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THE VINYARD SHIPBUILDING COMPANY:

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MILFORD, SUSSEX COUNTY, DELAWARE

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Scott A. Emory
A.D. Marble & Company

INTRODUCTION

A rapid rise in industrial technology during the last half of the nineteenth century introduced monumental changes to the shipbuilding industry. Steel production after the Civil War grew rapidly in the United States with the introduction of the Bessemer (1856) and open hearth (1868) furnace processes (Singley 1988:47). Plate steel offered shipbuilders a stronger, easier-to-repair resource over the dwindling supply of viable timber. The high cost of processed steel plate in the United States, however, prohibited its acceptance by many shipyards and it did not become commercially feasible until the last decade of the 1800s (Bauer 1988:293). Low-pressure square boilers developed during the first half of the nineteenth century gave way to more powerful cylindrical Scotch boilers, then gasoline and diesel engines provided the killing blow for water craft propelled by the wind (Bauer 1988:292). Commercial electricity, especially during the early 1900s, fostered a major spurt in shipyard construction by implementing new tools and shipyard layout designs that streamlined the construction process and increased overall productivity.

The Vinyard Shipbuilding Company, located in Milford, Delaware (**see inset map**), mirrored a national pattern of small shipyard economic growth owing to the technology of the Industrial Revolution, only to collapse when interstate commerce transportation patterns shifted. The Vinyard shipyard adopted the inventions and technological advances wrought upon the shipbuilding industry of the nineteenth and twentieth centuries and slowly formed a business that sought to meld advancements in modern materials with the craftsmanship of artisans. Unlike larger, more complex shipyards in northern Delaware and Philadelphia, the Vinyard shipyard's position on a shallow tidal river in an agriculturally based community required a degree of modification in the vessel construction business. Construction processes, material use, and site layout at the Vinyard shipyard reflected national trends in shipbuilding, but retained distinctive traits of the geographical setting. Founding a shipbuilding business that incorporated technological advances in vessel construction, and at the same time contended with limited material resources and spatial boundaries of its community, created an industrial maritime setting unique in product, design, and function.

The Vinyard shipyard is an important subject for several reasons. First, the time frame of the shipyard, 1896 to the 1950s, has been covered on a national scale by various authors (Fassett 1948; Lane 1951). A large body of historical data documenting the rise of the United States shipbuilding industry at the turn of the century clearly anticipates the historical background needed to compare the Vinyard shipyard to large and small shipyards across the country. With this collection of books, charts, government reports, and similar materials, one can contrast and compare shipyard layouts, vessel designs, total production levels for a specific year, and other national trends.

Second, historical resources in the state of Delaware offer a collection of site-specific information containing names, dates, and other data relevant to the Vinyard Shipbuilding Company that would not likely be found in a general historical overview of national trends. Delaware's state archives contain a selection of maps, photographs, bills of sale, and hundreds of additional sources related to the Vinyard shipyard. The Historical Society of Milford contains an impressive collection of photographs detailing the shipyard's landscape and a selection of vessel profiles, tools, and line drawings. The site's recent age also presents the opportunity to interview individuals who worked at the shipyard. These shipwrights, office personnel, and laborers provide an excellent source of information about the background of workers, as well as first-hand information regarding physical changes to the site, important launching dates, and countless other bits of information known only to those who experienced the shipyard atmosphere firsthand.

Third, what possibly makes the Vinyard Shipbuilding Company such an important part of the maritime history of the United States is the shipyard itself. The original boathouse, marine railways, outbuildings, and tools from the beginnings of the shipyard are still extant. The joiner shop and metalsmith shop contain a diverse selection of hand and power tools dating from the 1920s, and are all functional. The workshops retain the original overhead belt-driven drive-shaft systems that powered several tools at one time; cost-effective and representative of adaptation at the Vinyard shipyard. The property boundaries remain the same since purchases in 1900 and 1906.

An archaeological survey of the waterfront and landside portions of the site accompanied the historical research. Historical documentation cannot answer all questions concerning the shipyard's physical growth if remains have been removed, buried, or inundated by the river's tidal flow. An archaeological investigation of the shipyard's riverfront helped identify submerged resources and uncovered features not documented in the historical record. The placement and shift of the waterfront pilings, support structures for submerged railways, and retaining wall technology are details only addressed through archaeological fieldwork. A terrestrial survey exposed buried remains reflecting shipyard growth and illustrating movement of buildings and railways as demands for a streamlined operation necessitated concentration of daily operations into one compact area. Artifacts uncovered from both water and soil provided information about shipyard operations not previously recorded. Overall, the archaeological survey is a necessary and vital component to the documentation of the Vinyard Shipbuilding Company's existence, and when used in conjunction with the historical data, yields invaluable information.

HISTORY OF THE VINYARD SHIPBUILDING COMPANY

The full impact of ship construction and river travel encompassed Milford in the middle of the nineteenth century, long after the town's settlement. Early maps of Milford illustrate how shipbuilders utilized the mud flats and riverbanks to construct sail and steam vessels for commercial trade. Mapmakers, such as Bailey and Company, took the liberty to include sail and steam vessels in their layout of Milford, providing a sense of "action", although not necessarily accurate, of ship traffic and shipyard activities (**Figure 1**). These maps reflected the repeated use over time of specific plots in the shipbuilding trade.

In the Beginning (1896-1914)

For Wilson M. Vinyard, founder of Vinyard Shipbuilding Company, the shores of the Mispillion River provided the perfect area for building a variety of craft. Vinyard (1867-1944), a native of Milford, was educated in the private schools of Milford and at the Wilmington Conference Academy of Dover (now Wesley College) (MHS 1978: 1).

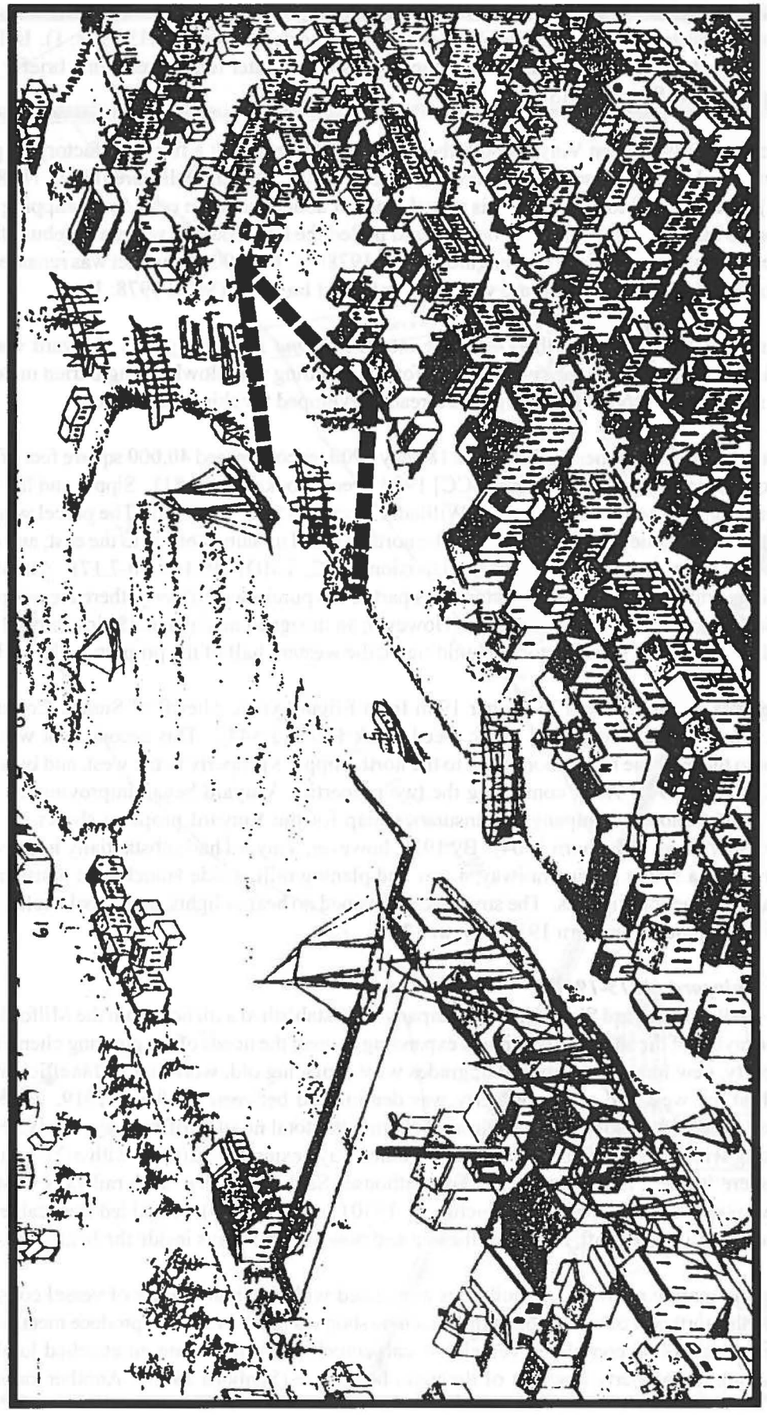

Figure 1. View of Milford, 1885. Vinyard Shipbuilding Company property is highlighted. Vessel on stocks is likely part of William Reville's shipyard. (Reprinted from O. H. Bailey, *Map of Milford, 1885.*)

From 1885 to 1891, Vinyard traveled across the mid-West, working in a grocery store and print shop, as a railroad surveyor, and as the assistant engineer on the Camden and Alexandria Railroad (MHS 1978: 1). In 1891, he went to Chicago and worked as an assistant engineer on the city's second water tunnel, returning briefly to Milford in April, 1892, to marry Ella Sharp (MHS 1978: 1).

Shipbuilding began in 1898, when Vinyard built the steamship *Delaware* at a furniture factory he purchased on the Fox River in New London, Wisconsin (Delaware State Archives, Dover, Delaware [DSA] 1898: Enrollment of Vessels 6:25). He returned to Milford in his vessel, and set about using the craft for a shipping business. In 1899, the *Delaware* burned to the waterline, but Vinyard pulled the hull from the water and rebuilt the ship using the old machinery, then later installing new engines (MHS 1978: 1). In 1900, the vessel was renamed *Emma Reis* for a local customer who supported Vinyard with regular freight business (MHS 1978: 1).

Despite successful reconstruction of the *Delaware* into the *Emma Reis*, Vinyard's shipyard was far from a thriving operation. Property along the river suitable for shipbuilding was slowly being buried under landfill for urban housing, so Vinyard resorted to buying land already developed for ship construction.

The first plot, purchased from James M. Sipple on 18 May 1900, encompassed 40,000 square feet of land (Sussex County Courthouse, Georgetown, Delaware [SCC] 1900: Deed Book 145:80-81). Sipple and his wife, Emma, obtained the land from the estate of shipbuilder William F. Reville (SCC 1900:80). The parcel was bordered by Franklin Street to the west, the Mispillion River to the north, a small unnamed brook to the east, and another lot to the south (Sussex County Courthouse, Tax Map Division [SCC, TMD] 1994: 3-30-7.17). Although the deed includes "buildings, improvements," and "fixtures" as part of the purchased property, there are no specific details concerning their design and size (SCC 1900:80). However, an unsigned map dated 28 November 1941, shows a storage/saw mill and a second smaller storage building on the western half of the property as being built in 1900.

A second parcel was purchased on 17 October 1906 from Elijah Lynch, Sheriff of Sussex County (Delaware State Archives, Dover, Delaware [DSA] 1906: Deed Book 156:543-544). This second plot was bounded by Columbia Street to the east, the Mispillion River to the north, Sipple's property to the west, and by a private lot to the south (SCC, TMD 1994). After combining the two properties, Vinyard began improving the shipbuilding facilities. The 1904 Sanborn Company fire insurance map for the Vinyard property shows no structures or shipbuilding areas on the site (Sanborn 1904). By 1910, however, Vinyard had substantially improved the wharf lot. The property had a single marine railway, a saw and planing mill, a side launch boat house, and a storage building for boat construction supplies. The structures contained no heat or lights, and a coal-fueled steam engine powered the mill equipment (Sanborn 1910) (**Figure 2**).

Growth of the Shipyard (1915-1930)

Site layout. By 1919, the Vinyard Shipbuilding Company had established a niche within the Milford shipbuilding community. The layout of the shipyard continued expanding to meet the needs of the growing clientele (**Figure 3**). Across the property, new improvements and upgrades were replacing old, worn-out and inefficient technology. The side launch at the west end of the property was demolished between 1910 and 1919. Five new marine railway launches were added along the waterfront, bringing the total number of railways to six. Four railways were 160 feet long with a beam of 30 feet, while two other ways extended 120 feet with a 25-foot beam. Both 120-foot ways were inside a large, electrically lit boathouse (Sanborn 1919). Two railways west of the main boathouse were covered under a protective structure by 1930 (Sanborn 1930). A braided steel cable, powered by the engine in the saw mill/mold loft, moved dollies up and down the railways inside the boathouses (**Figure 4**).

Complementing the marine railways, outbuildings associated with the many facets of vessel construction rose across the site. In the northeast corner, an outfitting machine shop was built in 1917 to produce metal accouterments for the decorative touches on completed vessels. A carpenter's shop, including an attached lumber shed and storeroom, sat along the property line east of the main boathouse (Sanborn 1919). Another carpenter's shop,

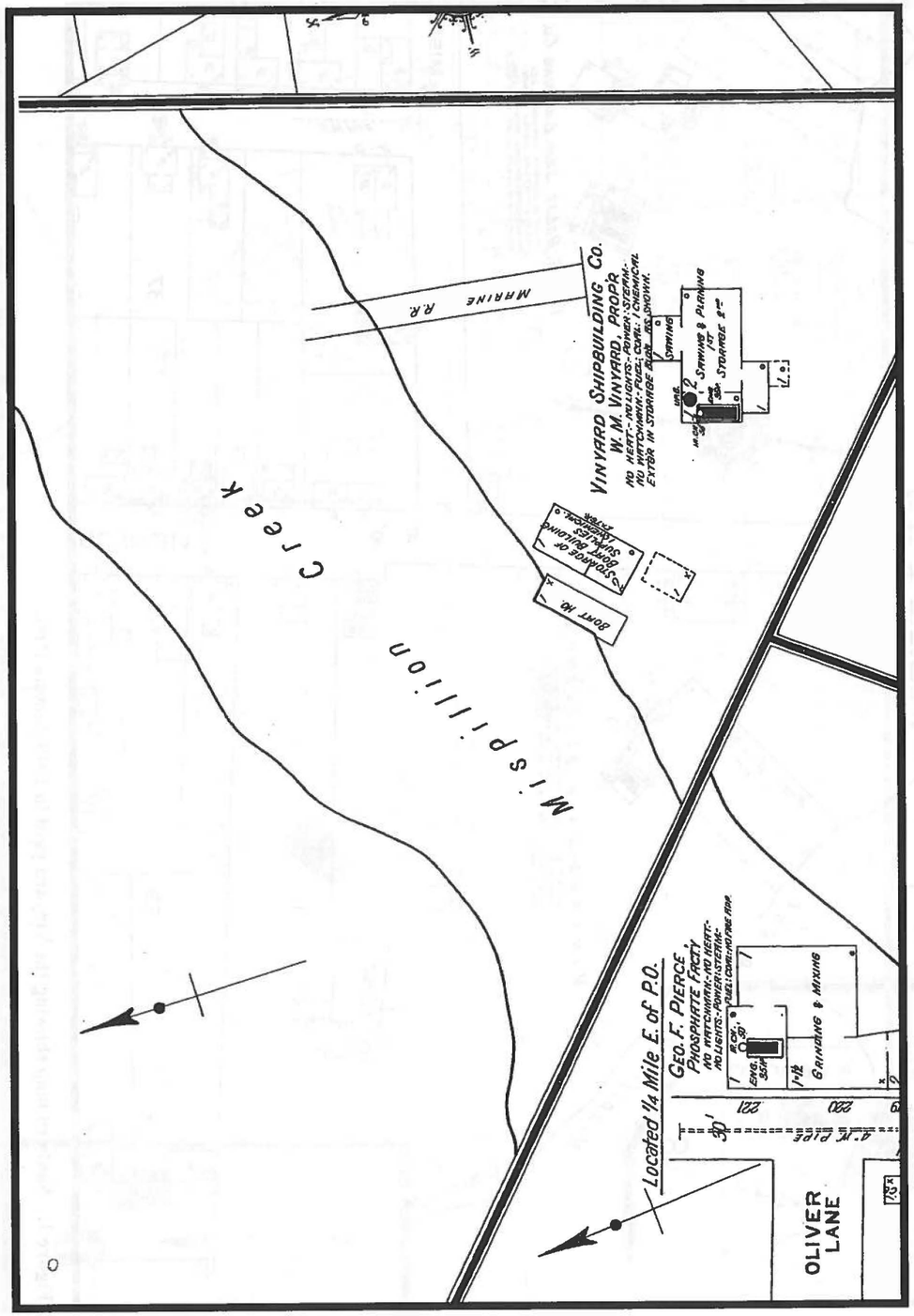

Figure 2. Sanborn map showing the Vinyard yard in 1910 (Sanborn 1910).

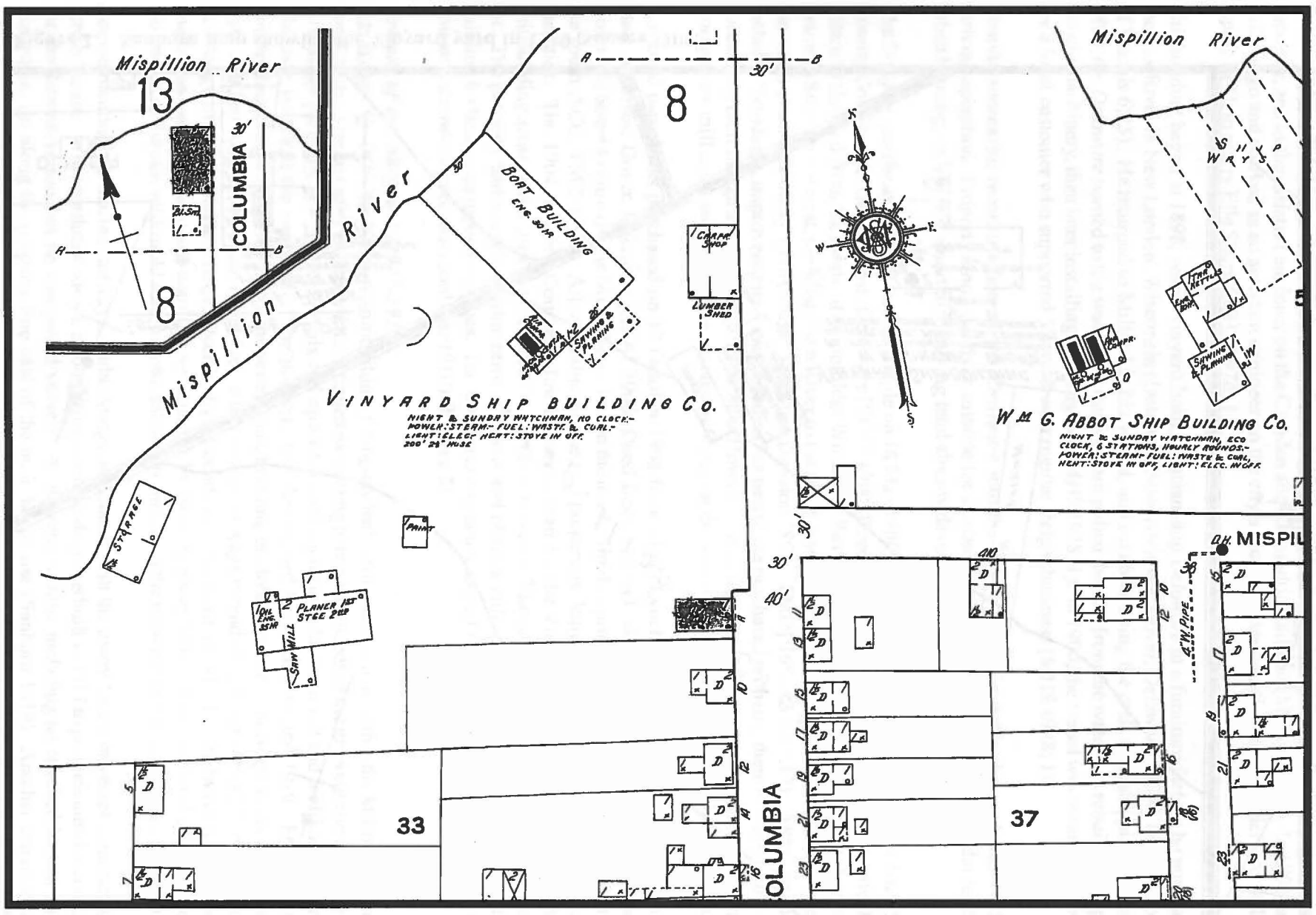

Figure 3. Sanborn map showing the Vinyard yard in 1919 (Sanborn 1919).

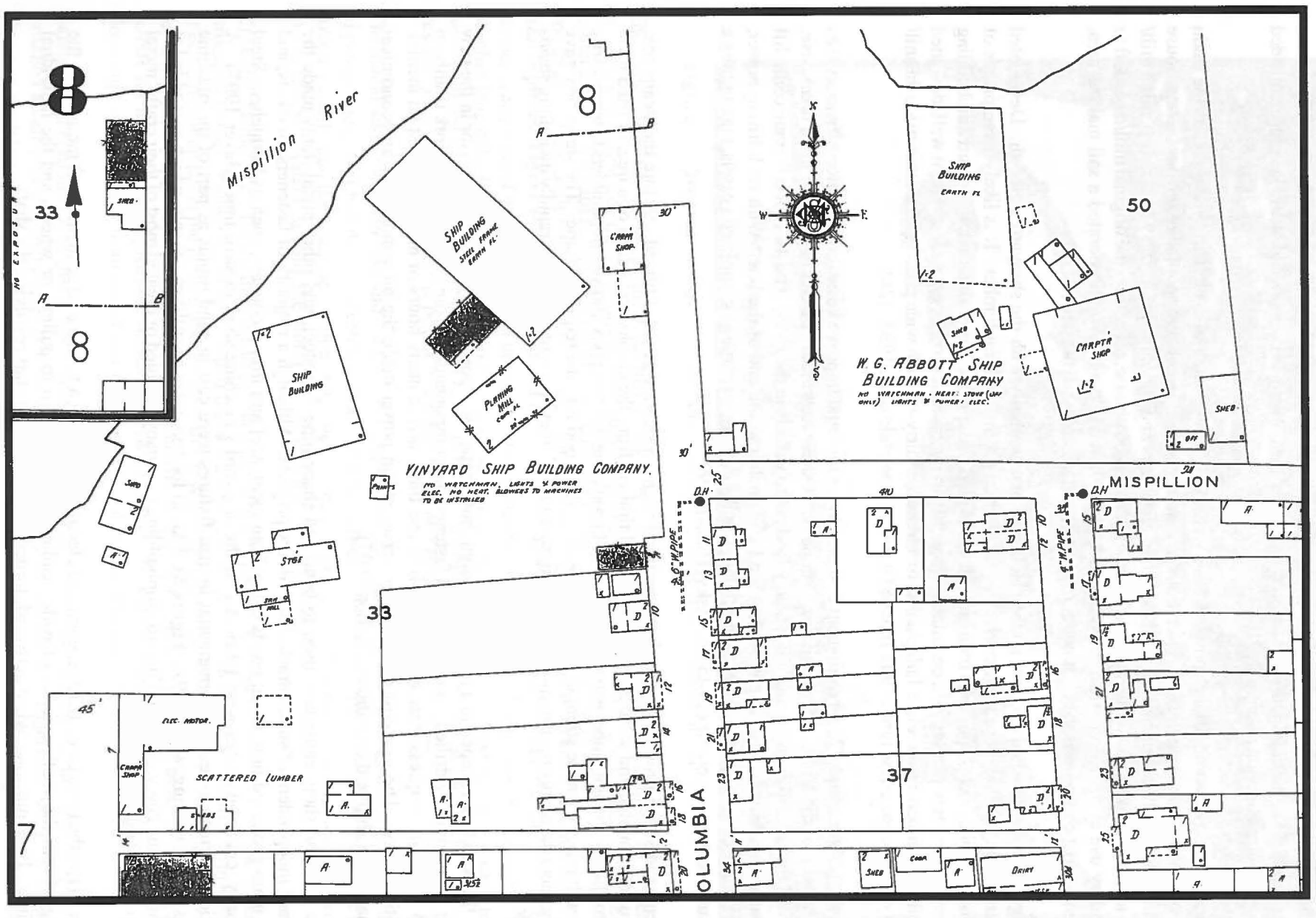

Figure 4. Sanborn map showing the Vinyard yard in 1930 (Sanborn 1930).

including an electric motor, was added to the southwest corner by 1930 (Sanborn 1930). In the southeast corner, a concrete office building provided storage area for the growing paperwork and record keeping demanded by increasing production (Sanborn 1919).

A joiner shop and an additional power house were built to the south and west, respectively, of the main boathouse, centralizing day-to-day operations in a smaller area. Steel cable spooled to the new power house furnished the means to pull vessels on the marine railways in and out of the river. In 1924, a new planing mill/ mold loft went into operation directly southwest of the main boathouse, relegating the original mill/mold loft to secondary use as a staging area. The mold loft in the new building also incorporated a sail making area, although most canvas was used for equipment and handrail covers (Hudson 1997).

Storage areas for finished and raw lumber increased exponentially with the shipyard's growth. Designated sites, including both exposed and covered areas, were used for stacking lumber. It is likely large pieces of unfinished timber were brought by train or truck and milled into specific dimensions at the Vinyard Shipbuilding Company. The new planing mill contained a large tilt-frame band saw on its exterior southern wall, designed to easily cut timbers into keels or hull planks. In addition, a thirty-six inch wide planer and jointer inside the mill could easily prepare raw timber into finished lumber (Doerrfeld et al. 1994: 126).

Equipment. New shipbuilding equipment designed to cut time and improve vessel construction efficiency was introduced into the Vinyard Shipbuilding Company. A sheer legs crane, placed east of the main boathouse, provided the capability to lift and place heavy loads onto vessels in the river. The 48-foot tall crane could lift 40 tons with a Mundy hoist engine with a head guy anchor at the end of the line. With such lifting power, Vinyard increased the yard's ability to install large, bulky engines on partially completed vessels, maintaining a self-sufficient operation for day-to-day tasks (Hudson 1997).

To bend and shape finished lumber into specific designs, a steam box was utilized. Before the steam box, shipbuilders hunted and selected naturally angled timbers from the crooks and bends of a tree, or used hand tools to shape a straight timber into a specific form. Introducing the steam box allowed shipbuilders to temporarily weaken lumber's tensile strength by steam, bending the wood into the required shape. The steam box gave shipbuilders the ability to custom-design certain structural timbers without relying on rapidly dwindling stands of oak.

Once the wood was shaped to a particular design, pneumatic tools powered by an air compressor in the new power house quickly drilled, hammered, and fastened the components into the vessel's framework (Sanborn 1919). The air compressor ran multiple tools at one time, saving many hours of manpower lost on menial, repetitive tasks. The low cost of air power versus steam power made the air compressor an economical alternative for shipyard operations (Hudson 1997).

In the machine shop, equipment used to bend and shape pipe, bar steel, and other metal items made the shipyard independent of subcontracted machinery projects. Although a majority of fasteners, brackets, and other mass-produced bulk metal goods came from local steel and iron producers, such as Bethlehem Steel Company, common pieces were fabricated at the shipyard's machine shop to save time (Baker 1997). A selection of custom-designed ornamental bronze fixtures were cast in sand molds as part of the machine shop's duties (Hollingsworth 1997) (**Figure 5**). Except for armament on military vessels, which was added at the Philadelphia Navy Yard, the Vinyard Shipbuilding Company installed or created most of their crafts' metal work (Baker 1997).

Power to run the tools came from an overhead electric motor which turned a large metal shaft mounted to the ceiling. From the shaft, a series of wide, leather belts led down to pulleys or wheels and the individual machines. Each machine, when activated, turned on the motor to start revolving the shaft.

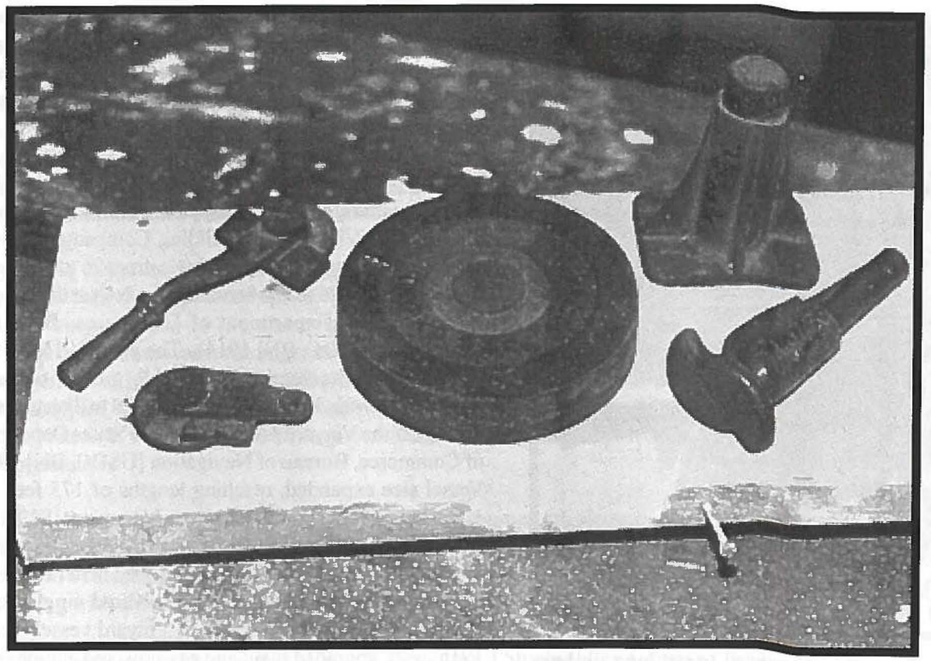

Figure 5. Wooden molds used for sand casting bronze and brass ship's hardware

The joiner shop offered the greatest advancements for the shipyard's workers. An assortment of power tools gave the shipwright a distinct edge in rapidly completing a vessel's many parts. A thirty-six inch wide planer and jointer allowed Vinyard to plane his own timber and save money on finished lumber (Doerrfeld et al. 1994: 126). For large timbers, a tilt frame band saw located outside the joiner shop expertly cut keels, hull planks, or other sizable pieces (**Figure 6**). To create tight-fitting joints, a mortise and tenon machine chiseled uniform holes and tenons in any type of wood, creating a production line assembly of interchangeable pieces. For banisters, poles, or other long cylindrical shapes, a 17-foot long wood lathe gave a shipwright the opportunity to create detailed woodworking for discriminating ship owners. Such tools not only offered a means for rapidly producing new vessels, but gave shipbuilders the power to quickly shape and replace rotten, damaged wood on older ships.

The machines in the joiner shop did not rely on a single, multiple-belt shaft as in the metalsmith shop. Each piece of power equipment had its own electric motor to furnish power. The largest cutting tools integrated the power source directly into the machine's frame. One piece of machinery, the 17 foot wood lathe, utilized an overhead motor and belt system, sharing the motor source with a large table router.

Upstairs, the mold loft floor exhibited an overlapping series of lines to trace out patterns for different pieces of structural timbers found on a vessel. Much like a giant puzzle, it took a trained shipwright to interpret where a specific template lay in the jumble of drawings, and how one piece fit with the next. Across the room, an electric sewing machine, crude by today's standards, stitched heavy canvas pieces to form small sails, railing canvas, and covers for the yachts and pleasure vessels. Vinyard used the sewing machines for more than canvas, creating floor rugs for the yachts from carpet material kept at the shipyard (Hudson 1997).

Safety considerations for shipyard workers led to improvements in the joiner shop. In the early 1930s, Vinyard installed an air-powered metal duct system to draw wood dust out of the shop (Sanborn 1930). A sheet metal shavings vault located outside the joiner shop received the excessive wood dust. The buildup of fine dust particles

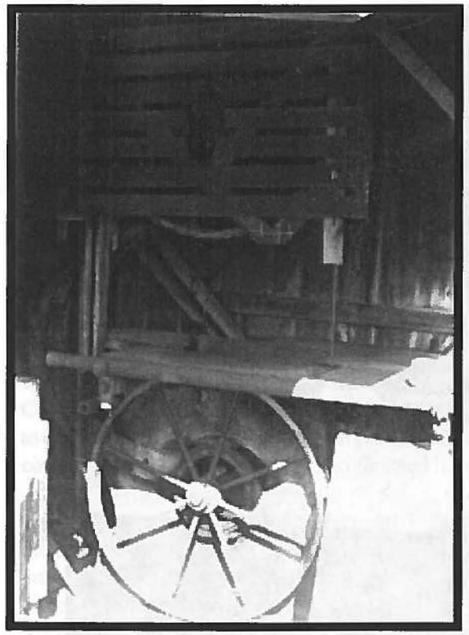

Figure 6. Bandsaw used to cut long timbers such as planking and beams.

from sanding and trimming lumber was a fire hazard, as well as harmful to the workers' lungs. Although the system was costly for a small operation, benefits from a possible reduction in insurance premiums and a positive reputation were worth the cost.

Vessel types. A variety of wooden pleasure yachts, fishing craft, freighters, and towing ships of various lengths were produced by Vinyard Shipbuilding Company. Between 1896 and 1914, nine civilian vessels, from 90 to 115 feet in length and 14 to 26 feet in breadth, were built at the shipyard (United States Department of Commerce, Bureau of Navigation [USDC, BN] 1914). The years 1915 to 1930, by contrast, witnessed an incredible growth of vessel production, with 33 civilian craft and 20 military vessels rolling off the Vinyard railways (United States Department of Commerce, Bureau of Navigation [USDC, BN] 1930). Vessel size expanded, reaching lengths of 175 feet, and 1000 tons net weight (*Delaware Magazine* 1919:127). Civilian craft interiors featured ornate woodwork throughout the main cabin and below deck, furnished better than some apartments at the time. Steam-powered single screw engines, found on the majority of Vinyard vessels before 1915, were upgraded to oil and gas-powered engines after 1915, increasing the range and efficiency of the boats.

Vinyard's success with military and civilian contracts led to several unique motorboat designs. *Venus*, a towing vessel built in 1930, was ordered for harbor work with the Mystic Steamship Company in Boston, Massachusetts (USDC, BN 1930). The boat was equipped with an electric engine to turn its screw, a feature not encountered on vessels at that time. The *J.C. Ritchie*, unlike the *Venus*, was the first freighter steamship in the United States to be equipped with a gasoline engine (MHS 1978:1). The boat, a freighter built in 1906, displaced 152 tons and stretched 114.1 feet long (United States Department of Commerce, Bureau of Navigation [USDC, BN] 1907).

Military craft produced by the Vinyard Shipbuilding Company found use in more than just the United States Navy. The United States Navy purchased three subchasers in 1917, each 110 feet long, equipped with three propellers and 660 horsepower engines (United States Department of Commerce, Bureau of Navigation [USDC, BN] 1918). In 1919, a pair of tug boats were added to the auxiliary fleet supplementing naval activities in east coast ports (United States Department of Commerce, Bureau of Navigation [USDC, BN] 1920). The Public Health Service, a branch of the Treasury Department, commissioned four boarding tugs and two station launches between 1925 and 1929. Approximately 40 to 55 feet in length, these boats served in harbors from Boston, Massachusetts, to Mobile, Alabama (USDC, BN 1930).

The United States Coast Guard purchased the largest number of military vessels from Vinyard Shipbuilding Company. Ten patrol craft, called "Six-Bitters" for their engines, were constructed between 1924 and 1925 to answer the growing need for boats monitoring shoreline activities along the Atlantic seaboard, as well as around the maritime regions of the United States (Scheina 1982:241). These powerful craft, 74 feet, 11 inches in length, boasted two 6-cylinder 400 horsepower Sterling gasoline engines turning twin propellers (Canney 1995:89).

Rise and Fall (1931-1950)

A continued demand for Vinyard's yachts and pleasure boats led to the expansion of the civilian craft line. The 1936 models released to the public contained eight different cruiser styles from which to choose. The buyer had a choice of vessel length, gas or diesel engines, and number of sleeping accommodations, to mention a few options. In 1938, ten cruiser models were produced for public consumption. The distinctive feature of the 1938 models was an increased emphasis on passengers' comfort, as evidenced by the expanded number of cabins, toilets, and sleeping areas onboard a single vessel. A 55-foot, "Double Cabin Enclosed Bridge Cruiser," for example, contained three cabins, three toilets, and sleeping arrangements for ten people.

The yard did suffer its share of ill fortune, however. The unfortunate death of Wilson M. Vinyard in January 1944, upset both the shipyard workers as well as the local community (Croft, 13 February 1977:3). His son, Wilson S. Vinyard (1894-1973), took over the shipyard and continued to produce masterpiece vessels. Sonny, as his friends called him, was no stranger to the shipbuilding profession. After graduating from Drexel Institute of Philadelphia in 1915 with an engineering degree, he returned to work by his father's side, designing new vessels for the shipyard (MHS 1978:1). Although he did not have the practical hands-on experience of some yard workers, Wilson S. Vinyard applied his engineering skills to design and improve the motorboats his father constructed in the boathouses.

Wilson S. Vinyard maintained a steady production of commercial pleasure craft. A total of fifty-nine wooden yachts, freighters, fishing vessels, and other craft slid down the rails of the Vinyard Shipbuilding Company and motored off to destinations along the east coast. The years 1935 and 1936 were peaks for total vessel production, culminating with eleven and fourteen vessels launched, respectively.

When the United States entered World War II, the Vinyard Shipbuilding Company easily geared its production assembly to produce military vessels for the war effort. A third marine railway was already inside the main boathouse to accommodate increased shipbuilding activities (Sanborn 1943) (**Figure 7**). East of the main boathouse, the number 3 marine railway from 1919 operated as a secondary station for putting final details on vessels constructed inside the boathouse. An overhead gantry crane, the only addition from the war, was installed during the early 1940s inside the main boathouse (Hudson 1997).

Modifications to the grounds had already prepared the shipyard for wartime activities. Water lines and fire hydrants installed in the main boathouse and near the sheer legs crane and boiler room, enhanced the workers' abilities to combat any fire. Toilets located near the center of the shipyard complex gave employees much needed relief during the day. A wire fence surrounding the yard kept out intruders and curious onlookers.

When wartime production flooded the Vinyard Shipbuilding Company with contracts, no time was wasted in building an impressive fleet. Fourteen subchasers were built between April, 1941 and July, 1944 (United States Navy, Bureau of Ships [USN, BS] 1946:271). Two classes of subchasers were specifically ordered. The SC497 class measured 110 feet long, had a 17 foot breadth, and a 6 foot 6 inch depth. Twelve vessels were built and equipped with twin gas engines rated for 1540 horsepower combined (United States Treasury Department, Bureau of Customs [USTD, BC] 1949). The SC1466 class was 111 feet 6 inches in length, had a beam of 18 feet 7 3/4 inches, and a depth of 5 feet 1 inch. Two 1200-horsepower gas engines powered these craft (USTD, BC 1949). Vinyard received $130,000 to $140,000 for each SC497 class boat and $127,500 for each SC1466 vessel (USN, BS 1946:271).

At the end of World War II, shipyard activities returned to luxury yacht and cruiser production. Despite the boost from wartime construction, post-war vessel production failed to match previous levels of growth. The Vinyard Shipbuilding Company never achieved prewar levels. In 1948, *Mateka III*, the last wooden yacht, was launched from the marine railway in the main boathouse (USTD, BC 1949). Shipyard employees, many of whom had worked at the yard since 1925, were dismissed due to the lack of business. Lay-offs forced shipwrights to become carpenters, marine engine mechanics to become car mechanics or refrigeration technicians, and electricians

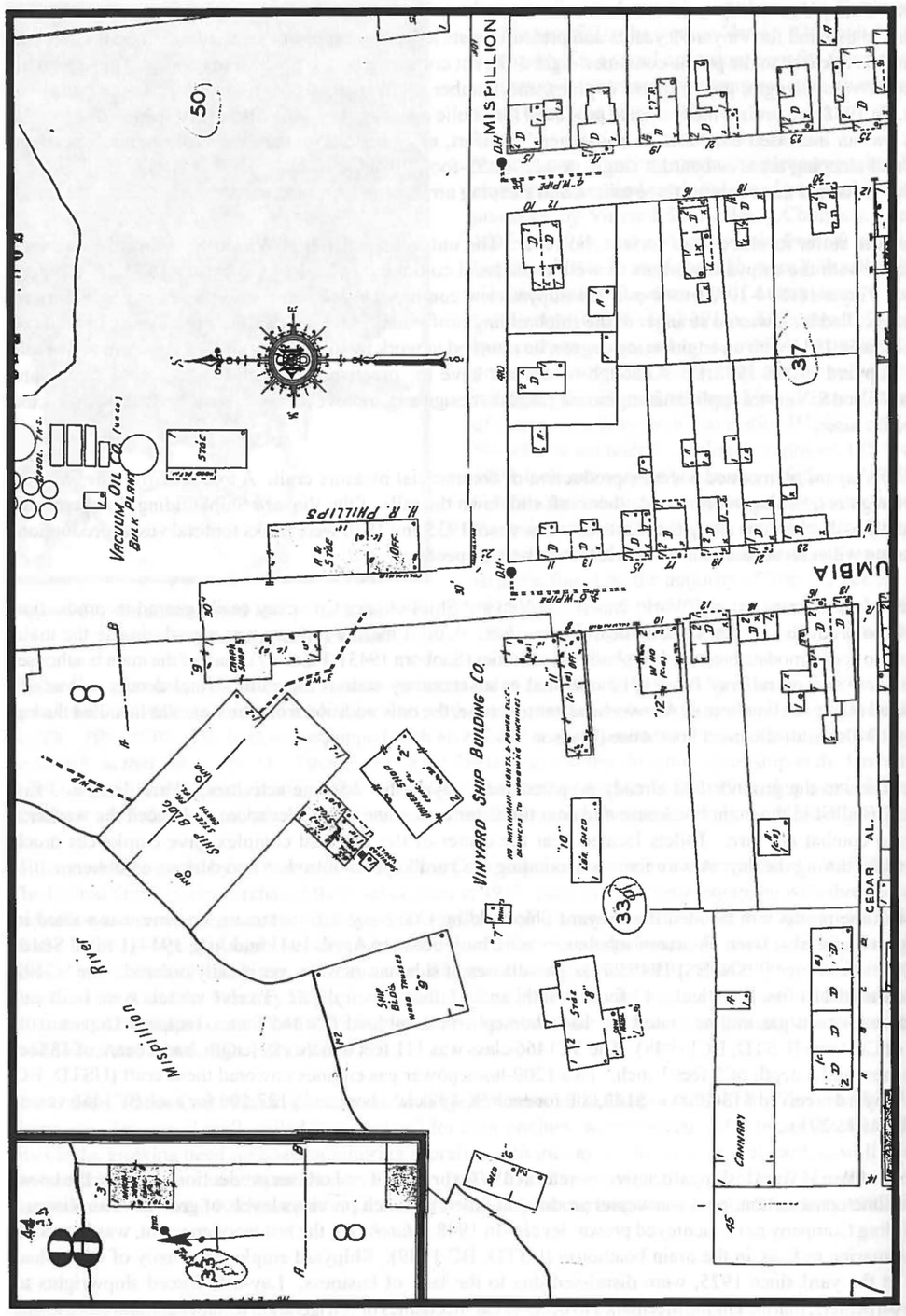

Figure 7. Sanborn map showing the Vinyard yard in 1943 (Sanborn 1930, revised 1943).

to work within the domestic community (Deputy Jr. 1996). The demise of the shipyard brought economic hardship to Milford as well. Shipyard workers living in boarding houses and apartments disappeared, along with their weekly purchases at grocery stores, clothing shops, and other businesses. In addition, rail service suffered a minor loss due to the gradual phasing out of materials brought in to build the ships.

Retooling of the Trade (1950-1974)

Closure of the wood vessel industry brought the Vinyard Shipbuilding Company to a standstill. Despite the absence of wood beams and skeletal framework, vessel sales of another sort took over the shipyard. The yard closed briefly from 1954 to 1955 in preparation for redesigning the yard's operations for a new type of vessel (Deputy Jr. 1996). Fiberglass hull boats replaced the wooden yachts and cruisers the Vinyard Shipbuilding Company built and sold for so many years. Several manufacturers displayed their merchandise across the eastern half of the shipyard, much like an automobile dealership, but these fiberglass boats were not built at the yard. The machine shop allowed repairs on the Mercury and Evinrude outboard engines sold with the boats (Griffith 1968:F2). The older Cummins diesel and Sterling gas engines from earlier yachts and cruisers were also serviced through the machine shop's facilities (Hudson 1997).

Although fiberglass boats captured the major share of business at the shipyard, wooden vessels still received maintenance, repairs, and storage. The joiner shop/mold loft functioned to make any repair necessary for the hundreds of wooden parts found on the cruisers. In addition, on-site storage facilities permitted boat owners the luxury of placing their craft in safe storage out of the harsh, winter weather (Hancock and Downing 1987:384).

As a result of concentrating on fiberglass boat sales in the eastern portion of the yard, the shipyard decreased to half its original size. Structures in the western half of the site were demolished because their use became less important to the daily function of the shipyard. Between 1963 and 1964, the original sawmill/mold loft was torn down and cleared away to create space for an aluminum storage building. The large boathouse west of the main boathouse met a similar fate, leaving behind one of its railways as a reminder of its existence. Additional showroom space and an outboard shop were added to the concrete office building to prepare for customer needs. In 1965, Vinyard added a showroom off-site for sales and service of fiberglass craft (Hancock and Downing 1987:321). The new showroom store, placed next to Interstate Route 113, a busy highway thorofare, had the potential to expose Vinyard's business to a larger customer base than the downtown-based shipyard.

Shifting production from wooden yachts and cruisers to fiberglass boats successfully maintained the Vinyard Shipbuilding Company's livelihood. Much of the craftsmanship associated with wooden vessel construction was lost with the introduction of mass-produced fiberglass material. Yet, those employees who stayed with the company as engine mechanics, repairmen for the older wooden vessels, or salesmen for the fiberglass boats, all shared a shipbuilding heritage with Wilson S. Vinyard that would never be encountered again in the small town of Milford. Vinyard passed away on 8 January 1973, having fostered the shipbuilding legacy his father brought to Milford with his desire to keep the tradition alive in a town slowly losing its maritime heritage.

From Wood to Steel (1975-1983)

With Vinyard's demise, the prospect of ship construction returning to Milford seemed a lost cause. Yet, before the end of the year, news about Vinyard's shipyard facility returning to operation became public knowledge. The town newspaper reported in October that the shipyard had been purchased by a New York firm and that construction would continue on the property (*The Chronicle* 1973:1). The new owners, Mr. and Mrs. Richard Taubler, and Joseph Pokorny, together formed Delaware Marine and Manufacturing Company, Incorporated, in 1975, effectively taking control of the shipyard and bringing vessel construction back to Milford (Dickerson 1976:1). John Hollingsworth served as general manager and supervised daily shipyard operations.

Unlike the wood or fiberglass boats, Delaware Marine and Manufacturing, Inc., built steel component vessels, including tugs, ferries, barges, and pilot boats. Each component for a vessel, whether the bow, stern, or mid-section, was constructed separate from the others, then welded together in the final assembly. Steel plate and steel beams, as well as other materials used in the vessels, were brought to the site by trucks and stored on the property. Eleven self-propelled vessels and four barges were constructed in the shipyard by October, 1980 (Taubler 1980). One additional towboat and three barges were under construction between 1980 and 1983. Vessel production stopped in early 1983, due to a shallow river that could not support the size of vessels built at the shipyard (Croft, 14 February 1977:2; Murray 1995).

The Shipyard Today (1983-Present)

The shipyard became an overgrown, neglected industrial site after closure of Delaware Marine and Manufacturing, Inc. Buildings fell into disrepair despite the continued limited use of the shipyard by John Hollingsworth. On 20 August 1996, a new owner signed the deed to take over control of the shipyard (Sussex County Courthouse, Georgetown, Delaware [SCC] 1996: Deed Book 2143:204-205). J. Sudler Lofland purchased the property intending to renovate and improve the buildings, clear the grounds, and return the property to its historical character. The shipyard would remain in use as a limited repair and maintenance facility for pleasure craft.

Lofland began a series of structural renovations to improve the safety and aesthetics of standing buildings. The main boathouse received a new roof and windows in January 1997, greatly improving the appearance of the building. The machine shop also received a new roof in January 1997, eliminating a gaping hole left when the old roof collapsed after years of neglect (**Figure 8**). The entire property received a thorough cleaning, removing years of graffiti, overgrown weeds, small trees, and accumulated trash.

The property owner's desire to retain the historical fabric of the Vinyard Shipbuilding Company presents an opportunity for understanding what was once a thriving industry. Although many original buildings were demolished, standing structures offer an exclusive insight into vessel construction and technological advances that gave Vinyard an advantage in producing high-quality civilian and military vessels. Both the historical and archaeological significance of the shipyard contribute significantly in documenting Delaware's twentieth-century wooden shipbuilding history.

Figure 8. Metalsmith's shop and furnace.

EXCAVATION RESULTS

An initial pedestrian survey of the Vinyard Shipbuilding Company property was conducted at low tide to identify areas best suited for subsurface testing. This overview was also designed to detect any aboveground indications of cultural resources within the project area. The entire waterfront was also surveyed for submerged cultural resources. No artifacts were removed from the river bottom.

As a means of organizing the field work, the Vinyard Shipbuilding Company project area was divided into five zones: A) concrete wharf/crane platform, B) main boathouse, C) exposed marine railway, D) a wooden, side launching way, and E) a possible early, side launching way at the west end of the property. A total of seventeen 3-foot by 3-foot test units were excavated within the shipyard property (**Figure 9**). In the following discussion, each survey zone will be presented separately.

Concrete Wharf / Crane Platform

Located at the eastern end of the project area, the concrete wharf/crane platform zone encompasses an approximate 125-foot by 100-foot area. The wharf/crane platform area is bordered to the west by the main boathouse and to the south and east by the machine/metalsmith's shop. A concrete and wood piling wharf keeps the land mass from eroding into the Mispillion River on the north. At the eastern and western ends of the wharf, small deposits of stone riprap prevent erosion into the river. Transplanted grass covers the land surface of the wharf/platform zone. Little other vegetation is visible.

One 3-foot by 3-foot test unit, designated Unit 1, was excavated in the concrete wharf/crane platform area. Placed against the 6-foot by 2.7-foot rear left concrete mount of the shear leg crane, Unit 1 revealed a 2.6-foot wide block of concrete overlying a disturbed very pale brown gravelly sand fill. A .2- foot wide, dark brown root mat separated the bottom of the concrete block from the sandy fill soil. Soils surrounding the concrete platform consisted of a disturbed, very pale brown gravelly sand fill, similar to the fill found below the concrete platform. The dark brown root mat was absent from the soil stratigraphy surrounding the concrete mount. The water table was reached at 3 feet below the surface. No units were placed within four feet of the wharf due to soil subsidence through cracks in the concrete wall.

Cultural material recovered from the excavation was limited to one iron worm-screw pipe clamp, measuring 4 1/4 inches by 3 3/4 inches, and two sherds of blue-gray stoneware, recovered in the upper .4 to .9 feet of the sandy fill. No subsurface features were encountered.

Investigations along the submerged northern edge of the wharf/crane platform area revealed several distinct variations in wharf wall design. The wharf wall proper consisted of two parts; a 3.1-foot high submerged wooden log wall overlain by a 3.6-foot thick reinforced concrete cap. This cap was composed of several 16-foot long sections butted together. 24-feet long wood pilings were driven into the riverbed at the joints of the concrete slabs to hold the composite wharf wall in place. The lower wooden wall resembled a series of rough-hewn logs driven end-first into the riverbed, much like a palisade fence. At least three lines of log pilings extended into the fast lands were visible in the wall makeup. Debris eroded from the land's edge was visible where wooden logs had rotted away or been removed. Eroded portions of the concrete cap revealed iron or steel rebar in the concrete.

Adjacent to the west end of the concrete cap, a large flat timber extended the line of the wharf wall to the edge of the boathouse basin. The timber, 16 feet long, by 2 feet 5 inches wide by 5 inches thick, rested approximately 4.3 feet above the riverbed on a series of pilings. Several iron nails were in this timber, but did not appear to have any pattern indicating use. Two 8-inch diameter wooden pilings buttressed the northwest corner of the timber, the only pilings visibly associated with the structure not used to support the plank itself.

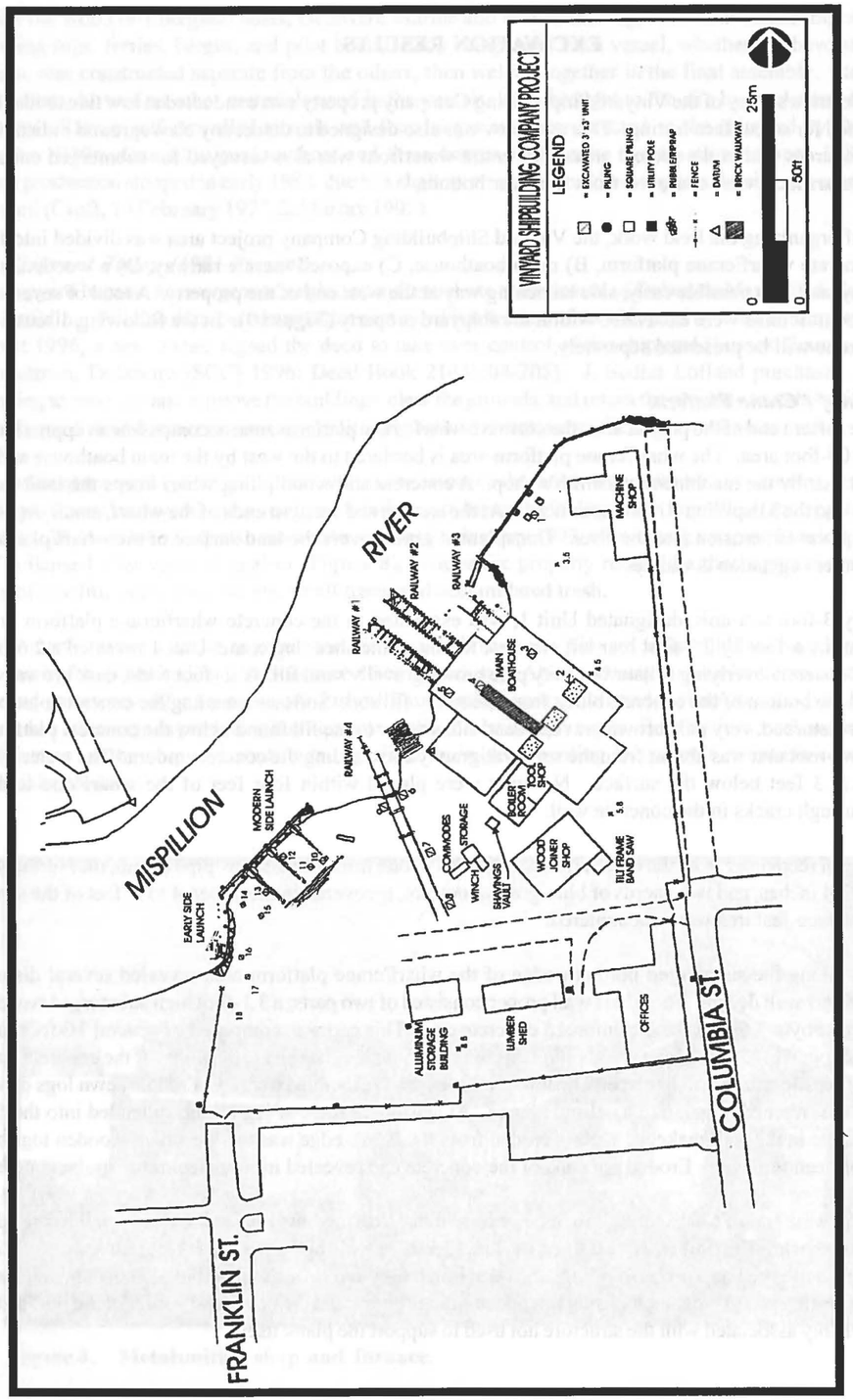

Figure 9. Vinyard Shipbuilding Company project site map.

Main Boathouse

The main boathouse of the Vinyard Shipbuilding Company is a 120-foot by 84-foot corrugated sheet metal-clad steel and wood frame structure situated along the Mispillion River (Sussex County Assessment Office 1974:3). Two large sliding doors, approximately 40 feet wide by 25 feet high, originally hung in the opening of the boathouse at the river, but were removed in the 1960s. A row of cantilevered windows, which permits a section within each window to open, line each side of the boathouse and allows ample natural light and air circulation into the building. The original two-level shingle roof was refurbished in 1997 with green corrugated-texture fiberglass panels. The ground surface inside the boathouse is a compacted sandy loam.

There are three bays inside the building; two steel-framed bays in the center and west, and a wood-framed bay in the east. Each bay contains a marine railway extending into the river, designated Railway 1 (west), Railway 2 (center), and Railway 3 (east). A brick walkway is present between the center and western railways. Two fire hydrants, one near the headway of Railway 3 and the second between the midpoint of Railways 1 and 2, are inside the boathouse.

A large concrete pad, approximately 30 feet by 15 feet, lies at the head of each railway. The rail lines' shore ends are fastened into the concrete pad. The rails extend down into the river. Railroad ties anchor the rail lines onto the boathouse floor. The railroad ties follow a pattern of two incomplete ties, consisting of two 14-inch long by 6- to 8-inch wide by 4-inch thick ties, under each rail, and a third complete 10-foot long by 6- to 8-inch wide by 4-inch thick tie.

Four 3-foot by 3-foot test units were excavated inside the boathouse. Units 2 and 3 were placed on Railway 3, and Units 4 and 5 placed on Railway 1. These test excavations were sited because of observed differences between structural materials in the bays and the length of the rail lines. Test unit profiles indicate that soils located across the boathouse were similar, a series of gray to dark brown sands capped with multiple levels of clay and sand. The sandy soils exhibited low to medium concentrations of gravel, ranging from 30% to 45% gravel, which decreased with depth.

Unit 2, placed near the head of Railway 3, contained a dense layer of crushed shell and cultural refuse between .5 and .95 feet below the surface (**Figure 10**). A total of 17 artifacts, four faunal, three oyster/clam shell, ten glass, and three ceramic, were recovered from this level. Above this level, a gray clay sand (10YR 6/1) capped the surface. A mottled yellow (10YR 7/6), gray (10YR 7/1), and dark brown (10YR 3/3) clay fill was encountered below the refuse layer. Beneath the mottled clay fill was a dark brown sterile silty sand (10YR 3/3), the natural subsoil base found along the riverbank (Truitt 1966:1).

Unit 3, approximately 25 feet north of Unit 2, did not contain a shell layer. Instead, a sterile layer of black sand was found between .8 and 1.1 feet below the surface. Thin lenses of different colored sands were found below the black sand. Similar to Unit 2, a dark gray sterile sand (10YR 5/1) capped the black sand. In addition, a dark brown sterile silty sand (10YR 3/3) composed the base soil.

Unit 4, placed at the north end of the brick walkway, revealed a thin brown organic loam (10YR 3/4), suggestive of decomposing sawdust, between and underneath the bricks. A black organic loam (10YR 2/1) capped with a yellowish-brown sand loam (10YR 5/6) was found under the brick/organic layer. A gravelly dark brown sandy clay loam (10YR 3/2), distinct from the dark brown sterile silty sand found at the bottom of other units inside the boathouse, was found at the bottom of the excavation.

In Unit 5, thin layers of brownish yellow clay (10YR 6/8), dark brown organic residue (10YR 3/3), and iron leachate from exposure to the rail line, were excavated within .4 foot of the surface. A gray clay sand layer (10YR 6/1) and a dark gray clayey sand and shell layer (10YR 5/1) were encountered between .4 to 1.3 feet below surface. Although the shell level was not as densely packed with shell fragments as the refuse layer in

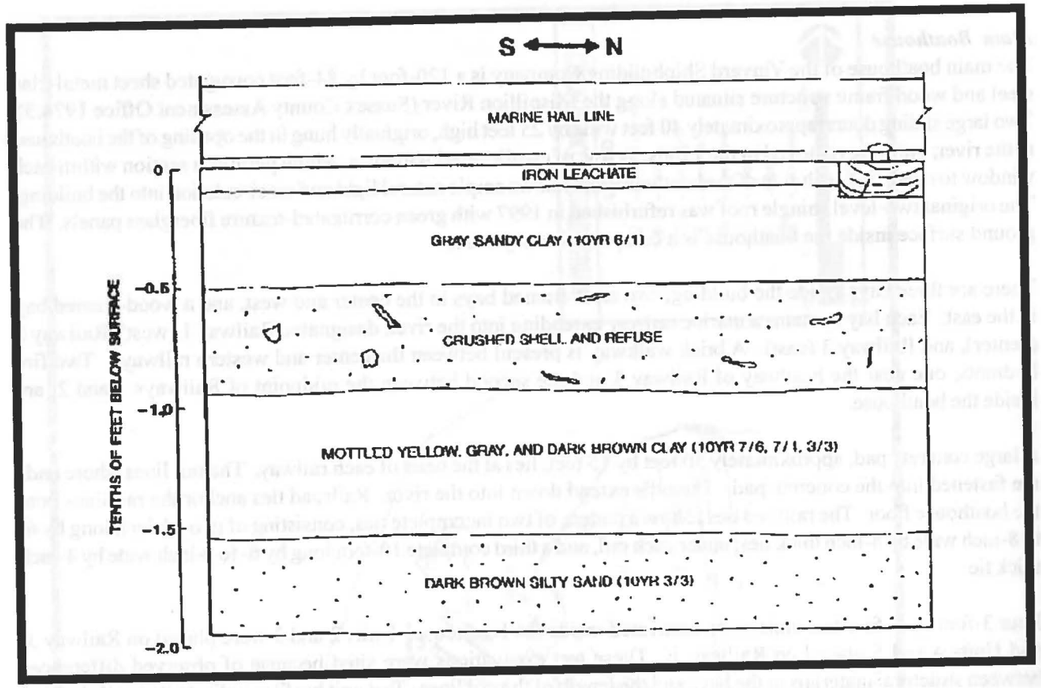

Figure 10. Unit 2, west wall profile.

Unit 2, the amount of material present was a drastic change given the lack of artifact bearing soils in the western half of the boat house. Below the shell layer, a gravelly yellow (10YR 7/6) and light gray (10YR 7/1) sandy fill was found at the bottom of the unit.

Artifacts collected across the general surface of the boathouse consisted of a variety of fasteners and hardware associated with construction and maintenance of wooden vessels. Various sizes of wrought iron nails comprised the majority of fasteners recovered, with a one-foot long spike being the largest. Two galvanized nails and a galvanized spike were also found. A bronze drift pin and a bronze threaded bolt and nut are the few alloys uncovered from the assemblage. One dark green glass bottle lip fragment represented domestic materials in the artifact collection found on the surface of the boathouse floor.

Below the waterline inside the boathouse, a thick layer of sediment from runoff and erosion covered the floor. A visual survey revealed that the boathouse railways continued into the river channel, and were in surprisingly good condition, still anchored at their termini in the center of the channel. Railway 1, 170.9 feet long, terminated at a 7-foot long by 2-foot wide by 4-inch thick timber mounted on pilings driven into the riverbed. At the rail's end, two 5-foot long by 10-inch wide iron plate braces were welded to the inside of the rails and fastened to the center of the 7-foot long timber, forming a "V" pattern. A triangular iron chock welded on top of the left rail terminus and a rectangular iron chock welded on top of the right rail terminus prevented rail dollies from running off into the river.

Railway 2, 170 feet long, did not have a raised timber support at the end of the rail lines. Instead, two 8-inch wide square pilings provided holding points to anchor the rail lines in the river. The rails lines were fastened at the bottom of the pilings' south side. Two 7-foot long by 10-inch wide iron plates, placed in an "X" design at the

rail ends, braced the rails and prevented flexing from the weight of vessels and the carriage. Two iron rectangular chocks were visible at the ends of the rails. No pilings were visible along the outside or inside edges of the rail lines.

Railway 3, 101.25 feet long, rested at its riverine end on a 7-foot long by 10-inch wide by 4-inch thick timber. The timber was situated 89.5 feet from the edge of the concrete pad in the boathouse and lay in the sediment of the riverbed. Two 3-inch diameter pilings placed between the rails braced the north edge of the timber. The tops of the small pilings extended 4 inches above the top of the rail lines, and 7 inches above the surface of the timber. Immediately to the north of the 3-inch diameter pilings, a 1.5-inch wide iron bar spacer was welded between the insides of the rails.

Directly east of the iron bar spacer and outside of the rail was an 8-inch diameter round piling. The piling exhibited a 6-inch deep notch cut into its west half. The top of the east rail line, sunk in the muck of the river, rested evenly with the bottom of the notch. No fasteners were visible in the notch of the piling. A second piling, 6-inches in diameter, was found 5 feet north of the previous piling. The top of this piling and the top of the east rail line were at the same level above the river bottom. The 6-inch diameter piling exhibited no notches or fasteners on its surface.

Exposed Marine Railway

West of the main boathouse, another set of rail lines lies exposed to the elements. This railway, designated Railway 4, consists of an 162.5-foot long pair of rails extending into the river. The left and right rails, 4.2 feet apart, do not end at the same point in the riverbed, but disappear at 162.5 feet and 144 feet, respectively. A derelict vessel is currently supported on blocks at the railway's head. The railway dolly used to bring the vessel up is no longer present. There are no visible signs on the surface of a previous boathouse or other structure over this marine railway.

Four units were excavated around Railway 4. Units 6 and 9 were placed inside the rails to examine the soil profile of the rail bed. Units 7 and 8 were excavated five and ten feet, respectively, east of the railway to determine if foundation remains of a previous boathouse structure existed. Soils east of the rails contained traces of overlying fill, and with the close proximity of standing historic structures, offered the greatest possibility for buried structural remains.

Unit 6, a shallow excavation to the depth of .4 foot, revealed a dense layer of mottled clay (10YR 5/8) associated with filling episodes. An organic root mat, .25 thick, covered the surface of the mottled clay. The unit's excavation halted due to high tide flooding.

Unit 9, directly west of Unit 6, contained similar mottled clay, with a layer of yellowish brown sand (10YR 5/8) on the west side of the rail. A very dark grayish brown sandy loam (10YR 3/2) capped the fill on the east side of the rail, while a brown organic humus (10YR 4/3) was found on the west side of the rail. A small channel of yellowish brown clay loam (10YR 5/8) and a very dark gray charred loam (10YR 3/1) was uncovered at approximately .45 foot below surface on the inside edge of the rail line. Exposure of the unit's surface revealed a root used to temporarily support the rail on the sinking railroad tie. The root patch rested on top of the wood tie, and was held in place with two iron nails.

Away from the rail lines, Units 7 and 8 revealed varied soil horizons. Unit 7 had a profile of silty sands and sands overlying a light gray to dark gray silty sand base (10YR 7/1-5/1). A band of brownish yellow sand (10YR 6/8) with iron leachate and cobbles, .6 foot to .85 foot below surface, separated the thin overlying lenses of fill from the thicker gray sands. Artifacts from Unit 7, mostly from the upper sand lenses, included clear plastic, aluminum beer can fragments, and vinyl sheeting. A limited number of fasteners, including six steel nails and two steel bolts, were encountered with the modern debris. Structural materials from the light gray sand bottom lens include slate and brick fragments.

Unit 8, located near the head of the rails, contained a series of sand layers over a base of gray sand (10YR 6/1). Between .75 foot to 1.8 feet, a dense horizon of railroad bed fill, including shell, brick, and ash, over a thin layer of waterlogged wood and organic debris was encountered. The water table was reached 3.2 feet below the surface.

Submerged resources associated with Railway 4 were limited. Despite the presence of the railway on the surface, its terminal point vanished into the mud and sediments of the river. An end point could not be established without dredging the riverbed.

A large wooden boat ramp was discovered at the river's edge 25 feet northeast of the exposed marine railway. The ramp, composed of sixteen 10-inch to 14-inch-wide planks nailed to 6-inch by 8-inch stringers, rested at the low tide line of the bank. Three square pilings, each 3 inches by 4 inches, braced the ramp against the rise and fall of the tides. No artifacts were found in association with the ramp, and the ramp was left in place.

Side Launch Ways

The western half of the waterfront property contained a wooden, side launching, ways composed of three sets of wooden rails. The launch extended down to the water's edge and was anchored on a large timber and piling bulkhead.

The rails consisted of three sets of composite timbers anchored on three concrete pads with steel fasteners (**Figure 11**). Each rail, measuring 39 feet 4.25 inches long by 11 inches wide by 5 inches thick, exhibited a series of scarf joints where ends of adjacent timbers met to complete a continuous rail. The scarf joints varied from 5 to 6 inches in length, with a 1-inch wide by 3/4-inch to 1-inch deep gap at the timber mating surface. Poured concrete pads supported the rail lines at the marshy riverfront. The 38-foot 4-inch long key-shaped pads narrowed from 10 feet wide at the river's edge to 33 inches wide at the head of the beveled base. The platform width narrowed at 8.5 feet to 10.5 feet from the platform's riverine end.

On top of each platform, a steel rectangular latch was bolted into the concrete pad at the rail head. Approximately 1.2-feet high by 1.5-feet wide, the latches were coated with red lead paint. The latch on launch way #1 had a "#1" welded on the east side and "RRT 5/22/81 #1" on the latch's west side.

A variety of fasteners were found at the wooden side launching ways. One and one-half inch-wide steel nuts and 1-inch-wide steel bolts secured the wooden rails on their concrete base. Each pair of nuts and bolts, painted with red lead paint, were systematically placed along the length of the rail line, and capped with 2 7/8-inch-wide diameter wood plugs. A series of 6d common nails were also found on the surface of the rails, a majority of them at the river end. A number of 4d and 8d common nails were found driven into the inside of the rails. Some nails still secured thin rotted wood strips.

Four units were excavated in the side launch area. The units uncovered a series of fill episodes overlying a wet, gray-to-dark gray sand base (10YR 4/1-6/1). Units located next to the concrete pads had a crushed stone layer below the concrete pad. The crushed stone acted as a support foundation, preventing the heavy concrete pad and rail from sinking into the unstable fill.

The east end of the side launch revealed an earlier living surface deep in the soil. Unit 10, located at the east end rail head, contained a layer of logs 2.7 feet below surface at the interface of the dark gray clay sand subsoil (10YR 4/1). The logs, laid parallel to the river's edge, varied from 4 inches to 5 inches in diameter, and were remarkably well preserved in the wet soil. The logs showed signs of having been trimmed of smaller branches, unlike similar branch debris found across the shipyard. Overlying soils consisted of a black sand (10YR 2/1) from 1.9 to 2.4 feet, and an orange and dark brown sand (7.5YR 7/8 and 4/2) from 2.4 to 2.7 feet. These soils did not contain artifacts. The presence of ground water seepage prevented further excavations into the log layer.

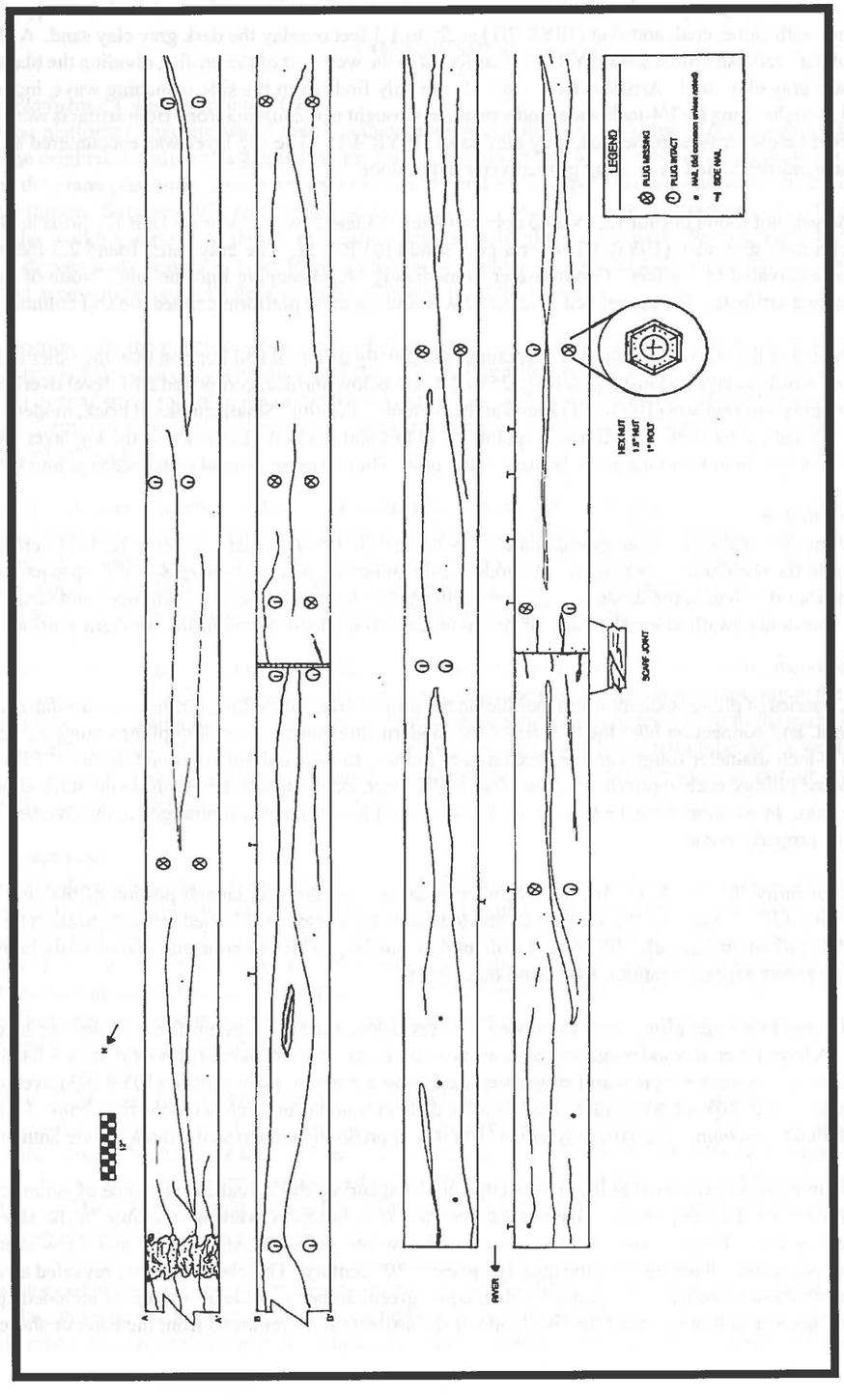

Figure 11. Wood side launch way #1.

In Unit 11, the dark gray clay sand subsoil was encountered at 1.3 feet below surface. A root mat-capped layer of black sand with stone, coal, and slag (10YR 2/1) at .25 to 1.3 feet overlay the dark gray clay sand. A .3 foot-thick lens of dark reddish brown sand (5YR 3/4) was found in the west half of the profile, dividing the black sand from the dark gray clay sand. Artifacts from Unit 11, the only finds from the side launching ways, included a treenail, 5 1/2-inches long by 3/4-inch wide, and a repaired wrought iron caulking iron. Both artifacts were found 1.7 to 1.8 feet below surface in the dark gray clay sand (10YR 4/1). The log layer was encountered at 2 feet below surface, accompanied by seeping groundwater in the floor.

The log base was not found in Unit 12, located approximately 13 feet down slope from Unit 11. Soils in Unit 12 consisted of a dark gray clay (10YR 4/1) over a gray sand (10YR 6/1). The gray sand, found 2.3 feet below surface, was excavated to 2.9 feet. Groundwater immediately began seeping into the unit. None of the soil lenses contained artifacts. The gravel bed associated with the concrete platform capped the soil column.

Unit 13, situated at the west end of the site, contained a distinctly different soil horizon than the other units. A thick layer of mottled clays and historic debris, .25 to 2.4 feet below surface, comprised a fill level overlying an atypical dark gray sand subsoil (10YR 4/1) found at the bottom of the unit. Small chunks of brick, modern metal scrap, and crushed oyster shell were found in quantities in this soil horizon. Evidence of the log layer was not encountered 2.4 feet below surface at the bottom of the unit. There was no ground water seepage into the unit.

Early Side Launch

At the western end of the site is an approximately 50- by 150-foot rectangular section. The land here slopes gently down to the river at the west end of the modern side launching ways. A sharp 8-foot drop separates the project area from the river at the western edge in this 50- by 150-foot tract. New growth trees and scrub brush cover a 15 foot-wide swath along the edge of the river, capturing flood debris at the northern portion of the lower bank.

In the river, a series of pilings extends north, parallel to the project area's shoreline, turning east around a bend in the waterfront, and connecting with the timbers of the modern side launch. Standing pilings range in size and shape from 4-inch diameter rough-surfaced rectangular timbers to 6-inch diameter round timbers. Five large creosote-coated pilings, each approximately one foot in diameter, extend in a line from the bend of the shoreline up onto the land. In addition, a stacked cluster of 15- to 20-foot long pilings is submerged in the riverbed at the southwestern property corner.

A total of four units, T.U.'s 14, 15, 16, and 18, were excavated on the side launch portion of the site. Two additional units, T.U. 17 and T.U. 19, were not excavated due to the presence of buried utilities. Soils in this area consisted of disturbed sand and clay fills mixed with modern building debris, organic material (stumps, branches, roots), and an assortment of ceramics, glass, and other items.

Unit 15, adjacent to a large piling, was excavated 3.5 feet below surface. The profile revealed six layers of modern fill. A large tapered wood plug, similar to an oversized cork, was uncovered approximately 3 feet below surface in Unit 15. A thick root mat and substantial dark brown gravelly loam topsoil (10YR 3/3) overlying a brownish yellow sand (10YR 6/8) characterized Unit 18, distinct from the units closer to the river bank. Units 15, 16, and 18 failed to encounter the dark gray sands (10YR 4/1) predominant across the modern side launch area.

Although no units were excavated at the river's edge, a visual survey did reveal the presence of ceramics and glass eroding out of the steep bank. Glass, ceramics, and iron fasteners were also visible in the shoreline sediments at low tide. The majority of ceramics were whitewares, redwares, stonewares, and a few sherds of transfer-print porcelain, all dating from the mid-19th to early 20th century. The glass assembly revealed a variety of bottle and container fragments in shades of blue, aqua, green, amber, and clear. Fasteners included spikes, nails, staples, screws, and other metal debris. None of the artifacts were removed from the bank or shoreline.

CONCLUSIONS

Crane Platform / Concrete Wharf Area

The crane platform / concrete wharf area has undergone major landscape changes. A photograph from 1917 shows the original shoreline as a gently sloping dirt bank held in place by a simple wood palisade wharf wall in front of the crane platform. Two auxiliary railways, #5 and #6, occupied the area between the crane and the main boathouse. Between 1931 and 1934 a concrete wall was installed over the palisade wharf wall, effectively raising the working surface of the lot to create a deeper basin along the wharf. Raising the wharf's height allowed deeper draft vessels to float freely in the river, avoided damage to a ship's bottom at low tide, and permitted access to the vessel's deck at an equal height from the wharf.

In conjunction with the concrete wharf wall, a large quantity of sandy, gravelly fill was brought in to raise the existing level of the area even with the top of the wall. Soil profiles in Unit 1 revealed a 2.6-foot thick layer of sandy fill over a buried root mat, the original working surface of the lot. The sandy fill surrounded the concrete crane platform, but was not found under it. Today, the same area consists of a flat sandy lot held back by the concrete wharf wall.

As a result of the concrete wharf wall addition and fill deposition, there is a high possibility that material remains associated with early crane platform area activities are buried under the fill. The presence of the intact root mat below the fill indicates that the earlier working surface was not disturbed, and that artifacts could survive below the overburden. The fill episode did not affect auxiliary railway #6, as the rail line was still in use in 1941, so the potential for cultural remains within the railway footprint are especially strong.

In addition, there is a high possibility for cultural remains in the river. Reuse of the existing wood palisade, an economic alternative to a full-scale wharf reconstruction, contained the land mass from spilling in the water and burying timbers and artifacts. As a consequence, many of the structural timbers related to the earlier design of and association with the wharf are still visible. One particular example, a large, flat timber at the west end of the wharf, corresponds with the placement of auxiliary railway #6. This timber served as an anchor point for the ends of the railway to deposit the vessel into the river.

Main Boathouse

The main boathouse has retained much of its original design and function. Architecturally, the boathouse exhibits the original building materials and concrete foundation. The center and western bays, framed in steel beams and trusses, were built between 1910 and 1919. An overhead gantry crane was added to the western bay between 1941 and 1945 (Hudson 1997). The eastern wooden beam and truss bay, added to accommodate year-round vessel production and above-average volume, was built between 1931 and 1934. The beam and truss interior design illustrates the concept of no-frills, cost-effective function by utilizing a simple structural shell to keep out the elements allowing year-round operations.

The original rails were removed between 1931 and 1934, and new lines installed, as witnessed by the three-year gap in vessel construction in Table 4. The old rails were deposited in a pile near the headways of the modern wood side launch. At the same time, 5.5-inch thick concrete pads were installed at the headways of the three railways. It is unlikely the concrete headways date from the construction of the original boathouse. The financial priority would have been to build the boathouse first and improve existing launchways and structures, then deal with cosmetic additions as time and money dictated.

Archaeological evidence corroborates this interpretation. Soil profiles in Units 2 and 5 show that a layer of gray sandy clay, the base for the railway, overlies a layer of gray sand mixed with crushed shell, glass, bone, and ceramic refuse, the original fill layer brought in to raise the surface of the area. The 5.5-inch thick concrete pad

corresponds with the gray sandy clay immediately below the rail line and leachate. Removing the original rail lines would have disturbed the refuse-laden fill, so a new soil bed would have been brought in to cover the earlier, disturbed soil horizon. The new soil bed would be graded to accommodate the concrete pad at the headway. In the case of Unit 5, railway #1 comprises a third set of rails, as evidenced by the buried iron leachate lens below the railroad ties. Oral testimony verifies this third set of rails (Hollingsworth 1997).

Unit 3 soils provide an even greater focus on the construction phase of the boathouse railways. Soils in Unit 3 depict a series of thin, sandy lenses over the marshy riverbank mud flat, distinct from the refuse-laden horizon visible in the other units. A comparison of early maps revealed that Unit 3 was excavated in the proximity of auxiliary railway #5, which was removed between 1931 and 1934 from the crane platform area to facilitate construction of the wooden boathouse bay. As a result, the sand lenses can be dated from the construction of the wood bay or earlier. Additional soil profiling to the north (towards the river) and east (towards the crane platform) would provide a better idea of the spatial distribution of the sand lenses, and a narrower date of activity.

Exposed Railway #4

A single marine railway represents the last remainder of the first marine railway boathouse built on the Vinyard shipyard property. By 1910, a pair of marine railways were laid out from the original saw / planer mill down to the river. The 1930 Sanborn map shows the rail lines under a structure, although the map does not indicate what materials were used in the building. By 1964, the old boathouse was demolished. Information derived from the unsigned 1964 map does not clarify whether the present-day missing rail line was removed at this time.

Despite the abundance of information available from maps concerning the placement of the boathouse, the remains of the structure were not found. A cursory examination of the area revealed a jumbled mix of sands, clays, building debris, and modern refuse. Subsurface excavations revealed that a variety of brown, gray and black sands and silts, indicative of periodic fill episodes, blanketed the old boathouse area. Twentieth-century refuse, both architectural and domestic household, was mixed in with the sands and silts. To uncover the post features or sill lines of the old boathouse, the area of exposed railway #4 would have to be stripped down to the original working surface. The old boathouse site is too large an area to randomly place single 3-foot by 3-foot test excavations in an attempt to uncover a building foundation.

An especially interesting aspect of the frugality of the Vinyard Shipbuilding Company was observed with railway #4. A root patch was uncovered in Unit 9 anchoring the west rail to the surface (**Figure 12**). The root was firmly held in place with two iron spikes, so it was not a temporary patch. It appears that the rail tie subsided into the fill, leaving the rail loose from its anchor. The root patch successfully held the rail line in place, and saved the company time and money. The root patch also shows that the rail lines were considered a secondary work site, as frequently used railways required railroad ties to absorb stress from the large construction volume. A root patch would not support the weight and vibration of the railway dollies and their cargo.

Modern Wood Side Launch

The modern wood side launch west of the main boathouse was built in 1981 to compliment the three sheltered marine railways. Steel vessel components were brought together and assembled on the wooden ways, and the completed vessel launched sideways into the Mispillion River. The initials "RRT", for Richard R. Taubler, one of the yard owners, and "5 22 81", for the construction date, on the eastern concrete pad firmly date the wooden launch into the Delaware Marine and Manufacturing Company's steel shipbuilding operations.

However, below the surface of the modern wood side launch lies an earlier feature associated with the Vinyard Shipbuilding Company. A log floor was discovered between 2.1 and 2.8 feet below the present surface across the eastern half of the launch. The logs were trimmed of all branches and protrusions, unlike wood debris found across the site, and were laid loosely over the soil. No metal or wood fasteners were used to lock the logs into place. A wrought iron caulking tool with a mended handle was uncovered just above the log surface. With the

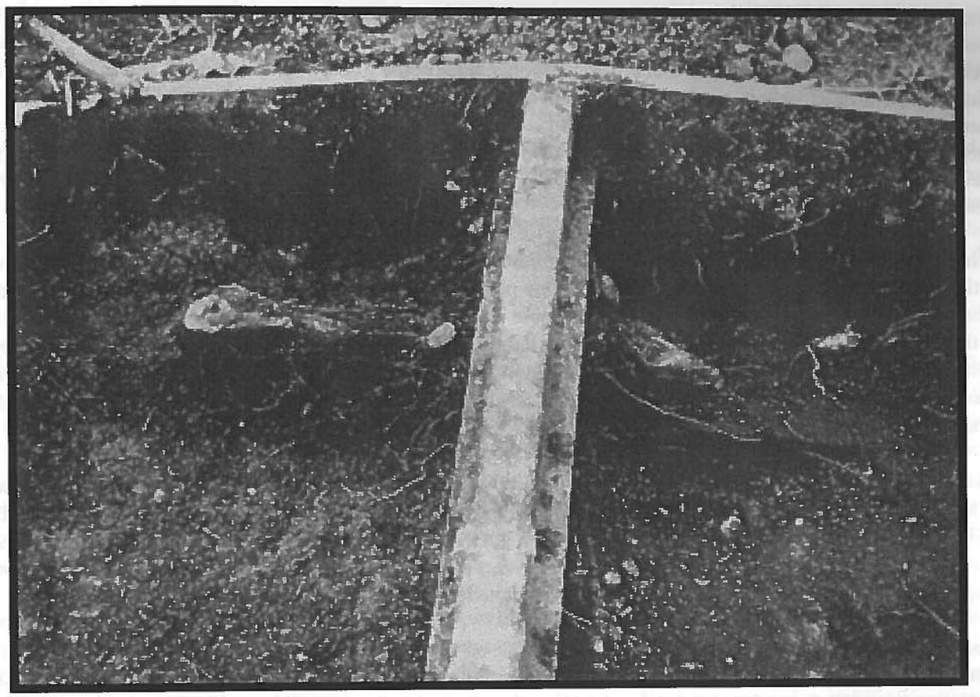

Figure 12. Root used as a shim to support marine rail.

seeping water table and muddy soil, the log floor served as a cheap, sturdy platform for workmen to stand upon, allowing them access to vessels and materials at the water's edge without the hazards of slipping on or sinking into the soft river bank.

Along the waterfront, a series of pilings and revetments under the terminal ends of the wood launch ways delineate where previous wharf walls held back the shoreline. Maps from 1941 and 1963 indicate that a concrete wharf once stood along the shoreline, but no concrete remains to suggest its presence. Underwater investigations of the revetments and pilings did note that the northernmost line of pilings, inundated with debris and timbers inshore of it, had their tops cut off to facilitate the wooden launch ways, and therefore predate the wood launch. With the eroding fast lands and disheveled collection of palings and pilings, it was difficult to distinguish periods of occupation based on timber placement. A better sense of temporal and spatial growth of the revetted waterfront would be accomplished with a large-scale controlled removal of the overburden, thereby exposing the earlier waterfront surface, and tracing the placement of the various size timbers.

Early Side Launch

Although the early side launch boathouse, storage shed, and a smaller shed no longer exist at the west end of the property, the 1910 Sanborn map depicts the size, material composition, and use of the three structures. As the oldest shipbuilding structure on the property, the side launch boathouse offered the greatest possibility of a link to earlier shipyard occupations through the launching technology, building design, and artifacts related to vessel construction.

The archaeological excavations exposing the early boathouse remains proved to be a futile effort. More than 3.5 feet of fill was brought in to raise the level of the west end. Similar to railway #4, various levels of fill contain architectural debris, such as brick and concrete, rubber tires, bottle glass, bones, ceramics, and modern refuse. Much of the artifact collection dates from the twentieth century, hampering the use of ceramics and glass as date-specific markers. In addition, the transposed nature of fill horizons, such as modern concrete below redware sherds, indicates that soil level placement in the column can not guarantee an accurate time frame. The entire west end would have to be stripped of its overburden in order to ascertain the extent of buried remains of the boathouse and two sheds.

A number of square and round pilings and other timbers along the shoreline provided a boundary for boathouse activities otherwise buried under tons of soil. One portion of exposed timbers formed the basis of a revetted wharf wall, although only a ragged section was visible. To the south of the wharf wall, a series of logs laid parallel to the shoreline resembled a basin floor, especially if the wharf wall continued south into the river bank. Iron eye bolts were visible on the ends of the first two logs towards the shoreline, but the use of such hardware was not clear. Additional square and round timbers proceeded north along the shoreline, continuing the track of the wharf wall.

The lack of archaeological data does not lessen site significance. The 1910 Sanborn map provides enough data to argue that the boathouse served as the central building site during the early formative years of the yard. By 1930, the boathouse was removed from the property, but the storage shed continued to be used for supplies. At the same time, two new boathouses were built on the east half of the property, signifying the spatial shift from a single structure operation to a cluster of facilities designed to improve the flow of vessel construction.

Workshops

Not all of the shipyard activities occurred on marine railways or launches. A series of buildings harbored the preliminary stages of vessel construction, whether the shaping of timbers, metal casting, or paperwork processing for the final bill of sale. The tools, papers, and materials left behind from the day to day operations provides an outline of how the shipyard built itself up from a small, rural shipbuilding occupation.

The joiner shop and machine shop contain a compliment of tools illustrating the technological progression of the Vinyard shipyard. Chisels, saws, augers, and other hand tools represent the traditional ship construction implements, while in the same context pneumatic drills and planers, as well as modern arc welding equipment, usher in the advancements of the twentieth century. Together these items portray the shipyard's adaptation to technological advances in shipbuilding tools, all the while retaining the traditional hand tools which withstood the test of time.

Even the original saw and planing mill on the west half of the property, demolished by 1964, presents its activities through map documentation. The saw and planing mill served not only to cut timbers, but raised and lowered vessels into the river via a braided steel cable spooled across the property. The same retrieval system was used in the new boathouse, but with a different power source. Vinyard saw the successful designs in tools and equipment from the old saw and planing mill and transferred them into the updated facilities.

Final Summary

Overall, the Vinyard Shipbuilding Company faced many difficult tasks as it progressed through the twentieth century. Wooden ships happened to be the reigning product of earlier neighboring shipyards. However, Vinyard entered the business as steel and iron became the choice materials for vessel construction. The shipyard adopted the steel and iron in their vessels, yet still maintained a larger percentage of wooden structural components in their ships. Unlike the shipyards in Wilmington and Philadelphia, Vinyard did not experience the pressure to build massive steel ships, as the river's width limited the size of vessels, and large stands of timber were still commercially plentiful, so he continued to build vessels based on local influences.

The shipyard layout changed as a result of the melding of steel and wood. Where the earlier sawmill and side launch boathouse occupied the western half of the property, the later phase grouped multiple facilities into a smaller eastern area. The concentration of new buildings and railways promoted a smooth, flowing assembly line operation from fabrication shops to the railways.

It was the changing needs of boat owners which dictated the fate of the Vinyard Shipbuilding Company. Wooden pleasure craft were not requested by the fishermen or pleasure-seekers anymore. A shift to fiberglass boats reduced the shipyard to a salesroom, despite the limited engine and hull repairs on site. The introduction of steel shipbuilding brought a temporary resurgence back to the town, rekindling hopes of a renewed maritime occupation along the waterfront. An insufficient river depth quickly ended the dream of a return to shipbuilding along the Mispillion River.

Future Research

Future research of the Vinyard Shipbuilding Company site should prioritize three distinct subjects. The first subject includes a thorough documentation of the hand and power tools located across the site. Much of the motorized wood- and metal-cutting machinery dates from the first quarter of the nineteenth century, possibly earlier, and exhibits manufacturers' names and serial numbers on the bodies. As shipbuilding tools and machinery were sold with a shipyard's closure, a collection of this caliber in one place provides a wealth of information on period equipment manufacturers and the technology incorporated into their products. A comparison between hand and power tools, as well as between different power tools themselves, would illustrate the technological benefits and / or drawbacks of the shipyard equipment, and how such results affected the shipyard operation.

The second subject concerns the landscape of the shipyard. Despite the current upkeep of the property, erosion and wear continue to alter the landscape. Waterfront areas exposed to severe erosion, in particular, are disappearing into the Mispillion River, along with any cultural resources buried within. Wharves, riverbanks, and railway beds eroding into the river must be stabilized to prevent further deterioration. Each area requiring stabilization would be handled individually, given the unique layout and design (i.e. marine railways versus concrete and wood wharf). Part of the stabilization program would include additional detailed documentation of the existing remains, such as photographs and drawings, to illustrate key features of each area.

The third subject for future research involves the numerous structures across the site. Each building contains a distinct historical character and use. By documenting the historic architectural component of each building, a database will be formed to compare other shipyard structures in Delaware, as well as across the country. Architectural traits related to regional preferences or economic backgrounds can be compared with the data gathered from the boathouse, workshops, and outbuildings.

What is to become of the Vinyard Shipbuilding Company property? The new owner continues to improve the facility with regular building maintenance and groundskeeping. A limited number of pleasure craft, both wood and fiberglass, are brought up on the railways for routine inspections, ensuring continued maintenance of the marine railways and associated equipment. The variety of power and hand tools for wood and metal shaping are still used and kept in perfect condition despite their age. Yet the shipyard will never return to pre-World War II levels of wooden vessel production. As a result, it is imperative that the shipyard is documented and recognized for retaining "...sufficient elements of the shipbuilding process, evidence of the machinery, and the landscape" of a wooden shipyard property type (Doerrfeld et al, 1994:193). There are so few surviving shipyards in Delaware, the information gathered from the Vinyard Shipbuilding Company would provide a wealth of details about small ship construction businesses, as well as the people and the community around it.

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