

APPENDIX A

Christina Riverwalk, Phase III & IV;
Market St. To Public Works Building;
City Of Wilmington, New Castle County, Delaware

**PHASE I
SUBMERGED CULTURAL RESOURCES
INVESTIGATION**

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TABLE OF CONTENTS

1.0 Introduction	1
2.0 Geographical Setting	2
3.0 Historical Background	2
3.1 Research Methods	2
3.2 Historical Overview	4
3.2.1 Shipbuilding	6
3.2.2 Steamboats & Shipping	9
4.0 Cultural Resources Potential	11
4.1 Criteria of Evaluation	11
5.0 Survey Investigations	12
5.1 Fieldwork Methods	12
5.2 Fieldwork Findings	14
6.0 Summary and Recommendations	16
7.0 References Cited	17

Figures

1.0 INTRODUCTION

The following technical report describes a Phase 1 Submerged Cultural Resources Investigation that was performed in conjunction with Construction Phases III & IV (Market St. to the Public Works Building) of the Christina Riverwalk Project, Christina River, Wilmington, New Castle County, Delaware. (Figure 1). This work was performed for Rummel, Klepper, & Kahl, LLP (RK&K) by Dolan Research, Inc. (DR), in connection with the improvement and development of the northern bank of the Christina River in Wilmington. The submerged cultural resources investigation involved a remote sensing survey designed to locate targets associated with submerged historic and archaeological sites adjacent to the Christina River northern shoreline from Market Street to the Public Works Building in Wilmington.

Project tasks performed included: background and documentary research; magnetic and acoustic remote sensing with follow-up target analysis; analysis of assembled research and field data; and preparation of this report. The purposes of these investigations were twofold: to determine the presence or absence of potentially significant submerged or shoreline cultural resources; and secondly to assess likely project impacts and make recommendations as to the need for further submerged cultural resources studies.

These investigations were conducted in accordance with the instructions and intents of various applicable Federal and State legislation and guidelines governing the evaluation of project impacts on archaeological resources, notably: Section 101(b)(4) of the National Environmental Policy Act of 1969; Section 1(3) and 2(b) of Executive Order 11593; Section 106 of the National Historic Preservation Act; 23 CFR 771, as amended October 30, 1980; the guidelines developed by the Advisory Council on Historic Preservation published November 26, 1980; the amended Procedures for the Protection of Historic and Cultural Properties as set forth in 36 CFR Part 800 (October 1, 1986); and Executive Order 215.

Analysis of fieldwork data confirms the presence of no targets associated with potentially significant submerged cultural resources within the Christina River Project Area. No additional underwater archaeological investigation is recommended for the Riverwalk development along this section of the Christina River.

2.0 GEOGRAPHICAL SETTING

The study area is located adjacent to the Christina River northern shoreline in Wilmington, New Castle County, Delaware. It extends approximately 1,500 feet west from the Route 13 (Market Street) Bridge. The Christina River rises in New Castle County, flows northeasterly 16 miles, passing through Wilmington and empties into the Delaware River at a location approximately 85 miles upstream from its confluence with the Atlantic Ocean and 29 miles below Philadelphia. At the study area, the Christina River is approximately 300 feet wide and follows a broad, sweeping curve from the southwest to the northeast as it flows downstream through Wilmington. The study area is approximately 2.5 miles upstream from the mouth of the Christina River. The Christina River Basin covers about 565 square miles in northern Delaware, extreme southeastern Pennsylvania, and the northeastern corner of Maryland. It includes portions of Chester, Delaware, and Lancaster Counties in Pennsylvania, New Castle County, Delaware, and a small portion of Cecil County, Maryland. The principal tributaries of the Christina River are White Clay Creek and Brandywine Creek (U.S. Army Corps of Engineers, 1974).

The Army Corps of Engineers maintains a navigable channel in the Christina River to Newport, Delaware,

approximately 10 miles above the Delaware River ship channel. Water depth in the Christina River shipping channel varies from 35 ft. near the Delaware River channel to seven ft. upstream at Newport, Delaware. At the project area the river depth is maintained at 21 ft. From a point 4.2 miles from the Delaware River channel, water depth in river decreases to seven ft. A seven ft. depth is maintained in the river from that point upstream to head of navigation on the river at Newport, Delaware, approximately 10 miles from the Delaware River channel (U.S. Army Corps of Engineers, 1962). The Christina River is tidal at the project area, with an average tidal range of 5.5 ft. between high tide and low tide.

3.0 HISTORICAL BACKGROUND

3.1 Research Methods

A wide variety of information sources were consulted for this study. Basic information sources routinely examined for all aspects of submerged cultural resources work in Delaware include: the site maps, files, technical reports, and planning documents held by the Delaware State Historic Preservation Office and the Delaware State Museum; archival data held by the Delaware State Archives and the Historical Society of Delaware; and materials held by the U.S. Army Corps of Engineers, Philadelphia District (COE). Local and county libraries and historical societies were also visited by project personnel during the course of background research.

Project personnel contacted local archaeologists, watermen, sport and commercial divers, knowledgeable professional and avocational historians, and interested lay persons with knowledge of Delaware maritime history. Primary and secondary sources, maps and atlases pertaining to the maritime history of Delaware were examined at maritime institutions, federal, state and local libraries and historical societies. At the National Archives, a variety of record groups containing information on shipwrecks, ship construction, naval activity, and maritime trade activities were consulted. Site specific research, pertaining to individual vessels was conducted at the Independence Seaport Museum, the Historical Society of Pennsylvania, and the Steamship Historical Society in Baltimore. Other national and regional repositories visited in conjunction with the maritime historical research include the Cartographic Branch of National Archives, Library of Congress, the Free Library of Philadelphia, University of Pennsylvania's Van Pelt Library as well as the various Delaware State agencies and COE offices noted above.

Documentary data were used to provide a framework for identifying submerged historic archaeological resources which may have been deposited within the borrow area, and to determine the extent of subsequent activities that may have removed or disturbed such resources. Historic and maritime activities in the Christina River were therefore researched and documented. Both primary and secondary source materials, including historic maps and charts, were consulted to provide data on local and regional historical developments, while local residents and other experts on Delaware history and archaeology were also contacted.

The emphasis of background research focused on maritime activity in the project vicinity. A broad-based historic overview was included as part of the write up for the terrestrial archaeological portion of this project (MAAR Associates, Inc., 1998). Historic maps, secondary and primary shipwreck lists, primary historical accounts, newspapers, and county and thematic histories were all used to develop a set of expected submerged resources within the project area.

Shoreline and submerged historic resources were considered with reference to the Delaware Comprehensive

Historic Preservation Plan (Ames et. al. 1989) and the ongoing state preservation planning process. Of particular relevance to the current study is the recently developed historic archaeological context on the Maritime Theme in Delaware with the Sub-Theme Shipwrecks, Coastal Zone (Koski-Karell 1995). Other relevant studies include; an historic context on aids-to-navigation prepared for Delaware (Paul 1989), a survey of all remaining aids (Ames et. al. 1991) and an archaeological survey of the Bombay Hook Lighthouse (De Cunzo and Silber 1992).

The context of shipwrecks relates to the following themes identified in the Delaware Comprehensive Historic Preservation Plan: Fishing and Oystering; and Transportation and Communication. Shipwreck episodes in the Delaware Bay occurred during all five chronological periods established in the Delaware Plan (1630-1940). The context of navigational aids relates to the following themes identified in the Delaware Comprehensive Historic Preservation Plan: Fishing and Oystering; Transportation and Communication; and Architecture, Engineering, and Decorative Arts. Navigational improvements in the Delaware Bay occurred during the third, fourth and fifth chronological periods established in the Delaware Plan (1770-1940). The context of regional shipping activities in and around Delaware Bay relates to the following themes identified in the Delaware Plan: Agriculture; Fishing and Oystering; Retailing and Wholesaling; and Transportation and Communication. Regional shipping patterns in Delaware Bay were an important feature of commerce during all five chronological periods established in the Delaware Plan (1630-1940).

3.2 Historical Overview

Historic activity in Delaware Bay dates to 1609 when Henry Hudson first discovered the Bay while surveying the northeast coast of North America for the Dutch East India Company. Hudson noted the entrance of Delaware Bay, but did not explore up into the upper Bay and River. His observations of Delaware Bay were recorded and eventually stimulated a significant interest in additional exploration, trade, and colonization of the region. In 1614 the State General of Holland granted the merchants of Amsterdam and Hoorn exclusive privileges to trade between forty and forty-five degrees of latitude in an area identified as the territory "New Netherlands." The first Dutch explorers came to Delaware Bay from New Amsterdam (New York City) in October 1614. By decree from the Hague, October 11, 1614, the owners of five Dutch ships were authorized to establish the United Company of Merchants with the exclusive rights to explore the area between New France in the north and Virginia to the south. Captain Cornelius Hendrickson was one of the first to explore the bay aboard the *Onrust* (Restless). Captain Hendrickson produced the first chart of Delaware Bay and River in 1615. Included in a brief report submitted to the Dutch merchants, Hendrickson claimed to have found "certain lands, a bay and three rivers situated between 38 degrees and 40 degrees" (Weslager, 1961; p. 45). Soon the Dutch merchants set up trading stations and settlements at various locations along the banks of Delaware Bay and River. In 1623, the Dutch East India Company constructed the first of several fortifications on the east shore of the bay.

Swedish explorers were also active in the Delaware Bay region. In 1629 the Swedish West Indian Company purchased from the Indians a two mile wide tract of land on the west side of the bay which extended 32 miles from Cape Henlopen north to a location above present Bowers Beach, Delaware. Although the purchase was ratified in 1630, it was not until Peter Minuit arrived with an expedition in 1638 that the Swedish attempted to settle the region (Hazard, 1850). The Swedes eventually settled further upriver at a more suitable landing site on the west shore, near present Wilmington, Delaware.

For the next three decades the Swedes and Dutch co-existed in the Delaware Valley until 1664 when the British, under the command of Sir Robert Carr, assumed command of the region. When King Charles II made a grant of lands in the Delaware Valley to his brother James, Duke of York, the Duke sent a flotilla of

warships under Carr's direction to subjugate the Dutch and Swedes and institute British control in the area. After several years of limited interest on the part of the Duke of York, King Charles II deeded a substantial portion of the territory to William Penn in 1682. Penn subsequently established an English colony, Pennsylvania, on the Delaware River with Philadelphia as its capital (Weslager, 1961).

In 1684, Penn also acquired the other three lower counties (present-day Delaware) from the Duke of York to add to his Pennsylvania holdings. With Penn's involvement the colonization process and economic growth in Delaware became tied more closely to Philadelphia and Pennsylvania. Throughout the colonial period, settlement in the lower Delaware Valley consolidated in regions where solid banks came to the Delaware's edge; for most of the waterfront was marshland and unhealthy for habitation. New Castle, and Wilmington, Delaware, Burlington, and Bordentown, New Jersey, and Philadelphia, Pennsylvania developed at locations of this type. In the lower portion of the Delaware Valley, population centers were again on high land. The high land was often some distance up a creek navigable only by shallow-draft vessels. Dover, Delaware, and Salem, New Jersey, were examples of this. Some colonial-era towns developed because they were stopping points along the 60-mile stretch of river on the much-traveled route from New York to Baltimore. This applies to Trenton and Bordentown, New Jersey, near the northeast bend of the river, and to New Castle and Wilmington, Delaware, near the southwest bend. Philadelphia, in the middle of this line of travel, was not merely a stop on the line but developed into a trade and travel center itself (Tyler, 1955).

Throughout much of the colonial period, wheat, rye, barley and tobacco were the principle colonial products of Delaware Valley inhabitants. After being hauled by wagon to mills established along the banks of the Schuylkill River, Brandywine Creek, and other swift-water tributaries of the Delaware, the flour was placed aboard shallops and taken down the Christina River to the Delaware River for shipment up to Philadelphia for consumption or further shipment. For the duration of the colonial period, the Delaware Valley region remained predominantly agricultural. The agricultural landscape that developed in response emphasized the importance of river and coastal transportation routes over roads. The system of agricultural production and transportation routes facilitated the rise of Philadelphia as one of the most important ports in the British Empire at the onset of the Revolutionary War.

The economic development of the Wilmington region was disrupted by the Revolutionary War, as the British blockaded all shipping and conducted raids along the shores of Delaware Bay (De Cunzo and Catts, 1990). After the war, Delaware Valley merchants were freed from the restrictions of the Navigation Acts, and again prospered. Philadelphia became the most active port in North America, with its ships reaching new markets in the East Indies and across the world. By 1800 there were 40 Philadelphia vessels in the China trade, about as many more trading in South America, and a considerable number still trading in Europe. The War of 1812 caused a second disruption to the social and economic life of Delaware Valley residents, but shortly thereafter, local inhabitants began to focus again on industry and agriculture. A water link between Delaware Bay and Chesapeake Bay was forged when the Chesapeake and Delaware Canal opened in 1829. Traffic across the peninsula between the two bays was so heavy that it supported the canal, a previously constructed turnpike, and within a few years, the New Castle and Frenchtown Railroad, one of the first railroads in America (Tyler, 1955). Manufacturing came to the upper Delaware Valley in the first half of the nineteenth century. By 1850 Wilmington had become a leading manufacturer of railroad cars, heavy machinery, gunpowder, textiles, flour and iron steamships (Weslager and Heite, 1988).

The introduction of steam technology had a dramatic effect on industries throughout the Delaware Valley. Regional companies became leaders in the production of steam engines for railroad locomotives and steamships. Several local companies also made railroad cars and car wheels, before expanding into the production of iron hulled steamships. Delaware River shipyards gained an international reputation for

producing quality iron hulled steam vessels. Coal fuel was needed to power steam engines. Extensive anthracite coal reserves along the Lehigh and Schuylkill rivers were developed. Coal became a leading export for Delaware River ports during the nineteenth and twentieth centuries. Related industries of iron and steel, initially founded in the Delaware Valley since the colonial period, expanded after the nineteenth century.

The large chemical industry of the Delaware Estuary began with the development of several small tanneries in and around New Castle County, Delaware, during the nineteenth century. Native black oak trees provided tanbark and local livestock production provided skins for the tanners. By the middle of the nineteenth century, Wilmington became a major producer of leather merchandise. Experiments were conducted in the tanning process that would revolutionize the leather making process. Prosperity gained from gunpowder production during the Civil War, allowed the local DuPont Company to expand over the next thirty years into one of the world's largest producer of chemicals and munitions. Petroleum-related industries and refineries were also established shortly after the discovery of oil in central and northwestern Pennsylvania in the nineteenth century. Philadelphia refineries are among the oldest in the world still producing refined oil products (Weslager and Heite, 1988).

Several specific historical Maritime themes relating to Wilmington and the lower Delaware River are discussed in detail in the following sections.

3.2.1 Shipbuilding

Historically, the Delaware Valley had a strong shipbuilding industry. From the years before William Penn founded Pennsylvania up through the Second World War, Delaware Valley shipyards have been among the most productive in the country. With the combination of available resources and skilled labor, Delaware Valley shipyards rapidly established a strong shipbuilding tradition. The first documented ships built by Europeans date to the middle of the seventeenth century during the Dutch and Swedish occupation. Although references to shipbuilding from this period are sparse, records indicate that the Swedes in 1644 endeavored to build "two large, beautiful boats, one for use at Elfsborg, the other at Fort Christina" (Brewington, 1939; pg. 50). The Swedes remained active in shipbuilding for the next several years; their carpenters finished a sloop, a barge, and a 200-ton ship by 1651. However, Swedish shipbuilding ceased in 1655 when the Dutch assumed control of the valley. There is no record of Dutch boatbuilding during this era, but it would not be unreasonable to assume that some boatbuilding was being completed to support the several forts and outposts that were built.

Shipbuilding increased dramatically with the English presence in the Delaware Valley after 1664. One of the first vessels built by English settlers was the ship *Glob*, constructed in 1675. At least two other vessels were built that year along the Delaware River shoreline (Brewington, 1939). In his designs for his colony, William Penn had intended to establish a strong tradition of shipbuilding. He recognized the potential of the hardwood forests that stretched along the upper portions of the Delaware River. This vast source of timber suitable for shipbuilding was vital, particularly since much of England's natural wood supply had been exhausted by the end of the seventeenth century.

With the combination of available resources and skilled labor, Delaware Valley shipyards rapidly became among the most active in all the colonies. In 1700, there were four commercial shipyards in operation along the Delaware River. Between 1682 and the beginning of maritime records in 1722 (ship registers, started by the port authorities to collect customs), the average number of ships built is estimated to be slightly less than ten vessels per year, most less than 50 tons in size (Crowther, 1973). Several family shipyards were responsible for the majority of the early eighteenth century vessels built in the Delaware Valley. West,

Penrose, Humphries, Bowers, Eyre, Cramp, Lynn and Vaughan were some of the prominent shipyards in the area.

After 1722 an estimation of the output of the shipyards in the Delaware Valley can be determined from the Ship Registers of Pennsylvania, 1722-1775. A total of 3,241 vessels were registered in Philadelphia over this period. A large percentage of that number were undoubtedly built in local yards. Between 1722 and 1776 Delaware Valley yards produced approximately 95,000 tons of shipping if one estimates the output of missing years in the registers and adds that number to the total recorded output of 87,346 tons (Crowther, 1973). The average tonnage of individual vessels increased steadily throughout the entire 54-year period. Six types of vessels were listed in the registers: square-rigged ships, sloops, brigantines, snows, schooners and shallops. These were the vessel types predominantly used in the Delaware River and Bay during the colonial period. Their basic distinguishing characteristics were the type of sails and rigging used, but they also varied in size as well. By 1770, Pennsylvania, New Jersey and Delaware shipyards were among the most active in terms of tonnage of vessels built.

Technological innovations ushered in with the Industrial Revolution helped to change the nature of shipping and shipbuilding on the Delaware River and Bay during the nineteenth century. Iron-hulled steam vessels rapidly became the standard vessel type operating on the waterway. Shipbuilding yards along the banks of the Delaware soon were producing more iron-hulled vessels than any other region in the country and quickly earned the reputation as the "Clyde" of American shipbuilding. Harlan and Hollingsworth Shipyard of Wilmington became the nation's leader in producing quality iron-hulled steam vessels. Originally opened as a yard to build railroad cars in 1836, the firm was founded by Mahlon Betts, a foundryman and Samuel Pusey, a machinist. They were soon joined by Samuel Harlen, a cabinet maker who led the firm into steam engine building and vessel repair work and eventually into iron shipbuilding. Elijah Hollingsworth, who had been a foreman with the Baldwin Locomotive works, became a partner in 1841 after buying out Samuel Pusey's interest (Tyler, 1958).

The yard then known as Betts, Harlen & Hollingsworth built its first two iron hulled boats in 1844. The two 98-ft. long screw steamers, Ocean and Ashland, were intended for a new steamboat line from Philadelphia to Albany via the new Delaware-Raritan Canal. After Betts retired in 1849, the yard became known as Harlan & Hollingsworth. Over the next 70 years Harlan & Hollingsworth established itself as the country's leading shipyard producing iron-hulled steam vessels. Between 1844 and 1887, Harlan & Hollingsworth built 232 boats of all descriptions and sizes. The company grew so large that it occupied a 43 acre plant on both sides of the river that involved 168 distinct industries, trades and callings in building its ships (Brandt, 1927). The other prominent Wilmington shipyard that produced iron-hulled ships was Pusey & Jones, which was started in 1849 by two machinists Joshua Pusey and John Jones. They opened their yard at the site of the former Wilmington Whaling Co. at the foot of Walnut Street on the Christina River. Among other noteworthy achievements, Pusey & Jones launched the country's first iron hulled sailing vessel in 1854 (Tyler, 1958).

In the 12-year span between 1845-1857 Wilmington shipyards constructed more iron tonnage than all the rest of the country combined. During that period, Wilmington yards built 10,886 tons (35 ships) while the second most active city, Philadelphia launched only 2,430 tons (13 ships) (Tyler, 1958). In support of the iron shipbuilding industry, several machine shops and saw mills were successfully operated in Wilmington dating to the middle of the nineteenth century.

Several nineteenth century Wilmington shipyards were building traditional wooden-hull sailing vessels. Dating back to the start of the nineteenth century, local shipwrights produced sloops, schooners, shallops, and a variety of small vessels for local trade and the thriving fish/shellfish industry. Occasionally, much larger

vessels were constructed for overseas trade. The schooner rig, adapted from early eighteenth-century English and European vessel types, became popular throughout the lower Delaware Bay. A small crew could effectively operate a schooner-rigged vessel. Various types of schooners were developed in the eastern United States: "Virginia Schooner," "Baltimore Clipper," and "Bay Schooner" versions were all developed by American shipwrights in the nineteenth century. A version of the Bay Schooner, referring to the Chesapeake Bay, was modified by Delaware boatbuilders to adapt to the Delaware River and Bay's strong tides and shallow waters. "By the 1920's Delaware Bay schooners had taken on their own unique characteristics. Increased length of the hull lines, a freeboard with a long sweeping shoreline, and smaller heart-shaped sterns with elliptical tops characterized New Jersey schooners" (Witty, 1986; p. 96). As schooners became more popular among watermen, Delaware Bay sloops were dismantled and refitted as schooners with their characteristic fore and aft sail rig. During the first half of the twentieth century wind powered oyster schooners were eventually outfitted with motors and pilot houses (Sebold & Leach, 1991).

One of Wilmington's earliest shipyards was operated by Enoch Moore at the foot of East Fourth Street. Other prominent Wilmington wood shipbuilders include; W.&A. Thatcher (at the foot of Walnut Street), and Young (at the foot of Walnut Street) (Tyler, 1958). The majority of the vessels built at these yards were schooners, sloops, shallops, and fishing boats that utilized local wood products, particularly white oak and pine. Productivity of the yards began to decline in the 1880s when wooden sailing ships were gradually phased out of coastal shipping (Hoffecker, 1977).

The context of regional shipbuilding activities relates to the following themes identified in the Delaware Plan: Transportation and Communication, and Architecture, Engineering and Decorative Arts. Regional shipbuilding activities in the region occurred during the second and third chronological periods established in the Delaware Plan (1730-1830), but it was most prevalent during the fourth and fifth chronological periods (1830-1940).

3.2.2 Steamboats & Shipping

Steamboats plying the Christina and Delaware Rivers played a large role in Wilmington's economic development. In 1809, the first steamboat service on the Delaware River was established between Philadelphia and Bordentown, New Jersey. Steamboats originating in Philadelphia were soon expanding their routes to cover all portions of Delaware Bay. By 1813, seven steamboats were reported operating on the Delaware River. Wilmington's first steamboat service dates to 1814. In 1819, Vesta was the first steamboat to venture down Delaware Bay to Cape May, New Jersey. It completed the trip twice a week (Baker, 1976). Since it took a while before mariners gained sufficient confidence with the reliability of steam propelled vessels, most of the early steam craft on the Delaware were also outfitted with a sail rig and limited to operation close to shore. Other early Delaware Bay steamboat service extended from Philadelphia to Wilmington and Smyrna, Delaware and Salem, New Jersey.

Despite the proliferation of steamboat, the vast majority of shipping activity between Philadelphia and Wilmington was still carried by sail packets and freight boats during the first half of the nineteenth century. Starting in the eighteenth century sail packets, typically small two and three-masted schooners and sloops, had carried agricultural products from Delaware farmers to Philadelphia. The two most prominent Wilmington lines were the Warner Line and the Bush Line. Warner was the pioneer, established in 1773 and the Bush Line was set up three years later. Both lines continued in operation for more than 100 years and during that time the Warner Line continuously operated a sloop named Fame (Elliott, 1970).

The Chesapeake and Delaware Canal, connecting the Delaware River just above Reedy Island to the

Chesapeake Bay via the Elk River, was opened on October 14, 1829. The canal created an all water route from Baltimore to Philadelphia and dramatically spurred steamboat operations on the Lower Delaware. Originally, the canal was 36 ft. wide at the bottom, 66 ft. wide at the top, and 10 ft. deep. A series of locks were required to allow navigation between the two waterways. Although the canal had little impact on shipping in lower Delaware Bay, it forged a water link between Philadelphia and Baltimore.

In 1820 the Wilmington Steamboat Company began regular freight and passenger service from Philadelphia to Wilmington using the steamer Superior. Superior made regular eight-hour trips between Wilmington and Philadelphia. Several years later, the 156 ft.-long steamer Wilmington also joined the service. Although the Reybold Line also operated steamers out of Wilmington, the Wilmington Steamboat Company, later known as the Wilson Line, dominated steamboat activity out of Wilmington throughout the second half of the nineteenth century. It's major competition came from railroad companies (primarily the Philadelphia, Wilmington and Baltimore Railroad) that offered rail service between Baltimore and Philadelphia, as well as their own line of steamers (Elliott, 1970).

Shields Wilson reorganized the Wilmington Steamboat Company in 1882 and henceforth it was known as The Wilson Line. The Wilson Line began a period of sustained growth that lasted until the 1930s. Wilson Line steamers used on the Philadelphia-Wilmington run included; Wilmington, Brandywine, City of Chester, City of Trenton, Quaker City, City of Wilmington, City of Philadelphia, City of Camden, State of Delaware and State of Pennsylvania (Elliott, 1970). All of these steamers with the exception of the two State boats were built at Harlen & Hollingsworth shipyard in Wilmington. The last Wilson Line steamers, State of Pennsylvania and State of Delaware, were built in 1922-1923 at the other prominent Wilmington shipyard, Pusey & Jones.

Competition for the Wilson Line's Philadelphia-Wilmington route arose in 1901. In that year the Delaware River Navigation Company, which formerly operated only on the upper Delaware River, established a new line that linked Philadelphia, Chester and Wilmington in direct competition with the Wilson Line. Service for the Delaware River Navigation Company's new southern steamboat route was provided by steamers John A. Warner, and Diamond State.

World War I triggered significant industrial expansion on the Lower Delaware. The duPont powderworks received enormous war orders and had to open new facilities at several sites in New Jersey to meet increased product demand. Thousands of powderworkers from the tristate region were recruited for the new plants located in the vicinity of Penns Grove, New Jersey. The majority of the Pennsylvania and Delaware workers took Wilson Line ferries across the Delaware River to Penns Grove to get to work. New ferry piers had to be built at Deepwater Point and Carneys Point, New Jersey. Overwhelmed by this new traffic, the Wilson Line purchased several steamers to handle the new ferry service load. Wilson Line purchased the following boats for use in the Penns Grove ferry service; Long Beach, Arctic, Cape May, Peerless, and City of Reading. During peak years, steamboats and ferries made more than 30 Wilson sailings from Wilmington every day. Wilmington became a thriving steamboat port in the second decade of the twentieth century. By 1916, the Penns Grove ferries alone were making 16 sailings daily. Two separate ferry entities, Christina Ferry Company and the Wilmington & Penns Grove Transportation Company were established accommodate this new traffic (Elliott, 1970).

Excursion steam voyages also became a focus for Wilmington steamboat operators. In 1921 Wilson Line steamers began direct sailings to Riverview Beach, New Jersey. One day outings on the Delaware River to both Riverview Beach and Penns Grove became enormously popular and steamers were carrying thousands of passengers every day from Wilmington and Philadelphia. New, larger steamers (State of Pennsylvania and

State of Delaware) were built in 1922 to handle this traffic. At 225 ft. long, these new steamers had a capacity of 4,000 passengers. This excursion boom in the 1920s made the Wilson Line one of the world's busiest steamboat operators (Elliott, 1970).

In 1925, competition for the lucrative excursion service was generated by the formation of the New Castle-Pennsville Ferries, known as the White Line. After two years of direct competition, the White Line merged with the Wilson Line and the Delaware-New Jersey Ferry Company, a new subsidiary of the Wilson Line, was formed. The new company had nine ferryboats which when added to the Wilson Line's nine passenger-cargo steamers formed a fleet that could carry up to 20,000 passengers daily (Elliott, 1970).

However, competition from trucks took away much of the freight business, and trains were carrying more passengers. The Depression took away much of the steamboat business and the steamboat traffic in Wilmington began a slow and steady decline until all operations ceased out of Wilmington in the 1960s. The Wilson Line ferries across the Delaware River were replaced by the opening of the Delaware Memorial Bridge in 1951.

4.0 CULTURAL RESOURCES POTENTIAL

This chapter addresses in broad terms the potential for submerged cultural resources within the Christina River project Area.

4.1 Criteria of Evaluation

The information generated by these investigations was considered in terms of the criteria for evaluation outlined by the U.S. Department of the Interior, National Register Program. Nautical vessels and shipwreck sites, generally excepting reconstructions and reproductions, are considered historic if they are eligible for listing in the National Register of Historic Places at a local, regional, national, or international level of significance. To be eligible for the National Register of Historic Places, a vessel or site "must be significant in American history, architecture, archaeology, engineering, or culture, and possess integrity of location, design, setting, materials, workmanship, feeling, and association." To be considered significant the vessel or site must meet one or more of four National Register criteria:

- A. Association with events that have made a significant contribution to the broad patterns of our history; or
- B. Association with the lives of persons significant in our past; or
- C. Embodiment of 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. Sites that have yielded, or may be likely to yield, information important in prehistory or history.

National Register of Historic Places Bulletin 20 clarifies the National Register review process with regard to shipwrecks and other submerged cultural resources. Shipwrecks must meet at least one of the above criteria and retain integrity of location, design, settings, materials, workmanship, feelings and association.

Determining the significance of a historic vessel depends on establishing whether the vessel is:

1. the sole, best, or a good representative of a specific vessel type; or
2. is associated with a significant designer or builder; or
3. was involved in important maritime trade, naval recreational, government, or commercial activities.

Properties which qualify for the National Register, must have significance in one or more "Areas of Significance" that are listed in National Register Bulletin 16A. Although 29 specific categories are listed, only some are relevant to the submerged cultural resources in the Lower Delaware Bay and Delaware River. Architecture, commerce, engineering, industry, invention, maritime history and transportation are potentially applicable data categories for the type of submerged cultural resources which may be expected in the Christina River study area.

Historic records indicate the presence of one wreck site near the Christina River project area. Although not within the boundaries of the present project area, a shipwreck site presumed to be the wreck of the Wilson Line steamer State of Pennsylvania was discovered slightly upstream of the project area. The State of Pennsylvania was placed on the National Register of Historic Places in 1979. If the development of the Wilmington Riverwalk project proceeds upstream to include this wreck site, a comprehensive archaeological examination of the site would be recommended.

5.0 SURVEY INVESTIGATIONS

A comprehensive remote sensing survey was conducted in the Christina River from Market Street to the Public Works Building (Figure 2). The purpose this investigation was to locate, identify and preliminarily assess the significance of submerged cultural resources that might be affected by shoreline construction activity. The underwater survey was designed to generate sufficient magnetic and acoustic remote sensing data to identify anomalies caused by submerged cultural resources. Analysis of the remote sensing data aimed to isolate targets of potential historical significance that might require further investigation or avoidance. No diving was undertaken during this project.

5.1 Fieldwork Methods

All remote sensing fieldwork was carried out from a 25-foot survey vessel suitable for open and shoal water operations. A Geometrics, G-881, cesium magnetometer, capable of +/- one gamma resolution, was employed to collect magnetic remote sensing data. A one-second sampling rate by the magnetometer's towed sensor, coupled with a 3.5- to 4-knot vessel speed, assured a magnetic sample every five ft. A Marine Sonics two-channel digital acoustic recorder with a 600 kHz side scan sensor was used to collect acoustic data. Digital acoustic data was recorded to a mini-tower PC computer.

Survey vessel trackline control and position fixing were obtained by using a laptop PC-based software package (Hypack) in conjunction with a Navstar Differential Global Positioning System (DGPS) on board the survey vessel. The onboard laptop computer was interfaced with the DGPS satellite positioning system. Differential corrections were provided by a U.S. Coast Guard beacon transmitting from Cape Henlopen, Delaware. Positioning data from the DGPS was converted by the onboard computer to Delaware NAD 83

X,Y coordinates in real time. These X,Y coordinates were used to guide the survey vessel precisely along predetermined tracklines. While surveying, vessel positions were continually updated on the computer monitor to assist the vessel operator, and the processed X,Y data were continually logged on computer disk for post-survey processing and plotting.

Magnetic and acoustic data were collected simultaneously. Two onboard computers, a laptop and a mini-tower, were used to collect the magnetic and acoustic data. Positioning data from the DGPS system were sent to each computer, providing exact coordinates for each system and ensuring that all data was properly interfaced. To allow for the detection of subtle magnetic anomalies typically associated with smaller wooden vessels, survey lane spacing was established at 50-foot offsets. Since the side scanning sonar transducer has an effective range of more than 150 feet in each channel, 50-foot lane offsets provided comprehensive acoustic coverage for each area. DGPS position fixes were recorded every 25 feet along each survey lane.

Magnetic data and sonar records were inspected for potential manmade features present on the bottom surface. After fieldwork data were collected, magnetic data were correlated with sonar records, and targets of potential significance were identified and designated. Targets signatures located during the survey were refined to permit highly accurate positioning and to facilitate signature analysis.

Magnetometer data were analyzed in terms of the following parameters: magnetic intensity (total distortion of the magnetic background measured in gammas); pulse duration (detectable signature duration); signature characteristics (negative monopolar, positive monopolar, dipolar, or multi-component); and spatial extent (total area of disturbance). Acoustic (side scan sonar) targets were analyzed according to their spatial extent, configuration, location and environmental context. Magnetic records were correlated with the acoustic targets to provide comprehensive remote sensing information on the identity of the material generating the remote sensing signatures. The integrated data for each target site were finally assessed with reference to typical submerged cultural resource signatures generated during three decades of magnetic and acoustic remote sensing surveys, enabling the isolation of target signatures that were suggestive of significant submerged cultural materials.

These procedures for analyzing remote sensing targets have been developed in the course of compiling a database of target signatures over the last three decades. Starting in the 1960s, archaeologists primarily relied on magnetic remote sensing data, collected with proton precession magnetometers, to locate submerged cultural resources. However, magnetic data collected alone often provides inconclusive or partial evidence about submerged cultural resource sites. Underwater archaeological research conducted over the last two decades indicates that shipwreck sites may produce a variety of magnetic signatures. Furthermore, modern debris often generates magnetic signatures that share similar characteristics with certain types of shipwreck sites.

The ambiguous nature of magnetic signatures has led researchers to use acoustic and occasionally sub-bottom remote sensing equipment in conjunction with a magnetometer on most underwater archaeological surveys. Acoustic data, in the form of sonar records, are produced by processing sound waves emitted into the water column on both sides of the submerged sensor and bounced back off the bottom surface and exposed objects. Digital state-of-the-art sonar units can produce a high-resolution sonar record that is almost photographic in quality. However, a certain degree of structural integrity must remain above the bottom for a site to produce a reliable shipwreck signature on side scan sonar. Where no structure survives above the bottom surface researchers must rely on magnetic data to help locate shipwreck remains. Additional data provided by acoustic instruments frequently permit target identification to be made solely from remote sensing

information. A combination of magnetic and acoustic remote sensing data has proven to be the most effective method of accurately identifying and assessing submerged archaeological sites. Typically, the most attractive targets produce both well-defined magnetic and acoustic signatures.

5.2 Fieldwork Findings

A two-person project crew completed the remote sensing survey in the Christina River on October 27, 1998. At the Christina River Project Area, from Market Street to the Public Works Building, four lanes spaced 50 feet apart were completed parallel to the northern shoreline of the river.

Analysis of the remote sensing data confirmed the existence of no remote sensing targets that were considered suggestive of a submerged cultural resource. There was considerable magnetic noise on the survey lane next to the shoreline. Otherwise, there were only magnetic signatures generated by single source objects - signatures that are typically associated with modern debris. Sonar records confirmed the presence of some debris-related material along the shoreline; including tree limbs, car/truck tires, deteriorating pilings, and bulkhead rubble. There was no remote sensing evidence of potential submerged cultural resources along this stretch of the Christina River. An iron-hulled shipwreck site was observed adjacent to the Wilmington shoreline slightly upstream of the project area. This wreck is believed to be the site of the former Wilson Line steamer, State of Pennsylvania. However, this wreck site is beyond the boundaries of the present project area.

No additional underwater archaeological investigation is recommended in conjunction with Construction Phases III & IV (Market St. to the Public Works Building) of the Christina Riverwalk Project, Christina River, Wilmington, New Castle County, Delaware.

All underwater survey field notes, magnetometer and sonar records, are stored at the offices of DR, 4425 Osage Avenue, Philadelphia, PA 19014.

6.0 SUMMARY AND RECOMMENDATIONS

Historic maritime activity in the Delaware Bay dates from the first half of the 17th century when Dutch, Swedish and English pioneers commenced trading and settlement in the region. Since that time, the Delaware Bay and its tributaries have served as transportation arteries for the subsequent colonization and socio-economic development of Delaware, New Jersey and Pennsylvania. Wilmington has a strong maritime tradition that dates back to the first half of the seventeenth century when Dutch settlers first arrived at the mouth of the Christina River. As Delaware economy developed, the Christina River became a vital shipping point between Delaware merchants and farmers and the larger ports of Baltimore and Philadelphia. In support of the shipping activities, numerous maritime-related industries thrived along Wilmington's waterfront. During the nineteenth century, Wilmington became the country's leading manufacturer of iron hulled steamboats. The port also developed into a major landing site for a series of steamboat and ferry lines.

As a result of the extensive historic maritime activity in the Christina River, a variety of underwater resources may be anticipated in the Wilmington vicinity. The identification of underwater resources relating to this historic maritime activity is relevant to the goals developed in Delaware's recently published statewide historic preservation planning documents. Indeed, the top priority below-ground historic context in the Delaware Comprehensive Historic Preservation Plan is identified as: Historic Theme - Settlement Patterns and Demographic Change, Chronological Period/Theme - 1630 to 1730+/-, Exploration and Frontier Settlement; to which other important themes, notably Fishing and Oystering, and Transportation and Communication, are intimately related (Ames et. al. 1989). Similarly, in the companion Management Plan for Historical Archaeological Resources, the second-ranked statewide priority is identified as the preservation and management of historical archaeological maritime resources for the entire period of historic activity, 1630-1940 (De Cunzo and Catts 1990). Clearly, underwater resources in the Delaware waters are potentially important both in elaborating key statewide historic contexts, themes and property types and in the appropriate management of Delaware's cultural heritage.

While a wreck site was located upstream of the project area, the comprehensive remote sensing survey of the Christina River Project Area using magnetic and acoustic instrumentation failed to identify any submerged cultural resources. No additional underwater archaeological investigation is recommended in conjunction with Construction Phases III & IV (Market St. to the Public Works Building) of the Christina Riverwalk Project, Christina River, Wilmington, New Castle County, Delaware.

7.0 REFERENCES CITED

Ames, David, Mary Callahan, Bernard Herman and Rebecca Siders

- 1989 "Delaware Comprehensive Historic Preservation Plan." Center for Historic Architecture and Engineering, College of Urban Affairs and Public Policy, University of Delaware, Newark, Delaware.

Ames, David, Leslie Bashman and Rebecca Siders

- 1991 "Delaware's Aids to Navigation: A Survey and National Register Eligibility Evaluation." University of Delaware Center for Archaeological Research. Manuscript on file at the Delaware State Historic Preservation Office. Dover, Delaware.

Baker, William,

- 1976 "Commercial Shipping and Shipbuilding In the Delaware Valley." Society of Naval Architects and Marine Engineers, Spring Meeting Papers. Philadelphia, Pennsylvania.

Brandt, Francis

- 1929 *The Majestic Delaware, The Nation's Foremost Historic River.* The Brandt and Gummere Company, Philadelphia, Pennsylvania.

Brewington, M.V.,

- 1939 "Maritime Philadelphia, 1609-1836." *Pennsylvania Magazine of Biography and History*, Historical Society of Pennsylvania, Philadelphia, Pennsylvania.

Crowther, Simeon

- 1973 "The Shipbuilding Output of the Delaware Valley, 1722-1775." *Proceedings, American Philosophical Society*, Volume 117, Philadelphia, Pennsylvania.

DeCunzo, LuAnn and Wade Catts

- 1990 "Management Plan for Delaware's Historical Archaeological Resources." University of Delaware Center for Archaeological Research, Newark, Delaware.

DeCunzo, LuAnn and Barbara Hsiao Silber

- 1992 "Intensive Archaeological Survey and Historical Documentation of the Bombay Hook Light Station and Keeper's House, Kent County, Delaware (7K-A-130)." Manuscript on file at the Delaware State Historic Preservation Office, Dover, Delaware.

Elliott, Richard

- 1970 *The Saga of the Wilson Line, Last of the Steamboats.* Tidewater Publishers, Cambridge, Maryland.

Hazard, Samuel, editor

- 1850 *Hazard's Annals of Pennsylvania 1609 - 1682.* Hazard and Mitchell, Philadelphia, Pennsylvania.

Hoffecker, Carol

- 1977 *Delaware, A Bicentennial History.* W.W. Norton & Company, New York, New York.

Koski-Karell, Daniel

1995 "Historic Archaeological Context on the Maritime Theme with the Sub-Theme Shipwrecks, Coastal Zone (1495-1940+/-). Volume I -- Historic Context." Delaware Division of Historical and Cultural Affairs, Bureau of Archaeology and Historical Preservation, Dover, Delaware.

Paul, Michael

1989 "Historic Context for Aids to Navigation in Delaware." Manuscript on file at the Delaware State Historic Preservation Office. Dover, Delaware.

Sebold, Kimberly and Leach, Sara.

1991 Historic Themes and Resources within the New Jersey Coastal Heritage Trail, Southern New Jersey and the Delaware Bay: Cape May, Cumberland, and Salem Counties. Department of the Interior, National Park Service, Washington D.C.

Tyler, David

1955 The Bay and River Delaware, A Pictorial History. Cornell Maritime Press, Cambridge, Maryland.

1958 The American Clyde, A History of Iron and Steel Shipbuilding on the Delaware From 1840 to World War I. University of Delaware Press, Newark, Delaware.

U. S. Army Corps of Engineers

1962 Report to the Chief of Engineers, U.S. Army. Washington, D.C.

1974 Water Resources Study, Metropolitan Christina River Basin, Plan of Study. Report on file with the U.S. Army Corps of Engineers, Philadelphia District Library, Philadelphia, Pennsylvania.

Weslager, C.A.

1961 Dutch Explorers, Traders and Settlers in the Delaware Valley, 1609-1664. Philadelphia, Pennsylvania.

Weslager, C.A. and Louise Heite

1988 "History of the Delaware Estuary." In, The Delaware Estuary: Rediscovering Forgotten Resource. University of Delaware Seagrass Program, Newark, Delaware.

Witty, Anne

1986 "The Oystering Fleet of Delaware Bay." The Challenge of Folk Materials for New Jersey Museums. Trenton, New Jersey.