2004 PHILADELPHIA NAVY YARD MASTER PLAN

PHILADELPHIA INDUSTRIAL DEVELOPMENT CORPORATION
LIBERTY PROPERTY TRUST
SYNTERRA PARTNERS

ROBERT A.M. STERN ARCHITECTS
For more than 250 years there has been an American navy yard on the banks of the Delaware River in Philadelphia. From giving birth to the United States Navy and Marine Corps, to launching and spanning thousands of ships to the nation’s defense, to generating innovation and excellence in aviation and maritime research and production, Philadelphia’s Delaware River has been at the leading edge of military, commercial, and industrial advancement since the days of our Founding Fathers.

Since 1876, the physical and emotional center of this activity has been focused on a landsape at the northern tip of Philadelphia, at the confluence of the Delaware and Schuykill Rivers. Known through time by many different names such as League Island, the Philadelphia Naval Shipyard, the Philadelphia Naval Station, Mount Air Station and the Philadelphia Naval Complex, we call it today simply The Navy Yard. Although it was home to hundreds of thousands of workers and was the livelihood to hundreds of businesses over the years from throughout the region, the life, beauty, and assets of The Navy Yard were kept at an arm’s length from the general public as the Navy’s activities in support of our nation’s defense were necessarily undertaken behind a guarded gate. As a result, this land and its potential have remained largely undiscovered.

A series of events over the last decade have begun to change this reality, paving the way for new opportunities. Rooted in the decisions of the Federal Base Closures and Realignment Commission of the early 1990’s, the U.S. Navy officially decommisioned its Naval Shipyard and Naval Station in 1994 and 1996 respectively making the way for both the redevelopment of the site and a new era of Navy engineering, research, and development in Philadelphia.

As part of this transition, in 1996 the City of Philadelphia’s Mayor’s Commission on Defense Conversion published a Community Reuse Plan that established the fundamentals for a vision that would guide initial redevelopment of the site for nearly a decade. This plan was steeped in a process that built a consensus for reuse from the broadest base of Philadelphia’s citizens, public officials, and public and private institutions. This public-private support has provided the solid framework for long-term redevelopment of the site. This plan also provided the foundation and energy necessary for the Philadelphia Industrial Development Corporation, as the City’s economic development corporation, to accept ownership of more than 1,000 acres from the Navy in 2000 and move forward with development.

In the initial years of transition, an extraordinary amount of investment and activity has been occurring at the site. With more than 4 million square feet of occupied buildings and a work force in excess of 6,000, the Navy Yard has begun to re-establish itself as a substantial economic engine for our region. The Navy’s remaining civilian workforce, largely focused on cutting edge engineering, research, and design in the areas of propulsion and energy, represents a strong “anchor tenant.” Much of the private employment established to date has built on the site’s industrial and maritime assets. The development of the Kvaerner Philadelphia Shipyard has built on these traditional assets with a new, state-of-the-art commercial shipbuilding facility and workforce that is the most modern and well trained in the world.

This Plan also offers a vision that builds on the property’s essential assets, which include: an unmatched historic district with extraordinary turn-of-the-century architecture and landscapes; the site’s enormous scale; its location at the center of the region’s transportation networks and labor force; the critical mass of its existing activity; its more than 2.5 miles of waterfront along the Delaware River; and its proximity to the cultural amenities and intellectual capital of the region. This Plan builds upon all of these assets while it mitigates the site’s main current drawback: its perceived and actual separation from Center City.

The 2004 Master Plan represents an update and, in some ways, an extension of the 1994 Community Reuse Plan and the initial industrial-focused redevelopment that has occurred to date. It builds on the principles established for the reuse of this enormous property and explores in more depth the potential for development of the 500 acres located in the central portion of the site along Broad Street and east along the Delaware River.

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This Plan’s vision is one of a dynamic, mixed-use waterfront community that includes everything one would expect from a great city: industrial development, offices, retail, waterfront amenities, executive conferencing, research and development, improved mass transit, great public spaces, and the potential for residential development. It is a vision grounded in the essential urban planning values of historic preservation, mixed-use development, increasing public access to the water, pedestrian oriented streets and sidewalks, mass transit, smart regional growth, and sustainability. At the same time, it is based on a realistic evaluation of market opportunities.

We have many people to thank for their efforts in developing this vision. First, to Mayor John F. Street for his personal commitment and leadership in planning for and promoting the reuse of Philadelphia’s key neighborhoods and commercial districts, including The Navy Yard. To our Board of Directors for their support of development at The Navy Yard to date and for undertaking this fresh evaluation of the site and its opportunities. To Liberty Property Trust and Synterra Partners for their initial commitment to developing commercial office space at an otherwise untapped site and for their invaluable partnership in funding, managing, and shaping this exciting new course to both a visionary and realistic way. To the broad-based Executive and Advisory Committees who volunteered their time and provided us with critical and invaluable feedback throughout this process. Finally, to the professionals whose experience, skill, and effort produced this Plan. The Navy Yard is an extraordinary asset and this Plan aims to bring it to full utilization, stimulating new life and a future of economic growth by extending the city to the water.

We see this Plan as a catalyst that stimulates continued investment, while it encourages a broad spectrum of public and private sector representative to engage in an ongoing dialogue about the future of this historic asset. We are honored by our role in shepherd the process and welcome your participation.

January 2004
Philadelphia Industrial Development Corporation
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EXECUTIVE SUMMARY
The 2004 Plan focuses on five districts within the 1,200-acre Philadelphia Navy Yard: the Historic Core, Corporate Center, Research Park, Marina District, and East End.

Figure 1
Larger in area than Center City Philadelphia and located at the foot of historic Broad Street, 3.5 miles south of City Hall, the Philadelphia Navy Yard presents an extraordinary opportunity for redevelopment in this essential and uniquely American city. The 2004 Philadelphia Navy Yard Master Plan (the “2004 Plan”) rivals the scale of Thomas Holme’s Philadelphia Plan for William Penn in 1682 and follows in a long-standing Philadelphia tradition of urban planning.

The Site
The Navy Yard benefits from a unique and valuable set of architectural, landscape, and infrastructure assets. Its 1.200 acres contain 282 existing buildings of which 233 are contributing historic structures, and seven miles of waterfront open to a broad reach of the Delaware and Schuylkill Rivers. Today approximately 6,000 workers, covering the spectrum of industrial, service, and research and development jobs, find their employment on the site in four million square feet of buildings.

The Navy Yard’s location provides expansive south-facing river views, views of the city decline to the north, and proximity to the 347-acre Franklin D. Roosevelt Park, a vibrant residential neighborhood, and a cluster of professional sports stadiums. The Navy Yard’s location is a critical gateway and primarily east of Broad Street. In addition, the site’s historic assets include the former Mustin Airfield (87 acres) on the eastern portion of the site, the former Mustin Airfield, the former Mustin Airfield, and seven miles of waterfront open to a broad reach of the Delaware and Schuylkill Rivers. The Navy Yard’s location is a critical gateway and primarily east of Broad Street. In addition, the site’s historic assets include the former Mustin Airfield (87 acres) on the eastern portion of the site, the former Mustin Airfield, the former Mustin Airfield, and seven miles of waterfront open to a broad reach of the Delaware and Schuylkill Rivers. Today approximately 6,000 workers, covering the spectrum of industrial, service, and research and development jobs, find their employment on the site in four million square feet of buildings.

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The Plan
Within The Navy Yard’s 1.200 acres, the western portion of the site (the Shipyard) is largely occupied by the Navy, commercial shipbuilding, and other industrial activities and the Plan assumes the Navy will continue to develop those uses. To the east of the Shipyard, the Plan establishes for districts, each with its own distinct character, assets, and development objectives. The Plan proposes that these districts create a dynamic, mixed-use waterfront development that successfully extends the city south to its riverfront. The districts include:

- The Corporate Center (72 acres) is located between Broad Street and Long Island Boulevard near The Navy Yard’s historic gateway. Approximately 1.4 million square feet of new office space, 10,000 square feet of retail, and 3,000 parking spaces are proposed for this district.
- The Historic Core (66 acres) flanks Broad Street and opens up to the Delaware River to the south. Building upon its many historic buildings and landscape elements, the 2004 Plan proposes the reuse of approximately 2.4 million square feet of existing buildings integrated with approximately 1.4 million square feet of new development. Overall, this will create 950,000 square feet of office space, 590 residential units, 110,000 square feet of cultural use, and 64,000 square feet of retail. The Plan also creates an opportunity for a 750,000-square-foot academic or research campus.
- The Research Park (68 acres) is designated for research and development, office, light manufacturing, and distribution facilities.
- The Maritime District (135 acres) focuses on a new, 250-slip marina, as well as an executive conference center, recreation, and maritime support facilities. Two development options, one primarily commercial and one primarily residential, are presented in the 2004 Plan.
- The East End (67 acres) is presented in the Plan in three alternative configurations: a 1.5 million-square-foot industrial development, a 3,500-unit residential neighborhood, and an East End Center, linked to one another by a triangle of primary streets: Broad Street, North Street, and 9th Street.

In total, the 2004 Plan calls for the renovation and reuse of 2.5 million square feet of existing buildings and the creation of up to 12 million square feet of new buildings, 31 acres of public goods space, 16,300 parking spaces, and 250 marina slips. The Plan requires approximately $140 million on-site infrastructure and supports nearly $2 billion of private investment.

The rich array of existing finances provide a compelling context for the Plan. Historic architecture and mature landscape create a sense of place that cannot be replicated. The Plan carefully considers the existing historic fabric, identifies opportunities for continued preservation, and proposes new construction that both complements and rejuvenates the site’s historic assets.

The Plan is organized around a clear hierarchy of new and existing streets that build on the site’s valuable urban street grid. A new diagonal roadway (“Diagonal Boulevard”) connects The Navy Yard’s historic gateway to the proposed marina and becomes a principal organizing element of the Corporate Center and Maritime District. Diagonal Boulevard focuses development energy toward the proposed marina and eastern end of the site, opening valuable waterfront front for development and balancing development currently focused in and around the Historic Core. The Corporate Center, Historic Core, and Maritime District are linked to one another by a triangle of primary streets: Broad Street, Diagonal Boulevard, and Kathy Hawk Avenue. While the existing four-lane Long Island Boulevard serves as a bypass road for traffic to the Research Park and East End and is extended to provide a high-volume connection to proposed Navy Yard entrance points at Delaware Avenue to the east and 20th Street to the west.

The Plan proposes a significant network of public green spaces and parks that define development sites. These spaces are connected by greenways – streets flanked by landscaping and parklike and bicycle paths. The Plan also proposes that the planning area’s prime stretch of waterfront be improved, activated, and made accessible in an amenity for both public use and future development. More than two miles of waterfront are proposed for public access along a new Eco-friendly Esplanade. Additionally, approximately 27 acres of wetlands are used to create parks, natural habitats, and landscaped buffer/within The Navy Yard.

The proposed green space network is an important component of the Plan’s emphasis on environmentally responsible and sustainable development. The focus on sustainable building and planning strategies during the early stages of planning aims to maximize the positive impact of these strategies while minimizing associated costs and constraints. Parking lots are sized to include “bioswales” for stormwater retention and filtering. A network of reservoirs, reflecting pools, and wetlands integrated throughout the development also facilitates stormwater retention. New buildings within The Navy Yard will address a spectrum of environmental issues including energy use, natural daylighting, waste product recycling and use of renewable materials – in brief, environmentally responsible planning and design practices are central to the Plan.

As the site at the edge of a dense urban area, the Plan examines alternatives for increased mass transit and proposes improvements that capitalize on this location, connecting the site to the city and regional mass transit networks and workforce. The Plan specifically recommends immediate improvements to bus connections between The Navy Yard and the Broad Street Subway as an initial way to re-connect the site with the regional population. In addition, the Plan calls for a one-mile extension of the SEPTA Broad Street Subway line, bringing fixed-rail mass transit to The Navy Yard from the Paterson Avenue station. This $260 million investment offers the opportunity to advance the density and pace of development in a way that no other investment could while reinvigorating the entire Broad Street Subway line to serve the Navy Yard.

The Navy Yard presents unique and exciting opportunities for Philadelphia to grow into its natural borders extending the vitality of the city, preserving significant historic assets, encouraging new access to the waterfront, and establishing a regional asset that will attract and retain current and future generations to live, work, and play. This Plan gives direction to this potential by establishing a set of practical, yet imaginative, principles that will guide planning and investment decisions in the short- and long-term.

This Document
This document presents The Navy Yard Master Plan in several parts. Part I includes detailed plans for the Corporate Center and Historic Core, conceptual plans for the Research Park, Maritime District, and East End, and a summary of issues related to the Plan’s implementation. Supporting analysis of planning issues such as street types, public open space, parking, retail, and design, sustainable design, adaptive reuse, and utilities are included in Part II. Design Guidelines for development in the Corporate Center, Historic Core, and Maritime District are presented in a separate document.
Figure 2. The 2004 Plan showing the residential development option in the Marina District and the industrial option in the East End.
HISTORY
The last station log for the Philadelphia Naval Shipyard was entered on September 27, 1996, ending over 200 years of the U.S. Navy’s operation of a military base in Philadelphia. Navy operations in Philadelphia started with the founding of the U.S. Navy itself. Under the direction of Benjamin Franklin, ships from Philadelphia’s local naval establishment were sold to Congress in 1775 to form a Continental Navy. These ships were built in the Philadelphia neighborhood of Southwark along the Delaware River. In 1801, a U.S. Navy Yard was established at Philadelphia in the Southwark maritime district. As a major center for ship design and development, the Southwark Navy Yard advanced from wooden sailing ships to steam-powered iron warships. During the Civil War it became clear that the expanding Southwark community was limiting the expansion of Navy operations at this site. In 1861, a fire engulfed the Navy Yard at Southwark, reinforcing the need for relocation. Officials began to look at League Island, two miles downstream, as the location for a new, first-class Navy Yard in Philadelphia.

In 1874, the first building constructed by the Navy on League Island was the Civil Engineer’s Residence or “Quarters A” (Fig. 6). From this building the Navy civil engineer directed the dredging of the Reserve Basin in League Island’s back channel and the construction of a caisson extending Broad Street to the island (Fig. 3). This new large freshwater basin was a particularly important improvement for storing the new ironclad fleet. A street grid was established on League Island to serve as the armature for development. Five east-west avenues crossed the central axis of Broad Street while a series of parallel north-south streets were planned to either side. Buildings were to be grouped along Broad Street in accordance with Navy Department organization. In addition to Quarters A, between 1874 and 1877 the Navy built the Bureau of Yards and Docks Storehouse and Office (Building 1), Boiler and Engine House (Building 2), Iron Plating Shop (Building 3), Bureau of Steam Engineering Storehouse and Shop (Building 4), and Bureau of Construction and Repair Mold Loft (Building 7).

In 1875, the Navy permanently relocated to League Island from Southwark. Initially the Yard struggled in its new location with storms and flooding that destroyed its floating dry dock and covered shipbuilding facilities. The government improved the facility, building permanent dry docks in 1891 and 1897, officers’ quarters along the Reserve Basin and the Delaware, and the Commander’s Office on Broad Street, as well as research and testing facilities for engines, propellers, and wireless telegraphy. Expansion from the early 1890s through World War I saw the Philadelphia Navy Yard emerge as a first-class naval industrial base (Fig. 4). The Marine Corps Reservation to the east of Broad Street and immediately south of the back channel grew to include barracks, officer’s quarters, a parade ground, drill field, rifle range, and banyanland. In 1911, the Marine Corps Advance Base Training School was transferred from Newport, Rhode Island, to League Island. Shipbuilding commenced just prior to the outbreak of World War I in August 1914 and the first ship, troopship Idaho/s, built at The Navy Yard was launched in June 1916. wartime expansion between 1916 and 1919 gave deep to the present dry Navy Yard. League Island was divided along Broad Street into one navy base on the east side and a shipyard on the west side. In 1917, a naval aircraft factory was developed along with an airstrip on the flat eastern part of the growing island. With a hangar, office building, smithsou, and engine shop, The Navy Yard’s excellent location was ideal for testing seaplanes. By 1919, with the construction of a new 1,000-foot dry dock, the Philadelphia Navy Yard emerged as America’s most modern facility for the building of large ships.

Despite this pre-eminence, postwar disarmament forced the scrapping of two new battle cruisers and activities at The Navy Yard, released from construction of new ships to the decommissioning and scrapping of obsolete warships. This work provided a constant

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The workforce at The Navy Yard peaked in March of 1943 at nearly 60,000 civilian workers. The surge of workers led to increased ferry service across the Delaware to New Jersey as well as the construction of moderately-priced housing in the surrounding neighborhoods of South Philadelphia. As a self-contained industrial "city," League Island dealt with typical social and economic issues of its time. It had a weekly newspaper and hosted war-bond rallies, concerts, and celebrity appearances to boost patriotism and the morale of workers (Figs. 12, 15, and 16).

The post-World War II years once again saw The Navy Yard in a period of demobilization, downsizing, and reorganization. The Navy deactivated 16 ships in the reserve basin as its role in support of the fleet declined, reaching a postwar workforce low in 1949. Rumors of closure circulated but were stopped by U.S. involvement in the Korean War as The Navy Yard received and overhauled numerous destroyers, aircraft carriers, and submarines. Activity continued after the Korean War and through the Cold War era with an emphasis on the modernizing of submarines, destroyers, and light carriers for potential anti-submarine warfare with the Soviet Navy. This was the most productive peacetime era for the Philadelphia Navy Yard with a workforce of over 9,000. With U.S. involvement in Vietnam this workforce grew to 15,000 by 1967 – the largest since World War II.

During the post-Vietnam years the U.S. Navy fleet shrank from 680 ships to 360 in 1978 and the closure of the Navy's Philadelphia base was once again rumored. The Soviet Navy outnumbered the American fleet in all ships except aircraft carriers. Congressional hearings to remedy this disparity found that older ships such as Philadelphia could not compete technologically with private yards on the Chesapeake and Gulf Coast. It was found that the Philadelphia Navy Yard failed to meet six out of ten basic requirements for maintaining the fleet. Most importantly, given its proximity to a major city, the Philadelphia Navy Yard never received a license to build and repair the nuclear-powered ships which made up the majority of the Cold War fleet. The Navy Yard continued to overhaul older warships as part of the Fleet Rehabilitation and Modernization Program (FRAM) and 500 housing units were built on the far east end of League Island to house civilians and cross-off ships in the program. Under President Carter the Yard of The Navy Yard was further prolonged through the Service Life Extension Program (SLEEP), which overhauled and modernized older aircraft carriers rather than build new ones. With its two 1,000-foot dry docks, Philadelphia was one of only two government facilities capable of such work.

In 1977, during the SLEEP era, the historic Marine Corps Reservation was closed, ending a 200-year Marine Corps presence in the city in which it was founded. It was thought that the SLEEP could keep The Navy Yard active for the next twenty years but in 1990 the Base Closure and Realignment Commission (BRAC) put the yard on its list for future closures. The Persian Gulf War briefly provided new work in reactingivate mothballed transport ships in the Reserve Basin, but in July 1991, the Navy recommended to the BRAC to close the naval base and naval shipyard in Philadelphia. Efforts by local and state politicians to keep The Navy Yard open failed and the base began preparations for conversion to civilian use. Philadelphia Mayor Ed Rendell formed a Commission of Defense Conversions that in conjunction with the Philadelphia Industrial Development Corporation (PIDC) led the creation of a "Community reuse Plan." The plan was submitted to the Navy in 1994 as a basis for transition and a conveyance for redevelopment.
Figure 11. Reserve Basin, 1938

Figure 12. President Franklin D. Roosevelt visiting The Navy Yard, 1940

Figure 13. Yards and Docks Store House, 1880 (Building 1)

Figure 14. Waterfront Development, 1911

Figure 15. Judy Garland entertaining lunchtime crowds, 1942

Figure 16. USS New Hampshire football team, 1917

Figure 17. Dry Dock 1, 1919
THE SITE
Figure 18. Locator Plan. The Navy Yard encompasses an area comparable in size to Center City Philadelphia measured from the Delaware River to the Schuylkill River, from Vine Street to South Street. It is truly urban in scale, with the capacity to contain several neighborhoods with a mix of uses and characters.

The Philadelphia Navy Yard consists of 1,200 acres of land along the Delaware River, 3.5 miles from Center City Philadelphia, at the southern end of Broad Street (Fig. 18). Broad Street is the primary artery linking The Navy Yard and the civic, cultural, commercial, recreational, and residential life of the city. Heading south from City Hall, Broad Street passes through the city’s Central Business District, past the Avenue of the Arts District with its new Kimmel Center for the Performing Arts and Academy of Music, through the commercial and residential neighborhoods of South Philadelphia, past the stadiums and arenas of Philadelphia’s professional sports teams, to terminate in The Navy Yard at the Delaware River.

The Navy Yard encompasses an area comparable in size to Center City Philadelphia measured from the Delaware River to the Schuylkill River, from Vine Street to South Street. It is truly urban in scale, with the capacity to contain several neighborhoods with a mix of uses and characters.

While the Broad Street axis places The Navy Yard in a prominent geographical position, the Interstate 95 elevated highway and the CSX Rail Yards that form the northern boundary of the site isolate The Navy Yard from the rest of the city. Franklin Delano Roosevelt Park and the stadium complex, both to the immediate north of I-95, further this effect. This physical separation served its function when the site was an active Navy Base, creating clear lines of security, but today it means that many Philadelphians are unfamiliar with The Navy Yard and its vast potential.

Although these physical constraints limit local traffic access to the site, the highway and rail lines provide broad regional access. The ramps to I-95 at The Navy Yard entrance provide direct highway access to the primary vehicular route between New York and Washington and to all areas of the immediate Philadelphia, southern New Jersey, and Delaware region. The proximity of I-76 further improves access between The Navy Yard and Center City Philadelphia and its northern and western suburbs. The Navy Yard is highly visible from the elevated I-95 as it passes the site, providing a currently untapped opportunity for public recognition.

Adding even broader regional and international access, Philadelphia’s regional passenger rail hub, 30th Street Station, is located 3.5 miles from The Navy Yard, and Philadelphia International Airport, west of The Navy Yard on the Delaware River, is less than a ten-minute trip away.

Street access to The Navy Yard currently exists at Broad Street only. Historically, the site was also accessible at its western end from 26th Street. This point of access, though currently closed, could be easily reopened when its use is justified. At the site’s eastern end, Delaware Avenue currently terminates in mid yards immediately north of The Navy Yard. An extension of Delaware Avenue is proposed as a third point of access to The Navy Yard. Both the 26th Street and Delaware Avenue site access options are discussed and evaluated later in this study.
The existing subway stop at Pattison Avenue on the Broad Street Subway is approximately three-quarters of a mile north of The Navy Yard entrance. The distance to the majority of The Navy Yard site, and the character of the walk between The Navy Yard and the subway stop, make the existing line and stop only a minor asset to the site as a whole. Improving the streetscape and pedestrian connections of Broad Street under the I-95 overpass would strengthen the connection between the subway stop and sites immediately adjacent to the gateway. Regularly scheduled bus service from the Pattison Avenue station to key points within The Navy Yard will allow the site to benefit more fully from its proximity to the subway. Detailed feasibility and implementation studies related to the eventual extension of the subway to The Navy Yard and construction of a trans-Delaware rail service between The Navy Yard and southern New Jersey should continue beyond the conceptual analyses included in later sections of this Plan.

One of The Navy Yard’s primary assets is its roughly seven miles of shoreline along the Delaware River, the Schuylkill River, and the Naval Reserve Basin. Of this frontage 1.14 miles is within the industrial area north of the Reserve Basin, 3.27 miles is within the Shipyard, and 2.58 miles is within the 2004 Plan study area (Fig. 19). Views across the river from The Navy Yard are primarily of green New Jersey shoreline, with the exception of the Eagle Point refinery, which occupies a portion of the opposite riverbank (Fig. 20). Streets within The Navy Yard that run perpendicular to the riverfront often allow river views from deep within the site. The Delaware River is over 1.5 miles wide in this area, making the far shore quite distant, and allowing a broad area for recreational boating and other river traffic. In addition to the Delaware River frontage, the Reserve Basin (Fig. 21) provides a dramatic view of water and large ships immediately upon entering The Navy Yard. Looking away from the water, The Navy Yard site also affords expansive views to the north of the sports stadiums and the city skyline beyond (Fig. 22).
Figure 21. View west from the Corporate Center – a dramatic view of water and large ships immediately visible upon entering The Navy Yard.

Figure 22. View north from the Corporate Center – expansive views of F.D.R. Park, Philadelphia’s sports stadiums, and the city skyline beyond.
Within The Navy Yard, as it exists today, Broad Street remains the primary organizing element, connecting The Navy Yard’s historic gates to the river and dividing the site into two distinct zones. To the west of Broad Street is the Reserve Basin, the site of the Kvaerner shipyard, and related large-scale industrial facilities. Along and to the east of Broad Street is an area that historically served as the Naval Station with the Navy’s residential, recreational, and administrative facilities. These two zones lie within the nationally registered Philadelphia Naval Shipyard Historic District. This designation signifies The Navy Yard’s importance in American history and protects it as a historic and archaeological resource by providing guidelines for reuse and preservation (Fig. 25). A majority of development areas at The Navy Yard also fall within a “Keystone Opportunity Zone” (KOZ) (Fig. 24). These designated areas benefit from certain tax incentives which encourage economic development.

The variety of buildings present at The Navy Yard recalls the breadth and complexity of its former use. Both 19th and 20th century former industrial buildings (Figs. 28 and 33) lie in close proximity to administrative and residential buildings (Figs. 30 and 38). Since The Navy Yard was transferred to PIDC in 2000, selective demolition has created building sites within the Historic Core, cleared the site for the proposed Corporate Center, and allowed for improved integration between the Historic Core and adjacent new construction.

Buildings deemed to be of lasting value have been secured and stabilized. Many of these have already been recopposed by office and light industrial uses including Quarters A (Fig. 31), an 1874 Italianate residence which now houses the on-site offices of PIDC, and Building 101, a 1901 former Marine Barracks which now houses offices of a large architectural and engineering company (Fig. 32). Several former officers’ quarters along the Reserve Basin and Delaware River currently house professional offices (Fig. 39). The former Commander’s Office on Broad Street was renovated during 2001 and 2002 for office use (Fig. 35). Two buildings at The Navy Yard are listed individually on the National Register of Historic Places. The first, the aforementioned Quarters A, the former Civil Engineer’s Quarters, is the oldest structure at The Navy Yard. The second, the oldest Marine Barracks on site, faces the Marine Parade Ground (Fig. 29). This building is currently vacant and is under consideration for residential conversion.

The streets at The Navy Yard differ greatly from each other in character and use. In general, a regular grid of streets surrounds the north-south axis of Broad Street (Fig. 42). Kitty Hawk Avenue connects The Navy Yard’s 26th Street entrance to the west with Broad Street. League Island Boulevard, and The Navy Yard’s largest area of future development to the east. To the east of Broad Street and within the Historic District, Kitty Hawk Avenue has an active urban character (Fig. 44). League Island Boulevard is a wide, single-lane road with a suburban character. Built in 2001, League Island Boulevard connects The Navy Yard’s Broad Street entrance and 359 to future building sites on the now abandoned Mustin Airfield. In contrast to the centrally located and double-loaded Kitty Hawk Avenue, League Island Boulevard hugs The Navy Yard’s northern boundary and provides direct access to development sites only along its south side (Fig. 43).
Figure 26: Opportunities and constraints of The Navy Yard and surrounding areas of Philadelphia and southern New Jersey.
Connected to these streets are a variety of open spaces ranging from small to large and from formal to informal. Most of the existing formal outdoor spaces are gathered along Broad Street. Immediately south of the existing Navy Yard gatehouses (Fig. 41), large yards for the officers’ quarters sit opposite the grand presence of Navy ships in the Reserve Basin (Figs. 35 and 46). Further south, the eight-acre greensward of the Marine Parade Ground, flanked by the Marine Barracks, marks the center of the original base (Fig. 47). It was formerly used for recreation and as a drill field, had a bandstand, and was the site of war bond rallies for shipyard workers. Further south still are the landscaped grounds of the Commander’s office and Pier 1, located at the foot of Broad Street. To the east of Broad Street, the open space in the Historic Core consists primarily of empty lots where buildings have been demolished, parking lots, and the remnants of former recreational amenities such as basketball and tennis courts. The former airfield east of League Island Boulevard is today mostly open land with its original runways largely intact. Further east still and interspersed among vacant parking lots and a 1976 350-unit Navy crew housing development are several irregularly-shaped wetlands (Fig. 48).
Figure 32. Building 101, Marine Barracks (Rankin, Kellogg, and Crane, Architects, 1901)

Among The Navy Yard’s most significant existing open spaces is the three miles of Delaware River waterfront within the 2004 Plan’s study area. The character of this waterfront varies greatly across the site. West of Broad Street, in the Shipyard, much of the waterfront is active and industrial with numerous piers extending into the river and dry docks carving into the land. To the immediate east of the former ferry landing, at the foot of Broad Street, the waterfront has a residential character, with former officers’ quarters dotting the tree-lined waterfront (Fig. 33). Moving east, the waterfront again takes on an industrial character briefly at the site of the existing Navy propulsion research facility beyond which the waterfront is the open and undeveloped edge of the former airfield, eventually becoming natural riverbank and wetland.

Figure 33. Building 87, Storehouse D-Aircraft (1920)

Figure 34. Building 653, Seaplane Hangar (Robert and Schaefer, Architects, 1943)

Figure 35. Navy Ships in the Reserve Basin
Figure 36. Building 1, Yard and Dock Storehouse and Offices (1875)

Figure 37. Building 3, C&R Iron Plating Shop (1877)

Figure 38. Building 26, Yard and Dock Commander’s Office (1901)

Figure 39. Officers’ Quarters (C.C. Welcott, Civil Engineer, Architect, 1900)

Figure 40. Building 75, Aircraft Office Building (1918)
Figure 49. Dry Dock 1, looking south (Robert E. Peary, Civil Engineer, 1899)

Figure 50. Existing green space along Admiral Peary Way, looking west

Figure 51. Officers’ Quarters on Admiral Peary Way, looking east

Figure 52. Delaware River waterfront from Pier 1
Navy Retained Properties

Although closed in 1998 as a fully commissioned Navy base, several Navy operations continue at The Navy Yard. Within the two million square feet of property retained by the Navy (Fig. 53), operations include a sizable submarine propeller casting and machining facility and research and development facilities for ship propulsion systems engineering. The Reserve Basin is one of the Navy's lowest salinity deep-water moorings and is retained for the storage of mothballed ships.

Green Space

Most of the existing formal green spaces at The Navy Yard are clustered along Broad Street (Fig. 54). These include the area around Quarters A by The Navy Yard’s main gate, the yards in front of the officers’ quarters facing the Reserve Basin, the Marine Parade Ground, and the grounds of the Commander’s Office at the intersection of Kitty Hawk Avenue and Broad Street. The mature trees lining Broad Street from the main gate to the Delaware River make Broad Street itself a significant green space. Along Admiral Peary Way, landscaped yards surround officers’ quarters facing the Delaware River. An existing green space immediately south of the Receiving Station contains the remnants of basketball and tennis courts.

Historic Buildings

The Philadelphia Navy Yard National Register of Historic Places Registration Form, completed in March 1999, lists 282 buildings (Fig. 55). Of these, 233 are considered to be resources contributing to the historical development of The Navy Yard in terms of the “integrity, location, design, setting, materials, craftsmanship, feeling, and association” (National Register of Historic Places, Registration Form prepared by John Milner Associates, March 1999).

Two of these “contributing resources” (Quarters A and the Marine Barracks), are listed individually on the National Register of Historic Places:

- The Civil Engineers Quarters (Quarters A), located immediately west of The Navy Yard’s main gate, was built from 1870 to 1874 and is the oldest existing building at The Navy Yard. It was the first of what was to be a series of villas built along the north side of the Reserve Basin.
- The Marine Barracks (Building 10), a three-story brick building designed by architect Henry Ives Cobb, is located on the southeast corner of the Marine Parade.
Built in 1901, it housed the Marine Corps following that group’s relocation to the Philadelphia Navy Yard from Newport, Rhode Island. Fifty-nine buildings within The Navy Yard are considered to be “non-contributing resources.” Non-contributing resources are deemed to “lack historical and/or architectural integrity or do not date from the period of significance of the complex.” Most of these buildings were constructed in the second half of the twentieth century.

Demolition, Renovation, and New Construction

A thorough assessment initiated with the 1994 Community Reuse Plan has resulted in a list of Navy Yard buildings deemed to lack long-term value. Most of these have already been demolished. The Corporate Center is proposed for a 72-acre development parcel where approximately two dozen buildings have been demolished. Within the Historic Core, buildings have been removed because they hindered the reestablishment of the street grid, had little reuse value, or compromised the value of other more significant buildings. In most cases these demolished buildings offered little in historic value or aesthetic character. Future demolition will be coordinated by PIDC.

Nearly 50 buildings at The Navy Yard have been identified for renovation and adaptive reuse. Many of these have already been renovated and include former officers’ residences, barracks, office and industrial buildings. New uses to date include office space and support facilities for a cruise ship terminal. Conversion to residential use is currently being considered for several buildings.

Recent, new construction at The Navy Yard consists of three major projects:

- A four-lane, ½ mile long portion of League Island Boulevard, completed in 2001.
- A 75,000-square-foot biotechnology research/development and fabrication facility, under construction as of late 2003.

This increase in activity, coupled with the clearing of potential sites for larger commercial and mixed-use development east of Broad Street, has set the stage for the 2004 Plan and a new chapter in the life of the Philadelphia Navy Yard (Fig. 56).
MASTER PLAN OVERVIEW
Planning Objectives

The goal of the 2004 Philadelphia Navy Yard Master Plan is to establish a clear, compelling, and viable vision for future development at The Navy Yard. Several planning objectives related to this goal have guided the development of the 2004 Plan:

- To capitalize on and enhance the site’s existing historic buildings and landscape features.
- To plan for mixed-use development that will encourage around-the-clock activity, adapt to changing market conditions, and establish an identity that overcomes the current sense of pioneering on the part of large office tenants.
- To create identifiable districts and focal points within those districts.
- To establish a clear and efficient road network.
- To craft an integrated system of public open spaces and pedestrian routes, and facilitate public access to the waterfront.
- To encourage environmentally sustainable development through “green” planning and building practices.
- To plan for mass transit in order to reinforce the site’s central regional location and to connect the property more effectively to the city, region, and its workforce.
- To develop clear strategies to meet the technical infrastructure needs of phased development.

Historic Preservation and Adaptive Reuse

Significant among The Navy Yard’s existing assets are its many historic buildings and landscape elements. These are the dominant features of the site today and provide an attractive and unique context for future development. While a large area of The Navy Yard is designated a National Register Historic District, many of The Navy Yard’s existing buildings have outlived their original purposes. This Plan proposes the preservation and adaptive reuse of approximately 39 existing buildings within the study area including 20 that have already been renovated. Several existing but to date unrenovated buildings within The Navy Yard have been studied to assess their suitability for reuse. The results of these analyses are included in the Adaptive Reuse section of Part II. All preservation work within the National Historic District is subject to the review of the Commonwealth of Pennsylvania State Historic Preservation Office (SHPO) and must comply with Department of Interior historic preservation standards. Those involved in historic preservation and adaptive reuse work within the Historic District are encouraged to look beyond these standards and to preserve buildings in a manner that is consistent with their original uses, although their future uses may be different.

Beyond the many remaining opportunities for continued renovation, the 2004 Plan proposes complementary new buildings, roads, and open spaces within the Historic Core and adjoining districts. The developers and architects of new buildings at The Navy Yard are encouraged to achieve the highest standard in design and to capitalize on The Navy Yard’s existing historic assets. Design Guidelines, which expand upon these concepts, are included in a separate document.

Mixed Use

The size of The Navy Yard can easily encompass a wide range of uses, and the existing building stock speaks to this capacity for diversity. At its peak as a military base, The Navy Yard was a vibrant mixed-use community.
As The Navy Yard develops, a mix of uses will provide flexibility, adapting to the ebb and flow of real estate markets. While this Plan does not set a specific schedule for full development, it recognizes that development will probably occur over several business cycles, and that demand will shift between market segments. The Plan responds to business-cycle risk by proposing that The Navy Yard be developed as five distinct districts, each with a different proposed use, or mix of uses, and each able to be developed at a pace independent of the development of other districts. The Plan consciously does not prescribe a single rigid implementation sequence, but rather allows for a variety of phasing options allowing development to respond quickly to changing markets.

The Plan’s proposed mix of uses includes office, convenience retail, research and development, light industrial and special uses including an executive conference center, and a cruise ship terminal (Fig. 59). The Plan proposes to include both rental and owner-occupied residential development, although these are currently prohibited by the deed restriction imposed by the Navy. The Plan contemplates the voiding of this restriction, the initial redevelopment of existing buildings within the Historic Core into rental apartments, and the eventual construction of additional rental units in the Historic Core. Longer term home ownership opportunities exist for the Marina District and East End, depending on the environmental, site, and market conditions. The mix of uses proposed by the 2004 Plan, in combination with existing industrial and shipyard uses, is intended to assure more rapid development at The Navy Yard than any single use would allow and to support the rapid growth of a market for on-site amenities such as retail, food service, and recreation. The mix of uses will bring round-the-clock activity to The Navy Yard, as office and industrial workers leave at the end of the business day, streets will be occupied and shops and restaurants patronized by residents returning to their homes. The adoption of a clear and compelling plan, that includes a mix of uses, and particularly the residential development, will help to overcome the sense of pioneering that major corporate users may currently feel, and hence will support the core commercial and employment-generating objectives of The Navy Yard’s redevelopment.

Though such a diverse mix of uses might at first seem mutually incompatible, the large size of The Navy Yard and the careful distribution of uses across the site ensures that these many uses are mutually supportive and that conflicts among uses are minimized. Residential uses are proposed within the Historic Core, and as one option, within the Marina District and East End. Office uses are proposed in the Corporate Center, within the Historic Core and as an option in the Marina District. Light industrial, research and development, distribution, and large destination uses are located in the Research Park and East End, respectively. These locations are adjacent to active rail lines, direct vehicular routes to 26th Street and Delaware Avenue and Port of Philadelphia facilities, benefiting from this industrial infrastructure while buffering the non-industrial portions of The Navy Yard from it. Existing and proposed on-site industrial uses at The Navy Yard are themselves buffered from non-industrial uses by a network of parks and public open spaces which incorporate most of the required wetlands.
Figure 59. Plan showing the various building uses throughout The Navy Yard

Districts and their Focal Points

By creating five districts with distinct and defining characteristics, the 2004 Navy Yard Master Plan seeks to achieve round-the-clock activity at The Navy Yard and both diversity of and balance between uses.

The 2004 Plan proposes five districts (Fig. 1):

1. The Corporate Center, situated around the northern half of the Diagonal Boulevard, is proposed to contain primarily office buildings totaling approximately 1.4 million square feet of new construction.

2. To the south and west of the Corporate Center, the Historic Core contains The Navy Yard’s most historically significant existing buildings, and is proposed to accommodate a mix of residential, retail, and institutional uses including a cruise ship terminal. There are neighborhoods within the Historic Core, including a proposed residential neighborhood and an academic or corporate R & D campus.

3. The Research Park lies along the northern edge of The Navy Yard, east of the Corporate Center. It is intended for research and light manufacturing and distribution facilities.

4. The Marina District lies out of the Historic Core at the southern end of the Diagonal Boulevard, centered on the new recreational marina, providing the potential for a mix of residential, office, and special uses including a proposed executive conference center.

5. The East End, as its name suggests, lies at the far eastern end of The Navy Yard site, separated from the Marina District by a historic seaplane hangar. Three options for the use and character of the East End are proposed and assessed in this plan: residential, industrial, and open space in the form of a golf course.

These districts, while distinct in character, are collected and connected so as to benefit from mutual adjacency.

The 2004 Plan proposes focal points that define the image and character of both The Navy Yard as a whole and each district. Parks and public open spaces define the centers or edges of districts. Buildings create gateways, frame views, or terminate vistas.

The proposed marine acts as such a focal point for The Navy Yard at a whole – a powerful regional attraction that activates the waterfront and serves as both an organizing element and an amenity for future development. Lying at the far end of the Diagonal Boulevard from The Navy Yard’s historic Broad Street gateway, it draws activity to the east within the site to the largest undeveloped parcels, balancing the Historic Core with its string of public open spaces along Broad Street. The marina is an active and identifiable physical destination, a symbolic reference to The Navy Yard’s history, and a point of contact between the city, its people, and its waterfront. Its location close to, but downstream from, Center City, close to regional highways and on a broad, low-current and low-wake reach of the Delaware River is highly suitable for this use.
Street Network

Much of the Historic Core of the Navy Yard has an urban street grid, and, in places, a strong street-wall of buildings. This plan corrects the inconsistencies and irregularities in this grid that have developed over time. Eleventh Street, 12th Street, and Kitty Hawk Avenue all have slight shifts in alignment or variations in widths along their lengths. Among the Historic Core’s streets, Flagship Drive is particularly ill-defined. In some places buildings interrupt the street grid or are set back from the street inconsistently. While Broad Street retains its well-defined and consistently landscaped character for much of its length from the Navy Yard gates to the Delaware River, inconsistencies in alignment and character among these other streets undermine the clarity and hierarchy of the Historic Core’s street system. The plan proposes the realignment and re-landscaping of portions of most of the existing streets within the Historic Core and proposes that 11th Street be shifted to the west along its entire length by approximately 165 feet. These changes are described in greater detail later in this document.

The northeastern portions of the Historic Core and the adjacent Corporate Center have until recently been characterized by relatively low-quality buildings and by a particularly haphazard pattern of streets. In this area of the Navy Yard most buildings have been recently demolished and the plan proposes the improvement and, in many cases, the realignment of existing streets. New streets are proposed to complete traffic patterns and facilitate traffic movement within the Corporate Center and Historic Core and between these two districts and the eastern portions of the Navy Yard site. The proposed Diagonal Boulevard is the most significant of these new streets.

The Diagonal Boulevard is a new main street for the Corporate Center and an organizing element for the central portion of the Navy Yard:

- It creates a clear connection from the Navy Yard’s Broad Street entrance to the Delaware River and to new development proposed for the eastern portion of the site.
- It allows League Island Boulevard to function as an arterial bypass road keeping heavy industrial traffic out of the Corporate Center.
- It works with Broad Street and Kitty Hawk Avenue to create a clear triangle of primary streets.

Laid over the triangle of main streets composed of Broad Street, Kitty Hawk Avenue, and the Diagonal are secondary streets and greenway streets that connect the Navy Yard’s several public open spaces (Fig. 60 and 61). This pattern provides a clear hierarchy within the road system, and road redundancy to ease traffic flow. Proposed street cross sections for each of these street types are included in Part II of the Master Plan document.

League Island Boulevard and its proposed extensions play an important part in the Navy Yard Plan. This divided four-lane roadway runs as a collector street for the Corporate Center, bringing traffic directly to approximately half of the Corporate Center’s parking. League Island Boulevard also diverts traffic destined for the Marina District, Research Park, and East End away from the streets of the Historic Core and Corporate Center. By means of an extension to the west, north of the Reserve Basin, and an extension to the east flanking The Navy Yard’s northern boundary (Mustin Road), League Island Boulevard is the central link in a chain of high-capacity roadways that will provide access to and from each of the Broad Street, 26th Street, and Delaware Avenue entrances to the Navy Yard.

Open Spaces

The 2004 Plan calls for an exceptional quantity, quality, and diversity of public open space within the Navy Yard. Aside from providing a public amenity, open spaces add value to...
adjacent building parcels. Proposed open spaces range from formally landscaped parks to naturally landscaped wetland areas. Some open spaces—such as the Marine Parade Ground for example—exist and will be re-programmed, but otherwise left largely as they are. Some, like the waterfront, will be both physically improved and rendered more publicly accessible, while others that do not exist currently are proposed by the Plan. Among the proposed and existing open spaces, many consist largely of active recreational amenities such as basketball courts, tennis courts, or baseball diamonds. Others are intended for passive activities and are proposed to include lawns and ponds or fountains.

The Plan’s proposed open spaces are linked by greenway streets, pedestrian routes, and bicycle paths to form a network of public amenities (Fig. 61).

Sustainable Design

Central to the 2004 Plan is the premise that the redevelopment of The Navy Yard should be an example of environmental sustainability. In many respects, the redevelopment of The Navy Yard is an inherently environmentally responsible undertaking. Redevelopment of previously developed sites reduces development pressure on greenfield sites. The medium-to-high-density development proposed by this Plan reduces the land consumed by development as compared to typical low-density suburban development. Mixed-use development, also central to this Plan, reduces automobile traffic when it replaces single-use development. Redevelopment close to existing cities is environmentally responsible according to a variety of other criteria as compared with development of new sites at the urban fringe.

The 2004 Plan proposes to go far beyond these inherent environmental advantages, however. It proposes the extension of fixed-guideway mass transit to The Navy Yard site, allowing for even greater eventual development density and for reduced traffic generation and reduced use of the site for parking lots, parking structures, and roadways. The Plan proposes that all required stormwater retention and runoff water quality mitigation take place onsite in a combination of reconstructed wetlands, improved existing wetlands, and parking lot “bioswales” which reduce the urban heat island effect and provide natural habitats while they retain stormwater. The Plan also proposes the demolition of the existing seawall and the construction of new native riparian habitats and intertidal wetlands along portions of the Delaware River waterfront.

The Plan proposes that all new buildings at The Navy Yard strive for high standards of environmentally responsible design and specifically that new buildings register with the United States Green Buildings Council (Leadership in Energy and Environmental Design) and encourage projects to meet or exceed LEED™ Silver level certification. A more detailed description of the Plan’s environmental sustainability initiatives is included in Part II of this document.
Mass Transit

The 2004 Plan examines opportunities for using and extending the City of Philadelphia’s existing first-rate mass transit system. Suggested improvements include both bus and subway service.

Currently SEPTA’s Broad Street Subway line comes to within three quarters of a mile of the Navy Yard. This Plan proposes to extend the subway line into the Navy Yard (Fig. 63) giving the site mass transit access to the entire greater Philadelphia region. This improvement will greatly expand the potential workforce for the Navy Yard and ease the commute for residents of the Navy Yard to other parts of the city.

The Plan also identifies the opportunity to connect Center City Philadelphia and southern New Jersey through the construction of a new PATCO line below the Delaware River and connecting at the Navy Yard to SEPTA’s Broad Street Subway line.

The 2004 Plan recommends these mass transit initiatives but it requires neither. Furthermore, the Plan is designed to accommodate construction of either or both of these mass transit initiatives at any time during the Navy Yard’s redevelopment. While the Plan does not depend on either of these infrastructure projects, they would significantly enhance the quality of life and create valuable development opportunities at the Navy Yard.

Technical Strategies

Planning for the redevelopment of the Navy Yard has involved careful study of, and planning for, a variety of technical issues including traffic and mass transit, environmental impacts, and utility infrastructure requirements. The dense development of the Navy Yard in the past means that utility infrastructure (water, electricity, gas, communication, and storm and sanitary sewer) is already present on site but needs to be modernized and expanded to support future development. Broadly considered, the Plan is organized to take advantage of this existing infrastructure. The Diagonal Boulevard, for example, is carefully aligned to avoid an existing sewer lift station and a transformer substation. Proposed buildings along 11th Street are located so as to minimize relocation of existing utilities.

Floodplain and geotechnical issues are of concern across most of the Navy Yard site. Much of the site lies below the 100-year floodplain and regrading and filling of portions of the site will be required to place the ground floors of proposed buildings above this level. Soils with unstable bearing capacity are also present across the site. These conditions will require the use of foundation systems including caissons or piles in the Marina District and East End. The use of surcharging to raise the site will compress existing soils and improve bearing capacities while reducing long-term settlement impact.

This Plan has been developed in conjunction with an array of technical studies related to the issues mentioned above. These are summarized in Part II of this document.
Figures 65-67 are a representative sample of adaptive reuse studies.
CORPORATE CENTER
The Corporate Center covers 72 acres as the gateway to The Navy Yard east of Broad Street. This area is to be developed as 1.4 million square feet of Class A office space in ten to twelve buildings, ranging from three to six stories in height. Its location, with high visibility from the I-95 overpass, will make it a landmark commercial enclave and symbol of the overall rejuvenation of The Navy Yard. Over 5,000 parking spaces are proposed in a combination of surface parking and single-level parking structures affording a parking ratio of approximately four spaces per 1,000 square feet of office space. At an average rate of one employee per 250 square feet of office space, the proposed office development within the Corporate Center will support 5,600 jobs. This area is located within the tax advantaged KOSZ.

The Corporate Center is organized along the Diagonal Boulevard and around the three public open spaces arrayed along that boulevard: the Crescent Park, the Central Green, and the Triangle at Kitty Hawk Avenue. The Corporate Center is bounded on the north and east by League Island Boulevard and on the south and west by the Historic Core. It is expected to be developed during the early phases of work covered by the Plan.

Located at the southeast corner of the intersection of League Island Boulevard and Broad Street, the 3.5-acre Crescent Park marks the entrance to the new Navy Yard and the start of the Diagonal Boulevard, which proceeds through the Corporate Center to the Marina District and Delaware River. Two historic gatehouses, one situated on the east side (Building 501) and the other (Building 500) on the west side of Broad Street, mark the entrance to the Historic Core. These gates frame views to the large ships in the Reserve Basin and the marine officers’ housing along Broad Street. The west gatehouse, Building 501, is slated to be reused as office space. Due to its location in Crescent Park, the Plan proposes that the east gatehouse, Building 500, be converted to a café, restaurant, or other public/convenience use with direct access and views of the park and to the Reserve Basin.

At the south and east edges of Crescent Park, three proposed office buildings are arrayed along the curved extension of Langley Avenue. These buildings define the southeastern edge of the park and frame entrances to the Corporate Center along the Diagonal Boulevard and 13th Street. The ground floors of these buildings facing Crescent Park are reserved for retail use to activate the adjacent park and to provide convenient retail for all members of The Navy Yard community as well as patrons of the adjacent sports complex and nearby neighborhoods. These buildings are positioned to benefit from views to Crescent Park, the Reserve Basin, and the city skyline (Figs. 21 and 22), and to create a face for the Corporate Center when viewed from the northwest and I-95. Crescent Park will contain a ceremonial entrance lawn at the intersection of Broad Street and League Island Boulevard and a mix of passive and active uses to meet the recreational and leisure needs of office workers in the surrounding buildings.

Figure 68. Perspective view of Corporate Center, looking southeast

Sneary Architectural Illustration
Within the Corporate Center, office buildings line the Diagonal Boulevard, creating street walls that mark a uniform cornice line and set back distance, trademarks of grand boulevards historically. Where possible, proposed buildings are located at street corners. Where buildings do not front on the Boulevard, a double row of trees extends the line of the building facades along the street. The Diagonal Boulevard creates an exciting urban dialogue with Broad Street, the former facilitating new development and future expansion east, the latter, reinforcing The Navy Yard’s historical assets and connection to the city (Fig. 66).

Within the Corporate Center, parking lots are located behind the office buildings that front on the Diagonal, with vehicular access from League Island Boulevard or the secondary streets that connect to Broad Street and the Historic Core. These parking lots are generously planted with shade trees and provided with built-in “bioswales” for retention and purification of stormwater. Three single-level parking decks are proposed, two along League Island Boulevard and one along 13th Street. These are sited to minimize their visibility from adjacent office buildings and major streets. League Island Boulevard, together with the parking areas on its north side, creates a buffer between the Corporate Center’s office buildings and the industrial rail yards to the north.

At the center of the Corporate Center lies the 5.5-acre Central Green, a five-sided, open space with the Diagonal Boulevard on its northeast edge. New four- and five-story office buildings form four edges of the space, while along the southern side is the elegant red brick Georgian style Receiving Station Square building. The Plan proposes that the Receiving Station be redeveloped as a multi-family residential building, serving as a gateway to a cluster of adjacent residential buildings in the Historic Core. Roughly the size of Rittenhouse Square in Center City Philadelphia, the Central Green establishes a public space at the heart of the Corporate Center that acts as a link between the Corporate Center and the Historic Core (Fig. 61). The park accommodates the shift in the geometry of the street grid between these two districts, ensuring that view corridors along all the streets connecting the two districts are terminated to the north by building corners and the park, while allowing views of the river to the south.

Just beyond the southeast end of the Corporate Center lies the Historic Core’s Campus area and the Triangle, which is designed to accommodate the proposed Navy Yard transit station. The large quantity of greenspace within and adjacent to the Corporate Center provides every building with direct open-space views adding value to the development parcels. It also provides transitions between commercial and residential developments while creating valuable public amenities that can be utilized by both building types.
Figure 70. Perspective view of the Central Green.

Source: Architectural Illustration
HISTORIC CORE
The most important asset of the Historic Core is its collection of historic and architecturally rich buildings and landscape. The preservation and reuse of the existing building stock provides a unique and valuable context upon which to build. The Historic Core’s existing buildings span a broad spectrum of building types, from massive multi-story warehouses to single-family homes, high-bay industrial buildings, and even a chapel. Many of these structures have been recently restored and reoccupied, while still others remain vacant awaiting renovation and adaptive reuse. The Historic Core is already home to 25 private businesses representing tens of millions of dollars of tax credit quality preservation. A significant portion of the existing buildings available for reuse, as well as cleared parcels, is also within the KOZ. As full build-out, the Historic Core will contain nearly 5 million square feet of program. Of that, 1.1 million square feet are currently occupied, 2.4 million square feet would be renovations, and 1.4 million square feet would be new structures (Fig. 74).

Another asset of the Historic Core is the existing street grid facilitating the growth of the Historic Core within a traditional urban fabric. The existing character of the streets range from the historic and well maintained to the erratic and deteriorated. The proposed new streets of the 2004 Master Plan connect the existing grid to the river as well as to the balance of the site.

Broad Street provides the spine of the Historic Core and is the primary existing route into The Navy Yard. Its stately tree-lined edges run from the historic entrance gate, past the Reserve Basin with its grand Navy vessels and the Marine Parade Ground, to Pier 1 and the restored building restored as a Cruise Ship Terminal on the Delaware River. Across this north-south axis, streets connect what was traditionally the Shipyard (to the west) with the previously residential and administrative area known as the Naval Station. Numbered streets run parallel to Broad Street, extending the street grid of Center City Philadelphia.

The Historic Core’s third key asset is its nearly 1 mile of waterfront, including the Reserve Basin, several piers, and a dry dock. The existing waterfront varies between areas of green lawn with mature trees to areas characterized by the stained metal and concrete of an industrial shipyard. Dry Dock 1, within this historically industrial portion of the site, marks the western end of the Historic Core waterfront. At the Historic Core’s northwest corner a further length of waterfront overlooks the Reserve Basin.

The Plan

The 2004 Plan proposes neighborhoods within the Historic Core defined by scale, building type, and location. These areas include:

- A gateway neighborhood, located around the intersection of League Island Boulevard and Broad Street.
- A residential neighborhood along 12th and 13th Streets.
- A commercial and arts neighborhood around Dry Dock 1.
- An office neighborhood along 13th Street and the waterfront containing a mix of renovation and new construction.
- A campus near the intersection of the Diagonal Boulevard and Kitty Hawk Avenue.

None of these is wholly independent or precisely delineated geographically but rather each has a unique character, which, when merged together, mutually reinforce both existing and future development.
The Gateway Neighborhood

The gateway neighborhood marks the beginning of a series of historic nodes along the Broad Street corridor. The neighborhood includes the Navy Yard’s two existing gatehouses, the historic landmark Quarters A, and land along the east and north sides of the Reserve Basin containing the historic officers’ quarters and Navy ships respectively.

The two gatehouses are proposed to be preserved and used for some combination of office, retail, or restaurant use. The eastern building of this pair (Building 502) is located within Crescent Park with convenient adjacent parking and a site which provides southern light and southeast views across the Reserve Basin, making it an ideal site for retail, restaurant, or other public use. The western building (Building 501) is currently occupied by an office tenant. A new parking lot is proposed to the immediate northwest of this building to meet its parking needs. Both buildings are highly visible along this stretch of Broad Street giving them valuable tenant identity.

To the west of the gatehouses is Quarters A, the oldest building at The Navy Yard and a nationally registered landmark. Built as a residence, this building currently houses the Philadelphia Industrial Development Corporation’s service offices. The 2004 Plan proposes that Quarters A continue to be put to this or similar use.

To the west of Quarters A, a recently cleaned Navy-owned site of approximately five acres is proposed for either retail or office use, should it become available for development. The 2004 Plan shows approximately 47,000 square feet of single-story retail on this site with associated parking. With a valuable location near The Navy Yard’s main entrance, adjacent to Langley Avenue and the proposed extension to the 25th Street entrance, and benefiting from southern views across the Reserve Basin, this site encourages a higher density retail use.

South of the gatehouses a row of two-story, stately brick and limestone former Marine officers’ quarters fronts on Broad Street, with the Reserve Basin to the west and the Corporate Center to the east. These have been recently restored and are occupied by a variety of office tenants suited to the domestic scale of these buildings. The 2004 Plan recommends that all of these buildings be preserved and that they remain in commercial use. Although these buildings do not have individual historic landmark status, it is recommended that future work on their exterior facades continue to comply, to the maximum extent possible, with Department of the Interior standards. It is also recommended that these buildings do not receive additions and that the yards surrounding them be landscaped and maintained as a single unified yard, as they were when used by the Navy.

The Residential Neighborhood

The residential neighborhood within the Historic Core is roughly bounded by the Marine Parade Ground on the west, 11th Street on the east, and the Central Green on the north. Four existing buildings within this neighborhood are proposed for conversion to multi-family residential use. The narrow floor depth of Building 50 (the Marine Barracks) and Receiving Station Square lend themselves to conversion to multi-family residential units, most with double and many with triple exposure and many with direct private ground floor entrances. Parking for Building 100 is located east of the building. Parking for the Receiving Station is located on-site.

Buildings 83 and 424 lend themselves to loft-style residential conversion. Their large floor plans and the cost associated with the necessary core out of these centers make these buildings less than ideal for office conversion, particularly in light of the nearby Residences:

Figure 72. Building uses in the Historic Core
Figure 73. View of Constitution Square and the residences in the Historic Core

opportunities for new office construction within the Corporate Center and Historic Core. Most of the resulting residential units have only a single exposure and are quite deep, but they benefit from high ceilings, large windows, and indoor parking in the center of the upper floors of these large former warehouse buildings. Both of these loft buildings will benefit from the removal of the central portion of their upper floors to create landscaped roof. The northern of these two buildings is proposed to rise to ten stories, marking the southwest corner of the Central Green and providing open views in premium upper-floor units. A two-story drive trusses this block from east to west providing access to parking. This drive is subtly angled to align at its eastern end with the pavilioned facade of the Reveille Station and at its western end with the central piers of Building 100.

Both the converted residential buildings and the new residential buildings contain their own parking at ratios of 1.5 spaces per unit or higher. To meet the parking requirements essential to the commercial and office redevelopment of the Historic Core, two three-story parking garages are proposed with a total of approximately 2,500 spaces. These have been centrally located on either side of Building 624 between Kitty Hawk Avenue and Flagship Drive, providing the greatest flexibility in distributing the available spaces to meet demand. These two new structures will further reinforce the intervals of Kitty Hawk Avenue and Flagship Drive, and in keeping with the character of the large industrial warehouse buildings along these streets. Their height and character will be guided by a set of design controls to protect views and relationships to surrounding historic structures.

The Dry Dock 1 Neighborhood

The neighborhood surrounding Dry Dock 1, more than any area within the Historic Core, retains and benefits from The Navy Yard’s dock block of robust late 19th and early 20th century industrial buildings. This area also benefits from the increased waterfront created by Dry Dock 1, projecting 460 feet into the site and Piers 1 and 2 projecting 900 feet into the river. Within this neighborhood several structures of little functional, aesthetic, or historical value have recently been demolished, freeing several of The Navy Yard’s oldest and architecturally finest buildings for reuse. These loft-type buildings with spacious open floors are perfectly suited for conversion to professional office space. Of these, Buildings 3 and 6 have been removed as a commercial cruise ship terminal and Building 25 has been stabilized and is in use as an office/industrial facility. Building 10 has recently undergone a multi-million dollar renovation restoring its 19th century details and preparing it for office use (Fig. 73). Neighborhood Buildings 11, 12, and 13 have been stabilized and cleared of recent alterations and await renovation for reuse by commercial and institutional tenants.

Building 543 is both the largest and most recently constructed of this cluster of buildings, providing a transition and buffer from more large scale industrial buildings to the west. Its central bay, 60 feet high and 80 feet wide, runs the entire length of the building, giving it a grand interior space but rendering it difficult to reuse as conventional commercial space. The 2004 Plan suggests that Building 543 be reused by commercial tenants who can benefit from the building’s large floor plate and high central bay. An alternate, highly appropriate, and desirable use for this building is as a museum or gallery for contemporary art, similar to other museums in industrial buildings of this type, such as the Dia Center in Beacon, New York, The Massachusetts Museum of Contemporary Art (MassMoca) in North Adams, Massachusetts, and the Tate Modern in London, England. Properly conceived and executed, this use for Building 543 would complement the surrounding offices, activate the waterfront, and make The Navy Yard an attraction.
While Philadelphia has a long-standing tradition of art and world-renowned museums, it currently lacks such an exhibit space. More information on the three comparable museum facilities mentioned above is included in Part II of this document.

The 2004 Plan calls for the redevelopment of the area around Dry Dock 1 by redefining the streets and sidewalks, providing parking, and encouraging a pedestrian-friendly environment. Essential to this is the creation of an outdoor plaza around the dry dock, providing the opportunity for retail and dining venues, with the active dry dock itself retained as a water feature.

The 11th Street Office Neighborhood

The proposed neighborhood of office buildings along 11th Street offers approximately 787,000 square feet of office space in four new and three renovated buildings. The four new buildings are located in two pairs, one on the south side of Constitution Park at the intersection of Kitty Hawk Avenue and 11th Street (mentioned above), and the second pair on the east side of 11th Street between Flagship Drive and the waterfront. Each of these pairs of buildings can be combined into a single, large building to tenant needs require. Each benefits from adjacency to convenient structured parking located on 11th Street between Kitty Hawk Avenue and Flagship Drive and from immediate adjacency to attractive public open spaces.

Office buildings within this neighborhood slated for renovation include Buildings 75 and 76, both of which will be rendered much more attractive and marketable than they are today, by the relocation of 11th Street to the west, the construction of a broad, landscaped front yard for both buildings, and the construction of structured parking to the west, across 11th Street. Building 611 is the largest existing building within this neighborhood. Like Building 543, Building 611 has huge floor plates and a double-height central bay. Its long, narrow proportions and adjacency to adequate on-grade parking make it attractive for certain types of open-plan office use. If physical conditions limit reuse, this site offers a prime opportunity for new construction with proximity to the river and new waterfront promenade. A concept design for reuse of Building 611 as an office building is included in Part II of this document.

The Campus Neighborhood

The proposed campus at The Navy Yard is bounded by 11th Street, League Island Boulevard, Constitution Avenue, and Kitty Hawk Avenue (Fig. 75). It includes frontage on both the Diagonal Boulevard and the Triangle with its proposed transit station. This key 13-acre site is located at the junction of the Historic Core, Corporate Center, Research Park, and Marina District and shares in most of the positive assets of each of these districts. The campus is modeled on successful comparables such as the new UCSF Life Sciences Campus at Mission Bay in San Francisco or Massachusetts General Hospital’s research campus at the Charlestown Navy Yard in Boston. This campus, whether it be academic, institutional, corporate, government, or a combination, has the potential to catalyze development throughout The Navy Yard from its central location.

The proposed campus consists of six five- to six-story buildings ranging in size from 100,000 square feet to 220,000 square feet and totaling roughly 750,000 square feet. These are arrayed in a radial pattern that meditates between the geometries of the Historic Core and the Corporate Center to form a series of interlinked crescent-shaped landscaped quadrangles. The quadrangles are landscaped with lawns, trees, and pedestrian paths. A water feature and landscaped meadow become the focus of the largest quadrangle. The westernmost quadrangle uses the existing six-story facade of Building 76 as its southern.
edge, allowing for a possible extension of the campus towards the river and an adaptive reuse of this building as part of the campus. No roads cut through the campus area, yet each building is given prominent street frontage on one of the streets that surround the campus or frontage on the new Triangle. The campus is also designed so that it may be occupied by either a single user or several users in individual quadrangles and buildings.

A six-level, 1,750-space parking garage along Kitty Hawk Avenue satisfies most of the campus’s expected parking needs at a ratio of four spaces per 1,000 square feet. The remaining parking needs are met by a four-story garage located east of League Island Boulevard and south of the Triangle. The first of these two campus garages creates a buffer between the campus and the Navy-retained buildings to the south. It also maintains the streetwall along Kitty Hawk Avenue established by the existing warehouses and proposed parking structures to the west. This amount of parking, however, could be reduced if the potential subway extension and Navy Yard station are realized.

The buildings of the proposed campus are sited and sized to accommodate either office or laboratory use while the location of the campus allows for additional campus-related buildings on all sides. The close proximity of the campus to the Corporate Center and Research Park allows for beneficial adjacency between the campus and related private sector development.

Open Space

Beyond the identity provided by the Historic Core’s various neighborhoods, several open spaces also give its identity and structure and provide valuable amenities. Some of these are existing, such as the Marine Parade Ground and the Riverfront Esplanade, which will be upgraded. Others are new, such as the Triangle with its proposed subway station, Constitution Square, or the Central Green at the interface between the Historic Core and the Corporate Center. Each of these public open spaces is detailed in Part II of this document.

Streets

A strong urban street grid characterizes the best parts of the Historic Core. However, this grid is eroded, interrupted, and increasingly irregular as one moves east from Broad Street. The 2004 Plan re-establishes and re-enforces the grid wherever possible. Street alignments are straightened where existing misalignments disrupt traffic or view corridors. The Plan proposes that 12th Street, in the block south of Constitution Avenue, be shifted east of its existing alignment to align with the northern portion of this street. Flagship Drive, whose alignment and width currently shift several times along its length, is to be regularized. The largest proposed change to the street grid is the relocation of 11th Street by approximately 168 feet to the west of its current alignment. This simple change allows appropriate views for the Central Green and Constitution Square, creates improved street frontage for the undeveloped Receiving Station and Building 611, provides a buffer between 11th Street and the Navy-retained Building 87, creates a forecourt for Buildings 75 and 76, and creates potentially valuable development parcels in several locations along the east side of 11th Street. It also creates a direct link between the Corporate Center and the Delaware River through the Historic Core.
RESEARCH PARK
The 2004 Plan’s proposed Research Park responds to the need for commercial space for research and development, biotechnology/pharmaceutical labs, and manufacturing and/or distribution. These uses benefit from proximity to the amenities and markets of Center City and the highly educated workforce provided by the Philadelphia region and its many academic institutions. As with portions of the Historic Core, and Corporate Center, this area lies within the state-designated tax advantaged KOZ encouraging economic development.

The proposed Research Park includes adequate space for parking, loading, and large floor-plate buildings, and benefits from convenient access to the regional transportation network. League Island Boulevard and a relocated Mustin Road provide direct connections to Delaware Avenue, Broad Street, and I-95, while segregating associated truck traffic from the other areas of The Navy Yard. Active rail lines are located along this district’s northern edge. The Research Park’s first building, a 75,000-square-foot research and development facility is currently under construction. The 2004 Plan proposes another five such buildings within the district (Fig. 77), although these sites can be combined or subdivided to meet the needs of a broad spectrum of sizes or potential users. For example, a single, large user such as a distribution facility could be sited within this district (Fig. 78).

These proposed buildings are a mix of single-story, high-bay buildings with facilities for loading, a mixture of office/lab and warehouse type spaces, and mid-rise office/research buildings. The 2004 Plan shows six buildings of approximately 75,000 gross square feet, painted so loading bays face each other or are concealed from public view. A pair of mid-rise office/research buildings totaling 200,000 square feet continues the streetwall of the Diagonal Boulevard.

The Research Park is buffered from the potential residential or office areas of the Marina District to the south by a substantial landscaped barrier of wetlands. The Research Park, along with these wetlands, also shields the Marina District from the rail yards to the north.
MARINA DISTRICT
Figure 79. View of the Marina District looking northwest.
Figure 80. Building uses for the residential option of the Marina District
The Marina District consists of approximately 115 acres centrally located on The Navy Yard’s Delaware waterfront, east of the Historic Core, southwest of the Corporate Center, and south of the Research Park. With its 2-mile waterfront, the Marina District is a prime area that facilitates the eastern expansion of new development at The Navy Yard. The 2004 Plan proposes two development options for the Marina District: a primarily residential option with approximately 1,400 residential units comprised of townhouses and mid-rise buildings, and a commercial option with approximately 1.5 million square feet of office space. Both options include an executive conference center, a combination of surface and structured parking, retail space along the Diagonal Boulevard and Riverfront Esplanade, a recreation facility in the former Seaplane Hangar, and a 250-slip marina including on-shore facilities. A mix of the two options could be easily incorporated by utilizing the same configuration of the marina, streets, and utility infrastructure for a blend of commercial and residential as determined by the market.

Marina

The Marina establishes an active, water-dependent use on the site that, along with the Riverfront Esplanade, serves to draw people to the waterfront and activate the waterfront and surrounding public spaces (Figs. 79 and 80). It consists of approximately nine acres of water, separated from the Delaware River by a series of piers, breakwaters, and wave attenuators. Approximately half of the marina is excavated from existing land and half is water beyond the existing seawall. Excavating into the land creates views and consequently more valuable development parcels compared to an uninterrupted linear edge. A pedestrian pier and breakwater with a wave attenuator extends from the eastern edge of the marina, protecting it from river traffic. A beacon, located on the breakwater, terminates the axis of the Diagonal Boulevard and provides a point of orientation for river traffic. The proposed marina is designed to accommodate 250 slips ranging between 20 and 40 feet in length. Public green space along the edge of the marina links to The Navy Yard’s proposed Riverfront Esplanade and includes approximately one acre of tidel wetlands with pedestrian paths providing access to the waterfront (Fig. 37). The marina’s on-shore facilities include its administration, restaurant, and maintenance facilities. These are located in the marina’s eastern edge adjacent to a boat ramp and an on-shore maintenance yard. Adjacent to the boat ramp is a vehicle drop-off and parking lot for the marina including parking for both cars and trailered boats. This same lot would also provide ice-water storage for boats during winter months.

The Diagonal Boulevard is an important organizing element for the Marina District and an essential vehicular and visual link between The Navy Yard entrance at Broad Street and the marina. It directly connects this formerly isolated tract of land to the rest of The Navy Yard both visually and for pedestrians and vehicles, allowing greater utilization of the Delaware River as a valuable asset. In the final two blocks before the marina the Diagonal Boulevard includes wide, landscaped medians. Two similarly widened and landscaped streets radian from the marina toward the north and northeast bringing river views deep into the site. The Marina District is buffered from the Research Park to the north by a park that contains softball and provides development sites on the northern edge of the Marina District with an open-space amenity while allowing for diverse uses between these two areas.

Residential Option

The proposed residential development option for the Marina District (Fig. 83) consists of nearly 1,400 mid-rise and townhouse units, up to 105,000 square feet of ground floor retail, and 175,000 square feet of office space. Parking is provided in a combination of private individual garages for townhouses, surface parking lots, multi-level parking decks, and street parking to achieve parking ratios of 1.5 spaces/per residential unit, 4.0 spaces per square foot for office space, and 7.0 spaces per square foot for retail space.

Four- to six-story condominium/apartment buildings within the Marina District are located along the Diagonal Boulevard and marina waterfront and include ground floor retail space. At the land of each linear green emanating from the marina site an eight- or twelve-story building. These provide a visual terminus to each axis and allow for greater density of development with direct views to the water.

Much of the balance of the Marina District’s proposed residential development consists of three- and four-story townhouses and two-family duplexes, most of which are located behind the first row of waterfront development. Conceptual townhouse designs are illustrated in Part II of this document. The 2004 Plan proposes that each townhouse in this Marina District development option have a front door facing a public street in addition to private, covered parking, facing an alley behind. A variety of common, landscaped open areas for passive use are located among the Marina District’s proposed townhouses (Fig. 83). There is space in the residential option to include uses such as a school and community center.

Buffering the residential area from the industrial activities of the Navy buildings to the west are two office buildings. One is located on the waterfront while the other, with its parking structure, anchors the south side of The Triangle.

Commercial Option

The flexibility of the Master Plan is illustrated by the commercial option for the Marina District (Fig. 82). If the market dictates, an expansion of the Corporate Center or Research Park, for single or multiple users, of approximately 1.5 million square feet of office or R&D space can be accommodated in three- and four-story buildings. These include up to 50,000 square feet of ground floor retail located along the Diagonal Boulevard and around the marina. A parking ratio of 4.0 cars per 1,000 square feet of building is achieved through surface lots and multi-level parking structures. In this option the streets and open space plan remains essentially the same with the buildings arranged radially around the marina with linear green parks extending into the site providing views to the river.

Separating both Marina District options from development to the east is the historic former Navy Seaplane Hangar (Building 653), proposed for reuse as a recreational facility for the marina community. An executive conference center is included at the western edge of the marina (Figs. 83 through 86). It contains 179 guestrooms, 10,000 square feet of meeting and conference space, as well as a restaurant/lounge and fitness center. At ten stories, it is one of the tallest buildings planned for The Navy Yard and provides a visual anchor on the waterfront at the southern end of the Diagonal.
Figure 82. Building uses for the office option of the Marina District.
Figure 87. Section through proposed apartments/offices at the marina edge.
Figure 88. Perspective view of the marina and riverside development in the Marina District
EAST END
The Navy Yard’s 47-acre East End district is bounded to the south and east by a 2.3-mile length of the Delaware River, to the north by existing CSX and Norfolk Southern intermodal railroad freight yards, and to the west by the historic Seaplane Hangar (Building 653). The Delaware River shoreline immediately north of the East End is occupied by active Philadelphia Regional Port Authority facilities and a related intermodal freight facility. Vehicle access to this portion of The Navy Yard is currently from Broad Street by way of League Island Boulevard and Mustin Road. A southern extension of Delaware Avenue from its current terminus in the port facility is planned. This is required to support any development in this area of The Navy Yard due to its remoteness from Broad Street and capacity of the existing road network.

Most of the East End is currently unused and contains the remains of a runway of the now-decommissioned Mustin Airfield in addition to now-vacant Navy housing and related recreational and community facilities, built during the 1970s for Navy crews. All existing buildings in this area are more than four feet below the 100-year floodplain and consequently not suitable for reuse (Fig. 109). The East End consists of filled land and has soils with low bearing capacity, unsuitable for conventional foundation systems. The 2004 Plan proposes that the entire East End be surcharged, thereby compacting the existing soils and raising the site above the 100-year floodplain. More information on this strategy is contained in Part II of this document.

Three development options for the East End are illustrated in this document:

1. **Industrial**: The use of the East End for approximately 1.5 million square feet of industrial buildings or distribution centers with truck, port, and rail access.
2. **Residential**: Residential development totaling approximately 3,500 units.
3. **Golf**: An 18-hole golf course and support facilities.

All three East End design options propose a continuous linear park with pedestrian and bicycle trails that run along the waterfront, connecting to the Riverfront Esplanade at the Marina District and Historic Core, thereby ensuring public access to the water along the entire length of The Navy Yard Master Plan area.
Industrial

The East End, because of its proximity, can easily link to port facilities, road, rail, and shipping transportation networks. It also provides unique economic development opportunities since there is no other publicly controlled landmass of this size available within the city of Philadelphia. For these reasons there is strong support for industrial and/or distribution center development in the Navy Yard’s East End. This document illustrates one potential industrial development option for the East End, containing two warehouse/distribution facilities, of approximately 925,000 and 560,000 square feet respectively (Fig. 90). These facilities can be 40-foot-high bay buildings with attached office/administration space. A counterclockwise loop road allows truck access to all sides of both buildings. A rail spur can serve either or both buildings. Parking for employees is provided at both the east and west ends of these proposed buildings. Vehicular access to these facilities is provided by the Mustin Road extension from the west and the planned Delaware Avenue connection from the north and east.

The proposed industrial/distribution facilities in this East End development option are buffered from the Marina District by the historic Seaplane Hangar (proposed to be converted to a recreational use serving all Navy Yard districts), parking for the distribution facilities, and a park containing tidal wetlands. Proposed industrial development in this East End option is never closer than 100 yards to any new development in the Marina District. No direct road connection is required between the Marina District and the industrial plan for the East End, although the Plan could accommodate it if deemed necessary. Truck access to the East End from the west along Mustin Road could be prohibited, limiting truck traffic access to the Delaware Avenue extension.

Residential

The East End offers some of the best river views within the Navy Yard, and the Master Plan proposes a residential concept plan designed to benefit from these views and the East End’s extensive riverfrontage (Fig. 91).

Residential development in this option is arranged around three linear parks that project inland from the river’s edge bringing water views into the site and allowing residents living throughout the East End to benefit from these views. A proposed street grid consists of streets paralleling the water’s edge and cross-streets marking the edges of the proposed open spaces. Within the southern half of each of these linear parks a tidal cove with adjacent tidal wetlands creates a visual amenity while allowing the possibility of mooring and marina facilities serving residents.

The East End residential option proposes three tiers of housing, corresponding to the three north/south blocks of the proposed street grid. The southeastern tier, fronting on the Delaware River, contains four- to six-story buildings with attached, structured parking. These proposed garages are landscaped on their roofs creating raised courtyards and landscaped views for inward facing units. The second tier of residential development consists primarily of townhouses with attached or detached rear garages. The third tier of residential development combines townhouses with private gardens around communal areas.
courtyards. Some mid-rise apartment buildings are placed within the second and third tiers of development where open spaces or water views merit higher density.

At the eastern end of the site, four residential towers, ranging in height from 14 to 20 stories benefit from sweeping views afforded by the bend to the north in the Delaware River while creating a focal point for the East End. These towers are built above landscaped parking structures and include common facilities such as health clubs and tennis courts.

Both the Marina District and East End residential development options require the many retail, recreational and civic amenities proposed by the 2004 Plan. The Plan also accommodates space for the anticipated schools which will be needed if most or all of the contemplated residential development is built.

Golf

The East End was studied as the site for an 18-hole golf course (Fig. 92). This development option would require far less infrastructure than other options mentioned above, have the least impact on traffic volume, and would not require most of the site surcharging or deep foundations required by those other options. Development as a golf course could be a temporary, interim use for the East End while serving as a local amenity.

As illustrated in this document, the golf course’s proposed clubhouse is located south of the Seaplane Hangar with an elevated restaurant terrace overlooking the Delaware River. The Seaplane Hangar (Building 653) is proposed for conversion to an indoor driving range and golf cart/maintenance storage facility. Because this development is located within the Philadelphia Naval Shipyard Historic District (Fig. 22), it would be subject to additional historic preservation reviews. From the hangar, the course starts westward and progresses clockwise. The finishing holes located along the Delaware River incorporate tidal wetland areas and emphasize river views. The course plays just over 6,700 yards and would have a dramatic and picturesque setting, with river and skyline views along most of its length. The golf course concept design illustrated in this document demonstrates that an 18-hole course would require all of the East End and much of the Marina District. Even within this site of approximately 442 acres the tightness of the course does not allow for residential or commercial development around most of the golf course. Such development, capitalizing on the open space amenity provided by a golf course, is necessary to justify the investment in the construction of the golf course. Consequently, the 2004 Plan does not recommend development of the East End as a golf course.
IMPLEMENTATION
The 2004 Plan proposes strategies for supporting short-term and long-term development at The Navy Yard. The purpose of this section is to summarize the total development program and the associated infrastructure costs while describing the overall physical site constraints and infrastructure issues. Solutions are proposed for the land development challenges in regards to implementing the Plan, phasing flexibility is discussed, and a series of recommendations for initiating development at The Navy Yard are presented.

Program Summary

With its more than 4 million occupied square feet and 6,000 jobs, The Navy Yard has begun to reestablish itself as a major center of economic activity within the Philadelphia region. The Master Plan proposes to further strengthen this position through a mix of uses that capitalizes on the property’s assets, establishing a new, vibrant and viable submarket in the center of the region.

The development envisioned in the Master Plan will have a significant regional impact, diversifying and expanding employment, productivity, and the tax base of city and region. Figure 93 summarizes the overall development program options proposed by the Master Plan.

**Figure 93. Program summary of The Navy Yard including various options for the Marina District and East End**

Program Summary

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<td>0 2,500,000</td>
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<td>2,800,000</td>
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<td>1,500,000</td>
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<td>860,000</td>
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<td>0 1,400</td>
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<td>6,000</td>
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<td>19,300 to 26,100</td>
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* Included in new and renovated floor area above.
** Assumes an average ratio of 250 square feet per employee within the floor area listed above.
*** Range depending on development options pursued in the Marina District and East End.

**Figure 94. Construction of a pharmaceutical R&D facility in the Research Park, north of League Island Boulevard**

**Figure 95. Shuttle bus heading north on Broad Street, leaving The Navy Yard**
Infrastructure Costs

Significant public and private investment will be required to support the proposed development. Detailed cost analysis is difficult at a master plan level, and is subject to changing market conditions. The long-range nature of the 2004 Plan means that it will evolve and change as it is implemented, and that the timeframe for it to be realized will cover a range of market environments. Order-of-magnitude cost analysis has been a part of the planning process, and has been important in determining the feasibility of the different elements of the Plan. The table in Figure 96 indicates conceptual costs for key on-site infrastructure elements of the Plan in 2005 dollars.

In addition to these project-specific infrastructure costs, there are several important off-site improvements that are required to achieve the property’s full development capacity, including:

- **Broad Street Subway Extension** - The extension of the Broad Street Subway south from Pattison Avenue approximately 1 mile into The Navy Yard represents a critical opportunity to truly connect The Navy Yard to the city, the regional transportation network and the regional workforce, advancing the pace and density of development in a way that no other investment could. The subway extension also offers SEPTA the opportunity to establish a dynamic, mixed-use destination at the termination of the Broad Street line, reinvigorating the entire line. The extension of the Broad Street Subway is estimated to cost $258.7 million.

- **Delaware Avenue Extension** - The southward extension of Delaware Avenue from its current terminus at Pattison Avenue represents a critical access improvement for the eastern portion of The Navy Yard. It is anticipated that this extension will be grade-separated from the existing rail yards and port traffic currently located in this area. This access point is required to support the new construction options identified in the Plan, particularly to separate road traffic generated in the Research Park, Marina District, and East End, as well as the traffic anticipated from the adjacent Norfolk Southern Intermodal Yard, from the Broad Street entrance. The extension also offers an important secondary ingress/egress point for other portions of The Navy Yard development. Estimated cost is $10 million.

- **26th Street Extension** - Improving the access from 26th Street and Penrose Avenue south into The Navy Yard reestablishes a critical access point on the western portion of the site. This route was previously used by the Navy and requires a new surfacing, lighting, sidewalks, and landscape improvements to establish a viable roadway. Once implemented, the 26th Street extension will connect from Broad Street west and north to the Pratt Bridge, providing an important connection to I-95 south, I-476, and I-76 east and west that will relieve Broad Street as the only connecting point to the regional highway system. This connection will provide primary and secondary access for industrial development in the Shipyard and for office and residential development in the Corporate Center and Historic Core. Estimated cost is $4.5 million.

- **Electric Transmission Improvements** - As development proceeds at The Navy Yard, an improved and expanded electric transmission system to the site will be required to provide the capacity, quality, and reliability expected by modern users. These improvements will support The Navy Yard’s redevelopment and surrounding commercial and industrial development in South Philadelphia, which is also served by a constrained electric delivery system. Estimated cost is $15 million.

![PHILADELPHIA NAVY YARD MASTER PLAN](image_url)

### INFRASTRUCTURE CONSTRUCTION ESTIMATE

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<tr>
<th>DISTRICT</th>
<th>PROJECTED PRIVATE INVESTMENT</th>
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<td><strong>CORPORATE CENTER &amp; HISTORIC CORE</strong></td>
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<td><strong>RESEARCH PARK</strong></td>
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<td><strong>MARINA DISTRICT</strong></td>
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<td><strong>INDUSTRIAL OPTION</strong></td>
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Figure 97. Projected private investment necessary for development.

### Private Investment

The proposed investment in infrastructure is capable of leveraging significant private investment. This projected private investment is itemized in Figure 97, by development district and development type.

Depending on the development scenario implemented, total private investment can range from $1.4 billion to $2.2 billion.
Development Phasing

The 2004 Plan has been carefully designed to allow maximum flexibility as the Plan is built out over time. In the extreme, any one of the Plan’s five districts could be built without requiring construction of the other districts, provided the necessary infrastructure connections are in place. Figures 98, 99, 100, and 101 illustrate four such extreme scenarios, in which a single zone of new construction is built but no other new zones are developed. Each figure assumes that the Historic Core and only one other part of the Plan – the Corporate Center, the Campus, the Marina District, or the Research Park and East End – are developed. While none of these extremes is proposed as an actual phasing scenario, the exercise shows that each district is largely independent of construction of new infrastructure in other districts.

The degree of implementation flexibility demonstrated by these diagrams is an essential strength of the Plan, allowing it to respond to cycles and fluctuations within real estate markets and to respond swiftly to a specific large user such as a major corporate, research, or distribution tenant.

Site Constraints/Infrastructure

A variety of site constraints and practical implementation issues are addressed by the Plan. These include:
- Utility Networks
- Soil Conditions
- Grading and Stormwater Management
- Wetlands
- Traffic and Vehicular Access
- Mass Transit
Utility Networks

Utility infrastructure upgrades will be required to support development. Initially, the quality and capacity of electrical transmission to the site needs to be improved. In addition, the 2004 Plan assesses the quality and capacity of existing utility distribution systems through The Navy Yard and has estimated long-term utility infrastructure requirements necessary to support proposed development. This work will need to be developed and coordinated by PIDC on a project-by-project basis. Existing utility systems are proposed to be retained and extended. Where this is not feasible, new systems are proposed. These new utilities are organized in ways that capitalize on existing systems and efficiently serve future development. The utility systems assessed include electricity, gas, water supply, sanitary sewer, communication, and stormwater systems. Existing and proposed utility systems are illustrated in Figures 102 through 107. A more detailed utility distribution plan is described in Part II.

Soil Conditions

The land in the eastern portion of The Navy Yard consists of fill placed in the Delaware River in the first half of the 20th Century. Below the fill material is a highly compressible alluvial soil layer. This soft soil condition requires special, and expensive, measures for building foundations. The 2004 Plan proposes a variety of solutions to this condition, including the use of deep foundation systems including piles, caissons, or slurry walls. The most comprehensive and cost-effective strategy of site “surcharging” is also proposed. In this process, excess fill is placed over the site and is left long enough to allow the existing soil layers to be compacted by the additional weight of this overlying layer reducing any future settling. When the existing soil has been compacted sufficiently to support buildings on conventional foundations some or all of the added fill is removed. The surcharging process may require five years or more and may be scheduled in rolling phases, where fill material is moved from one portion of the site to another. The material used for this process may be readily available as the result of river dredging currently under consideration for nearby sections of the Delaware River. Soil and dredge material removed during the construction of the marina may also be used. A detailed geotechnical summary is located in Part II of this document.

Grading and Stormwater Management

Much of the 2004 Plan study area lies below the 100-year floodplain level as established by FEMA (Fig. 109). This presents a constraint on future development. Many existing structures within The Navy Yard are below the 100-year floodplain elevation. Some buildings, however, were built with their first floor levels raised above the 100-year floodplain elevation.
The 2004 Plan calls for the importation of fill for re-grading portions of the Corporate Center, Research Park, Marina District, and East End to raise the new construction within these districts above the 100-year floodplain level. Re-grading will also address the site’s drainage needs. Re-grading at The Navy Yard should be done in conjunction with the recharging of the site. In this way, fill can be used to simultaneously compact the existing soil, raise the existing grade above the floodplain, and provide appropriate slopes for stormwater drainage. In areas where re-grading is not feasible or practical, such as adjacent to certain existing buildings, ground floor levels will need to be built above the minimum required elevations.

Wetlands

The 2004 Plan addresses constraints posed by existing wetlands. The Navy Yard site east of Broad Street currently contains approximately 27.5 acres of wetlands (Fig. 109). Through a combination of wetland preservation and creation, the Plan proposes both higher quality wetlands (tidal as opposed to upland for example), and a greater quantity of wetlands. These wetlands can and should be attractively landscaped and integrated into the Plan as recreational amenities, served by pedestrian and bicycle trails. In several areas landscaped wetlands are proposed to serve as buffers between the Plan’s districts and different land uses. A more detailed wetlands summary is included in Part II.

Traffic and Vehicular Access

Traffic patterns and demands have been modeled for the 2004 Plan’s several development options. This modeling indicates clearly that the Plan’s primary traffic constraint is the congestion at evening peak hours created by the bottleneck at the intersection of League Island Boulevard and Broad Street. The proposed additional site ingress and egress points at 26th Street and Delaware Avenue will significantly improve, though not fully eliminate, projected congestion at League Island Boulevard and Broad Street. These improvements are therefore essential to the full build-out of the Plan as envisioned. A detailed traffic study is described in Part II.

Mass Transit

The 2004 Plan strongly encourages that the overall mass transit system at The Navy Yard be upgraded. Improvement in this area will reduce the aforementioned automobile congestion as well as directly connect The Navy Yard to Philadelphia’s regional mass transit system and regional workforce.

Existing bus service should be expanded and follow a new loop based on the new street configuration linking Broad Street, Kitty Hawk Avenue, and Diagonal Boulevard. This bus line should run on a regular schedule and link directly to the existing SEPTA subway...
station on Broad Street at Pattison Avenue. The Plan suggests that a process should be commenced immediately to further evaluate and seek funding for implementing the extension of the Broad Street Subway into The Navy Yard out a stop located in the Triangle. Although the realization could be several years off, starting this endeavor will announce the long-term plans for The Navy Yard and establish momentum for new developments. An overall mass transit study is included in Part II.

Recommendations

In order to further prepare The Navy Yard to meet development demands, the Plan recommends that specific elements and aspects of the proposed Navy Yard development be implemented as soon as possible. These items are listed below:

- Continue the preservation and adaptive reuse of historic buildings and public spaces, including the primary street grid in the Historic Core.
- Improve the 26th Street connections to The Navy Yard including the Reserve Basin lift bridge and its connection to Kitty Hawk Avenue.
- Construct the Delaware Avenue connection to the site on the east.
- Build Crescent Park and initiate portions of the Diagonal Boulevard.
- Continue to upgrade and construct the primary utility infrastructure.
- Demolish the remaining non-contributing buildings and structures.
- Seek to remove the existing deed restriction prohibiting residential development on-site.
- Surcharge portions of the site in the Research Park, Marina District and East End.
- Improve riverfront access including construction of the Marina and Riverfront Esplanade.
- Continue to improve existing mass transit options including SEPTA shuttle bus service.
- Initiate the process for implementing the extension of the SEPTA Broad Street Subway from Pattison Avenue to The Navy Yard.

Beyond current and ongoing efforts to market The Navy Yard to private sector tenants in each of the proposed land-use categories the Plan recommends that two lead tenants be sought actively. These are:

- A government, private, or academic institution for the proposed campus. At over 750,000 square feet, a campus of this size would represent a sizable entity in a central location on the site.
- A significant cultural institution for the redevelopment of Building 543 or other appropriate building as a gallery or performance space. Such use would activate the waterfront and provide regional public exposure for The Navy Yard.
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2004 PHILADELPHIA NAVY YARD MASTER PLAN

PART II

PHILADELPHIA INDUSTRIAL DEVELOPMENT CORPORATION
LIBERTY PROPERTY TRUST
SYNTERRA PARTNERS

ROBERT A.M. STERN ARCHITECTS
MARKET ANALYSIS
The success of a development master plan depends on demand for the proposed type of development. To provide the 2004 Plan with a solid foundation for its near-term and long-term viability, market studies were conducted corresponding to several proposed uses. The intent of these studies was to:

1. Identify and verify the existence of market demand.
2. Define and detail the nature of that demand.
3. Quantify an appropriate level of response to that demand.

Detailed market analyses were conducted for residential as well as key special uses, including retail use, a marina, and a conference center hotel. Less detailed investigations explored industrial uses, recreational uses, and the potential for an academic or research campus. The 2004 Plan has been shaped according to these studies and represents a development product well suited to projected market needs.

**Office**

The 2004 Plan proposes the development of newly constructed Class A office and research space in two to three principal types of uses. The Navy Yard Corporate Center will provide quality mid-rise office space oriented to office users requiring and/or desiring the following:

- Large floor plates
- Campus setting
- Free parking
- Convenient access to Center City, the airport, and Amtrak
- Kayak Opportunity Zone incentives

Also available is a substantial pool of knowledge workers, university graduates, and young professionals who reside in and around Center City Philadelphia.

The Corporate Center will meet the needs of these companies with a centrally located office environment that features three-to-six-story buildings ranging in size between 50,000 and 200,000 RSF and parking averaging 4 cars per 1,000 RSF. With these characteristics the Corporate Center addresses the needs between Philadelphia’s Center City office market and traditional suburban office developments.

The second type of user requires the flexible space associated with research and development, including chemical and pharmaceutical laboratory activities. The Navy Yard Research Park can accommodate the needs of these companies with buildings that are typically one- or two-story high-bay structures with adequate space and facilities for loading, and a mixture of office/lab and warehouse spaces. These companies would be attracted by a location near the region’s major medical research institutions, convenient parking, large building floor plates, and a site central to the region’s highly educated workforce. The ease of access to highways and air shipping networks provides added attraction for such research.

**Residential – Rental**

Regional market analysis indicates strong rental demand, with the target market for rental units being singles and couples without children. Housing developments would need to provide 1 to 1.75 parking spaces per unit, and units would need to be competitive in terms of size and quality to offset the dis location of an untethered location and inferior access to some amenities. Units should be slightly larger than comparable Center City units. The recommended mix of unit sizes would be 10% studios, 30% one-bedroom, and 60% two-bedrooms. The amenities offered could include: free trash picker parking, security, high-speed internet access, a fitness center, tennis courts, outdoor open space, river access, docks to the subway, improved city bus service, and a water shuttle to Penn’s Landing. Essential local services, such as laundries, cleaners, convenience stores/neighborhood ATMs, etc., should be available. Rental units would best be established in the Historic Core first, initially through conversion of existing buildings and later through new construction. The Navy Yard could absorb an estimated 100 units per year and support 900 units by 2011. Disadvantages facing housing in The Navy Yard include potential noise from the airport and railroads, limited public transportation access and, in the early stages, a lack of amenities and potential disturbance from nearby construction.

**Residential – Ownership**

While analysis indicates an overall strong regional demand for single-family and townhouse ownership units, high quality for-sale housing is seen as a longer-term option in The Navy Yard. This lower-density development type should wait until a rental residential base has been established. Single family and townhome development is better suited to the more open eastern portions of the site – the Marina and the East End – which also has later phases of development.

The target market for ownership is people who live and work in the city or commute within the region along the I-95 corridor. One or two parking spaces should be provided per unit. Amenities required for townhouse units are the same or greater than those for rental units. Planning should match the predicted absorption rate of 60 units a year in the initial phases, increasing to as much as 100 units a year after the residential component of The Navy Yard is successfully established.

**Retail**

Long-range retail demand is difficult to assess because it depends on the build-out of the 2004 Plan. Therefore, this study’s analysis focused on existing demand and demand in the initial development stages. Initial retail business during this time would be generated primarily by workers and residents from The Navy Yard, and secondarily by visitors from the adjacent sports facilities and nearby residential neighborhoods.

The sports stadiums would generate retail traffic easily. To capture that market, a number of factors would be critical, including marketing (advertising and tie-ins), improved physical connections, high visibility, parking and shuttle service, and vendors with name recognition. The traffic that could be captured would largely be food-related, and would not support most retail retail. Furthermore, in the early phases of development, the number of workers and residents in The Navy Yard may not be sufficient to support retail.

With the above-mentioned office development in the first two years and 100,000 square feet of office space per year after that, The Navy Yard can support 20,000 to 40,000 square feet of retail. The food-related retail would consist of two to three restaurants, one or two boutique shops, and a coffee shop. Non-food retail would be largely services and convenience retail: dry cleaner, newsstand, post office, copping, hair and beauty, or similar. This initial retail should be clustered together near the gateway at Broad Street and Longue Island Boulevard to maximize the size and proximity of the potential market.

**Marina**

Market analysis shows that anticipated demand for recreational boating marinas and expected regional supply of such facilities will create sufficient demand to support a Navy Yard marina, provided the public sector provides financial support for establishing necessary infrastructure. The marina’s location would be highly desirable for its proximity to I-95, the city, the sports stadiums, and a walk-section of the Delaware River.

The proposed facility would accommodate 250 slips for boats 20 to 40 feet in size, with most slips in the 30-foot size (and 1 slip available for boats over 40 feet). The marina would operate year-round, offering both permanent (50%) and transient (15%) slips, dry rack storage for 150 boats, and support amenities. To maximize the market appeal, the marina should be targeted to attract both family boaters, concerned with child-oriented amenities such as swimming pools and game rooms, and adult boaters, looking for features like proximity to restaurants and bars. Marina features and facilities would include: a breakwater or wave attenuation, freshwater and electric hookups at all slips, a blazing start, septic pump-out facilities, boat lift, repair facility, and 24-hour security.

**Executive Conference Center Hotel**

Market analysis indicates that while there is not sufficient demand to support a four-star hotel in The Navy Yard, an executive conference center with lodging facilities would have a wider regional draw, and could do well. The recommended facility would be competing primarily for regional executive conference center demand and secondarily for local meeting and group demand. The recommended program calls for 150 guest rooms, 27 meeting and conference rooms ranging in size from 500 square feet to 1,000 square feet, and a 250-seat restaurant/dining room. Additional amenities would include a business center and a health club with pool and sauna, as well as access to nearby golf facilities, tennis courts, basketball/volleyball courts, and jogging trails. A shuttle service to Center City, Old City, and Penn’s Landing would enhance the conference center.

The Navy Yard’s location, ease of highway access, proximity to the airport, and relative isolation are all considered marketplace advantages. There would be a beneficial synergy between the conference facility and the proposed office and residential uses. A waterfront location would be an asset, and the proposed marina would add to the center’s appeal.

**Campus**

Study of similar mixed-use developments suggests that one or more tenants with sufficient critical mass to create a campus within The Navy Yard would catalyze development growth. Specific companies considered include the academic and research facilities of the UCSF Life Sciences campus at Mission Bay, San Francisco, and the also proposed General Electric Research Center campus at the Charlestown Navy Yard in Boston. The ideal anchor tenant would both build on the existing economic and intellectual infrastructure of the region, and generate opportunities for new businesses in affiliated fields. The Navy Yard offers easy access to regional transportation, a labor force that includes highly educated workers, proximity to major university research centers, adjacency of the Navy operations, and a site that can accommodate a mix of building types including office, research, and production. Research suggests that corporate, institutional, academic, or government users in the life sciences, pharmaceutical, or propulsion and power engineering fields would be ideal candidates.

**Industrial Warehouse/Distribution Center**

Currently, should a company requiring 700,000 to 1,000,000 square feet of warehouse/distribution or industrial space wish to locate in Philadelphia, there are few available sites with enough acreage to accommodate that need. Even fewer sites can boast the transportation advantages of The Navy Yard’s East End, relative to port, rail, and highway access. The East End offers an opportunity to respond to this specific potential market demand.
RETAIL
The 2004 Plan does not propose large-scale destination retail uses at The Navy Yard because these uses are already accommodated nearby in South Philadelphia. Nonetheless, the development options proposed by the 2004 Plan will require, at a minimum, convenience retail development supporting the daily needs of workers, residents, and visitors. The Plan identifies opportunities for primary retail development at five locations within The Navy Yard (Fig. 1):

- Around the intersection of League Island Boulevard and Broad Street including the ground floors of the three proposed buildings fronting on Crescent Park
- West of Constitution Square, within the reused Buildings 489 and 661, and ground floors of Buildings 83 and 624 when they are converted to residential uses
- Within the ground floors of all buildings facing the Triangle
- Within the ground floors of buildings fronting on the marina
- Within buildings fronting on Dry Dock 1

In addition to the primary retail space designated by the Plan, additional, future opportunities for retail have been identified. This space is located along the Diagonal Boulevard and is intended for retail uses if demand exists. Buildings within these locations should be designed with ground floor ceiling heights adequate to support retail uses and with extensively glazed facades in appropriate relationship to adjacent sidewalks. Parking provided in the Plan for office development at a rate of 4 cars per 1,000 square feet would not be adequate to also serve both the primary and secondary retail. Lower parking ratios for office development or increased amounts of structured parking would be necessary for a full build-out of the retail.

The Navy Yard planning team recognizes that a critical population of residents and workers is necessary to support any retail amenities but that these amenities are required to attract that critical population. Furthermore, the Plan recognizes that as population grows in The Navy Yard, retail demand will also grow. Thus the Plan recommends that critical initial retail amenities be constructed at League Island Boulevard and Broad Street.
STREETS
One of the Philadelphia Navy Yard’s primary assets is its existing street grid with its stock of historic buildings. The construction of League Island Boulevard in 2001 created the first portion of a multi-lane arterial roadway connecting Broad Street to the East End (Fig. 3). Building upon these existing assets the 2004 Plan reinforces and clarifies the historic street grid within the Historic Core and proposes a new network of streets east and north of the Historic Core. It further supports the proposed construction of a new Delaware Avenue entrance to The Navy Yard from the east and a reopened 26th Street entrance to The Navy Yard from the west. In addressing The Navy Yard’s street network, the Plan seeks to:

• Create a clear hierarchy of streets that vary in character in response to the needs of vehicles, pedestrians, and adjacent land uses.
• Create visual links and establish or reinforce connections between existing development and new development at The Navy Yard.
• Improve access into and through the site and enhance access by transportation modes other than the car.
• Provide pleasant, walkable streets with points of interest, connecting open spaces, and direct links to the waterfront.

The street network plan (Fig. 2) illustrates and describes five general street types within the Plan. Street plans and cross-sections are proposed for each of these street types (Figs. 5 through 28).

- **Collector Streets**: Collector Streets are those characterized by higher traffic volumes and speeds. They are designed to handle truck traffic, and where possible, they include landscape buffers. Collector Streets funnel and distribute traffic to and from The Navy Yard, linking to existing city streets to the north and to the nearby Interstate highways. Collector Streets at The Navy Yard include the existing League Island Boulevard, the extension to the proposed 26th Street entrance to the west, the new Mustin Road linking to the proposed Delaware Avenue extension to the east, and Broad Street north of the existing Navy Yard gateway.

- **Main Streets**: Main Streets are characterized by wide sidewalks, bicycle lanes, and street trees in walls between the sidewalk and parking lane. Main Streets at The Navy Yard include Broad Street south of the gateway, Kitty Hawk Avenue, and the proposed Diagonal Boulevard. Together, these form a triangle of roads, connecting the Corporate Center, Historic Core, and Marina District, and extending to the waterfront.

- **Greenway Streets**: Greenway Streets are characterized by a double row of street trees framing wide sidewalks. Greenway Streets link the Corporate Center to the Historic Core and extend via Intrepid Avenue to the Reserve Basin and via 11th Street to the Delaware River. The 2004 Plan proposes that 11th Street be relocated 165 feet east of its current location thereby strengthening the connection from the Corporate Center to the Delaware River. This relocated street establishes building sites between the Historic Core and the retained Navy buildings to the east.

- **Secondary Streets**: Secondary Streets are generally 2-lane, 2-way streets with on-street parking. Secondary Streets at The Navy Yard connect Collector Streets, Main Streets, and Greenway Streets and establish an urban, pedestrian-friendly pattern of traditional city blocks. The majority of The Navy Yard’s Secondary Streets are either existing streets within the Historic Core or new streets within the Marina District.
Waterfront Street: Admiral Peary Way and its extension along the Navy Yard waterfront is a unique street type due to its waterfront location. It is designed in conjunction with a waterfront pedestrian esplanade, intended to provide public access to the Navy Yard’s entire Delaware River frontage. The cross-section of this Waterfront Street varies along its length, but consistently provides a pedestrian route along the water’s edge. Benches and shade trees are provided in certain areas.

Bicycle Movement

The proposed Navy Yard street network is designed to encourage bicycle use. A proposed network of bicycle routes includes on-street bike routes on the Diagonal Boulevard, Kitty Hawk Avenue, and Broad Street and an off-street bike path along the waterfront esplanade and adjacent to League Island Boulevard. The Plan’s emphasis on bicycle use is consistent with the 2004 Plan’s sustainable design goals.

Pedestrian Movement

Safe and convenient pedestrian movement is a priority on the 2004 Plan’s proposed Main, Greenway, Secondary, and Waterfront Streets. Sidewalks are proposed adjacent to all of these streets and the proposed design of the Waterfront Street includes a broad, public esplanade adjacent to the river.

Each of the proposed street types includes land adjacent to the street which is designated the “Sidewalk Corridor.” The sidewalk corridor on each street is divided into three distinct zones: the curbside zone, the pedestrian zone, and the frontage zone. The curbside zone buffers pedestrians from the adjacent roadway, and is also the area where elements such as street trees, light poles, and street furniture are located. The pedestrian zone is the area intended for pedestrian travel and is proposed to be permanently free of impediments to pedestrian movement. The frontage zone is the area between the pedestrian zone and adjacent buildings. This zone gives pedestrians a comfortable space at the building fronts and also provides a place for temporary uses such as sidewalk cafes, storefront displays, and additional planting. Detailed and site-specific street improvement designs will require coordination between the street and sidewalk corridor designs proposed by the 2004 Plan and the specific features of each site including existing and proposed buildings.

Figure 3. The current street system lacks organization and integration.

Figure 4. Sectional comparisons of streets at The Navy Yard and Center City Philadelphia.
Figure 5. Section and plan detailing the character of League Island Boulevard east of Broad Street

Figure 6. Section of Langley Avenue west of Broad Street

Figure 7. Collector Street keyplan

Collector Streets

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<tr>
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Figure 8. Collector Street characteristics
Main Streets

Figure 9. Main Street keyplan

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Figure 10. Main Street characteristics

Figure 11. Section and plan of Diagonal Boulevard, showing on-street parallel parking

Figure 12. Section of on-street parallel parking and adjacent parking lots on Diagonal Boulevard

Figure 13. Section and plan of Kitty Hawk Avenue at Broad Street, showing bicycle paths and on-street parallel parking

Figure 14. Section detailing the character of Kitty Hawk Avenue at 11th Street
Greenway Streets

Figure 15. Section and plan of Greenway Street, showing on-street parallel parking.

Figure 16. Section of adjacent parking lots and on-street parallel parking on Greenway Street.

Figure 17. Greenway Street keyplan.

STREET ELEMENTS

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Urban Design Feature

TRAFFIC MANAGEMENT FEATURES

- Soft Extensions at Signals
- Alternative Parking at Pedestrian Crossings

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Figure 18. Greenway Street characteristics.
Secondary Streets

Figure 19. Secondary Street keyplan

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Figure 20. Secondary Street characteristics

Figure 21. Section and plan of Secondary Street showing on-street parallel parking

Figure 22. Section and plan of Secondary Street showing on-street parallel parking
Figure 22. Section of Waterfront Street between Broad Street and 13th Street with seawall edge

Figure 23. Section of Waterfront Street between 13th Street and 11th Street with seawall edge

Figure 24. Section of Waterfront Street between 11th Street and League Island Boulevard showing on-street parallel parking and naturally planted river edge

Figure 25. Section of Waterfront Street east of League Island Boulevard showing on-street parallel parking and seawall edge

Figure 26. Section of Waterfront Street east of League Island Boulevard showing on-street parallel parking and naturally planted river edge

Figure 27. Waterfront Street keyplan

Figure 28. Waterfront Street characteristics

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OPEN SPACE
The 2004 Plan proposes a network of new and existing public open spaces the incremental development of which is essential to the success of the Plan. The proposed open space plan seeks to:

- Provide a framework for development with public open spaces that provide identity to neighborhoods within The Navy Yard and create links among those neighborhoods.
- Add value to development parcels by providing adjacent green space amenities.
- Provide public access to a continuous 2.5 mile length of waterfront.
- Forge social communities within The Navy Yard’s neighborhoods by providing public areas of gathering and outdoor activity.
- Create areas of pervious surface, facilitating natural water filtration and, on some sites, providing wetlands and stormwater retention.

This section describes the 2004 Plan’s open space plan and describes the approximate size and design characteristics of open spaces proposed for each of the Plan’s districts.

The Open Space Plan

Approximately 54 percent of the land within the 2004 Plan study area consists of outdoor open space including existing green spaces within the Historic Core, proposed parks, landscaped buffers along streets, public and private plazas, trails, outdoor recreational amenities, wetlands and stormwater retention areas. Many of these open space features are public while others are within proposed development parcels and include courtyards, plazas, and landscaped areas around buildings and within parking areas.

The open space plan includes a variety of public parks of different sizes, programs and characters. These are distributed throughout The Navy Yard but are linked to the waterfront wherever possible. Seven parks create the backbone of the proposed Navy Yard park system (Fig. 29).

1. Crescent Park (proposed)
2. The Central Green (proposed)
3. The Marine Parade Ground (existing)
4. Constitution Square (proposed)
5. The Triangle (proposed)
6. Dry Dock 1 and Pier 1 (existing)
7. Riverfront Esplanade (partially existing)

Brief descriptions of each of these follow.

In addition to these more formal parks, corridors of green space separate the Corporate Center and Marina District from the Research Park and the adjacent railyard. Designed to provide a visual and physical buffer between different adjacent land uses, these green spaces offer Navy Yard residents and employees access to naturally landscaped outdoor areas and recreational opportunities. A proposed system of pedestrian and bicycle trails connects existing and created wetlands to the Delaware River.

Taken together the many open spaces proposed for The Navy Yard serve a major role in uniting several districts proposed by the Plan while both creating useful and attractive outdoor places for people and restoring the ecological health of natural systems within the site.
Crescent Park

Description
Marking one’s arrival at The Navy Yard, Crescent Park is located at the confluence of three of The Navy Yard’s primary streets: Broad Street, The Diagonal Boulevard, and League Island Boulevard (Fig. 30). Radiating southeast in concentric circles from the intersection of Broad Street and League Island Boulevard, the three layers that define Crescent Park are: the front lawn area, the activity area, and the retail street area.

In the first layer, at the corner of Broad Street and League Island Boulevard, the front lawn area acts as the passive entrance forecourt to the first three buildings and the Diagonal Boulevard.

The second layer, the activity area, contains: the east gatehouse (Building 500), a trellis structure, parking, formal seating areas, and an active recreation area. Sculptural and/or light elements mark the beginning of the Diagonal Boulevard. The east gatehouse is proposed to be converted to a restaurant, retail, or other public use with outdoor seating and a view of the park, Broad Street corridor, and Reserve Basin.

The third layer is the street area containing the extension of Langley Avenue and the buildings across Langley Avenue, which form the visual edges of the park. This edge of the space is activated and defined with ground floor retail.

Size
3.46 Acres

Use
Crescent Park contains formal and informal seating and gathering areas, basketball court, volleyball court, a bocce ball court, and informal play areas. A café or restaurant may also be included.

CRESCENT PARK PROGRAM ELEMENTS

REQUIRED
Art, Sculpture/Icon
Bicycle Racks
Formal Gardens
Off-Street Parking
Project Signage
Restaurant/Outdoor Terrace

SUGGESTED
Basketball Court
Drinking Fountain
Sand Volleyball Court

The Central Green

Description
The Central Green, bordered by Diagonal Boulevard to the north, 11th and 12th Streets to the east and west, and Normandy Place to the south, is the centerpiece of The Navy Yard Corporate Center (Fig. 31). This park strengthens the physical and symbolic connection between the Historic Core and the Corporate Center providing distinguished street addresses for existing and new buildings. It provides a mix of passive use areas that accommodate events of varying size.

The Central Green includes civic and community landmarks including gardens, monuments, and water features. The southern portion of the park contains a large pond with naturalized planting edges, a small island and public art that terminates the view north along 11th Street.

The pond functions dually for stormwater retention and as a visual and passive recreation water amenity. The Central Green helps to knit the Corporate Center to the Historic Core.

Size
5.50 Acres

Use
The Central Green offers a wide array of passive recreational uses including open lawn areas, shaded seating areas, a central restaurant/bar, specialty kiosks, and newsstands. Concerts, festivals, or other special events could also be held here.

CENTRAL GREEN PROGRAM ELEMENTS

REQUIRED
Bicycle Racks
Formal Gardens
Lighting
Outdoor Special Event Area
Seating/Gathering Area
Water Feature

SUGGESTED
Art, Sculpture
Concession/Restaurant
Drinking Fountain
Fountain
Natural Area
Restrooms
Shade Structures
Constitution Square

Description
Constitution Square is an elegant, one-block, park in the tradition of Philadelphia neighborhood parks (Fig. 32). With its axial geometry, planting, and stately, regularly spaced trees, the park defines the center of this predominantly residential neighborhood. A dog run, basketball court, and picnic area ring the perimeter separated by wide walkways that lead to a formal central lawn.

Though simple in design, Constitution Square contains a variety of spaces in which people can be seen or watched, play in the sun or relax.

Size
2.38 Acres

Use
Constitution Square has a mix of spaces for active and passive uses which focus on meeting the everyday needs of adjacent neighbors.

Marine Parade Ground

Description
Located along historic Broad Street, the Marine Parade Ground is an elegant expanse of lawn ringed with mature trees and bordered on the east by the historic Marine Barracks (Buildings 100 and 101). It is a grand, ceremonial space reflecting its position as the symbolic heart of The Navy Yard (Fig. 33).

The open space plan identifies recreational uses that will activate the Marine Parade Ground by restoring active uses while retaining the open, historic quality of the green space.

Four passive entrance gardens, on each corner, are designed in reverence to the historical setting of the park.

Size
8.15 Acres

Use
The Marine Parade Ground offers a variety of active recreation including softball fields, a multipurpose field, volleyball courts, and four seating areas.
The Triangle

Description
The Triangle marks the intersection of League Island Boulevard, Diagonal Boulevard, and the primary east-west connection, Kitty Hawk Avenue. The unique geometry of the park links the Corporate Center and Historic Core to the Research Park area and Marina District to the southeast.

Mounded landforms and strictly treeless seating areas establish a centrally located public space and site for a proposed transit station (Fig. 34). The Triangle adds value to this site and provides a stepping point for pedestrians traveling from Crescent Park to the Marina.

Size
1.10 Acres

The Triangle will primarily house passive activities with seating and gathering areas surrounding the proposed transit station.

Dry Dock 1 and Pier 1

Description
The Dry Dock 1 area is an active urban space that provides areas for public gatherings, performances, outdoor markets, dining, and cultural events. Passengers from the adjacent cruise ship terminal may flow into the space. The distinctive shape of the flooded Dry Dock brings water into The Navy Yard and creates a strong focal point for the surrounding historic buildings (Fig. 35).

The 2004 Plan calls for those buildings to be renovated so that they open onto the dry dock plaza area with seating or market areas, and in the case of the proposed gallery in Building 543, a sculpture garden. A public walkway provides pedestrian circulation and service vehicle access around Dry Dock 1.

The main features of the space will be a live performance stage and adjacent seating area, the continued maritime activity. The winch house and marine railway are restored to reveal The Navy Yard’s shipbuilding legacy.

Pier 1, in contrast to Dry Dock 1, is an extension from the land into the Delaware River, marking the terminus of the Broad Street axis. A large sculptural object marks the starting point to Broad Street and the entrance to the pier.

The pier has passive seating areas on the west side for viewing cruise ships and inactive military vessels and lawn seating areas with views on the east side for viewing the river.

The pier has the potential to host a permanent restaurant boat on the east side of the pier. Transformation of the existing pier helps restore the historic connection to the river by encouraging people to go to the waterfront. Together, Dry Dock 1 and Pier 1 mark the west end of the Riverfront Esplanade.

Size
Dry Dock 1: .39 Acres, Pier 1: .98 Acres

Use
Dry Dock 1 offers an array of uses including a performance stage, seating areas, restaurant/bar areas, pedestrian walk, and sculpture garden. Pier 1 has seating, viewing, and seating areas with dedicated fishing areas.

THE TRIANGLE PROGRAM ELEMENTS

REQUIRED
Lighting
Seating/Gathering Areas

SUGGESTED
Art/Sculpture
Landmark Beacons
Bus Stop/Transit Center
Landscape Identity

DRY DOCK 1 / PIER 1 PROGRAM ELEMENTS

REQUIRED
Bicycle Racks
Formal Planting
Lighting
Outdoor Special Event Area
Seating/Gathering Areas
Shade Structures

SUGGESTED
Gazebo/Seating Structure
Sculpture/Public Art
Outdoor Market/Retail
Philadelphia has a rich tradition of public open spaces. William Penn’s original city plan was based on a direct connection to public greens and beautiful public squares. Rittenhouse Square is one of the most successful and identifiable of the city’s public squares.

In the adjacent figures a square representing Rittenhouse Square is overlaid with plans of The Navy Yard open spaces at the same scale to illustrate their size relative to this well known space.

The drawings assist in understanding the scale of the various spaces and the spatial relationships between buildings, streets, pathways, and landscaping.
Figure 43. View of The Navy Yard and Philadelphia skyline, looking north.

Figure 44. View of The Navy Yard’s riverfront edge and Delaware River, looking east.
Riverfront Esplanade

Description
The Master Plan reclaims the waterfront for the inhabitants of The Navy Yard and the City of Philadelphia by providing access across the entire south edge of The Navy Yard east of Dry Dock 1, enabling residents, employees, and visitors to move along the bank of the Delaware River and experience the beauty of the water (Fig. 45).

The esplanade extends approximately two miles from the Dry Dock area through the East End. A series of points of interest occur along the esplanade. The river edge varies from a hard-constructed esplanade in the Historic Core to a naturalized edge around the Marina and in the East End. Native plant species of the Delaware River system will be found along the naturalized edge increasing the natural habitat for birds, animals, and fish.

Size
9.30 Acres

Length
2.05 Miles

Use
The recreational use along the esplanade includes traditional urban waterfront uses such as cycling, walking, running, and in-line skating, with seating and fishing areas incorporated along the path.

RIVERFRONT ESPLANADE PROGRAM ELEMENTS

<table>
<thead>
<tr>
<th>REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle and Pedestrian Trails</td>
</tr>
<tr>
<td>Bicycle Racks</td>
</tr>
<tr>
<td>Lighting</td>
</tr>
<tr>
<td>Parking</td>
</tr>
<tr>
<td>Railing</td>
</tr>
<tr>
<td>Seating/Gathering</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SUGGESTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basketball/Court Games</td>
</tr>
<tr>
<td>Natural Areas</td>
</tr>
</tbody>
</table>

Figure 45. Sketch of the Riverfront Esplanade from its start at Dry Dock 1 to the Seaplane Hangar
Wetlands

The Navy Yard currently contains approximately 27.5 acres of wetlands comprised of seven isolated wetlands in the Research Park, Marina District, East End and adjacent rail yard properties (Fig. 46). The delineation of the wetland areas is based on U.S. Fish and Wildlife Service National Wetland Inventory maps of 1995. Existing wetlands at The Navy Yard are low-grade wetlands characterized by poor soil and significant stands of Common Reed (Phragmites). These wetlands have developed primarily due to poor drainage of stormwater.

The 2004 Plan identifies several strategies for wetland mitigation that are dependent on the type and amount of development that occurs in the East End (Fig. 47). The Plan identifies global strategies that can be implemented holistically. This approach will create a contiguous wetland that is interconnected within the site and connected to the Delaware River enhancing the local ecosystem and strengthening the organizational structure of the Plan.

The Plan’s proposed wetland strategies include retention of existing wetlands, consolidation and creation of new wetland areas on- or off-site, and habitat improvements to the river shallows along the Delaware River. The created wetlands will be a combination of fresh-water and tidal water and contain several different plant communities. All options include recreational trails for residents, workers, and the general public.

The creation of these new, higher quality wetlands will benefit The Navy Yard and the region by providing habitat for birds, fish, and other wildlife, storing floodwater, trapping sediments, filtering chemical pollutants from runoff, and providing recreational and educational opportunities.
<table>
<thead>
<tr>
<th>DEVELOPMENT OPTION</th>
<th>INDUSTRIAL</th>
<th>RESIDENTIAL</th>
<th>GOLF COURSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WETLAND AREA IMPACTED</td>
<td>All wetlands outside parcel 8B</td>
<td>All wetlands outside parcel 8B</td>
<td>All wetlands outside parcel 8B</td>
</tr>
<tr>
<td>REPLACEMENT AREA OF WETLAND REQUIRED</td>
<td>18.45 acres</td>
<td>18.45 acres</td>
<td>18.45 acres</td>
</tr>
<tr>
<td>WETLAND MITIGATION STRATEGY</td>
<td>Mitigate wetlands on the existing site.</td>
<td>Mitigate wetlands on the existing site.</td>
<td>Mitigate wetlands on the existing site.</td>
</tr>
<tr>
<td></td>
<td>- Enhance existing wetlands and create 14.95 acres new wetlands in Parcel 8B</td>
<td>- Enhance existing wetlands and create 14.95 acres new wetlands in Parcel 8B</td>
<td>- Create 18.45 acres of wetlands throughout the golf course</td>
</tr>
<tr>
<td></td>
<td>- Create 2.5 acres new wetlands between East End, Marina District, and Research Park</td>
<td>- Create 7.0 acres new wetlands between East End, Marina District, and Research Park</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Create 1.0 acres of river shallows in the Marina area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL WETLANDS CREATED</td>
<td>18.45 acres</td>
<td>21.95 acres</td>
<td>27.5 acres</td>
</tr>
</tbody>
</table>

Note: Replacement area is based on a one-to-one replacement ratio. Replacement area may be higher depending on actual delineation of wetland area.
Note: Location of Parcel 8B is identified in Fig. 46.

Figure 47: Comparison of affected wetlands for each East End development option
SUSTAINABLE DESIGN
The concept of sustainable development is based in part on the understanding that development—through physical, economic, and social impacts—has historically led to the degradation of critical natural and cultural resources. Central to the practice of sustainable development is recognizing that all decisions—from initial concept through development of design, construction, and operation—impact the natural and cultural resources of the local, regional, and global environments. These choices must be evaluated in the context of natural and cultural conservation.

The 2004 Master Plan incorporates a number of sustainable design elements at both a regional and a local, site-specific scale with the goal of creating a community in balance with a healthy environment, while achieving levels of social well-being and economic prosperity that are superior to typical developments.

Sustainable design strategies employed by the Master Plan at a regional scale include the following (Fig. 48):

1. Redevelopment of an urban site with existing but underutilized infrastructure reduces sprawl and the costs and impacts of extending new infrastructure to a greenfield site.
2. The site’s location, close to existing mass transportation systems, and the integration and extension of mass transit proposed by the 2004 Plan, increases density, reduces automobile trips, and reduces the amount of land devoted to roads and parking.
3. The economic viability of the project strengthens the local economic base of the City of Philadelphia. Stronger, more locally self-sufficient economies are more environmentally sustainable.
4. Rehabilitation and reuse of brownfield sites utilizes existing resources and land assets, increasing the value of the site, and benefiting the surrounding community.
5. By developing The Navy Yard, which is a brownfield site, the pressure to develop greenfield sites elsewhere in the region is reduced.
6. Environmentally sensitive development of The Navy Yard will improve the existing environment of the Delaware Water Basin, which benefits the entire Delaware watershed region.

Figure 48: Sustainable design principles at the regional level
The Master Plan incorporates a number of strategies related to sustainable development at a site scale (Fig. 49). These include the following:

1. A mix of land uses and higher densities. The Plan integrates a variety of land use types and increases the diversity of uses and the density of development in the Navy Yard. The vitality and security of the site is enhanced by having day and night uses that create critical mass and integrate retail and open spaces. Higher density environments conserve, lever natural resources.

2. Reduced development footprints and compact building forms. Compact building forms that grow vertically rather than horizontally are proposed for most of the building sites. This reduces the overall building footprint and permits more efficient use of land and resources allowing for more open space. Creating compact building forms also allows for a greater return on the initial foundation and infrastructure investment and reduces the long-term operating cost of utilities.

3. Connected / integrated land use patterns. The Plan connects various land use patterns through infill building sites and open spaces. The blending of land uses creates structure that connects the Historic Core and surrounding area into a cohesive community. The synergies created allow for greater resource efficiency.

4. Public waterfront access. The Delaware River has a history of industrial waterfront uses that have limited public access to the river. The Plan is designed to encourage the residents, workers, and the public to reconnect with more than two miles of previously inaccessible Delaware River frontages.

5. Retained and reused historic structures. Tremendous amounts of embodied energy and costs exist in the buildings and infrastructure of the Navy Yard. Retaining and reusing structures extends the life cycle of the buildings, conserves resources, retains cultural resources, reduces waste, and reduces environmental impacts of new buildings through the reduction of material manufacturing and transportation.

6. Minimized disturbance of existing open space. Existing open space that is a vital component of the Historic Core has been retained and re-used in the 2004 Plan. This includes the Marine Parade Ground, office’s quarters and Broad Street landscape. There is a number of infilled and under-utilized existing open spaces with un-compacted soils, which would be suitable to support plant material. (Soils that have been compacted, by a now-dismantled building structure, for example, are more difficult to plant in.)

7. Creation of significant open space. Open space plays an important role in defining the framework for development in the Navy Yard. In the Corporate Center and Historic Core, 54 percent of the site has been retained as open space. (Open space is considered to be any area not used for the building footprint, access roads, sidewalks, or parking. Open space must be vegetated and previously.) A series of interconnected, variably programmed, and appropriately sized civic open spaces have been distributed throughout the redevelopment area of The Navy Yard. Multi-functional spaces extend range from large public open space to bioswales in the parking areas. The high ratio of open space to developed space increases land value, livability, and protects natural resources.

8. Integrated/ accessible parks, trails, and open space. Parks, trails, and open space are interconnected across the site to provide alternatives to vehicles for getting around the community. The locations encourage outdoor activities and create a sense of connection with the natural environment.

9. Pedestrian-friendly stormscapes. Storms have been designated to promote walking and bicycling, thereby reducing the dependency on the automobile. Sidewalks are provided on both sides of the street and air connected at all intersections. A grid system of roads creates block widths that are short enough to provide easy pedestrian movement and encourage walking.

10. Street design that reduces resources. Street widths have been minimized to reduce the travel speed of automobiles and reduce material required to construct the roadways. Narrower street widths reduce stormwater runoff by lessening the amount of impervious surface. Adjacent to roadways, additional width has been placed in the landscape areas to increase the amount of open space.

11. Mass transportation. The Plan creates a development pattern that encourages buses, shuttles, ferries, and rail transportation, which reduces fuel consumption, road congestion, and vehicle trips. The existing bus line is proposed to be extended into new development areas, and schedule expanded in response to development. A future intermodal union with shuttle bus and subway service are integrated into the Plan.

12. Designated bicycle routes. The Diagonal, Kitty Hawk, and Broad Street have been designated as on-street bicycle routes having a dedicated bicycle lane. Bike paths are also included adjacent to Long Island Boulevard.

13. Minimized surface parking with structural parking. Structured parking occurs in several areas of the Plan which allows for greater density, increases open space, and reduces the amount of impervious coverage.

14. Stormwater detention/evapotranspiration. The Plan promotes strategies to minimize stormwater runoff and groundwater contamination. Street trees, narrow streets, surfaces drainage, and other naturalized stormwater storage facilities reduce the peak flow rates and enhance the water quality of the Delaware River. In addition open air storm drainage reduces infrastructure cost and materials use.

15. Bio-filteration and groundwater recharge. Smaller detention areas, naturalized channels, and overland flows that mimic natural systems are incorporated into the Plan. These methods improve water quality, slow run-off concentration time, allow groundwater recharge, and reduce the area of larger storm drainage facilities.

16. Enhanced wetlands/ habitat restoration. The Plan protects and improves existing wetlands, offering the potential for new freshwater and tidal wetlands.

17. Planting to optimize shading and use exposure, and minimize wind exposure. Deciduous trees planted in a calculated distance from the buildings will allow solar access when desired in the winter, but provide shade in the summer. Trees planted in parking areas will reduce pavement heat islands and minimize impact on microclimates for people and wildlife. Planting around outdoor gathering spaces is designed to minimize exposure to winter winds.

18. Ecologically based planting regimes. The Plan identifies ecologically based planting areas that increase biodiversity, retain soil moisture, and enhance the natural habitat. A native or regionally adapted plant palette with high survivability is suggested for all landscape areas.
Figure 49: Sustainable design principles at site level
Stormwater Management

An important component of the overall sustainable design approach is development of a low impact stormwater system. This approach combines several "best management practices" to minimize the adverse environmental impacts of development at The Navy Yard. The major goal of stormwater management is the reduction of stormwater peak flows, total stormwater volume, and the amount of pollutants acquired in stormwater runoff. The Plan decentralizes the collection system and allows stormwater controls to be implemented incrementally as different phases are developed.

The Plan controls the flow of stormwater close to the source by integrating the landscape and built environments (Figs. 50 and 51). Every surface in the system is considered part of the hydrologic cycle and can be used to improve the stormwater management. Open spaces, for example, will be used to detain, infiltrate, and filter runoff; and hard surfaces will be sloped to direct runoff toward receiving green spaces.

The Master Plan incorporates the following best management practices:

**Bioretention Systems**
Bioretention systems, or rain gardens, are depressed, vegetated areas that manage stormwater quality and quantity. The Plan incorporates bioswales in the median strips and islands in all parking lots. Water collects in the depression and slowly infiltrates through layers of mulch and prepared soil. The soil and vegetation provide water quality treatment through infiltration and uptake; peak flow is reduced by the detention on the surface and in the soil matrix; and runoff volume is reduced through infiltration.

**Vegetated Swales**
Vegetated swales are located in several open space areas. The swales provide filtration of stormwater runoff and reduce piping and infrastructure costs.

**Surface Detention**
The Plan identifies areas in which runoff is collected and directed to a temporary above-ground storage basin. Detention created by ponds in parks and wetland areas reduces the peak flow of stormwater runoff by managing the release rate of stormwater to the Delaware River.

**Wet Ponds**
A wet pond is planned in each of the different development areas. A wet pond is a stormwater basin with a permanent pool. Water retained here is no longer rapidly flowing, which allows time for the settling of suspended materials.
A portion of the wetlands area will be used for stormwater management. The wetlands area will replicate the natural hydrologic conditions to provide stormwater detention, reduction of peak flow, settling of suspended materials, and plant uptake of dissolved pollutants.

**Depressed Green Spaces**

Green spaces such as medians, islands, or planting strips along streets and sidewalks are planned to be lower than the surrounding grade. This system will allow for some surface storage as the water infiltrates into the ground, thereby increasing infiltration and reducing stormwater volume.

**Interrupt Flow Over Impervious Surfaces**

Depressed median strips and islands in parking areas and roads collect stormwater runoff. The overflow can be designed to flow to a secondary pervious area, before ultimately flowing into a storm drain, allowing further opportunities for infiltration. This method reduces impervious building material and minimizes the cost of infrastructure such as pipes and inlets necessary for a parking lot.

**Slope Impervious Surfaces to Green Spaces**

Parking lots, sidewalks, walkways, and roads will be graded so that the runoff sheet flows into the green spaces. Overflow from these green areas will flow to secondary green spaces or to the pipe infrastructure. Runoff will be directed to park areas to support water features such as a pond or wetland garden.

**Street Trees**

Leaves, branches, and trunks of trees intercept rainfall over the pervious areas in which they are planted and the impervious areas over which their canopies stretch.

Implementation of these best management practices will not only reduce stormwater peak flows, volume and levels of pollutants but will also reduce the urban heat island effect, save energy and water, lower utility fees, and provide a more aesthetically pleasing landscape.
TRAFFIC
The 2004 Master Plan builds on The Navy Yard’s existing street grid to create an organized street system with both a clear hierarchy of streets and a network that allows multiple connections for ease of traffic movement. Given this efficient internal structure, the primary traffic constraint facing The Navy Yard is the limited vehicular access from the rest of the city. Currently, the entrance at Broad Street provides the only active access to the site. While this situation serves the security goals of the Naval Base by creating a control point, it represents a potential bottleneck as The Navy Yard is developed.

**Previous Conditions**

The planning process for the 2004 Plan considered both the previous traffic conditions, when the full Navy Base was in operation, and the existing traffic conditions in 2003. A September 1994 report, the Philadelphia Naval Base Reuse Strategy, Final Technical Report, Architecture and Planning, was reviewed to understand the previous traffic conditions. While the traffic volumes documented in that report are not pertinent to the Navy Yard, the recorded traffic volumes entering and exiting the property at Broad Street at Intrepid Avenue or Kitty Hawk Avenue. The recorded traffic volumes entering and exiting the property at Broad Street at Intrepid Avenue or Kitty Hawk Avenue are:

- **Morning peak (6:30-7:30 am)**: 1248
- **Afternoon peak (3:15-4:15 pm)**: 1472
- **Evening peak (4:30-5:30 pm)**: 726

**Regional Access**

Currently, Broad Street provides the only active access into and out of The Navy Yard. Two major routes, I-76 and I-95, provide regional access to Broad Street. The most direct route to The Navy Yard is from southbound I-95, with an interchange at Broad Street immediately north of the entrance to The Navy Yard. Arriving from northbound I-95, motorists exit northbound on Broad Street, and make a U-turn at Patton Avenue to travel south on Broad Street into The Navy Yard. A similar route is required for travel south on I-95 leaving The Navy Yard; travel north on Broad Street, make a U-turn at Patton Avenue, then travel south to the I-95 ramp. There is an interchange on Broad Street north of the sports complex that provides access to and from east and westbound I-76.

Additional Access Points

Additional access points to The Navy Yard will be needed to serve the proposed development. The 2004 Plan recommends two additional access points: re-opening 26th Street on the west and extending Delaware Avenue to The Navy Yard at the East End. Of these, the re-opening of 26th Street is likely to occur first.

Sixty-six Street intersects Patton Avenue, which provides a direct connection to I-76 east and I-95 south, immediately north of the southwestern corner of The Navy Yard property. Because the route between northbound I-95 and the Broad Street entrance to The Navy Yard is somewhat circuitous, access via 26th Street and Patton Avenue will provide a desirable alternative. The northbound 26th Street exit from The Navy Yard provides a convenient connection to westbound I-76.

The City of Philadelphia has been considering an extension of Delaware Avenue towards Temple University for several years, and is currently examining the engineering and design of this project. A connection to Delaware Avenue would provide access from The Navy Yard to I-76 and I-95, via Oak Street and Front Street. Providing this connection to The Navy Yard is technically feasible but would involve the acquisition of a number of affected property owners, including the Padawor Avenue Marine Terminal, ISS, and NorthSouth.

**Proposed Development Assumptions**

The planning process considered various development scenarios and evaluated the trip generation characteristics of each. The specific development assumptions used in this analysis are shown in Figure 53. Trip generation information was estimated based on rates compiled by the Institute of Transportation Engineers and published in the sixth edition of Trip Generation.

The mid-afternoon volumes are higher than might be expected, due to the industrial work that occurs at The Navy Yard. This requires employees to work earlier shifts which and before the typical late afternoon peak hour.

The predominant flow of existing inbound traffic in the morning peak hour makes a right turn from Broad Street at Intrepid Avenue or Kitty Hawk Avenue. About 10 percent of the entering traffic turns left on League Island Boulevard. During both the mid-afternoon and late afternoon peak hours, the reverse is true, with the predominant movements being left turns from Intrepid Avenue and Kitty Hawk Avenue onto Broad Street.

Trucks are currently not permitted on Broad Street between Langley Avenue and Intrepid Avenue, due to weight restrictions on the bridgehead adjacent to the Reserve Basin. Trucks entering the site from the north currently turn left at League Island Boulevard and cross Broad Street at Intrepid Avenue or Kitty Hawk Avenue.

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noted in the 1994 Reuse Study mentioned previously in this section. These find-ings support an aggressive promotion of mass transit options and suggest that percent, will exceed some of the heaviest traveled areas in the city. With all three access points, the inbound traffic in the morning would be almost three development including minimal mass transit usage of 5 to 10 percent.

Figure 55 shows the total traffic volumes generated by the existing and proposed (Figs. 59 through 61), with approximately 30 percent of the total traffic shifting to 26th Street, and about 15 percent shifting to Delaware Avenue.

Figure 55 shows the total traffic volumes generated by the existing and proposed development including minimal mass transit usage of 5 to 10 percent. With all three access points, the inbound traffic in the morning would be almost three times the existing volume. The outbound afternoon volumes would be almost five times the existing volume. Note that the projected traffic volumes entering and exiting Broad Street, with the two additional access points and minimal mass transit usage of 5 to 10 percent, will exceed some of the heaviest traveled areas in the city. These findings support an aggressive promotion of mass transit options and suggest that later phases of development may require implementation of off-site improvements noted in the 1994 Reuse Study mentioned previously in this section.

Access Recommendations

26th Street

It is highly recommended that 26th Street be opened for access as soon as possible. This route provides convenient access from I-95 south and west I-76. The roadway from 26th Street to Broad Street should be upgraded, including surfacing, curbing, landscaping, lighting, signage, and other streetscape improvements to give motorists a sense of security and comfort and to eliminate any perception of 26th Street as a “back door.”

Analysis of the intersection of Paterson Avenue and 26th Street was not included in this study. However, given the current conditions at the intersection and projected traffic volumes, it is anticipated that appropriate improvements will be made to allow this intersection to operate at an acceptable level of service. Two lanes in each direction should be provided on 26th Street between Paterson Avenue and the bridge over the Reserve Base. At the intersection of 26th Street and Langley Avenue, some traffic is anticipated to proceed across the bridge and travel Constitution Avenue or Kitty Hawk Avenue, while the remainder of the traffic is anticipated to turn onto Langley Avenue.

Delaware Avenue

The extension of Delaware Avenue into the East End be a grade-separated four-lane roadway that would connect to the existing Delaware Avenue near Pattison Avenue. Access from I-95

Evaluation of access to/from I-95 was not included in this analysis; however, some observations about traffic around and along I-95 were made. The large warehouses, sports venues, rail terminals, and port facilities generate plenty of traffic activity without the future Navy Yard development. The intersections in the area, at Broad Street and Front Street, are old and already experience some congestion, particularly when there are sporting events. In addition, the Front Street interchange has tight turning radii on the ramps and at the intersections of the ramp and the surface streets.

The area’s I-95 access problems result from the combination of uses and the condition of the existing network. It is recommended that DVRPC, as the planning organization for the region, conduct a feasibility study to address this area’s access issues along I-76 and I-95. Such a study could recommend improvements that could be added to the regional Transportation Improvement Program for future implementation.

Internal Circulation

The intersection of Broad Street and League Island Boulevard was evaluated to determine a recommended lane configuration based upon the projected traffic volumes at full build-out and minimal mass transit usage of 5 to 10 percent. Initial analysis examined extending League Island Boulevard westward past Broad Street toward the proposed 26th Street access; however, it was determined that due to lower turning movements, keeping this 3-way intersection as it is would ease the traffic.

Traffic using the 26th Street access would use Langley Avenue, or would shift further south to Constitution Avenue and Kitty Hawk Avenue. This would also encourage drivers to use Langley Boulevard and the Langley Avenue extension, rather than League Island Boulevard. The resulting requirements for Broad Street and League Island Boulevard would be three lanes westbound, four lanes southbound, and three lanes northbound (Fig. 56). All lanes are recommended to be 12 feet wide.

A five-lane cross-section on Broad Street at Langley Avenue, consisting of two through lanes and one exclusive left turn lane in each direction, is recommended at full build-out (Fig. 57). For Langley Avenue and the Langley Avenue extension, a four-lane cross-section, including two through lanes and separate right and left turn lanes, is suggested. Langley Avenue, which is currently 30 feet wide and recommended to have lane widths of 11 or 12 feet, will require widening.

Figure 56. Broad Street and League Island Boulevard interaction

Figure 57. Broad Street and Langley Avenue/Paterson intersection
Figure 59. Relative traffic volumes at full build-out of the 2004 Plan, with only Broad Street access

Figure 60. Relative traffic volumes at full build-out of the 2004 Plan with Broad Street and 26th Street access

Figure 61. Relative traffic at full build-out of the 2004 Plan volumes with Broad Street, 26th Street, and Delaware Avenue access

TRAFFIC

Broad Street is 82 feet wide north of Langley Avenue and narrows to 76 feet at the gateway. The recommended five-lane cross-section would fit comfortably at both widths. However, south of Langley Avenue, Broad Street measures only 46 feet wide, enough width to reasonably provide four travel lanes. As traffic increases, a five-lane cross-section will be required, along with widening the street. This presents a challenge, as the west side of the Broad Street contains a sidewalk and the bulkhead of the Reserve Basin, and the east side borders a 25 foot wide grass strip and sidewalk adjacent to the Marine Parade Ground. Additionally, any changes in the roadway in the Historic Core could be an issue from a historic preservation perspective.

Even with these lane configurations and all three access points active, operational concerns remain about a full build-out scenario with assumed minimal mass transit use. A queue analysis for the intersection of Broad Street and Langley Avenue showed each southbound through lane on Broad Street having an average queue length of over 1,100 feet. This back up would extend through the League Island Boulevard intersection, as these intersections are about 500 feet apart. The northbound through movement on Langley Avenue extension is projected to have an average queue length of 660 feet. While these queue lengths might suggest the addition of more through-lanes on Broad Street, additional lanes are not recommended given the physical constraints of the site.

Note that the queue conditions described above would not be immediate and are only projected for full build-out of all program elements, without the Broad Street Subway extension, and assuming minimal usage of mass transit. Widening Broad Street should not be considered until traffic volumes reach a level that would justify construction. A re-evaluation of traffic conditions should be conducted in five to seven years.

As previously noted, the base assumption for transit usage is 5 to 10 percent of trips. An analysis of the traffic volumes on Broad Street assuming higher transit usages of 15, 20, and 30 percent, reveals dramatically reduced traffic loads. The traffic volumes on Broad Street would decrease by 5, 9, and 17 percent, respectively. These lower volumes do not affect the recommended lane configurations; however, the projected queue lengths would be greatly reduced. Assuming a transit usage of 30 percent, the projected queue lengths on Broad Street at Langley Avenue would be approximately half of what they would be in the worst-case scenario (of only 5 to 10 percent transit usage). This clearly illustrates the benefits of implementing a shuttle bus system and extending the Broad Street Subway, thereby increasing the percentage of commuters in The Navy Yard who use mass transit and reducing the vehicular loads.

Signalization

As traffic volumes grow, some intersections within The Navy Yard street network will require a traffic signal. Traffic volumes should be monitored and as conditions dictate, signals modified or installed at the following intersections:

- Broad Street and League Island Boulevard
- Broad Street and Langley Avenue (currently signalized)
- Broad Street and Intrepid Avenue (currently signalized)
- Broad Street and Constitution Avenue (currently signalized)
- Broad Street and Kitty Hawk Avenue (currently signalized)
- League Island Boulevard and Langley Avenue
- League Island Boulevard and Intrepid Avenue
- League Island Boulevard and 11th Street
- League Island Boulevard and Constitution Avenue
- League Island Boulevard and Diagonal Boulevard
- Kitty Hawk Avenue and 11th Street
- Kitty Hawk Avenue and Diagonal Boulevard

More information on the internal street network, classification of the roadways, and typical cross-sections, are contained in the “Street Network” section of this document.
MASS TRANSIT
The 2004 Master Plan envisioned a vibrant, pedestrian-friendly, environmentally sustainable, urban community. Integration of mass transit into the Plan supports the reduction of these goals: Mass transit reduces the amount of land, energy, money, and other resources devoted to vehicular circulation and parking, and the waste and pollution generated by automobile traffic. Mass transit will also greatly reduce traffic congestion and improve connections between the potential workforce and centers of employment.

A variety of mass transit options were examined in developing the 2004 Plan, including bus, rail, and ferry routes. Recommended options have been integrated into the Plan. It should be noted that the status of the mass transit options was current at the time of writing and may have changed since, including implementation of some of the Plan’s recommendations. The following section summarizes these analyses of several mass transit options for The Navy Yard.

**Transit Planning Principles**

In analyzing public transportation alternatives in The Navy Yard, four fundamental transportation planning objectives have been considered:

- **Modal Choice.** Trips generated by the development of The Navy Yard can be made via various mass transit options or private vehicles. A significant percentage of the population is transit-dependent or prefers to use transit. Mass transit should provide an attractive alternative to private vehicles, and minimize the number of changes between modes of transportation to complete a trip.

- **Mobility.** The 2004 Plan seeks to increase mobility for the greatest number of people between points of origin and destinations. Home to work trips are the major category of trip types, and thus adequate provision for commuting is the primary goal.

- **Effective Use of Resources.** While providing mode choice and a host of mobility options is desirable, it must be recognized that there are limited amounts of resources, particularly financial, that can be applied to meeting these needs. Provision of public transportation services must realistically address the effective use of the region’s available resources.

- **Volume/Capacity.** Public transportation must be gauged to meet demand in a manner that is economically viable and comparable to other mode options. In justifying the economic investment, a balance must be sought between current demand and future demand. Future demand can be hard to gauge as the very existence of public transportation can increase that demand by encouraging development.

**Past and Current Transit Service**

**Past Transit Service**

At one time, The Navy Yard was served by several streetcar lines. Over time bus routes replaced the streetcars, and routes were revisited. Prior to the closing of the Naval Shipyards in 1996, three bus routes provided service to The Navy Yard: Routes C, G, and 17. The Navy Yard area was also served by a ferry across the Delaware River from National Park, New Jersey.

**Current Service**

Existing public transportation service provided by the Southeastern Pennsylvania Transportation Authority (SEPTA) consists of extensions of selected runs of the Route 17 bus from its main terminus at 20th and Johnson Street to The Navy Yard via the Broad Street Subway station at Broad Street and Pattison Avenue. Route 17 originates at Front and Market Streets in Center City, operates west across Center City on Market Street and JFK Boulevard, and then south via 19th and 20th Streets to 20th and Johnson Streets. The extension to The Navy Yard operates on Pattison Ave and thensouth on Broad Street and through The Navy Yard on Constitution Avenue, Walnut Street and Flagship Drive to a terminus at Flagship Drive and Broad Street. One AM and one PM trip follows an alternate route within The Navy Yard to a terminus at Kitty Hawk Avenue and 19th Streets. The main part of Route 17 provides frequent service, every 4 to 5 minutes during peak hours, but extensions to The Navy Yard only run every 30 minutes during off-peak hours, and every 60 minutes mid-day. Only one trip operates during the evening hours.

Past studies indicate that about 30% of riders to and from The Navy Yard use the Route 17 as a shuttle to and from the subway at Broad Street and Pattison Avenue; only 20% ride the bus to and from Center City or other points along its route. The subway operates every 5 minutes during the peak and mid-day hours, 11 minutes during the evening hours, running time between City Hall and Pattison Avenue is 11 minutes.

**Previous Transit Studies**

Two previous studies assess mass transit at The Navy Yard. The earlier of these two studies, completed in 1966 when The Navy Yard was assumed to remain in full operation, contemplated extending the Broad Street Subway. A later study, completed in 2001, focused primarily on improving bus service to and within The Navy Yard.

**Broad Street Subway: Extension**

A 1966 engineering feasibility study examined extending the Broad Street Subway from its current terminus at Pattison Avenue to The Navy Yard. The extension was proposed to double track and located entirely in a reinforced concrete box subway tunnel constructed by cut and cover methods. The alignment was located south of and primarily parallel to Broad Street, terminating at a single new station at Broad Street and Constitution Avenue. A center platform station and a station with both center and side platforms were considered. At Pattison Avenue, tracks exist on two levels, one of which is used for storage. Both the upper and lower levels of the station were proposed to be connected to the extension.

The profile for the extension was driven by the need to cross beneath I-95 highway and its access ramp (although the highway was under design at the time of the study), beneath the railroad tracks on the south side of I-95, and beneath a major sewer within The Navy Yard. These constraints still exist.

The estimated cost of construction of the extension in 1966 was approximately $14 million. Current costs would be higher due to inflation and additional factors that now impact construction projects in general and this project in particular; such as, additional development of I-95, increased environmental-related costs, Occupational Safety and Health Administration (OSHA) related costs, and Americans with Disabilities Act (ADA) related costs.

**Navy Yard Public Transit Study**

A 2001 study focusing on bus services to The Navy Yard examined several alternatives based on the following principles:

- The primary market would be commuters.
- Primary access should provide connection to the Broad Street Subway.
- Service must be frequent to compete with the automobile.
- Bus stops should be located to minimize walking distances.
- Services should be simple and easy to understand with options that do not vary by time of day and with consistent clock face headings.
- Schedules and headings should be coordinated with existing SEPTA services.
- Service should be capable of gradual expansion as The Navy Yard develops.
- Branding of the service can be used in promoting the development of The Navy Yard.

The recommendations of the study included immediate improvements, modifications to the routes, and new transit initiatives. These initiatives included 2 possible routes: a downtown shuttle that would loop through The Navy Yard, and a local shuttle that would connect The Navy Yard to the Pattison Avenue subway station. Such a shuttle can operate more consistently and reliably than extension of an existing long bus route and can be more economically tailored for the needs of The Navy Yard including, if desired, to match the headways of connecting subway trains. However these recommended shuttle routes would either require more frequent service to the Pattison Avenue station or duplicate the rail line for the majority of its route.

**Current Public Transportation Alternatives**

Transit service for trips external to The Navy Yard can be provided by three basic modes: 
- **Rail**
- **Bus**
- **Ferry**

Stated rail service options include:
- **Extension of the Broad Street Subway line**
- **Extension of PATCO lines**
- **New light rail lines**

**Broad Street Subway**

**Extension to Navy Yard**

The Broad Street Subway (BSS) is one of two major subway lines in Philadelphia, the other being the Market Frankford Elevated (MFE). The BSS route runs beneath Broad Street from Pattison Avenue at its southern terminus to Four Rock Transportation Center near the northern city limit. It connects with many of SEPTA's bus routes and provides access to a large area of the City. Through its connection to the MFE and the regional rail system at City Hall Station, and the PATCO system at the Wilmington-Loxton Station, the BSS offers a two-way ride between south Philadelphia and much of the metropolitan area. Its extension to The Navy Yard offers the potential to serve a very large geographic area (Fig. 64).

Due to the profile constraints of I-95, the rail availability, and a sewer line, the BSS would need to be underground throughout its length. Pattison Avenue is the current terminus for the BSS. The Pattison Avenue Station has two levels, one for active revenue service and one for train storage. While the 1966 study proposed extending both levels, there is potential savings by eliminating the connection of the lower level. In this case, a reverse move to position these tracks at the end of the new extension would be required for the initial northbound morning run.
Initial estimates project a capital investment of approximately $260 million to construct this subway extension. Further study to refine this rough estimate is needed.

Broad Street Subway Summary Comments:

- **Modal Choice** – The subway extension is effective for home-to-work based trips with the potential for a large number of one-seat rides.
- **Mobility** – The Broad Street Subway provides excellent connections to subway, PATCO, and regional rail system.
- **Effective Use of Resources** – This option takes advantage of existing infrastructure over the majority of the Navy Yard-Center City route, and would not require a significant increase in operating expenses.
- **Volume/Capacity** - Additional volume generated by Navy Yard would not require a large change in capacity on the BSS.

**Regional Rail**
The Pennsylvania side of the Delaware Valley has a well-developed regional rail system which presents additional options for extending rail service to the Navy Yard. During development of the 2004 Plan, three alternative alignment options were identified:

**Extension of R1 Airport Line**
This option would extend the existing R1 Airport line from the Philadelphia International Airport (PHL), across the Schuylkill River parallel to Penrose Avenue and then join existing CSX/NS freight rail right-of-way to reach The Navy Yard. (Fig. 65)

An extension of the line from its present terminus at Terminal E of PHL is essentially impractical due to the restricted right-of-way available in that part of the airport. Further east, where the alignment crosses the Schuylkill River, navigation requirements would necessitate a bridge of longer than (over 1.5 miles) and of similar height (300 feet) to the Penrose Avenue bridge, or alternatively, a tunnel beneath the river.

The R1 uses overhead, high voltage AC electrification, as do all of SEPTA’s regional rail lines. Thus an extension would also need to be electrified. The alternative, to use diesel powered rolling stock, would prohibit the trains from using the Center City tunnel, thereby restricting access to downtown. This would also necessitate using the lower level of 30th Street Station as a terminus, contingent upon Amtrak being able to provide appropriate platform time. Use of diesel equipment in an at-grade environment in The Navy Yard may also be undesirable.

**Branch from R1 Airport Line**
This option would branch from the existing R1 Airport line near 60th Street, cross the Schuylkill River, and then join existing CSX/NS freight rail right-of-way to reach The Navy Yard. (Fig. 65)

This option would also require a new crossing of the Schuylkill River on either a high level bridge or long approaches, or a tunnel. Branching from the existing R1 line would require a new additional service (as opposed to extending the existing R1 service) to serve The Navy Yard, existing capacity and scheduling issues on the Northeast Corridor and through the Center City Commuter Rail tunnel. As with the previous option, electrification would be required to operate into Center City via the existing tunnel.

**New Route via NS High Line**
A third option would use existing freight rail right-of-way. From The Navy Yard in 30th Street Station via the 23rd Street viaduct in South Philadelphia, the aerial rail bridge over the Schuylkill River, and the High Line viaduct to a point above the existing regional rail tracks on the upper level of 30th Street Station (Fig. 65). A new platform on the High Line could be connected to the regional rail platforms below with stairs, ramps, and elevators. Although this route was previously electrified and most of the existing structures are still in place, a diesel operation would also be possible, as the service would not operate through the Center City tunnel.

**Regional Rail Summary Comments**
All three regional rail options would require extensive negotiations and agreements with CSX and/or NS to occupy their right-of-way and/or share tracks that are already used extensively for freight operations in and near terminals where long trains occasionally stop and occupy tracks for extended periods of time. An arrangement that protects current and future rail freight needs and accommodates frequent passenger service will likely be very difficult, and may be impractical to achieve.

**PATCO**
PATCO is a suburban rapid transit style service connecting the New Jersey suburbs with Philadelphia via the Ben Franklin Bridge and a subway tunnel in Center City. The electrified system draws power from a third rail, relies on high level platforms, and operates on a fully grade-separated right-of-way. Both train operation and fare collection are automated. The Delaware River Port Authority, which operates PATCO, is presently studying the potential for expansions to the existing system, both in southern New Jersey.
Figure 63. Sections of the proposed Broad Street Subway extension through the tunnel and through the Navy Yard Station, with a proposed lower tunnel for potential PATCO access.
and in Center City. The planning team developed two ideas for potential PATCO routes to serve The Navy Yard.

**Extension via CSX**

This option would extend a tunnel west under Locust Street from the present terminus at 10th Street to the Schuylkill River. The alignment would then turn south and follow the CSX right-of-way to grade along the east bank of the Schuylkill River. That right-of-way extends to the main entrance to The Navy Yard on Broad Street. (Fig. 66)

The introduction of PATCO technology in this corridor raises a number of issues. The alignment itself is efficient for trips originating in New Jersey. Better connections can be made with the Broad Street subway for those trips of trips. The third rail power system requires that the track be completely grade-separated along its entire route. This presents a problem where there are vehicular crossings along the route. Having the third rail in close proximity to freight rail operations in yard areas is also a safety concern. As an alternative, a paralleling for overhead current collection on the CSX portion of the route could be considered, but that would involve retiming existing PATCO vehicles, which might be impractical given the tight overhead clearance in the subway tunnels. PATCO vehicles are not compliant with Federal Railroad Administration (FRA) regulations. Thus joint use of a freight rail right-of-way would introduce a variety of technical and safety issues that would need to be addressed.

Coordination with CSX would also be significant as the alignment includes a critical area in CSX’s network. Freight railroads are reluctant to cede any capacity for other uses. Coordination with CSX would also be significant as the alignment includes a critical area in CSX’s network. Freight railroads are reluctant to cede any capacity for other uses. Coordination with CSX would also be significant as the alignment includes a critical area in CSX’s network. Freight railroads are reluctant to cede any capacity for other uses.

**Branch via Delaware Waterfront**

A second alignment was evaluated using Columbus Boulevard (Fig. 67). This would extend from The Navy Yard through the East End district, turn north to join with Columbus Boulevard, and terminate in the vicinity of the Fox Franklin Bridge. Frequency with grade crossings along Columbus Boulevard would add present obstacles for this alignment. A direct connection to the existing PATCO line near the Fox Franklin Bridge would be difficult.

**Delaware Tunnel Route**

PATCO lines from Southern New Jersey could cross under the river south of The Navy Yard and a transfer could occur between the subway and the PATCO lines, if the Broad Street Subway line were extended to The Navy Yard. This option is shown in the plan and section (Figs. 62 and 63).

The Delaware River at this point is approximately three-quarters of a mile wide. Allowing for the proposed increase in depth of the shipping channel to 45 feet, the river of the tunnel would be about 80 feet below the surface. Fortunately, the shipping channel is close to the New Jersey side of the river. This will permit a station to be located near the ground surface within The Navy Yard (south of the Triangle) and still allow a tunnel with adequate grades to extend below the river. The tunnel itself might be feasibly constructed by submerging prefabricated tubes in a trench cut in the riverbed. With a station immediately below street level on the diagonal alignment just north of Kitty Hawk Avenue at the Triangle, minimum track grades of 2% descending on the Pennsylvania side of the river and 3.5% ascending on the New Jersey side would be possible.

On the New Jersey side of the river, the density of development is presently inadequate to create demand in proportion to the capacity that would be provided by such rail connections. However providing a straight rail link between the New Jersey residential populations and the Philadelphia job market could be a boon to the region.

**PATCO Summary Comments**

- **Modal Choice** – Extension of existing PATCO lines would be inefficient for New Jersey-based home to work trips to or from The Navy Yard, although the Delaware tunnel route would be effective for such trips. Pennsylvania based trips would require interagency transfers from SEPTA’s system.
- **Mobility** – The options provide connections to the existing PATCO system. The CSX route is only modestly effective in connecting to the regional rail system, the Columbus Boulevard route does not connect with regional rail. The Columbus Boulevard Route provides good connections to venues along Delaware Avenue. The Delaware Tunnel route would provide connection to the subway system in conjunction with an extension of the Broad Street Subway.
- **Effective Use of Resources** – A significant amount of new infrastructure required including tunnels in Center City for the CSX route, grade separation structures along the Columbus Boulevard route, or a new river tunnel for the Delaware Tunnel route.
- **Volume/Capacity** – The additional volume generated would not require a change in capacity of the rail lines, but would not justify the level of capital expenditure required.

**Light Rail**

Unlike regional rail and rapid transit modes, which generally require separate rights-of-way and, in some cases, total grade separation, light rail systems have the flexibility to operate on streets with other traffic and thus has the potential to avoid difficult engineering issues and the high costs associated with subway construction. It can also serve more frequent stops without the need for costly stations.

**Light Rail via Delaware Waterfront**

Rather than using PATCO technology along Columbus Boulevard as noted above, light rail could be built at grade, in many areas using the median currently used for local freight service. A significant advantage of this option would be the ability to serve many of the existing and proposed shopping and entertainment venues along the Center City Delaware River waterfront as well as The Navy Yard. The light rail vehicles could either be powered by overhead catenary or use diesel motors. To comply with federal regulations, the use of existing freight tracks would require that freight operation be restricted to nighttime hours when there is no light rail service. The northern terminus of the light rail service could be extended to 7th and Market Streets or to Spring Garden Street to connect with the Market-Frankford rapid transit line, or at Franklin Square to connect with the PATCO line. (Fig. 67)

**Light Rail Summary Comments**

- **Modal Choice** – Light rail introduces another mode and therefore requires more transfers between modes.
- **Mobility** – Light Rail offers a potentially weak connection to PATCO and METRO at north terminals, but a direct rail ride from most parts of origin. The connection to the regional rail system would be poor.
- **Effective Use of Resources** – A significant amount of new infrastructure required, including grade separation with CSX/NS main freight operations.
- **Volume/Capacity** – The volume generated by Navy Yard combined with Columbus Boulevard patronage may be commensurate with the level of capital expenditure and operating subsidy required.
Bus Access

Building on the previous study, three new shuttle bus-based transit initiatives were considered.

Pattison Shuttle
This would be a dedicated shuttle bus route circulating through The Navy Yard and connecting to the Broad Street Subway at the Pattison Avenue Station (Fig. 69). Because most transit users will have already made a transfer to the Broad Street Subway, the additional transfer between the shuttle and subway should be as seamless and easy as possible. It is proposed that the shuttles operate at the same frequency as the subway service, with bus departures scheduled a set time after arrival of each subway train. As with the subway, headways would be 8 minutes during weekday peak and mid-day hours, and 11 minutes during weekday evening hours. Service would operate 18 hours per day including Saturdays and Sundays. To further reduce the inconvenience of the transfer, free transfers between the shuttle and subway are recommended. Within The Navy Yard, the shuttle would operate counter-clockwise via Broad Street, Kitty Hawk Avenue, and the proposed new diagonal boulevard. At Pattison Avenue the shuttle would loop within the existing parking lot adjacent to the subway terminal on the south side of Pattison Avenue. If SEPTA operates the service, it is assumed the buses would operate from SEPTA’s Southern Depot. Under the plan, existing Route 17 buses that operate to The Navy Yard would instead terminate at the Pattison Avenue station. Two vehicles would be required for peak and base service.

Oregon Shuttle
This service would be identical to the Pattison Shuttle except that the route would extend up Broad Street to the Oregon Avenue Station of the subway, where connections could also be made to SEPTA Routes 5, 7, and 69 buses (Fig. 70). At the Oregon Avenue Station the shuttle would loop counterclockwise via Oregon Avenue, 13th Street, and Moyamensing Avenue. Three vehicles would be required for peak service, and two for base service.
This service would operate through The Navy Yard on the same route as the other shuttles, service the Pattison Avenue station of the Broad Street Subway, and then operate nonstop to Center City where local service would be provided along Market Street to provide connections to Amtrak at 30th Street, Regional Rail at 30th, 15th and 11th Streets, and PATCO at 8th Street as well as numerous bus and trolley lines (Fig. 71). From The Navy Yard, the large loop to Center City would operate north on Broad Street, west and north on I-76, east on Market Street, south on I-95, south on Front Street, west on Pattison Avenue, and south on Broad Street back to The Navy Yard. Since this service would provide direct connections to other regional services and eliminate the additional transfer to the Broad Street Subway, a less intensive service than the other shuttles is proposed. Headways would be 15 minutes during weekday peak hours, and 30 minutes at all other times including weekends. The service would operate 18 hours per day and require 4 vehicles during peak hours and two vehicles at other times.

Route 17M would be cut back to Broad and Pattison under all three of the above scenarios. The routing described through The Navy Yard would be the same for all three options. This route could be expanded as development at The Navy Yard generates additional demand. The following table summarizes the estimated annual operating costs for the three shuttle service options. The cost of SEPTA operation is based on SEPTA’s fully allocated unit costs for its city transit division bus service. If SEPTA operates the service, it is assumed that SEPTA will provide the necessary vehicles out of its existing stock. The estimated cost of a private operator is based on SEPTA’s fully allocated cost per vehicle hour for its contract operations. In such case, it is assumed that the hourly cost would include provision of the vehicles by the private operator.

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<th>SHUTTLE BUS OPTIONS SUMMARY</th>
<th>CONNECTIONS</th>
<th>DAILY SERVICE HOURS</th>
<th>PEAK HEADWAYS (minutes)</th>
<th>PEAK VEHICLES</th>
<th>ANNUAL OPERATING COST WITH SEPTA OPERATION</th>
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**Ferry**

A ferry line could run on the Delaware River from The Navy Yard and might connect various points including Penn’s Landing, the Camden Waterfront, Fort Mifflin, and National Park, New Jersey (Fig. 72). The proposed ferry would primarily be useful for recreational/social transportation by connecting the entertainment and tourist venues of the Penn’s Landing area to the Camden Waterfront, The Navy Yard, and Historic Fort Mifflin. For The Navy Yard, such a ferry may be an appropriate consideration during later phases of development when a conference center, marina, and other recreational facilities are built.

For commuter access from Center City, the proposed ferry would not be attractive because it would be slow, circuitous, and not well connected to the rest of the region’s transit system. It may make sense for commuters in Southern New Jersey to use a Park-and-Ride ferry system from National Park, if there is sufficient off-site employment at The Navy Yard.

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**Internal Circulation Routes**

While bus routes are flexible and can be altered fairly easily to accommodate changes in demand, rail routes must be fixed. Routing within The Navy Yard must balance serving current demand with anticipating future needs, and balance the relative ease of construction through open areas that have little current demand with the constraints of coordinating with existing buildings and infrastructure, which currently generate demand.

A route that follows the Diagonal Boulevard has been shown to be the most feasible route in construction, which could be done before, after, or concurrent with the construction of the boulevard itself, and create minimal interference to traffic or building sites.

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**Transit Station Locations**

Due to the costs, the number of underground rail stations would likely be limited to one, or at most two, within The Navy Yard. An at-grade rail system could allow more frequent stops. Any option that proposes crossing under the Delaware River will limit the location of stations relative to the river so as to allow for a suitable gradient for the river tunnel.

The Triangle has been chosen as the optimal location for a future transit station (Fig. 62). This location situates the station at the intersection of two of the main streets of The Navy Yard (The Diagonal Boulevard and Kitty Hawk Avenue), at the conjunction of four of the planning districts (The Corporate Center, The Historic Core, Research Park, and the Marina District), and immediately adjacent to the proposed campuses. The stations would be able to serve current trip-generating land uses and future development equally. Significant residential populations to become established in the Marina District and the East End, a second station could be considered in the vicinity of the Marina. The location also allows for pull-off spaces for buses.

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**Internal Shuttle**

At full build-out, an internal shuttle bus system within The Navy Yard could be beneficial. Internal shuttles would be especially appropriate in conjunction with extension of rail service into The Navy Yard, and could be coordinated with rail service. The nature of the proposed development lends itself to development of shuttle routes. There will be a variety of uses of land that will introduce requirements for transit making throughout the day, not just at rush hour. Private providers such as conference centers, office buildings, or apartment complexes might augment an internal shuttle service operated as a public service.

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**Conclusion**

For the near term, a dedicated shuttle bus service between The Navy Yard and the Pattison Avenue station of the Broad Street Subway could be readily implemented without significant capital investment. The shuttle could provide circulation and distribution within The Navy Yard, and the Broad Street Subway provides very good connections to the entire regional transit system. To be most effective the shuttle operation should match...
The subway in frequency with timed connections at Pattison Avenue, preferably with no additional fare required. The annual operating cost is estimated at between $300,000 and $600,000.

The extension of the Broad Street Subway to The Navy Yard is the most efficient and cost-effective way to bring rail-based mass transit to The Navy Yard. Such an extension would both serve an existing population and dramatically increase the value of future development for relatively little cost compared to other rail expansion projects in the region.

There is no question that such an investment would be an extremely effective catalyst for, and complement to, development in The Navy Yard.

The Broad Street Subway extension would be a major capital investment and due to the time required for planning studies, environmental assessments, design, and construction, this would necessarily be a long-term solution. To be fully integrated into the development of The Navy Yard, it is recommended that more detailed feasibility studies, from both planning and funding perspectives, be launched as soon as possible. As the lead time for such a project will likely mean it lags behind initial development in The Navy Yard, the 2004 Plan has been designed to allow future integration of this project and to minimize any increased cost or complexity.

Extension of PATCO lines from New Jersey to The Navy Yard would be a boon to both The Navy Yard and to Center City Philadelphia, reinforcing its role as a regional hub. Such a project is technically possible, though would cost many times more than the Broad Street Subway extension to The Navy Yard. A project of that magnitude and cost would have to be considered and evaluated in a regional context including ongoing studies for expansion of the PATCO system.
RESIDENTIAL TYPOLOGIES
buildings within the Historic Core for residential conversion, creating approximately 525
As an initial phase of residential development the 2004 Plan proposes the reuse of four
and low-rise) and opportunities for single-family townhouses.

Figure 73. Townhouse unit types that could make up the majority of residences in the residential option for the East End

Four units are proposed in the first floor and second floor of Buildings 489 and 661. These proposed renovations are presented in the following plans. They provide parking at a ratio of 1.5 to 2 spaces per unit.

With the residential options for both the Marina District and East End, along with the residential units in the Historic Core, the Master Plan would have a total of up to 5,435 residential units in the Historic Core, line the edges of the Diagonal Boulevard, Delaware River, and marina, for a total of 1,075 units. In addition they mark the terminus of the linear greens that radiate from the marina. The Marina District residential option contains a total of approximately 1,400 units. This represents a community comparable in size to such Philadelphia neighborhoods as Logan Square (1,200 units) or Packer Park (1,100 units). The housing types modeled for the Master Plan create densities of approximately 22 persons/acre, similar to Packer Park.

The East End residential option contains an additional 2,530 units along the river’s edge and at the end of neighborhood greens. Of these units approximately 980 are shown as townhouse units, and 1,543 as multi-family block units. At the far eastern part of the East End are four 14- to 20-story hi-rise multi-family buildings, containing approximately 485 units total, and providing excellent views up and down the Delaware River. All housing units include parking at a ratio of 1.5 spaces per unit or better.

Residential uses are an important component of a 24-hour, mixed-use environment. The activity created by residential uses during off-hours, when offices are closed, promotes security through resident “eyes on the street”. Residential uses also help build the critical mass of population necessary to support retail amenities and parks that serve office workers, and make The Navy Yard a competitive site for office development. Current deed restrictions do not allow for residential use on the site; however, residential use is needed to support office development. Building upon the proposed reuse of several existing historic structures, while providing the vitality needed to support office development, building upon the proposed reuse of several buildings in the Historic Core as residential apartment buildings, the 2004 Plan proposes infill and new construction of urban residential building types: apartment blocks (hi-rise and low-rise) and townhouses.

Infill and new construction of urban residential building types: apartment blocks (hi-rise and low-rise) and townhouses.

RESIDENTIAL TYPOLOGIES

- Type A is a 3,000 square foot unit with a lot size of 80 feet by 25 feet. This type incorporates a detached two-car garage accessed off a rear alley and a private 8-foot by 25-foot courtyard.
- Type B pairs two 2,490 square foot units in an 80-foot by 42-foot lot with a shared courtyard and detached garages.
- Type C is a 3,625 square foot unit on a 35-foot by 25-foot lot. With the shallower lot depth this unit type attaches the garage to the ground floor with a private terrace on the roof of the garage, accessed from the second floor.

Unit Type C is proposed in the residential option of the Marina District creating 303 units overall. Types A and C are proposed for the residential option for the East End creating 983 townhouse units.

In the Marina District residential option, multi-story, multi-family blocks similar to those proposed as infill in the Historic Core, line the edges of the Diagonal Boulevard, Delaware River, and marina, for a total of 1,075 units. In addition they mark the terminus of the linear greens that radiate from the marina. The Marina District residential option contains a total of approximately 1,400 units. This represents a community comparable in size to such Philadelphia neighborhoods as Logan Square (1,200 units) or Packer Park (1,100 units). The housing types modeled for the Master Plan create densities of approximately 22 persons/acre, similar to Packer Park.

The East End residential option contains an additional 2,530 units along the river’s edge and at the end of neighborhood greens. Of these units approximately 980 are shown as townhouse units, and 1,543 as multi-family block units. At the far eastern part of the East End are four 14- to 20-floor hi-rise multi-family buildings, containing approximately 485 units total, and providing excellent views up and down the Delaware River. All housing units include parking at a ratio of 1.5 spaces per unit or better.

With the residential options for both the Marina District and East End, along with the residential units in the Historic Core, the Master Plan would have a total of up to 5,435 units of new residential construction, consisting of 4,130 multi-family units and 1,305 single-family townhouses.

The East End residential option contains an additional 2,530 units along the river’s edge and at the end of neighborhood greens. Of these units approximately 980 are shown as townhouse units, and 1,543 as multi-family block units. At the far eastern part of the East End are four 14- to 20-floor hi-rise multi-family buildings, containing approximately 485 units total, and providing excellent views up and down the Delaware River. All housing units include parking at a ratio of 1.5 spaces per unit or better.
Figure 74. Plans and sections for the proposed apartment building in the Historic Core
### Building Analysis

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### Parking Analysis

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Figure 75. Plans, sections, and analysis for the proposed apartment building in the Historic Core.
ADAPTIVE REUSE
The Historic Core consists of 167 acres, all of which lie in the Nationally Registered Philadelphia Naval Shipyard Historic District. Being listed as a national historic district classifies almost all of the existing buildings within this area as contributing structures to the history of The Navy Yard. Two of those buildings (Building 100 and Quarters A) arelisted individually on the National Register of Historic Places. All renovations to buildings within the district will need to comply with the Secretary of Interior Standards.

Within the Historic Core The Navy Yard’s building history unfolds as one moves out from the Broad Street corridor (Fig. 76). The buildings clustered along Broad Street were largely built in the mid-1800s, those slightly further east and west during the 1940s at the height of activity at the base. Among the existing buildings, six have been analyzed for adaptive reuse as part of the 2004 Plan and proposals are given here for appropriate reuse programs based on their attributes. The six buildings are:

- Building 100
- Receiving Station Square (Buildings 104, 640 and 608)
- Building 83
- Building 624
- Building 611
- Building 543

These six were chosen for more detailed study because they represent the spectrum of building types found at The Navy Yard, and also present some of the more complex reuse challenges for adapting The Navy Yard’s existing structures. By demonstrating how these buildings could be adapted to future uses, the 2004 Master Plan points the way to a more comprehensive program of adaptive reuse in The Navy Yard.
Located along the southeast corner of the historic Marine Parade Ground, Building 100 functioned originally as a Marine Corps barracks. With the front door facing west across the Marine Parade Ground toward Broad Street, Building 100 is bordered to the south by Constitution Avenue and to the east by 13th Street (Fig. 77). Immediately to its north sit another former Marine barracks, which has recently been converted to office space. Across 13th Street to the east is a proposed new residential development and to the south across Constitution is a Navy retained block. Designed by architect Henry Ives Cobb, Building 100 is one of two buildings at The Navy Yard individually listed on the National Register. It was built in 1901 as part of the expansion of the Marine Corps Reservation on League Island and subsequently became part of the newly established Marine Corps Advance Base Training School.

Building 100 consists of a three-story hip-roofed central block flanked by two-story wings that terminate in two-story hip-roofed pavilions on the north and south. The central block has a stone-arched arcade on the first floor ornamented with terra cotta capitals and carved stone eagles atop globes, the symbol of the U.S. Marines. The flanking wings have projecting shed roof porches on the west elevation with brick columns and iron guardrails (Figs. 78 through 81).

Given the narrow depth of the former barracks, residential units would be the most feasible and appropriate reuse (Figs. 82 and 83). An elevator core could be located in the three-story central block, accessible at the ground floor from the parking on the east and providing handicapped access to the building’s simplex units. The space adjacent to the core and under the porch could be used as a storage or utility basement. Flanking the core, on the first floor, is a simplex unit within the central block and six duplexes in the wings and end pavilions. The duplex units have direct access from the ground level with either a porch or front stoop. The second floor contains two more simplex units while the entire third floor of the central block is another simplex unit. Altogether, the five simplex units average 1,900 square feet and the six duplexes 1,730 square feet. The average floor area for all eleven units is 1,805 square feet.
Figure 78. West facade

Figure 79. Entry on west facade

Figure 80. Exterior covered walkway

Figure 81. Detail of entry on west facade
Figure 82. Elevations and plan of adaptive reuse for Building 100
### Proposed Plans and Analysis for the Adaptive Reuse of Building 100

#### Building Analysis

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#### Unit Details

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<td>Unit 11</td>
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#### Parking Analysis

| Parking Space Count | 24 |
| Parking Space Per Unit Rate | 2.2 |
Centrally located on the northern edge of the historic district, adjacent to the Corporate Center, Receiving Station Square is a "C"-shaped complex of three connected buildings built successively over the course of twenty-three years. Normandy Place and Constitution Avenue border Receiving Station Square to the north and south with 11th Street to the east and 12th Street to the west (Fig. 84). The proposed Central Green sits immediately to the north, while Constitution Park lies directly on the south of the building. The building helps to anchor and define the edges of both of these open spaces. Receiving Station Square's central location makes it highly accessible from most of the proposed development at The Navy Yard. The building acts as a pivot point, transitioning between the Corporate Center and the Historic Core.

Building 104 (Figs. 85, 87, and 88), the south arm of the complex, was built in 1919 for housing new recruits as part of a Navy training camp. The brick, three-story, former barracks consists of two gable-roofed end pavilions connected by long gable-roofed block. A south-facing, brick arcade runs the length of Building 640's ground floor between the end pavilions. The roof of this central block has pedimented dormers and is crowned by a conical cupola at its center. The gables of the end pavilions are capped with shorter, round cupolas.

Along the north side, Building 608 (Fig. 86), built in 1941, mirrors the architecture of Building 104, aside from some small differences in its footprints. Differences to note, however, are the additional dormers on the roof of the central block and the enclosure of the arcades at the ground floor, a later alteration to the original building.

Building 640 (Figs. 89 and 90), built in 1942, faces west along 12th Street, linking Buildings 104 and 608 together. A central, porticoed block with brick columns marks the original entrance, and is flanked by two gable-roofed pavilions. Connecting the central block to the pavilions are eave-fronted wings with ground floor brick arcades, some of which have been enclosed. Pedimented dormers project from the roof and a wood cupola sits atop the central block's roof ridge. A portion of the arcade on the south end has been enclosed.

With the building's arms having depths of less than 50 feet, too narrow for efficient office use, conversion to residential units is the best reuse alternative for Receiving Station Square (Figs. 91 and 92). Essential to this proposed conversion is the removal of the T-shaped service structures in the middle of the block, late additions to the building. This allows courtyard space to be used for providing the needed amount of parking, as well as providing light and direct access to the units from the courtyard. Two stories of simplex units surround the parking with a series of duplex units on the third and fourth floors. Ground floor units can be accessed directly from the courtyard parking and have porches that face toward the street within the arcades. In order to achieve this, those previously open arcades for Buildings 608 and 640 that have been enclosed would be restored to their original condition. The second and third floor units would be reached via elevators located in the corner pavilions. The roof of the ground floor porch would provide an opportunity for terraces for the second floor units. Overall, proposed unit count is 45 simplex units with an average square footage of 1,330 square feet and 23 duplex units with an average of 1,960 square feet. The total square footage for the proposed conversion of Receiving Station Square is 106,760 square feet.
Figure 91. Existing plan and elevations for the adaptive reuse of Receiving Station Square.
Figure 92. Proposed section, plans, and analysis for the adaptive reuse of Receiving Station Square.

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Fronting on 13th Street, Building 83 is a large, low-floor plate former warehouse built in 1919. It is located between Constitution Avenue to the north and Kitty Hawk Avenue to the south (Fig. 93). Immediately to the east are buildings proposed to be reused as recreational amenities for the residents of The Navy Yard. To the north are proposed new residential buildings and, to the west, existing Navy-retained buildings. Just to the south is the site of a proposed parking garage.

At eight stories and a footprint of nearly 200 feet by 400 feet, Building 83 is one of the tallest and largest structures at The Navy Yard (Fig. 96). Built of concrete and brick, it is eight bays wide across its Constitution Avenue elevation and 17 bays wide along 13th Street. Concrete piers extend from the ground to the cornice separating the bays and forming a grid with the concrete floor. In the middle bays, windows sit over brick spandrels within this concrete grid (Fig. 94). The ground floor consists of loading bays covered by an awning that extends the length of the building (Fig. 95).

Two options were examined for the potential reuse of Building 83, office and residential. For conversion to office space a lightwell would need to be carved from the middle of the floor plate. The resulting depths between the exterior wall and the lightwell would be substandard for an office layout. It would furthermore not be possible to accommodate sufficient parking within the building to serve the office space. These drawbacks mean that this reuse could not compete favorably with smaller conversions or new construction.

The industrial character of Building 83 and its location adjacent to the proposed residential zone of The Navy Yard makes it ideal for converting to loft-type residential units, with high ceilings and open floor plans (Figs. 97 and 98). Units in the proposed conversion would ring the perimeter of the floor plate along a single loaded corridor with the parking in the middle of each floor. From the ground to the third floors, units will be located on the north and south ends, while the fourth floor would have units on all four sides. Above the fourth floor it is proposed to core-out the center of the floor plate so the units on floors five through eight will look out onto a planted courtyard. The ground floor spaces along Constitution Avenue or Kitty Hawk Avenue could also be used for retail. Because of the building’s height, the upper floors would have river and skyline views. Floor-to-floor heights of the proposed parking structure to the south would be minimized, so that Building 83, with its high floor-to-floor heights, would remain south facing views from most floors. Overall, there would be 166 units at an average of 1,540 square feet per unit. The total building square footage is 484,586 square feet with 292,130 square feet for the residential units and 192,456 square feet for parking, providing 208 spaces.

**BUILDING 83**

![Figure 93. Building 83 locator plan](image-url)
Figure 94. Exterior wall detail

Figure 95. View of loading dock

Figure 96. View of northwest corner
Figure 97. Elevation, plans, and sections for the adaptive reuse of Building 83
ADAPTIVE REUSE

BUILDING ANALYSIS

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PARKING ANALYSIS

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Figure 98. Section, plans, and analysis for the adaptive reuse of Building 83
Located in the middle of a large central block within the historic district, Building 624 is bordered by Kitty Hawk Avenue to the north and Flagship Drive to the south (Fig. 99). Immediately to either side are proposed parking structures separating Building 624 from 11th Street to the east and 13th Street to the west. Just south, on the other side of Flagship Drive, is another large block containing Building 611.

Building 624, built in 1941, is eight stories and like Building 83 is a concrete and brick warehouse (Fig. 100). It is larger than Building 83, however, with footprint dimensions of 270 feet by 400 feet. Concrete pilasters divide the structure into fourteen bays east to west, and twenty bays north to south. The majority of the windows are flanked on either side by glass block with concrete spandrels. Like Building 83 most of the ground floor originally functioned as loading docks (Fig. 101).

As with Building 83, the best strategy for adaptive reuse is to utilize the industrial attributes in conversion to residential loft units (Figs. 103 and 104). The ground floor contains the entrance lobbies and units or possibly retail space at the north and south end with parking in between. New elevator cores, located in the four corners of the parking area, give access to the upper floors. Floor two is similar to the ground floor with units on the north and south ends of the building. Floors three through five have units completely around the perimeter off a single loaded corridor with the parking internal. Because the floor-to-floor heights of the building are so much greater than the floor-to-floor of the adjacent parking structures proposed to the east and west, the third floor windows would be higher than the parking garage roof, so that direct views of the garages would be minimized. Floors seven and eight are "cored-out" to create a central courtyard on floor six. This nearly 28,000-square-foot open-air courtyard could be landscaped and used as command space or a mix of private space for 6th floor residents and command space for the rest of the building. Apartments on floors seven and eight are double loaded, with some units looking into this sizable courtyard. A new, ninth floor could possibly be added on top of the structure, consisting of penthouse units set back from the exterior walls with private terraces. The total building area is 971,770 square feet with 428,000 square feet in residential units and a 543,770 square foot parking area for 842 spaces. Given that only 297 spaces provide the required parking ratio of 1.5 spaces per unit, the excess spaces are utilized for other new adjacent buildings, such as Building 611.
Figure 100. View of northeast corner

Figure 101. Loading dock detail

Figure 102. View of interior
Figure 103. Plans and sections of adaptive reuse for Building 624.
Figure 104. Proposed plans, sections, and analysis for the adaptive reuse of Building 624

Building Analysis:
- Building Area: 822,830 GSF
- Residential Area: 477,690 NSF
- Unit Count: 268
- Average Unit Size: 1,400 NSF
- Range in Unit Size: 1,245 - 2,400 NSF

Parking Analysis:
- Parking Spaces to Fulfill 1.5 Ratio: 402
- Extra Parking Spaces Provided: 202
- Total Parking Space Count: 604

PROPOSED SECTION BB

PROPOSED PLAN - FLOORS 3-5
30 UNITS PER FLOOR
96 PARKING SPACES PER FLOOR

PROPOSED PLAN - FLOOR 6
48 UNITS

PROPOSED PLAN - FLOORS 7-8
48 UNITS PER FLOOR

COURTYARD

Figure 104. Proposed plans, sections, and analysis for the adaptive reuse of Building 624
Building 611, built in 1942, is a former storehouse and Naval Air Material Center. It is set back in roughly the center of a large block bordered by flagship Drive to the north, 11th Street to the east, and 13th Street to the west (Fig. 105). Just to the south is a cluster of former officers’ quarters, which front on Admiral Peary Way and the Delaware River waterfront. The small-scale of the officers’ quarters, and the generous distances between them, afford Building 611 views of the Delaware River.

Building 611 is a long single-story steel frame building, 700 feet long, with a footprint area of 124,000 square feet. It is two-stories tall, with a central, double-height hall that projects above the flanking two-story shed roof blocks. The exterior consists of metal panels with long ribbon windows sheathed in corrugated wireglass panels (Figs. 106 and 108).

The floor plans of Building 611 are large enough to support its proposed reuse as an office building (Fig. 107). The proposed office space is located within the two-story blocks with the long central hall acting as a spine of common space and circulation. New elevator cores are placed on both the east and west, off of this circulation spine. It is proposed that the exterior metal panels could be replaced so that the entire facade is clad in glass affording expansive views to the river beyond. The total building area is 220,980 square feet with 166,210 square feet of rentable commercial space (Figs. 109 and 110).

Building 611 faces additional reuse constraints due to its ground floor level being within the 100-year floodplain. To raise occupied areas in the building above the 100-year floodplain, the surrounding grade between the street and the building could slope up toward the building and the ground floor level could be further raised a few steps above that. Both the setbacks around the building and the high ceiling height of the first floor allow for this possibility. If costs or other constraints make this approach unfeasible, the building’s foundations could be reused to create a small campus-like cluster of buildings. A dense grouping of three to five buildings could serve as an appropriate transition from the larger-scaled buildings to the north to the smaller residential buildings to the south.
Figure 106. View of southwest corner

Figure 107. View of interior

Figure 108. Exterior detail
Figure 109: Plans, sections, and elevation for the adaptive reuse of Building 611
Figure 110. Plan, sections, and analysis for the adaptive reuse of Building 611.
Building 543 is a former Pipe and Coppersmith Shop built in 1939 just west of Dry Dock 1, the first dry dock at The Navy Yard. Located west of Broad Street at the terminus of Flagship Drive on the north and facing the riverfront to its south, it sits among some of the oldest buildings at The Navy Yard (Fig. 111). Many of these former workshop buildings are slated for renovation as office buildings. Building 543 acts as a buffer to the industrial and Navy activities immediately to the west and marks the western edge of the studied redevelopment area. In the 2004 Master Plan, the dry dock is proposed for conversion to a public plaza that would mark the western terminus of the waterfront esplanade.

Compared to those adjacent historic buildings slated for reuse, Building 543 has a much larger footprint, measuring approximately 200 feet by 400 feet. A central high bay with roof monitors runs north-south and is flanked by shorter two-story masses with an additional one-story mass to the east (Fig. 113). The central block has large doors at the north and south ends, flanked by awning windows. The two-story blocks have large awning windows, and the single-story block’s fenestration consists of ribbons of awning windows (Figs. 112, 114, and 115).

Building 543 was tested for office use, but proved inefficient given the large footprint and difficulty in serving both the wings and central bay with vertical circulation. The adjacency to active industrial uses and difficulty in providing sufficient parking also worked against the feasibility of an office program.

The 2004 Master Plan proposes an art gallery/museum or similar exhibition space for reuse of Building 543 (Fig. 116). While Philadelphia has a proud tradition of art and museums, it currently lacks sufficient space capable of displaying large modern works. There are several successful examples of similar industrial buildings being converted to museums for large-scale modern art, such as the Dia:Beacon in upstate New York, Mass MoCA in western Massachusetts, and the Tate Modern in London (Figs. 117 through 126). The central high bay of Building 543, much like the one in the Tate Modern, affords opportunities for large-scale installations and a public gathering space. Such a space could also accommodate exhibitions of aircraft, ships, or other large-sized displays. The flanking two-story blocks could be used as smaller gallery spaces. Wrapping around the east and south elevations along the dry dock and the riverfront is a proposed single-story retail addition, which could house a museum store and café/restaurant facing the Dry Dock plaza. The total floor area is 107,085 square feet with 77,670 square feet for the gallery and 29,415 square feet for the retail addition.

Building 543 is a former Pipe and Coppersmith Shop built in 1939 just west of Dry Dock 1, the first dry dock at The Navy Yard. Located west of Broad Street at the terminus of Flagship Drive on the north and facing the riverfront to its south, it sits among some of the oldest buildings at The Navy Yard (Fig. 111). Many of these former workshop buildings are slated for renovation as office buildings. Building 543 acts as a buffer to the industrial and Navy activities immediately to the west and marks the western edge of the studied redevelopment area. In the 2004 Master Plan, the dry dock is proposed for conversion to a public plaza that would mark the western terminus of the waterfront esplanade.

Compared to those adjacent historic buildings slated for reuse, Building 543 has a much larger footprint, measuring approximately 200 feet by 400 feet. A central high bay with roof monitors runs north-south and is flanked by shorter two-story masses with an additional one-story mass to the east (Fig. 113). The central block has large doors at the north and south ends, flanked by awning windows. The two-story blocks have large awning windows, and the single-story block’s fenestration consists of ribbons of awning windows (Figs. 112, 114, and 115).

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Figure 112. View of northeast corner

Figure 113. View of interior

Figure 114. View of west facade

Figure 115. View of east facade
PHILADELPHIA NAVY YARD MASTER PLAN

Figure 116. Plans, elevations, sections, and analysis for the adaptive reuse of Building 543

**GALLERY OPTION BUILDING ANALYSIS**

<table>
<thead>
<tr>
<th></th>
<th>SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gallery</td>
<td>77,670</td>
</tr>
<tr>
<td>Retail</td>
<td>29,415</td>
</tr>
<tr>
<td>Total Usable</td>
<td>107,085</td>
</tr>
</tbody>
</table>

**PARKING ANALYSIS**

| Parking Space Count | 69 |
| Parking Spaces per 1000 NSF | 2.5 |
Figure 117. Aerial view

Figure 118. View of interior gallery space

Figure 119. Comparison between the footprints of Dia: Beacon and Building 543

Figure 120. View of exterior

Figure 121. View of interior before renovation

Figure 122. View of interior after renovation

Figure 123. Comparison between the footprints of Mass MoCA and Building 543

Figure 124. View of exterior

Figure 125. View of interior entrance hall

Figure 126. Comparison between the footprints of Tate Modern and Building 543

Figure 127. View of exterior

Figure 128. View of interior after renovation

Figure 129. Comparison between the footprints of Tate Modern and Building 543

Figure 130. View of interior

Figure 131. Comparison between the footprints of Tate Modern and Building 543
FLOODPLAIN AND SOILS
Figure 127. The Navy Yard falls into three categories relating to the 100- and 500-year floodplains

Development at The Navy Yard will encompass the construction of a wide range of structure types throughout the site. Potential structure types may include, but are not limited to, residential wood-framed structures, single-story commercial structures, multi-story commercial and residential structures, large warehouses, entertainment venues, and a marina. Although certain low-bearing capacity soil conditions present a difficulty for some kinds of construction, there are various geotechnical engineering solutions. These engineering alternatives provide viable structural solutions, at some premium for construction, for the different types of development.

History

The Navy Yard is located on the former League Island, which lay just offshore of where the southern end of Broad Street meets the Delaware River. League Island was almost 400 acres in area when the City of Philadelphia granted title to the Department of the Navy in 1868. By 1996, the facility was approximately 1,200 acres in area. Almost 600 acres of land were created using dredged materials from the river bottom at the eastern end of League Island to fill in the Back Channel, former marshlands, streams, and some open water.

Existing Conditions

The majority of the surface soils at The Navy Yard consist of the fill material placed by the Department of the Navy to raise the elevation and increase the size of League Island. The fill-soils generally consist of river bottom materials of gray sands and silts. Occasionally gravel, ash, glass, concrete, and brick can be found in the fill material from prior demolitions over the last 150 years. The depth of fill ranges from 3 feet to approximately 15 feet, with the deeper areas located in the northeastern and eastern-most portions of the site, which were previously either marshlands or cracker water.

Below the fill material is a soft gray soil layer that was deposited naturally at the site by the Schuylkill and Delaware Rivers. This alluvial (deposited by water) soil layer consists of fine sand, silt, clay, and organic material. The physical properties of this soil layer make it highly compressible when loads are applied. The soft gray soil layer is up to approximately 80 feet thick but typically ranges from 30 to 40 feet thick (Fig. 130). Deposits of compact sand and gravel and stiff clays underlie the soft gray soil layer. These somewhat dense sand and gravel and stiff clay deposits are situated at depths ranging from approximately 15 to 80 feet below the ground surface.

Groundwater throughout The Navy Yard can be encountered at depths ranging from 2 to 12 feet below the current ground surface. Groundwater levels within The Navy Yard are typically 3 feet below mean sea level due to the tidal influence of the nearby Schuylkill and Delaware Rivers.

Design Considerations

The geotechnical challenges for construction within The Navy Yard are caused by the highly compressible nature of the underlying soft gray soil layer. The soil placed as fill material adds significant weight (load) to the old marshland and river bottom areas covered by the fill soil. As the Department of the Navy placed fill material to raise and extend League Island, water and voids were squeezed out of the underlying soft gray soil layer and gradual compression of the underlying layer occurred. This compression can be seen at the ground surface as settlement (lowering of surface elevation). This compression process continues to occur today, and will be increased by any additional load, either from more fill material, or the weight of new buildings.

Several design considerations must be made for new development given these soil conditions, including:

- Controlling the impact of initial settlement caused by new building construction
- Evaluating the amount of settlement and the ability of the newly constructed structures to tolerate long-term settlement
- Carefully selecting the foundation loading distribution

Compression caused by foundations requiring a bearing capacity in excess of 4,000 pounds per square foot will generally cause localized settlement of the existing subsurface layers (Fig. 129). Various construction techniques and building foundation methods for addressing this are presented later in this section.

Ground surface elevations for a large portion of The Navy Yard lie below the 100-year floodplain (Fig. 127). Buildings whose first-floor elevation is below the 100-year floodplain are difficult to insure in the commercial insurance market. Therefore raising the elevation of either a building's inhabited floor levels or the entire site surrounding the building (with fill soil) above the 100-year flood plain level will be a further design consideration. Such site fill would also cause settlement.

Furthermore, the rates of settlement for buildings and surrounding site areas are likely to be different. This difference could create shear loads on any below-grade site utilities where they tie into the building or enter existing utility infrastructure (manholes). The settlement due to fill placement over a large area is estimated for several depths of fill and is presented in Figure 128.

Several alternatives are available to help limit the amount of settlement that will occur after the new structure is constructed. The following sections review various alternative foundation solutions for dealing with the relatively low bearing soils encountered at The Navy Yard. These alternative foundation techniques, while providing the necessary solutions, do impose a cost premium to standard foundation construction. The foundation options available to a particular development depend primarily on the local subsurface conditions including depth of the water table during construction, structure type, and proposed loading.

Foundation Construction Alternatives

Because of the potential for settlement, the majority of existing structures at The Navy Yard were constructed with pile foundations. These pile foundations transfer the building loads to the lower lying layers of compact sands and gravels, which can support the load. With pile foundations, an additional load is added to the soft gray soil layer and therefore settlement is prevented or reduced.

While pile foundations have been used in the past, piles are not cost effective for most single-story buildings. With the use of proactive settlement limitation techniques, new buildings can be constructed without the use of piles.

Several alternatives are available to help limit the amount of settlement that will occur after the new structure is constructed. The following sections review various alternative foundation solutions for dealing with the relatively low bearing soils encountered at The Navy Yard. These alternative foundation techniques, while providing the necessary solutions, do impose a cost premium to standard foundation construction. The foundation options available to a particular development depend primarily on the local subsurface conditions including depth of the water table during construction, structure type, and proposed loading.

Figure 128. Table showing the estimated settlement of the soft gray soil layer

<table>
<thead>
<tr>
<th>SOIL SETTLEMENT</th>
<th>DEPTH OF NEW FILL</th>
<th>SETTLEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 foot</td>
<td>4-9 inches</td>
<td>1 inch</td>
</tr>
<tr>
<td>4 foot</td>
<td>5-11 inches</td>
<td>3 inches</td>
</tr>
<tr>
<td>8 foot</td>
<td>7-14 inches</td>
<td>4 inches</td>
</tr>
</tbody>
</table>

The soil conditions at The Navy Yard may be addressed through the use of particular foundation construction methods, through construction techniques for limiting settlement, or through a combination of these strategies. These alternatives are described below.

SOIL FLOODPLAIN AND SOILS
Conventional Spot Footings

Conventional spot footings for building loads associated with residential wood-framed structures can typically be carried by the surface fills that are located throughout The Navy Yard. In general, residential wood-framed structures may be constructed with conventional spread footings based on typical depths below the ground surface (±3 feet below grade) with a floor slab supported on-grade (Fig. 125). Surcharging loading (see below) in the area of the proposed residential structures is recommended to limit the amount of settlement that will occur after the buildings are constructed.

Floating Stone Mat with Conventional Footings

In general, single-story commercial structures may be constructed with conventional spread footings based on typical depths below the building pad’s surface (±3 feet below grade) with a floor slab supported on-grade. The building loads associated with single-story commercial structures can typically be “carried” by the subsurface fills that are generally located throughout The Navy Yard. However, there are areas in The Navy Yard where the surface fills may be inadequate to support the single-story commercial buildings. Where this situation exists, alternative foundation methods may be appropriate. One alternative method already applied recently in The Navy Yard for typical single-story retail, industrial, or commercial structures involves the use of a compacted stone mat in varying thicknesses greater than 3 feet.

This mat of stone would “float” on top of the existing soils and its design intent is to “bridge” the low bearing capacity subsurface soils by keeping the loads from conventional spot footings out of the lower bearing strata. Even with the “bearing” stone mat in place, it is still desirable that conventional footings be based at the typical depths described above. This shallow system would eliminate localized settlement caused by the “pressure bulb” under spread footings.

Stone Packed into Drilled Soil Shafts - GeoPiers™

Proprietary foundation system such as GeoPiers™ can also provide an option for support of loads given the subgrade soils condition. GeoPiers consist of drilled shafts which are filled with compacted stone. Typically spaced at about 7 feet on center and extending about 24 feet below grade, they are used to support spread footings or typical foundation depths. Buildings using this system could be designed with a conventional floor slab supported on-grade. The system is an alternative “subgrade improvement method” and should be considered for light to moderate building loads. The system is generally not cost effective when used to support the loads associated with main fills required to raise the grade of an entire site and are typically used only for individual column loads. Loads associated with floor slabs are either transferred to grade beams supported by the Helical Piers, or if the floor slab loads are not significant, the slab may be supported on-grade.

Steel Pipe or Timber Pilings

Heavy structures such as multi-story office or residential buildings will most likely require steel pipe or timber piles depending on the depth required to reach underlying sands or gravels (Fig. 131). Large warehouse-type structures may also require a deep foundation system in order to transfer large wind loads to the underlying sands and gravels. These larger structures will have to utilize an end-bearing pile foundation system set into these deeper sand and gravel layers.

Depending on location within The Navy Yard, the compact sand and gravel layers will be encountered at depths ranging from 15 to 80 feet below the ground surface. End-bearing piles should be used to support the grade beam foundation system and ground floor structural slab. Although a conservative approach in these buildings may also require a structurally supported ground floor slab, thought should be given to the use of the flooding stone mat concept described above to support the ground floor. This alternative is a less expensive method that may be considered in conjunction with soil settlement limiting techniques described below.

Construction Techniques for Limiting Settlement

Some of the construction techniques most applicable to the particular geotechnical challenges at The Navy Yard are as follows:

- **Subsurface Dewatering**
  - An additional technique, which may be employed either by itself or in conjunction with the surcharge technique, is subsurface dewatering. This technique reduces the time required for initial construction settlement and/or reduces the amount of time necessary for any surcharging. It works by removing water from the subsurface soils and/or lowering the water table during construction. A large “French drain” system is constructed around a building site perimeter in order to lower the water table during construction of the building pad and foundation system.
Detoxification of the surface fills on the site shortens the distance water has to travel to be squashed out of the soft gray soil. This helps speed up compression of the soft gray soil layer.

Subsurface detoxification is helpful when construction schedules do not allow for sufficient natural settlement of the soft gray soil layer. Detoxification can be used in conjunction with surcharge loading in order to reduce the overall time schedule by as much as 6 to 12 weeks depending on the particular subsurface conditions of an individual site.

Construction Sequencing

The careful coordination and planning of the construction of the three typically hazardous components of a building site has an impact on the duration and speed of settlement. These three major components coincide with the completion of three milestones in a project’s construction: the building pad is filled, the erection of a building’s structural frame, and the placement of the (usually concrete) floor slab(s). Sequencing should be planned to promote the maximum settlement early in construction by placing fill used to raise site grades and constructing building pads as early as possible. Construction of the structural elements (e.g. building frame and slab-on-grade) should be delayed as long as possible.

Other Construction Techniques

Additionally, settlement monitoring, for real-time performance of surface and subsurface settlement rates, will assist in ensuring that the loads settle uniformly. The use of settlement limiting techniques will significantly reduce differential settlements related to development of the individual building site and the settlement related to imposing new building loads.

**Schedule and Cost Impacts**

The construction schedule should be planned to help reduce settlement and the impact of any settlement. Site surcharge, although a premium, may be less costly than deep foundation systems such as piles, due to the generally unreasoned usual for site fill currently required at The Navy Yard. The combination of settlement limiting techniques and foundation construction alternatives must be carefully evaluated for each given site and the structure proposed.

Determinate the best combination will require analyses of the cost premium associated with each strategy and the sensitivity of the project’s construction delivery schedule.

**Conclusion and General Recommendations**

The above recommendations apply to the general soil conditions at The Navy Yard. However, due to the large scale of the development area, and the lack of detailed geotechnical information, it is important to emphasize that a detailed geotechnical exploration and evaluation be performed on each potential construction site.

A site-specific geotechnical evaluation should be undertaken to accurately determine the existing soil conditions and to provide foundation and construction recommendations specific to the proposed development. Serious consideration should be given to all the means and methods available to the geotechnical and structural engineers in performing this evaluation, including test borings, test pits, test trenches, load cell testing, and other invasive and investigative analysis.
UTILITIES
Electrical Distribution System

The electrical distribution network was constructed during the World War I, World War II, and Cold War expansion phases. The electric system distribution facilities are primarily owned by PAID and are serviced and maintained by Cinergy Solutions under a management contract.

The existing 13.2-kilovolt primary electrical service is delivered in two primary services at separate locations within The Navy Yard. The eastern primary system serves the two-thirds of The Navy Yard east of Broad Street. This service runs parallel to Broad Street, under I-95, the CSX and Norfolk Southern railroad tracks and League Island Boulevard. The eastern primary system is served by three distinct 13.2-kilovolt main feeders, provided by PECO Energy, which run from PECO’s Southwark substation. The western primary system connects to a primary substation for the western third of The Navy Yard. It is supplied via 26th Street and serves The Navy Yard’s heavy industrial facilities (including the Kvaerner Philadelphia Shipyard facility and the Navy). These two main substations can be connected by two tie lines for emergency use.

The existing system is characterized by a sophisticated cable distribution system that runs through The Navy Yard via an underground duct bank and manhole network. The key advantage of this system is that the components are buried underground and therefore much less susceptible to power outages caused by violent storms, high winds, or inclement weather. The below-ground network also has the added aesthetic benefit of having no utility poles or overhead wires. The disadvantages of the underground system include the increased cost for initial construction of concrete encased conduit banks and manholes, and the deterioration of the older vitreous clay and concrete duct banks. Over the last 40 years these older facilities have deteriorated from ground subsidence, water infiltration, and deferred maintenance under the Navy. Additionally, the occasional flooding caused by tidal influences on the ground water table increases maintenance expenses.

The majority of the development envisioned in the 2004 Plan can be served via an existing electrical substation in Building 664, which also encloses the distribution breakers. The building is located along the new Diagonal Boulevard, north of Constitution Avenue. This primary to secondary service has a potential maximum continuous service rating of 13.6 megawatts.

An entirely new power distribution system is also being considered in order to maintain The Navy Yard’s maximum development potential. A long-term task will be to evaluate how much of the existing system will eventually need replacement due to the effects of age on maintenance costs, current carrying capacity, and operating safety. The processes of planning engineering, feasibility evaluations, phasing assessments, and obtaining funding for design and construction are anticipated to take three to five years.

The 2004 Master Plan recommends that all future electrical distribution be constructed at the same time as the street system in order to maximize efficiency and minimize costs.
Natural Gas Distribution System

The Philadelphia Gas Works (PGW) owns and actively maintains a complex gas distribution system within The Navy Yard. Medium- to high-pressure gas is available for all types of potential demand, ranging from simple heating applications to sophisticated gas-powered systems, including more robust applications involving CHP or on-site turbine power generation.

The operational dynamics of the gas distribution system serving The Navy Yard have evolved over the last century with multiple improvements and modifications. As a former defense facility, the system incorporates a redundant “Security of Supply” feeder system to maintain and ensure adequate gas pressure and supply reinforcement.

The primary high-pressure gas main that enters The Navy Yard from Broad Street is anticipated to remain the main supply conduit. PGW is considering extending this main supply line southward along League Island Boulevard to supply the anticipated building development in the Corporate Center, Historic Core, and Marina District. Natural gas distribution and supply issues will be addressed by PGW, according to their Engineering and Planning Department’s guidelines and City code, within capital investment guidelines under Pennsylvania’s applicable laws.

If there is sufficient need, PGW and PIDC may explore the possibility of creating an additional high-pressure supply main via a future connection in the East End within the right-of-way of the proposed Delaware Avenue extension. This potential connection might provide an economical alternative to other new gas supply network expansions.

The 2004 Master Plan addresses planned development needs by augmenting the existing grid with new main supply lines. The new gas lines will follow the proposed street network and would be constructed within the street right-of-way for all new road segments, subject to PGW’s design and approval. The gas supply lines could be built incrementally to coincide with the other utilities and roads serving the development.
The sanitary sewer collection system in The Navy Yard was built by the Navy, with multiple additions and improvements made throughout the last century. The ownership of the existing system is in the process of being transferred to the City of Philadelphia's Water Department (PWD). PWD currently maintains and operates the entire system as the agent for the Philadelphia Authority for Industrial Development (PAID) and has been actively involved in its design and management since 1995.

The existing sewer grid system dates from the turn of the 20th century and most of the existing modern plant was built as a result of the Navy's growth during World War I, World War II, the Korean Conflict, and the Vietnam War. The sewer system utilizes a gravity flow collection system that directs sewage via a series of mains to a central pumping station. The station, built in 1951 and modernized in 2003, has a capacity of 6,750 gallons per minute. The pump station discharge line, a 30-inch diameter cast-iron pipe, runs roughly along the current alignment of 13th Street. The station has a total capacity of 9.72 million gallons per day. This capacity is sufficient to support up to 8,300 single-family homes (at 300 gallons per day per household) or 20 million square feet of commercial office space (at 0.125 gallons per day per square foot).

The existing discharge line, as it heads north, runs parallel to, and approximately 700 feet east of, Broad Street, and continues under I-95 to tie into the city sewer system at 11th Street. The 11th Street sewer connects to the Pattison Avenue interceptor and the effluent is treated at the Southeast Sewage Treatment Plant located on Pattison Avenue between I-95 and Delaware Avenue, 1.5 miles to the northeast.

Unlike many older portions of Philadelphia’s sewer system, which handle both stormwater and sewage, The Navy Yard’s sewage and stormwater are handled by two separate and distinct systems. This dual system design reduced initial cost, and was efficient because it directed stormwater back into the Delaware River and treated the sanitary sewage in an on-site facility (although this facility no longer exists). This dual system remains the most ecologically sound and cost-effective means for handling storm and sewer collection.

The existing sanitary sewer pump station is assumed to have sufficient capacity for the Master Plan development for the first 10 to 20 years, depending on the rate and extent of development. As the East End is developed, an additional sanitary lift station will need to be designed and constructed. This second lift station could either discharge the flow to the existing pump station or follow the proposed Delaware Avenue extension to the Southeast Sewage Treatment Plant. The combination of the new and existing system will continue to utilize the cost-effective gravity flow design.

Pipe sizes will vary from 6 to 24 inches in diameter based upon anticipated flows, with the largest sizes along Diagonal Boulevard, the new extensions of Kelly Hawk Avenue to the East End, and the primary streets of the Plan. The 30-inch discharge pipe will need to be relocated from the pump station to the median of League Island Boulevard. The existing vitreous clay and cast-iron pipe system will need to be extended using cast-iron pipe, meeting all PWD standards for design and installation. All sewer lines will need to be designed in cooperation with, and with the approval of, PWD’s Engineering & Design Planning Group and sized to meet the anticipated demand at full build out.

It is recommended that the new sections of the sewer network be constructed along with the new sections of the road network, and in most cases, follow the new road system.
Stormwater Drainage System

The stormwater collection system in The Navy Yard was constructed from the turn of the 20th century into the 1940s as The Navy Yard expanded. The ownership of the existing system is in the process of being transferred from PAID to PWD, which currently maintains and operates the entire system and has been actively involved in its design and management.

The sewer system uses a gravity flow collection system that directs stormwater through a series of mains to multiple discharge points in the Reserve Basin and the Delaware River. The overall site drainage system is also designed so that these regions that gather stormwater direct it towards the Reserve Basin and the Delaware River. Existing pipe sizes in the storm drainage network vary from 8 to 78 inches in diameter.

The 2004 Plan proposes a network that re-uses as many existing elements as possible and enhances the current system where needed. Pipe sizes in the new network will vary from 15 to 78 inches in diameter based upon assumptions of flow and using best management practices for stormwater design. The proposed system will utilize the existing points of discharge into the Reserve Basin and Delaware River where possible. It is anticipated that only one new discharge point will be required for the East End’s stormwater system, although this depends on the longer term development of the East End.

The strategy of utilizing existing discharges will minimize construction costs as well as eliminate legal costs associated with obtaining the necessary permits from the National Pollution Discharge Elimination System for new discharge points. However, there are areas where the 2004 Plan proposes building pads over portions of the existing storm collection systems. These particular portions of the systems will be reviewed on a case-by-case basis. Such areas include the former Martin Naval Air Station, around the historic Seaplane Hanger (Building 653), and large portions of the Historic Core and East End where existing structures need to be demolished or have been demolished to make way for new development.

Additionally, the active and continual implementation of the 2004 Plan’s sustainable design recommendations is key to improving The Navy Yard’s impact on the environment. These recommendations include the use of porous pavements in parking lots, bioswales, green roofs, and retention basins that double as recreational water features in parks and public greenways.
The water main distribution system in The Navy Yard was built by the Navy and updated and improved throughout the last century. Most of the existing modern plant was built between 1900 and the early 1940's. The ownership of the existing system is in the process of being transferred to PWD, which currently maintains and operates the entire system as the agent for PAID, and has been actively involved in its design and management since 1995.

During the early 1990’s several new mains or portions of the mains in the Historic Core were reconfigured by the Navy. A key element of the existing system is a relatively modern cast-iron distribution system with meter districts equipped with back-flow prevention devices that maintain the purity and quality of the water supply.

The 2004 Plan utilizes the existing street grid loop system to the greatest extent feasible. Where this is not viable, the 2004 Plan proposes replacing inadequate mains, extending dead-end mains, and constructing new mains where none currently exist. Through this strategy, the Plan will create a complete and reliable loop system that addresses the anticipated development needs.

The existing supply, which flows south into The Navy Yard via a pair of 24-inch diameter mains on the east and west sides of Broad Street, has been retained in the 2004 Plan. Currently the system operates at a pressure of 70 pounds per square inch (psi) via the existing pump station located in Building 778, north of Intrepid Avenue and east of 13th Street. This pump station, built in 1946, has a capacity of 5,200 gallons per minute, which equates to 7.488 million gallons per day. The pump station contains a series of booster pumps that operate in response to the site’s fluctuating water demand.

Existing water main lines vary in size from 12 to 24 inches in diameter. Sizes of new pipe will vary from 6-inch diameter laterals to 24-inch diameter mains based on anticipated demand, which is expected to be greatest in the Corporate Center, the Research Park, and the East End.

The water main distribution system is currently being studied by PWD to evaluate the overall quality and reliability of the existing service so that PWD can best manage future growth. Recommendations and conclusions of that study will be incorporated into the infrastructure engineering of any new development. The Navy Yard’s water pressure is one of the highest in the city. However PWD’s study may recommend the removal of the pump station for cost efficiency reasons, which means that the pressure would be reduced to the city standard of about 35 psi.

Final pipe sizes will depend on the density and height of future structures as The Navy Yard is built out. Development should be engineered to allow for future installation of fire booster pumps. A future large diameter (24 inches or greater) connection in the East End of The Navy Yard is recommended. This proposed line would enter from the northeast side of the East End, via the proposed Delaware Avenue extension and would help balance the system by providing both an additional source of pressure and an alternate point of supply.

This connection at the East End would provide The Navy Yard with a complete looped system, eliminating the potential for service interruptions caused either by accidents or scheduled maintenance. Interruption is likely with only a single water supply point at Broad Street, but two points of supply would avoid interference with tenants and owners. To decrease initial cost, this additional water supply connection should be built concurrently with the Delaware Avenue road connection.

New water mains should be constructed in coordination with, and simultaneous to, the construction of the new roads they run under. Following the pattern of the street network will be most efficient in terms of PWD’s engineering design, initial cost of construction, and long-term maintenance. Where existing lines must be modified or upgraded, this will be done as part of the development scope of that specific local area.
PHILADELPHIA NAVY YARD MASTER PLAN

Communication Distribution System

The communication distribution network was designed and built by the Navy and the majority of the system dates from between the 1930’s and the 1970’s. Although the original system was a copper line phone network, Verizon of Pennsylvania, Inc. (Verizon) began to deploy a fiber optic-based network with the turnover of The Navy Yard to PIDC in March 2000, and expanded it with a fiber optic loop.

The Navy Yard is served by Verizon’s Dewey Central Office via a 216-fiber sheath fiber optic cable, running to Building 501 on the west side of Broad Street at The Navy Yard’s entrance. This building functions as the distribution hub and will house a new fiber optic-fed remote terminal containing SONET capable digital electronic equipment. From this central point, new fiber optic cable is distributed along the street grid.

The communication system currently runs from Building 501 east to 13th Street, then south to Kitty Hawk Avenue, then east to League Island Boulevard. The system follows League Island Boulevard north and west back to Building 501 to close the loop. Both the copper lines and the new fiber optic lines run in duct banks below the street and generally follow the street grid.

Fiber optic service within The Navy Yard is capable of providing diverse routing as well as point-to-point service. As development occurs, Verizon may consider developing diverse routing capability outside The Navy Yard, entering via 26th Street. This option would create a second external service, providing complete internal and external diversity.

In the eastern part of The Navy Yard, Verizon has constructed a 72-fiber sheath that runs along the northern end of the Research Park and into CSX’s intermodal railyard. In addition to servicing the railyard, this cable could also service future development in the Research Park and East End. If development requires it, Verizon could expand the existing cable or add cable, and connect it to the existing duct bank system. In addition, this existing installation is capable of being expanded and extended to the east along Mustin Road. The system could then turn north via the proposed Delaware Avenue extension, and connect the East End to Verizon’s Market Street Central Office, providing an alternate diverse external routing to The Navy Yard.

In the long term, overall service requirements should be evaluated with each new construction or redevelopment project and large-scale evaluations of The Navy Yard’s projected expansion should occur about every 5 years. Should development be more residential than commercial and industrial, less ultimate capacity will be required.

In the short term, the age of the existing system, its maintenance costs, efficiency, and handling capacity will need to be evaluated to determine how much of the existing system will eventually need to be replaced. In order to maintain maximum flexibility, consideration should be given to the design and development of an independent communication pathway, which would allow other providers to offer competitive service.

The process of planning and engineering feasibility evaluations, phasing assessments, and obtaining funding for design and construction as well as approvals for capital investment is anticipated to require three to five years. The Plan recommends that all future communication pathways or duct banks be constructed at the same time as the street system in order to maximize efficiency and minimize costs.
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