INSTITUTE OF MARITIME HISTORY

2006 FIELD SEASON
NEW CASTLE, DELAWARE
HARBOR RECONNAISSANCE
PROJECT REPORT

1. INTRODUCTION

During the week of July 16 to 22, 2006, volunteers with the Institute of Maritime History and the Marine Chapter of ASD made a Phase I reconnaissance of the historic harbor area at New Castle, Delaware, under the guidance of Mr. Craig Lukezic of the Division of Historical and Cultural Affairs.

The goal was to locate and map the material remains of maritime activities in order to determine whether significant artifacts may be at risk from future development of the waterfront and might be lost if not protected or conserved in the near future.

The survey area covered the waterfront from Bull Hill Park to Battery Park and from the high tide mark to the edge of the shipping channel (see aerial photograph to the right).

Most of the colonial harbor area is filled in or heavily silted over. Sediment depths exceed 8 feet in places. We sampled exposed surface and near-surface sediments for evidence of materials that might be historical to the area.

Many artifacts were found along the shore, especially off Packet Alley and into the harbor proper. However, artifacts near shore were broken, scattered, and mingled with recent material, and appear to be landfill. They included yellow brick, bottle fragments, and roofing slate pieces. Two large, submerged structures were also found by sidescan sonar. All potentially historic artifacts were examined, photographed, and left *in situ*. Locations were recorded by GPS. Data from this survey suggest that any historic artifacts in the harbor are deeply embedded in clay or mud and thereby partially protected from casual disturbance and periodic water movement.

SECTION 2. HISTORICAL CONTEXT.

Originally named "New Amstel", New Castle was founded in 1651 as a Dutch trading post protected by Fort Casimir. The town and fort were taken by the Swedish colony of New Sweden in 1654, were retaken by the Dutch in 1655, and passed to English control in the 3rd Anglo-Dutch War (1684).

New Castle sits on the western boundary of the Delaware River at latitude 39º34' North. The map shown to the right was drawn by P. Lindstrom in 1654-1655 to show Delaware Bay off the Atlantic Ocean and the Delaware River of New Sweden. New Castle appears on the right side of the river at the middle of the depicted area, marked by (●).

New Castle was the first source of fresh water for vessels entering the river in colonial days. It was also strategically located for protection of upriver settlements, including the city of Philadelphia. It became the first capital of Delaware, and remained an active seaport for exactly three centuries.

Linked to the Chesapeake Bay by road and later by railroad, New Castle served as a major point for transshipment of cargo and passengers moving from Philadelphia and the northeast to Baltimore and southern points.

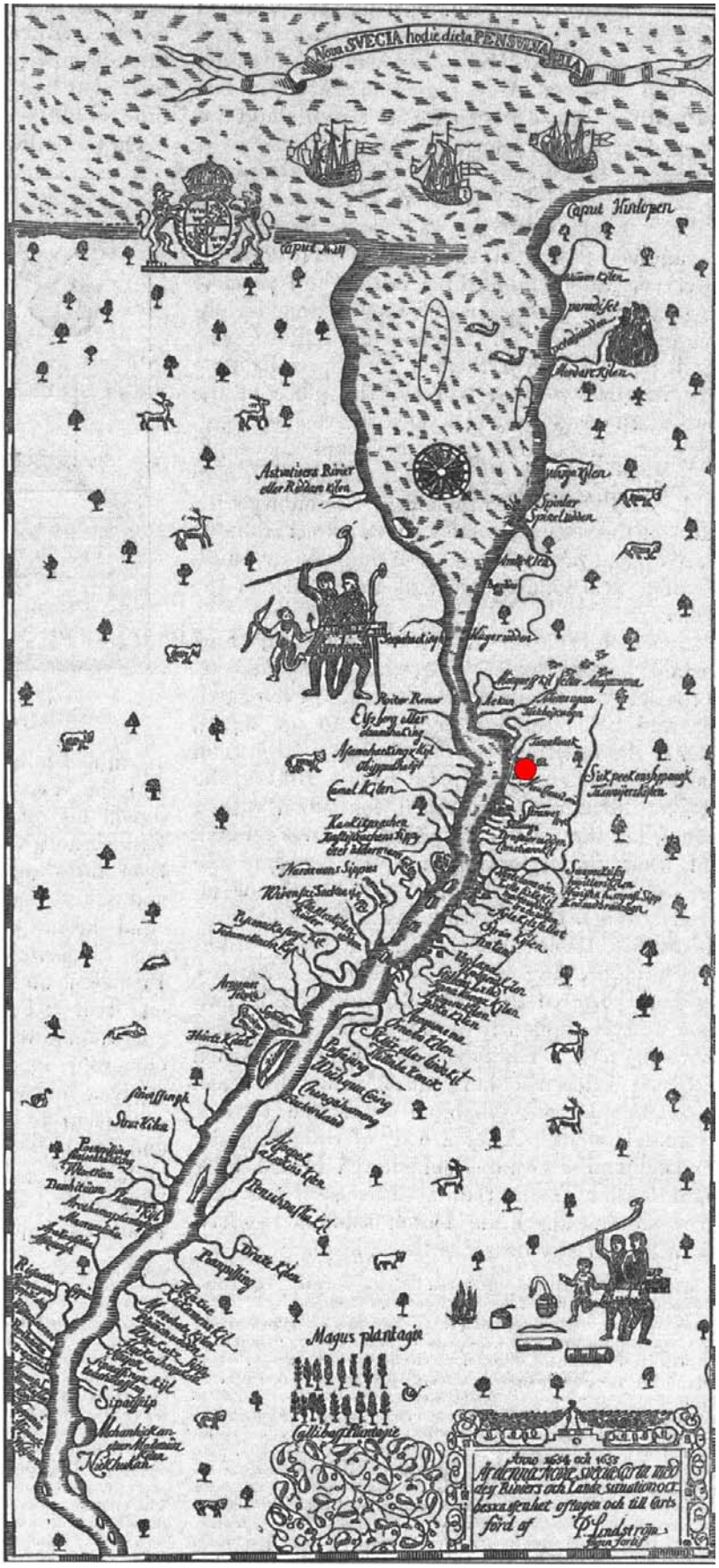
Its last commercial navigation ended in 1951 when the Delaware Memorial Bridge opened and the ferry service to Pennsville, New Jersey, closed (according to Cooper, 2001).

The cupola of the existing courthouse, which was built in 1732, is the center of the 12-mile circle that defines the northern boundary of Delaware.

Much of the historic waterfront area from Delaware Street to Harmony Street burned in 1824.

Several sets of ice piers were built at New Castle to protect shipping. The first was funded by a lottery in 1794 and completed about 1800.

The most recent piers were built by the Corps of Engineers in the mid to late 1870s, of timber faced and topped with stone. Seven surviving ice piers are listed on the National Register (structure 82-002333).



A view of the New Castle waterfront in 1830, by Robert Shaw, from a mural aboard a Delaware River steamer. On the jacket cover of *350 Years of New Castle, Delaware*, by Constance J. Cooper, 2001. Courtesy of the Historical Society of Delaware.

SECTION 3. SURVEY METHODS AND RESULTS

A. Ambient environmental conditions

The survey was conducted during a local heat wave when air temperatures exceeded 90º F for six successive days. The period of July 15 to18 was particularly oppressive, with temperatures reaching 104º. A break in the heat wave occurred on July 19 with a reduction in air temperatures by 10º F for 19 to 22 July. Water temperatures were in the 70 to 72º range, providing welcome relief from the heat. Even so, the teams had to be careful to avoid heat injuries. Lots of water was consumed by all survey participants during daytime hours.

Diving conditions were characterized by opaque brown water and much floating debris, mostly natural.

Figure 1. Diver immersed in milk chocolate river water.

Figure 2. Floating debris adjacent to shoreline fill zone.

An oil spill in the Port of Wilmington on July 17 added insult to injury. Although most of the spill was contained by primary or secondary catchments at the source, some oil did reach New Castle and was noticed by our divers.

B. Hydrology, Geology, and Biota

The shoreline of the Delaware River at New Castle is characterized by an irregular contour in roughly a northeast to southwest orientation. The average high tide during our survey ranged from 4.9 to 5.9 feet above the charting datum (Mean Lower Low Water). Low water ranged from 0.0 to 0.5 feet above datum. Those predicted values were altered slightly by local rainfall and storm activity. During the survey, tropical storm Beryl passed across the region, leading to slightly higher high tides and lower low tides, particularly during the evenings of 20 to 21 July.

The project area includes granite rocks that were probably imported for the construction of the ice piers and shoreline support. We encountered lots of brick fragments and many smaller stones and rocks scattered in the otherwise homogeneous sedimentary clay and mud.

The entire shoreline of New Castle is either privately owned or public land. There is a narrow zone (approximately 40 to 60 meters) of *Spartina* marsh grass extends along the river's edge from modern sea walls that have been constructed to contain the raised shore. The only break in this grass occurs around the stone border of the inner row of shore-connected ice piers and around the outcropping at the end of Delaware Street. Elevation of the shore along the Battery Park and Bull Hill Park areas measured at 3.0 to 5.0 meters according to GPS readings taken during the survey. At flood tide, water levels reached to within 2.0 meters of the ground level. Although we did not observe such, under extreme rain and wind conditions parts of Battery Park should be flooded.

Within the grass beds, small fresh water streams meander through to the gradually sloping mud flats. Within these streams, a population of bivalve mollusks abounds. These represent assorted species of freshwater clams. They are concentrated in the streams and range from 0.5 to 2.0 inches in maximum dimensions. They are not of commercial value and there was no evidence that they are collected or consumed by local residents.

In these streams and extending into the edges of the river are juvenile fish. Many of the local residents and visitors fish from the public pier and the creek north of the Old Ferry Dock. From brief conversations with some of them, it appears that they catch and presumably eat river fish despite health warnings posted in English and Spanish.

C. Boat team

The IMH research vessel *Roper*, a 36-foot converted shrimp boat, conducted a remote sensing search by sidescan sonar, from the one-fathom isobath to the edge of the shipping channel, and from below the flagpole in Battery Park to above the old ferry terminal at the foot of Chestnut Street (marked "Ruins" on Figure 3). Search lanes were spaced 80 yards, with the maximum sonar range also set to 80 yards to achieve 200% coverage of the area.

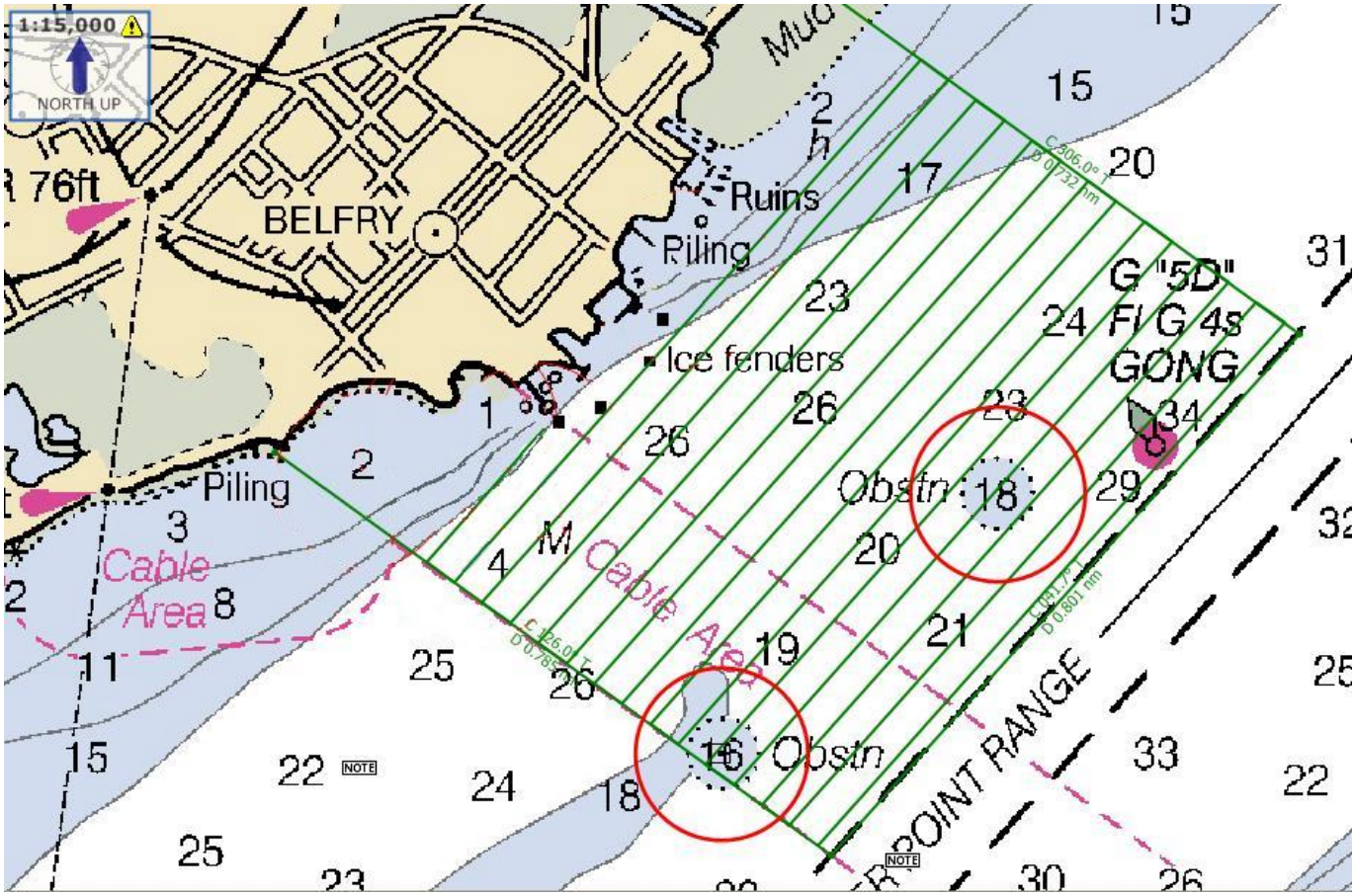


Figure 3. Navigational chart 12311, showing sonar survey tracks out to the navigational channel of the Delaware River.

We employed a "Humminbird 987C SI Combo" sidescan sonar unit set to a frequency of 455 kHz. The downlooking channel frequency was set to 200 kHz. The transducer was mounted to *Roper*'s transom at a depth of 1 foot. Divers investigated all anomalies found by sonar, but were not always able to find them in the turbid water.

The charted 16-foot obstruction at the south corner of the search area had been investigated in IMH's first Delaware reconnaissance in November 2005. It was found then to be a large pile of coal. It might be the remains of the barge *Estelle*, 182 tons, wood, built at Wilmington in 1884, home ported Philadelphia, which sank on 8 May 1912 in collision with the British steamer *Antaeus*. (*Charles* 2003) We do not know if any structure lies under the coal. We did not investigate it further in 2006.

The charted 18-foot obstruction near channel buoy "5D" was first thought to be a tree, but on subsequent dives it was found to be a large piece of metal pipe, approximately 36 inches in diameter and 75 feet long.

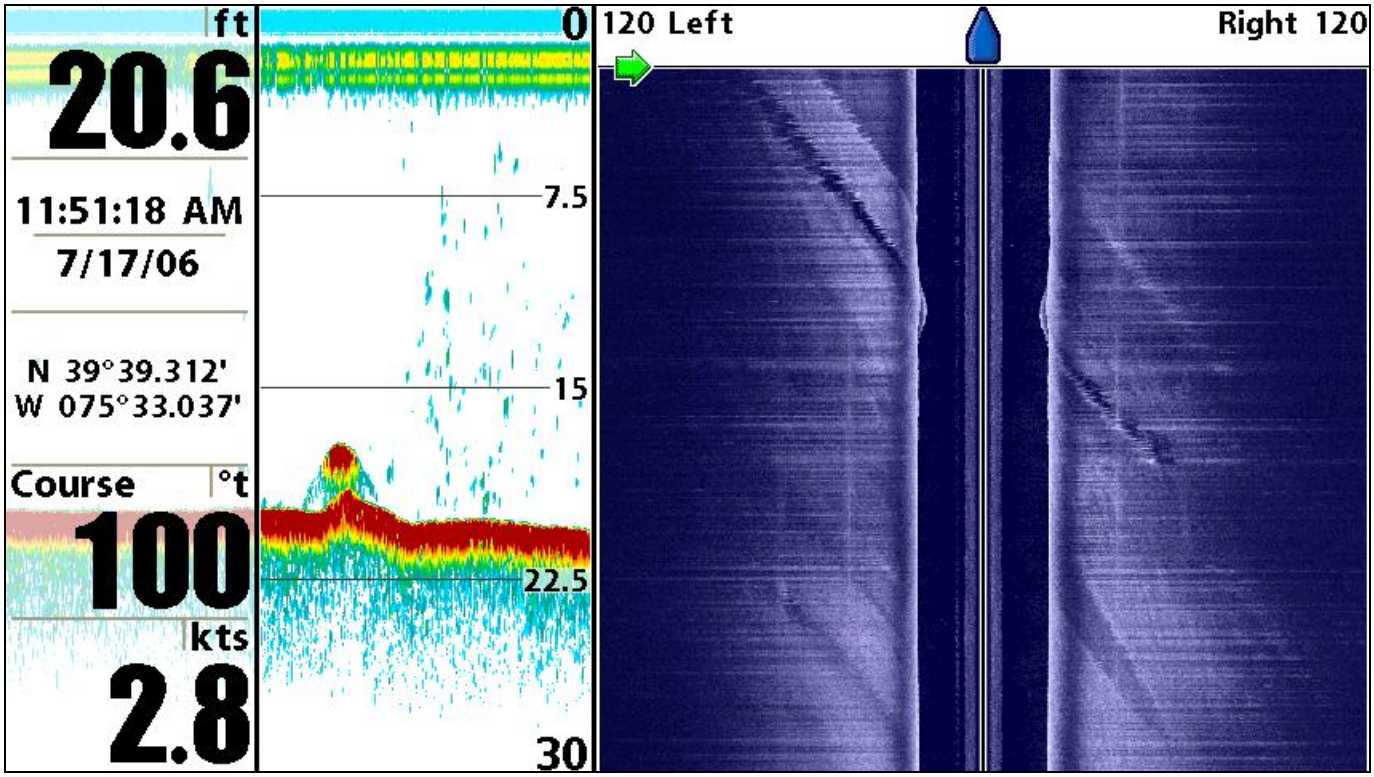


Figure 4. Data display from Humminbird 987C SI. Data and fishfinder image to left, sidescan image to right.

A small piece of worked wood, possibly a stave from a small cask, was found near the 18-foot obstruction. It was recovered and photographed (Figures 5 to 8), and then returned to the site. Scraps of other wood were found at the site, but they did not appear to have been worked.

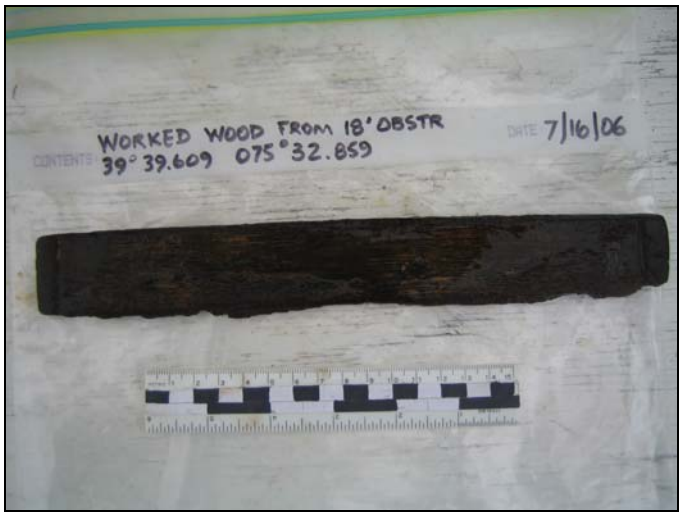


Figure 5. Wooden stave recovered from offshore site.


Figure 6. Detail of one end of the stave.

Figure 7. Detail of the opposite end of the stave.

Figure 8. Side view of the stave.

Targets 58 and 59, lying south of the courthouse cupola (marked "BELFRY" on Figure 3) and directly off Battery Park, were parts of a large wooden crib structure which was investigated by the shore team and is reported in part D(4) of this section. Figures 9 and 10 are sidescan sonar images of the structure, which measures approximately 75 by 120 feet. See Figures 38 through 47 and their accompanying text, pages 20 et seq., below.

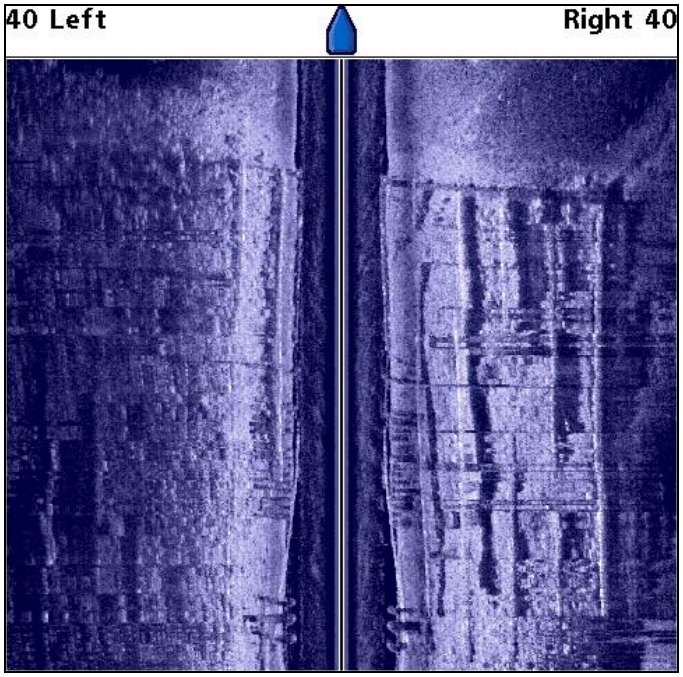


Figure 9. Sidescan image of cribbing.

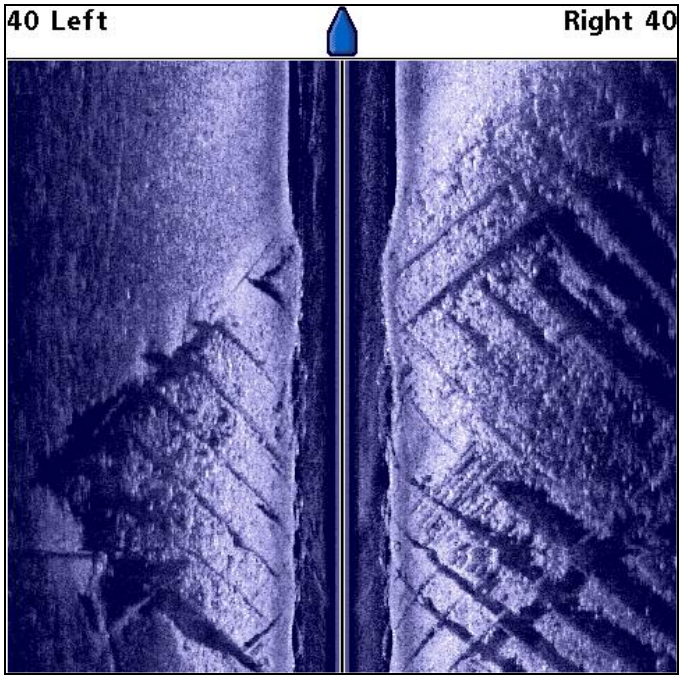


Figure 10. Sidescan image of cribbing

Target 60 was a small, indistinct anomaly, which the divers could not find. Target 61 was a pile of brick. Target 64 was a bed of mussels.

Due to shallow water we did not sidescan the old ferry terminal area (see map in Section 1). Approximately 250 yards southwest of the terminal we found a large, diamond-shaped, timber and stone structure, which is believed to be the remains of an ice pier that was destroyed by ice in January 1927. See Figures 11 and 12, below. Divers measured the sides to be 8.6 to 8.7 meters long. A least depth of 7 feet was found by sonar. Water turbidity prevented detailed analysis.

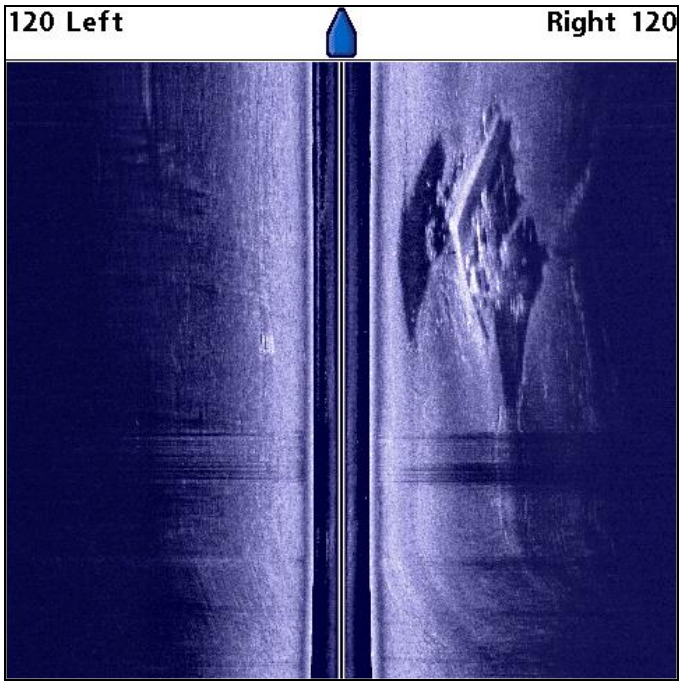


Figure 11. Submerged diamond-shaped ice pier.

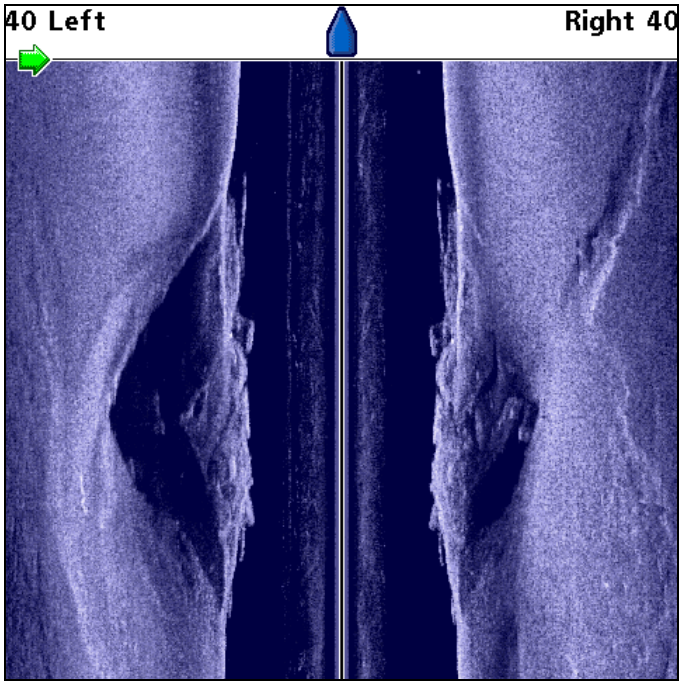


Figure 12. Same in larger view, vessel passing over it.

The sunken structure lies northeast of a line connecting the northeastern 1803 ice pier ("A" on Figure 13, or "B" on Figure 14) and the 1874 ice pier ("B" on Figure 13, "K" on Figure 14). Figure 14, a Corps of Engineers map dated 1879, shows a hexagonal or lozenge shaped ice pier ("H") lying right on that line, but the structure we found does not conform to that map either in position or in shape.

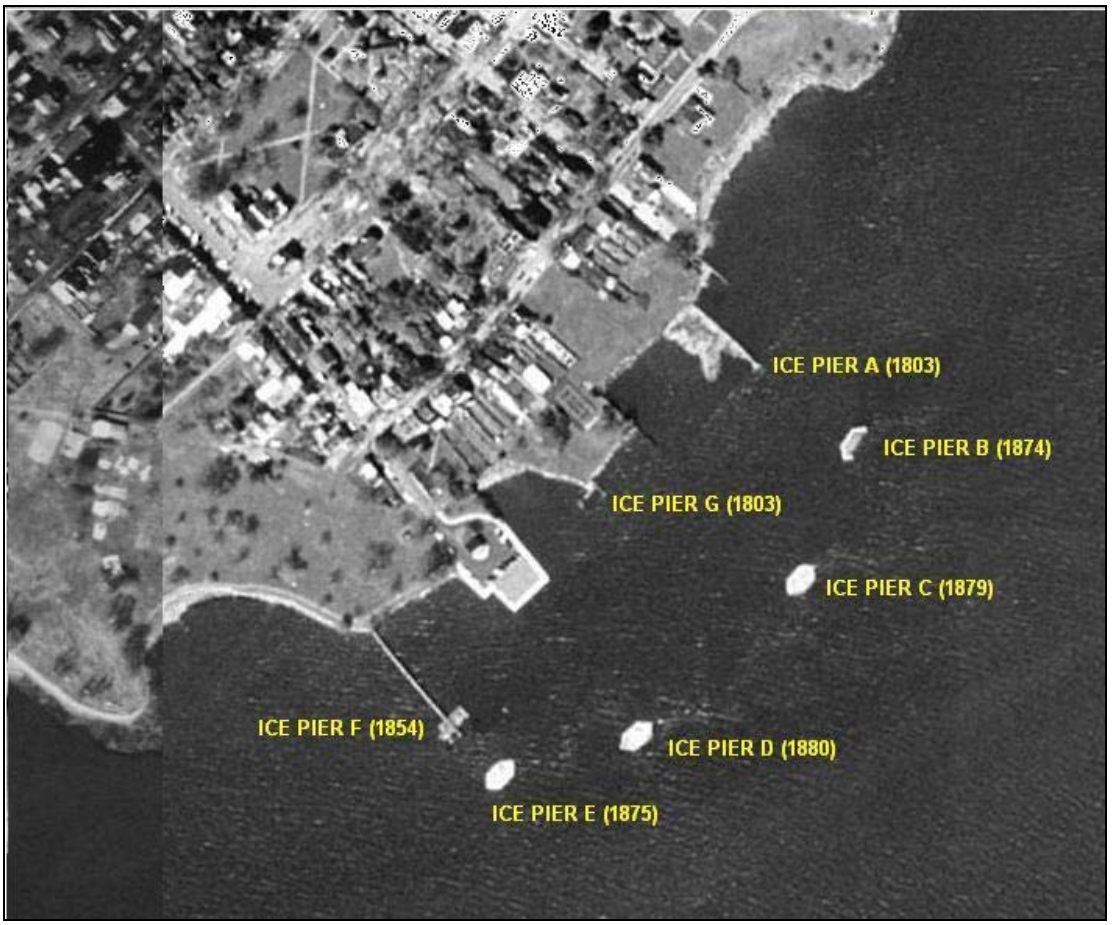


Figure 13. Aerial photograph of ice piers, with dates of construction and letter designations from National Register nomination.

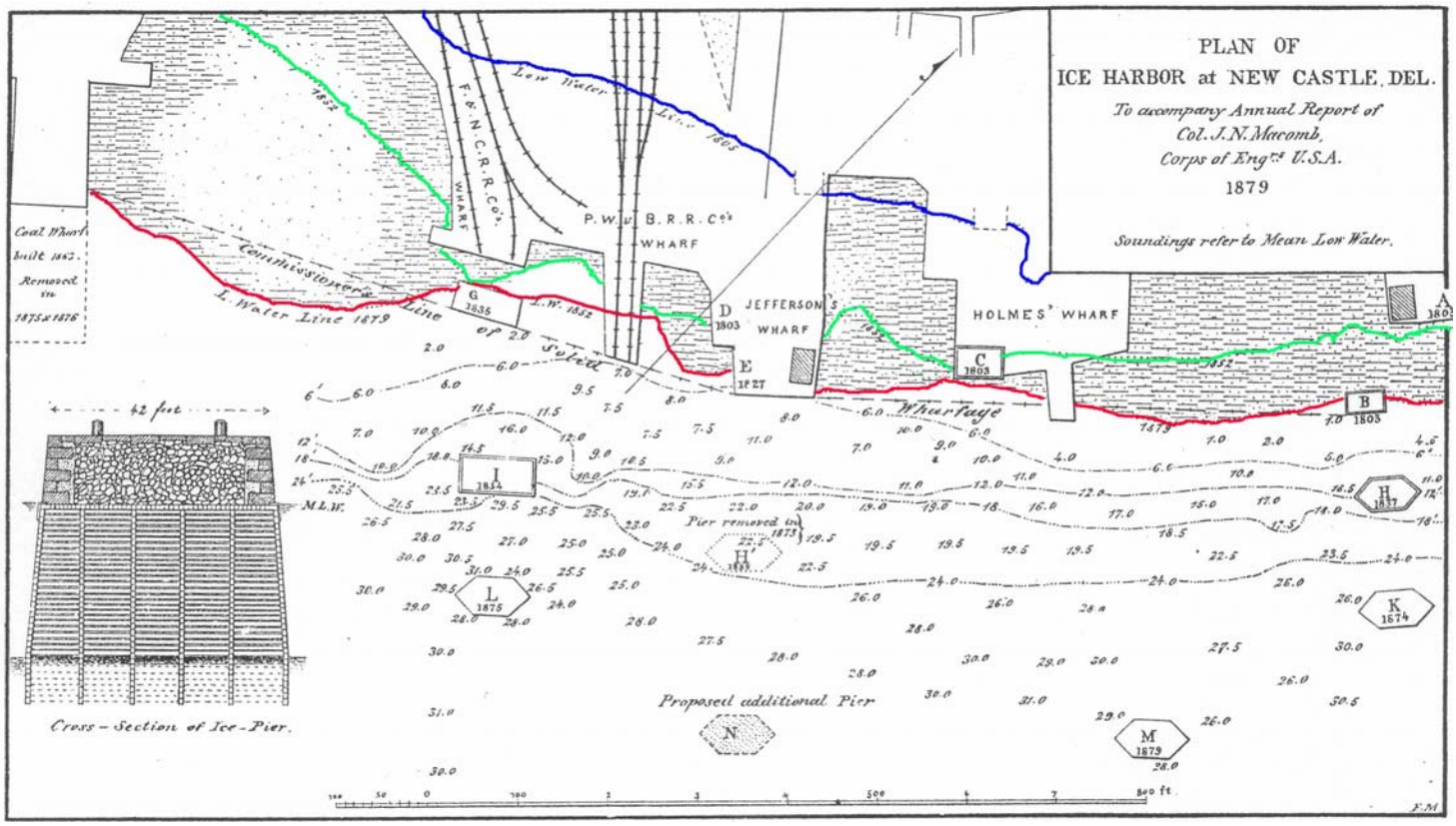


Figure 14. US Army Corps of Engineers diagram of the New Castle waterfront dated 1879.

Another Corps of Engineers map dated 1969 (Figure 15 on next page) shows a diamond-shaped ice pier in that general area. The position we obtained by GPS does not quite agree with that map either, nor does that map depict the southeastern 1803 pier ("G" on Figure 13, or "C" on Figure 14).

Figure 14 indicates that another, hexagonal pier (marked "H'") once lay directly off Jefferson Wharf but was removed in 1873. We did not find any scar or structure from that pier, but remnants might exist under the silt.

D. Shore team

The shore team conducted an extensive survey of the inner harbor within the inter-tidal zone along the waterfront from Battery Park in the southwest, to the old ferry dock in the northeast. Progressing from the modern fill areas shoreward, we surveyed the adjacent zone of tidal flotsam, through the *Spartina* marsh grass, to the shallow clay/mud flats, and out to the end of the clay zone, where the bottom drops off to depths well exceeding our maximum probe length of 8 feet. Surveys were conducted primarily under outgoing and low tidal conditions that allowed wading, snorkeling, and shallow water SCUBA diving.

Our survey consisted of probing into the river bottom with four- to eight-foot rods. A hand-held Fisher "M-Scope" magnetometer was also used to scan for metallic objects. We took GPS readings with a Garmin 12 unit to record the location of surface, submerged, and subsurface objects of historical potential. Digital photographs were made of the identified artifacts for reporting to the Project Archaeologist. All artifacts found, regardless of their identification as historically significant, were left in place where found after their documentation.

(1) Members of the shore team

Volunteers were organized according to the prevailing water conditions and the areas to be surveyed. They worked in teams of two to six volunteers to cover the areas in question. A flat-bottomed aluminum skiff and an inflatable boat were used for support during some of their shallow water work.

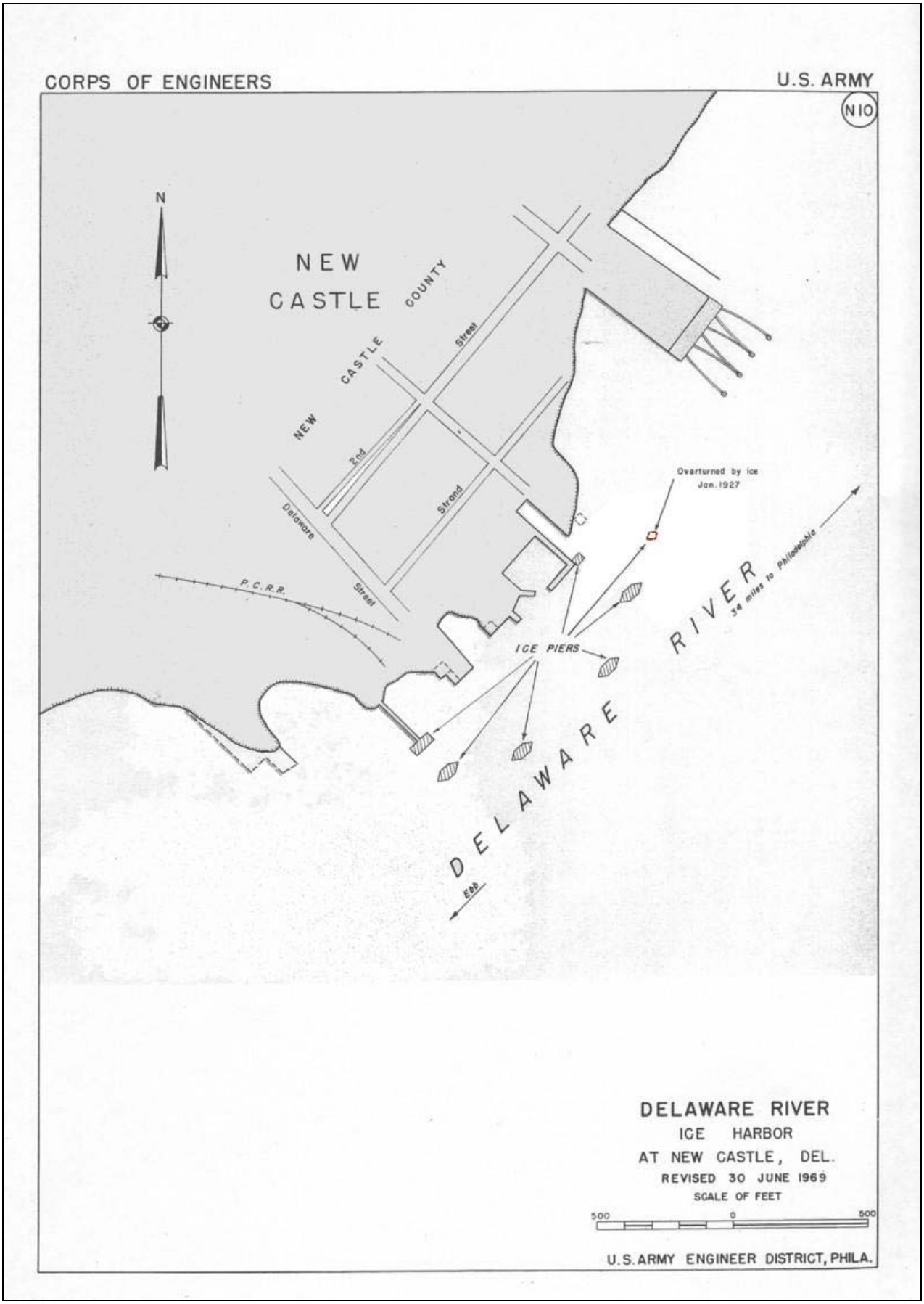


Figure 15. U.S. Army Corps of Engineers plan for ice piers, 1969. A diamond-shaped pier was overturned in 1927.

(2) Probe survey results

The boundary of the clay-mud transition along the river shoreline was plotted using GPS recordings by William Utley and Athena Trakadas. This boundary represents the line where the semi-solid bottom abruptly shifts to deep, unstable mud whose depth exceeds our longest probe (around 8 feet). These data were mapped on a Mylar overlay of the New Castle Harbor waterfront. See Figure 16 for those results.

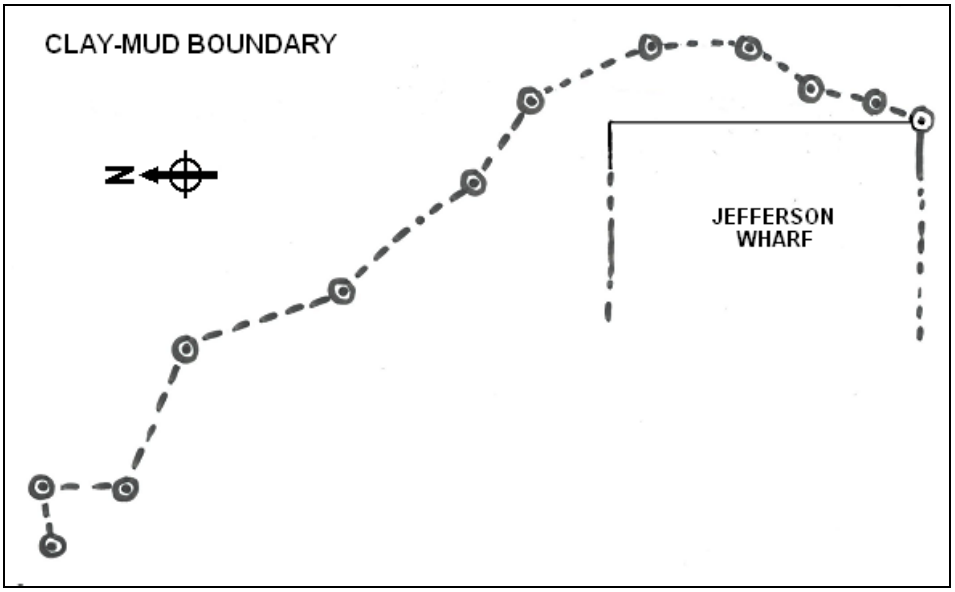


Figure 16. Plot of clay-mud transition boundary

The artifacts of potential historical importance identified and documented in the shoreline search included old red brick of various sizes, yellow brick, slate tiles, internally glazed earthenware pottery, whiteware dinner pieces (plates, cups, bowls), metal objects, brown and green glass bottle shards, and some hand-crafted wooden objects.

Metal distribution was determined using a hand-held magnetometer. We found that metal-bearing rocks were responsible for some of the strongest signals identified. In other instances, metallic objects such as spikes, copper sheeting, and aluminum plates were identified.

One interesting find was a small, rectangular, red brick that may have been used for decorative purposes around doorways and windows, especially in the Flemish pattern of brick design. (Figures 28 and 29) The yellow brick was thought to be Dutch, perhaps brought over on ships as ballast and used in the construction of houses and other buildings. The slate tiles may have been used for roofing, although flat slate pieces had many other applications from writing tablets to kitchen instruments. The pottery and dinnerware were those that would have been used for everyday serving and eating. None of the shards showed decorative patterns to suggest that they may have been display items, elaborate tableware, or fine quality dining ceramics.

Most of the artifacts found were located in the sediment to the river side of the grass beds and within inches of the surface. Some of these were even protruding from the mud.

The shoreline between the inner ice pier at the riverward extension of Alexander Alley (Church Alley) and the corrugated metal cribbing at Laird marina contained the greatest concentration and variety of artifacts. This area of coastline includes the historic Packet Alley landing where transshipment of cargo and passengers traveling from and between Wilmington, Philadelphia and Baltimore occurred. Because this was a heavily trafficked area, it is not surprising that this would be a concentrated area of old manmade objects.

Figure 17. Ceramic and roofing slate fragments from the Packet Alley site.

Figure 18. A fragment of yellow brick found at shore end of Harmony Street. These bricks were used as ballast in Dutch ships and later for construction of roads and buildings.

Figure 19. Another yellow brick fragment from the Packet alley site.

Figure 20. Worked stone (a railroad track keeper) and embossed red brick from the Packet Alley site.

Figure 21. Yellow brick, top view.

Figure 22. Yellow brick, side view

Fig. 23. Bottle fragment, top.

Figure 24. Bottle fragment, side view.

Figure 25. Bottle fragment, bottom view.

Figure 26. A ceramic shard from dinnerware at Packet alley site.

Figure 27. A river cobblestone and ceramic fragments from the Packet Alley site.

Figure 28. A small formed red brick with a central depression

Figure 29. Reverse of the small red brick, showing a charred edge.

Figure 30. A clay fragment containing the imprint of a fossil mollusc. This paleontological specimen found along the shore suggests that the clay sediment of the river bed was deposited as many as 380 million years ago (Weslager, 1944). The fossil imprint, less than one inch in diameter, is that of an ammonoid cephalopod (Kirchgasser, 2005). From the Packet Alley site.

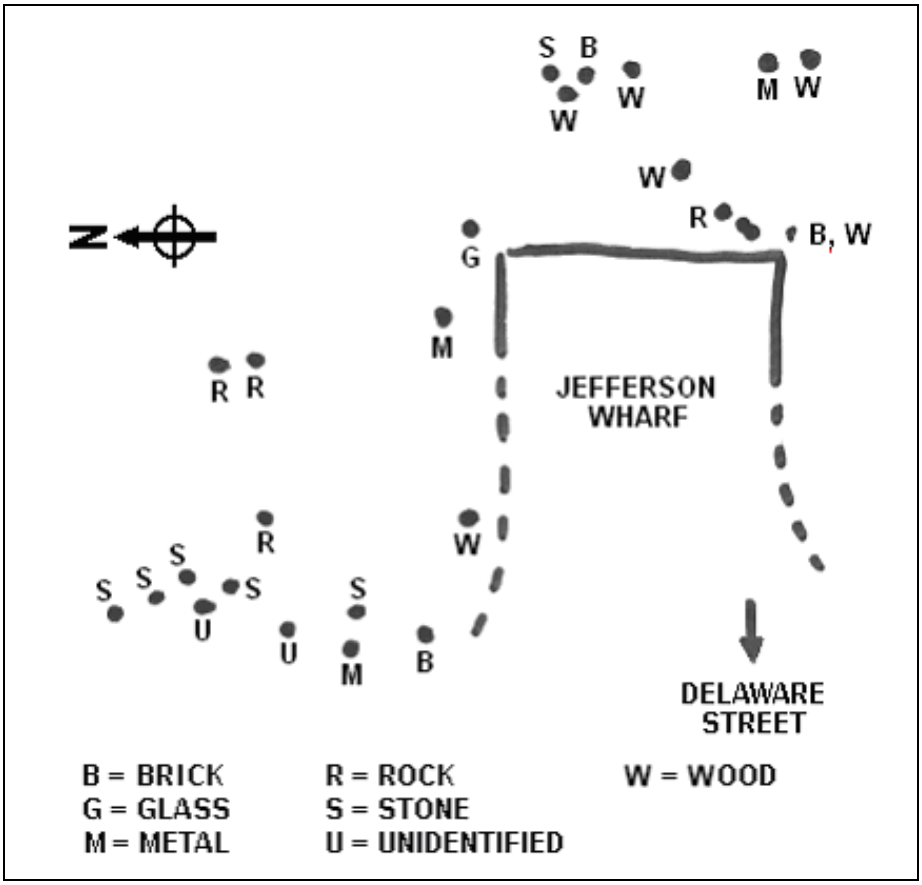


Figure 31. The general disposition of the artifacts found along the shore near the Delaware Street Pier.

(3) Wharf remains

In the Packet Alley landing area an extensive array of wharf pilings extending into the river was examined by the shore team. Direct measurements were made on the overall dimensions of the pilings and on several of the inter-piling distances. The association of the L-shaped wharf pilings with shore support timbers and wooden buttressing at the shoreline was also documented in photographs. These details were most evident at low tide. A map of the assembly of wharf pilings is shown in Figure 32.

The wharf consisted of a major broad portion oriented directly out into the river, with a lateral narrower and shorter extension from the outer northern face of the complex. The corner pilings throughout the entire structure were reinforced in triplicate, but all other internal and intermediate pilings were individually placed. The spacing between the pilings averaged approximately 3.0 meters. The large rough timbers lying parallel to the end of the pilings were stacked on top of one another and anchored by long metal spikes. The heads of the spikes resembled truncated pyramids in shape. Several isolated spikes were pointed at their opposite ends.

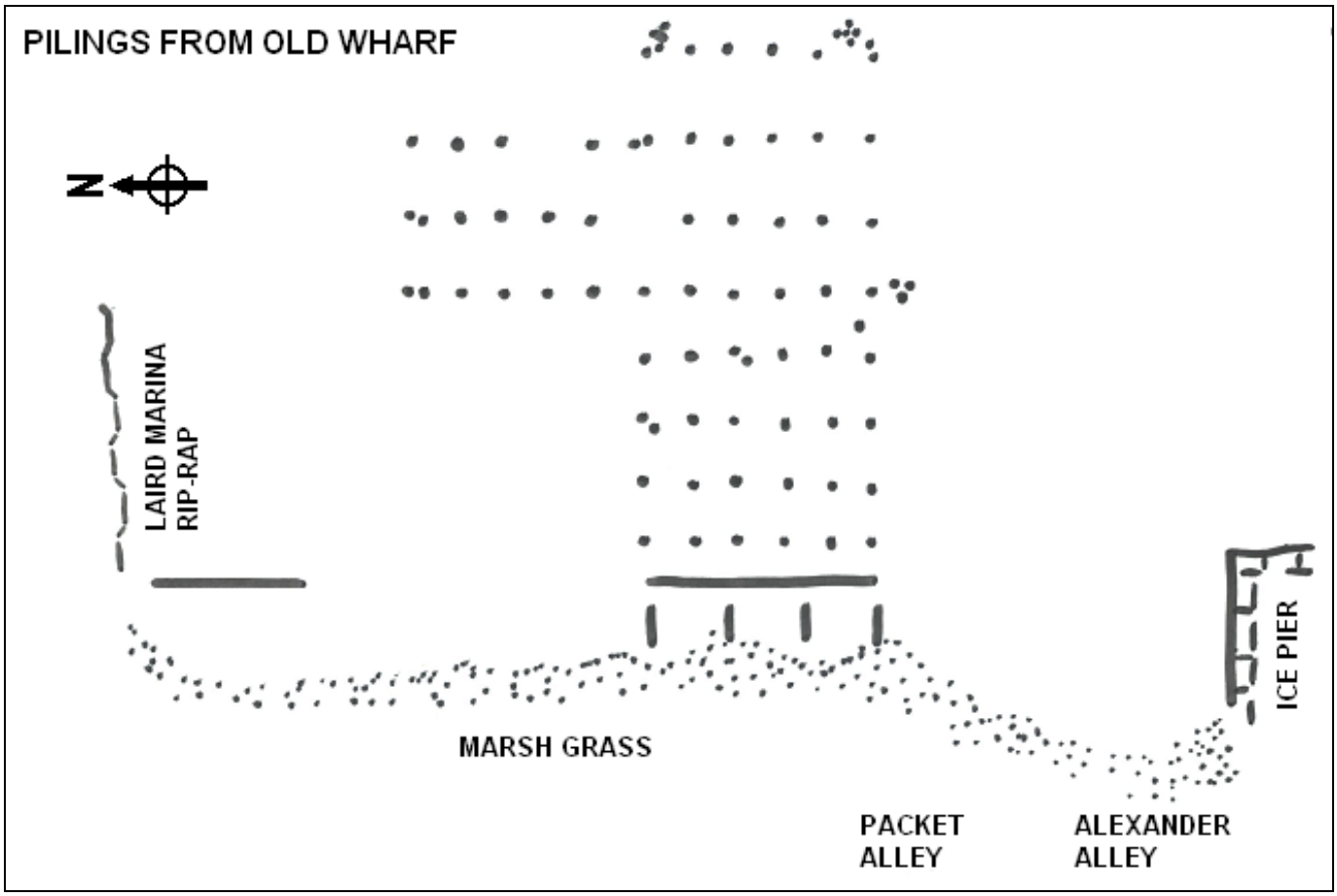


Figure 32. Diagram to scale showing vertical wharf pilings in Packet Alley area.

Figure 33. A foot-long spike dislodged from the horizontal timbers along the shore side of the pilings. The head of this spike is pyramidal, as seen in Figure 34.

Figure 34. A horizontal timber with a spike in place from the Packet Alley site. Two red bricks lie in the sediment above the timber. The larger one is modern; the smaller one may be older and be a decorative brick used in a Flemish design pattern.

Figure 35. Exposed pilings in an L-shaped arrangement at the Packet Alley site. Ice pier "C" is visible in the background.

Figure 36. Looking upriver to the north to show the relationship between the pilings and remnants of the Laird marina to the left of the field. Ice pier "B" is seen in background.

A set of deeply set, large, rough timbers of comparable thickness to the parallel shore timbers were angled at ~30º toward the pilings of the main wharf (Figure 37). Whether this set of timbers supported an inclined ramp from shore, or represented a shallow water reinforcement of the wharf proper, is not known.

Figure 37. The shore timber assembly looking downriver to the south. The inner ice pier "G" at the end of Alexander Alley is seen to the upper right of the field. Note the horizontal and diagonal wharf timbers.

With the exception of the ice pier adjacent to Battery Park, all others ice piers of the inner set are connected directly to shore by land fill. The Battery Park inner ice pier was measured to be about 110 to 115 meters from the shoreline of the Park. This distance may have been the approximate separation from the shoreline for the other inner ice piers several centuries ago. Prior to 1701 there were no houses on the river side of The Strand. However, lots were later extended from The Strand for 600 feet into the Delaware River. These long, narrow lots are recorded in State land records. We assume that once the properties were sold, these lots were developed into home sites, and the gardens and lawns were extended by dumping fill and topsoil into the river.

(4) Battery Park Cribbing

Off the point that extends into the river from the southern end of Battery Park, near the flagpole, is an extensive cribbing that was mapped by two members of the shore team. Several SCUBA dives were made on this site after it was discovered on sidescan by the boat team. Initial measurements were made underwater to determine the spacings of timbers and the subjacent metal cribbing of this assemblage. Photographs of portions exposed at low tide follow as Figures 38 to 45. Sketches by Michelle Damian and Athena Trakadas follow as Figures 46 and 47.

The cribbing consists of sets of timbers laid alternately parallel and perpendicular to shore on 5-foot centers. In some cases the timbers are notched into each other; in other cases they are simply laid and spiked. The interstices are filled with stone rubble.

Figure 38. Edge of wooden cribbing and gravel surface.

Figure 39. Another view of wooden cribbing

Figure 40. As tide comes in, the cribbing is submerged.

Figure 41. Cribbing viewed to the north. Ice pier F to left.

Figure 42. Cribbing further exposed.

Figure 43. Shore cribbing

Figure 44. Looking east toward Battery Park.

Figure 45. Detail of stacked timbers in cribbing

Additional cribbing was found throughout the grass beds extending below Battery Park. This cribbing may have at one time supported piers, wharves, or other structures. The cribbing may also have been installed to retain landfill added to extend shoreline properties toward the river.

One consequence of these installations of cribbings has been to promote silt deposition along the shoreline. Shifting sediment during tidal exchanges has led to erosion of the outer wall of several of the ice piers and to siltation that builds up behind the cribbing. This has contributed to the loss of water clarity in the river and is responsible for the very soft bottom found by the survey team along the shore.

(5) Channels between ice piers

Several SCUBA dives were made by members of the shore team to sample the bottom configuration between the inner and outer ice piers. These channels could only be dived under slack water conditions, because the current reached levels of about three knots as the tide came in or went out. It was impossible for a diver to maintain stability or conduct circle searches under such high velocity flow.

Our initial attempts to run a line from the inner to the outer ice piers proved to be unsuccessful, because the line was constantly stressed and often broken due to the rapid tidal flow. Vertical lines could not be attached to this horizontal line with any reliability. We eventually dived in the channel by mounting a mushroom anchor to a float for descent and orientation of the diver. The line was close to 30 feet long because the depth, even at low tide, was nearly 20 feet. Zero visibility conditions prevailed at depth. Hence, searches were conducted by feeling objects on the bottom.

The bottom was covered with gravel and was firm to the touch, although soft mud and silt were confronted as the ice piers were approached. On the bottom were scattered mollusk shells, massive wooden timbers, large stones, and assorted unidentified heavy objects. Small objects, if close by, were difficult to identify or differentiate. The opportunity for divers to survey this area was limited by obstructions from natural objects and by the lack of visibility. Hence, we did not spend much time exploring this zone. In the event that a subsequent survey of the intervals between ice piers is requested, water turbidity and current would dictate the best ways to proceed.

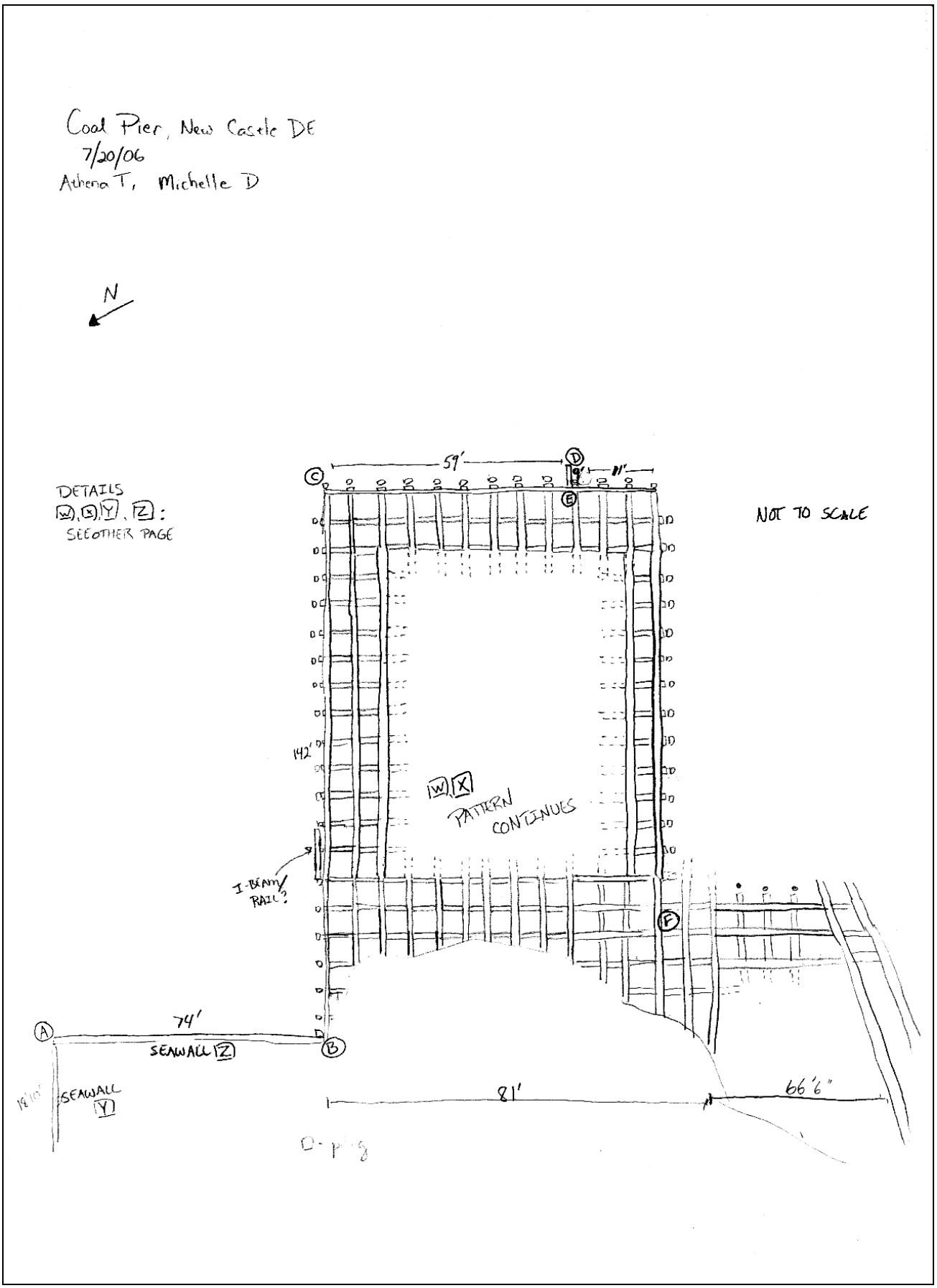


Figure 46. Overview sketch of Battery Park wooden cribbing arrangement.

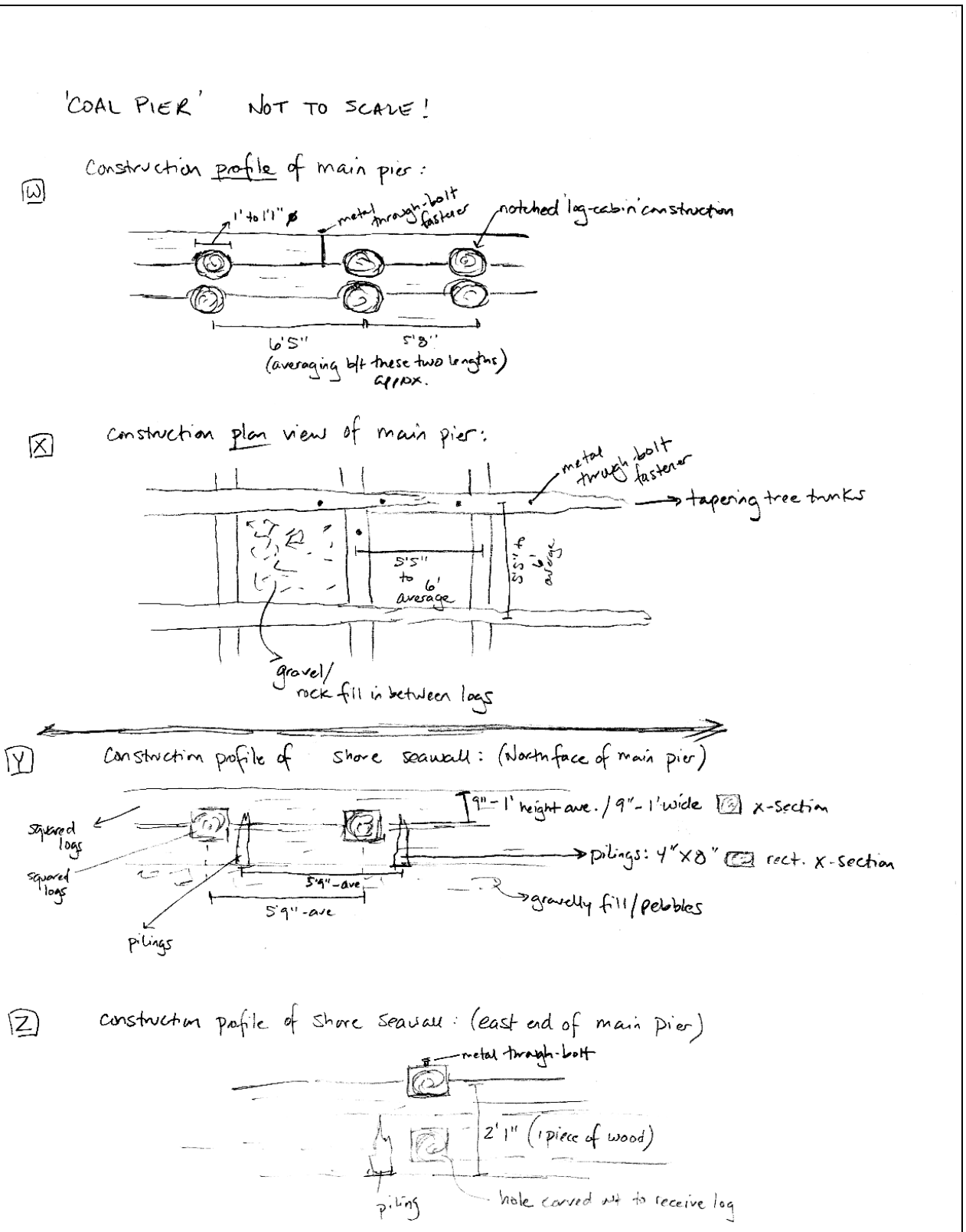


Figure 47. Rough sketches of construction detail in the wooden cribbing along Battery Park waterfront.

SECTION 4. DISCUSSION

Several major findings have resulted from this harbor reconnaissance project: First, we were able to locate and describe the ice pier that was lost during the winter of 1927. Images from our sidescan sonar record indicate that this structure was diamond-shaped, and was therefore uniquely configured in comparison to the other, hexagonal ice piers. We were unable to determine whether other construction details were similar to the extant ice piers in the harbor. However, that objective might be considered as an objective for a subsequent survey.

We identified vertical pilings from a wharf construction in the extended Packet Alley region of the shore. We also identified an area of extensive wooden cribbing off Battery Park. Reference to an 1858 map (Figure 48) reprinted in the New Castle Historical Society's summary of New Castle (Cooper, 2001) suggests an identity for both of these structures. As shown in the following outline from that map, the former might be remnants of the Holmes Wharf and the latter might be the PW&B Railroad Company wharf.

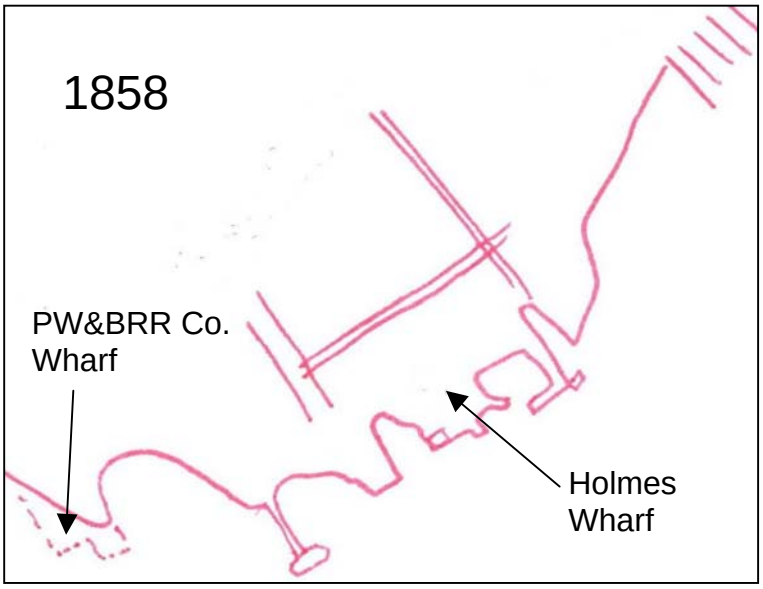


Figure 48. An outline of a map of the New Castle harbor dated 1858 showing a wharf owned and operated by the PW&B Railroad Company that corresponds in position to the Battery Park cribbing, and another wharf, the Holmes Wharf, corresponding in position to the pilings found at the extension of Packet Alley. From Cooper (2001), p. 115.

Data collected during this survey suggest that historical artifacts may have been displaced from their point of origin along the coast. The forceful movement of the waters of the Delaware River combined with the heavy accumulation of soft muddy sediment and erosion of landfill deposited by property owners have buried or removed these artifacts from exposure in the immediate harbor area. If artifacts are buried they are protected and cannot be accessed without extensive intrusion through several feet of surface mud and subsurface clay deposits. Digging below the surface was not proposed for this preliminary, non-invasive, Phase I survey, but digging might be appropriate for consideration in subsequent surveys. If such artifacts have been degraded or removed by natural events, their fragmentary remnants are scattered along the river bed at considerable depths of mud and clay. Therefore, they may lie beyond the zone of influence of shoreline development or surface construction.

If Phase II excavation within the intertidal zone were approved by the state archaeological office, this might be done in two ways. First, randomly placed sample cores of up to 12 inches in diameter might be taken through the entire thickness of mud and clay sediment. These cores might then be extracted and examined for artifacts. Our survey data suggest that the area at the end of Packet Alley surrounding the wharf pilings in that section of the New Castle waterfront appears most appropriate to conduct a coring survey.

Second, a miniature cofferdam, several feet in width, could be inserted down to a solid subsurface of clay. Placement of such a structure would be appropriate in the Packet Alley extension surrounding as well as among the wharf pilings. The overlying water and mud within the dam could be slowly pumped out and screened for small artifacts as the opening deepens. Once reached, the clay base of this pit could be examined carefully for larger artifacts. These two minimally invasive procedures (coring and cofferdamming) would allow detailed exploration

of the deep sediment of the intertidal zone and might enable discovery of intact historical cultural resources from earlier periods than we have been able to identify in this non-invasive, surface survey.

Another suggestion for further work, if desired by state officials, would be to re-examine the same shore area during a late fall or winter blowout. An extremely low tide would be expected to uncover additional riverbed surface area and may dry out the sediment to make wading through the mud and on the clay easier and safer for the survey team. This would allow subsurface probing and may uncover additional artifacts.

Our experience in surveying this historic site supports such additional study. Potential findings would be a valuable addition to the restoration activities that have been developed in the historic district of New Castle. Displays currently in place at the Amstel house, the Old Dutch house, and the Reed house, although representative of the historic period, do not include many archaeological specimens from the town. No submerged archaeological resources from the period of early settlement by the Dutch, the Swedes, or the English are currently on exhibit.

This first organized underwater survey conducted in the harbor area has been very encouraging and informative. However, we envision that additional underwater surveys might uncover significant archaeological evidence to provide a basis for a display of submerged artifacts from New Castle harbor to reflect activities there during both the formative and commercial periods.

SECTION 5. REFERENCES CITED

Charles, J.D. 2003. *New Jersey, Delaware, Pennsylvania Shipwreck Accounts, 1705 to 1950.* Joan D. Charles, Hampton, VA.

Cooper, C.J. (Ed.) 2001. *350 Years of New Castle, Delaware, Chapters in a Town's History*. New Castle Historical Society, Cedar Tree Books, Wilmington, DE.

Kirchgasser, W. 2005. *On the Trail of Devonian Goniatite Cephalopods in New York State*. American Paleontology 13:22-25.

Weslager, C.A. 1944. *Delaware's Buried Past.* Rutgers University Press, New Brunswick, NJ.

SECTION 6. ACKNOWLEDGMENTS

We extend profound thanks to the residents and officials of New Castle, especially the City Administrator, Mrs. Cathryn Thomas; Mrs. Bruce Dalleo of the New Castle Historical Society; Dr. James L. Meek; the Archaeological Society of Delaware; Mrs. Daisy Miller of the Rodeway Inn; Mrs. Deemer of the Terry House; Chief Bill Simpson of the Good-Will Fire Company; and Mr. and Mrs. Carpenter of the *New Castle Weekly,* for their hospitality and enthusiastic support.

Respectfully submitted,

INSTITUTE OF MARITIME HISTORY

Samuel P. Turner, Ph.D.	Raymond L. Hayes, Ph.D.	David P. Howe
President	Project Coordinator	Project Manager

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APPENDIX 1. GPS DATA RECORDS.

A. <u>Offshore points</u>:

ICE PIER "A" (1803)	NE corner	39° 39.538' N	075° 33.583' W
	NW corner	39° 39.540' N	075° 33.586' W
	SW corner	39° 39.535' N	075° 33.591' W
	SE corner	39° 39.533' N	075° 33.588' W
ICE PIER "B" (1874)	corner 1	39° 39.517' N	075° 33.536' W
	corner 2	39° 39.517' N	075° 33.543' W
	corner 3	39° 39.512' N	075° 33.548' W
	corner 4	39° 39.506' N	075° 33.547' W
	corner 5	39° 39.507' N	075° 33.543' W
	corner 6	39° 39.516' N	075° 33.539' W
ICE PIER "C" (1879)	corner 1	39° 39.470' N	075° 33.561' W
	corner 2	39° 39.470' N	075° 33.567' W
	corner 3	39° 39.464' N	075° 33.576' W
	corner 4	39° 39.459' N	075° 33.573' W
	corner 5	(collapsed)	
	corner 6	39° 39.466' N	075° 33.561' W
ICE PIER "D" (1880)	corner 1	39° 39.414' N	075° 33.632' W
	corner 2	39° 39.414' N	075° 33.638' W
	corner 3	39° 39.410' N	075° 33.646' W
	corner 4	39° 39.406' N	075° 33.647' W
	corner 5	39° 39.406' N	075° 33.641' W
	corner 6	39° 39.410' N	075° 33.635' W
ICE PIER "E" (1875)	corner 1	39° 39.401' N	075° 33.695' W
	corner 2	39° 39.302' N	075° 33.701' W
	corner 3	39° 39.397' N	075° 33.707' W
	corner 4	39° 39.392' N	075° 33.707' W
	corner 5	39° 39.392' N	075° 33.701' W
	corner 6	39° 39.397' N	075° 33.695' W
ICE PIER "F" (1854)	NE corner	39° 39.492' N	075° 33.653' W
	NW corner	39° 39.496' N	075° 33.658' W
	SE corner	39° 39.488' N	075° 33.662' W
	SW corner	39° 39.492' N	075° 33.666' W
ICE PIER "G" (1803)	NW corner	39° 39.423' N	075° 33.714' W
	NE corner	39° 39.417' N	075° 33.714' W
	SE corner	39° 39.407' N	075° 33.723' W
	SW corner	39° 39.411' N	075° 33.727' W

APPENDIX 2. PROJECT SCHEDULE.

Sat., 15 July:	1050	*Roper* departed home port, Tall Timbers, Maryland
Sun., 16 July:	0620	*Roper* sidescanned the east side of Pea Patch Island, with no findings.
	0715	*Roper* docked at New Castle.
	0900	Crew mustered at Battery Park, New Castle.
	1030	*Roper* ran sidescan search lanes from outer ice piers to shipping channel
	1030	Shore team reconned and magged inside the outer ice piers, from the 1852 pier (F) around the Delaware Street pier to the westernmost 1802 ice pier (G). They found indeterminate timbers and a variety of artifacts including brick and small metallic objects.
	1312	Steinmetz and Taylor dived "18 OBSTN," found tree, barrel stave.
	1630	*Roper* docked.
Mon., 17 July:	1015	*Roper* underway with Damian, Howe, Knoerl, Leverett, Smith, Wigton
	1030	*Roper* scanned for scar of ice pier that was removed in 1874, did not find it, but found another pier that was destroyed by ice in January 1927. Damian and Knoerl dived and mapped it.
	1000	Shore team searched from Wilson Ferry pier to eastern 1802 ice pier (A); found yellow brick, ceramics (English whiteware, earthenware), wine bottle (18th century?), decorative red brick, modern junk -- all jumbled and probably landfill.
	1100	Smith and Wigton dived "18 OBSTN" again, found mud.
	1245	Damian, Knoerl, Smith and Wigton dived sunken ice pier.
	1345	*Roper* docked.
Tue., 18 July:	1000	*Roper* underway with Howe, Larimore, Leverett, Smith, Utley. Towed Damian, Hayes, and Trakadas in skiff to Laird marina.
	"	Shore team reconned and magged from marina to the western 1802 ice pier ("G"), found yellow brick, red brick, roofing slates, cobblestone, railroad sleepers, bottles, ceramics (rectangular bowl, dinnerware), wharf foundation at foot of Packet Alley. Got GPS numbers for both of the 1802 piers, and the 1854 pier.
	1015	*Roper* scanned the cove below the flagpole, found old coal pier on sidescan (Figures 38 et seq.); Smith dived "60" (mussels) and "61" (bricks). Weather very hot (104° F).
	1200	Shore team mapped clay ledge from Alexander (Church) Alley to Packet Alley.
	1222	*Roper* docked; cleaned seawater strainer.
Wed., 19 July:	0700	*Roper* underway with Damian, Howe, Leverett, and Trakadas.
	0730	Damian and Trakadas dived "64," found nothing
	0810	Damian and Trakadas dived and mapped coal pier.
	0850	*Roper* docked.
	1000	All teams toured Amstel House, Old Dutch House, courthouse, and Read House; ate lunch at The Arsenal courtesy of the Archaeological Society of Delaware
	1620	*Roper* underway to get GPS numbers of outer ice piers. Shore team mapped Packet Alley wharf.
	1700	*Roper* docked.
Thur., 20 July:	0742	*Roper* underway with Berkey, Damian, Howe, Leverett, and Speir.
	0830	*Roper* scanned coal pier; Hayes and Trakadas dived and mapped it.
	0936	Berkey, Damian, and Speir mapped sunken ice pier.
	1025	*Roper* docked.
	1430	Shore team reconned off Packet Alley, and continued mapping coal pier.
Fri., 21 July:	0945	*Roper* underway with Howe, Leverett, Speir, and Wigton. Speir and Wigton dived "18 OBSTN" again, found tree. Completed all sidescan search lanes.
	1200	*Roper* docked.

Sat., 22 July: 1014 *Roper* underway. Pierce and Steinmetz dived "18 OBSTN" again, identified it as a large metal pipe.
1223 *Roper* docked.
1710 *Roper* departed New Castle.

Sun., 23 July: 1250 *Roper* arrived at Tall Timbers, Maryland.

APPENDIX 3. SURVEY PARTICIPANTS

Principal Investigator: Craig Lukezic, M.A. Project Manager: David P. Howe, J.D.
Project Coordinator: Raymond L. Hayes, Ph.D. Researcher: James L. Meek, Ph.D.

day / name / date (July 2006)	Sat 15	Sun 16	Mon 17	Tue 18	Wed 19	Thu 20	Fri 21	Sat 22	Sun 23	diver	archaeological training *
Craig Lukezic		A	A	A	A					yes	pro
Scott Emory		D	D							yes	pro
T. Kurt Knoerl		D	D							yes	pro
Athena Trakadas		C	C	C	C	C	B			yes	pro
Thomas J. Berkey						C	C			yes	avo
Jack Cooper					C	C				yes	avo
Michelle Damian		B	B	B	B	B	B			yes	avo
Raymond L. Hayes, Ph.D.		C	C	C	C	C	C			yes	avo
David P. Howe	B	B	B	B	B	B	B	B	B	yes	avo
Isabel Mack								B		yes	avo
Kirk Pierce								B	B	yes	avo
Michelle Ryan		C								yes	avo
Robert A. Speir					B	B	C			yes	avo
Joyce Steinmetz		B					B	B		yes	avo
William I. Taylor, II										yes	avo
William E. Utley		D	D	C	C					yes	avo
Steven Smith			B	B	B	B	B			yes	avo
John Wigton		B	B				C	B		yes	avo
Bill Driscoll		D								no	no
Lexie Driscoll		D								no	no
David Fowler	B									no	no
Andrew Larimore		C	C	C						yes	no
Theodore Leverett	B	B	B	B	B	B	B	B	B	no	no
Timothy Manuelides, Esq.		C								yes	no
James L. Meek, Ph.D.		A	A	A	A	A	A	A		no	no
Kenneth Oppenheimer		C								yes	no
A Supervisors		**2**	**2**	**2**	**2**	**1**	**1**				
B Boat Team	**3**	**6**	**5**	**4**	**5**	**5**	**6**	**6**	**3**		
C Shore Team 1		**5**	**3**	**4**	**4**	**4**	**4**				
D Shore Team 2		**5**	**3**								
TOTAL 85 MAN-DAYS	**3**	**18**	**13**	**10**	**11**	**10**	**11**	**6**	**3**		**4 pro, 14 avo**

* "pro" = Holds an M.A. degree or otherwise meets Interior standards for designation as a Principal Investigator.
"avo" = Has substantial training and field experience as an avocational in underwater archaeology.