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National Parks of New York Harbor Waterborne Transportation Study

Draft Final Report

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Prepared by

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14. ABSTRACT

This Waterborne Transportation Study assesses the viability of water transportation as an access mode serving Gateway and other assets of the National Parks of New York Harbor, and develops a preliminary ferry service concept plan to serve the needs of park visitors. The study consisted of the following principal tasks: (1) identification of opportunities to implement ferry services; (2) analysis of advantages and disadvantages of different service options; (3) identification of required improvements and investments associated with different service concepts; (4) feasibility assessment of alternatives; and (5) development of a ferry service concept plan.

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Executive Summary

The National Parks of New York Harbor offer visitors the opportunity to experience the present-day natural environment of the seashore and a centuries old maritime past, right at the doorstep of the nation's largest metropolis. Traffic congestion and circuitous routing on local roadways result in difficult automobile access to the Gateway National Recreational Area (NRA) and other park assets. Access to all three units by public transportation also is poor, due to their location at the periphery of urban development, away from urban neighborhoods and commercial centers.

Ferry service has a natural advantage over land-based modes in an area centered on the water. Passengers also frequently enjoy the experience of travel by boat. Water transportation thus is an attractive concept for improving access to currently underutilized resources in Gateway NRA. The revival of marine transportation as a major mode of travel throughout the harbor presents significant opportunities to integrate potential Gateway NRA ferry routes with the resources of a broader regional ferry network.

The purposes of the *Waterborne Transportation Study* are: (1) to assess the viability of water transportation as an access mode serving the Gateway NRA and other assets of the National Parks of New York Harbor and (2) to develop a preliminary ferry service concept plan to serve the needs of park visitors. The study consisted of the following principal tasks: (1) identification of opportunities to implement ferry services; (2) analysis of advantages and disadvantages of different service options; (3) identification of required improvements and investments associated with different service concepts; (4) feasibility assessment of alternatives; and (5) development of a ferry service concept plan.

Market and Site Analysis

To identify the most promising ferry routes, both market (demand) and site (supply) factors were evaluated, first in a broad screening of potential opportunities and subsequently in a more focused feasibility assessment. The screening of potential routes based on market factors considered available information on visitation at each of the three Gateway NRA units, as well as the origins of trips for existing and potential ferry markets, comparing travel times of ferries versus automobiles and land-based transit services. The site analysis addressed physical conditions at potential dock/ferry landing sites, based on such criteria as presence of existing docks and their condition, current use and resource sensitivity, landside access characteristics, and marine or waterside conditions, such as depth of sea bed, tidal currents, wind and sea exposure, and proximity to shipping lanes.

Based on the initial screening, a short list of most promising ferry landing sites was developed. The list included Fort Wadsworth/Battery Weed on Staten Island, Riis Landing and Canarsie Pier at the Jamaica Bay/Breezy Point unit, and two sites near Fort Hancock on Sandy Hook. Additional sites that could serve as origins for ferry service to the Gateway NRA included Battery Park in Manhattan, Fulton Ferry Landing (Brooklyn) and Brooklyn Army Terminal, several sites in northern New Jersey on the Hudson River and Upper New York Bay, and New Jersey sites in Monmouth County near Sandy Hook.

The short-listed potential ferry landing sites in Gateway NRA and Battery Park were subjected to more detailed site condition assessment. Preliminary concept designs were then developed for needed improvements. Cost estimates for recommended improvements are as follows:

- Torpedo Pier, Fort Wadsworth: Phase 1, including temporary floating dock and landside improvements: $400,000
- Riis Landing, Jamaica Bay/Breezy Point: new float, reorganization of piers, breakwater repair, site improvements: $725,000
- Sandy Hook: Phase 1: seasonal ferry terminal, ramps, site improvements: $675,000
  Phase 2: fixed pie, terminal facilities - $2,100,000
- Battery Park (Marine Inspection Office pier)

Ridership scenarios were developed for major origin-destination combinations. Predicted potential demand among park visitors was in the range of 10,000-20,000 passengers per year at each unit. Revenue projections based on these estimates were compared to estimates of vessel operating costs and a pro-rated allocation of vessel capital costs. The results of this analysis suggested that service on the routes connecting the major short-listed ferry landing sites could be financially viable, if the routes are operated as incremental additions to other successful services, primarily services that serve the commuter market.

Concept Plan

A ferry service concept plan was developed incorporating recommended routes and docking locations. The "core" of the system would be created by the construction or installation of docks and associated terminal facilities at three locations within Gateway NRA:

- Torpedo Pier at Fort Wadsworth
- Riis Landing at Breezy Point
- Fort Hancock at Sandy Hook

A phased approach to developing these facilities is recommended, with the initial priority being the provision of floats and implementation of improvements required for safe and reliable operations. Investment in the construction of fixed piers is recommended as a longer-term priority, following the demonstration of initial success in building a market for the services provided.

Battery Park is another landing site included in the proposed core system, chiefly because creating a commuter service from Riis Landing to Manhattan is the most promising strategy for funding visitor service to Jamaica Bay/Breezy Point and Fort Wadsworth. The Park Service can investigate the feasibility of using existing berthing locations at Battery Park during the initial phase of operations, prior to committing to the investment in new facilities. Once ferry operations have been successfully established, the development of the Marine Inspection Office (MIO) pier at Battery Park may be necessary to support service to Riis Landing. An improved and expanded ferry landing facility at the MIO dock

facility would provide increased docking capacity at Battery Park, as may be needed to accommodate the additional vessel traffic associated with expanded service.

The core ferry landing facilities administered by the Park Service would be connected by a set of routes, as follows:

- Riis Landing-Fort Wadsworth-Battery Park: commuter and visitor
- Sandy Hook-Fort Wadworth-Battery Park: primarily seasonal, visitor-oriented service in initial phase

Service to Fort Wadsworth can be provided as an intermediate stop on both routes, requiring minimal route diversion because of Fort Wadsworth's central location at the narrows. The link between Riis Landing and Battery Park is identified as a core route largely because operating commuter service between the two points would provide the financial means to support visitor service. Battery Park, as the departure point for existing services to the Statue of Liberty and Ellis Island, also represents a logical hub for potential new excursion services, such as a tour of historic harbor fortifications, including Castle Clinton, Battery Weed/Fort Wadsworth, Castle William on Governor's Island, and Fort Hancock.

Several additional potential routes would serve Gateway NRA markets that are likely to be comparable in size to the market coming from Manhattan. These routes include:

- Fulton Ferry Landing – Riis Landing
- Brooklyn Army Terminal – Riis Landing
- New Jersey Hudson River/Upper Bay sites (Weehawken, Hoboken, Jersey City, Liberty State Park) – Sandy Hook or possibly Riis Landing
- New Jersey Bayshore (South Amboy, Belford) – Sandy Hook

In the case of this latter set of routes, the Park Service would not own or manage the docks serving visitor origins. The Park Service could facilitate or support the implementation of these routes through a variety of mechanisms, chief of which would be concession agreements with private operators to provide service from existing docks at the origin points. Since service to the park units generally would be concentrated in off-peak hours, relative to commuter service, there are likely to be multiple opportunities to initiate such services, without undue capacity limitations or conflicts at existing docking facilities.

Service to Riis Landing on weekends would be seasonal, from May through September, and would be year-round on weekdays, serving commuters in one direction and, most often, visitors who would be traveling in the reverse direction. The initial service between New Jersey origins and Sandy Hook is likely to be

seasonal and limited to weekends. On a longer term basis, as the planned renovation and reuse of buildings at Fort Hancock proceeds, a weekday service between Manhattan and Sandy Hook, perhaps with an intermediate stop at Fort Wadsworth, may be viable.

A secondary route that is considered promising would connect Riis Landing with Canarsie Pier. In this case, Riis Landing would serve as a hub with a primary route connection to Battery Park, Fort Wadsworth, and Fulton Ferry Landing or Brooklyn Army Terminal. The connection to Canarsie Pier would be a single spoke from this hub, with Canarsie Pier serving primarily as a destination. Another potential spoke from the Riis Landing hub would be a link to or excursion route through the Jamaica Bay Wildlife Refuge.

The financial feasibility of the proposed ferry system depends on the ability to "piggyback" routes serving park visitors onto other services that serve larger markets, typically commuters. As the number of services in the harbor grows, opportunities for such "piggy-backing" can be expected to increase. There are two possible alternative strategies for funding Gateway NRA ferry services:

- Pooling or sharing revenues with Statue of Liberty/Ellis Island services
- Subsidizing the service from other public sources.

In the absence of funding from either of these two alternative sources, "piggybacking" of park ferry services onto commuter routes appears to be a financial necessity.

1.0 Introduction: Study Objectives and Technical Approach

The National Parks of New York Harbor fill a unique role in reconnecting the nation's largest metropolis with its historic waterfront and maritime heritage. The Gateway National Recreation Area (Gateway NRA), consisting of units at Staten Island, Sandy Hook, and Jamaica Bay, offers some of the region's most spectacular beaches, an internationally renowned wildlife refuge, salt marshes, fishing areas, hiking trails, fields, and a multiplicity of activities, cultural resources, and educational services. The location of these remarkable resources amidst urban neighborhoods and sprawling suburbs adds immeasurably to their value for area residents and visitors.

Historic fortifications at each of the units testify to the strategic location of the sites in forming a literal gateway by sea to New York City and coastal New Jersey. The key park assets of the Statue of Liberty and Ellis Island are national symbols of freedom that beckon to visitors from across the United States and throughout the world. Castle Clinton, an historic fortification at the southern tip of Manhattan in Battery Park, is a national monument housing a visitor center for the national parks of Manhattan. Ferries bound for Liberty and Ellis Islands depart from adjacent docks.

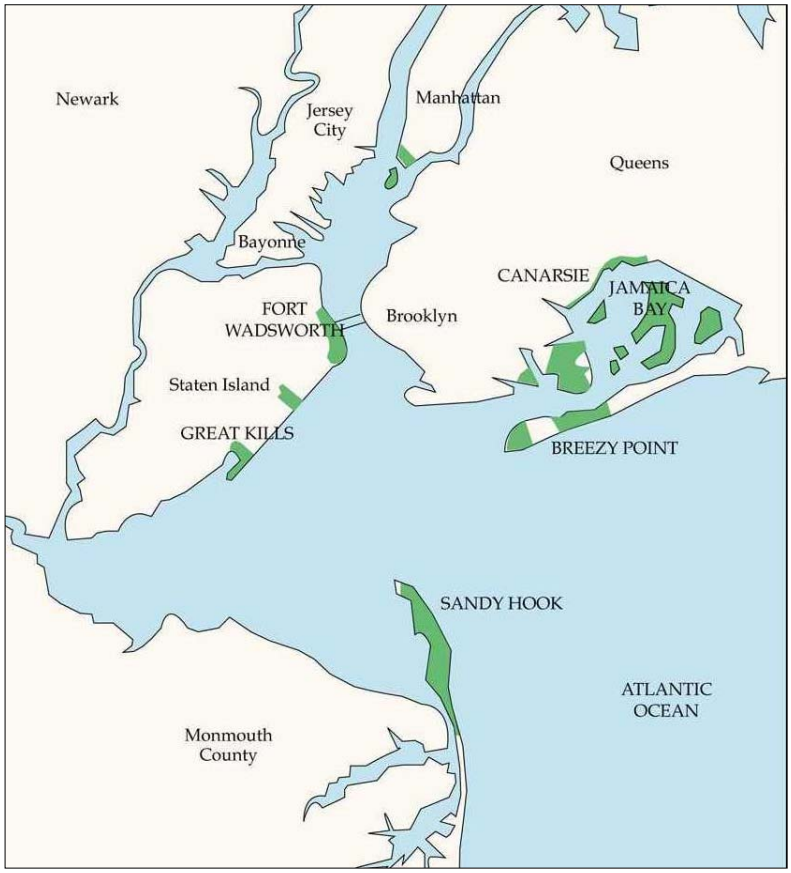

Figure 1-1
New York Harbor

The common bond linking these sites is their integral relationship to the harbor. The water currently serves to *divide* the sites from one another, however, rather than to link them together, in the absence of a coordinated waterborne transportation system. Adding new water transportation services can serve not only to vastly improve *access* to the individual park assets in the face of escalating traffic congestion on area roadways, but also to reinforce the essential nature of the fortifications, beaches, and natural areas of the park as features of the harbor (Figure 1-1).

New York harbor is in the midst of a marine transportation renaissance, as the number and variety of passenger services expands with each passing year and waterfront redevelopment flourishes. The growth of ferry services reflects the natural advantages of this mode of transportation in an area where the land forms a ring around the water on three sides. Whereas the water is a constraint on land-based transportation, forcing these systems into circuitous patterns with bottlenecks created at a necessarily limited number of bridge and tunnel crossings, ferry routings frequently are more direct. As area roadways become increasingly clogged with traffic, the relative advantage of water transportation increases. An additional benefit is that passengers frequently enjoy the experience of traveling on the water.

This report documents the Waterborne Transportation System Planning Study performed by the Volpe National Transportation Systems Center, in association with contractors Cambridge Systematics, Inc., Norris and Norris Architects, and Childs Engineering Corporation for the National Park Service (Park Service), National Parks of New York Harbor. The primary purposes of the study are twofold:

- Assess the viability of water transportation as an access mode serving the Gateway NRA and other assets of the National Parks of New York Harbor
- Develop a preliminary ferry service concept plan to serve the needs of park visitors.

The plan, as presented in this report, identifies a proposed route structure, docking and terminal facilities, and financial, operating, and management strategies, including options for integrating Gateway services with Statue of Liberty/Ellis Island ferry operations.

1.2 Study Approach

An analytical framework was developed for the study, incorporating five major component elements:

1. identification of opportunities to implement ferry services at the National Parks of New York Harbor, focusing on the three units of the Gateway
2. analysis of advantages and disadvantages for different options
3. identification of required improvements and investments associated with different service concepts
4. assessment of the feasibility of potential ferry service options
5. development of a plan identifying the components of a recommended ferry service concept and strategies to maximize the prospects for its success.

As noted above, the study focused on service to the Gateway NRA, because these park units currently have little or no access by water and prospects for improving land-based transportation service are limited. In addition, all three Gateway units have resources that currently are not used to their full capacity, due partly to access constraints, and in some cases, to lack of widespread visibility.

Transit is an important mode of transportation in metropolitan New York and many residents of the area's city neighborhoods do not own their own cars. The natural

resources offered by the Gateway NRA may be particularly attractive to people who lack the mobility provided by automobiles to seek far flung recreational options, but ironically, the Gateway units are located in areas on the periphery of urban development, where transit service is poor. Water transportation may be the best—and is quite likely the most appealing—option for improving transit service to these areas. Not least of the potential benefits that may be realized is enhanced visibility of the maritime resources that are central to the function of the park units.

In identifying the most promising ferry service options, the study helps to establish priorities for investment in transportation improvements at the Gateway NRA. Two complementary factors, as reflected in the study's analytical framework, have governed the development of study recommendations: opportunity and feasibility. Opportunity arises as the network of water transportation services rapidly expands in New York Harbor and ferries are revived as a major access mode. The study suggests how the Park Service can best take advantage of this opportunity, identifying the services that offer the greatest benefits and determining which of them are most feasible.

Both market (demand) and site (supply) factors were evaluated, first in a broad screening of potential opportunities and subsequently in a more focused feasibility assessment. This latter assessment served as the basis for determining the most promising service options. Preliminary concept designs were developed for recommended ferry landing sites at Gateway NRA and Battery Park. Implementation strategies and necessary landside transportation connections were then developed in support of recommended services.

1.3 Concept Plan Elements

A principal product of this study, further documented in Section 10.0 of this report, is a ferry service concept plan for the National Parks of New York Harbor. The primary elements of the plan relate to the establishment of permanent dock facilities at the following locations:

- Battery Park in Lower Manhattan, adjacent to Castle Clinton
- Fort Wadsworth at the Staten Island Unit
- Riis Landing at the Jamaica Bay Unit
- Fort Hancock at Sandy Hook

Services connecting these locations, all of which are at properties administered by the Park Service, would form the core of a water transportation network that could be linked to additional routes operated in the harbor under other auspices. Secondary sites that hold promise as direct feeders into this core network include:

- Fulton Ferry Landing in Brooklyn
- Brooklyn Army Terminal

- Canarsie Pier at the Jamaica Bay Unit
- New Jersey sites on the Hudson River, Upper New York Bay, and the Bayshore area of Monmouth County near Sandy Hook

Ferry services linking these points were judged to be potentially viable in terms of ridership, financial factors, and operating condition

2.0 Overview of Gateway NRA Units

2.1 Staten Island

The Staten Island Unit of Gateway NRA extends along the southeastern shore of the island and includes sites at Fort Wadsworth, Miller Field, and Great Kills Park (Figure 2-1). Hoffman and Swinburne Islands are also part of this unit, although they are closed to visitors. Each of the three actively used sites is distinct in terms of uses, resources, and visitation. Fort Wadsworth, located next to the Verrazano-Narrows Bridge adjacent to the Arrochar residential section, is a former military installation. Miller Field (226 acres), located in the Grant City/New Dorp section of Staten Island, is a former army airfield. Great Kills Park (1,000 acres), located to the south of Miller Field in the Oakwood section, is a well-used water recreation resource.

Figure 2-1

The Staten Island Unit serves to a large extent as a local park for borough residents with the exception of Fort Wadsworth, which attracts visitors from the New York region and is expected to draw visitors from other U.S. and international destinations. Fort Wadsworth serves as the starting point for the New York City Marathon (32,000 runners) each November. All of the pre-race activities and the start of the race itself take place at this location. In addition, Fort Wadsworth serves as the finishing point for five-borough Bike New York ride, which takes place on the first Sunday in May with more than 30,000 cyclists.

Both of these major events present an opportunity for excursion ferry services from Brooklyn and Manhattan to a new dock at Fort Wadsworth.

Great Kills Park and Miller Field are located adjacent to residential communities and do not have good regional highway access. Miller Field serves as an important community resource for recreational activities. In addition to water recreation activities, Great Kills Park offers excellent opportunities for other activities such as jogging, in-line skating, cycling and bird watching.

Current Access Options

Although it is possible to travel to the park sites by public transit from Manhattan, the trip is time consuming and requires use of the Staten Island Ferry, the Staten Island Rapid Transit line, and local bus routes. Auto access from within Staten Island is good, although parking constraints at Great Kills Park and Miller Field can limit visitation at these sites. Auto access from New Jersey or from Brooklyn entails bridge crossings, which means that toll charges are involved. The end result is that at present, the Gateway facilities in the Staten Island Unit are principally local park facilities. While efforts are underway to expand the use of Fort Wadsworth for a variety of purposes, including educational uses, the time required to travel to and from Fort Wadsworth makes for difficult access by people who are not located in nearby communities.

2.2 Jamaica Bay/Breezy Point Unit

The Jamaica Bay/Breezy Point Unit (Figure 2-2) includes the Brooklyn and Queens sections of Gateway NRA. Divided into three distinct areas, the unit includes an historic airport (Floyd Bennett Field), a beach recreation area (Jacob Riis Park), a former military site (Fort Tilden), a wildlife refuge (Jamaica Bay) and an historic pier (Canarsie). Each of these sites offers a variety of recreational activities. Tennis, golf, boating and horseback riding opportunities are also offered by authorized concessionaires.

Breezy Point lies south of Jamaica Bay on the western end of the Rockaway peninsula and contains approximately 1,059 acres and 4.5 miles of ocean beaches. The area includes the popular Jacob Riis Park, transferred to Gateway from New York City, other lands in the central portion of the peninsula and at the tip that were previously acquired by the city and donated to the park, and most of the lands and facilities within the Fort Tilden military complex. Two communities remain as enclaves of single-family houses within the unit boundary – the Breezy Point Cooperative and the community of Roxbury (both represented by the administration of the Cooperative). Virtually the entire Jamaica Bay/Breezy Point unit is surrounded by water.

Current Access Options

The roadways providing access to the Jamaica Bay/Breezy Point Unit are frequently congested with traffic, although circulation within the unit generally is adequate. Belt Parkway, an east-west highway connecting Staten Island with Long Island and other destinations, is the only major highway in the area. Primary access is via Flatbush Avenue. Transit, the principal means of access for so many people in New York, does not serve the unit well. The only attraction that is close to a subway station is the Jamaica Bay Wildlife Refuge Visitor Center. All other visitor destinations are beyond walking distance from a transit station. Bus service is available from the transit stations, but the need to transfer and other factors limit the attractiveness of transit. Constrained auto access, congestion on existing access roadways, and the limitations of the transit system probably reduce visitation.

Within Breezy Point, development is located around a well-established road system. Rockaway Beach Boulevard, the primary east-west circulation route, connects with the Marine Parkway Bridge, which provides access to Brooklyn, and with Beach Channel Drive which serves the Rockaways and Queens. The majority of visitors to Breezy Point use the access route for Floyd Bennett Field.

2.3 Sandy Hook

Sandy Hook is located on a peninsula at the northern end of New Jersey's Atlantic shoreline, just north of the town of Atlantic Highlands (Figure 2.3). The unit covers approximately 1,665 land acres, including 13 miles of ocean beaches and sheltered bayside coves, hundreds of acres of ecologically significant barrier-beach vegetation, and at the northern end of the lands, facilities, and fortifications of the Fort Hancock complex.

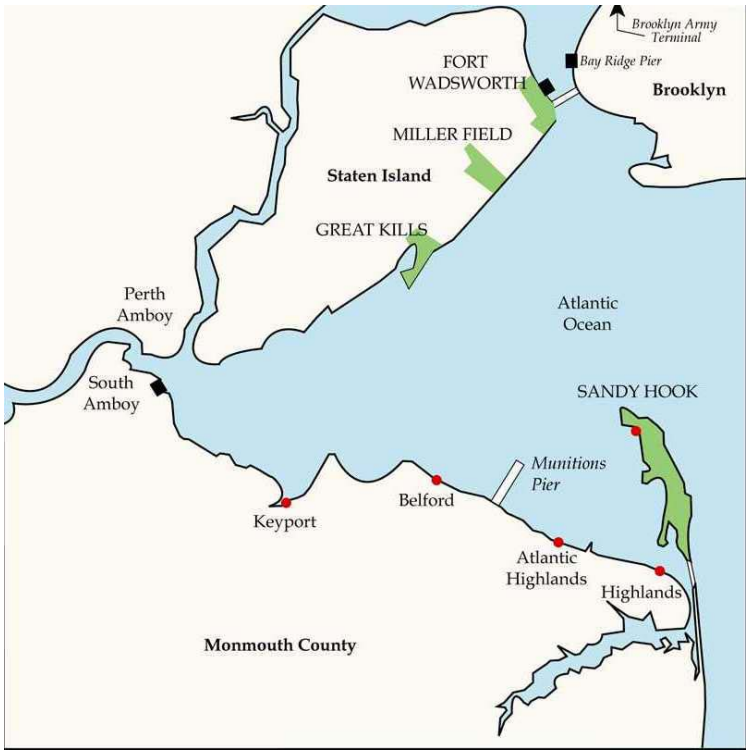

Figure 2-3
Sandy Hook

The U.S. Coast Guard and U.S. Army Corps of Engineers maintain properties at the Sandy Hook tip that are separate from the park. The Park Service owns and administers the historic Sandy Hook Lighthouse.

Current Access Options

Automobile: Most people travel to Sandy Hook by automobile. Primary auto access is via Route 36, a local east-west highway that connects to the Garden State Parkway, which carries about one-third of the auto trips to the park. Circulation within the unit is along the main north-south road, which connects with Route 36 at the Highlands bridge just south of Sandy Hook and runs the full length of the unit into the Fort Hancock/North Beach area. Secondary roads permit access to developed areas east and west of the main road.

Delays are routine on weekends during the summer season, due to the opening of a drawbridge near the entrance. Parking closures are another common occurrence when visitation is at peak levels during the summer. The parking lots at Sandy Hook are full on peak summer weekends, thereby limiting access to the park.

Transit: The nearest local transit service to Sandy Hook is provided by New Jersey Transit. The M24 bus runs between Red Bank and Highlands and stops at the park entrance. A bus rider would have to walk two miles from the bus stop to the nearest bathing beach. The other bathing beaches are approximately five miles into the park. Regional bus service to the area is provided by Academy Bus Lines, a private carrier, New Jersey Transit Commuter Rail (North Jersey Coast Line Station at Red Bank), and New York Fast Ferry and Seastreak (providing service between nearby Atlantic Highlands and Highlands, NJ and Manhattan), but none provides service to the park itself.

Ferry: Sand Hook is the only Gateway unit with an existing ferry service. During the summer months, New York Waterway offers weekend ferry service from Midtown and Lower Manhattan to a temporary dock (spud barge) at Fort Hancock on Sandy Hook. The 75-minute service, which features early- and mid-morning departures, is marketed as an "escape to the beach" and carries approximately 5,000 passengers over the course of the summer. This service has attracted a sizeable market even with relatively high fares ($25 per adult and $12.50 per child), suggesting that there is likely to be a market for expanded water transportation services to Sandy Hook.

Bicycle Transportation: Bicycles are well-suited to provide internal circulation within the Sandy Hook peninsula. The main access road is a scenic, relatively flat and straight roadway. Greater bicycle use could increase beach access without an undue impact on parking resources. Unfortunately, there is little accommodation for bicycles at this time. No paths or lanes are provided and potential conflicts with vehicle traffic present safety risks for cyclists. In 1998, a cyclist was killed in a collision with a motor vehicle. The four-lane access road could potentially be reconfigured to accommodate bicycles.

Currently a bicycle path in Sandy Hook is in the design phase, with construction beginning in 2002. It will run parallel to the main road beginning at the Park entrance and continuing all the way to Fort Hancock. It will be located on the east (ocean) side of the road in the beginning, but will need to cross the main road and continue on the west side (bay side) when there is no longer room on the east side.

While conditions are favorable for using bicycles within the Sandy Hook Unit, the roadways beyond the peninsula are less hospitable. For those traveling to the park by transit, it might be possible to offer either loaner bikes (i.e. free bicycles) or bicycle rentals at the park entrance. This would require the construction of a storage and bicycle management facility. A similar arrangement could be provided at the ferry terminals, supplementing shuttle bus service connections between the dock and destinations within the park.

In the future, park visitors will be able to travel on the Bay Shore bike trail, which begins in Allenhurst and currently ends in Atlantic Highlands. The 22-mile trail is almost complete except for the final 3 miles, which will connect Atlantic Highlands to the Sandy Hook Gate.

Until the link to the park is completed, the availability of ferry service between Atlantic Highlands and Sandy Hook would allow a bicyclist to travel on the bike path to Atlantic Highlands and then take the ferry service to Sandy

Shuttle Bus: At present, the current ferry operation includes a bus connection between the ferry terminal, the Sandy Hook Lighthouse, the Visitors Center and three beaches. This 45-passenger capacity shuttle bus meets ferry arrivals and otherwise operates on an hourly schedule on weekends and holidays from mid-morning until late afternoon. The service is free for ferry riders, and cost $1 for other Sandy Hook visitors.

A second service, the Bayshore Beach Trolley, operates between business in the Highlands and the beaches within Sandy Hook. The trolley service is primarily intended to encourage spending at local businesses and is not geared toward internal park circulation. The service did not operate in 2000 due of lack of funding but there are current plans to restart the operation in 2001 with significant service expansion.

3.0 Screening of Potential Sites: Gateway National Recreation Area Destinations

How should water transportation services be configured to best meet the needs of the National Parks of New York Harbor? Transportation services of all kinds are defined at their most basic level by the places or locations they travel to and from: their points of origin and destination. Thus, a critical early phase in ferry service planning is identification of the most promising locations for the siting of dock facilities, which will form the endpoints of the routes (or links in a more complicated network route configuration serving multiple locations) traveled over the water.

The first step in the process of identifying suitable dock locations was a screening of potential sites. Two factors fundamental to the viability of water transportation services were considered:

1. Preliminary market analysis, based on *level of existing and potential visitation* at specific centers of activity or destinations within the parks
2. *Dock site characteristics*, such as presence of existing docks and their condition, landside characteristics such as access to prime destinations within the park,topography, current use and resource sensitivity, and navigational or waterside considerations, such as depth of sea bed, tidal currents, wind and sea exposure, and proximity to shipping lanes.

The purpose of this screening was to select, from among the full range of potential possibilities, those dock sites that warranted more detailed feasibility analysis in the second phase of the study.

3.1 Visitation

The market for ferry services will be some portion of the total visitation at destinations within the parks. Monthly levels of visitation at the Gateway NRA units in 1999 are shown in Table 3-1.

Table 3-1: Gateway National Recreation Area
1999 Visitation

Gateway Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**
Sandy Hook	57,651	62,969	57,062	50,097	135,798	459,198	530,713	501,310	161,281	107,592	82,434	81,344	**2,287,449**
(percent of annual visitation)	2.52%	2.75%	2.49%	2.19%	5.94%	20.07%	23.20%	21.92%	7.05%	4.70%	3.60%	3.56%	**34%**
Staten Island - Great Kills Park	24,621	35,224	53,162	62,900	104,572	109,551	173,929	191,123	132,048	77,074	75,440	128,737	1,168,381
(percent of annual visitation)	2.11%	3.01%	4.55%	5.38%	8.95%	9.38%	14.89%	16.36%	11.30%	6.60%	6.46%	11.02%	
Staten Island - Fort Wadsworth	728	1,402	2,845	5,111	39,555	8,116	29,621	25,357	20,350	20,350	56,083	16,187	225,705
(percent of annual visitation)	0.32%	0.62%	1.26%	2.26%	17.53%	3.60%	13.12%	11.23%	9.02%	9.02%	24.85%	7.17%	
Staten Island - Miller Field	4,904	3,291	3,083	9,970	44,275	57,891	90,890	97,901	105,511	105,511	60,868	23,344	607,439
(percent of annual visitation)	0.81%	0.54%	0.51%	1.64%	7.29%	9.53%	14.96%	16.12%	17.37%	17.37%	10.02%	3.84%	
Staten Island - Total	*30,253*	*39,917*	*59,090*	*77,981*	*188,402*	*175,558*	*294,440*	*314,381*	*257,909*	*202,935*	*192,391*	*168,268*	**2,001,527**
(percent of annual visitation)	1.51%	1.99%	2.95%	3.90%	9.41%	8.77%	14.71%	15.71%	12.89%	10.14%	9.61%	8.41%	**30%**
Jamaica Bay - Floyd Bennett Field	42,094	34,411	49,679	49,623	109,029	72,215	101,785	114,008	81,866	81,866	105,997	30,340	872,913
(percent of annual visitation)	4.82%	3.94%	5.69%	5.68%	12.49%	8.27%	11.66%	13.06%	9.38%	9.38%	12.14%	3.48%	
Jamaica Bay – Jamaica Bay Wildlife Refuge	12,905	20,758	25,393	26,393	53,685	44,653	43,295	42,275	17,230	17,230	11,718	10,518	326,053
(percent of annual visitation)	3.96%	6.37%	7.79%	8.09%	16.47%	13.70%	13.28%	12.97%	5.28%	5.28%	3.59%	3.23%	
Jamaica Bay – Canarsie Pier/Plumb Beach	7,198	6,256	36,038	36,038	16,000	31,498	89,670	44,960	18,345	19,663	19,663	4,377	329,706
(percent of annual visitation)	2.18%	1.90%	10.93%	10.93%	4.85%	9.55%	27.20%	13.64%	5.56%	5.96%	5.96%	1.33%	
Jamaica Bay - Riis Park/ Fort Tilden	19,475	17,101	18,050	21,512	29,524	147,474	247,803	243,315	25,624	25,624	20,198	22,709	838,409
(percent of annual visitation)	2.32%	2.04%	2.15%	2.57%	3.52%	17.59%	29.56%	29.02%	3.06%	3.06%	2.41%	2.71%	
Jamaica Bay - Total	*81,672*	*78,526*	*129,160*	*133,566*	*208,238*	*295,840*	*482,554*	*444,558*	*143,065*	*144,383*	*157,576*	*67,944*	**2,367,081**
(percent of annual visitation)	3.45%	3.32%	5.46%	5.64%	8.80%	12.50%	20.39%	18.78%	6.04%	6.10%	6.66%	2.87%	**36%**

Total Gateway	*169,576*	*181,412*	*245,312*	*261,644*	*532,439*	*930,596*	*1,307,707*	*1,260,250*	*562,255*	*454,910*	*432,402*	*317,556*	**6,656,057**
(percent of annual visitation)	2.55%	2.73%	3.69%	3.93%	8.00%	13.98%	19.65%	18.93%	8.45%	6.83%	6.50%	4.77%	

The table shows that total annual visitation at the three units combined was over 6.6 million and that each unit accounted for over 2 million of this total. At all three units there are multiple attractions that could provide a market for ferry service.

3.1.1 Staten Island

The most popular destination by far at Staten Island is Great Kills Park, which had five times the Fort Wadsworth's visitation of 225,705 in 1999. In peak months other than November (during which the New York City Marathon boosts visitation totals on a single day), Fort Wadsworth 1999 visitation was in the 20,000-40,000 range, which translates into daily averages ranging from about 700 to 1,300 visitors. Miller Field is a former air station and is currently used as an active and varied recreation area, predominantly by Staten Island residents. Visitation in 1999 exceeded 600,000.

Ferry service oriented to Fort Wadsworth has some advantages, despite visitation being considerably lower than at Great Kills and Miller Field. The latter two sites primarily serve a local market of Staten Island residents, while Fort Wadsworth draws visitors from a broader geographic area. Moreover, an anticipated expansion of programming at the Fort Wadsworth visitor center could produce a significant increase in visitation among student groups on class trips, many or most of which could be expected to originate from areas outside Staten Island, particularly if improved transportation options were available. In any case, the number of daily peak season visitors is sufficient to warrant further consideration of Fort Wadsworth as a ferry route destination.

While Great Kills and Miller Field currently serve as local recreational facilities, the geographic market for these sites could conceivably be expanded through promotional efforts and improved visibility and access. A shuttle bus service could be implemented on a trial basis to transport visitors arriving at Fort Wadsworth by ferry to Great Kills and/or Miller field, thus testing the potential to expand the use of these sites to a broader geographic market. Fort Wadsworth, however, is a resource of historical and educational interest beyond that of a local recreational facility and is, from a market standpoint, the logical site for ferry access at the Staten Island unit.

3.1.2 Jamaica Bay

Annual visitation levels are comparable at the Jamaica Bay unit's two primary centers of activity—Jacob Riis Park/Fort Tilden and Floyd Bennett Field. Over 800,000 visitors went to each of these sites in 1999, although the distribution throughout the course of the year was markedly different. Not surprisingly, over 75 percent of the visitation to Jacob Riis Park/Fort Tilden, where the beach is the major attraction, occurred during the three-month period from June through August, while visitation at Floyd Bennett Field was more evenly distributed from June through November. Canarsie Pier/Plumb Beach and the Jamaica Bay Wildlife Refuge each attracted over 300,000 visitors in 1999. Visitation at the Wildlife Refuge was concentrated to a

significant degree in the period from May through August, while Canarsie Pier's peak season extended from March through August.

Visitation at all the Jamaica Bay sites combined was over 2.3 million, with 66 percent of that total compressed into the three-month period from June through August. Because the most intensive use is at Jacob Riis Park in the summer season, serving visitors to this site would be a logical priority, although there could be a significant market for water-based transportation service to other sites. Distribution of ferry passengers throughout the unit by shuttle buses or trams would be an integral component of the ferry service operation.

3.1.3 Sandy Hook

Visitation at Sandy Hook is distributed among seven miles of beaches, trails and natural areas spread across the length of the peninsula. Landside transportation service, in the form of a shuttle bus or tram, would be necessary to distribute ferry passengers among these locations, irrespective of where a ferry landing might be located. Loaner or rental bicycles made available near the ferry dock could supplement the shuttle service, providing an alternative mode of landside distribution for some ferry passengers.

It may be advantageous, despite the necessity of providing landside shuttle services, to locate the ferry dock within close proximity of a destination where the park wishes to attract more visitors, such as North Beach, which is over five miles from the park entrance. Another consideration concerning landside access is the planned adaptive reuse of buildings on the Fort Hancock campus for office space and other uses. Both employees and visitors represent a potential year-round market for ferry services.

3.2 Dock Site Characteristics

3.2.1 Staten Island

Fort Wadsworth: The Park Service has completed preliminary design studies at the site of the former Torpedo Dock, just northwest of the historic Civil War fortification, and proposes to restore the granite seawall and pier and to add a floating ferry dock. Other sites to the south and west of the proposed site and Verrazano Narrows Bridge are not suitable because of shoal water conditions and exposure to an ocean fetch to the southeast . Although not without some waterside exposure and navigation issues, the best site to serve Fort Wadsworth is the Torpedo Pier.

Miller Field: The southeast edge of the park consists of a continuous beach front with no navigation channels or inlets that would accommodate a ferry landing, without significant dredging and breakwater protection. No suitable ferry landings were identified at Miller Field.

Great Kills Park: Included within the park is a large marina facility with access to a large number of moorings. The harbor has a long, narrow and well-marked channel

entrance that connects to the deeper water of the Lower Bay. It is understood that ferry landings have been considered in the past both within the Park near the marina and on the Great Kills town side of the harbor. A ferry landing would be technically feasible in either location. The primary concerns are what markets would be served by a ferry service, whether or not the Park in its current configuration has adequate additional capacity for more visitation, and whether or not the Park has an interest in providing such a service.

Preferred sites:

- Fort Wadsworth Torpedo Pier
- Great Kills Park Marina

3.2.2 Jamaica Bay/Floyd Bennett Field

Jamaica Bay/Breezy Point Unit activity and resource centers consist of a variety of locations including Breezy Point, Fort Tilden and Jacob Riis Park on the Rockaway Peninsula, Floyd Bennett Field on Barren Island, Canarsie Pier, and the Jamaica Bay Wildlife Preserve.

Breezy Point: There are several piers projecting into the Rockaway Inlet, one of which is used for excursion vessel berthing and loading during the summer season. Much of the somewhat protected northwest side of the peninsula has a gradually sloping sandy beach edge with limited potential for dock landings. While several of dock locations southwest of Fort Tilden were visited, they all appeared to be too remote from public park resources for reasonable walking connections, had limited public access through the gated residential communities, and would require substantial intermodal bus links to provide visitor access to the south shore beaches and the more remote Fort Tilden/Jacob Riis Park sites. No options were carried forward for these sites.

Fort Tilden/Jacob Riis Park: Several dock sites were considered: 1) adaptation of the the Coast Guard Station basin on the inlet side, 2) a new pier at the site of the former Fort Tilden rail pier, and 3) a new ocean side pier near the Jacob Riis Bath House.

The *Coast Guard Station* site is located within the protected basin on the west side of the Marine Parkway Bridge abutment on the Rockaway Inlet side of the peninsula. This site has been designated by the Park Service as an early action project with the addition of a temporary spud barge landing and ramps already in place as of September 2000. The site offers protected berthing year round behind a wooden breakwater, which protects the dredged basin from wind and wave action along the exposed south shore of the Inlet. In order to provide a well-functioning ferry landing , various replacements, alterations and additions to the existing floats and boardwalks would be needed, as well as restoration or removal of a deteriorating section of the west breakwater at the entrance to the Basin.

The most heavily used Fort Tilden/ Jacob Riis Park resources are on the south side of the peninsula and are not all within easy walking distance, being approximately 15 minutes by foot to the central beach pavilion and recreation areas. Landside access and shuttle links to the park destinations would need to be provided through the site immediately adjacent to the west, which would accommodate trolley drop-offs, pedestrian paths, possible parking and support facilities. There is some expectation that a major portion of the Coast Guard site may be turned over to the Park Service, but no definite time frame had been determined as of the completion of this study. Because of the protected basin, and anticipated availability of the most of the Coast Guard facilities, the site was carried forward for detailed analysis.

Another site considered was the former ***Fort Tilden rail and supply pier*** to the west of the Coast Guard basin. All that remains of the pier is a dense pile field with most piles in det4riorated condition in the inter-tidal zone. The site is similar to those fixed piers further west on Breezy Point in being exposed to a long fetch and wind and wave action, and having shallow water some distance from the shore. A replacement pier would require a combination of the following to provide year round ferry berthing: 1) removal of the pile field, 2) an extended fixed pier with attached floats, 3) dredging, and/or 4) construction of a breakwater similar to that at the Coast Guard Station to provide protection serve the small to midsize ferry vessels anticipated.

As with the adjacent Coast Guard Basin site, shuttle links to the park destinations would need to be provided to the Fort Tilden/ Jacob Riis Park resources on the south or ocean side of the Peninsula. Construction of a fixed pier, breakwater and ferry landing at the former rail pier site would be considerably more costly in terms of construction, dredging, and environmental permits required. For these reasons the site was not recommended for further analysis.

The third site considered was on the ocean side in front of the restored ***Jacob Riis Bath House***. Development of a ferry landing at this site would entail construction of a long, elevated sea pier with a partial basin protected by a breakwater to allow for landing of ferry vessels. Most traditional ocean piers were intended primarily for pedestrian or amusement uses on top, with occasional use for larger ship landings in fair weather. In order to accommodate a smaller passenger ferry, a protected basin would be needed, built solidly to withstand major ocean storms and hurricanes.

While the site would be more convenient for ferry connections to the beach front resources, the costs of construction of pier and basin facilities on the ocean side would be much greater for equivalent facilities on the Inlet side. In addition such a facility would require extensive environmental review of the piers and basin construction because of impacts on sand migration and erosion along the beachfront. In addition, a larger seagoing class of ferry might be required to operate in the open ocean as opposed to the smaller vessels currently operating within New York Harbor and the more protected Inlet waters. For these reasons this site was not considered for further evaluation.

Floyd Bennett Field: The ***marina at Dead Horse Bay*** is a potential ferry dock site.. The marina site would require use of some of the shoreline with direct access to the deepwater channel within the bay. Use of the parking during weekdays could provide ferry access to the Fort Tilden site. However, the current parking areas are largely committed to marina users during the summer weekend periods. While parking and ferrying across to the proposed Fort Tilden landing might save crossing the bridge and paying the toll, it is hard to imagine any demand from park visitors who have vast areas of parking available next to the beach, at least until such time as the Jacob Riis lot is once again filled on a regular basis. Alternatively, the site might be useful on a temporary basis when the bridge is closed for reconstruction. Without a clear ongoing need for park visitor use, and with the direct use conflicts with summer marina activities, the site was not recommended for further study as a ferry landing.

Canarsie Pier in Brooklyn is currently used as a recreational area and fishing pier serving a large population in Queens and Brooklyn. The site has recently been renovated with new entrance, walkways, benches, lighting and parking. It is a popular year round attraction for the Queens neighborhoods to the north across the Belt Parkway and the parking lot on site is filled to capacity during many summer weekends.

The site has a float landing that could be used by ferries, subject to modifications of current dock management concessions. Ferry services arriving at the site would attract users to the park to enjoy the existing restaurant, recreation and fishing facilities. This market is likely to consist in large part of visitors who don't own automobiles and additional demand that exceeds the capacity of the parking lot.

Jamaica Bay Wildlife Preserve could accommodate increased visitation and interpretive opportunities if there were environmentally friendly ferry routes through its constituent islands. Strategically located ferry landings for smaller vessels could be established for ecology and wildlife tours to the sites. Guided water tours through the islands along the deepwater channels could handle passengers on vessels ranging from 30 up to 300 passengers. Services and visitation to specific islands would need to sized to match the capacity of the individual resources, and might suggest smaller vessels.

Jamaica Bay/Breezy Point Unit sites carried forward for further assessment in this report included the following:

- Fort Tilden/Riis Landing at the Coast Guard Station
- Canarsie Pier
- Jamaica Bay Refuge Islands (various sites)

3.2.3 Sandy Hook:

There is a temporary ferry landing at Fort Hancock next to the Post Chapel and south of the Coast Guard Station. The dock facility is a floating spud barge privately owned and maintained by the current service operator, NYWaterways. The site is well protected in most weather conditions from the entrance to New York Harbor, and also has adequate

water depth close to shore. From the landside, the site serves the Fort Hancock complex well and generally delivers passengers close to the less-used beaches at the north end of the Hook. The historic buildings and Park Service headquarters are within easy walking distance of the ferry landing site.

From the waterside the siting at the end of the peninsula on the bay side would pose navigational challenges as the shoreline is generally quite shallow and might necessitate dredging. From the landside, much of the area south of Fort Hancock is considered a wildlife habitat and used for limited passive recreation. A site at the current dock location or several hundred yards north of that site on what is currently U.S. Coast Guard property is proposed by Park Service staff as the preferred site for a new permanent facility.

- Based on initial field inspection, it was determined that either the current Fort Hancock dock site, or the site to the north was best suited from both a navigational and location standpoints.

3.3 Summary

Based on the screening of potential locations within the Gateway NRA, the following sites were chosen for continued consideration in this study, in terms of needed physical improvements, dock and facility design, associated costs, and market characteristics:

Staten Island
- Fort Wadsworth
- Great Kills Park Marina

Jamaica Bay/Breezy Point
- Fort Tilden/Riis Landing – Coast Guard Station
- Canarsie Pier
- Jamaica Bay Wildlife Refuge

Sandy Hook
- Fort Hancock

The screening criteria included: (1) a broad sense of the size and distribution of potential markets within the Gateway NRA and (2) feasibility of potential sites in terms of their physical characteristics. These sites are subsequently analyzed as the *destinations* of ferry routes that have *origins* across and around New York Bay, in Manhattan, Brooklyn, Queens, and New Jersey. These potential *origin* points are considered in Section 4.0.

4.0 Screening of Potential Sites: Visitor Origins

The destination endpoints of potential ferry routes at Gateway NRA need to matched with corresponding origin points, where visitors or employees would board the ferries departing for the park units. As with the destinations, origin locations have a major influence on potential markets. While the Park Service generally will not be developing the docks at potential origin points beyond the boundaries of its own properties, potential landing sites are identified and reviewed in this section in conjunction with assessing the overall feasibility of the ferry service concept. If the Park Service invests in necessary dock improvements at the Gateway NRA, will suitable docking facilities be available at visitor origin points to support park-based ferry services?

4.1 Market Characteristics

Market analysis is a critical component in the planning of potential ferry services. The viability of ferry service concepts rests to a significant degree on the number of passengers that will use the service. The implementation of new ferry services will require substantial investment in dock facilities, landside shuttle services, operation and possibly the purchase of vessels, and in many cases, physical improvements to the roads and pedestrian pathways linking docks to destinations within the parks.

Analyzing the market for park ferry services differs from the typical travel demand forecasting problem. A major complication is the need to anticipate the level of potential visitation demand, rather than simply the preference for one mode of transportation versus another. If park programs expand, potential demand can grow significantly.

Moreover, marketing can have a major impact on the size of potential markets. Public awareness is always a factor in developing markets for new transportation services. Most public transportation services, however, are oriented to the commuter market, which is more constant and easier to reach with conventional forms of informational media than are recreational travelers. Perhaps an even greater challenge is to increase public awareness of the resources and programs at the park itself.

The visitation levels cited in Section 3.1 represent an important determinant of the size of potential markets for ferry services. Of equal importance are several additional factors that relate to visitors' origins and travel characteristics:

(1) Travel origins: Where are visitors are coming from?
(2) Travel times of ferries versus automobiles and existing transit services: From what locations can ferries provide equal or better service to destinations at the Gateway NRA?
(3) Transit-dependent market: Residents and visitors in the New York metropolitan area who do not own or have access to automobiles.

These factors are addressed below for each of the Gateway NRA units.

4.1.1 Staten Island

Visitor origin data are available only for Great Kills Park, among the three Staten Island Unit sites. These data show that just over 80 percent of visitation is from Staten Island, supporting the logical presumption that, by virtue of its function and location, the site serves as a local recreational resource. While there are no specific data on the origins of visitors to Fort Wadsworth, the nature of the resource suggests that visitation is drawn from a broader geographic area.

Moreover, a combination of factors suggests a potential to significantly expand the number of visitors to Fort Wadsworth from points throughout the region. Transportation access currently is limited. Fort Wadsworth is located at the northeast corner of Staten Island and while access via I-278 is reasonably direct, routing on the frequently-congested roadway network is circuitous from much of the metropolitan area. Great Kills Park and Miller Field are adjacent to residential communities and do not have good regional highway access. Although it is possible to travel to the Staten Island Unit sites by public transit from Manhattan, the routing is time-consuming and inconvenient, requiring multiple transfers. Local bus service connecting the Staten Island Ferry and Fort Wadsworth operates on relatively infrequent headways through busy city streets, resulting in prohibitively long travel times. The mode of access to Fort Wadsworth for nearly all visitors beyond walking distance is the private automobile.

Ferry services would be competitive with automobiles from most locations in the metropolitan area, in terms of total travel time, assuming automobile,walking, or transit access to the ferry dock at point of origin. Table 4-1 below compares automobile travel times to vessel and total travel times by ferry (including landside access and boarding times).

Table 4-1 Travel Time to Fort Wadsworth* (minutes)

From	Manhattan	Brooklyn	NJ-Liberty State Park	Hoboken
Auto	45	30	45	55
Ferry - In-Vessel	23	17	23	33
Ferry - Total	43	37	43	53

* Times are approximate and will vary by type of vessel in service.

In addition to the attractive access charactersitics of ferry service, the prospects are good for substantially increasing visitation at Fort Wadworth through new programmatic activities, thus expanding the potential ferry service market. Park planners have identified several opportunities to increase visitation, including the continuing development of a school educational center that will attract students from all the NYC boroughs. Construction of the space is now complete, but additional funds, estimated at $4 million, are required for exhibit materials. Current plans call for Battery Weed to be open to the public, which will dramatically enhance the attractiveness of this site for

visitors. Longer-trm plans call for conversion of the former officer's club into a restaurant.

4.1.2 Jamaica Bay/Breezy Point

Visitation data show that the Jamaica Bay/Breezy Point unit draws over 50% of its visitation from Brooklyn, nearly 30 percent from Queens, and a smaller but still-substantial share from Manhattan. The natural beauty and recreational opportunities afforded at this unit are a rare asset in an area where urban development so dominates the landscape. There is likely to be significant potential to expand usage of these resources among a greater number of area residents and visitors to the area.

Ferry services could potentially attract existing users of the park who prefer the experience to driving in traffic. Driving times can be much longer than total ferry travel times (estimated to be about 1 hour, including landside access) during commuter rush hours and other times when traffic is heavy. The major source of ferry ridership, however, is likely to be residents of the same areas that currently contribute most of the unit's visitation (i.e. Brooklyn, Queens, and to a lesser extent, Manhattan) who do not own or have access to automobiles. Because the population is so large and the rate of private vehicle ownership is relatively low within the core of the New York City, the market from this source could be substantial.

4.1.3 Sandy Hook

Sandy Hook is primarily a regional park for New Jersey residents, half of whom come from nearby Monmouth and Middlesex Counties. Only 6.5 percent come from New York State. A ferry service operating on a limited schedule between Manhattan and Sandy Hook during summer weekends attracts about 5,000 riders per season, even with relatively high fares of $25 pr round trip, demonstrating that there is quantifiable demand for ferry service from this location. It is logical to expect that other urban centers, specifically those in Northern New Jersey on the western shore of Upper New York Bay and the Hudson River, might also represent a potential market. Higher rates of private vehicle ownership and lower levels of population, however, would constrain the number of ferry users at these locations, relative to Manhattan.

A major component of the potential market consists of potential visitors--numbering in the thousands on summer weekend days--who are turned away from Sandy Hook due to its limited parking capacity of 4,800 spaces. According to rangers at the Sandy Hook Unit, 11,000 vehicles pass through the contact station on peak days in July. There are, therefore, passengers in over 6,000 vehicles who face the prospect of being denied entry until other vehicles leave the park. To the extent that vehicle arrivals occur late in the day, however, when parking spaces become available, the total number of vehicles denied entry would be reduced below the maximum of 6,000.

Heavy traffic on peak days on the Route 36 approach to Sandy Hook is another factor that could motivate visitors to choose a ferry service option. Ideally, the ferry landing sites would intercept vehicles prior to their encountering major traffic delays. Sites should have good access to and from Route 36 and be "upstream" of congested segments of the roadway network.

4.2 Potential Dock Sites at Points of Origin

The basic criteria for evaluating the feasibility of potential dock sites parallel those applied to Gateway NRA sites in Section 3.2:

- presence of existing docks and their condition
- current use and resource sensitivity
- landside characteristics such as access to markets, which may be by walking, private vehicle, or public transportation, depending on the location
- pace for access, boarding, ticketing current use and resource sensitivity
- navigational or waterside considerations, such as depth of sea bed, tidal currents, wind and sea exposure, and proximity to shipping lanes.

Potential docking sites are reviewed in this section for each of the major market areas from which users of ferry services to Gateway NRA are likely to originate. These sites are shown in Figure 4-1 and listed in Table 4-2.

Figure 4-1
Potential Dock Sites

Table 4-2
Potential Ferry Route Origin Points:
Dock Locations

Manhattan

Departure Points:
- Battery Park
  -Battery Apron Slip #2
  -Marine Inspection Office Pier
- World Financial Center
- West 38th Street
- Pier 11
- South Street Seaport
- East 34th Street

Destination Points:
- Statue of Liberty
- Ellis Island
- Governor's Island
- Riverside Park/Grant's Tomb

Brooklyn

- Fulton Ferry Landing
- Brooklyn Army Terminal
- Bay Ridge Pier
- Coney Island
- Sheepshead Bay

Queens
- Hunter's Point

New Jersey
Upper New York Bay/Hudson River:
- Port Imperial/Weehawken
- Hoboken Ferry Terminal
- Colgate Ferry Terminal/Jersey City
- Liberty State Park/Central Railroad Terminal

Bayshore:
- Perth Amboy Ferry Terminal
- South Amboy Ferry Terminal
- Keyport
- Belford Ferry Terminal
- Atlantic Highlands
- Highlands

Long Island
- JFK Airport
- Rockaway

4.2.1 Manhattan

Manhattan is a potential market for all three Gateway NRA units. In addition, various Manhattan Historic Sites that are administered by the Park Service properties may benefit from improved water transportation access. Thus, some of the sites reviewed in Manhattan have the potential to serve a dual purpose, as both departure points for the Gateway NRA and destinations serving Manhattan Sites. Both purposes are considered in this section, but the priority is providing departure points for Gateway NRA destinations. It is considered advantageous for docks to be located at sites administered by the Park Service to facilitate the management of route franchises.

Some sites considered as potential departure points for ferry services already have functioning ferry landings, but require improved or new services. Others may have landings but may need alterations to provide the access and /or level of service desired. Other sites may require new landings.

None of the existing sites currently provides adequate ferry docking access meeting Federal ADA guidelines. The State of New York does not as yet have any building codes covering access in the marine environment and appears to be awaiting the forthcoming adoption of standards at the Federal level. Hence, existing ferry dock sites in Manhattan and at other New York Harbor locations do not provide what might be considered compliant access at all average tide conditions based on landside codes and standards.

Origin/Departure Sites

Battery Park:

Battery Park is located at the southern-most tip of Manhattan and as such provides ferry landings for service to the Statue of Liberty and Ellis Island, operated by the Circle Line under a concession agreement with the Park Service. The Park Service has jurisdiction only over Castle Clinton, but assists the park owner, the City of New York, in patrolling and maintaining related facilities. The recently renovated apron of the park includes approximately six fixed ramp and fender slips that are used by double deck ferries, loading to upper or lower deck depending on the tide. The exposed location at the southern tip of Manhattan is susceptible to all wake and wash conditions of the converging Hudson River and East River shipping channels, which cause considerable ambient wave action along the curving face. In addition, the park perimeter faces a long fetch to the southwest of approximately 4 nautical miles towards Staten Island. Several slips are designated for year round use by the Statue/Ellis ferry vendor.

Additional slip space is desired by the Park Service to provide ferry links to the Gateway NRA units. Several options have been identified in conjunction with this study**.** ***Slip #2*** is located close to the Park Service's Castle Clinton/Battery Park visitor facilities and ranger station, and may be available for Park Service concession use. The ***Pier A***

Building site, with restoration for mixed public and private uses nearing completion, has a protected but narrow slip on the north side. This slip site is apparently already committed by the private developer of the site for use by excursion vessels. While this site might have been a possibility for ferry berthing, its limited width and length combined with future commitments to excursion uses precludes the location for further consideration as a departure point for service to Gateway NRA. The ***Marine Inspection Office/Coast Guard*** facility next to the Staten Island South Ferry Building has three finger piers and several small basins protected by stone jetties. This site, which is actively used only on the southern most pier nearest to South Ferry, offers several options for new ferry landings while affording some protection from the ambient wake and wash conditions.

Battery Park site is well-situated as a new ferry departure site for the Gateway NRA, guided tours of historic harbor fortifications, and expanded services to the Statue and Ellis Island. The site will continue to be a major visitor destination, with the combination of Castle Clinton, the major restoration of the perimeter walkway which is nearing completion, and the spectacular panoramic views of New York Harbor. When plans for Governors Island are complete, including additional Park Service venues, Battery Park will be the logical ferry landing site. The site has excellent transit connections to Manhattan and to the other NYC Boroughs, with multiple subway lines stopping within a 5-minute walk and the Staten Island/South Ferry terminal adjacent. Commercial parking lots are available nearby with excess capacity on weekends, when the Wall Street offices are closed. Multiple landing facilities may be needed at Battery Park in the coming years to accommodate the variety of ferry services which may stop at the site. With its excellent location and transit connections, the site is a strong candidate to become a Manhattan ferry hub catering to New York City residents as well as to visitors.

Priority sites for service to Gateway NRA:

- Battery Apron Slip #2
- Marine Inspection Office Piers

Required improvements and related design issues are discussed in Section 5.2.

Additional Manhattan Origin/Departure Sites:

Manhattan has numerous existing ferry docks, many of serve in-bound commuters. Some of thes sites have excellent transit connections, which could provide access from multiple origin points for outbound trips to Gateway NRA. In November of 2000, the Metropolitan Waterfront Alliance released a draft report and announced plans for an Upper New York Bay "Harbor Loop" to provide a shuttle ferry for commuter and recreational purposes connecting 25 sites in New York and New Jersey. There are likely to be opportunities for integrating services to Gateway NRA and other potential sites in the National Parks of New York Harbor with routes in the Harbor Loop, should both of these concepts be implemented.

Sites considered as potential departure points for services to Gateway NRA are identified below.These sites currently are used as landings for one or more ferry services as noted. As with most other ferry terminals in the New York Harbor area, none of these sites is ADA compliant, although many have long ramps and are generally easy to use. Various options exist for connecting current ferry services during off peak seasonal periods from these Manhatttan sites to a central lower Manhattan distribution point at Battery Park. Sites included in the proposed Harbor Loop plan are designated with an asterisk.

World Financial Center* (Existing): Located in the shadow of the World Trade Center at Battery Park City,the existing floating barge terminal is controlled by the Port Authority. The terminal is used by multiple cross Hudson ferry routes operated by NYWaterway serving the Wall Street area of lower Manhattan.

West 38th Street (Existing) One of the few privately owned ferry terminals in Manhattan, the site serves multiple cross Hudson routes operated by NY Waterway and serving the Midtown area.

Pier 11 (Existing): Located on the East River on the southeastern side of lower Manhattan, the recently renovated pier facility serves several commuter and excursion routes, including the Sea Streak service from Monmouth County.

South Street Seaport* (Existing): Just north of Pier 11, the landings currently serve primarily excursion and charter ferry routes, at this popular visitor destination.

East 34th Street (Existing): Also located on the East River, the floating docks serve several commuter and airport shuttle routes, and provide bus links to other midtown work destinations. Current ferry operations include Sea Streak and NY Fast Ferry routes to Monmouth County as well as the LaGuardia water shuttle and Queens routes operated by NYWaterway.

Destination Sites

Several dock sites that are not viewed as potential departure points for routes to Gateway NRA are considered in this study because they could be important nodes in the National Parks of New York ferry network. These sites are located at Liberty, Ellis Island, and Governor's Island.

Statue of Liberty/Ellis Island: The two island dock sites are among the most heavily used in the Harbor today and promise to attract more visitors in the future based on current trends. Primary concerns at these dock sites relate to the accessibility of the ferry landings and the capacity of the docking facilities to meet future visitation needs. While the docks and landings are similar to those at Battery Park, they would not be considered ADA accessible at the full tide range. It should be noted that the current Federal efforts underway to prescribe ADA access standards for vessels are expected to result in vessel

requirements and configurations that are not reflected in the multi-deck operations currently used by the Circle Line for the ferry concession. Phased dock improvements may need to address the two issues of ADA access and berthing capacity at both sites.

Statue of Liberty: There are currently two finger piers at the Statue of Liberty, with the pier on the southwest face of the island used for ferry boardings. Both sites are exposed to wind and wave action in the Upper Bay and are without the protection of breakwaters. This exposure is likely to delay the docking and loading process during periodic adverse wind and weather conditions. The pier is used actively year round, seven days a week transporting visitors from Manhattan and Liberty State Park to the Statue. At a site visit to the active southwest pier, it appeared that there are three landing gates with fixed height ramps for the larger Circle Line ferries and one berth for the smaller Park Service vessels. Apparently, the heavy demand for visitors to the Statue often necessitates the stacking of waiting vessels for dock space to become available, while passengers queue on the pier and the approach paths. The long lines of passengers may be attributed primarily to the marketing and operations patterns of the current ferry concessionaire, and not necessarily to the dock configuration. Capacity and crowding issues at the Statue itself are a significant concern, as discussed in the report Appendix.

Ellis Island: There is one primary ferry landing area with multiple berthing slips at Ellis Island along the northeast face of the basin that occupies the center of the island. The ferry landing slips or gates at Ellis Island are similar in detail to those at the Statue of Liberty and Battery Park, with fixed ramps along the bulkhead. The basin provides a much more protected landing location with wind and wave exposure only to the southeast. The basin also has potential for additional future landings at the head and southwest bulkhead, should they be needed. Although not as continually overcrowded with visitors as the Statue, visitation is increasing to the recently restored main immigration building and could require expanded ferry facilities in the future.

The ferry facility challenges at the Statue and Ellis are somewhat different than at many of the other sites considered. The dock needs are to provide adequate capacity to handle the growing demand for visitation, while also meeting ADA access requirements, both of which will require substantial additions to the existing pier and bulkhead respectively. The overcrowding and long waiting periods, particularly at the Statue, may also necessitate changes in the concession agreement when it is rebid in 2004.

Additional Potential Destination Sites:

Two other Manhattan-based sites appear to have potential for direct ferry service links: 1) Riverside Park and Grant's Tomb located at 125th Street on the upper west side, and 2) Governors Island located a short distance south of the Battery.

The **Riverside Park/Grant's Tomb** site is located enticingly close to the Upper West Side Hudson River shore. The site could serve a dual purpose: as a destination for both the park and Grant's Tomb, as well as a departure site for connections to other Manhattan

Park sites and the Gateway Parks. While ferry connections to other Manhattan Park sites might be desirable, there are several important constraints. The site has no suitable ferry landing at present. Pedestrian connections from the river edge to the monument would be constrained by substantial elevation changes and the presence of the Henry Hudson Parkway and its tangle of access ramps. The location of a ferry landing would need to be coordinated with an access point across the parkway and connections to residential neighborhoods.

By contrast, **Governor's Island** potentially offers an attractive and accessible ferry destination, depending on final masterplan uses for the island. The layout of the island includes vacated Coast Guard facilities, historic structures such as the companion fort to Castle Clinton, substantial parade grounds, and open space. It is not only an inviting potential destination, but indeed relies solely on ferry service for access, with current intermittent service by roll-on – roll-off car ferry. There is a passenger ferry landing at the north end of the island that used to be linked to the Marine Inspection Building docks at Battery Park

As of the completion of the current study, the future uses of the island are still undecided. While it is virtually certain that there will be public park attractions, quite likely under the auspices of the Park Service, ferry opportunities and uses will need to be considered at a later date when masterplans are further advanced and an implementation schedule is determined. For example, if there is a substantial residential component to the Governor's Island masterplan, a new ferry service might combine commuter and visitor services. When those plans and development commitments are further along, a market analysis and dock needs assessment should be conducted.

4.2.2 Brooklyn

Five Brooklyn sites are considered as ferry origin or departure points to Gateway NRA, particularly to Jamaica Bay/Breezy Point and Fort Wadsworth: Fulton Ferry Park, the Brooklyn Army Terminal, the Bay Ridge Pier, the Coney Island Pier and Sheepshead Bay. Each site has advantages and weaknesses and would serve different resident populations. Sites designated with an asterisk are included in the proposed Harbor Loop plan.

Empire-Fulton Ferry State Park*: This site is on the East River between the Brooklyn Bridge and the Manhattan Bridge. A ferry landing is located at the south end of the park at the Brooklyn Bridge and serves the primary purpose of offering an alternative transit mode for Brooklyn residents. Ferry services have been provided periodically to Pier 11 in lower Manhattan. The surrounding area contains a mixture of uses with high levels of activity, including Brooklyn Heights and other residential neighborhoods. Stops on the A, C, and F subway lines are within convenient walking distance, providing excellent transit connections to much of Brooklyn and parts of Manhattan and Queens. By water, the site would be approximately 1 nautical mile further in distance from any of the Gateway NRA sites than the proposed Battery Park terminal.

The site would be an attractive departure point primarily for Brooklyn residents within walking distance of the ferry landing, but could also attract significant numbers of passengers via subway connections. In addition, the park and surrounding area are being marketed by the City as a tourist destination accessible from Manhattan by walking across the Brooklyn Bridge.

Brooklyn Army Terminal*: This complex of buildings, which has been converted into a large mixed use office, retail and residential complex, faces Upper New York Bay. An existing floating pier is used as a weekday commuter ferry landing for Brooklyn residents heading for lower Manhattan, and could also become a stop on a ferry route to Jacob Riis Park. There is an available weekend parking supply, but transit is limited to bus service and a subway stop approximately one mile away.

Bay Ridge Pier*: Located to the south of the Brooklyn Army Terminal, this site recently has been restored as a recreational facility for the residential neighborhoods across the Belt Parkway. While within walking distance of a somewhat larger residential population than the Army Terminal site, there is currently no floating dock facility and very limited parking at the site. The transit connections are limited to bus services and the subway, which is an approximately one-mile walk.to the east, as in the case of the Brooklyn Army Terminal. The availability of parking and presence of a currently functioning ferry landing favor the Brooklyn Army Terminal over the Bay Ridge Pier to serve the same general residential population.

Coney Island: The amusement park has a long "ocean" pier in a central location. The advantages of this site are a large captive audience of park visitors and good subway connections to a portion of Brooklyn. A significant disadvantage is that there are no residential neighborhoods within walking distance. Moreover, the existing high level ocean pier itself is not actively used for ferry berthing, because of its exposure to wave and storm action at the entrance to New York Harbor and the Atlantic Ocean. A heavy-duty breakwater or basin would be needed to adapt the pier for ferry use, in addition to floats and ramps up to the rather high deck level. The associated expense would be disproportionate to the likely size of the ferry market originating at this location.

Sheepshead Bay: This location offers a variety of protected ferry landing sites including a number of existing docks, with ample parking. The sites are separated from residential neighborhoods by the Beltway Highway and do not have good transit access. The available parking is used primarily by recreational boaters during summer weekends, which might conflict a with "park and float" stop in Sheepshead Bay.

- The most promising ferry origin or departure sites in Brooklyn are the Fulton Ferry Landing and Brooklyn Army Terminal, from the standpoint of proximity of residential populations and transit connections. Both have functioning ferry docks.

4.2.3 Queens

Hunter's Point is adjacent to a waterfront park and near the commuter terminus for the Long Island Rail Road. The attractive park provides for a ferry destination, while the intermodal connections offer opportunities for a departure link. Agreements will be needed for new ferry services to use the ferry landing. The availability of an existing landing indicates the potential for near term ferry operations to the site, depending on routes and market demand and/or the interest of the existing operator to extend current services seasonally and during weekends. Next steps would include assessment of dock management arrangements, berthing capacity, ADA access and landside support needs prior to introducing new seasonal ferry services.

4.2.4 New Jersey

Potential origin/departure ferry landing sites in New Jersey fall into two categories; 1) Hudson River/Upper New York Bay sites which could potentially provide access to the Manhattan departure points for Gateway Park ferry links, and 2) Bayshore sites which might provide "park and float" links to the Sandy Hook Gateway Park.

Potential Hudson River ferry landing sites include the following:

Port Imperial/Weehawken (Existing): With parking for over 4000 cars and a variety of NYWaterway ferry services to Manhattan, including year round weekend links to Manhattan, the Weehawken site currently provides seasonal linking shuttle services to the Sandy Hook ferry route. The aging floating dock is currently accessible. A planned replacement terminal will offer improved access and amenities. Since much of the parking is currently used by weekday commuters, there would be ample parking capacity during seasonal weekend demand periods. There is also bus transit service and a future light rail link to the terminal planned.

Hoboken Ferry Terminal (Existing): The Hoboken terminal is currently an active ferry departure point for NYWaterway shuttle links to World Financial Center in lower Manhattan. The dock has particularly good transit access via commuter rail, PATH, and the Hudson Shore light rail systems, but only limited parking resources. The terminal is also within walking distance of the downtown Hoboken residential area. The transit access offers potential access to a larger hinterland, particularly for ferry links to waterfront park sites in Manhattan.

Colgate Ferry Terminal/Jersey City (Existing): Another existing dock and shuttle service connects Jersey City to Manhattan with a short 5 minute ferry ride to World Financial Center. The site has commuter parking which potentially would be available for seasonal weekend use for a shuttle link to Lower Manhattan and Sandy Hook. While the site would serve Jersey City residents well, the auto access to highways is poor. The site also has transit connections, including the new Hudson Bergen Light Rail Transit line. The current ferry service is operated by NYWaterway.

Liberty State Park/Central Railroad Terminal* (New): The park includes multiple ferry landing sites, with the most promising potentially at the restored Ferry Building, located a short distance from Ellis Island. While there is a large parking lot adjacent, it is reserved for use by State Park visitors. The Park enjoys good regional highway access, but relatively limited transit connections. There is a second ferry landing along the basin adjacent to the park, which has more ample parking. The Liberty State Park sites offer the advantage of alternative ferry connections to the Statue of Liberty and Ellis Island as well as to Manhattan. The site would require dock improvements in order to meet ADA standards and accommodate additional new ferry services. A choice might need to be made between the Park site and Colgate/Jersey City, which are in close proximity and would draw from similar residential areas. The Jersey City site appears to be the better choice, due to its superior transit access and close proximity to high-density residential neighborhoods.

The potential Bayshore ferry landing sites are in Middlesex and Monmouth counties along the New Jersey shore of the outer New York Harbor. These sites include both existing and proposed docks. The sites could provide "park and float" ferry services to Sandy Hook Gateway Park, primarily on busy summer weekends when Route 36 regularly experiences traffic tie-ups in the Highlands area of Monmouth County.

Perth Amboy Ferry Terminal (Existing): The recently completed ferry terminal is actually located at the southeast end of the Kill Van Kull, replicating the town's historic landing. It is located in a predominantly residential area with a limited amount of parking, much of which is used by recreational boaters during summer weekends. The site is also somewhat remote from the highway network and requires driving across the length of Perth Amboy. There are plans for a future commuter ferry service but no commitments form operators so far. The site is the farthest west along the Bayshore and is approximately 12 nautical miles by water from Fort Hancock. The site is not a choice location for departures to Sandy Hook, primarily because of its parking limitations. Another disadvantage compared to some other potential sites is the considerable distance that would need to be traveled by water.

South Amboy Ferry Terminal: A commuter ferry terminal is proposed for South Amboy in close proximity to the Shore Line of the NJ Transit commuter rail system. The site has good highway access and an ample weekend parking supply would be available at the site. The proposed dock location would also be about 12 nautical miles from Sandy Hook. The site is far enough upstream from the Route 36 congestion points to provide a worthwhile park and float location for New Jersey and Staten Island residents headed for Sandy Hook by car and also offers an alternative commuter rail connection.

Keyport: Keyport has a town pier suitable for ferry use and is located approximately 10 nautical miles by water from Sandy Hook. There is a limited amount of parking near the dock, which is actively used on summer weekends, and the site is some distance from Route 36, requiring a drive across the town of Keyport. There is also a long, narrow

approach channel to deeper water that is heavily used by recreational boaters during the summer season. For these reasons, the Keyport site is not viable as a terminal for Park Service ferry operations.

Belford Ferry Terminal (In construction): A new ferry terminal is currently in construction at Belford, located a short distance from Route 36 and 5 nautical miles by water from Sandy Hook. The site will be used primarily for weekday commuter service with NYWaterway as the designated operator. There will be a 500-space parking lot with ample weekend capacity for feeder service to Sandy Hook. As there is likely to be weekend service to Manhattan from Belford, the Sandy Hook service could readily be provided as an incremental addition, "piggy-backing" on that service. The site is well situated, in terms of proximity to Sandy Hook by water and the highway network by land.

Atlantic Highlands: Existing commuter services operate to Manhattan and the dock site is a short distance from Route 36. The short water distance to Sandy Hook is an advantage, and the link could be added as a piggy-back on the commuter service during the weekdays. However, summer weekday parking is limited by commuter use and weekend parking is limited by the active town marina and nearby restaurant. Expansion opportunities for parking are limited and costly, based on current land ownership and use patterns. During weekdays the site has no excess parking and is close to the Park entrance. For these reasons, the Atlantic Highland site is not suitable as a base for service to Sandy Hook or other sites in the National Parks of New York Harbor.

Highlands: Similarly, there are two commuter ferry services to Manhattan from Highlands that pass by the proposed Sandy Hook dock location. While the two Highlands docks are near Route 36, they are also very close to the Park entrance. On summer weekends, anyone driving as far as Highlands will already have encountered the traffic jams at the approach to the bridge. During the week, anyone driving would be too close to the Park entrance to have any reason to stop and take a ferry.

4.2.5 Long Island

Two sites on the south shore of Long Island were considered as departure points for possible piggy-back services to Gateway NRA, added on to longer distance transit and commuter ferries. Neither site currently has a ferry dock or parking facilities. Therefore, both would be considered longer-term options. Because of the long water travel distances to Manhattan, any service from these sites to destinations in the National Parks of New York Harbor would need to be secondary and combined with other ferry services.

JFK Airport (New): Located on the northeast side of Jamaica Bay, JFK Airport has been proposed as a ferry site for transporting air passengers to Manhattan as well as conveying smaller air freight packages. If such services were initiated and parking and/or transit links were available at the site, the incremental addition of "piggy-back" stops at the Gateway NRA and Battery Park might be feasible. It is unlikely that service to the Parks

alone could generate enough ridership to justify the substantial infrastructure and operations costs associated with such a service.

Rockaway (New): Another site considered is in Rockaway between the Marine Parkway Bridge and the Cross Bay Bridge. This site between the Marine Parkway Bridge and the Cross Bay Bridge was considered as a base for a combination of commuter and park-based ferry services. As with the JFK Airport site, such a ferry landing would rely on a primary operation such as a year round commuter link for the Rockaway peninsula communities. A feeder service to the Gateway NRA then could be attached to the commuter service. As with JFK, a new landing and parking would be needed to initiate service.

Both of these sites were judged to be impractical as departure points for ferry routes serving the National Parks of New York Harbor, because of their dependence on non-park related ferry services, their need for substantial infrastructure investment, and in the case of Rockaway, redundancy with the more logical Riis Landing site.

4.3 Summary

The review of potential ferry origin landing sites indicated that ferry services connecting Gateway NRA to docks at the following locations represent the most viable routes.

Manhattan

- Battery Park – primary site

Possible secondary, feeder routes might also be initiated from the following sites, which have existing, operational docks:

- World Financial Center
- West 38th Street – secondary feeder
- East 34th Street – secondary feeder
- Pier 11

Expansion of these docking facilities may be necessary if the number and frequency of ferry services continues to increase.

In addition to the above origin ferry landings, modifications of existing facilities are recommended as follows at major destination ferry landings administered under Park Service auspices:

- Statue of Liberty – modify existing southwest finger pier
- Ellis Island – modify and expand existing basin bulkhead

Brooklyn
- Fulton Ferry Landing
- Brooklyn Army Terminal

Queens
- Hunters Point

New Jersey
- Port Imperial/Weehawken
- Hoboken Ferry Terminal
- Colgate Ferry Terminal/Jersey City
- Liberty State Park
- South Amboy
- Belford

There are existing ferry landings at all of the above locations, except South Amboy and Belford, New Jersey, that are suitable for accommodating ferry service to Gateway NRA. Appropriate docking facilities currently are under construction at Belford and are proposed for South Amboy.

5.0 Terminal Site Improvements

A checklist of site and facility conditions, as summarized below, was used to determine the types of physical improvements that would be needed at those sites judged to be the most viable for serving ferry routes to and from the National Parks of New York Harbor.

Site Condition Checklist:

- Navigation: terminal location must adapt to local navigation conditions.
- Wind, weather and fetch: historic and seasonal wave action, geographical factors such as fetch, currents, tides and other weather activated conditions
- Environmental: location and design to respect environmental conditions.
- Regulatory and Permitting Requirements: design to consider all local, state and federal codes and permit requirements.
- Landside Access: site should have good transit, highway, street and/or pedestrian/bicycle access.
- Intermodal Connections: existing and new intermodal links are needed at most sites varying according to whether it is an origin, a destination or both
- Parking: may vary from site to site depending on origin or destination role and location.
- Site Conditions Survey: for final recommended sites current land and water surveys will be required for final design.
- Proximity to visitor destination and/or population center: needs will differ depending on the origin or destination character of the site.
- Historic resource impacts: resources need to be respected and enhanced at terminal locations.
- Property ownership/ current uses: for destination sites NPS ownership is essential; for origin sites, agreements will be needed with current owners and/or managers.
- Site area: water and landside site area needs to be sufficient for initial phases as wellas longer term expansion needs.
- Piers and Floats: various combinations of fixed piers, ramps and floats may be needed in response to location and use needs.
- Breakwater/Wave Attenuation: sites exposed to wind, wave and/or wake action may require
- Dredging: new sites should avoid locations requiring substantial dredging; existing sites may require maintenance dredging.
- ADA Access: dock designs should include consistent ADA access solutions, anticipating federal rule makiing.
- Safety features: consistent treatments of terminal sites for safety including lighting, communication, and maritime environment needs
- Amenities: origins and destinations should provide appropriate and consistent user support needs for respective seasons of use.
- Waiting and Ticketing: waiting areas should be included at most origins and all destinations, including sheltered waiting; flexibility for different operators' ticketing needs will be needed primarily at origin sites..
- Signage and Information: a consistent system of multi-media information and directional signage should be applied to all sites and major approaches.

The assessment of site conditions and needs for the short list of most promising sites is summarized in the following tables, which are divided into Gateway NRA sites (Table 5.1), Manhattan Sites (Table 5.2), and other sites (Table 5.3). The tables include assigned

site priority, status of docks at each site, waterside and dock layout needs, landside and upland needs, and general site issues.

Table 5.1: Gateway Park Units Terminal Site Conditions and Needs

Park Unit and Site	Site Prior-ity	Dock Status	Waterside and Dock Needs				Landside and Upland Needs				**General Issues**
			ADA Access	Dredge Needs	Break-Water	Pier/ Floats	ADA Access	Parking/ Transit	User Amen- ities	Prop'y Owner ship	
Sandy Hook:											
- Ft. Hancock	Core	Exist'g temp. priv.	No	No	None/ Nw/sw needed	Small pier/ season Floats	No paths/ Gravel parking lot	~50 spaces/ no transit	None	NPS	Needs permanent terminal
Jamaica Bay:											
- Ft. Tilden/ Riis landing	Core	Exist'g Temp NPS	No	No	Yes/ Repair	Yes/ Temp. spud Barge	No paths/ Gravel lot	Misc. park'g/no transit	None	NPS/ Coast Guard	Needs perma-nent terminal
- Canarsie Pier	Second	Exist'g	No	No	None	Yes	Yes	Park'g/ bus	Yes	NPS	Expand ferry conces-sion
Staten Island:											
:- Ft. Wadsworth/ Torpedo Pier	Core	None	No	No, Pull Piles	None	Partial pier/ no floats	No paths	No park'g/no shuttle	None	NPS	Needs temp. and perma-nent Terminal

Table 5.2: Manhattan Park Unit Terminal Site Conditions and Needs

Park Unit and Site	Site Priority	Dock Status	Waterside/ Dock Conditions /Needs				Landside/ Upland Conditions/Needs				General Issues
			ADA Access	Dredge	Break-Water	Pier/ Floats	ADA Access	Park/ Transit	User Amen-ities	Prop Owner-ship	
Manhattan											
Battery Park: - MIB	Core	Part'l Exist'g	No	No	No	Exist. Pier/ new floats	Yes	No park/ good transit	None	NPS/ SNY	NPS needs expanded dock capacity
Statue of Liberty: - Southwest Dock	Core	3 Exist'g slips	No	Yes	No	Exist. Pier/ new floats	Yes	NA	Limit-Shelter	NPS	Current concessi on uses dock capacity
Ellis Island - Basin	Core	2 Exist'g slips	No	No	No	Exist. Pier/ new floats	Yes	NA	Yes	NPS	Current concessi on uses dock capacity
Riverside Park: -Grant's Tomb	Future	None	-	-	-	New pier/ new floats	No	No park, no transit	No	SNY/ NPS	No dock site existing or proposed
Governor's Island: - Passenger Dock	Future	Exist'g	No	No	No	Exsit. Pier/ new floats	Yes	No park needed	No	USCG	Existing pass-enger dock has potential for future uses

Table 5.3: Other Terminal Site Conditions and Needs

Location and Site	Site Priority	Dock Status	Waterside and Dock Needs				Landside and Upland Needs				General Issues
			ADA Access	Dredge	Break-Water	Pier/ Floats	ADA Access	Park/ Transit	User Amenities	Prop Ownership	
Manhattan:											
- W. 38th St.	Second Feeder	Exist'g	No	No	No	Yes/ Yes	Yes	No/ drop/ bus	Yes	Priv.	Private Operator
- E. 34th St.	Second Feeder	Exist'g	No	No	No	Bulk./ Yes	Yes	No/ drop/ bus	Yes	CNY	Expand dock space
- Pier 11	Second Feeder	Exist'g	No	No	No	Yes/ Yes	Yes	No/ drop/ Bus/ sub	Yes	CNY	Multiple operators
- World Financial Center	Second Feeder	Exist'g	No	No	No	Bulk/ Yes	Yes	No/no	Yes	PA/N YNJ	Expand dock space
Brooklyn/ Queens											
- Hunters Point	Second Feeder /dest'n	Exist'g	No	No	No	Yes/ Yes	Yes	Yes/ LIRR/ Bus	Yes	SNY/ CNY?	Seek dock agreement
- Fulton Street Ferry	Second Feeder /dest'n	Proposed	-	No	No	Proposed	?	No/ Bus/ sub	No	CNY?	Dock completion and mangement
- Brooklyn Army Terminal	Second Feeder	Exist'g	No	No	No	Yes,/ Yes	Yes	Yes/ Bus	No	CNY?	Dock management
- Sheepshead Bay	Second Feeder	Exist'g	No	No	No	Yes/ Yes	?	Yes/ Bus	No	CNY/ Conces'n	Dock management
- Rockaway	Future Feeder Commute	None	-	?	?	No/ No	No Site	?	?	?	Needs site and plan
- JFK Airport	Future Feeder Freight	None	-	?	?	No/no	No Site	?	?	?	Needs site and plan
New Jersey											
- Weehawken	Second Feeder	Exist'g /Prop.	Yes	No	No	Yes/ Yes	Yes	Yes/ Bus	Yes	Priv.	New prop'd dock & management

- Hoboken	Second Feeder	Exist'g /Prop.	Yes	No	No	Yes/ Yes	Yes	No/ yes	Yes	PA/NJ DOT	Expand Dock
- Jersey City	Second Feeder	Exist'g	No	No	No	Yes/ Yes	Yes	Yes/ Yes	No	Priv.	Seek dock agree-ment
- Liberty State Park	Second Feeder /Dest'n	Exist'g /Prop	No	No	No	No/no	No Site	Yes/ no	No	SNJ	New dock and manag-ement
- South Amboy	Second	Prop'd	-	?	No	No/no	No Site	No/ No	No	NJ DOT	New dock and mange-ment
- Belford	Second	In Constr.	Yes	Yes	No	Bulk./ Yes	Yes	Yes/ yes	Yes	Mon-Mouth Cty	Dock comple-tion

5.1 Terminal Program Needs and Dock Specifications at the National Parks of New York Harbor

The subset of potential sites judged to be most promising were subjected to more detailed assessment following the initial screening, summarized in previous sections. The results of this analysis are presented in this section.

5.1.1 Gateway NRA Sites

Fort Wadsworth/Torpedo Pier

While plans have been prepared to restore the bulkhead and historic fixed Torpedo Pier at Battery Weed, work has not yet started on the project. A ferry landing is proposed that could be installed prior to and during the restoration and reused at the site after completion. A concept design for the interim installation of the ferry landing is described in Section 6.2.1.

Dock and Waterside Requirements: The requirements are for a ferry landing as a central point on the core ferry system to accommodate vessels up to the 90-foot length assumed for service to Sandy Hook and Riis Landing. A detailed feasibility analysis and plan were prepared for the Park Service (by Langan Engineering and Environmental Services) for restoration of the historic Torpedo Pier and Battery Weed bulkhead. As there is no specific time frame for the restoration, it may be advantageous to install a spud-supported float and ramp system in the interim to allow for access to Fort Wadsworth by water in the short term. A minimum float of 20' x 90' would be recommended, although a larger barge could be used. The landing would need to provide a berth for the large ferries.

Landside and Upland Requirements: Immediate landside needs would include a waiting shelter and restrooms near the foot of the Torpedo Pier, information and directional signs, a

vehicular drop-off near Battery Weed, and pedestrian pathway connections from the now overgrown area surrounding the pier. In the longer term, after the ferry system is established, there may be a need for a 50 to 100 space parking area to be shared by ferry users from Staten Island connecting to other NPS park units and Battery Weed visitors. The vehicle drop-off may need to be large enough to accommodate several shuttle buses to transport ferry visitors to the other more distant and uphill visitor sites at Fort Wadsworth.

Riis Landing/Breezy Point

A temporary ferry landing has been in place at the proposed Coast Guard Basin since September 2000. Fuller use of the landing site would require replacement of the facility with a smaller floating barge and a reorganization of the other basin docks. A concept design for the permanent Riis Landing terminal is described in Section 6.2.1.

Dock and Waterside Requirements: The Coast Guard basin provides an excellent setting for a year round ferry landing, offering a protected area free from the chop and wave action which builds up on the Rockaway Inlet. However, the basin requires reorganization of its existing floating and fixed piers to allow for a reasonable turning basin area and berthing for the larger ferries and smaller Coast Guard and Park Service vessels. The current temporary spud barge ferry landing was located to minimize other changes within the basin and, with its large footprint area, doesn't allow adequate area for the larger ferries to navigate the small basin area. While there are many potential layouts for the basin, several components would be common to any plan; 1) providing a two- berth ferry landing for up to 90 foot vessels, 2) retaining ample layover berthing for existing and projected Coast Guard, NPS and other agency vessels in the 20 to 40 foot range, 3) allowing for ADA ramp access to the ferry landing from the adjacent Fort Tilden Rail Pier property, and 4) repairing the existing outer breakwater.

Landside and Upland Requirements: The landside needs for the terminal are based on anticipated multiple uses of the ferry terminal, including the seasonal Core ferry route from Battery Park, seasonal excursion connections to Jamaica Bay and Canarsie Pier, and possible year round commuter service from Riis Landing to Manhattan. The combined ferry uses require standard upland improvements including sheltered waiting area, restrooms, vehicular dropoff, and parking. Such improvements would be located on the Fort Tilden Rail Pier NPS property to the west of the basin, and sited near the current ramp connection to the ferry landing. Parking needs will grow as ferry ridership and uses evolve. A recommended target of 100 – 150 spaces for the Fort Tilden Pier site could be phased in as plans for the full site buildoutare finalized. If the commuter ferry is successful, an additional 250 to 300 spaces may be needed offsite, preferably within easy walking distance across Rockaway Beach Boulevard at Fort Tilden and/or at the Jacob Riis parking lot with a pathway and shuttle bus connection.

There is also an opportunity for creating a bayfront park around the ferry landing as a mini-destination and new attraction for ferry visitors as well as other ferry users, including Rockaway commuters and Breezy Point residents. Such a waterfront park would serve as a gateway and new gathering spot for the Fort Tilden/ Jacob Riis Park resource. The site could become a multi-

season attraction similar to Canarsie Pier, with an attractively landscaped beach front and a possible fishing pier.

Canarsie Pier

Canarsie Pier is an attractive potential secondary ferry terminal site that could be a feeder service to a local primary hub at Riis Landing. Guided tours of Jamaica Bay also could be based at the Riis Landing hub. The floating dock at Canarsie Pier appears to be suitable for accommodating new ferry services, subject to modifications of current dock management concessions. Ramp modifications to the floating dock may be needed to provide ADA access, at such time as new services are introduced. A more detailed assessment of the dock, water depths and navigation conditions should be conducted to determine the types of vessels that can use the facility. Additional float space may be needed if multiple new services an operators are attracted to the terminal. Because of the availability of a floating dock, new services could be initiated in the short term.

Sandy Hook/Fort Hancock

A new permanent dock would be provided at one of two possible sites on the Sandy Hook Bay side of Fort Hancock, replacing the current privately maintained spud barge. A concept design for the terminal is described in Section 6.2.1.

Dock and Waterside Requirements:

Two site variations are proposed for further consideration in final design; 1) at the current Post Chapel site, which includes a small pile supported transitions pier and is on NPS property, and 2) a new site approximately 700 feet to the north, which is currently on USCG property. Three design factors are critical and should be noted. The gradual sloping beach contours require location of the landing area to be approximately 100 to 150 feet outshore of the current bulkhead depending on the location and angle of the dock. Substantial wind and wave exposure at the site must be considered, particularly if the dock is to be usable during the off-peak months, and most likely will require some type of wave attenuation. The further north the dock is located, the greater the protection provided by the "Hook" from prevailing winter weather patterns (northeast, north and northwest winds). The location and configuration of the docks need to be clear of the navigational needs of the existing Coast Guard dock basin to the north of the sites being considered. Based on these factors, the northern most site is clearly preferable for either an interim or year round dock location.

Stakeholder interviews and site inspection suggest that a breakwater is needed to provide a protected landing area year round, and particularly to allow for sheltered boarding during strong westerly winds. A floating barge secured with spud piles connected to the shore by long 6 foot wide ramps is recommended as the preferred dock design (the same dock design approach is recommended for all core terminals). The landing dock will generally need to accommodate vessels of up to 90 feet in length and 7 foot draft, or vessels similar to the current high speed catamarans currently operating out of the Bayshore terminals. A nominal freeboard height of 4

feet would be needed. Ramp connections to a floating dock will be needed to provide ADA access for the 5 foot normal tide range, preferably by use of moveable (non-mechanical) ramps. In addition it would be desirable to have a lower 2 foot freeboard float attached to the main float for smaller NPS and tenant vessels. Future needs include incorporation of layover slips for NPS smaller vessels ranging from 20 to 40 feet in length.

Specific Marine Institution Berthing Needs: There are several long-term marine institution tenants at Sandy hook all of whom own and operate vessels at or near the site. The plans for a permanent dock should include consideration for provision of a landing that can accommodate such vessels as well as the feasibility of transient or year round layover slips for some portion of the marine institution vessels. The following fleet of vessels is maintained by three long term tenants including: the Marine Academy of Science and Technology (MAST), the New Jersey Marine Science Consortium, and National Marine Fisheries/NOAA. While it may not be the case that any or all of these vessels could be berthed at the new terminal, the needs are documented as described by representatives of each institution for purposes of consideration in subsequent planning and design phases.

1) Marine Academy of Science and Technology (MAST): MAST owns and operates the 65 foot research vessel, *RV Blue Sea,* which is berthed at the USCG dock complex immediately behind the breakwater. While the arrangement has worked well for a number of years, MAST has to re-permit the dock with the Coast Guard every two years which leads to uncertainty about long term berthing at that location. The Coast Guard dock complex and breakwater are scheduled for reconstruction since the west facing breakwater is "severely overstressed" in its present condition. MAST would be interested in an alternative year round berthing site that offered a protected location similar to the Coast Guard site.

- *RV Blue Sea*, 65' length with 4'- 6" draft

2) New Jersey Marine Science Consortium: The Marine Science Consortium owns and operates one large 60 foot research vessel, the *RV Walford*, and several smaller open vessels. The research vessel may be larger in the future, in the 90' to 100' range, and a 30 foot pontoon boat may be added to the fleet. The *Walford* is berthed year round at the Highlands along with the smaller vessels. The Consortium would have an interest in a new dock facility at Fort Hancock for several use scenarios. First choice would be for a temporary berthing space for the *Walford* to pick up and discharge passengers near their Sandy Hook/Fort Hancock labs. A second choice would be to have a year round berthing slip for the *Walford* at the new dock facility. And a third or ideal choice would be to have berthing for the *Walford* as well as for the smaller vessels with room for the vessels to increase in size.

- *RV Walford:* 60' length and 6'-6" draft (could expand to 90' to 100' in length), requires shore power and fresh water.
- Smaller open vessels of 21', 17' and 14' in length, require fresh water.
- Future addition of 30', shallow draft pontoon boat

3) National Marine Fisheries/NOAA: The National Marine Fisheries division of the National Oceanic and Atmosphere Administration maintains and operates the 72 foot research vessel *RV Gloria Michelle*, which is docked year round at the Coast Guard station docks except during cruises to New England waters in May, July and September. Other vessels operated include a 23 foot trawler which is docked at Atlantic Highlands, as well as a 22 foot whaler and 22 foot outboard both of which are kept on trailers. The National Marine Fisheries would be interested in year round berthing slips for the *Gloria Michelle* and the smaller trawler, as well as temporary landings for the smaller trailer vessels.

- *RV Gloria Michelle:* 72' length and 9'-6" draft, steel hull stern trawler, requires 220 volt shore power, fresh water, telephone jack..
- *RV Tony P.:*23' length and 3' draft, fiberglass A-frame trawler requires shore poer and fresh water..
- *RV Whaler:* 22' length outboard, requires fresh water.
- *RV Harvey:* 22' length outboard, requires fresh water.

Landside and Upland Requirements: Landside needs vary depending on the final site selected. Generally each site would include ADA accessible pathway connections from dock entrance to the main road system, vehicular drop-off for autos and shuttle buses, and a sheltered waiting area with visitor information clearly displayed. Desired visitor amenities would include a food concession within easy walking distance, rest rooms, and a shuttle bus connection to the beach sites and other Sandy Hook attractions. Since many of the beach sites are some distance form the Fort Hancock ferry landing site, it is intended that the proposed renovation and reuse of campus buildings will include visitor amenities close to the terminal such as historic interpretative exhibits, as well as food concessions and possibly a seasonal gift shop. A multi-purpose parking area for auto visitors could also be located near the terminal, which would also serve the marine institutions use of the ferry landing for boarding of research vessels. It is not anticipated that any vessel servicing would take place at the ferry landing.

5.2 Other National Parks of New York Harbor Sites

Statue of Liberty:

The site includes the actively used ferry pier on the southwest side of the island. The 3 existing fixed landing slips are similar to the Battery Park departure slips, and are used by the Circle Line year round to transport visitors to and from the best known attraction in New York City. Given the excessive current visitation to the Statue, the needs at this site are quite different than for other Park Service terminal locations. There are improvements and modifications needed for the ferry pier, which should be resolved in conjunction with a visitor management program, discussed in the report Appendix.

Dock and Waterside Requirements: Since there are Park Service's concerns about the current visitation levels being to great for the resources available at the statue, the dock and waterside needs appear to be more qualitative than quantitative. The objectives would be to improve the quality of the visitor experience rather than making it possible to transport more visitors to the

island. The existing fixed slips and boarding procedures are not likely to meet the expected federal ADA access requirements. As with other sites around the harbor, one proven solution would be to provide multiple floats and ramps around the perimeter of the existing fixed pier, allowing for at least the same number of berths currently available. The landing system should also allow for more rapid boarding and unloading to expedite the transition component of the trip. Soundings and surveys were not available, but it is likely that dredging may be needed if the docking process is to be improved.

Landside and Upland Requirements: While landside needs were not evaluated in detail, it was apparent from observation at peak and off-peak times that queuing for the ferry departure is a dominant part of the visit and that efforts are needed to make this process more pleasant and comfortable for visitors. Such amenities as sheltered waiting, benches, refreshment concessions, and rest rooms are needed. In addition there are opportunities to enhance the promenades through such methods as providing interpretive exhibits, landscaping with shade trees, and careful attention to surface materials and pathway furniture.

Ellis Island

The recently renovated halls at Ellis Island are attracting increasing numbers of visitors, but, unlike the Statue of Liberty, there is additional capacity on the island and with other buildings currently being restored. The three fixed landing slips provide ample capacity for the current ferry operation, but may not be adequate for future demands.

Dock and Waterside Requirements: The existing slips are locate in a protected basin which makes berthing and boarding more comfortable than at other harbor locations. The slips are not ADA accessible however, and will eventually require the same type of modifications recommended at other non-compliant existing sites. The basin is wide enough to add a string of floats and ramps to increase the number of berths and expedite boarding. Depending on the next ferry concession contracts, it is estimated that a total of four to five berthing locations should be developed at Ellis Island in addition to NPS and service docks.

Landside and Upland Requirements: The landside promenade and nearby visitor facilities in the exhibition space appear to be generally appropriate for the current ferry visitation. Sheltered waiting is somewhat removed from the slips and not suitable for the queuing locations. Landscaping with shade trees does help. However as visitation increases, it will be necessary to monitor the adequacy of the visitor amenities including rest room and shelter locations.

Battery Park

This site currently serves as the major departure point for the Statue and Ellis, and is proposed to be the Manhattan hub for new core ferry routes to the Gateway Park sites. In addition, it is described as a candidate for a proposed Harbor Loop Ferry system. These needs translate into a substantial expansion of ferry berthing areas, if all of existing and the proposed services are to be accommodated.

Dock and Waterside Requirements: The dock needs fit into two categories; 1) new berths for the Gateway Core routes, and 2) improvements to the 7 existing fixed slip berths along the promenade. The new berths will need to expand as ferry services grow, starting with one all-purpose berth to handle up to 90 foot vessels, which is recommended for the Marine Inspection Office slip sites. The new berths at the MIO slips would benefit from the wave attenuation provided by the granite piers in knocking down the ambient chop and the periodic wakes from the Staten Island ferries to and from the nearby Whitehall ferry terminal. The new berths could be provided by floats with spud piles located in one or more of the three slip areas. The longer term improvements to the existing fixed bulkhead slips would require a different approach with the placement of larger floats alongside the bulkhead similar to the dock at the World Financial Center.

Landside and Upland Requirements: The landside needs for the new berths at the Marine Inspection Office site would include waiting shelter with information, restrooms, pedestrian connections to the Battery Park waterfront promenade, and signage. Vehicular drop-offs would need to be combined with those for the Staten Island Ferry at the Whitehall terminal. Location of the new berths and landside access would require completion of agreements with the Coast Guard for use of the slips and access through the existing parking area.

Summary of Terminal Program Needs and Dock Specifications

The information on dock site conditions and proposed physical improvements is summarized below in Table 5-4.

Table 5-4
National Harbor Parks of New York

Park Unit and Site	Site Priority	Dock Status	Waterside and Dock Needs				Landside and Upland Needs				General Issues
			Ferry Berths	Vessel Size/ Draft	Free-board Height	Other	ADA Access Improv.	Drop-off/ Parking	Park Shuttle	Support /Ameni- ties	
Gateway Parks											
- Ft. Hancock	Core	Temp. /priv.	New, 2 site alts.	Up to 90'/ Draft 7'	4' - 0" to 5 '- 0"	Float and ramp	New Ped. Paths	Drop near dock/ 50 spaces	Yes, to beach sites	Stan-Dard + Park gate-way	Terminal in 2 phases , Propt'y Transfer
- Ft. Tilden/ Riis landing	Core	Temp. NPS	New at Basin	Up to 90'/ Draft 7'	4' - 0" to 5 '- 0"	Float and ramp	New Ped. Paths	Drop near dock/ 100-150 spaces	Yes; to Riis Park	Stan-Dard + Park gate-way	Replace temp. landing, Propt'y transfer
:- Ft. Wadsworth/ Torpedo Pier	Core	None	New at Tor-pedo Pier	Up to 90'/ Draft 7'	4' - 0" to 5 '- 0"	Float and ramp	New Ped. Paths	Drop near dock/ 50-100 spaces	Yes; to upper Ft. Wads-worth	Stan-Dard + Park gate-way	2 Phases, Possible reuse of Riis barge
Manhattan											
Battery Park: - MIO - Exist'g slips	Core	1 Limitd use at MIB, Exist'g 7 slips	New @ MIB, Mod. Exist slips	Up to 90'/ Draft 7'	4' - 0" to 5 '- 0"	Float and ramp	New Ped. Paths at MIB	Drop at White hall/ No park'g	No	Stan-dard at MIB	2 Phases w/MIB first, prop'ty agree-ment
Statue of Liberty: - Southwest Dock	Core	3 Exist'g Slips	Mod. exist. Slips	Up to 90'/ Draft 7'	4' - 0" to 5 '- 0"	Float and ramp	None	No vehi-cles	No	Add to stan-dard	Coordi-nate w/ Next conces-sion
Ellis Island - Basin	Core	2 Exist'g slips	Mod. & add to exist. Slips	Up to 90'/ Draft 7'	4' - 0" to 5 '- 0"	Float and ramp	None	No vehi-cles	No	Add to stan-dard	Expand, Coordi-nate w/ Next conces-sion

6.0 Dock Site Design

Concept designs were developed as part of this study for docks at the three Gateway NRA sites and the Marine Inspection Office site at Battery Park. The dock design challenges at the Gateway NRA and other sites in the National Parks of New York (Battery Park, Statue of Liberty and Ellis Island) suggested the need for a consistent system of access meeting anticipated ADA standards in similar tide and navigation conditions. In considering the needs for dock facilities in different settings, as identified in Section 5.0, a set of objectives addressing common needs was established.

- A consistent dock access system from vessel to upland meeting anticipated ADA standards would be beneficial within each park unit as well as between sites at different units. Currently there are too many different design solutions among existing New York Bay docks, none of which meets accessibility requirements.

- A cost-effective solution to the access and dock needs is needed in terms of capital costs. Funding for dock construction is scarce and the dollars available should secure the maximum number of dock installations for each phase of construction.

- The dock designs should optimize maintenance requirements for the different sites, particularly those sites where maintenance and service poses more challenges.

- Dock systems should be durable enough to withstand extreme weather patterns during hurricane events and winter storms.

- Dock capacity should meet current and projected visitor demands, and should allow for expansion as demand increases.

- Dock solutions for ADA access are likely to be quite different in character than current non-accessible installations.

- Provide a dock facility with berthing capacity and freeboard height to meet the needs of the largest number of vessels in the New York Harbor fleet. The boarding height of most vessels is between 3'-6" an 5'-6", or a median of 4"- 6".

- Reuse existing pier structures to the degree feasible: avoid building new or replacement piers.

6.1 Dock System Description

The concept that evolved was to explore a component dock system with a kit of interchangeable parts to be adapted to as many different site conditions as possible. A typical plan is shown in Figure 6-1, the Phase 1 application to Sandy Hook. The system developed by the project team consists of the following components:

- Standard steel barge base: 20' x 90' with a 4'0" freeboard height.

- Steel pile supports for the barge independent of pier structures: barge and fixed ramps would generally remain in the water year-round, but could be easily detached form the piles whenever needed for maintenance or remote storage.

- A fixed aluminum ramp on the barge consisting of a single 20' x 6' segments with a constant one in 12 slope.

- Moveable aluminum gangway at 50' in length: the long aluminum truss allows for a maximum slope of one to 20 during the normal tide range of 5'-0".

- Miscellaneous barge fittings including railings, cleats, signs, lifesaving equipment, etc.

- Pile supported platform connecting to existing piers, and supporting the gangway.

- Add-on elements to the base structure might include a 2'-0" freeboard float for smaller vessels, and/or additional 4'-0" freeboard floats to expand dock capacity when needed.

Maintenance and Upkeep

The component system would have many advantages in terms of maintenance. The steel barge system would have extra thick steel plate and would require major maintenance on a 10-year cycle. It is recommended that all park units using the component dock collaborate on maintenance programs, using their collective equipment, staff, and financial resources to maintain the facilities. An extra barge unit might be kept on hand to be interchangeable with any of standard dock installations to allow the 10-year maintenance to be conducted independently. Other component hardware pieces such as bolts, railings, lighting, or other stock elements. The independent pile and barge structure away from the existing wood piers will eliminate the current damage caused by boats landing against the face

6.2 Dock Concept Designs by Park Unit and Site

Concept designs prepared for Sandy Hook/Fort Hancock, Riis Landing at Jamaica Bay/Breezy Point, the Torpedo Pier at Fort Wadsworth, and the Marine Inspection are preliminary in nature. The designs were prepared to provide test applications of the proposed component system and cost estimates for basic capital improvements for funding purposes. While preliminary site inspections were conducted, additional survey and bathemetry efforts are needed as well as detailed design. It is also important to note that permits are likely to be required from the U.S Army Corps of Engineers (ACOE) and New Jersey Department of Environmental Protection (DEP) or New York DEP depending on the site location. As the development of dock designs continues, it would be advisable to schedule pre-application meetings with the ACOE and state DEPs prior to finalizing designs, particularly at Sandy Hook, where the shellfish and fish habitats will need to be considered.

6.2.1 Core Terminal Priority Sites

Gateway Parks

1. Sandy Hook/Fort Hancock:

A new permanent dock with integral breakwater would be provided at one of two possible sites on the Sandy Hook Bay side of Fort Hancock, replacing the current privately maintained spud barge. Primary terminal uses would be for Sandy Hook National Seashore visitors including a landing for seasonal ferry service from Battery Park and other feeder sites around Upper New York Bay.

A secondary potential use would be for peak weekend park and ride service from one or more Bayshore terminals in New Jersey. Another secondary use of such a terminal would be year round ferry service for current and future weekday tenant commuters occupying space in the historic Fort Hancock campus buildings. In addition, there is an interest in berthing and landing space for vessels operated by current federal or institutional tenants such the National Oceanic and Atmospheric Association (NOAA), the Marine Academy of Science and Technology (MAST), and the New Jersey Marine Science Consortium. It is recommended that the new terminal facility would be owned and managed by the Park Service through its Sandy Hook Unit.

Waterside and Dock Design: .It is recommended that the terminal be designed to include two phases as shown in Figures 6-1 and 6-2. Phase 1 would provide a seasonal ferry terminal. The design would consist of a custom built, 80'x 20' spud barge attached to the shore with a 50' x 6' moveable ramp, connected to a 30' x 6' fixed ramp extending from the bulkhead at the shore end. The purpose of the two ramp system is to extend the landing location far enough from the bulkhead to provide a minimum of 8 feet depth at the inboard end of the float to accommodate vessel draft in all tide conditions. The barge would be designed with a 4 foot freeboard and have a 24' x 6' fixed ramp and platform at the inshore end, to achieve the full ADA access required. The spuds would be located on the north side of the barge allowing for the south side to be used for vessel berthing. A smaller 2 foot freeboard float could be added at the east or inshore end of the main float if needed for smaller vessel landings.

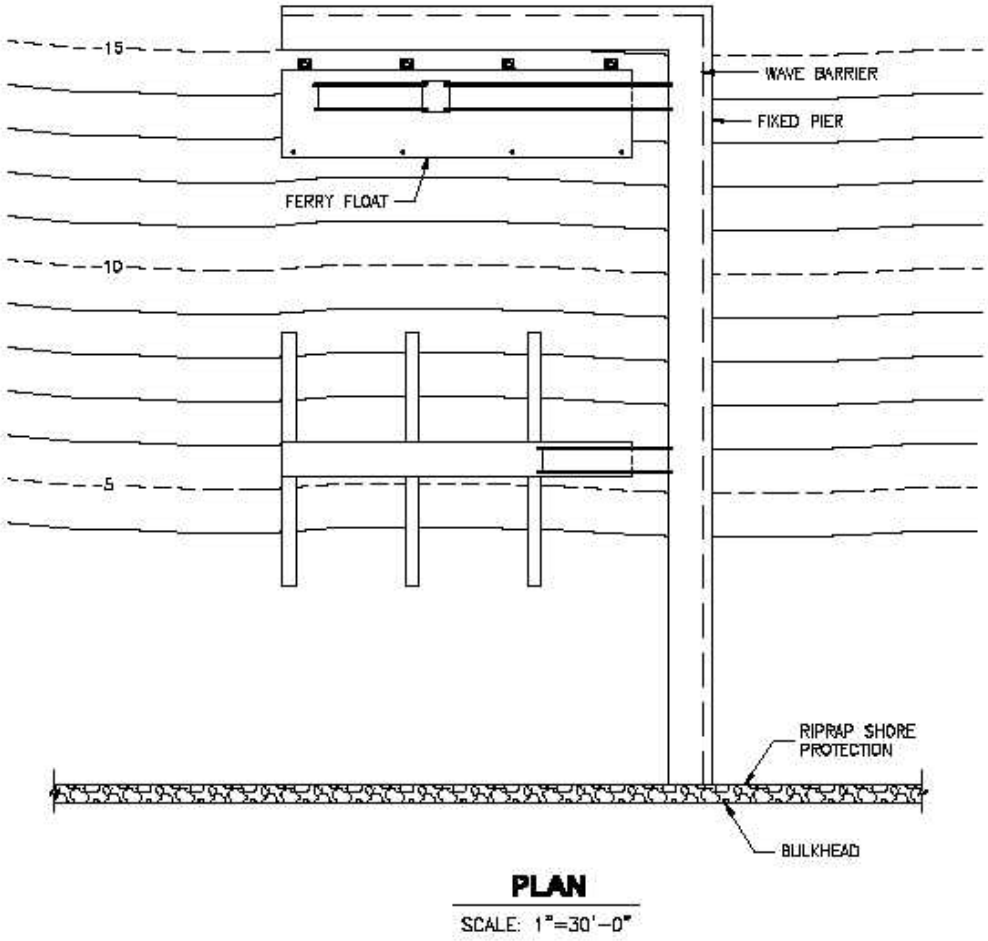

Figure 6-1
Sandy Hook Phase 1 Concept Design

Another variation of this configuration would include a second spud barge moored at the end and perpendicular to the barge facing north. While more costly in terms of the extra float barge cost, such an arrangement would provide a test layout for a permanent fixed breakwater pier, and would offer a sheltered landing area from the problematic westerly wind conditions which create excessive wave exposure at either of the two dock sites being considered. Such a phase 1 option should be considered in the next design phase.

Phase 2 would provide a year round ferry and larger vessel landing along with seasonal slips for smaller vessels of up to 25 feet. The full build terminal would consist of an "L" shaped fixed pier with wave attenuation built into the outside face. The "L" as depicted would open to the south, affording protection from the north and west, which constitute the longer fetches and direction of storm events. Based on further discussions with the institutional vessel operators, it may be more advantageous to orient the "L" to the north to provide more protection from the summer south west winds and fetch, while relying on

the Hook to provide protection from the northwest. In order to reach deep enough water the fixed pier would extend approximately 180 feet to the west, with the "L" being 100 feet long to create a protected basin area. The Phase 1 floating barge and ramps would be reused and located immediately behind the "L" section, and would serve as the year round ferry landing. Slips for 10 smaller vessels could be located inshore of the ferry landing, and would have a separate ramp connection from the fixed pier. This configuration would accommodate most of the year round and seasonal Sandy Hook NPS needs for ferry service and small vessel berthing. While slips could be provided for larger tenant vessels in the 50 to 75 foot range, it would require a longer and more costly fixed pier to provide adequate basin space and water depth.

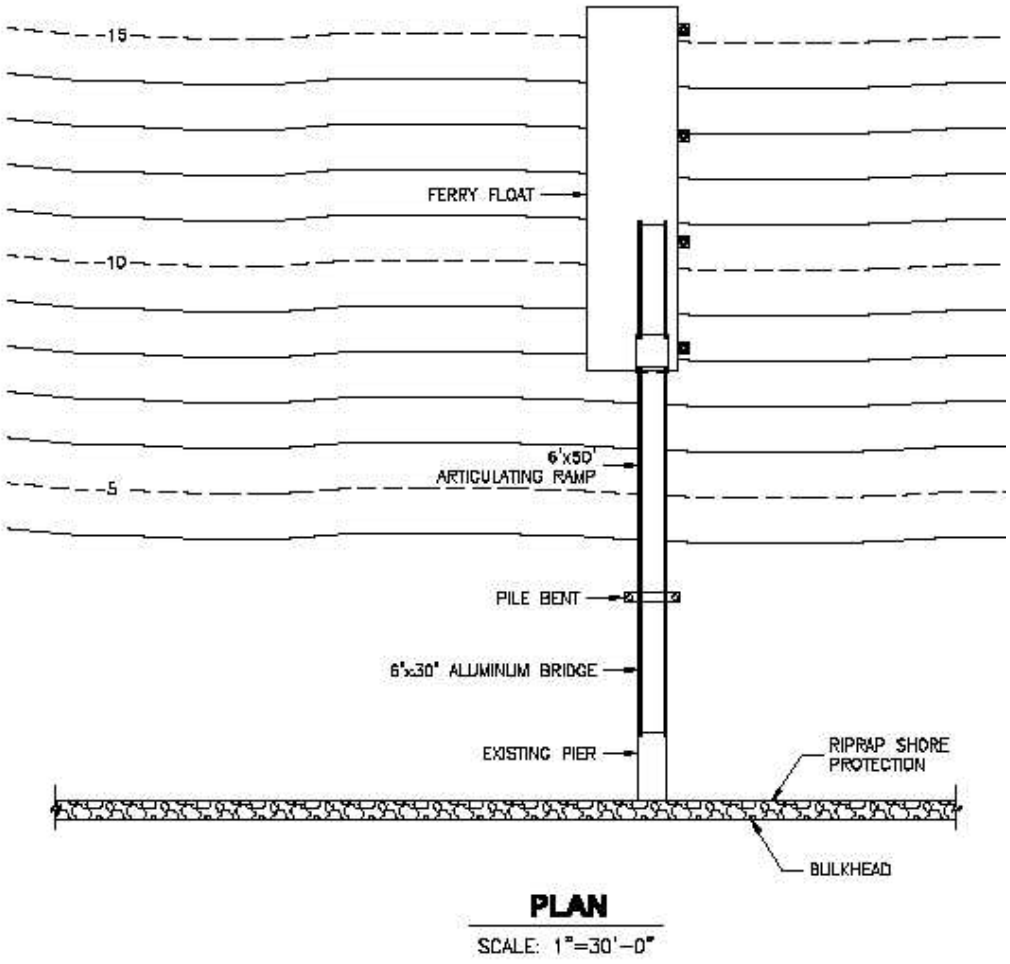

Figure 6-2
Sandy Hook Phase 2 Concept Design

The two design phases could be applied to either of the two sites under consideration: at the Post Chapel site or at the new site on Coast Guard property 700 feet to the north. The existing site has the advantage of an existing parking and drop-off area, and a small fixed pier that provides an elevated grade level transition over the bulkhead. The phases allow for a variety of different implementation approaches depending on funding availability and property ownership. For example, one possibility would be to locate the Phase 1 landing at the existing site, taking advantage of the parking and small pier, and to build the Phase 2 fixed pier at the new site once the land has been transferred as anticipated. Another approach would be to implement the full build solution at the coast Guard site if adequate funding were available and the property had been turned over to the Park Service. The new site is generally favored since it would offer greater protection for the year round use of the terminal as it is tucked closer to the "Hook".

The final designs and choice of fixed piers versus floating dock configurations will need to take into account such environmental factors such as littoral drift along the beach, fish and shellfish habitats, and any other shoreline factors required for ACOE and NJDEP permits.

Landside and Upland Improvements: Both sites would need to develop the same upland components described in the program needs: ADA compliant pathways from dock to street, sheltered waiting, restrooms, vehicular drop-off, parking for approximately 50 cars, information and signage. It would also be recommended that the site be designed to serve as a new Gateway to Fort Hancock and Sandy Hook. The landing area could be designed as a small landscaped park-like waiting area, which could include additional elements such as interpretive exhibits, benches, play sculpture, picnic tables, and a flag pole. The area could become a small bayfront attraction for all Sandy Hook visitors, as well as occupants of the Fort Hancock campus.

Phasing and Next Steps: The terminal needs generally fall in short term and longer term time frames. The short term or Phase 1 needs are to install the seasonal ferry landing, which could be a designed as permanent version of the existing private operator maintained spud barge. The longer term or Phase 2 needs would be to build the year round facility which would require the breakwater and fixed pier to allow for safe landing and boarding during the periodically rougher wave and weather conditions experienced from fall to spring. Further detailed marine analysis is needed to determine the likely necessity for securing the northern most site, and determining the preferred breakwater configuration and orientation. It is proposed that the longer-term dock facilities be designed to incorporate the initial spud barge and ramps needed for the seasonal operation. With regard to the two sites being considered, the northern most site currently on Coast Guard property would appear to be the more protected and preferred location. While the recently completed Coast Guard masterplan recommends turnover of property which would allow for use of the preferred site, the actual transfer had not taken place at the time of the report. The Coast Guard also is committed to repair and/or replacing their existing breakwater which is deteriorating and is severely over stressed in its present condition. A new Park Service pier might need to be coordinated with that construction

process, and there may be economies to doing both projects simultaneously under one contract. It is recommended that efforts continue to affect the proposed transfer so that a location can be selected and Park Service plans for the dock can be finalized.

Cost Estimates: In addition to the two concept plan phases, preliminary cost estimates were prepared for each concept. Based on the concept designs and unit costs for the waterside elements included, the Phase 1 terminal costs were estimated at $675,000, including design, engineering and contingencies. The Phase 2 full build fixed pier was estismated at $2,100,000, including the same float system and ramps as in Phase 1, as well as basic upland improvements. If Phase 2 were built incorporating the Phase 1 docks and ramps, the cost would be reduced by the amount of those elements, or approximately $600,000. A more detailed breakdown of the estimated costs is included in Section 6.3.

2. Riis Landing at Jamaica Bay /Breezy Point:

A new permanent dock would be provided in the Coast Guard Basin, replacing the current temporary spud barge. Primary terminal uses would be for Jacob Riis Park and Fort Tilden visitors, including seasonal ferry service from Battery Park, Fort Wadsworth and other feeder sites around Upper New York Bay. Potential secondary seasonal park uses of the terminal would be shuttle connections to Canarsie Pier and excursions to Jamaica Bay. As a means of supporting the park ferry services, ferry operators have expressed an interest in providing year round commuter service from the site for Rockaway and Breezy Point residents. These combined uses would require a variety of landside support services. While the NPS owns the Ft. Tilden rail pier site adjacent to the Coast Guard Basin, formal agreements are needed between NPS and the Coast Guard for access to and use of the basin, possibly including the main building and assorted smaller outbuildings. The concept design for the permanent ferry dock and reorganization of the basin floats and piers is shown in Figure 6-3.

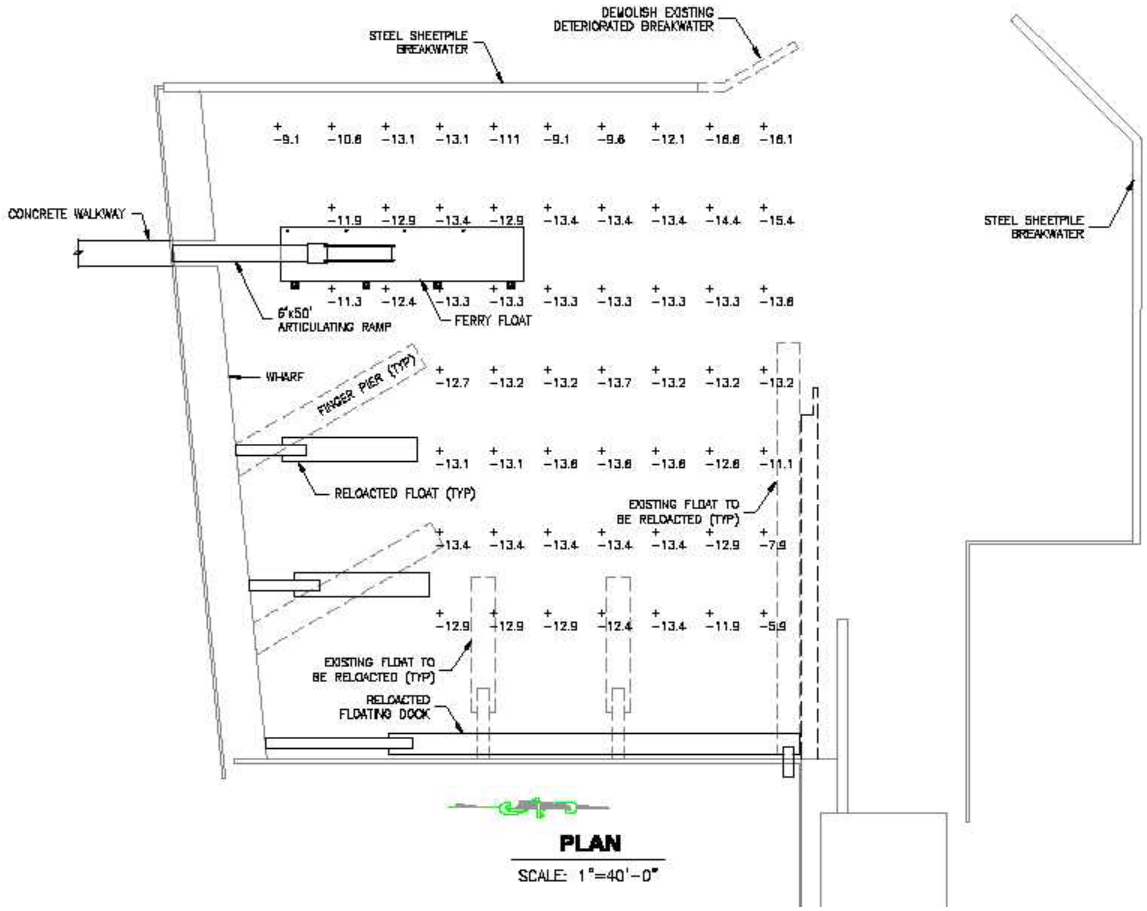

Figure 6-3
Riis Landing Concept Design

Waterside and Dock Design: The Coast Guard basin has good water depth in most areas. Marine inspections of the breakwater found it to be fundamentally sound and likely to have a good 10 to 15 plus years of useful life remaining as long as minor repairs are made to the outer western arm, in terms of removing the damaged end section. A reorganization of the floats and fixed piers would also be recommended to create a larger vessel turning basin within the breakwater. The existing oversized 30' by 100' (approximately) spud barge would be relocated to another site, possibly to the Torpedo Pier at Fort Wadsworth, and replaced with a smaller custom built barge of 20'x 90'. The new float would be connected to the Ft. Tilden rail pier site by a fixed wooden pier and a moveable 50'x 6' ramp. An additional 20' fixed ramp would be located on the float to complete the ADA access needs for the local tide range. The ferry float would be held in place with spud piles and would provide primary berthing on the outshore side of the float. If longer term ferry use required added berthing capacity, a float extension could be added, and the piles could be relocated. It is expected that short to mid term berthing can be accommodated with a single 90' berth through use of time slots. For smaller ferries, a lower freeboard float of 10'x 20' could be attached to the inboard side of the main float.

The reorganization of the basin shown in Figure 6-3 represents one concept approach to providing additional berthing while allowing for a larger turning basin for the larger ferries and smaller Coast Guard and Park Service vessels. The smaller ferry landing replaces the existing barge in the southwest corner of the basin allowing enough room for a catamaran with a 30-foot beam to berth comfortably on the west side of the float. The two diagonal fixed piers on the south bulkhead are replaced with the two relocated 2'-0" freeboard floats and ramps, currently on the east bulkhead. The south bulkhead then becomes the new site for the longer floating dock which currently lies next to the former marine railway basin. The south breakwater would be altered by removal of the deteriorating north end, and reinforcement of the new end section. The new wider opening would be somewhat more exposed to wave action. The relocation of the floats would place them in more protected areas of the basin, and be less exposed to the new entrance. These alterations would result in an equal number of berthing locations by reusing the existing floats, while at the same time creating a much larger turning basin for all vessels, including the largest ferries.

The current barge float dock will continue to be serviceable until the permanent installation is complete. One immediate modification to the present dock installation is recommended. If it is to be used for start-up ferry operations during the 2001 season. The barge could be ballasted to lower the freeboard from its current estimated 8 feet to 5 feet so that the dock can be used by a broader range of vessel sizes. The lower freeboard would also allow for a better ramp connection.

Landside and Upland Improvements: There are several interesting site plan options for organizing support needs and visitor amenities. The options would utilize the resources at the two adjacent Riis Landing sites in different ways through phased improvements. The general plan, however would be to locate most or all of the ferry landing support

activities at the Park Service-owned rail pier site including sheltered waiting areas, restrooms, vehicular drop-off, and ferry parking, as well as other visitor amenities. In addition to ferry support needs, the two sites combined offer an opportunity for a new gateway to the Breezy Point park resources in the form of a lively bay side waterfront park, organized around the ferry landing.

The rail pier site occupies approximately 5.6 acres, with 550 feet of each front on the Rockaway Inlet. The rail pier pile field extends 220 feet from the bulkhead. The site is large enough to accommodate the needed ferry support uses as well as other potential visitor attractions. While there are various site development plans possible, one conceptual approach for organizing the site might be similar to the character and uses included in the recent renovations at Canarsie Pier. The site would become a ferry gateway and new visitor destination for ferry riders as well as Breezy Point and Rockaway residents. Site features might include the following:

- Ferry Support Functions: These could be organized primarily along the east property line keeping the dock access point in the same general location as at present. The ferry visitor orientation center would be included in a small pavilion near the dock entrance. A waiting area and restrooms would be included as well as a visitor information kiosk, with activity choices for the Jamaica Bay/Breezy Point park sites as well as ferry and shuttle bus schedules.
- Pedestrian Path Network: The former military supply site has no sidewalks or pathways connecting to the nearby Ft.Tilden and ocean beach at Jacob Riis. A clear, safe and well maintained set of pedestrian and bicycle paths needs to be developed to connect to the park attractions, continuing to and through Ft. Tilden. The Boulevard crossing will require a pedestrian activated stop light and well marked cross walk, most likely at the existing lighted intersection and site entrance.
- Vehicular Access: The access road and vehicular drop-off would be located nearby. Visitor parking for 100 to 150 cars would be provided in landscaped clusters further away from the water to be shared by ferry riders, commuters and other site attractions.
- Perimeter Waterfront Boardwalk: As the Coast Guard property was transferred to the Park, the chain link fence could be removed and a public boardwalk could be developed along the western basin edge.. The basin boardwalk could be extended along the bayside beach with steps providing access to portions that are exposed at different tide conditions, and suitable for bathing. A fishing pier could be developed on portions of the remaining rail pier pile structure.
- Activity Areas: Several different outdoor activity areas could be developed sequentially away from the ferry landing entrance and along the waterfront. Benches and picnic tables could be incorporated on the land side of the boardwalk. A childrens' play area could be included with a nautical theme. A small amphitheater and stage could be included as a focal element.
- Landscaping: The site is currently mostly hardscape, with the exception of a nice lawn and mature trees near the Boulevard that should be retained. Site landscaping would need to be developed

- Indoor Activities and Concessions: The remaining buildings could be incrementally redeveloped to crate a four-season site. The remaining structures could accommodate a combination of concessions including a restaurant, café and gift shop. NPS use of the buildings might include a larger Breezy Point visitor and interpretive center with meeting areas and administrative space, as well as changing facilities for bayfront and returning Riis Park.bathers.

The adjacent Coast Guard site consists of approximately 1.7 acres of land with an additional 1.9 acres of watersheet in the protected basin area. With respect to the property, the Coast Guard intends to downsize its vessel and landside operations, and transfer a large portion of the site including buildings and dock management responsibilities to the Park Service in the near future. The site contains several buildings and a limited amount of ground area. Vehicular circulation to the site is limited by its proximity to the off ramps of the bridge to the north. A transition plan is needed for the site to determine building space and vessel storage needs for the Coast Guard and other tenants such as the Harbor Park Police. The Jamaica Bay/ Breezy Point NPS unit has already made initial improvements at the ferry landing. Ideally, the site will be planned and reused as a seamless extension of the Rail Pier site. The large colonial Coast Guard building has potential for a variety of adaptive reuses, including as a small waterfront inn and restaurant. The boat shed could house maritime exhibits or may continue to be used as and active Coast Guard or Park Police outpost. The boardwalk could be continued around the basin.

Phasing and Next Steps: The initial phase of the Riis Landing is already completed and consists of the current temporary ferry dock installed in the basin, which is intended to serve for start-up service to the site during the 2001 season. Phase 2 would consist of the installation of the new float, reorganization of the basin piers and floats, repair of the breakwater, and improvements to the adjacent Ft. Tilden Rail Pier site, as described above. If funding is available Phase 2 could be implemented at an earlier date, but would require a fast track schedule to be completed in time for the 2001 season.

Property transfer agreements for portions of the of the Coast Guard land and water area need to be finalized by the USCG and Park Service and prepare for the permanent Phase 2 improvements. A final design needs to be prepared for the Phase 2 basin reorganization and new floats. The specific quantity and location of berthing floats for the small vessel fleet would need to be determined in the next design phase of the projects with particular concern for the Coast Guard and Park Service vessel needs.

Cost Estimates: Preliminary cost estimates for the Phase 2 permanent dock installation and basin reorganization, were estimated at $725,000, based on the concept design, including design, engineering and contingencies. The cost estimate includes a new floating dock and fittings, ramp system, breakwater modifications, finger pier demolition, and basin reorganization. The cost estimate does not include construction of access infrastructure, utilities or landside support facilities on the adjacent Rail Pier site. A more detailed breakdown of the estimated dock and basin costs are included in Section 6.3.

3. Torpedo Pier at Fort Wadsworth:

The ferry landing at the Torpedo Pier site is proposed for development in two phases. The Phase 1 temporary installation would precede full restoration of the Torpedo Pier and adjacent bulkhead to the north of Battery Weed. Development of a landing in the near term is recommended so that Fort Wadsworth can be included as a Gateway stop along the early ferry routes. The proposed Phase 1 concept design is shown in Figure 6-4. The Phase 2 dock facility would be developed in conjunction with the restoration of the Torpedo Pier.

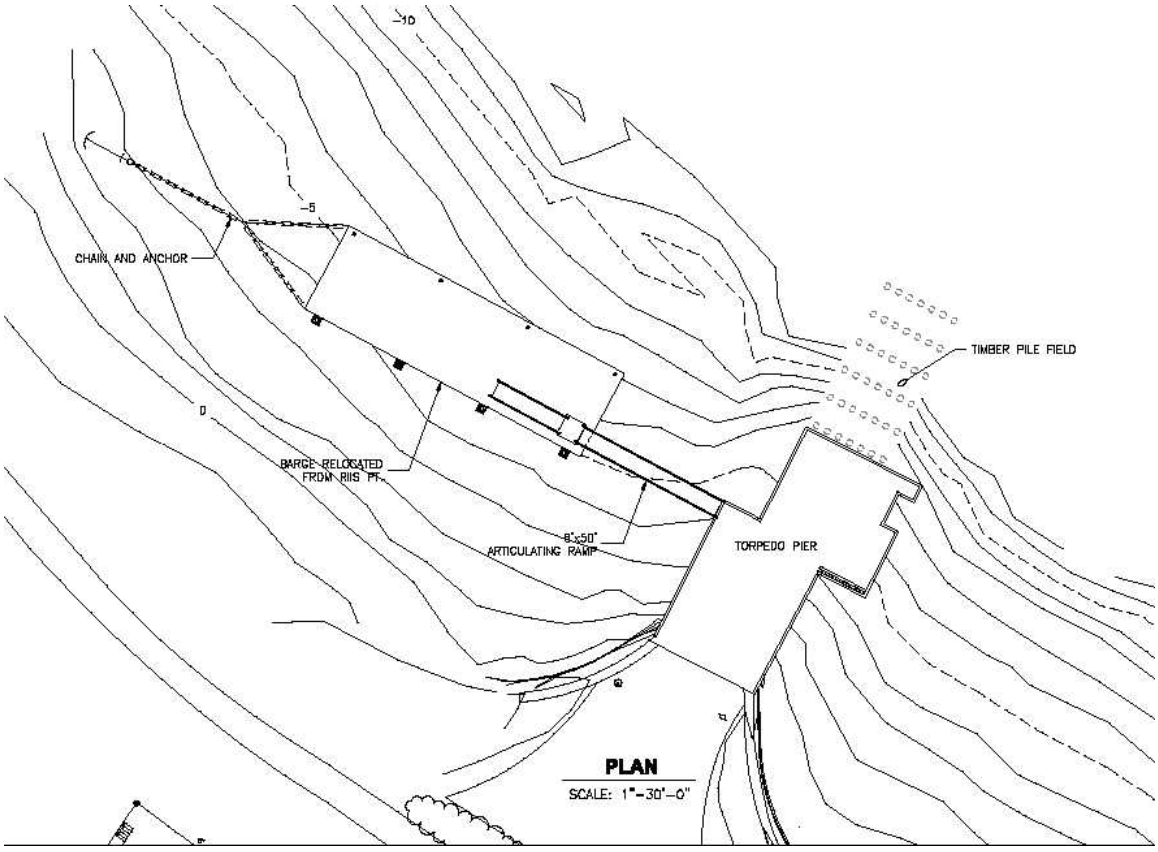

Figure 6-4
Staten Island Torpedo Pier Concept Design

Waterside and Dock Design: The existing Torpedo Pier site ahs not been actively used for several decades, and a deteriorating pile field remains a the outboard end of remaining sections of the granite pier. A floating barge would be installed north of the existing Torpedo Pier structure, connected to the shore with a moveable 50'x 6' ramp. A fixed ramp of 20'x 6' would be installed on the float. The combined fixed and moveable ramp system and connections would be needed to the existing Torpedo Pier to provide ADA access. The navigation conditions at the narrows with a strong river and tidal current require that the floating dock be oriented parallel to the shore, to allow for upstream docking. In addition an anchor would be deployed at the north end facing the stronger

combined river and ebb tidal flow. If the timing is right with respect to the installation of the proposed permanent dock at Riis Landing, the existing 30'x 100' barge could be relocated and used as the Phase 1 dock at the Torpedo Pier, as depicted in the concept plan. If not, a new 90'x 20' float dock could be used at FortWadsworth, with the intention of reusing it as part of the permanent installation in conjunction with the Torpedo Pier restoration.

Landside and Upland Improvements: Eventually, the standard array of ferry support facilities will need to be developed at the site, including a waiting shelter, rest rooms, vehicle drop-off and shared parking area. Initially in Phase 1, there would need to be installation of safe pedestrian paths connecting to the ferry landing, most likely along a reopened and improved road connection to the pier. A temporary walkway with railings is likely to be needed across the pier itself to provide safe access to the ferry landing ramps. Since the site near Battery Weed is somewhat remote and vertically separated from other Fort Wadsworth attractions, there will need to be clear pathway links up the access road with directional signage. It may also be necessary to offer a shuttle bus link for peak periods and for groups arriving by ferry. In Phase 1, some of the visitor conveniences may be shared with Battery Weed. However, a sheltered waiting area for the ferries with schedule and park orientation information should be located near the foot of the Torpedo Pier.

Phasing and Next Steps: A two phased implementation plan is proposed for the Torpedo Pier ferry terminal site. Phase 1 would consist of the temporary float landing implementation along with basic landside access and support improvements. Phase 2 would include the restoration of the Torpedo Pier and a permanent ferry float landing installation. Next steps would include final design and implementation of the Phase 1 interim pier. At the same time final design should proceed for the Phase 2 masterplan including coordination of the final ferry floats and the Torpedo Pier. Phase 2 should allow for continuing seasonal ferry operations at the temporary installation during construction.

Cost Estimates: Preliminary cost estimates for the temporary dock installation based on the Phase 1 concept design were $400,000, including relocation design, site engineering and contingencies. The cost estimate includes installation of the current Riis Landing barge, new barge fittings, ramp system, and mooring anchor. The cost estimate does not include construction of access infrastructure, utilities or landside support facilities, which will need to be coordinated with a separate design and cost estimate for Phase 2, which would also include a new permanent float and appropriate connections to the restored Torpedo Pier. A more detailed breakdown of the Phase 1 estimated cost is provided in Section 6.3.

4. Battery Park Marine Inspection Office (MIO)

There are seven existing bulkhead slips along the Battery Park promenade, which are expected to continue in use by the larger harbor ferries such as the Circle Line, which

have concession agreements and landing rights. These berthing locations are exposed to wind and wave action, do not meet ADA requirements, and may not have the flexibility to accommodate new Gateway ferry services. Hence a new dock location is recommended to handle potential new services and operators. The proposed new ferry landing at the Battery Park is recommended for installation at the Marine Inspection Office piers site. Depending on demand levels, it may be developed in one, two or more phases. The proposed Phase 1 concept design is shown in Figure 6-5.

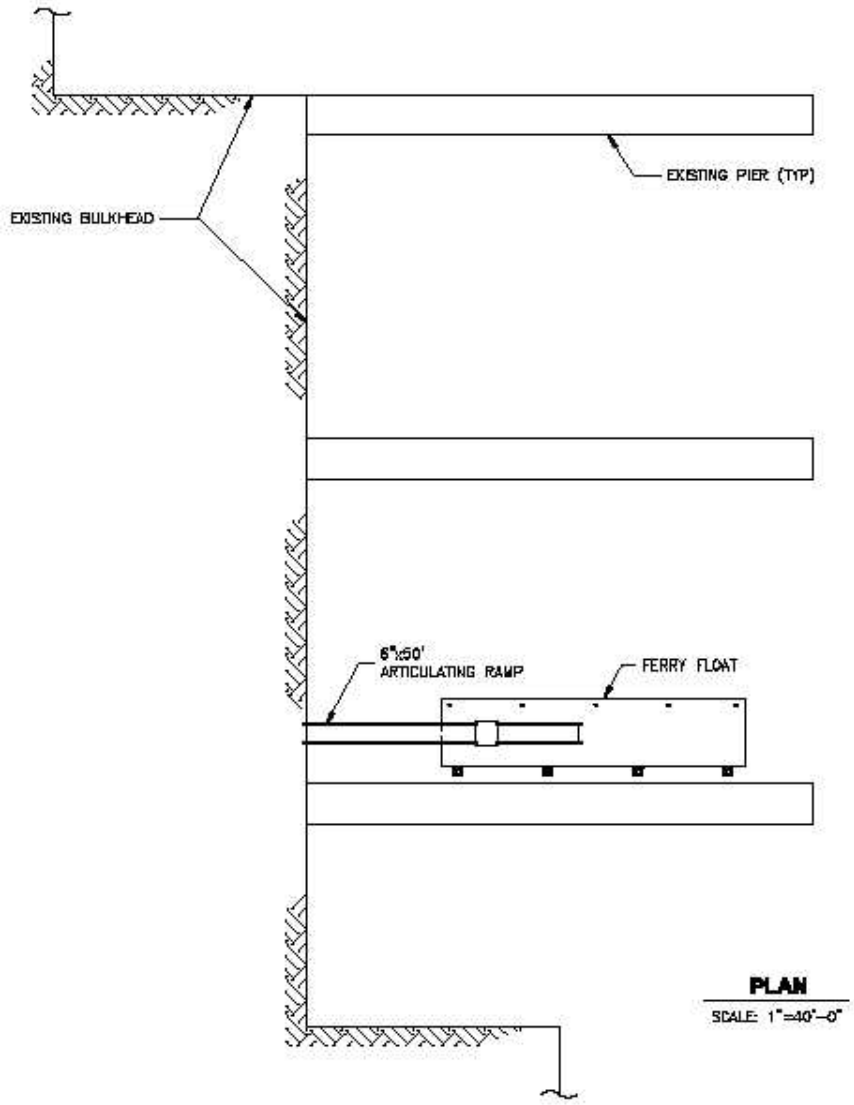

Figure 6-5
Marine Inspection Office Pier Concept Design

Waterside and Dock Design: The MIO site offers several potential benefits when compared to the current bulkhead slips. The existing three granite finger piers provide more protection for vessel berthing than the exposed bulkhead sites by breaking down the

ambient and wind generated wave action. With three protected slip areas, there is room for multiple landing sites. The site is currently federally owned and maintained by the Coast Guard, and could be transferred to the Park Service, whereas the bulkhead slips are owned by the state and available to the Park Service on a limited use basis. The current site has limited use as a small ferry landing on the east face of the eastern most finger, serving Coast Guard and Park Service needs.

The concept design shown includes a spud supported float of 90' x 20' with a 4'-0" freeboard placed perpendicular to the bulkhead between two of the fixed pier structures. Access to the floating landing would be by a 50 ' x 6' moveable ramp and a 20 'x 6' fixed ramp on the float. The berthing of vessels could be either side loading or end loading. Choice of the slip used would depend on the vessel berthing requirements, water depths and finger pier conditions, all of which would require further evaluation prior to a final design. The benefits of a floating pier would be provision of ADA access, and flexibility to accommodate a wider range of vessels from the larger catamarans most likely to be providing Gateway service to smaller vessels which might serve Governors Island, Harbor Loop and other new water transportation routes.

Landside and Upland Improvements: The MIO site has excellent nearby transit connections including the subway, bus lines, and the Staten Island Ferry at the nearby Whitehall terminal. Pedestrian connections to the Battery Park promenade would be needed by creating a waters edge walkway and connecting directly at the west and east ends. A sheltered waiting area and information kiosk would be needed near the ferry ramp connection. Restrooms could be included in the waiting shelter or incorporated in neighboring buildings. Signage would be needed directing visitors to the park, Castle Clinton, and transportation links including other ferry landings. Vehicular drop-offs would be at the east end near Whitehall. Parking for ferry users would be available at nearby commercial facilities.

Phasing and Next Steps: A multi-phased implementation plan is proposed for the Marine Inspection Office ferry terminal site. Phase 1 would consist of an initial float landing implementation in a selected slip location, along with basic landside access and support improvements. Phase 2 would include a second float landing installation at such time as ferry services expanded. One additional phase would be possible if future berthing demand so warranted. Next steps would include agreements with the Coast Guard for lease or transfer of the property to Park Service, followed by final design, funding and implementation of the Phase 1 pier. An assessment of the options for making the existing promenade bulkhead slips ADA accessible would also be needed at such time as the federal regulations are in place and plans for the next concession agreements for Statue and Ellis are determined.

Cost Estimates: Preliminary cost estimate for the Marine Inspection Office dock installation based on the concept design is $675,000. The estimate includes new float construction, ramps, dock design, site engineering and contingencies. The cost estimate does not include construction of landside access infrastructure, utilities or support

facilities, which will need to be determined with a separate design and cost estimate. Improvements for ADA access to existing bulkhead slips are also not included in the cost estimates. A more detailed breakdown of the estimated cost for the proposed MIO dock is included in Section 6.3.

6.3 Summary of Cost Estimates for Selected Core Terminal Sites

The cost estimates for the four gateway sites reflect components illustrated in the concept designs. The component and unit cost estimates are shown in Tables 6-1 through 6-5 in this section. The costs are calculated in 2001 dollars. Only the Sandy Hook estimate includes landside support cost allowances and estimates for two phases of dock construction.. The other three site estimates reflect only the waterside improvements and a single phase of construction.

COST ESTIMATE							DATE PREPARED Mar-01	SHEET 1 OF 1
ACTIVITY AND LOCATION: SANDY HOOK SEASONAL (PHASE I)			CEC JOB NUMBER: 1161-93.7					IDENTIFICATION NUMBER
NEW FERRY FLOATING DOCK			ESTIMATED BY: DLP					CATEGORY CODE NUMBER
			STATUS OF DESIGN: _% PED___ 35%___ 65%___ 100%___ FINAL___ OTHER					JOB ORDER NUMBER
	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
ITEM DESCRIPTION	NO.	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
FLOATING DOCK	1600	SF.					$175	$280,000
MOORING PILES	4	EA.					$12,000	$48,000
PILE BENT	1	EA.					$25,000	$25,000
FENDER & BOLLARDS	1	L.S.					$50,000	$50,000
RAMP SYSTEM	1	EA.					$100,000	$100,000
FLOAT DESIGN	1	EA.					$25,000	$25,000
SITE ENGINEERING	1	EA.					$15,000	$15,000
							SUBTOTAL =	$543,000
							CONTINGENCIES 20% =	$108,600
							TOTAL ESTIMATED COST =	$651,600
							RECOMMENDED BUDGET COST =	**$675,000**

Table 6-1
Sandy Hook Phase I Concept Design Cost Estimate

COST ESTIMATE

DATE PREPARED: Mar-01 | SHEET 1 OF 1

ACTIVITY AND LOCATION	SANDY HOOK
	NEW PIER / BREAKWATER / MARINA
	WITH PARKING / SHELTER AND REST ROOMS
CEC JOB NUMBER	1161-93.7
ESTIMATED BY	DLP
STATUS OF DESIGN	_X_ PED ___ 35% ___ 65% ___ 100% ___ FINAL ___ OTHER
IDENTIFICATION NUMBER	
CATEGORY CODE NUMBER	
JOB ORDER NUMBER	

ITEM DESCRIPTION	QUANTITY NO.	UNIT	MATERIAL COST UNIT COST	MATERIAL COST TOTAL	LABOR COST UNIT COST	LABOR COST TOTAL	ENGINEERING ESTIMATE UNIT COST	ENGINEERING ESTIMATE TOTAL
PIER / BREAKWATER	3000	SF.					$325	$975,000
FERRY FLOATING DOCK	1600	SF.					$175	$280,000
FENDER & BOLLARDS	1	L.S.					$50,000	$50,000
MARINA FLOATS	340	SF.					$75	$25,500
MOORING PILES	8	EA.					$9,000	$72,000
RAMP SYSTEM	1	EA.					$75,000	$75,000
PARKING AREA	500	SF.					$65	$32,500
SHELTER / RESTROOMS	600	SF.					$175	$105,000
SITE ENGINEERING	1	EA.					$75,000	$75,000
						SUBTOTAL =		$1,690,000
						CONTINGENCIES 20% =		$338,000
						TOTAL ESTIMATED COST =		$2,028,000
						RECOMMENDED BUDGET COST =		**$2,100,000**

Table 6-2
Sandy Hook Concept Design Phase 2 Cost Estimate

COST ESTIMATE

DATE PREPARED: Mar-01 | SHEET 1 OF 1

ACTIVITY AND LOCATION	USCG BASIN RIIS POINT
	NEW FERRY FLOATING DOCK
	PIER / BREAKWATER DEMO AND FLOAT RELOCATION
CEC JOB NUMBER	1161-93.7
ESTIMATED BY	DLP
STATUS OF DESIGN	_X_ PED ___ 35% ___ 65% ___ 100% ___ FINAL ___ OTHER
IDENTIFICATION NUMBER	
CATEGORY CODE NUMBER	
JOB ORDER NUMBER	

ITEM DESCRIPTION	QUANTITY NO.	UNIT	MATERIAL COST UNIT COST	MATERIAL COST TOTAL	LABOR COST UNIT COST	LABOR COST TOTAL	ENGINEERING ESTIMATE UNIT COST	ENGINEERING ESTIMATE TOTAL
FERRY FLOATING DOCK	1800	SF.					$175	$315,000
FENDER & BOLLARDS	1	L.S.					$50,000	$50,000
MOORING PILES	4	EA.					$12,000	$48,000
RAMP SYSTEM	1	EA.					$75,000	$75,000
BREAKWATER DEMO	100	LF.					$200	$20,000
FINGER PIER DEMO	160	SF.					$100	$16,000
FLOAT RELOCATION	1	EA.					$35,000	$35,000
FLOAT DESIGN	1	EA.					$25,000	$25,000
SITE ENGINEERING	1	EA.					$15,000	$15,000
						SUBTOTAL =		$599,000
						CONTINGENCIES 20% =		$119,800
						TOTAL ESTIMATED COST =		$718,800
						RECOMMENDED BUDGET COST =		**$725,000**

Table 6-3
Riis Landing Concept Design Cost Estimate

COST ESTIMATE

DATE PREPARED: Mar-01 | SHEET 1 OF 1

ACTIVITY AND LOCATION: TORPEDO PIER
NEW FERRY FLOATING DOCK
RELOCATED BARGE WITH SPUD PILES AND ANCHOR

CEC JOB NUMBER: 1161-93.7
ESTIMATED BY: DLP
STATUS OF DESIGN: _% PED ___ 35% ___ 65% ___ 100% ___ FINAL ___ OTHER

IDENTIFICATION NUMBER:
CATEGORY CODE NUMBER:
JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY NO.	UNIT	MATERIAL COST UNIT COST	MATERIAL COST TOTAL	LABOR COST UNIT COST	LABOR COST TOTAL	ENGINEERING ESTIMATE UNIT COST	ENGINEERING ESTIMATE TOTAL
BARGE RELOCATION	1	LS.					$30,000	$30,000
BARGE BALLASTING	1	LS.					$25,000	$25,000
FENDER & BOLLARDS	1	L.S.					$50,000	$50,000
MOORING PILES	4	EA.					$24,000	$96,000
MOORING ANCHOR	1	EA.					$25,000	$25,000
RAMP SYSTEM	1	EA.					$75,000	$75,000
RELOCATION DESIGN	1	EA.					$12,000	$12,000
SITE ENGINEERING	1	EA.					$15,000	$15,000
						SUBTOTAL =		$328,000
						CONTINGENCIES 20% =		$65,600
						TOTAL ESTIMATED COST =		$393,600
						RECOMMENDED BUDGET COST =		**$400,000**

Table 6-4
Torpedo Pier (Fort Wadsworth) Concept Design Cost Estimate

COST ESTIMATE

DATE PREPARED: Mar-01 | SHEET 1 OF 1

ACTIVITY AND LOCATION: USCG PIERS BATTERY PARK
NEW FERRY FLOATING DOCK

CEC JOB NUMBER: 1161-93.7
ESTIMATED BY: DLP
STATUS OF DESIGN: _% PED ___ 35% ___ 65% ___ 100% ___ FINAL ___ OTHER

IDENTIFICATION NUMBER:
CATEGORY CODE NUMBER:
JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY NO.	UNIT	MATERIAL COST UNIT COST	MATERIAL COST TOTAL	LABOR COST UNIT COST	LABOR COST TOTAL	ENGINEERING ESTIMATE UNIT COST	ENGINEERING ESTIMATE TOTAL
FLOATING DOCK	1800	SF.					$175	$315,000
MOORING PILES	6	EA.					$12,000	$72,000
FENDER & BOLLARDS	1	L.S.					$50,000	$50,000
RAMP SYSTEM	1	EA.					$75,000	$75,000
FLOAT DESIGN	1	EA.					$25,000	$25,000
SITE ENGINEERING	1	EA.					$15,000	$15,000
						SUBTOTAL =		$552,000
						CONTINGENCIES 20% =		$110,400
						TOTAL ESTIMATED COST =		$662,400
						RECOMMENDED BUDGET COST =		**$675,000**

Table 6-5
Marine Inspection Office Pier (Battery Park) Concept Design Cost Estimate

6.4 Recommended Additional Planning and Design Tasks

Additional planning and design tasks related to the terminal locations fit in four categories: 1) site surveys, 2) feasibility analyses for other core and secondary sites, 3) detailed design and cost estimates for all core sites, detailed, 4) environmental permitting, and 5) securing project funding.

1. **Site Surveys:** The existing base information for the terminal sites is insufficient for design and permitting of the terminal designs. Both water and land surveys are needed at most sites before further design can proceed. Surveys can be included as tasks in final design contracts, or may be less expensive and more consistent if bid as a separate inclusive contract.

- Land and water surveys for Sandy Hook/ Ft. Hancock, Ft. Wadsworth/Torpedo Pier, Battery Park/MIO, Statue of Liberty pier, Ellis Island basin.
- Land survey for Riis Landing/ Breezy Point including buildings.

2. **Feasibility Analyses for Other Core and Secondary Sites:** Terminal site selection and feasibility studies were conducted for four of core sites, and to a lesser degree for the remaining core sites and secondary sites. While such analyses need to be conducted in coordination with further route and operation analyses, more detailed evaluation is needed for the existing and new dock sites regarding terminal location, expansion and renovation needs.

- Core site feasibility analysis for the Statue of Liberty and Ellis Island dock sites, including berthing areas needed and preferred ADA access modifications.
- Secondary site feasibility analyses including selection ofearly action feeder and destination sites from the following list of secondary site candidates: West 38th Street/ Manhattan, East 34th Street/Manhattan, World Financial Center, Pier 11, Hunters Point/Queens, Fulton Street Ferry Landing, Brooklyn Army Terminal, Sheepshead Bay, Canarsie Pier, Port Imperial/Weehawken, Hoboken Ferry Terminal, Colgate Ferry Terminal/Jersey City, Liberty State Park, South Amboy, Belford.
- Future potential sites may also need additional study at a later date.

3. **Detailed Design for all Core Sites:** Once the surveys have been completed, more detailed design needs to be conducted in two steps. If the recommended common component system is to be considered, there would be economies to having a single design contract for multiple sites, possibly including all required permitting.

- Step one would be to complete final design and cost estimates for the four core sites already taken through concept design including Sandy Hook, Riis Landing, Fort Wadsworth, and Battery Park.

- Step two would be to complete design for the remaining two core sites, Statue and Ellis at such time as the next concession arrangements are clarified, as well as any high priority secondary sites that emerged from the feasibility evaluation.

4. **Filing and Obtaining Necessary Environmental Permitting:** Federal Army Corps of Engineers and state DEP permits will be necessary for the core and secondary sites where impacts exceed permit thresholds. Permit applications can be grouped to save time and cost. Permitting may involve different consultant firms than the design of the docks and landside support facilities, and may be let as one combined or as separate contracts. The permitting would proceed in two steps as described for the detailed design.

- Permitting for the four core sites already taken through concept design.
- Permitting for the remaining two core sites, Statue and Ellis, as well as any high priority secondary sites.

5. **Securing Project Funding:** In parallel with the detailed design and permitting process, funds need to be secured for the construction packages. Depending on funding availability, funding may be sought for varying groups of projects. It is important to complete detailed design and secure permits for all priority projects however, to be prepared for any funding sources that may be identified.

7.0 Market and Financial Analysis

This section compares estimates of the costs of providing ferry services to potential passenger revenues. While conventional travel demand forecasting methods cannot fully account for some of the critical factors affecting the market for park services, the analysis addresses market issues in terms of alternative scenarios. These scenarios have been developed based on market characteristics, as discussed in Section 4.1, and expectations regarding future plans and programs at the National Parks of New York Harbor. The analysis establishes "thresholds" defining the approximate size of the markets needed to support individual ferry routes and thus provides a key measure of the feasibility of potential ferry service concepts.

The origins and destinations identified in Sections 3.0 and 4.0 can be combined in a variety of ways to produce numerous route configurations. The most promising routings that emerge from the screening of market and site conditions include the following origin-destination pairs.

1. Destination: Sandy Hook
Origins: a) Bayshore sites - Belford, South Amboy
b) Manhattan
c) New Jersey – Upper Bay and Hudson River

2. Destination: Riis Landing
Origins: a) Brooklyn – Fulton Ferry Landing, Brooklyn Army Terminal
b) Manhattan

3. Destination: Fort Wadsworth
Origins: a) Manhattan
b) Brooklyn
c) New Jersey – Upper Bay and Hudson River

4. Destination: Canarsie Pier
Origins: a) Riis Landing

Canarsie Pier is seen as a secondary destination that could be incorporated into a route network with Riis Park as a primary hub, connecting with Canarsie Pier and perhaps to Sheepshead Bay. Visitation and potential ferry ridership levels are anticipated to be lower for Fort Wadsworth than for Sandy Hook and Riis Landing. Nevertheless, Fort Wadsworth's central location at the narrows places it essentially in the path of routes connecting Manhattan with both Sandy Hook and Jamaica Bay. Thus, the ridership thresholds needed to support service to Fort Wadsworth, as an adjunct to the other ferry routes, are much lower. Moreover, with its strategic position, Fort Wadsworth could provide a conceptual focal point integrating individual ferry routes into a thematically coherent and functionally unified network.

7.1 Market Scenarios

Scenarios were developed to test the revenue implications of different levels of potential ridership for individual routes. It is assumed that private providers will operate all services and will be wholly or largely responsible for meeting all vessel-related capital and operating costs (with the Park Service having financial responsibility for landside facilities, including docks, terminal facilities, and landside transportation connections). Irrespective of who funds these services, however, the amount of revenue that can be generated by users ultimately will have major implications regarding the viability of proposed services. The scenarios are identified below.

Fort Wadsworth: Scenario 1 for ferry service to Fort Wadsworth assumes an average of 100 passengers daily all through the year. Ridership is split evenly between students, reflecting the anticipated emphasis on programming for school groups, and other categories of passengers. Option 2 simply increases Option 1 ridership by 20 percent. It is assumed that ridership is drawn evenly from Manhattan, Brooklyn, and northern New Jersey.

Table 7-1 Fort Wadsworth Ferry Market Scenarios (annual ridership – round trip)

From:	Manhattan	Brooklyn	New Jersey-Upper Bay/Hudson
Scenario 1	12,000	12,000	12,000
Scenario 2	15,000	15,000	15,000

Jamaica Bay/Breezy Point: A single ridership scenario has been developed, based on ridership forecasting performed during an earlier phase of the current study. That earlier forecast used a standard transportation demand analysis approach to predict the percentage of *existing* visitors who would be diverted to a Manhattan-Riis Landing ferry service from their current access mode (automobile or transit). The above estimates incorporate a 50 percent increase in the earlier forecast for service from Manhattan, to account for *new* visitors among those who do not own cars, and the addition of markets of the same magnitude from two points of departure in Brooklyn—Fulton Ferry Landing and Brooklyn Army Terminal.

As discussed in Section 4.1.2, Jamaica Bay/Breezy Point serves a market based in Brooklyn and Queens, and areas in the western part of Brooklyn can be expected to have similar levels of demand as lower Manhattan. Both of the potential Brooklyn ferry terminals are close to populous neighborhoods and Fulton Ferry Landing, in particular, is well-served by subway connections. In addition, the Fulton Ferry area is within walking distance of Manhattan via the adjacent Brooklyn Bridge and has been identified as a focal

point for additional marketing to tourists. The ridership estimate from three origin points is shown below.

From:	Manhattan (Battery Park)	Brooklyn (Fulton)	Brooklyn (Army Terminal)
To: Riis Landing	10,800	10,800	10,800

Sandy Hook: As was noted previously in Section 4.1, thousands of vehicles are denied entry to Sandy Hook on most weekend summer days. A reasonably conservative demand scenario for a service based at Belford or South Amboy, over the 12 weeks of the summer season, is 15,000 passengers. This estimate is broadly consistent with the experience of the Manhattan-Sandy Hook ferry, which attracts about 5,000 passengers per season from a greater distance on a limited schedule and at a relatively high price.

Alternative fare scenarios were also considered for the existing weekend service from Manhattan. Two fare structure variations were considered, as follows:

- **Scenario 1** - $20 per person; $30 per family
- **Scenario 2** - $15 per person; $25 per family

It was assumed that half of existing ferry users travel in family groups and that the average family consists of 2.5 people. The reductions in fare can be expected to increase ridership, but not proportionately. A rough but standard transportation planning "rule of thumb" is that ridership will increase by 1/3 of the amount fares are reduced. The resulting impacts on revenue, starting from a base of 5,000 passengers per season with a $25 per person round trip fare, are as follows:

- Current fare structure - $125,000
- Scenario 1 - $88,600
- Scenario 2 - $72,400

These revenue estimates are compared to capital and operating costs in Section 7.2.

7.2 Cost Analysis

Capital and operating costs were estimated for a sample set of the most promising ferry routes, as identified earlier in this section. Most of the service for park visitation is treated as an incremental, seasonal addition to commuter service, i.e. "piggy-back." Some of this service is largely the backhaul segment of commuter routes. For example, in the case of service between Battery Park in Manhattan and Riis Landing, the costs of a dedicated commuter service are estimated and *incremental* or marginal costs associated

with the provision of visitor services are estimated separately. Some of the visitor service is assumed to be seasonal, while the commuter services operate on a year-round basis.

The service scenarios included in the cost analysis are summarized below in Table 7-2. The route configurations analyzed are

1) Sandy Hook - Battery Park
2) Sandy Hook - South Amboy, Belford
3) Riis Landing – Battery Park
4) Riis Landing – Fort Wadsworth-Battery Park
5) Riis Landing – Fort Wadsworth-Fulton Ferry Landing-Battery Park
6) Riis Landing – Canarsie Pier-Sheepshead Bay

Within these basic route configurations, service oriented to park visitors (as opposed to commuters) was assumed to vary by season and weekends versus weekdays, as shown in the summary table.

Table 7-2 Illustrative Ferry Service Scenarios

Origin	Destination	Schedule			Vessel	Service Profile
		Season	**Weekdays No. of Trips* Per Day**	**Weekends No. of Trips* Per Day**		
Battery Park	Sandy Hook	Summer	-	4	New 120' catamaran	Ancillary to Manhattan commuter service
South Amboy and Belford, NJ	Sandy Hook	Summer	-	6	Midspeed Monohull	Ancillary to Manhattan commuter service
Battery Park	Riis Landing	Year-Round	6	-	New 120' catamaran	Commuter
Battery Park and Fulton Ferry Landing (Brooklyn)	Fort Wadsworth and Riis Landing (Jamaica Bay)	Summer	7	6	New 120' catamaran	Ancillary/backhaul to Manhattan commuter service
Battery Park and Fulton Ferry Landing	Fort Wadsworth and Riis Landing	Shoulder (April, May, Sept.)	6	2	New 120' catamaran	Ancillary/Backhaul to Manhattan commuter service
Battery Park and Fulton Ferry Landing	Fort Wadsworth and Riis Landing	Oct.-March	1	-	New 120' catamaran	Ancillary/backhaul to Manhattan commuter service
Battery Park	Riis Landing	Summer	-	6	New 120' catamaran	Ancillary to Manhattan commuter service
Battery Park	Riis Landing	May, Sept	-	4		Ancillary to Manhattan commuter service
Riis Landing	Sheepshead Bay and Canarsie Pier	Summer	4	7	Conventional monohull	Dedicated Service
Riis Landing	Sheepshead Bay and Canarsie	May and September	-	4	Conventional monohull	Dedicated Service

*Round trips (i.e. one trip in each direction)

The costing methodology is the product of the Volpe Center fast ferry market analysis conducted for U.S. Navy Office of Naval Research[1] and more recent research into specific ferry markets, including other National Park Service site studies. Data are,

[1] Dyer, Armstrong, and Jain "SLICE Commercial and Non-Military Government Applications Analysis", draft version prepared October 1999.

generally, collected from trade literature, interviews with operators (including New York port area operators contacted specifically for this analysis), and technical and manufacturers' literature.

These estimates are rough order of magnitude only and are intended to provide an indication of the probable costs of operating the vessels chosen for each route and of the revenue returns based on the ridership scenarios identified in Section 7.1. The revenue projections serve as a rough base of comparison to operating costs (including pro-rated vessel capital costs), identifying the patronage levels needed for economically feasible services. All costs are exclusive of docks and other landside physical facilities.

Assumptions incorporated within the cost calculations are as follows:

- The costs of "primary" services, i.e., commuter service, are found for all cost categories. Marginal costs for ancillary "piggyback" services include fuel (and other consumables) and crew expenses for the added hours, as well as indirect costs associated with additional hours of running time and administrative burden due to the added passengers and extra sales.
- Ancillary operations are peak summer months and "shoulder" months, except in specified cases. Service frequency is described on a case basis below, and may be generally described as weekend service plus off-peak hours during weekdays.
- The working assumption of greatest importance is that the longer distance routes would be operated as a secondary service by companies engaged in regular, scheduled commuter transport. Some short distance service, i.e., the routes within the Jamaica Bay area, are assumed operated on a dedicated basis.
- Boats are assumed in all cases to run in the same mode as usual, i.e., under the same regulatory structure, with identical manning and safety appliances, and with identical operational approach.
- Direct operating costs such as salaries of vessel officers and crew, consumables, and hull insurance are allocated to the added services, essentially in proportion to operating hours. Details appear below.
- Maintenance is an important direct operating cost for which a proportional cost allocation does not wholly pertain. The Volpe model is based upon a body of acquired data indicating that 60% of annual maintenance costs are fixed and the remainder tied proportionally to hours of operation.
- Indirect operating costs such as marketing, reservations, dockage, P&I insurance, G&A, salaries of onboard passenger service personnel are allocated to the ancillary services as described below.
- Debt retirement and marine insurance costs are not allocated to ancillary service.

The Volpe Center cost model methodology and the specific input assumptions and data applied in this analysis are documented in the report Appendix.

Battery Park – Fulton Ferry Landing - Fort Wadsworth – Riis Landing Route

Three route variations, in addition to a commuter-only service, were considered between Battery Park and Riis Landing: Battery Park – Riis Landing; Battery Park – Fort

Wadsworth - Riis Landing; and Battery Park – Fulton Ferry Landing – Fort Wadsworth-Riis Landing. Key parameters and assumptions are as follows:

- The boat's normal operation is a commuter service from Battery Park to Fort Tilden. Frequency is six round trips per day, 250 days per year. Commuter boardings were tuned to the break even point, averaging 17% capacity (175,00 out of 1,050,000 available seats), with 100% of those at full adult fare. Fares are $10 for Jamaica Bay and $5 for Fort Wadsworth.
- Ancillary service from Fulton Ferry Landing (Brooklyn) and Battery Park to Fort Wadsworth and Riis Landing. There is weekend service: summer months (6 round trips/day), and shoulder months (two round trips/day) and year-round daily service during the week. The latter consists of back haul only September through April, and back haul plus one round trip during the summer Weekend only service from Battery Park to Fort Tilden with no stops at Fort Wadsworth. The service would run 12 weekends from June until August @ 6 round trips per day = 144 round trips, plus May and September weekends @ 4 round trips per day = 64 round trips. Total = 208 round trips.

The cost calculations incorporate the following particulars:

- Fast ferry is a 131' overall length catamaran, 35' in beam, 4.3' draft, powered by twin diesels delivering a total 4307 horsepower, with passenger capacity of 350. The newbuilding cost of the ferry was $7,000,000 in 1999. (This is a typical small sized catamaran of the type under construction in a number of U.S. shipyards.)
- The Park Service Gateway route is assumed to originate at Battery Park, with two service alternates: with and without an intermediate southbound stop at Fort Wadsworth, and on to Fort Tilden. The return trip in both cases runs directly from Fort Tilden to Battery Park.
- The route particulars are a total distance of 15 nm from Fort Tilden to Battery Park, with 14 nm at service speed. The route from Battery Park to Fort Wadsworth and Fort Tilden is a total of one mile longer, all of it assumed to be at low speed for entrance to and departure from the Fort Wadsworth terminal.
- Average fares for both commuter and ancillary service are $10/person, one way. This includes family discounts and commuter multi-pass tickets.

Four separate linked spreadsheets provide marginal costs for running the three alternate ancillary services. The cost and revenue results appear in Table 7-3and 7-4.

Table 7-3
Costs for Battery Park – Fort Tilden Services

	Battery Park – Fort Tilden commute only	Battery Park – Fort Wadsworth – Fort Tilden commute + ancillary service; Note 2	MARGINAL Cost, Battery Park - Fort Wadsworth - Fort Tilden ancillary service	MARGINAL Cost, Fort Wadsworth - Fulton Ferry ancillary service, Option 1; Note 3
Capital Debt Service; Note 1	**$433,281**	**$433,281**	**$0**	**$0**
Direct Operating Costs				
Salaries, Wages and Benefits	$99,000	$115,789	$16,789	$50,787
Vessel Fuel and Lubricants	$472,418	$502,305	$29,888	$218,728
Vessel Maintenance Costs	$309,876	$336,998	$27,122	$82,047
Marine Hull Insurance	$136,780	$136,780	$0	$0
Direct Operating Costs Subtotal	**$1,018,074**	**$1,091,873**	**$73,799**	**$351,562**
Indirect Operating Costs; Note 4	**$298,750**	**$326,470**	**$27,720**	**$25,410**
ALL COSTS	**$1,750,104**	**$1,851,623**	**$101,519**	**$376,972**
Operating hours	**1,600**	**1,871**	**271**	**821**
Hourly operating cost	**$1,094**	**$1,016**	**$375**	**$459**

Notes

1. Capital debt service for 131' catamaran built in 1999. Assume no allocation of this cost to ancillary services.
2. The Battery Park – Fort Wadsworth – Fort Tilden ancillary service does not include Fulton Ferry, Brooklyn, and runs weekends only May through September (4 trips/day in shoulder months and 6/day during peak months).
3. All direct costs except marine insurance rise in direct proportion to operating hours; adding Fulton Ferry service (this route segment still includes Fort Wadsworth) raises those costs relative to the Battery Park – Fort Wadsworth – Riis Landing service).
4. Indirect costs rise for ancillary services for several cost items on a per passenger basis.

Table 7-4
Revenues for Battery Park – Fort Wadsworth – Fort Tilden Services

	Battery Park – Fort Tilden commute only; Note 2	Battery Park – Fort Wadsworth - Fort Tilden commute + ancillary service (Note 3)	MARGINAL Revenue, Battery Park – Fort Wadsworth – Fort Tilden ancillary service (Note 3)	MARGINAL Revenue, Fort Wadsworth - Fulton Ferry ancillary service (Note 4)
Revenue; Note 1	$1,750,000	$1,918,000	$168,000	$276,000
Net	-$104	$66,377	$66,377	-$100,972

Notes:
1. Revenues do not include any sales of onboard services.
2. Commute only revenue based on 17% average capacity (175,000 passengers annually), at an average fare of $10 per person.
3. Assumes 16,800 passengers to Fort Wadsworth and Riis Landing (as per ridership scenarios).
4. Assumes 27,600 passengers to Fort Wadsworth and Riis Landing (as per ridership scenarios).

The major marginal cost items for added service to Gateway NRA destinations are fuel, maintenance, and labor. Tables 7-3 and 7-4 indicate high hourly costs ($1,094) for the commuter service and break-even revenue of $1.75M based on 175,000 passengers at an average fare of $10 per person. Ancillary services show lower hourly costs, mainly because of the assumption that capital debt and insurance costs are not allocated to these hours of operation.

Direct operating costs are identical for Options 1 and 2, for which only the numbers of passengers, and the associated per capita indirect costs, differ. The direct costs are much higher than the weekend only service for the plain reason that many more runs are assumed.

The marginal cost of a summer only weekend operation is lowest, and would show a substantial profit ($315,833) if, as assumed here, 3% of Jamaica Bay's visitors were to use the ferry. "Options 1 and 2" stipulate much more in the way of year round service. Option 1 would lose money based on the 1.4% patronage (21,500 passengers) assumed and the Option 2 scenario (6%, 93,450 passengers) would profit about $450,000.

Battery Park – Sandy Hook Route

The cost and revenue calculations have, in addition to the generic elements identified above, the following particulars:

- Fast ferry is a 131' overall length catamaran, 35' in beam, 4.3' draft, powered by twin diesels delivering a total 4307 horsepower, with passenger capacity of 350. The newbuilding cost of the ferry was $7,000,000 in 1999.
- The Park Service Gateway route (ancillary service) is assumed to originate at Battery Park, with two service alternates: with and without an intermediate southbound stop at Fort Wadsworth, and on to Sandy Hook. The return trip in both cases runs directly from Sandy Hook to Battery Park.
- The boat's normal operation is assumed to be a commuter service from Battery Park to Atlantic Highlands (or other terminal in the area at a comparable distance).
- The route particulars are a total distance of 14.8 nm from Sandy Hook to Battery Park, with 14 nm at service speed. The inclusion of a Fort Wadsworth stop adds one mile to the route, half of that assumed to be at low speed for entrance to and departure from the Fort Wadsworth terminal.
- Roundtrip fares are $20/$30 for person/family (50 percent families with average family size of 2.5). Total patronage for the season is 7767.

Paralleling the approach used in the case of the Riis Landing service, costs were estimated separately for direct service between Battery Park and Sandy Hook and service between those two points with an intermediate stop at Fort Wadsworth. The difference in cost between those two services represents the the marginal cost for adding the Fort Wadsworth stop to the weekend service (the daily commuter run was assumed <u>not</u> to include Fort Wadsworth). The results follow in Table 7-5 and 7-6.

Table 7-5
Costs for Battery Park – Sandy Hook Services

	Battery Park – New Jersey (or Sandy Hook) commute only	Battery Park - Fort Wadsworth - Sandy Hook or New Jersey (or Sandy Hook)commute + ancillary service; Note 2	MARGINAL Cost, Battery Park - Fort Wadsworth - Sandy Hook ancillary service
Capital Debt Service; Note 1	**$433,281**	**$433,281**	**$0**
Direct Operating Costs			
Salaries, Wages and Benefits	$92,813	$98,753	$5,940
Vessel Fuel and Lubricants	$462,753	$492,369	$29,616
Vessel Maintenance Costs	$299,880	$309,476	$9,596
Marine Hull Insurance	$136,780	$136,780	$0
Direct Operating Costs Subtotal	**$992,226**	**$1,037,378**	**$45,152**
Indirect Operating Costs; Note 5	**$298,750**	**$324,848**	**$26,098**
ALL COSTS	**$1,724,256**	**$1,795,507**	**$71,250**
Operating hours	**1,500**	**1,596**	**96**
Hourly operating cost	**$1,150**	**$1,125**	**$742**

Notes

1. Capital debt service for 120' catamaran built in 1999. Assume no allocation of this cost to ancillary services.

2. The Battery Park - Sandy Hook ancillary service runs 12 weekends only, 4 round trips per weekend, 192 one way trips total

Table 7-6
Revenues for Battery Park – Fort Wadsworth –Sandy Hook Services

	Battery Park - Sandy Hook commute only; Note 2	Battery Park - Fort Wadsworth - Sandy Hook commute + ancillary service; Note 3	MARGINAL Revenue, Battery Park - Fort Wadsworth - Sandy Hook ancillary service
Revenue; Note 1	$1,750,000	$1,834,000	$84,000
Net	$25,744	$38,493	$12,750

Notes

1. Revenues do not include any sales of onboard services, e.g., food.

2. Commute only revenue based on 17% average capacity (175,000 passengers annually), at average fare of $10 per person.

3. Assumes 7,767 additional passengers (round trip) for weekend service.

South Amboy to Sandy Hook Service

This hypothetical route provides service from South Amboy and Belford to Sandy Hook, 12 peak weekends per year, six times daily. The vessel is a 149 passenger only, diesel powered (1,800 hp) monohull with a service speed of 15 knots, crewed by a captain and two deck hands.

There is no primary service specified in this case. Marginal costs are calculated as before, neglecting in this case capital debt service and marine hull insurance. Total seasonal ridership of 15,000 passengers is assumed, as per the scenario in Section 7.1, at an average round trip fare of $8 from the two feeder locations. Results appear in Table 7-7.

Detailed results of the cost and revenue spreadsheets appear in the report Appendix.

Table 7-7
Costs and Revenues for South Amboy - Belford – Sandy Hook Services

Direct Operating Costs	
Salaries, Wages and Benefits (Deck and Engine, Officers & Crew)	$13,662
Vessel Fuel and Lubricants	$22,333
Vessel Maintenance Costs	$4,246
Marine Hull Insurance	$0
Direct Operating Costs Subtotal	$40,241
Indirect Operating Costs	
Marketing and Advertising	$1,459
Reservations & Sales	$1,094
Protection and Indemnity (P&I) Insurance	$5,250
General Administration	$10,364
Outside Professional Services	$4,291
Indirect Operating Costs Subtotal	$22,458
Total Operating Costs	
	$62,699
Operating Cost per Hour	
	$284
Revenues	
	$120,000
Net	
	$57,001

Notes
1. Assume 50% capacity: 10,728 passengers, 70% adults.
2. Debt service and marine hull insurance taken as zero.
3. Marginal costs and revenues for ancillary service only. Primary service not specified.
4. Maintenance costs for this service taken as 1/3 of yearly total.

Riis Landing

A service linking Riis Landing-Canarsie Pier-Sheepshead Bay also was analyzed in terms of potential costs and revenues. This would be a secondary routing based at the Riis Landing hub. The routing logically would be in a "hub and spokes" configuration, centered at Riis Landing, with the spokes ending at Sheepshead Bay and Canarsie Pier. Short route distances (2.6 and 4.4 miles) indicate that a conventional passenger boat, possibly of greater age and lesser capital value, would suffice for this service.

The assumption is that this would be a dedicated service by an older conventional monohull boat. The specific assumptions and conditions for this route analysis follow:

- The boat is similar to a 51' long wooden monohull, 13.7' in beam, 3.4' draft, powered by a single diesel delivering 600 horsepower, with passenger capacity of 97, modeled for similar service in the Fire Island study. Its service speed is 15 knots. The estimated year 2000 newbuilding cost of this boat is $223,100.
- The boat is assumed to be 60 years old, with no debt service for the owner. The configuration is similar to that of boats included ion the Fire Island analysis, i.e., including no amenities such as rest rooms (short duration trips), or food service.
- This route is assumed to originate at Riis Point, with hub and spoke service to Sheepshead Bay and Canarsie Pier; that is, every leg the boat runs either originates at or terminates at Breezy Point. The geography of the bay makes it impossible to run from Sheepshead Bay to Canarsie Pier without passing very close to the Riis Landing site.
- There is not assumed to be a "normal" operations mode for this boat; it would be a relatively low value asset, crewed by two deck personnel only.
- The vessel would operate May and September, weekends only, four circuits per day, June through August, weekends 7 circuits per day, and weekdays 4 circuits per day. There is potential for chartered trips during the school year, but this possibility is not reflected in this analysis.
- The route particulars are a distance of 2.6 nm from Breezy Point northwest to Sheepshead Bay, and 4.4 nm from Breezy Point north to Canarsie Pier. For this case, with its short routes and lower speed boat, the low speed operation is assumed to be only ¼ nm at departures and arrivals, and service speed is put on for the remainder of the routes.
- No dockage fees are charged by Park Service at the three terminal sites.
- The adult fare is $5.00 for adults and $2.50 for children, also similar to some the Fire Island cross Sound services.
- 3 crew members onboard include a captain and two deck hands.

There are a total of 47,142 available seats per season, given the stipulated service frequencies. In the absence of a market demand analysis, the cost and revenue values are found by the stipulation of three notional patronage ratios – the proportion of passengers to total capacity – chosen at 0.35, 0.50, and 0.70 (16,500, 23,571, and 33,000 passengers, respectively).

The results indicate that, without a subsidy, the operator would probably have to run the entire season in excess of 50% capacity to break even. At 70% patronage, a small profit would be possible. The summary results appear in Table 7-8.

Table 7-8
Annual Costs and Revenue, Jamaica Bay Dedicated Service

	Jamaica Bay 35% capacity patronage	Jamaica Bay 50% capacity patronage	Jamaica Bay 70% capacity patronage
Direct Operating Costs			
Salaries, Wages and Benefits	$31,712	$31,712	$31,712
Vessel Fuel and Lubricants	$11,578	$11,578	$11,578
Vessel Maintenance Costs	$14,315	$14,315	$14,315
Marine Hull Insurance	$669	$669	$669
Direct Operating Costs Subtotal	**$58,273**	**$58,273**	**$58,273**
Indirect Operating Costs			
Marketing and Advertising	$1,526	$2,180	$3,052
Reservations & Sales	$1,145	$1,635	$2,289
Protection and Indemnity (P&I) Insurance	$5,775	$8,250	$11,550
General Administration	$18,250	$21,786	$26,500
Outside Professional Services	$6,600	$9,428	$13,200
Indirect Operating Costs Subtotal	**$33,296**	**$43,279**	**$56,591**
Revenue- passenger fares	**$76,311**	**$109,016**	**$152,622**
Net Cash Flow Before Taxes	**-$15,258**	**$7,463**	**$37,758**

The results of the cost and revenue analysis are summarized in Table 7-9.

Table 7-9
Financial Summary

	Cost	Fare	Annual Ridership	Revenue	Net
Battery Park – Riis Landing $10 fare (commuter)	$1,750,000	$10	175,000*	$1,750,000	-
Battery Park-Ft. Wadsworth -Riis Landing- $10 fare (visitor)	$1,851,600** $101,500 marginal cost	$10	191,800 16,800 visitors	$1,918,000 $16,800 marginal	$66,480
Battery Park –Riis Landing - $20 fare (commuter)	$1,750,000	$20	175,000	$3,500,000	$1,750,000
Battery Park – Ft. Wadsworth – Riis Landing - $20 fare (visitor)	$1,851,600	$20	191,800 16,800 visitors	$3,836,000 $33,600	$2,086,000
Battery Park- Fulton Ferry-Ft. Wadsworth -Riis Landing - $10 fare	$376,970 marginal cost	$10	27,600	$276,000 marginal revenue	-$100,970
Battery Park-Ft. Wadsworth -Sandy Hook	$71,250 marginal cost	Sandy Hook: $15 per person; $25 per family Ft. Wadsworth: $5 per person	7,800	$84,000 marginal revenue	$12,700

South Amboy – Belfore-Sandy Hook	$61,204	$8	15,000	$120,000	$57,001
Riis Landing-Canarsie-Sheepshead Bay (35% capacity)	$91,570	$5 adults $2.50 children	16,500	$76,300	-$15,250
Riis Landing-Canarsie-Sheepshead Bay (50% capacity)	$101,552	$5 adults $2.50 children	23,570	$109,000	$7,500
Riis Landing-Canarsie-Sheepshead Bay (75% capacity)	$114,864	$5 adults $2.50 children	33,000	$152,600	$37,800

*Battery Park – Riis Landing commuter ridership calculated to breakeven point.
** Costs for Battery Park –Riis Landing visitor service include costs of commuter service.

The analysis shows that most of the services could operate with a modest to substantial surplus, assuming that the anticipated ridership scenarios prove to be realistic. Because the ridership forecasts for the service between Battery Park and Riis Landing were based on fares closer to $20 per day than $10, it is reasonable to assume that the ridership levels anticipated could be attained with the higher fare. In that case, all the services studied for Riis Landing, including the connection to Fulton Ferry Landing, would be financially feasible, assuming that some of the commuter service surplus can be used to cross-subsidize visitor services. At a fare of $10, the addition of service to Fulton Ferry Landing would result in a net deficit of about $100,000 annually.

The breakeven point at a $10 fare would be about 43,000 recreational or park-oriented passengers (rather than commuters) for the Battery Park-Fulton Ferry Landing-Ft.Wadsworth-Riis Landing routing, which represents an increase of 15,400 passengers or 56 percent above the level incorporated in the ridership scenario. The breakeven point for the commuter market is reached with the $10 fare. The ridership level of 175,000 commuters assumed in this analysis actually is consistent with the market forecast based on a fare closer to $20 and, therefore, can be considered to be fairly conservative.

The existing summer weekend service between Battery Park and Sandy Hook is estimated to operate at a substantial profit. Lowering fares from $25 to $20 or $15 may

be financially feasible. Ridership could increase as a result from the current level of about 5,000 to 7,000-8,000 passengers per season.

The observation that the primary potential park services appear to be financially viable is highly conditional on the assumption that most of these routes will "piggyback" on existing or new commuter services. This is particularly critical in the case of the primary or core service to Riis Landing. Much of the capital cost of the vessels in service would be borne by the commuter service. Marginal revenues from passengers traveling to and from the park represent only a small share of the annualized capital cost of the vessel(s), except in the case of the modestly scaled secondary service between Riis Landing and Canarsie Pier/Sheepshead Bay. It also is important to note that the estimated costs are exclusive of investments in docks and other landside facilities. It is assumed that these costs will be borne by the Park Service. The commuter service between Battery Park and Riis Landing may be sufficiently lucrative, however, to provide a funding source for either additional ferry services or some portion of landside costs.

8.0 Management/Operations Scenarios

The principal investment by the Park Service in providing ferry services for its visitors will be for landside physical infrastructure, specifically docks and associated facilities for passenger boarding and waiting, and probably the vehicles needed to transport passengers to their destinations within the park units. The most practical approach to operation and ownership of the vessels themselves in most cases will be to rely on private providers. Effective coordination with the private sector will be essential to ensure the success of ferry services and to achieve the benefits expected from investments in fixed facilities.

There are two basic models of dock management that the Park Service can follow: 1) awarding ferry concessions to a limited number of operators through dock management, and 2) allowing open dock use by multiple operators.

Scenario 1: Concession Agreements

The Park Service could offer concession agreements to one or more operators at each of its docks. The concession model of dock management would have several crucial advantages:

- The Park Service could guarantee a fixed amount of service according to a predictable schedule and at agreed-upon fare structure;
- Multiple services could be packaged together, such that an operator is required to cross-subsidize a less lucrative service with a share of the revenues generated by a profitable route. This may be particularly relevant in the case of Riis Landing, where, in the absence of a substantial subsidy from the Park Service, a combined commuter-visitor operation appears to be the most viable option. Concession contracts probably would be necessary to ensure that operators provide a stop at Fort Wadsworth on routes serving Sandy Hook and Riis Landing.
- The Park Service could include provisions in concession contracts requiring operators to participate in demonstration services.
- In the case where a single operator is awarded a substantial concession, the Park Service can consider requiring the operator to provide the landside shuttle service.
- Use of the docks could be scheduled more easily and ferry and shuttle bus schedules could be coordinated more effectively, thus improving the quality of service and allowing shuttle vehicles to be deployed more efficiently.

Scenario 2: Open Dock Policy for Multiple Operators

A second variation would be to open the dock use to multiple operators, and to charge a landing fee for maintenance and dock management. With an open dock

policy, the amount of service provided could be variable and schedules would be random and subject to operator interest and market demand. It is likely to be more difficult to market such services as the schedules might change without notice. Managing schedules would be difficult and the Park Service would have no influence over fare structures.

The advantage of an open dock policy is that with more operators having access to the docks, it is possible that multiple providers will in fact offer more frequent service. Given that the Park Service has an interest in attracting operators to some routes that may not be completely self-supporting, however, the greater control afforded by a concession agreement would be a priority consideration.

9.0 Landside Access

Passengers traveling to the parks by ferries will need landside shuttle bus, tram, or trolley services to reach destinations that are more than a short, walkable distance from the ferry landings. The landside component of the visitor's trip is an integral component of ferry service. Convenient, quick, comfortable, and attractive landside access is essential to attract passengers to ferries, particularly if they are required to pay for the service.

9.1 Landside Access Needs

Some form of landside transit service will be needed at each of the Gateway NRA sites. Basic conditions and requirements are as follows:

Fort Wadsworth: There is a significant grade change between the dock site, adjacent to Battery Weed at sea level, and the visitor center, the upper battery, and other facilities of the campus at Fort Wadsworth. These latter facilities are located at the top of a steep embankment grade separated vertically from the lower battery by approximately 75-100 feet of elevation. The connection between the dock and the facilities uphill is by a steep roadway following the path of the former torpedo railway. Shuttle service will be needed to transport visitors from the dock to the visitor center. Because the dock and the visitor center are separated by a short distance, a single vehicle can complete a round trip in a few minutes.

Riis Landing: The Riis Landing dock location is about 1.25 miles from the beach. A ferry passenger could walk to Riis Beach by following the route along 169th Street, although the distance exceeds the ¼-mile to ½-mile normally considered to be the limit for transit walk access. Shuttle connections from the docking facility to the beach are a necessary component of ferry service programming. Shuttle service also would be needed to support a commuter-oriented ferry service if a parking is provided only at the existing Riis Park parking facility, approximately a half mile away, rather than in a new parking area adjacent to the ferry landing itself.

Sandy Hook: Most of the beaches and other attractions at Sandy Hook are beyond a reasonable walking distance from the dock site. North Beach, at a little over ½ mile from the ferry landing, is at the limit of the customary walk distance for transit and the other beaches are farther away. In addition, because visitors frequently will be carrying items like blankets, beach chairs, clothing, and food, the distance they will be willing to walk is likely to be even shorter.

At present, Shamrock Coach Lines operates a summer weekend shuttle service available to both ferry users, at no cost, and other visitors, for a fare of $1. The bus serves five stops: Ferry Landing, Ft. Hancock Museum, Gunnison Beach, North Beach, and Beach Area E/Visitor Center. The buses run every 30-60

minutes, from 10:20 AM (first ferry arrival) to 6:30 PM (last ferry departure). The shuttle does not serve the two southernmost beaches (C and D), because traffic conditions south of the visitor center can interfere with the bus schedule. A substantial increase in ferry service will require an expansion of shuttle services. Extension of service to the beaches not currently served also might be beneficial and should be given further consideration.

Sandy Hook also would be an ideal setting for bicycle rentals. Some users of the ferry are likely to find bicycles attractive as a mode of circulation within the park unit. The optimal location for the rental concession would be near the ferry landing, if demand is sufficient. Alternatively, bicycle rentals could be consolidated near the park entrance with access from the ferry landing provided by shuttle.

Schedule Coordination: At all three units, coordination of ferry arrivals and departures with connecting landside transportation service is necessary. The challenge would be greatest under an open dock management scenario, as described in Section 8.0, where multiple operators could be using the docks on schedules that may be highly variable.

Dispatching of vehicles needs to be coordinated with the timing of ferry arrivals and departures, irrespective of the dock management approach selected. To the extent feasible, ferries should operate on a fixed and predictable schedule and the landside vehicle fleet should be sized and managed accordingly. Vehicle dispatching and management of dock operations also will be required, however, on a continuous basis. A communications protocol needs to be established such that the ferry operator or departure dock manager notifies the dispatching unit at the arrival dock of all ferry departures and the number of passengers on board each vessel.

9.2 Vehicle Selection Options

Shown below are several different options for the type(s) of vehicles that could be implemented to transport visitors to and from the ferry landings at the Gateway NRA. While these vehicles most commonly are powered by gasoline and diesel engines, they also can operate on alternate fuels (e.g. propane, electric and natural gas). Selection of alternate fuel versions of the vehicles will increase capital cost at the time of purchase and also result in higher operating costs. Fueling infrastructure cost increases will be depend on the choice of fuel chosen. Gateway NRA has an electric tram available for transportation at Riis Landing, although capacity would need to be increased, requiring the purchase of new vehicles. The following examples show the range of potential vehicle types that may suitable for deployment at the Gateway NRA.[2]

[2] The images and specifications for these vehicles are taken from the Specialty Vehicles, Inc. website. Their inclusion in this report is for illustrative purposes and does not constitute endorsement or indication of preference among available models or manufacturers.

Tram power car with trailer(s):

Figure 9-1 depicts a tram power car/trailer configuration. This type of vehicle has been successful in several different applications, with the primary deployment being at theme parks.

This model seats 18 passengers in the power tram and an additional 32 passengers in each trailer. The number of trailers that can be added is dependent on gradient, turning radius and other route characteristics.

One advantage to this configuration is that the power car can be operated with or without trailers. This allows the operator to quickly connect and disconnect trailers as needed to respond to different ridership conditions throughout the day. (Figure 9-3 shows a tram power car without trailers attached.)

A disadvantage of operating with relatively high-capacity trailer connections is that headway times will increase along the route, as fewer vehicles will be operating at any given time. If this configuration is chosen, wayside stops should be designed to accommodate passengers who are waiting for the tram.

Figure 9-2 shows the same tram configuration as Figure 1 with the addition of wheelchair accommodation as required by the Americans with Disabilities Act (ADA). Regardless of the configuration chosen, ADA compliance needs to be a primary concern.

Figure 9-2 ADA-Compliant tram power car with trailer(s)

Figure 9-3 Tram power car without trailer(s) attached

Another type of tram power car is shown in Figure 9-4. This type of power car carries 35 - 40 seated passengers and can be obtained in a variety of configurations, including fully open, half open, fully enclosed and removable side wall designs.

Figure 9- 4 Heavy-duty tram power car

This type of tram is widely used by airports, tour groups and other operators who want to provide passengers with more protection from inclement weather than is provided by the open tram configuration of Figure 9-3. This model seats 35-40 passengers in a variety of seating arrangements, such as forward-facing, perimeter and back-to-back.

Figure 9-5 Heavy-duty tram with trailer(s)

Increased passenger loading can be quickly realized by connecting a trailer to the heavy-duty tram power car, similar to the open-air tram of Figure 9-5. Each trailer seats 35-40 passengers and is available in the same configurations described above for the power car alone. The same wayside considerations apply to this "train" configuration, as passengers will be waiting longer along the route for the next tram.

Another possible vehicle for the proposed routes is a tug and trailer configuration, shown in Figure 9-6. This type of tram was very successful at the Olympics in Atlanta, shuttling athletes, coaches and Olympic officials to the various venues. The trailer seats 35 passengers and multiple trailers can be added, depending on the capacity requirements and route characteristics. The trailer can also be ordered with options, including roll-down sides for weather protection.

Figure 9-6 Tug and Trailer Configuration

Figure 9-7 shows a trackless replica trolley vehicle that is gaining in popularity. This model will seat up to 50 passengers, and it can be designed and built to replicate trolleys that operated many years ago.

Figure 9-7 Classic trolley design

The cost of any of the above trams or trolleys depends on many factors, including options chosen, paint schemes desired and other special considerations.

Capacity requirements are likely to be greatest at Sandy Hook during the peak season and at Riis Landing if a commuter-oriented service is implemented and additional parking is not provided close to the dock site. While relatively low capacity vehicles are likely to be sufficient in many instances at Fort Wadsworth, there will be a need for flexible capacity if plans succeed to enhance educational programming and attract school groups on a regular basis. In addition, the shuttle vehicle selected must have the capability to operate reliably on the steep grade between the dock site and the visitor center.

At all three units, capacity requirements can be expected to be highly variable, peaking at a high of about 200 passengers in a single arrival at Sandy Hook and declining to a low of fewer than 10 passengers. Sizing for a maximum load of about 100 passengers in three or four vehicles or lead unit/trailer combinations would be appropriate at Sandy Hook and Riis Landing, if a commuter-oriented service is offered at the latter site. Cycle times on the shuttle service would be less than 20 minutes, which would represent the maximum wait time for one or more fully-

loaded vehicles to drop-off passengers and return to the ferry landing a second time. Generally, the number of passengers arriving on a single ferry will be substantially lower than peak levels.

10.0 Statue of Liberty Concessions Contract and Visitation Management

Annual visitation at the Statue of Liberty is climbing steadily, exceeding 3.5 million in 1999. During this same year, a total of 5.4 million visits were recorded to the Statue and Ellis Island combined. The Statue attracts an average of 21,000 daily visitors on weekends during the peak summer season.

Visitation at current levels, particularly during the summer, frequently results in crowding and the need for visitors to wait in long lines to board boats to the Statue, to enter the Statue, and to board ferry service leaving Liberty Island. Crowding and queuing are particularly problematic for visitors waiting to enter the crown. Current operating policy restricts access to the crown to only those visitors who arrive at the Statue on the first two boats of the day. The conditions created by excessive use of the Statue detract from the quality of the visitor's experience and cause damage to the physical resource. Cyclic and routine maintenance required to ensure the stability of the resource cannot be performed effectively with visitation volumes at such high levels.

The Statue is served by ferries operated under a concession contract with Circle Line-Statue of Liberty Ferry, Inc. While the terms of this contract stipulate that the Superintendent must approve the ferry operating schedule, service frequencies are not planned with the objective of matching visitation to capacity limitations at the Statue. The current concession contract will expire in 2004, at which time a new contract will take effect. The bidding and negotiation of a new contract offer opportunities to address several crucial objectives:

- improving the management of visitation to the Statue
- integrating ferries within a coordinated New York Harbor Parks Alternative Transportation System (ATS)
- supporting more effective use of underutilized park units and other assets.

10.1 Existing Conditions

10.1.1 Concessions Contract Provisions

The ferry operator is required under the existing contract to provide service to the Statue in the peak season on a 30-minute schedule from both Battery Park in Lower Manhattan and Liberty State Park in Jersey City. The contract provides that the Superintendent will determine the minimum service standard in off-peak periods and that, at a minimum, service will consist of a loop connecting Battery Park, Liberty Island, and Ellis Island. Service is year-round, seven days a week, except on Christmas Day, when the Statue and Ellis Island are closed. The contract specifies maximum capacity and size of vessels. The contract does not stipulate fare levels, except to require that fares be the same from Battery Park and Liberty State Park and that no additional fare is charged for the service connecting Liberty and Ellis Islands.

10.1.2 Wait Times

The University of Vermont's School of Natural Resources conducted a survey of visitors to the Statue and Ellis Island for the National Park Service in 1998 on a sampling of days from July through September. Survey results showed that waiting time to enter the statue averaged 34.3 minutes. Waiting times in the period before 11:00 AM were approximately twice as long, however, as the daily average. Before 10:00 AM, waiting times to enter the Statue averaged 72 minutes. Variation in waiting times may be highly variable, although this information was not included in the survey report. The report notes that the longest waiting time for entry to the Statue recorded in the survey was four hours. Total visitation increased by nearly 5 percent from 1998, when the survey was conducted, to 1999, and waiting times can be expected to have increased somewhat as a result and will continue to grow as visitation rises.

The survey results indicate that waiting times do not build over the course of the day, as might be expected if ferries were carrying more visitors than could be processed through the Statue generally. Survey results actually show that the number of visitors arriving on Liberty Island via ferry peaks in the period from 11:00 AM to 1:00 PM, during which time average waiting times to enter the Statue decrease from 49 to 32 minutes. The excessive waiting times recorded in the early part of the day may be related to the slower processing time and queuing resulting from visitation to the Statue crown. Even though the only visitors permitted access to the crown are passengers on the first two boats of the day, the time required for these visitors to climb up to and down from the crown appears to cause a bottleneck at the entrance to the statue, where the effects on visitor flows last until about noon. Further reductions in the number of visitors allowed access to the crown may result in a substantial decrease in the queuing that occurs in the early part of the day.

While the 1998 survey shows that the longest waiting times are for entry into the Statue, visitors also wait to buy ferry tickets, to board the ferry at Battery Park and to board the ferry at Liberty and Ellis Islands. Visitors to the Statue wait an average of approximately 52 minutes at these locations, cumulatively. For those who visit both the Statue and Ellis Island, total average waiting time is nearly ten minutes longer. Thus, total average waiting time is substantial and could be expected to have a significant effect on visitor satisfaction. Survey respondents reported that they were willing to wait 61 minutes just to enter the Statue of Liberty, however, which is substantially longer than the recorded average waiting time of 34.3 minutes.

Evidence from the survey suggests overall that waiting and crowding are not yet at crisis proportions during most time periods and that further restriction of access to the Statue crown may alleviate the worst problems, which tend to be concentrated early in the day. Nevertheless, half of the time during the peak summer season, conditions are worse than the average or mean waiting time, and there are indications that the variation in waiting times may be quite large, ranging up to four hours in the worst of conditions. If visitation continues to grow at the substantial rate experienced in recent years, crowding and queuing problems will increase.

10.2 Planning for Improved Use of Resources

10.2.1 Carrying Capacity

The capacity of the Statue of Liberty physical resource is not now considered explicitly in determining the operating characteristics of ferry services. Re-bidding of the contract in 2004, however, will provide the means of instituting operating controls and procedures that can serve a potentially broad range of objectives, including resource protection and maintaining the quality of the visitor experience. As a foundation for developing contract provisions that address these issues, a necessary first step would be determination of the "carrying capacity" of the Statue and possibly Liberty Island and facilities on Ellis Island. Carrying capacity would be defined in terms of the volume of visitors that can be accommodated without resulting in significant resource damage or overcrowding and excessive waiting times.

In attempting to quantify carrying capacity, the crowding/waiting time issue is distinct from the objective of protecting the physical resource, to the extent that resource damage or physical maintenance requirements do not vary directly as a function of waiting times. For example, total volumes of visitation over a day, week, month, or year may be more relevant than the duration of waiting times to preserve the sustainability of the physical resource. In that case, carrying capacity may be defined in terms of daily visitation volumes, although this may not be sufficient to address the waiting time issue. To determine carrying capacity in terms of waiting time objectives, it will be necessary to quantify the time visitors spend in the Statue and how many visitors can be accommodated at this rate within a specific time interval, such as an hour. Any excess volume of visitors will result in queuing and the extent of waiting time can be estimated for different rates of arrivals at the Statue from ferries. Ferry level of service to the Statue then can be tailored to meet waiting time quality standards for the Statue. Carrying capacities also should be considered in determining the need for a reservation system.

10.2.2 New Transportation Service Options

Limiting the amount or frequency of ferry service to the Statue is only the most immediate and narrow of the options to be considered in addressing the problem of over-visitation. New ferry services can be developed serving additional destinations to accommodate Statue overflow, providing alternatives to current usage patterns. One potentially promising option that bears detailed study would be a cruise around the Statue, providing close-up viewing and on-board audio interpretation. A variation of this option might combine a cruise with the opportunity to disembark at Ellis Island. Yet another option, possibly even providing greater benefits to visitors and more effective use of park resources, would be services to additional park assets, such as Fort Wadsworth in Staten Island and Castle William on Governor's Island. These park assets could be linked thematically in a harbor fortifications tour, for example, connecting Castle Clinton, Castle William and Fort Wadsworth.

Capacity issues at the Statue provide the opportunity to consider ferry service from a broader perspective, as a means of integrating the Statue and Ellis Island within the larger conceptual framework of the New York Harbor Parks. Castle Clinton may emerge in a unified park

transportation plan as a ferry service hub, providing a base for a menu of ferry services and visitation opportunities, including the Statue and Ellis Island as prominent elements, but also encompassing assets at the Staten Island unit and Governor's Island, as noted above, as well as Jamaica Bay and Sandy Hook. Ferry service may have the potential to provide a defining and unifying element for the park, integrating its spatially and functionally diverse components into a unified whole. Another important consideration is the potential for the Statue ferry service to generate revenues that can be used to support other ferry connections in the New York Harbor Parks (from Castle Clinton to Jamaica Bay or Fort Wadsworth, for example) that may not be completely self-supporting.

11.0 Conclusions and Recommendations: Preliminary Concept Plan

The concept plan emerging from the analysis efforts described in previous sections is presented below. The central elements of this plan are the ferry routes proposed to serve the Gateway NRA and the dock sites that represent the origins and destinations of these routes. A ferry transportation system is proposed consisting of a core set of ferry landing sites at Gateway NRA units, Battery Park in Manhattan and other key locations in New York Harbor. Specific sites and a potential route configuration are identified below and in Figure 10-1.

Figure 11-1
Proposed System Concept Plan-Ferry Routes

11.1 Core Facilities

The "core" of the system would be created by the construction or installation of docks and associated terminal facilities at the following locations within Gateway NRA:

- Torpedo Pier at Fort Wadsworth
- Riis Landing at Breezy Point
- Fort Hancock at Staten Island

A phased approach to developing these facilities is recommended, with the initial priority being the provision of floats and implementation of improvements required for safe and reliable operations. Investment in the construction of fixed piers is recommended as a longer-term priority, following the demonstration of initial success in building a market for the services provided.

Battery Park is another landing site included in the proposed core system, chiefly because creating a commuter service from Riis Landing to Manhattan is the most promising strategy for funding visitor service to Jamaica Bay/Breezy Point and Fort Wadsworth. The Park Service can investigate the feasibility of using existing berthing locations at Battery Park during the initial phase of operations, prior to committing to the investment in new facilities. Once ferry operations have been successfully established, the development of the Marine Inspection Office (MIO) pier at Battery Park may be necessary to support service to Riis Landing and would have a number of important advantages.

An improved and expanded ferry landing facility at the MIO dock facility would provide increased docking capacity. Facilities would be designed to accommodate vessels ranging widely in size, including the large catamarans most likely to provide service to Gateway sites. The estimated costs of proposed dock facility improvements at the three Gateway sites and the MIO dock are as follows:

- Torpedo Pier- Phase 1: temporary floating dock, landside improvements $400,000
- Riis Landing – Phase 2 – new float, reorganization of piers, breakwater repair, site improvements - $725,000
- Sandy Hook – Phase 1: seasonal ferry terminal (80 x 20' spud barge, ramps, site improvements) - $675,000

  Phase 2 –fixed pier, terminal facilities - $2,100,000
- Marine Inspection Office – float construction, ramps - $675,000

The core ferry landing facilities administered by the Park Service would be connected by a set of routes, as follows:

- Riis Landing-Fort Wadsworth-Battery Park: commuter and visitor
- Sandy Hook-Fort Wadworth-Battery Park: primarily seasonal, visitor-oriented service in initial phase

Service to Fort Wadsworth can be provided as an intermediate stop on both routes, requiring minimal route diversion because of Fort Wadsworth's central location. The link between Riis Landing and Battery Park is identified as a core route largely because operating commuter service between the two points would provide the financial means to support visitor service. Battery Park, as the departure point for existing services to the Statue of Liberty and Ellis Island, also represents a logical hub for potential new excursion services, such as a tour of historic harbor fortifications, including Castle Clinton, Battery Weed/Fort Wadsworth, Castle William on Governor's Island, and Fort Hancock.

11.2 Additional Core Routes

Several additional potential routes would serve Gateway NRA markets that are likely to be of equal or greater size than the market coming from Manhattan. These routes include:

- Fulton Ferry Landing – Riis Landing
- Brooklyn Army Terminal – Riis Landing
- New Jersey Hudson River/Upper Bay sites (Weehawken, Hoboken, Jersey City, Liberty State Park) – Sandy Hook or possibly Riis Landing
- New Jersey Bayshore (South Amboy, Belford) – Sandy Hook

In the case of this latter set of routes, the Park Service would not own or manage the docks at the origin or departure sites. The Park Service could facilitate or support the implementation of these routes through a variety of mechanisms, however, chief of which would be concession agreements with private operators to provide service from existing docks at the origin points. Since service to the park units generally would be concentrated in off-peak hours, relative to commuter service, there are likely to be multiple opportunities to initiate such services, without undue capacity limitations or conflicts at existing docking facilities.

Service between the Fulton Ferry Landing or Brooklyn Army Terminal and Riis Landing could be added to the Battery Park-Riis Landing route, at modest cost in terms of travel time and operating expense. Because recreational resources at Jamaica Bay/Breezy Point are of greatest appeal to local residents, service to Brooklyn sites lacking good landside transit connections to the park unit is likely

to have good market potential. Service between New Jersey origins and Sandy Hook would be seasonal and limited to weekends. On a longer term basis, as the planned renovation and reuse of buildings at Fort Hancock proceeds, a weekday service between Manhattan and Sandy Hook, perhaps with an intermediate stop at Fort Wadsworth, may be viable.

A secondary route that is considered promising would connect Riis Landing with Canarsie Pier. In this case, Riis Landing would serve as a hub with a primary route connection to Battery Park, Fort Wadsworth, and Fulton Ferry Landing or Brooklyn Army Terminal. The connection to Canarsie Pier would be a single spoke from this hub, primarily carrying passengers *to* Canarsie Pier as a destination. Another potential spoke from the Riis Landing hub would be a link to or excursion route through the Jamaica Bay Wildlife Refuge. There may be additional opportunities in the future to include Gateway NRA sites as intermediate stops on other routes, such as those included in the Harbor Loop network and a service between Manhattan and JFK Airport.

11.3 Markets and Financial Feasibility

The review of market characteristics for Gateway NRA suggests that potential demand for ferry service among park visitors is likely to be in the range of 10,000-20,000 passengers per year at each unit. In the case of Staten Island, this estimate assumes increases in visitation by students on the order of 50,000 per year, in response to the expansion of educational programs. Ridership of 15,000 per year between New Jersey Bayshore points and Sandy Hook is considered likely during weekends from June through August. Estimates of ferry ridership to Riis Landing on the order of 10,000 per year are for a seasonal weekend service from May through September and year round weekday service, primarily as the backhaul for commuter service.

The analysis of service costs and potential revenues indicates that the ferry services identified above could be financially viable, in terms of covering vessel capital and operating costs, subject to several conditions:

- In the case of Riis Landing, a primary commuter service is provided to Battery Park, generating sufficient revenue to cover vessel capital costs.

- Other park-oriented routes are operated as incremental "piggyback" services to commuter routes. Private operators of existing or planned commuter boat services would serve the parks as an intermediate destination on the backhaul of commuter routes or add service to the parks during mid-day or weekend hours.

Thus, the implementation of service to the park as an addition or increment to privately operated commuter service is central to the financial viability of the proposed ferry system concept. As the number of services in the harbor proliferates, opportunities for such "piggy-backing" can be expected to increase.

It is important to note that the cost estimates included in the financial analysis are exclusive of Park Service investments in landside facilities and shuttle transportation services. Distribution and collection of passengers by shuttle bus, tram, or trolley will be needed to transport passengers between the ferry docks and their desired destinations at each of the Gateway NRA units.

There are two possible alternative strategies, in addition to piggy-backing, for funding Gateway NRA ferry services:

- Pooling or sharing revenues with Statue of Liberty/Ellis Island services
- Subsidizing the service from other public sources.

In the absence of funding from either of these two alternative sources, "piggybacking" of park ferry services onto commuter routes appears to be a financial necessity.

11.4 Coordination with Statue of Liberty Ferry Services

The existing concessions contract for Statue of Liberty and Ellis Island ferry service is a product of a time when visitation to these sites was substantially lower than it is today. Overcrowding, excessive waiting times, and damage to the Statue physical resource are all growing challenges that may require visitation management solutions, which could include controls on the flow of visitors arriving on Liberty Island by ferry and possibly a reservation system. Additional options could include the development of new ferry services with interpretive programs, such as all-water cruises around the Statue or connections to other New York Harbor Park assets, to accommodate overflow demand for access to the Statue and to provide new visitation opportunities.

Evidence from the survey conducted in the summer of 1998 suggests that crowding and queuing conditions at the Statue are not yet severe. These data do not address the question of possible damage to the Statue physical resource associated with high visitation volumes. The next step in planning for the new concession contract would be a technical assessment of the relationship of visitation volumes to both waiting times and physical resource impacts. Further steps would involve:

- development of quality standards for waiting times and crowding
- translation of quality standards and impacts data into quantitative carrying capacity estimates
- development of ferry service standards and operating restrictions based on carrying capacities

This effort could provide the technical foundation for a unified visitation management plan for the National Parks of New York Harbor. Ferry service standards, in terms of required headways and limits on vessel size or passenger boardings, would be a principal element of the plan and would be incorporated in the new Statue of Liberty/Ellis Island concessions contract. Another

major element of the plan would be a coordinated strategy for developing, operating and financing potential new services, including services to Gateway NRA. One approach to financing new services would be to package them with Statue service under a single contract with a private operator, providing a mechanism for sharing revenues among multiple services. The advantages and disadvantages of this approach, versus other strategies for cross-subsidizing new services, merit detailed analysis prior to bidding the concessions contract in 2004.

As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our parks and historic places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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