vessel 3	Arthur Kill, NY	Photo documentation only

HABS/HAER DOCUMENTATION

Photo documentation tools play an integral role in the project-area recordation process. As stipulated in the U.S. Department of Interior *Guidelines for Recording Historic Ships*, a large-format view camera (4-x-5-inch negatives or larger) is required to meet HAER standards. However, a 35mm camera can be used for difficult shots, as guidelines state. Given the condition and nature of most of the wreck sites, video documentation may offer an alternative. Not only does it provide a more comprehensive view, but it aids in mapping and analysis. In addition, video records can be archived or used as a reference tool.

MAPPING. Field methods for site mapping are detailed in the U.S. Department of Interior *Guidelines for Recording Historic Ships.* Briefly, vessels requiring field mapping fall into two categories, lines and construction drawings. Line drawings describe the shape of the vessel's hull. They are "contour maps" of the hull's compound curve. These drawings often include outboard profile or deck plan, deck breaks, masts, rails, rudders, or keel(s), etc. Construction drawings depict physical or structure features of the vessel. These drawings often contain structural features, fittings, propulsion, and deck machinery. Recommendations for each vessel in the project area are specific, spelled out in the "Recommendation" section for each vessel number.

SAFETY CONSIDERATIONS. Several sites recommended for investigation are dangerous and should be approached cautiously. Many sites are dilapidated, deteriorated, and in disrepair. Any site recommendations presented here should be tempered by common sense.

As for sites requiring sediment removal or diving, several considerations must be addressed. The project area is polluted. Primary health and safety considerations include (1) contaminated sediment, (2) poor water quality, (3) limited visibility, (4) dangerous currents, and (5) wreck debris.

The New Jersey Department of Environmental Protection determined high sediment levels of polychlorinated biphenyls (PCBs), and high molecular weight polynuclear aromatic hydrocarbons (HPAHs) in the Kill Van Kull. Also present in the sediment are heavy metals, pesticides, petroleum products and byproducts, dioxins, and volatile organic compounds (LPAHs). HPAHs include benzo (a) anthracene, chrysene, benzo (k) fluoranthene, benzo (a) pyrene, indeno (1,2,3-cd) pyrene, and dibenzo (a, h) anthracene. Similar contamination should be expected for the both Arthur Kill Reaches. Exposure to all these chemicals and compounds is hazardous (Fanning, et al. 1996).

Project-area water quality is poor. Fuels, solvents, and other products are present, but do not exceed EPA standards. Fecal coliform levels are relatively high, especially in summer. Total dissolved nitrogen, and phosphorous and dissolved orthophosphate are high. According to New Jersey Water Quality Standards, the Kill Van Kull is designated a secondary contact recreation area. Water is suitable for activity where water ingestion is minimal (Fanning et al. 1996).

To eliminate exposure to sediment, the highest level of protection is required. Divers are especially at risk. Divers will require dermal protective gear, surface-supplied air, and training recognition of symptoms associated with exposure. Safety plans should include, but not be limited to, first-aid contingency procedures and emergency evacuation plans. For in-depth details concerning diving and exposure in the project area, see Health and Safety Plan for Bayonne Reach II Cultural Resources Mitigation (DAWC51-94-D-0034), U. S. Army Corps of Engineers, New York District.

REFERENCES CITED

Adams, Arthur G.
1983 *The Hudson Through the Years*. Lind Publications, Westwood, N.J.

Albion, Robert Greenhalgh
1939 *The Rise of New York Port 1815-1860*. Reprinted. Northwestern University Press, Chicago. Originally published 1939, Charles Scribner's Sons, n.p.

Aldrich Publishing Company, Inc.
1912 *International Marine Engineering* 17:473. New York, New York.

Allen, Edward L.
1922 *Pilot Lore From Sail to Steam*. The National Service Bureau, New York, New York.

Anderson, Albert J.
1964 Old Place and the "Old Place Complex." *The Chesopiean* 2:13-14.

1967 Stanly Points. *The Chesopiean* 5:89.

Andrews, Charles M.
1937 *The Colonial Period of American History: The Settlements*. Vol. III. Yale University Press, New Haven.

Anonymous
1979 *Staten Island: An Architectural History*. Staten Island Institute of Arts and Sciences, Staten Island, New York.

Arnold, J. Barto III
1989 *Texas Shipwrecks: Overview of Historical Contexts*. Texas Antiquities Committee, Austin.

Baab, Tom
1953 New York's Floating Elevators. *Grain Elevators of New York* 20:2-4.

Bank of Manhattan Company
1915 *Ships and Shipping of Old New York*. Bank of Manhattan Company, New York, New York.

Barge Canal Bulletin
1908 A Suggestion for Boat Builders Series I, No. 10:306-308

1914 Boats Series VII (3):112

Barkhausen, Henry N.
1990 *Focusing on the Centerboard*. Manitowoc Maritime Museum, Manitowoc, Wisconsin.

Battelle Marine Sciences Laboratory
1996 *Summary of Core Sampling Data for Arthur Kill 1993 Sampling Survey*. Ms. on file, Battelle (Pacific Northwest Division), Sequim, Washington.

Bayles, Richard M. (editor)
1887 *History of Richmond County, New York.* L.E. Preston and Company.

Berger, Louis
1987 *Phase IA Cultural Resource Investigation Chateau Du Bois Development, Staten Island, New York.* CEQR No. 86-114R. Prepared by The Cultural Resource Group, Louis Berger and Associates, Inc., East Orange, New Jersey for Richmond Valley Estates, Inc., Staten Island, New York.

Betancourt, B.C., Jr.
1955 The Staten Island Steam Ferries. *Staten Island Historian* 16 (2):1-5.

Bethlehem Steel Company
1951 *Launching of General Managers Association Standard Scows.* Ms. on file, South Street Seaport Museum, New York, New York.

Black, Fredrick M.
1982 *A History of Fort Wadsworth, New York Harbor. Cultural Resources Management Study #7.* Prepared for the Division of Cultural Resources, North Atlantic Regional Office, National Park Service, U.S. Department of the Interior.

Brouwer, Norman
1983 *Survey of Cultural Resources in the Form of Derelict Ships and Barges, Area II (Completion) of Shooters Island, New Jersey.* New York Harbor Collection and Removal of Drift Project.

1985 *Recording of Selected Barges Lying at Edgewater, New Jersey, Supplement to Survey of Cultural Resources in the Form of Derelict Ships, Hudson River Shoreline of Edgewater, New Jersey.* New York Harbor Collection and Removal of Drift Project.

1987 Port of New York, 1860-1985: Moving Goods Within the Port. *Seaport: New York's History Magazine* 20 (4):30-35.

1990 *Synopsis History of Maritime Activity in New York State and New York State Vessel Typology.* Unpublished manuscript on file, South Street Seaport Museum, New York, New York.

1996 Original unpublished notes from the Arthur Kill, New York. Ms. on file, South Street Seaport Museum, New York, New York.

Bureau of Research Curriculum
ca. 1980s *Staten Island: A Resource Manual for School and Community.* Board of Education, New York City.

Burrow, Ian, and Richard Hunter
1990 *A Cultural Resource Survey for the Green Brook Flood Control Project in the City of Plainfield, the Boroughs of Bound Brook, Middlesex, Dunellen, North Plainfield, and South Plainfield and the Townships of Green Brook and Bridgewater, Middlesex, Somerset and Union Counties New Jersey.* Hunter Research, Inc.

Carr, Frank G.G.
1989 *Sailing Barges.* Terence Dalton Limited, Lavenham, Suffolk.

Chapelle, Howard I.
1935 *The History of American Sailing Ships*. W.W. Norton, New York.

1951 *American Small Sailing Craft: Their Design, Development, and Construction*. W.W. Norton, New York

Chinitz, Benjamin
1960 *Freight and the Metropolis: The Impact of America's Transportation Revolutions on the New York Region*. Harvard University Press, Cambridge.

Cleary, William E.
1956 Towing and Literage. *Marine News* (October):44, 45, 71.

Clute, J.J.
1877 *Annals of Staten Island, From Its Discovery to the Present Time*. Chas. Vogt Press, New York.

Corey, Steven H.
1991 Garbage in the Sea. *Seaport* (Winter/Spring):18-23.

Cornell, W.
1914 Organizing a Lighterage Department. *The Baltimore & Ohio Employees Magazine*. May 25

Cotterell, Harry, Jr.
1978 Double-Ender Diggings. *Steamboat Bill* 35(3):134.

Cotz, Joann, Edward Lehink, Herbert Githens, and William Askins
1985 *Sharrott Estates Archeological Project: Report on Mitigation Procedures in the Sandy Ground National Register District, Staten Island, New York*. Prepared for Woodrose Associates, Yonkers, New York by Archeological Research Consultants, Inc., Midland Park, New Jersey.

Conduit, Carl
1980 *The Port of New York: A History of the Rail and Terminal System from the Beginnings to Pennsylvania Station*. University of Chicago, Chicago.

Cudahy, Brian J.
1990 *Over and Back: The History of Ferryboats in New York Harbor*. Fordham University Press, New York.

Davies, Watson
1924 *The Story of Copper*. The Century Company, New York.

Dayton, Fred Erving
1939 *Steamboat Days*. Tudor Publishing, New York.

Dibner, Brent
1994 Railroads in New York Harbor Part 1: Overview of Railroad Marine Operations. *Tugbitts* 5(4):6-13

Dinkins, David D., and Richard L. Schaffer
1992 *New York City Comprehensive Waterfront Plan: Reclaiming the City's Edge*. New York Department of City Planning.

Donnelly, William T.
1905 Floating Drydock Construction. In *Floating Drydocks*, edited by Sven Anderson. The Maryland Steel Company, Sparrows Point, Maryland.

Douglas, George B.
1904 A Sailing Lighter. *The Rudder* 2:75-76.

Dunbaugh, Edwin S., and William DuBarry Thomas
1989 *William H. Webb: Shipbuilder*. Webb Institute of Naval Architecture, Glen Cove, New York.

Erismann, Martin C.
1912 New Menhaden Steamers for the Atlantic Coast. *International Marine Engineering* 2:71-73.

Fanning, Phillips, and Molnar
1996 *Health and Safety Plan for Bayonne Reach II, Cultural Resources Mitigation Draft Report*. Prepared for U.S. Army Corps of Engineers, New York District by Fanning, Phillips, and Molnar, Ronkonkoma, New York.

Flagg, Thomas
ca. 1970s The Railroad Navy: The Marine Operations of the Railroads in New York Port. Ms. on file, South Street Seaport Museum, New York.

1994 Railroad Marine Services at the Port of New York. *Transfer No. 10* April-June:6-10.

Flagg, Thomas, Gerry Weinstein, and Norman Brouwer
1992 *Reconnaissance of Marine Cultural Resources at the Newark Bay Site, Staten Island, New York*. New York City Long Range Sludge Management Plan GEIS III, New York City Department of Environmental Protection.

Flagg, Thomas, and Michael Raber
1990 Building Structure Inventory Form, Baltimore and Ohio Railroad West 26th Street Transfer Bridge. Prepared for New York State Office of Parks and Recreation and Historic Preservation, Division for Historic Preservation.

Flagg, Thomas
1996 Railroad Data. Ms. on file, Historical Documentation Services, New York, New York.

Franklin Institute
1859 *Journal of Franklin Institute* 3rd series 68(5):348.

1860 Notes. *Journal of Franklin Institute* 3rd series, 70(51):291.

Fuerst, Joanne
1978 Floating Grain Elevators in New York Harbor, 1848-1959. *American Neptune* 36(2):131-142.

George W. Rodgers Construction Company
1944 *Seventy-Fifth Anniversary Souvenir Edition*. George W. Rodgers, New York.

1954 *Three Quarters of a Century Plus Ten Years*. George W. Rodgers, New York.

Glucksman, Randy
1972 Progress Ahead Across the Bay. *Headlights* 34:2-3.

Government Printing Office
1937 *Merchant Vessels of the United States (Including Yachts and Government Vessels).* United States Government Printing Office, Washington.

Grava, Sigurd
1986 Water Mode to the Rescue: Past and Future Ferry Service in New York City. *Transportation Quarterly* 40(3):337.

Griffith, John
1854 *Treatise on Marine Naval Architecture.* George Phillip and Son, London.

Grover, David H.
1987 *U.S. Army Ships and Watercraft of World War II.* Naval Institute Press, Annapolis.

Hall, Henry
1884 *Report of the Tenth Census: Report on the Ship-Building Industry of the United States VIII.* Government Printing Office, Washington, D.C.

Harding, H. McL.
1912 Lighters and Lighterage in Harbor Freight Transference. *International Marine Engineering* 1:14-18.

Hawkins, N. M.E.
1987[1904] *New Catechism of the Steam Engine.* Lindsay Publications, Bradley, Illinois.

Hershkowitz, Leo, Edward S. Rutsch, and Leonard G. Bianchi
1985 *Cultural Resources Survey of the Property Occupying the Southeastern Corner of Huguenot Avenue and Arthur Kill Road, Borough of Richmond, New York, New York.* The Avon Organization, Staten Island, New York.

Hine, Charles Gilbert, and William T. Davis
1925 *Legends, Stories, and Folklore of Old Staten Island.* Staten Island Historical Society, Staten Island.

Hirsh, Rod
1980 Along the Waterfront. *Home News,* 31 August 1980: n.p.

Hoyt, Steven D., and James S. Schmidt
1994 *Mapping of the Utina (41NU264), Corpus Christi Entrance Channel, Nueces County, Texas.* Prepared for the U.S. Army Corps of Engineers, Galveston District by Espey, Huston and Associates, Inc., Austin, Texas.

Hurley, Andrew
1992 Oil and Water. *Seaport* 26(2):14-22.

Hutchins, John G.B.
1948 History and Development of the Shipbuilding Industry in the United States. In *The Shipbuilding Business in the United States of America,* Vol. I, edited by F.G. Fassett, Jr. The Society of Naval Architects and Marine Engineers, New York, New York.

International Marine Engineering
1912 A 20-Inch Morris Suction Dredge. 12 May 1912:183

James, Stephen R., Jr.
1987 *An Underwater Cultural Resources Survey and Determination of Eligibility of Five Shipwrecks, U. . Dike, Arthur Kill Channel, Union County, New Jersey*. Prepared for the U.S. Army Corps of Engineers, New York District by Consulting Nautical Archaeologists, Memphis, Tennessee.

1991 *Underwater Inspection of Seven Port Johnson Sailing Vessels, Bayonne Reach, New York Harbor Collection and Removal of Drift Project, Hudson County, New Jersey*. Prepared for the U.S. Army Corps of Engineers, New York District by Panamerican Consultants, Inc., Tuscaloosa, Alabama.

Johnson, Harry, and Fredrick S. Lightfoot
1980 *Maritime New York in Nineteenth-Century Photographs*. Dover, New York.

Kardas, Susan, and Edward Larrabee
1985 *Cultural Resource Reconnaissance New York Harbor Collection and Removal of Drift Project, Bayonne Reach, Hudson County, New Jersey*, Vol. I. Prepared by Historic Sites Reach, Princeton, New Jersey for the U.S. Army Corps of Engineers, New York District.

1985 *Historic American Building Survey/Historic American Engineering Record Level Recordation at The Ships Graveyards at Shooters Island, Staten Island, Richmond County, New York, and Bayonne, Elizabeth, Hudson, and Union Counties, New Jersey*. Prepared by Historic Sites Research, Princeton, New Jersey for the U.S. Army Corps of Engineers, New York District.

Kraft, Herbert C.
1977 Paleo-Indians in New Jersey. In *Amerinds and Their Paleoenvironments in Northeastern North America*, edited by W. Newman and B. Salwen. Annals of the New York Academy of Sciences II:264-281.

Kummel, Henry B., and J. Volney Lewis
1940 *The Geology of New Jersey*. Geologic Series Bulletin 50. Department of Conservation and Development, State of New Jersey.

Leng, Charles W., and Edward C. Delavan, Jr.
1924 *A Condensed History of Staten Island*. Staten Island Edison Corporation, New York.

Leng, Charles W., and William T. Davis
1930 *Staten Island and its People: A History 1609-1929*. Lewis Historical Publishing Company, New York.

MacGregor, David R.
1984 *Merchant Sailing Ships 1815-1850: Supremacy of Sail*. Naval Institute Press, Annapolis, Maryland.

Marcosson, Isaac
1949 *Metal Magic: The Story of the American Smelting and Refining Company*. Farrar, Straus, and Company, New York.

1957 *Anaconda*. Dodd, Mead, and Company, New York.

Marestier, Jean Baptiste
1824 *Memoir on Steamboats of the United States*. Royal Press, Paris.

Maritime Reporter
1975 75th Anniversary for Brewer Dry Dock. 15 February 1975.

Morrison, John H.
1958 *History of American Steam Navigation.* Stephen Daye Press, New York.

McKellar, N.L.
1959 American Shipbuilding in World War One. *The Belgian Shiplover* 17:319-341.

National Park Service
nd *How to Apply the National Register Criteria for Evaluation.* National Register Bulletin 15. U.S. Department of the Interior, Interagency Resources Division.

1985 *Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places.* National Register Bulletin 20. U.S. Department of the Interior, Interagency Resources Division.

New York, New Jersey Port and Harbor Development Commission
1920 *Joint Report with Comprehensive Plan and Recommendations*. J.B. Lyons Company, Albany.

New York Times (NYT)
1857 "Atlantic." 12 August.

1857 "Cork." 12 December.

1858 "Atlantic." 21 January.

1871 "Explosion." 1 August.

1909 "John H. Starin Dead; Active to the Last." 23 March.

Noble, John A.
1967 John A Noble Collection Essays. Ms. on file, South Street Seaport Museum, New York, New York.

1973 Original Unpublished Paper to Commemorate the Diamond Jubilee of the City of New York. Ms. on file, South Street Seaport Museum, New York, New York.

Norton, Alton A.
1916 New Tugs for Central Railroad of N.J.: Extensive Experience in Harbor Lighterage Service and Towing Leads to New Features and Improvements in Design of New Tugs. *Marine Engineering* 2:56-58.

Okulewicz, Steven C.
1990 *The New Field Guide to Staten Island's Rocks and Minerals*. Staten Island Institute of Arts and Sciences, Inc., New York.

Ottesen, Ann I., and Lorraine Williams
1969 *Test Excavation of the Goodrich Site (STD 11-1).* Ms. on file, Staten Island Institute of Arts and Sciences.

Pearce, David
1995 Marine Operations. *Transfer No. 16*. October-December 1995:3-11

Pearson, Charles E., and Joe J. Simmons
1995 *Underwater Archaeology of the Wreck of the Steamship Mary (41NU252) and Assessment of Seven Anomalies, Corpus Christi Entrance Channel, Nueces County, Texas*. Submitted to the U.S. Army Corps of Engineers, Galveston District by Coastal Environments, Inc., Baton Rouge, Louisiana.

Pearson, Colin (editor)
1987 Conservation of Marine Archaeology Objects. Butterworth and Company, London.

Perth Amboy Public Library
1954 Lehigh Valley RR to Close Down its Coal Dumper Here. Ms. on file, Perth Amboy Public Library.

Pomfret, John E.
1973 *Colonial New Jersey: A History*. Charles Scribner's Sons, New York.

Powell, Hugh
1976 Prince's Bay, Lemon Creek, and the Oyster Industry. Unpublished ms. on file, Sandy Ground, Box 2. Staten Island Institute of Arts and Sciences Archives.

Raber, Michael S., Thomas Flagg, Roselle Henn, and J. Levin
1985 *Final Report, Cultural Resources Investigations in Brooklyn Reach* 2. New York Harbor Collection and Removal of Drift Project for the New York District, U.S. Army Corps of Engineers.

Raber, Michael S., Thomas R. Flagg, Ernest A. Wiegand, Gerald Weinstein, and Norman Brouwer
1995 *Cultural Resources Reconnaissance of the Arthur Kill New York Reach: New York Harbor Collection and Removal of Drift Project*. Draft report prepared for Frederic R. Harris, Inc. On file, New York District, U.S. Army Corps of Engineers.

Raber, Michael S., Thomas R. Flagg, Ernest A. Wiegand, and Gerald Weinstein
1995a *Cultural Resources Reconnaissance of the Arthur Kill New Jersey Reach: New York Harbor Collection and Removal of Drift Project*. Draft report prepared for Frederic R. Harris, Inc. On file, New York District, U.S. Army Corps of Engineers.

Raber, Michael S., Thomas R. Flagg, Ernest A. Wiegand, Gerald Weinstein, and Norman Brouwer
1995b *Cultural Resources Reconnaissance of the Kill Van Kull Reach: New York Harbor Collection and Removal of Drift Project*. Draft report prepared for Frederic R. Harris, Inc. On file, New York District, U.S. Army Corps of Engineers.

Raber, Michael S., Thomas R. Flagg, Gerald Weinstein, and Norman Brouwer
1995c *Cultural Resources Mitigation Bayonne Reach II: Documentation of the Bayonne Peninsula Ship Graveyard*. Draft report prepared for U.S. Army Corps of Engineers, New York District, by WCH Industries, Inc., Fort Washington, Maryland.

Reed, Herbert B.
1955 The Staten Island-Perth Amboy Ferry. *Steamboat Bill* 3:17-18.

1959 The Port Richmond-Bergen Point Ferry. *The Staten Island Historian* 20(2):15-16

1961 The New Blazing Star Ferry. *The Staten Island Historian* 22(4):30-31.

Ritchie, William A.
1969 *The Archaeology of New York State*. Doubleday, Garden City, New York.

Ringwald, Donald C.
1965 *Hudson River Day Line: The Story of A Great American Steamboat Company*. Howell-North Books, Berkeley.

Rubertone, Patricia
1974 *Inventory and Assessment of Archaeological Potential of Distrigas Property, Rossville, Staten Island, New York*. Staten Island Institute of Arts and Sciences.

Rush, Thomas E.
1920 *The Port of New York. New York*. Double, Page, and Company, New York.

Sachs, Charles L., and Nancy H. Waters
1988 *Made on Staten Island*. Staten Island Historical Society, Richmondtown, New York.

Schneider, Gail
1977 *A Cool and Pleasant Retreat But A Hungry Soil. The Clay Pit Pond Area, Staten Island, New York*. The Staten Island Institute of Arts and Sciences.

Schuberth, Christopher J.
1968 *The Geology of New York City and Environs*. The Natural History Press, Garden City, New York.

Serig, Harold W.
1986 Witte's Marine Salvage. *Nautical Quarterly* (Summer):88-98.

Shepherd, Barnett
1979 *Sailor's Snug Harbor 1801-1976*. Snug Harbor Cultural Center in Association with Staten Island Institute of Arts and Sciences. Publishing Center for Cultural Resources, New York.

Shumway, Floyd M.
1975 *Seaport City: New York in 1775*. South Street Seaport Museum, New York City.

Silver, Annette
1984 The Smoking Point Site (STD 14-3), Staten Island, New York. *Proceedings, Staten Island Institute of Arts and Sciences* 33:1-46.

Skinner, Alanson
1909 *The Indians of Greater New York and the Lower Hudson*. Anthropological Papers, American Museum of Natural History, Vol. III, Hudson-Fulton Publication, September 1909.

Skinner, Alanson, and Max Schrabisch
1913 *A Preliminary Report on the Archaeological Survey of the State of New Jersey*. Geological Survey of New Jersey Bulletin 9.

Smith, Carlyle
1950 *The Archaeology of Coastal New York*. Anthropological Papers of the American Museum of Natural History 43(2).

Snediker, Quentin, and Ann Jenson
1992 *Chesapeake Bay Schooners*. Tidewater Publishers, Centreville, Maryland.

Spirek, James D.
1993 *USS Southfield: An Historical and Archaeological Investigation of a Converted Gunboat.* Unpublished Master's thesis, Department of Maritime History and Nautical Archaeology, East Carolina University, Greenville, North Carolina.

Squires, Benjamin M.
1918 New York Harbor Employees. *Monthly Labor Review* 7(1):1-21.

Advance (Staten Island)
1946 "Surplus Ships Anchoring at Prall's Island." 24 December.

1968 "Ship Skeletons in Kill Recall Tottenville's Ghost Industry." 24 March.

1974 "City OKs Island waterfront clean-up." 25 January.

1980 "Takeover of Brewer Dry Dock Spurs Economy on North Shore." 25 May.

1992 "Congress to OK Arthur Kill Dredging." 18 September.

1993 "Kill Van Kull Project Budgeted." 9 April.

1994 "Arthur Kill by Canoe a Refreshing Adventure." 29 July.

1994 "Rat-infested Barges Remain an Eyesore." 14 August.

Staten Island Institute of Arts and Sciences Archival Library
ca. 1970s *Tottenville Shipyards.* Ms. on file, Staten Island Institute of Arts and Sciences, Staten Island, New York.

Steinmeyer, Henry G.
1950 *Staten Island 1574-1898*. Staten Island Historical Society, Richmondtown, Staten Island.

Stevens, E.A.
1893 Some Thoughts on the Design of New York Ferry-Boats. *Transactions of the Society of Naval Architects and Marine Engineers* 1:196.

1897 Origin and Development of the Ferryboat. *Marine Engineering* 4:14

Strahler, Arthur, and Alan Strahler
1973 *Environmental Geoscience: Interaction Between Natural Systems and Man*. Hamilton Publishing, Santa Barbara.

Thomas, W. DuBarry
1994 The Shipbuilding Follies: World War I Edition. *Steamboat Bill* (Summer):166

Tidewater Atlantic Research
1993 *An Historical and Underwater Archaeological Investigation of the Remains of a 19th Century Centerboard Schooner in the Inner Harbor of Sheboygan, Wisconsin.* Ms. on file, City Hall, Sheboygan, Wisconsin.

United States Army Corps of Engineers
1979 *Shooters Island, New York and New Jersey Report to Congress*. Department of the Army, New York District, New York.

United States Coast Guard Merchant Marine Technical Division
ca. 1940s *Wooden Hull Inspection and Repair Manual*. Office of Merchant Marine Safety, n.p.

United States Congress
1920 *House Documents, Vol. 26, Part I: Water Terminal and Transfer Facilities*. 66th Congress, 2nd Session. Government Printing Office, Washington, D.C.

United States National Archives
n.d. Bureau of Marine Inspection and Navigation Vessel Documentation.

n.d. Record Group 32, Records of the U.S. Shipping Board General Files.

Van Diver, Brad B.
1985 *Roadside Geology of New York*. Mountain Press, Missoula.

Van Houten, F.B.
1969 Late Triassic Newark and Adjacent New York and Pennsylvania. In *Geology of Selected Areas in New Jersey and Eastern Pennsylvania*, edited by Seymour Subitzer. Rutgers University Press, New Brunswick.

Wacker, Peter O.
1975 *Land and People: A Cultural Geography of Preindustrial New Jersey Origins and Settlement Patterns*. Rutgers University, New Brunswick.

Watts, Gordon P., Jr.
1994 *Underwater Archaeological Excavation and Data Recovery at the Hilton Wreck, Northeast Cape Fear River, Wilmington, North Carolina*. Submitted to Environmental Resources Branch, U.S. Army Corps of Engineers, Wilmington District by Tidewater Atlantic Resources, Inc., Washington, North Carolina.

Whittier, Bob
1987 *Paddle Wheel Steamers and their Giant Engines*. Seamaster, Inc., Duxbury, Massachusetts.

Williams, Gatenby, and Charles Monroe Heath
1954 *William Guggenheim*. Lone Voice Publishing, New York.

Williams, Lorraine
1967 Archaeological Site Inventory Form for the Canada Hill Site, Staten Island, New York. On file, New York Department of Parks, Recreation and Historian Preservation, Peebles Island, New York.

Wilson, Billings
1930 *The Industrial Museum of New York: The Development of Transportation in the Port of New York District*. Museum of the Peaceful Arts, New York.

Writers Project Administration, Federal Writers Project
1946 *New Jersey: A Guide to Its Present and Past*. New York, Hastings House.