4.0 Existing Conditions

4.1 Introduction

This section presents the existing environmental conditions in the vicinity of the proposed Goethals Bridge Replacement (GBR) alternatives. The descriptions, methodologies, and data sources discussed in this section have been prepared in conformance with the National Environmental Policy Act of 1969 (NEPA) and other federal requirements, regulations, and guidelines, as applicable.

Existing environmental conditions vary depending on discipline, and actual baseline information may reflect 2004, 2005, 2006 and/or 2007 inventory data. The existing conditions for each environmental resource provide the context for assessing the environmental impacts associated with each resource, the results of which are presented in Section 5.0. Specifically, the following environmental disciplines are addressed in this section:

- Land Use and Zoning
- Socioeconomics
- Community Facilities
- Parklands and Recreational Facilities
- Historic Resources
- Archaeological Resources
- Visual Quality and Shadows
- Topography, Geology, and Soils
- Water Resources
- Floodplains
- Biotic Communities
- Wild, Scenic, and Recreational Rivers
- Navigation and Airspace
- Infrastructure
- Contaminated Materials
- Traffic and Transportation
- Air Quality
- Noise and Vibration

Section 4.0 is subdivided into separate sections based on each of the above disciplines. These sections are further organized into subsections that generally provide an introduction, a description of the methodology, and a description of the existing conditions for each resource.

4.2 Goethals Bridge Study Area

The overall Goethals Bridge Study Area (Study Area) consists of two separate components: a Primary Study Area and a Secondary Study Area. The Primary Study Area, which most closely follows the existing Goethals Bridge corridor, was developed to include all of the alternative bridge replacement alignments being considered such that the direct impacts of those alignments can be assessed and presented in Section 5.0. The Secondary Study Area extends from the boundary of the Primary Study Area to a point further out from the Goethals Bridge in order to allow indirect, or secondary, project-related impacts to be evaluated and presented in Section 5.0. In combination, these two separate Study Areas comprise the overall Goethals Bridge Study Area, all of which are depicted in Figure 4.2-1.

For some disciplines (e.g., wetlands), the discussion focuses on identifying the existing conditions within the Primary Study Area, since the potential impacts to result from any of the alternative alignments are primarily related to direct physical alteration within the proposed right-of-way. For other disciplines (e.g., socioeconomics), the discussion focuses on identifying existing conditions within the larger Goethals Bridge Study Area, since the potential impacts can be more geographically widespread.

4.2.1 Primary Study Area

The Primary Study Area encompasses the industrial waterfront in New Jersey, principally in the City of Elizabeth, with a smaller portion in the City of Linden, as well as some of the less-developed areas in the northwestern portion of Staten Island.

As depicted in Figure 4.2-1, the Primary Study Area is defined as the existing Goethals Bridge Corridor (in both New York and New Jersey). The Corridor encompasses the bridge itself and its approach alignments, running along I-278 from the western point where I-278 crosses over Bayway Avenue and the Staten Island Railroad (SIRR) tracks in New Jersey, to its eastern point where I-278 crosses over Forest Avenue in Staten Island. The Primary Study Area runs parallel to the Corridor and is defined as 500 feet (north and south) from the centerline of existing I-278 and the Goethals Bridge. The Primary Study Area actually extends further to the east in Staten Island than the proposed improvements.

4.2.2 Secondary Study Area

The Secondary Study Area, within which indirect, or secondary, project-related impacts may occur, extends approximately one-half mile in all directions from the Goethals Bridge Corridor. The overall Goethals Bridge Study Area has the same general configuration as the Primary Study Area, except that it is much larger (see Figure 4.2-1). Like the Primary Study Area, the Secondary Study Area encompasses the heavily industrialized waterfront in Elizabeth and Linden, and the less-developed industrial area of northwestern Staten Island. Overall, the limits of the Secondary Study Area run from Grier Avenue in Elizabeth on the west, to approximately Fahy Avenue in Staten Island on the east.

4.3 Other Study Areas

In addition to the Goethals Bridge Study Area and its separate Primary and Secondary components as discussed in Section 4.2 above, several other types of Study Areas were also considered, as applicable.

A separate Regional Study Area (see Figure 4.3-1) was established for identifying and evaluating traffic, transportation and air quality impacts. In addition, a Goethals Transportation Model (GTM) Study Area was established (see Figure 4.3-2) to perform the travel demand forecasting to assess the project-related impacts within the Regional Study Area (see Section 5.0) and an Area of Potential Effect (APE) was established to identify historic and archaeological resource areas (see Sections 4.8 and 4.9, respectively).

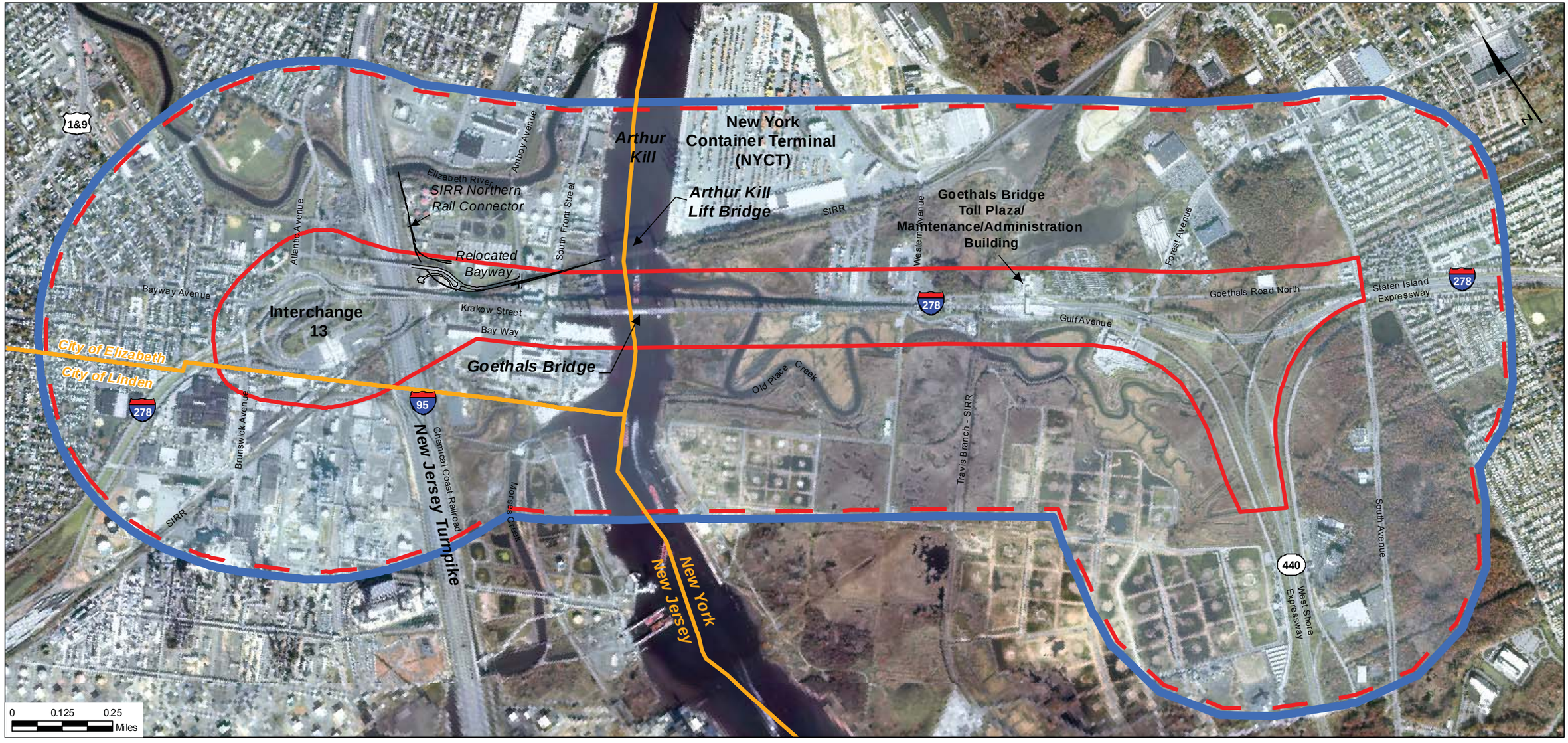
The Regional Study Area was also used to evaluate the Proposed Project's potential cumulative impacts, as well as other major transportation and development projects in the Goethals Bridge Corridor's vicinity and region, as discussed in Section 5.0.

As depicted in Figure 4.3-1, the Regional Study Area extends well beyond the Goethals Bridge Study Area, encompassing all or portions of the seven counties in New York and New Jersey that have the greatest potential to be affected by any Goethals Bridge Replacement and associated improvements. These include Richmond, and portions of Kings and New York Counties in New York, and portions of Union, Essex, Hudson and Middlesex Counties in New Jersey.

4.4 Land Use and Zoning

4.4.1 Introduction

The Goethals Bridge Study Area for the Proposed Project encompasses portions of the cities of Elizabeth and Linden in New Jersey and the Borough of Staten Island in New York City, New York. Because of their different development histories, the New Jersey and New York portions of the Goethals Bridge Study Area have different development patterns. The New Jersey side contains a higher density of industrial uses with a small pocket of residential use, while the New York side has industrial properties interspersed among large vacant lands and wetlands. The New York side has recently been the focus of new development plans, including major proposals for the former GATX property that have since been



Legend

- Primary Study Area
- Secondary Study Area
- Goethals Bridge Study Area

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.2-1
Goethals Bridge Study Area

United States Coast Guard

Legend

Roads

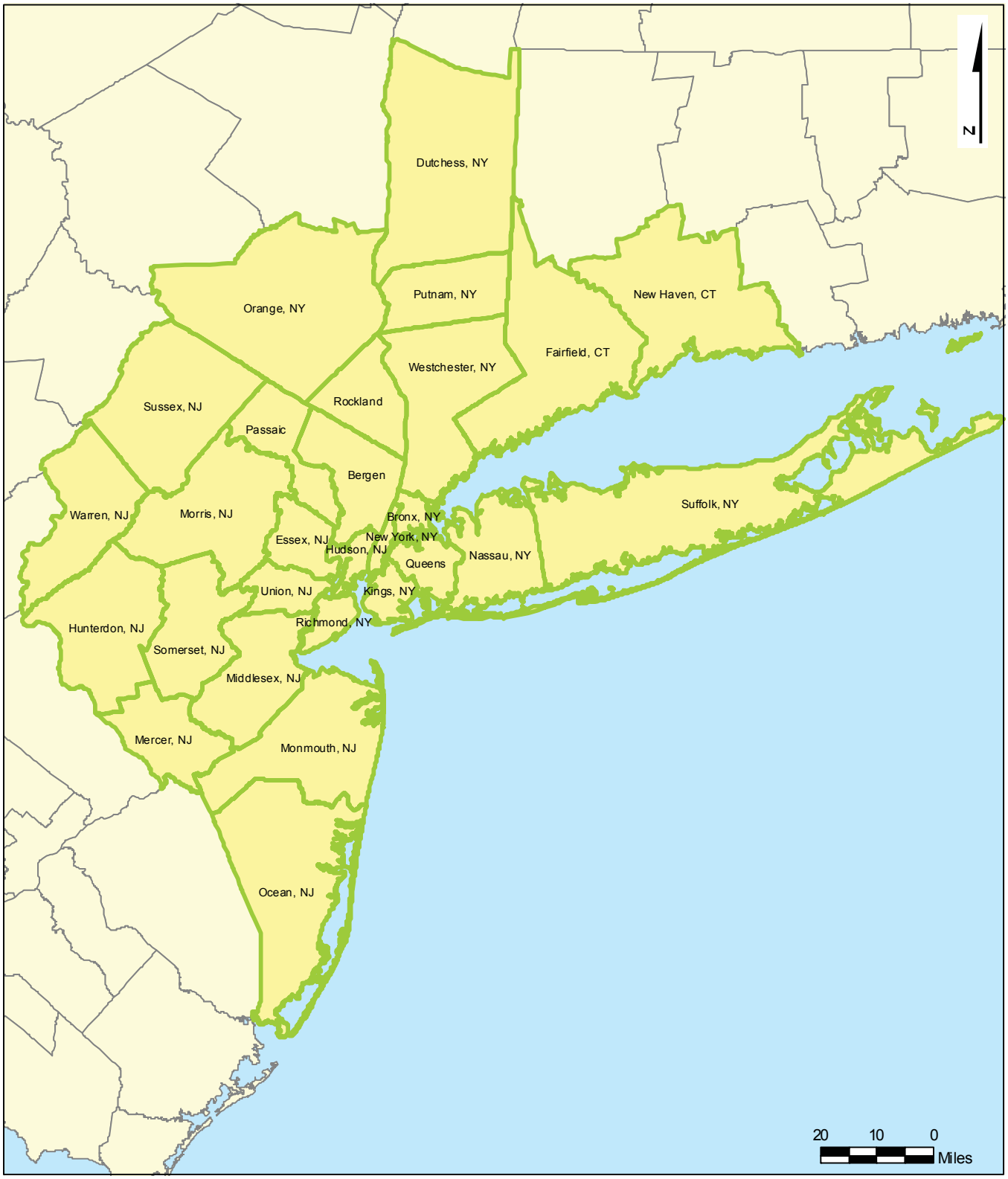
- Highways
- Secondary Roads
- Airports
- Railroad

Goethals Bridge Replacement EIS

FIGURE 4.3-1

Regional Study Area

United States Coast Guard



Goethals Bridge Replacement EIS

FIGURE 4.3-2

Goethals Transportation Model Study Area

United States Coast Guard

dropped from further consideration, and the expansion of port and intermodal facilities in and around the former Howland Hook Marine Terminal site (currently referred to as New York Container Terminal).

4.4.2 Land Use Overview

4.4.2.1 New Jersey

The Goethals Bridge Study Area cities of Elizabeth and Linden are located in Union County. Elizabeth is approximately 12 square miles in size, while Linden is approximately 11 square miles. Both cities consist of mostly medium-density residential, industrial, and commercial land uses. The city of Elizabeth serves as the county seat of Union County and therefore is the location of many county government facilities. In 2000, Elizabeth's total population was 120,568, equating to 9,865 persons per square mile. Linden has a lower density of 3,645 persons per square mile, with a total population of 39,394. Elizabeth's residential areas are distributed throughout the city, while none of Linden's residences are located east of the New Jersey Turnpike.

Both cities contain large industrial areas along the Arthur Kill. The area's diverse and complex transportation network, which has facilitated the prosperity of these industrial areas, includes numerous ports, railroads, highways, and an airport. These regional transportation facilities represent a large percentage of the total developed land in both cities and are a significant factor in the region's economic activity. Nearly half of Elizabeth's total land area is comprised of transportation facilities, including portions of Newark Liberty International Airport and Port Newark/Port Elizabeth, one of the world's largest container ports.

Transportation facilities combined with industrial uses occupy a substantial amount of Linden's overall land area, while the area along the Arthur Kill waterfront is occupied by an oil refinery, an electric generating station and various petroleum and chemical storage facilities.

4.4.2.2 New York

The Borough of Staten Island is located in Lower New York Bay and is separated from New Jersey by the Kill Van Kull on the north and the Arthur Kill on the west. For the most part, it is characterized by suburban, low-density residential development. According to the Borough's 2002 land use inventory, 36.2 percent of the Borough's land uses consisted of a mix of one- and two-family houses and multi-family properties[1]. Most of the industrial and manufacturing uses in the Borough are located on the low-lying banks of the Arthur Kill and Kill Van Kull. These include the Port Mobil, Con Edison and New York Container Terminal (NYCT) facilities.

Large areas within the borough are dedicated to open space and serve as a major amenity to the residential population, adding to the quality of life. The largest park in Staten Island, La Tourette Park and Golf Course, is a 511-acre active recreation park that is adjacent to the 100-acre Historic Richmond Town, which is owned by New York City and operated by the Staten Island Historical Society. Other parks include Clay Pit Pond State Preserve, Gateway National Recreation Area, Clove Lake Park, Great Kills Park, Miller Field, Fort Wadsworth and Silver Lake Park. None of these parks are located in the Goethals Bridge Study Area.

The former Fresh Kills landfill, located far to the south of the Goethals Bridge Study Area, is the largest physical landmark in the borough. This 2,200-acre area consists of 995 acres of former landfills that have been closed and capped. The site is currently being planned for re-use as a large regional park.

[1] NYC Department of Finance, Real Property Assessment Division, modified by NYC Department of City Planning, 2002.

4.4.3 Existing Land Use in the Goethals Bridge Study Area

4.4.3.1 New Jersey

In New Jersey, development is relatively dense with little room for further growth. The New Jersey Turnpike and the Chemical Coast Secondary Line divide the area into an eastern section that is predominantly industrial and a western section that is comprised mostly of residential and commercial uses and parkland. The existing Goethals Bridge approach (Route I-278) further divides the area into a northern section and a southern section.

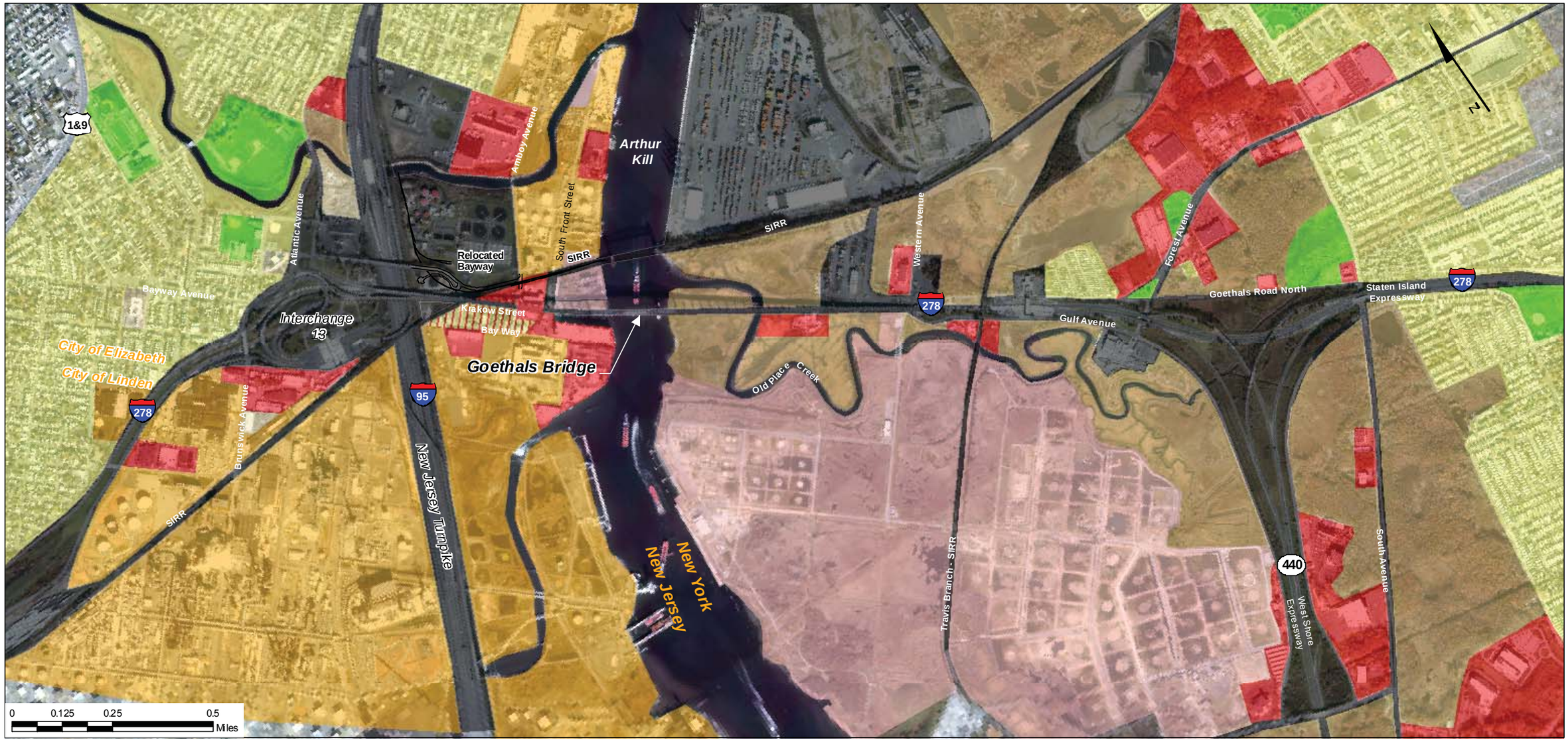
North of the existing Goethals Bridge approach along the Arthur Kill is a vacant parcel and the former Borne Chemical Company property (an abandoned industrial site). North of the Borne property is an oil company terminal which is located on both sides of South Front Street. Further north is a storage and builder supply company, several small industrial properties and the former Chemical Control Corporation site, a Superfund Site. A solid waste transfer station is located between South Front Street and Amboy Avenue and a former scrap metal facility is located between Amboy Avenue and the Chemical Coast Secondary Line Northern Connector, which was recently completed (see Section 4.17). Located north of the railroad on the west side of Amboy Avenue is the sewage treatment plant of the Joint Meeting of Municipalities, which runs to the Elizabeth River. North of the river on the south side of Third Avenue are a trucking terminal and a material supply yard belonging to the Elizabethtown Gas Co. In addition, Bayway has been recently relocated to directly connect with Amboy Avenue north of the bridge approach.

West of the Turnpike and north of Route I-278 are PSE&G's Bayway Switching Station, the City's animal shelter and the municipal recycling center, all of which are located along the east side of Trenton Avenue, south of the Elizabeth River. To the west of these properties, across Trenton Avenue, are Public School No. 22, Drotar Field, the Erxleben Recreation Center and extensive residential uses. Mattano Park, a large county park, and additional residential uses are located to the north of the Elizabeth River, west of Trenton Avenue.

South of the existing bridge approach and east of the Turnpike is a small residential and commercial neighborhood along Bay Way and Amboy Avenue. Four attached brick row houses and four detached homes (one of which is vacant) are located on the south side of Krakow Street and a two-story multi-family residence is located on Amboy Avenue; twelve residential or mixed-use structures are also located on the north side of Bay Way between the Chemical Coast Secondary Line and South Front Street. Between South Front Street and the Arthur Kill south of the bridge alignment is the Bayway Industrial Center, a complex of several warehouse buildings formerly known as the Joseph Cory furniture warehouse. On the south side of Bay Way, between South Front Street and the Chemical Coast Secondary Line, are the facilities of Phelps Dodge Specialty Copper Products. Further west on Bay Way, a new 197,335 square foot refrigerated and distribution warehouse facility, the Preferred Freezer Services operated by Campanelli Companies, was recently constructed and opened in 2008 at 150 Bay Way across from the residential neighborhood.

West of the Turnpike and south of I-278 on Allen Street are several commercial properties. In the Linden portion of the Goethals Bridge Study Area, the Goethals Industrial Park (the former Simmons Mattress Factory), several isolated residences and a USDA Plant Inspection Station are located along Brunswick Avenue. To the south, at the intersection of Brunswick and South Park Avenues, is the Conoco Phillips Bayway Refinery. Several commercial properties are located on the north side of South Park Avenue and the Staten Island Railroad (SIRR) which runs along the refinery's northern periphery.

Figure 4.4-1 depicts the generalized land use patterns in the New Jersey portion of the Goethals Bridge Study Area.



Legend

- Primary Study Area
- Secondary Study Area

Land Use

- Commercial
- Cemetery
- Industrial
- Park
- Public Facility
- Residential
- Mixed Use (Residential/Commercial)
- Transportation, Communication and Utilities
- Undeveloped
- Vacant Industrial

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.4-1
Existing Land Use

United States Coast Guard

4.4.3.2 New York

In the Borough of Staten Island, the Goethals Bridge Study Area is mostly undeveloped, although transportation, utility and some residential and commercial uses are present. Located to the north of the existing bridge approach, between the Arthur Kill and Western Avenue, is an expansive area of wetlands and the 187-acre New York Container Terminal. The SIRR runs between these two areas to the south. A Coca-Cola distributorship is located in the northwest quadrant of the intersection of Western Avenue and Goethals Road North. Located on the north side of Goethals Road North, between Western and Forest Avenues, are a Texas Eastern metering station (in the northeast quadrant of the intersection of Western Avenue and Goethals Road North), a large tract of undeveloped land, the Goethals Bridge administration building and maintenance facility, Goethals Garden Homes Community (a mobile home park), a new commercial plaza/strip mall near the intersection of Forest Avenue and Goethals Road North, and the Joseph Manna Park, a small passive city park. The Travis Branch of the SIRR crosses I-278 in a north-south direction east of Western Avenue.

At 2629 Forest Avenue Block 1384/Lot 37 & 11), next to the Joseph Manna Park, there is a new commercial development owned by MASUCCI Properties. This project includes the recently-completed, 27,000-square-foot commercial building with a 90-car parking lot, drywells and a septic system. The project also includes a split rail fence and a deed-restricted vegetated buffer area between the development and the wetland located at the north end of the property.

South of the bridge approach, between the Arthur Kill and the extension of Western Avenue, the area is primarily undeveloped wetlands. Only one commercial property is located in this area. Known as R.T. Baker & Son Machinery Salvage Company, this property handles the processing of batteries and auto parts. Located south of Old Place Creek, between the Arthur Kill and the West Shore Expressway, is the property of the former GATX Staten Island Terminal (an oil storage and transfer facility).

On the south side of Gulf Avenue, between Western and Forest Avenues, are two vacant commercial properties, a plumbing contractor, an environmental services contractor and KeySpan's Staten Island Service Center (recently acquired by National Grid).

Figure 4.4-1 depicts the generalized land use patterns in the Goethals Bridge Study Area in the Borough of Staten Island.

4.4.4 Existing Zoning in the Goethals Bridge Study Area

4.4.4.1 New Jersey

Elizabeth

The Goethals Bridge Study Area between the Arthur Kill and the New Jersey Turnpike is zoned as medium industrial (M-2), while the area immediately west of the Turnpike is zoned as light industrial (M-1). West of Trenton Avenue, zoning is primarily multifamily residential (R-3) with small areas zoned for single-family residential, commercial, and open space. The single-family residential district (R-1) encompasses Pulaski Street between Richmond Street and Clifton Street. Mattano Park and Drotar Park are zoned as Open Space, while the land along Bay Way and north of the Elizabeth River is zoned as a Special Commercial Zone.

Within the M-1 District, permitted uses include: light manufacturing, distribution and trucking, wholesale and storage, selected commercial uses, and automobile-related services. Permitted uses in the M-2 District include all the uses permitted in the M-1 zone, as well as other industrial uses such as bulk storage of petroleum, vehicle manufacturing and assembly and structural steel fabrication.

Linden

The Goethals Bridge Study Area includes a small portion of Linden. The predominant zoning designation for this portion is H-I, which allows heavy industrial activities, such as utility generating stations, truck terminals, tank farms, and other manufacturing and processing activities. This designation covers large portions of eastern Linden, with industrial activities situated in an area east of U.S. Route 1 & 9. A segment of the Study Area between Route I-278 and the SIRR is zoned L-I (light industrial). Adjacent to this area, bordering Elizabeth, is a small area zoned for two-family residential (R-2b).

Figure 4.4.2 depicts current zoning patterns within the cities of Elizabeth and Linden in the Goethals Bridge Study Area.

4.4.4.2 New York

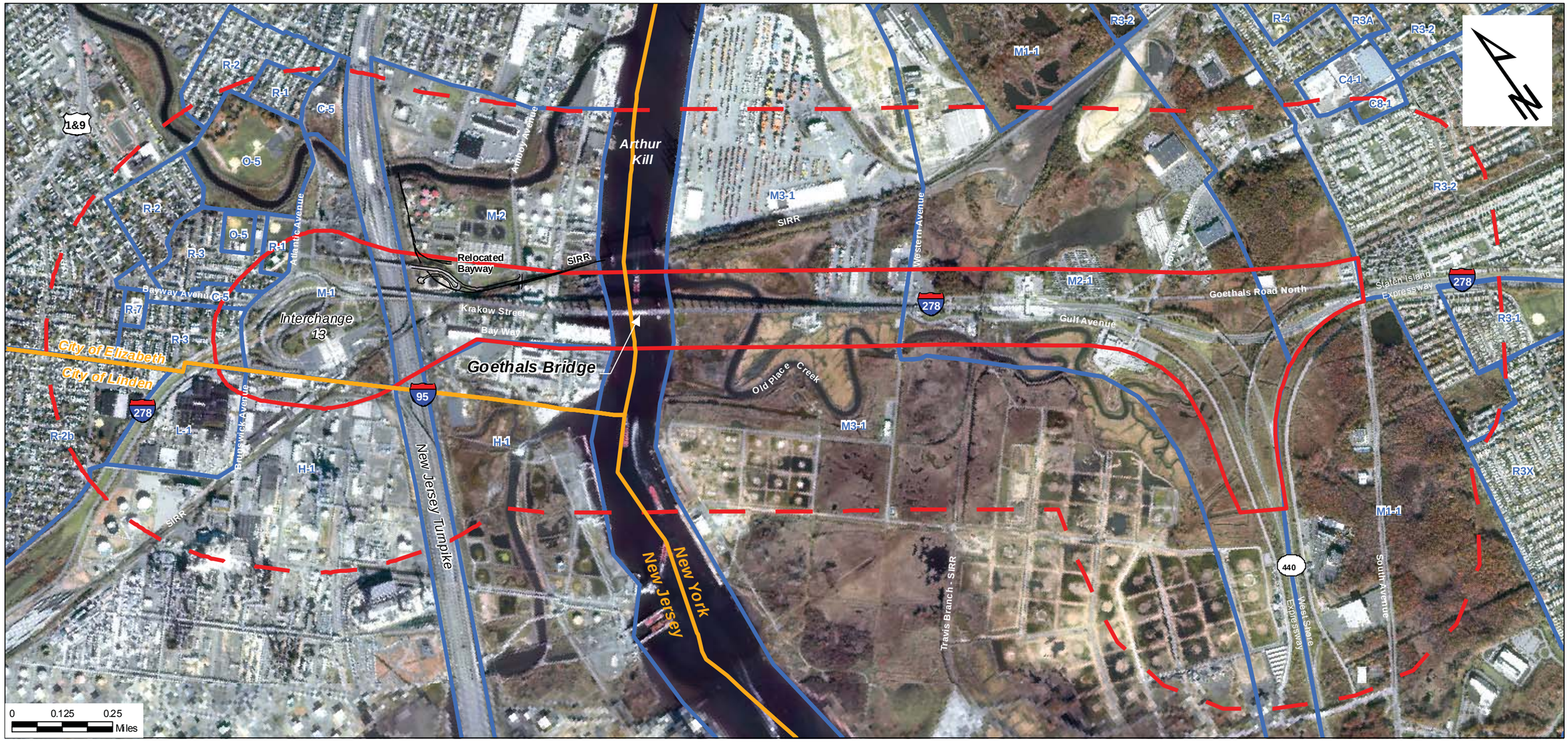
The northwestern end of Staten Island is zoned primarily for manufacturing and includes the M3-1 heavy, M2-1 medium, and M1-1 light manufacturing districts. According to the current Zoning Map, land is zoned for heavy industry between the Arthur Kill and Western Avenue, for medium industry between Western Avenue and the West Shore Expressway and for light industry east of the West Shore Expressway. The M3-1 District allows for heavy industrial uses, including chemical and power plants and foundries, while the light and medium manufacturing districts, M2 and M1, respectively, allow activities that conform to higher performance standards that control objectional influences on surrounding land uses.

Figure 4.4-2 depicts the current zoning within the Staten Island portion of the Goethals Bridge Study Area.

4.4.5 Planned Future Development

Programmed and committed projects typically constitute the reasonably foreseeable future conditions of the No-Build alternative (i.e., if the proposed Goethals Bridge Replacement would not be implemented), and serve as the future baseline against which the potential effects of the Proposed Project are compared for assessing any direct, indirect, and cumulative impacts. For the purpose of this evaluation, programmed and committed projects include both transportation projects/enhancements and land use development projects and are defined as those projects that: 1) have completed all applicable review and approval processes; 2) have obtained available or committed funding; 3) have been included in the Transportation Improvement Plan (TIP) of either of the two New York/New Jersey area's Metropolitan Planning Organizations (i.e., the New York Metropolitan Transportation Council [NYMTC] and the North Jersey Transportation Planning Authority [NJTPA]); and/or 4) are considered to be regionally significant so as to affect travel demand within the Goethals Bridge Study Area. Other relevant ongoing planning initiatives within the Goethals Bridge Study Area and its Regional Study Area are also presented in this section to characterize the planning context of the Proposed Project.[2]

[2] All of the programmed/committed projects and planning initiatives identified in this section are described in detail in Appendix C, and the recent, and in some cases, ongoing coordination efforts with those related transportation agencies (i.e., NJDOT, NJTA, NYSDOT, MTA, and NYCDOT) are described in Sections 5.20 and 6.0.



Legend

- Primary Study Area
- Secondary Study Area
- Zoning Districts
  - R - Residential
  - C - Commercial
  - M - Manufacturing
  - L - Light Industry
  - H - Heavy Industry
  - O - Open Space

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.4-2

Existing Zoning

United States Coast Guard

4.4.5.1 Projects and Planning Initiatives within the Goethals Study Area

While programmed/committed projects and planning initiatives have the potential to alter the area's character and land use, all of those significant projects and initiatives within the Goethals Bridge Study Area have been compiled in Table 4.4-1 and depicted in Figure 4.4-3. It is recognized that many of those development proposals have not yet received full approval and are dependent upon zoning changes or other changes; however, they were deemed important to consider given their direct proximity to the Goethals Bridge. The detailed description and most recent updates of those projects and initiatives within the Goethals Bridge Study Area are compiled and presented in Appendix C (*2008 Update of Programmed/Committed Projects and Ongoing Planning Initiatives*).

As presented in Table 4.4-1 and Figure 4.4-3, the most significant programmed and committed projects within the Goethals Bridge Study Area include the Jay Cashman Dredged Material Processing Facility in Elizabeth, as well as the Howland Hook Redevelopment Program, the NYCT Eastbound Ramp Access Improvement, the Old Place Creek Site Access development and the West Shore Expressway Corridor/Service Road Improvements, all of which are in Staten Island. One additional programmed and committed transportation project of regional significance includes the Arthur Kill Channel Deepening Program. In terms of ongoing planning initiatives in Staten Island, an as-of-right development of the former GATX property is assumed, as other recent plans for development of the property (i.e., NASCAR racetrack and ProLogis warehousing) never reached fruition; Reconstruction of the West Shore Expressway (WSE) / Staten Island Expressway (SIE) Interchange and the Staten Island West Shore Land Use and Transportation Study are also ongoing planning initiatives in Staten Island. In New Jersey, the ongoing planning initiatives include the NJ Turnpike Interchange 13 Reconfiguration Study, the Portfields Initiative, and the Missing Links Study for the US Route 1 & 9 and I-278 Interchange.

4.4.5.2 Other Projects and Planning Initiatives within the Regional Study Area

In addition to the aforementioned projects in the Goethals Bridge Study Area, there are several other transportation and land-use development projects beyond the limits of the Goethals Bridge Study Area, but within the Regional Study Area as defined in Section 4.3, that are either proposed or planned within the analysis timeframe of the GBR EIS (i.e., 2034). These other projects, which provide a context for assessing potential secondary and cumulative impacts (as presented in Section 5.24) are described in Appendix C of this EIS. Given the Goethals Bridge's direct connection to the Staten Island Expressway (SIE), other on-going transportation projects and planning initiatives along the SIE corridor that are located outside of the Goethals Bridge Study Area include: the SIE Median Bus Lane Extension to Slosson Avenue and other SIE Corridor Studies (i.e., the Access Ramps Improvement Study and the Priority Lane/Bus Lane Re-Designation/Bus Lane Extension Studies to Richmond Avenue) by the New York State Department of Transportation (NYSDOT); as well as the Verrazano-Narrows Toll Plaza Replacement Study and Bridge Rehabilitation by the Metropolitan Transportation Authority (MTA). Again, those projects and planning initiaves are further detailed in Appendix C.

4.4.6 Public Policy

Land use, zoning and development within the Goethals Bridge Study Area is governed by a framework of planning policies, established, in part, by community visions and needs that guide the manner by which land use patterns are developed. In the New Jersey portion of the Goethals Bridge Study Area, land use and growth patterns are governed by the public policies that are incorporated in the Master Plans of the Cities of Elizabeth and Linden, the County of Union, as well as the New Jersey State Development and Redevelopment Plan. In the Staten Island portion of the Goethals Bridge Study Area, land use and growth patterns are governed by policies that are incorporated in the land use and development regulations established in the Borough Master Plan and various Community/Borough Board Planning and Development policy documents. The recent 127-point PLANYC plan for New York City's vision of environmental sustainability by 2030, was also consulted in order to identify those specific initiatives

within Staten Island Community Boards 1 and 2 of Staten Island. Details regarding these policies are provided in Appendix D.1.

4.5 Socioeconomics

4.5.1 Methodology, Approach, and Data Sources

The Goethals Bridge Study Area comprises block groups located in the cities of Elizabeth and Linden in New Jersey and the Borough of Staten Island, New York. Data sources reviewed to prepare the socioeconomic profiles include U.S. Census materials, American Community Survey, U.S Economic Census products, and regional, county and municipal publications and files. Recent 2006 Annual Estimates of Population from the U.S. Census were used to adjust the population profiles as provided in the 2000 Census.

4.5.2 Demographics - New Jersey

4.5.2.1 Population and Racial/Ethnic Characteristics of the Goethals Bridge Study Area

According to the 2000 U.S. Census, a total of 15,825 persons reside within the New Jersey portion of the Goethals Bridge Study Area (see Table 4.5-1). Whites were the largest ethnic group, accounting for 63.7 percent of the area's residents. Blacks or African-Americans comprised 12.0 percent of the population. "Other" race groups accounted for 22.5 percent of the population; this category includes persons who identify themselves as two or more races, and Asians accounted for 1.3 percent of the population. In total, minorities comprised 64.1 percent of the population within the Goethals Bridge Study Area, while persons of Hispanic origin accounted for nearly half of the population (49.8 percent). Table 4.5-1 presents the various socioeconomic characteristics of the New Jersey portion of the Goethals Bridge Study Area.

Only the City of Elizabeth as a whole exhibited a higher percentage of minority persons (73.2 percent) than the Goethals Bridge Study Area. The percentage of minority persons in the City of Linden (42.1 percent) and Union County (45.8 percent) were lower than the corresponding percentages within the Goethals Bridge Study Area.

Persons of Hispanic origin accounted for nearly half of the total population (49.5 percent) within the City of Elizabeth, which is similar to that within the Goethals Bridge Study Area. Compared to the Goethals Bridge Study Area, the City of Linden (14.4 percent) and Union County (19.7 percent) contained much lower percentages of persons of Hispanic origin within their jurisdictions.

Historical data and population estimates at the municipal and county levels were also examined to better understand the trends in population growth within the larger region. Based on U.S. Census 1990 and 2000 data, the City of Elizabeth added 10,556 persons to its population during this 10-year period accounting for nearly a ten percent increase, while the City of Linden exhibited a more modest 7.3 percent increase in population over the same period. In Union County, 64,751 persons were added to the population over the ten-year period, resulting in a 5.8 percent increase in population.

TABLE 4.4-1
LIST OF SIGNIFICANT PROJECTS AND PLANNING INITIATIVES WITHIN THE GOETHALS BRIDGE STUDY AREA

Map Ref. (1)	Project Name (Sponsor)	Type of Project	Proposed Action (2)
		Bi-State	
1	Arthur Kill Channel Deepening Program (USACE)	Committed Project	As part of the Harbor Navigation Project, the USACE is currently deepening the Arthur Kill navigation channel along with providing selected widenings and realignments of the channel, and developing a 23-acre wetland mitigation program.
		New Jersey	
2	Jay Cashman Dredged Material Processing Facility (Private Developer)	Committed Project	Construction and operation of a full-scale upland dredged material processing facility within the former Borne Chemical Site located at 632-650 South Front Street along the Arthur Kill, just north of the Goethals Bridge.
3	NJ Turnpike Interchange 13 Reconfiguration Study (NJTA)	Planning Initiative	While the on-going NJTA study is broader in scale and is currently examining all interchanges along the NJ Turnpike north of Interchange 8A in Middlesex County for potential traffic improvements, the Interchange 13 is of special interest given its direct connection to the Goethals Bridge and local road network in Elizabeth..
4	Missing Links Study for US Route 1 & 9 and I-278 Interchange (NJDOT)	Planning Initiative	The NJDOT, in collaboration with the Cities of Elizabeth/Linden and the PANYNJ, is currently evaluating several ramp alternatives to complete the existing and partial interchange as a means to provide improved access for traffic from the NJ Turnpike at Interchange 13 and the Goethals Bridge to locations north and west of Bayway Circle, and vice versa.
5	Portfields Initiative (PANYNJ/EDA)	Planning Initiative	Joint project between the PANYNJ and New Jersey Economic Development Authority (EDA) for the development of warehousing and distribution opportunities for ocean and air freight-related operations in New Jersey. While up to 20 underutilized and brownfield sites have been identified, the Elizabeth Bayway Area & Reichold Chemical at Bayway Avenue and Front Street, in Elizabeth and Linden, have been identified as Site 11 within the Portfields Initiative. More specifically, this Site 11 is comprised of the Reichold Chemical, Cory Warehouse, and Elizabethtown Gas properties.
		New York	
6	Old Place Creek Site Access (NYSDEC)	Committed Project	Development of an access plan and improved open space opportunities with an on-site parking area (8-10 cars), walk-in only trails with educational signage, as well as a kayak launch area, fishing areas, and a viewing platform to Old Place Creek.
7	Howland Hook Redevelopment Program (PANYNJ)	Committed Project	Formerly known as the Howland Hook Marine Terminal (HHMT), the New York Container Terminal (NYCT) is being redeveloped with on-site and associated transportation expansions and improvements including berth extensions/reconfigurations and the construction of an intermodal rail terminal, etc. As part of this project, some planning studies are also underway including increased capacity opportunities at Parcel C and a new direct truck egress ramp (also known as the Westbound Ramp) to the westbound thoroughfare of I-278.
8	HHMT Eastbound Ramp Access Improvement (PANYNJ)	Committed Project	Provide a new direct truck ingress/egress ramp (also known as the Eastbound Ramp) between the NYCT and the eastbound thoroughfare of the Staten Island Expressway (I-278).
9	WSE Corridor/Service Road Improvements (NYSDOT)	Committed Project	Provide capacity and operational improvements to the arterial network distribution along the corridor of West Shore Expressway (WSE) (NY 440) and its key interchanges, and develop small-scale park-and-ride facilities along the WSE.
10	As-of-Right Development of the Former GATX Site (undetermined)	Planning Initiative	Over recent years, this 675-acre vacant industrial site, formerly known as the GATX Site, has been the subject of several redevelopment proposals (i.e., NASCAR racetrack, ProLogis warehousing) which never reached fruition. Given the uncertainty associated with the future sale of this large tract of vacant land, it is assumed that the site would, at a minimum, be developed as-of-right under its existing M2-1 and M3-1 zoning designations, with approximately 270,000 gross square feet (gsf) of retail space and 2.6 million gsf of industrial use.
11	Reconstruction of WSE/SIE Interchange (NYSDOT)	Planning Initiative	Reconstruction of this West Shore Expressway (NYS Route 440)/Staten Island Expressway (I-278) Interchange has been studied to support possible future bus/HOV lane expansion and improvements on the SIE as well as planned improvements in the Goethals Bridge corridor.
n/a (3)	SI West Shore Land Use & Transportation Study (NYCDCP)	Planning Initiative	Comprehensive assessment of land use issues and transportation needs along the West Shore of Staten Island. In parallel, the city has allocated funding to allow the Staten Island Economic Development Corporation (SIEDC) to advance the second phase of the West Shore Light Rail Plan.

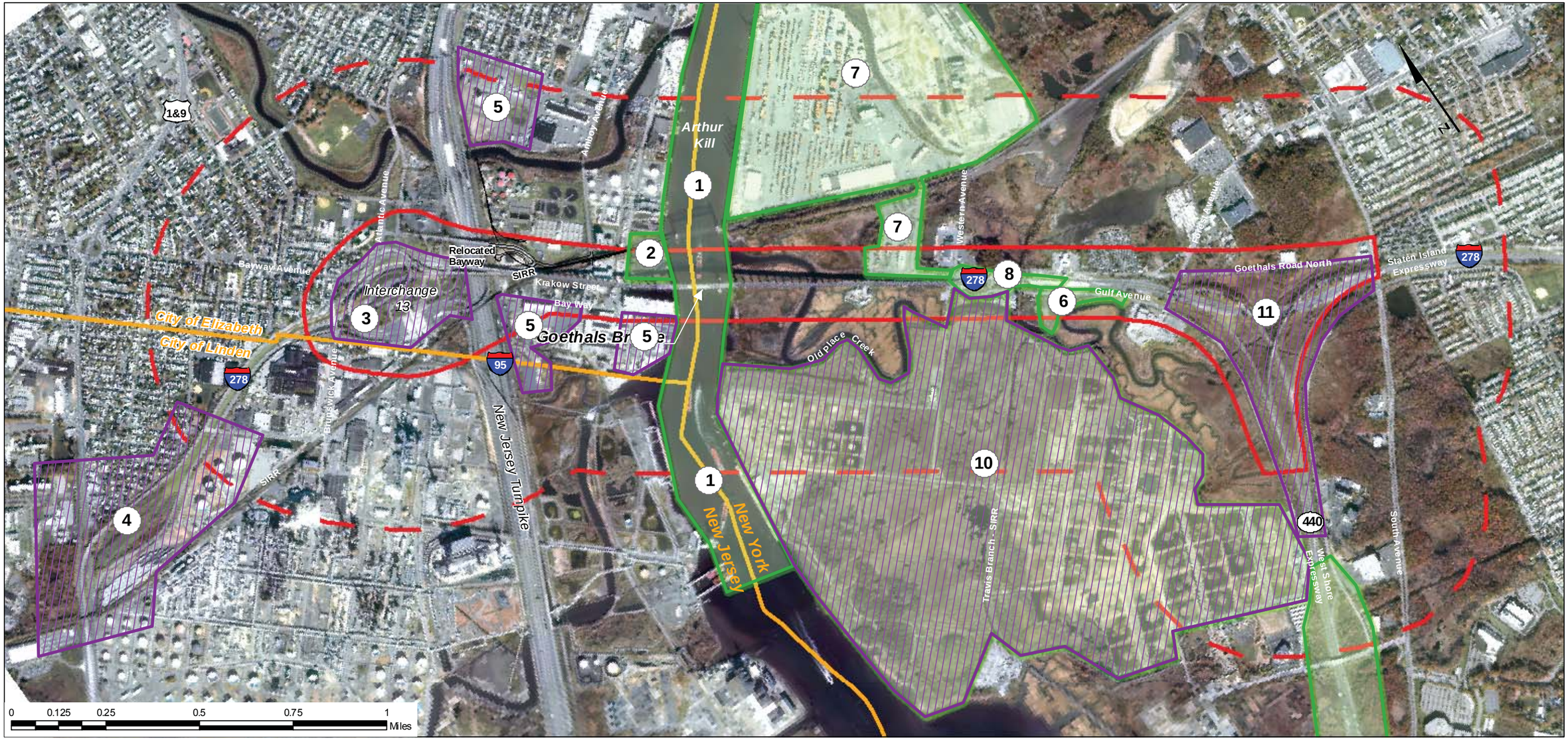
Source: Berger/PB, 2008.

Notes:

(1) The location of those projects and planning initiatives are also depicted on Figure 4.4-3.

(2) A detailed description and most current updates of those projects and planning initiatives are provided in Appendix C. Additionally, current GBR coordination efforts related to those other projects and planning initiatives are described in Section 6.0.

(3) This study is not depicted on Figure 4.4-3 as its study area covers the entire western shore of Staten Island.



Legend

- Primary Study Area
- Secondary Study Area
- Program Community Projects
- Planning Initiatives

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

PROGRAMMED AND COMMITTED PROJECTS

1. Arthur Kill Channel Deepening Program
2. J. Cashman Dredged Material Processing Facility
3. NJ Turnpike Interchange 13 Study Area
4. Missing Link Study for US Route 1 & 9 and I-278 Interchange
5. Portfields Initiative
6. NYSDEC's Old Place Creek Access Site
7. Howland Hook Redevelopment Program
8. HHMT Eastbound Ramp Access Improvement
9. West Shore Expressway Corridor/Service Road Improvements
10. As-of-Right Development of Former GATX Site
11. Reconstruction of WSE/SIE Interchange

Goethals Bridge Replacement EIS

FIGURE 4.4-3

Programmed/Committed Projects and Planning Initiatives Within the Goethals Study Area

United States Coast Guard

TABLE 4.5-1
POPULATION AND ECONOMIC CHARACTERISTICS – NEW JERSEY PORTION OF THE GOETHALS BRIDGE STUDY AREA AND SURROUNDING REGION

	Goethals Bridge Study Area - New Jersey		City of Elizabeth, NJ		City of Linden, NJ		Union County, NJ	
Race	**Number**	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**
White Alone	10,086	63.7%	67,250	55.8%	26,031	66.1%	342,302	65.5%
Non-Hispanic White	5,678	35.9%	32,338	26.8%	22,827	57.9%	283,345	54.2%
Hispanic-White	4,408	27.9%	34,912	29.0%	3,204	8.1%	58,957	11.3%
Non-White Alone	5,739	36.3%	53,318	44.2%	13,363	33.9%	180,239	34.5%
Black or African American Alone	1,898	12.0%	24,090	20.0%	8,981	22.8%	108,593	20.8%
American Indian and Alaska Native Alone	66	0.4%	580	0.5%	56	0.1%	1,215	0.2%
Asian Alone	206	1.3%	2,830	2.3%	925	2.3%	19,993	3.8%
Native Hawaiian and Other Pacific Islander	8	0.1%	55	0.0%	15	0.0%	201	0.0%
Other*	3,561	22.5%	25,763	21.4%	3,386	8.6%	50,237	9.6%
Total	15,825	100.0%	120,568	100.0%	39,394	100.0%	522,541	100.0%
Minority Population Total **	10,147	64.1%	88,230	73.2%	16,567	42.1%	239,196	45.8%
Hispanic Population Total	7,887	49.8%	59,627	49.5%	5,674	14.4%	103,011	19.7%
Age (Years)								
Under 5 Years	1,245	7.9%	9,266	7.7%	2,345	6.0%	36,441	7.0%
5-9 Years	1,277	8.1%	9,321	7.7%	2,535	6.4%	37,777	7.2%
10-14 Years	1,107	7.0%	8,466	7.0%	2,532	6.4%	35,977	6.9%
15-17 Years	613	3.9%	4,627	3.8%	1,434	3.6%	19,746	3.8%
18-24 Years	1,646	10.4%	13,035	10.8%	3,224	8.2%	41,469	7.9%
25-34 Years	2,676	16.9%	20,757	17.2%	5,748	14.6%	75,189	14.4%
35-49 Years	3,488	22.0%	27,364	22.7%	9,013	22.9%	125,006	23.9%
50-64 Years	2,020	12.8%	15,691	13.0%	6,137	15.6%	78,895	15.1%
65 Years and Above	1,753	11.1%	12,041	10.0%	6,426	16.3%	72,041	13.8%
Total	15,825	100.0%	120,568	100.0%	39,394	100.0%	522,541	100.0%
Number of Households								
Female Headed Households	1,095	20.4%	7,802	19.3%	2,081	13.8%	25,228	13.6%
Zero-Car Households	1,149	21.5%	10,207	25.2%	2,217	14.7%	23,653	12.7%
Poverty								
Persons Answering Question on Poverty	15,600		117,723		39,058		514,780	
Percentage below Poverty	2,738	17.6%	20,963	17.8%	2,490	6.4%	43,319	8.4%
Income								
Per-Capita Income ($)	$15,187		$15,114		$21,314		$26,992	
Median Household Income ($) (1999) ***	$36,590		$35,175		$46,345		$55,339	

Source: U.S. Department of Commerce, Bureau of Census. U.S. Census of Population and Housing, 2000
Total Population as of April 1, 2000.
Notes:
*The Other category includes census categories 'some other race alone' and two or more races'.
** The total minority population includes all those who have classified themselves as Black or African-American, Hispanic (White and Non-White), Asian Alone, American Indian or Alaskan Native, Native Hawaiian and Other Pacific Islander and Others.
*** The median household income was calculated by taking the weighted average of the median incomes of all the census block groups in the Study Area.

According to the 2006 American Community Survey (ACS), between 2000 and 2006, the City of Elizabeth added 8,769 persons for a total 2006 population of 129,337. This growth represents a 1.2 percent annual increase in population. In the same time period, Union County's total population increased from 522,541 to 531,088, representing a 0.3 percent annual increase in population. Due to 2006 ACS data only being available for geographic areas with a population of 65,000 or more, data from ESRI[3] was used to estimate the population of the City of Linden. From 2000 to 2007, the City of Linden's population grew from 39,394 to an estimated 40,869, representing a 0.5 percent annual increase in population. Figure 1 of Appendix D.2 depicts the percentage of minority residents in the New Jersey portion of the Goethals Bridge Study Area.

4.5.2.2 Age Characteristics

The New Jersey portion of the Goethals Bridge Study Area and the surrounding region exhibited fairly comparable age cohort patterns. Nearly 40 percent of the population is between the 25-49 age groups. However, persons in the 35-49 age cohort form the single largest group and represent nearly 25 percent of the entire population within the Goethals Bridge Study Area and larger region.

4.5.2.3 Income and Poverty

Per-capita income in the New Jersey portion of the Goethals Bridge Study Area was $15,187 in 1999, while the median household income was $36,590. The percentage of persons living below the poverty level was 17.6 percent with 18 percent of residents of the City of Elizabeth below poverty level. Per-capita and median household incomes in Linden as a whole were higher than those observed in the Goethals Bridge Study Area. In comparison, Union County residents had the highest per-capita earnings of $26,992. Figure 2 of Appendix D.2 depicts the percentage of persons living below poverty in the New Jersey portion of the Goethals Bridge Study Area.

4.5.2.4 Linguistic Isolation

As presented in Table 4.5-2, 24.2 percent of the households in the New Jersey portion of the Goethals Bridge Study Area had some difficulty speaking English. Spanish is the most common language, spoken by nearly 73.4 percent of the residents in the Goethals Bridge Study Area, which is almost identical to the City of Elizabeth as a whole, but higher than the adjacent City of Linden and Union County. Other common languages include Indo-European languages.

4.5.2.5 Educational Attainment Levels

As presented in Table 4.5-2, nearly 41 percent of the New Jersey portion of the Goethals Bridge Study Area residents reported less than a high school education, as compared to 38.2 percent in Elizabeth, 21.7 percent in Linden and 20.7 percent in Union County.

4.5.2.6 Housing

In the New Jersey portion of the Goethals Bridge Study Area, there were 5,502 housing units at the time of the 2000 U.S. Census. Of this number, 5,335 units (97.0 percent) were occupied. This occupancy rate was generally comparable to the surrounding region (see Table 4.5-2). Of the occupied units, 37.0 percent were owner-occupied and 63.0 percent were renter-occupied. A majority of the units in Elizabeth were renter-occupied (70.2 percent), while a majority of the units in Linden and Union County as a whole were owner-occupied.

[3] ESRI Demographic Update Methodology 2007/2012. http://www.esri.com

4.5.2.7 Labor Force Characteristics

Table 4.5-3 presents a comparative profile of the labor force within the Goethals Bridge Study Area and neighboring region. As indicated in the table, approximately nine percent of the civilian labor force within the New Jersey portion of the Goethals Bridge Study Area and the City of Elizabeth were reported as unemployed. The unemployment rates in the City of Linden and Union County were lower, at 5.6 percent. In the year 2000, there were a total of 6,174 employed persons residing within the Study Area.

TABLE 4.5-2
EDUCATIONAL ATTAINMENT AND HOUSING CHARACTERISTICS: NEW JERSEY PORTION OF THE GOETHALS BRIDGE STUDY AREA AND SURROUNDING REGION

	Goethals Bridge Study Area: New Jersey		City of Elizabeth, NJ		City of Linden, NJ		Union County, NJ	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Educational Attainment								
No Schooling Completed	520	5.3%	3,677	4.8%	338	1.2%	6,497	1.8%
Less than Ninth Grade	1,260	12.7%	10080	13.3%	2,025	7.4%	24,338	6.9%
9th to 12th Grade	2,241	22.6%	15,280	20.1%	3,577	13.1%	42,064	12.0%
High School Graduate	3,482	35.2%	24,321	32.0%	11,153	40.9%	104,431	29.7%
Some College, No Degree	1,186	12.0%	10,659	14.0%	4,905	18.0%	57,534	16.3%
Associate Degree	399	4.0%	2,694	3.5%	1,398	5.1%	16,815	4.8%
Bachelor's Degree	539	5.4%	6,011	7.9%	2,627	9.6%	61,760	17.6%
Graduate or Professional Degree	274	2.8%	3190	4.2%	1,215	4.5%	38,464	10.9%
TOTAL	9,901	100.0%	75,912	100.0%	27,238	100.0%	351,903	100.0%
Lingustically Isolated Households	1,299	24.2%	9,905	72.1%	1,483	16.0%	17,616	9.5%
- Spanish Speaking	953	73.4%	7,256	73.3%	377	25.4%	10,427	59.2%
- Other Indo-European languages	341	26.3%	2,358	23.8%	1,064	71.7%	6,059	34.4%
- Asian and Pacific Island languages	5	0.4%	172	1.7%	42	2.8%	800	4.5%
- Other	0	0.0%	119	1.2%	0	0.0%	330	1.9%
Housing Profile								
Total Housing Units	5,502	100.0%	42,838	100.0%	15,567	100.0%	192,945	100.0%
Occupied	5,335	97.0%	40,482	94.5%	15,052	96.7%	186,124	96.5%
Vacant	167	3.0%	2,356	5.5%	515	3.3%	6,821	3.5%
Occupied Housing Units	5,335	100.0%	40,482	100.0%	15,052	100.0%	186,124	100.0%
Owner Occupied	1,976	37.0%	12,057	29.8%	8,841	58.7%	114,688	61.6%
Renter Occupied	3,359	63.0%	28,425	70.2%	6,211	41.3%	71,436	38.4%
Median Contract Rent	$634		$616		$705		$676	
Median Housing Values	$144,800		$154,600		$152,100		$185,200	

Source: U.S. Department of Commerce, Bureau of Census. U.S. Census of Population and Housing, 2000
Notes:
A linguistically isolated household is one in which no one member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English very well. The Asian and Pacific Island category includes South, East and Southeast Asian languages.

TABLE 4.5-3
LABOR FORCE CHARACTERISTICS OF PERSONS RESIDING IN THE NEW JERSEY PORTION OF THE GOETHALS BRIDGE STUDY AREA AND SURROUNDING REGION

Areas	Total Labor Force	Employed Labor Force	Unemployed	Unemployment Rate
Goethals Bridge Study Area: NJ	6,785	6,174	611	9.0%
City of Elizabeth, NJ	52,421	47,671	4,732	9.0%
City of Linden, NJ	19,892	18,772	1,120	5.6%
Union County, NJ	258,641	244,197	14,369	5.6%

Source: U.S. Census of Population and Housing, 2000.
Notes: The total employed labor force includes persons in civilian occupations and the Armed Forces

According to the 2006 American Community Survey (ACS), the City of Elizabeth and Union County's unemployment rates have not changed significantly from the 2000 rate. The City of Elizabeth's unemployment rate remains at approximately nine percent while Union County's rate has slightly increased to 6.1 percent. Based on ESRI data, the City of Linden's unemployment rate is estimated to have increased 1.5 percent to a 2007 rate of 7.5 percent.

Elizabeth has a much larger labor force than Linden. Employment by industry sector was examined to characterize the employment profile of the residents within the Goethals Bridge Study Area and surrounding region. As presented in Table 4.5-4, the manufacturing sector employs the largest percentage of the workforce. As economic activity is dominated by heavy industrial activity, manufacturing seems the most likely choice of the persons residing in the area. Similarly, in Elizabeth and Linden, manufacturing is the single largest employer. Union County exhibited an employment pattern with educational, health and social services being the single largest employer of the county's workforce. The significance of manufacturing, health, education and social services as sources of local employment is presented in Table 4.5-4.

TABLE 4.5-4
EMPLOYMENT BY INDUSTRY SECTOR BY PLACE OF RESIDENCE: COMPARISON OF THE NEW JERSEY PORTION OF THE GOETHALS BRIDGE STUDY AREA WITH SURROUNDING REGION

Industry Sector	NJ Portion of the Study Area	City of Elizabeth	City of Linden	Union County, NJ
Total	100.0%	100.0%	100.0%	100.0%
Agriculture, forestry, fishing and hunting, and mining	0.0%	0.1%	0.1%	0.1%
Construction	6.7%	6.0%	5.3%	5.0%
Manufacturing	**20.9%**	**18.7%**	**19.6%**	15.0%
Wholesale trade	7.2%	6.5%	5.4%	4.7%
Retail trade	10.4%	11.5%	11.6%	10.2%
Transportation and warehousing, and utilities	11.9%	10.7%	9.7%	7.5%
Information	1.7%	2.3%	2.8%	4.5%
Finance, insurance, real estate and rental and leasing	5.0%	5.5%	6.7%	9.6%
Professional, scientific, management, administrative, and waste management services	9.2%	8.0%	9.3%	11.4%
Educational, health and social services	13.2%	14.9%	15.9%	**18.4%**
Arts, entertainment, recreation, accommodation and food services	6.0%	7.0%	4.4%	5.4%
Other services (except public administration)	4.4%	5.6%	4.4%	4.5%
Public administration	3.5%	3.2%	4.6%	3.8%

Source: U.S. Census of Population and Housing, 2000.

4.5.2.8 Journey-to-Work Characteristics

Driving was the most common means of transportation to work by persons living in the New Jersey portion of Goethals Bridge Study Area. As presented in Table 4.5-5, with approximately 83 percent of residents driving to work, public transportation was used by approximately 10 percent of the residents, with travel by bus being the most popular choice among this group. Only 15 percent of the residents using public transportation used rail transit to commute to their place of work. The surrounding region exhibited similar patterns, with driving being the most popular mode of transportation to work.

TABLE 4.5-5
MEANS OF TRANSPORTATION TO WORK: COMPARISON OF THE NEW JERSEY PORTION OF THE GOETHALS BRIDGE STUDY AREA AND SURROUNDING REGION

Means of Transportation to Work	NJ Portion of the Study Area	%	City of Elizabeth, NJ	%	City of Linden, NJ	%	Union County, NJ	%
Total Workers	6,039	100.0%	46,093	100.0%	18,381	100.0%	238,606	100.0%
Car, Truck or Van	*5,019*	*83.1%*	*35,461*	*76.9%*	*16,096*	*87.6%*	*197,011*	*82.6%*
Drove Alone	3,799	75.7%	27,210	76.7%	13,944	86.6%	169,325	85.9%
Carpooled	1,220	24.3%	8,251	23.3%	2,152	13.4%	27,686	14.1%
Public Transportation	*629*	*10.4%*	*6,795*	*14.7%*	*1,311*	*7.1%*	*25,294*	*10.6%*
Bus or trolley bus	487	77.4%	4,596	67.6%	543	41.4%	10,837	42.8%
Streetcar or trolley car	0	0.0%	55	0.8%	15	1.1%	133	0.5%
Subway or elevated	12	1.9%	474	7.0%	110	8.4%	1,302	5.1%
Railroad	92	14.6%	1,473	21.7%	577	44.0%	12,523	49.5%
Ferryboat	0	0.0%	0	0.0%	0	0.0%	44	0.2%
Taxicab	38	6.0%	197	2.9%	66	5.0%	455	1.8%
Other means	*115*	*1.9%*	*783*	*1.7%*	*121*	*0.7%*	*2,015*	*0.8%*
Worked at home	*84*	*1.4%*	*528*	*1.1%*	*169*	*0.9%*	*5,692*	*2.4%*
Motorcycle/Bicycle	*29*	*0.5%*	*246*	*0.5%*	*47*	*0.3%*	*865*	*0.4%*
Walked	*163*	*2.7%*	*2,280*	*4.9%*	*637*	*3.5%*	*7,729*	*3.2%*

Source: U.S. Census of Population and Housing.
Notes:
Italics totals reflect percentages by mode share of all workers commuting.
Non-italic percentages reflect the share of transportation with a given mode (e.g. type of public transportation

4.5.3 Demographics – New York

4.5.3.1 Population and Racial/Ethnic Characteristics of the Goethals Bridge Study Area

According to the 2000 U.S. Census, a total of 23,405 persons reside within the New York (Staten Island) portion of the Goethals Bridge Study Area (see Table 4.5-6). Whites were the largest ethnic group, accounting for 72.9 percent of the area's residents. The Borough of Staten Island as a whole exhibited a slightly higher share of persons who classified themselves as White, accounting for 77.6 percent of the total population. Blacks or African-Americans comprised 8.8 percent of the population in the Study Area, compared to 9.7 percent in the Borough. "Other" race groups comprised 10.4 percent of the population; this category includes persons who identify themselves as two or more races. Asians comprised 7.5 percent of the population. Minorities account for 35.3 percent of the New York portion of the Goethals Bridge Study Area population, with persons of Hispanic origin accounting for nearly 17 percent. The Borough of Staten Island exhibited a lower concentration of minority persons (28.7 percent) than the Goethals Bridge Study Area; however, Hispanics account for a higher proportion of the population within the Borough (42 percent) than the Goethals Bridge Study Area. Between 2000 and 2006, the Borough of Staten Island added 33,649 persons to its total population, representing a 1.3 percent annual increase in population. The total population of the Borough in 2006 was 477,377 persons[4]. Figure 1 of Appendix D.2 depicts the percentage of minority residents in the New York portion of the Goethals Bridge Study Area.

[4] 2006 American Community Survey (ACS), U.S. Census Bureau.

TABLE 4.5-6
POPULATION AND ECONOMIC CHARACTERISTICS – NEW YORK PORTION OF THE GOETHALS BRIDGE STUDY AREA AND STATEN ISLAND

	New York Portion of the Study Area		Staten Island Borough/Richmond County NY	
Race	**Number**	**Percentage**	**Number**	**Percentage**
White Alone	17,063	72.9%	344,319	77.6%
Non-Hispanic White	15,136	64.7%	316,316	71.3%
Hispanic-White	1,927	8.2%	28,003	6.3%
Non-White Alone	6,342	27.1%	99,409	22.4%
Black or African American Alone	2,071	8.8%	42,914	9.7%
American Indian and Alaska Native Alone	53	0.2%	1,107	0.2%
Asian Alone	1,765	7.5%	25,071	5.7%
Native Hawaiian and Other Pacific Islander	14	0.1%	182	0.0%
Other*	2,439	10.4%	30,135	6.8%
Total	23,405	100.0%	443,728	100.0%
Minority Population Total **	8,269	35.3%	127,412	28.7%
Hispanic Population Total	3,938	16.8%	53,550	42.0%
Age (Years)				
Under 5 Years	1,601	6.8%	29,783	6.7%
5-9 Years	1,864	8.0%	32,967	7.4%
10-14 Years	1,881	8.0%	32,203	7.3%
15-17 Years	1,061	4.5%	18,305	4.1%
18-24 Years	2,019	8.6%	37,932	8.5%
25-34 Years	3,489	14.9%	63,517	14.3%
35-49 Years	5,670	24.2%	106,120	23.9%
50-64 Years	3,879	16.6%	71,468	16.1%
65 Years and Above	1,941	8.3%	51,433	11.6%
Total	23,405	100.0%	443,728	100.0%
Number of Households				
Female Headed Households	978	12.1%	20,410	13.0%
Zero-Car Households	907	11.4%	28,691	18.4%
Poverty				
Persons Answering Question on Poverty	23,374		436,628	
Percentage below Poverty	1544	6.6%	43,866	10.0%
Income				
Per-Capita Income ($)	$22,614		$23,905	
Median Household Income ($) (1999) ***	$55,666		$55,039	

Source: U.S. Department of Commerce, Bureau of Census. U.S. Census of Population and Housing, 2000.
Notes:
*The Other category includes census categories 'some other race alone' and two or more races'.
** The total minority population includes all those who have classified themselves as Black or African-American, Hispanic (White and Non-White), Asian Alone, American Indian or Alaskan Native, Native Hawaiian and Other Pacific Islander and Others.
*** The median household income was calculated by taking the weighted average of the median incomes of all the census block groups in the Goethals Bridge Study Area.

4.5.3.2 Age Characteristics

Nearly 40 percent of the population in the New York portion of the Goethals Bridge Study Area is between the ages of 25 and 49. Persons in the 35-49 age cohort form the single largest group and represent nearly a quarter of the entire population. The larger region, which includes the entire Borough of Staten Island, exhibited similar age characteristics, with the 35-49 age group comprising the single largest age-cohort.

4.5.3.3 Income and Poverty

According to the 2000 U.S. Census, the per-capita income in the New York portion of the Goethals Bridge Study Area was $22,614, while the median household incomes were $55,666. Incomes for the entire Borough of Staten Island exhibited similar patterns, with slightly higher per-capita incomes ($23,905) but slightly lower median household incomes ($55,039). The percentage of persons living below the poverty level was 6.6 percent, as compared to 10.0 percent in the Borough of Staten Island as a whole. Figure 2 of Appendix D.2 depicts the percentage of persons living below poverty in the New York portion of the Goethals Bridge Study Area.

4.5.3.4 Educational Attainment Levels

Educational attainment levels within the New York portion of the Goethals Bridge Study Area and the surrounding region exhibit fairly comparable patterns, with persons completing high school comprising nearly 39 percent of the population in the Study Area compared to 34 percent in the Borough of Staten Island as a whole (see Table 4.5-7). Approximately 15 percent of the Goethals Bridge Study Area residents and 17 percent of Staten Island residents have less than a high school education.

4.5.3.5 Housing

Nearly 95.8 percent of housing units in the New York portion of the Goethals Bridge Study Area were occupied, 67.6 percent of which is owner-occupied (see Table 4.5-7).

4.5.3.6 Labor Force Characteristics

At the time of the 2000 U.S. Census, 6.6 percent of the New York portion of the Goethals Bridge Study Area residents were unemployed, while the Borough of Staten Island as a whole exhibited a slightly lower rate of unemployed persons (5.9 percent). Table 4.5-8 presents a comparative profile of the labor force within the Goethals Bridge Study Area. The 2006 American Community Survey (ACS) reveals that the Borough of Staten Island's unemployment rate has decreased from 5.9 percent to 5.4 percent.

In the year 2000, 10,748 persons who resided in the Goethals Bridge Study Area were employed. As shown in Table 4.5-9, this represents a small percentage of the total labor force of Staten Island, which has a total employed labor force of 195,074. Based on Census data, the educational, health and social services sector employs the highest number of persons, at 21.5 percent, in the Goethals Bridge Study Area, and in the Borough of Staten Island, approximately 25 percent (see Table 4.5-9).

4.5.3.7 Journey-to-Work Characteristics

Driving is the most common means of transportation for persons living in the New York portion of the Goethals Bridge Study Area. As presented in Table 4.5-10, 66 percent of residents drive to work. Public transportation is used by 30 percent of the residents, with commuting by bus the most popular mode (82 percent). The free ferry service operated between Staten Island and Manhattan by the New York City Department of Transportation (NYCDOT) is a popular mode of transportation by the residents of the

TABLE 4.5-7
EDUCATIONAL ATTAINMENT AND HOUSING CHARACTERISTICS – NEW YORK PORTION OF THE GOETHALS BRIDGE STUDY AREA AND STATEN ISLAND

	New York Portion of Goethals Bridge Study Area		Staten Island Borough/Richmond County NY	
Educational Attainment				
No Schooling Completed	109	0.7%	3,806	1.3%
Less than Ninth Grade	444	2.9%	12544	4.3%
9th to 12th Grade	1,661	11.0%	34,813	11.8%
High School Graduate	5,855	38.8%	98,845	33.6%
Some College, No Degree	3,096	20.5%	57,426	19.5%
Associate Degree	1,024	6.8%	18,247	6.2%
Bachelor's Degree	1,737	11.5%	41,517	14.1%
Graduate or Professional Degree	1,172	7.8%	26,597	9.1%
TOTAL	15,098	100.0%	293,795	100.0%
Lingustically Isolated Households	404	5.0%	7,872	5.0%
- Spanish Speaking	130	32.2%	2,633	33.4%
- Other Indo-European languages	129	31.9%	3,102	39.4%
- Asian and Pacific Island languages	129	31.9%	1,641	20.8%
- Other	16	4.0%	496	6.3%
Housing Profile				
Total Housing Units	8,296	100.0%	163,993	100.0%
Occupied	7,944	95.8%	156,341	95.3%
Vacant	352	4.2%	7,652	4.7%
Occupied Housing Units	7,944	100.0%	156,341	100.0%
Owner Occupied	5,369	67.6%	99,732	63.8%
Renter Occupied	2,575	32.4%	56,609	36.2%
Median Contract Rent	$738		$656	
Median Housing Values	$163,800		$216,600	

Source: U.S. Department of Commerce, Bureau of Census. U.S. Census of Population and Housing, 2000.
Notes:
A linguistically isolated household is one in which no one member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English very well. The Asian and Pacific Island category includes South, East and Southeast Asian languages.

TABLE 4.5-8
LABOR FORCE CHARACTERISTICS OF PERSONS RESIDING IN THE NEW YORK PORTION OF THE GOETHALS BRIDGE STUDY AREA

Areas	Total Labor Force	Employed Labor Force	Unemployed	Unemployment Rate
NY Study area	11,523	10,748	757	6.6%
Staten Island	207,766	195,074	12,203	5.9%

Source: U.S. Census of Population and Housing, 2000.
Notes: The total employed labor force includes persons in civilian occupations and the Armed Forces

TABLE 4.5-9
EMPLOYMENT BY INDUSTRY SECTOR
COMPARISON OF THE NEW YORK PORTION
OF THE GOETHALS BRIDGE STUDY AREA

Industry Sector	NY Portion of Study Area	Staten Island Borough/ Richmond County NY
Total	100.0%	100.0%
Agriculture, forestry, fishing and hunting, and mining	0.0%	0.0%
Construction	5.9%	5.6%
Manufacturing	4.2%	3.5%
Wholesale trade	2.2%	2.6%
Retail trade	11.0%	9.3%
Transportation and warehousing, and utilities	7.3%	7.8%
Information	4.3%	3.9%
Finance, insurance, real estate and rental and leasing	15.8%	14.3%
Professional, scientific, management, administrative, and waste management services	9.6%	10.7%
Educational, health and social services	**21.6%**	**24.5%**
Arts, entertainment, recreation, accommodation and food services	4.5%	5.4%
Other services (except public administration)	5.0%	4.5%
Public administration	8.7%	7.9%

Source: U.S. Census of Population and Housing, 2000.

TABLE 4.5-10
MEANS OF TRANSPORTATION TO WORK
COMPARISON OF THE NEW YORK PORTION
OF THE GOETHALS BRIDGE STUDY AREA

Means of Transportation to Work	Goethals Bridge Study Area	%	Staten Island	%
Total Workers	10,520	100.0%	191,145	100.0%
Car, Truck or Van	*6,928*	*65.9%*	*126,940*	*66.4%*
Drove Alone	5,508	79.5%	103,856	81.8%
Carpooled	1,420	20.5%	23,084	18.2%
Public Transportation	*3,162*	*30.1%*	*54,190*	*28.4%*
Bus or trolley bus	2,593	82.0%	36,678	67.7%
Streetcar or trolley car	0	0.0%	89	0.2%
Subway or elevated	111	3.5%	4,894	9.0%
Railroad	16	0.5%	1,705	3.1%
Ferryboat	426	13.5%	10,109	18.7%
Taxicab	16	0.5%	715	1.3%
Other Means	*46*	*0.4%*	*786*	*0.4%*
Worked at home	*116*	*1.1%*	*3,206*	*1.7%*
Motorcycle/Bicycle	*0*	*0.0%*	*478*	*0.3%*
Walked	*268*	*2.5%*	*5,545*	*2.9%*

Source: U.S. Census of Population and Housing.
Notes:
Italics totals reflect percentages by mode share of all workers commuting.
Non-italic percentages reflect the share of transportation with a given mode (e.g. type of public transportation).

Borough in their commute to work. The surrounding region exhibited similar patterns, with driving to work being the most popular mode of transportation to work.

4.5.4 Economics (Industry and Business) – New Jersey

The manufacturing sector is the single largest employer in Union County (Table 1 of Appendix D.3 identifies the number of employees and establishments by sector within the county). The manufacturing sector is also the single largest employer within the New Jersey portion of the Goethals Bridge Study Area and the surrounding region. Healthcare/social assistance and retail trade are the next two large employment sectors, employing 11.5 percent and 11.2 percent of the county's workforce respectively. In terms of the number of establishments, the retail trade sector exhibited the largest share of units, with nearly 15 percent of the total number of establishments.

An economic profile of the workforce was prepared by examining patterns in employment and the types of business enterprises at the zip code level. Three zip codes (07036, 07202 and 07206) comprise the New Jersey portion of the Goethals Bridge Study Area (Table 2 of Appendix D.3 presents the number of establishments by industry sector and their share within the three zip code region). Retail trade comprises the single largest sector within the three-zip code region, accounting for 17.5 percent of the total number of units, followed by Transportation & Warehousing (9.5%) and Manufacturing (9.3%). A similar pattern is exhibited by Union County with retail trade units being the single largest in terms of number of establishments. It should be noted that this particular sector is one of the top three employment sectors for residents within the Study Area.

Based on an economic profile of the types of business establishments comprising the selected TAZs (grouped at a zip code level) in New Jersey (see Table 2 in Appendix D.3), retail trade comprises the single largest industry sector (17.5% of the total number of units), followed by Transportation & Warehousing (9.5%) and Manufacturing (9.3%). In turn, the industrial and commercial businesses located near the Goethals Bridge make up the majority of the economic activity of those Transportation & Warehousing and Manufacturing establishments. Light-to-medium manufacturing establishments and warehouses are located between the NJ Turnpike and the Arthur Kill, as well as along Brunswick Avenue on the west side of the Turnpike between I-278 and the Staten Island Railroad. The heavy industrial activities of the Bayway Refinery occupy the large tract of land south of the Staten Island Railroad and west of the NJ Turnpike. Along Bayway Avenue and U.S. Route 1 & 9, the economic activities consist mainly of neighborhood and regional retail establishments. Other types of economic activity consist of businesses serving the local market along Atlantic Street west of the Turnpike and north of the Elizabeth River.

Within the Goethals Bridge Study Area specifically, the light-to-medium manufacturing establishments and warehousing businesses located between the NJ Turnpike and the Arthur Kill, either south or north of the Goethals Bridge, include a refrigerated warehouse, the Phelps Dodge Wire & Cable complex, Bayway Industrial Center (formerly known as the Cory Warehouse), a solid waste transfer station, Lorco Petroleum Services, an auto wrecker, junk yard, cement plant, Cycle Chemicals, Apex Chemicals and Yellow Freight. The Joint Meeting of Essex and Union Counties Treatment Plant is located between Amboy Avenue and the NJ Turnpike, on the south bank of the Elizabeth River. North of the Elizabeth River along Third Avenue near South Second Street is a former gas production plant which is used by the Elizabethtown Gas Company for material storage. On the west side of the Turnpike from this location is PSE&G's Bayway Switching Station. In addition to industrial and commercial operations, there are also auto-related and fast-food related businesses located near the intersection of Route I-278 and the Turnpike and neighborhood retail facilities along Bay Way.

4.5.5 Economics (Industry and Business) – New York

Table 3 of Appendix D.3 presents the number of employees and establishments by industry sector in Staten Island. Similar to trends exhibited in the New York portion of the Goethals Bridge Study Area, the health care and social assistance sector is the single largest employer in Staten Island as a whole, employing nearly 27 percent of the workforce. The retail trade sector is the second largest employer within the Borough of Staten Island and the Study Area. In terms of the number of establishments, the retail trade sector exhibited the largest number of business establishments (16.3 percent).

Two zip codes (10303 and 10314) encompass the Goethals Bridge Study Area in Staten Island. A profile of the employment patterns in the Goethals Bridge Study Area was prepared. The profile also included a review of the number and type of business establishment at the zip code local level (Table 4 of Appendix D.3 presents the number of establishments by industry sector and their share within the zip code region). Retail trade comprises the single largest sector within the zip code area, accounting for 20.4 percent of the total number of units. An identical pattern is exhibited within Staten Island as a whole, with retail trade units being the single largest in number. This particular sector is the second highest employment sector for residents within the New York portion of the Goethals Bridge Study Area.

The New York portion of the Goethals Bridge Study Area is largely undeveloped, with extensive wetlands. However there are several large shipping and rail transportation hubs, such as the New York Container Terminal, the Arlington Yards, and Port Ivory, located here. Other economic activities include small light-industrial uses, auto-related businesses, and retail establishments located along Gulf and Forest Avenues.

The New York Container Terminal (NYCT) is a major port facility for the shipment of containerized cargo through the Port of New York to the east and Midwest markets. The terminal contains a total of 187 acres and occupies much of the New York portion of the Goethals Bridge Study Area. The terminal is bound by the Goethals Bridge to the south, Western Avenue to the east, the Arthur Kill to the west, and Richmond Terrace to the north. The terminal opened in 1972 and was the largest employer on Staten Island, employing 1,000 people. More than 325,000 containers pass through the terminal each year. The terminal closed in 1987 when its single tenant, United States Lines, went bankrupt. Since then, the terminal has reopened and is undergoing a modernization program of its facilities to include terminal wharf extension and berth deepening, roadway and railroad improvements, and a new intermodal rail yard. These improvements are expected to enable the terminal to continue to operate as one of the major port facilities within the region.

To the east of the NYCT is the 40-acre Arlington Yards that once served the Staten Island Railroad, a branch of which connects the NYCT to freight railroads in New Jersey. This rail yard has recently been restored by the New York City Economic Development Corporation (NYCEDC) and the Port Authority, along with the lift bridge over the Arthur Kill. In addition, the Port Authority has completed a new connection to the Chemical Coast Secondary Line in New Jersey. The restored railroad serves the new 39-acre intermodal rail terminal recently constructed on a section of the Port Ivory tract, referred to as the ExpressRail Staten Island, and operated by NYCT. This facility serves commercial and manufacturing activities on the west shore of Staten Island. The Port Authority is currently leasing portions of this property for warehousing and distribution uses. Along Forest Avenue, several light-industrial uses, auto-related businesses, and retail establishments provide a variety of services to the Goethals Bridge Study Area.

South of the Goethals Bridge is a large (760-acre) vacant site that was formerly a GATX petroleum storage terminal. This brownfield site was recently the center of two large development proposals, initially for a NASCAR racetrack and commercial development, and then industrial warehousing and port facilities, but neither of these proposals reached fruition. Existing commercial operations immediately south of the Goethals Bridge are a plumbing contractor, an environmental services firm and an electrical

contractor along Gulf Avenue, the R.T. Baker & Son Machinery Salvage Company, formerly a junkyard for defunct transformers, and Keyspan's Staten Island Service Center at Gulf and Forest Avenues.

4.5.6 Environmental Justice

4.5.6.1 Introduction

Executive Order 12898, issued in 1994, directs federal agencies to incorporate *environmental justice* as part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations[5]. The environmental justice assessment includes a review of potential project induced impacts to determine if adverse effects would be disproporationately experienced by low-income and minority populations.

In 2003, the U.S. Coast Guard issued Commandant Instruction 5810.3 in reference to E.O. 12898 and the *Federal Register* "Notice" establishing the Environmental Justice (EJ) Strategy for the United States Coast Guard. The Commandant Instruction provides guidance to all Coast Guard commands on eliminating or mitigating any disproportionately high, adverse human health or environmental effects of its policies, programs, or activities on minority populations and low-income populations.

In New Jersey, an Executive Order on Environmental Justice was issued in February 2004 that stated its commitment to ensuring that communities of color and low-income communities are afforded fair-treatment and meaningful involvement in decision-making. State agencies are tasked with addressing environmental and environmental health concerns and called upon to serve or address issues raised by a multi-agency advisory task force. NJDEP administers the state's Environmental Justice Program and among its responsibilities is the appointment of an Advisory Council whose mission is to issue recommendations to NJDEP and the state's Task Force[6].

In New York State, NYSDEC established its own Environmental Justice Advisory Group comprised of representatives from state, local and federal government, community groups, environmental groups, and businesses. Directed and chaired by the state's Environmental Justice Coordinator, its focus includes developing recommendations for environmental permit policies and to ensure NYSDEC's programs are open and responsive to environmental justice concerns[7].

4.5.6.2 Methodology, Approach and Data Sources

The environmental justice inventory follows the guidance and methodologies recommended in the Federal Council on Environmental Quality's (CEQ's) *Environmental Justice Guidance under the National Environmental Policy Act*, (December 1997). The major steps in this process are:

- Identify Study Area
- Compile population characteristics and identify locations with populations of concern for environmental justice
- Conduct public outreach

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5 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, February 11, 1994.

6 *State of New Jersey, Environmental Justice Executive Order*, February 19, 2004. http://www.nj.gov/dep/ej/eo.html

7 *New York State Department of Environmental Conservation Commissioner Policy – 29, Environmental Justice and Permitting, March 19, 2003*. http://www.dec.state.ny.us/website/ej/ejpolicy.html

For the purpose of this evaluation, the Study Area for environmental justice is defined as those census blocks and block groups within ½-mile of the Goethals Bridge and the connecting roadways, which reflects the Goethals Bridge Study Area. The Goethals Bridge Study Area comprises one or more block groups in the cities of Elizabeth and Linden and in Staten Island, and it reflects those areas most likely to experience direct impacts and, in most cases, indirect community, human health and environmental impacts from the construction and operation of the proposed project.

Population and income characteristics from the 2000 U.S. Census of Population and Housing were inventoried and compiled to identify populations of concern for environmental justice. Block groups and blocks with minority and low-income population concentrations in excess of regional levels (i.e., thresholds) are noted. The Council on Environmental Quality (CEQ) guidance also indicates that sub-areas where more than 50% of the total population is minority are considered minority communities. The following information was collected for specific blocks or block groups and aggregated to enable a general comparison of the Study Area with the region.

- **Racial and Ethnic Characteristics—**Population in each census block of the Study Area was characterized using the racial categories White, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, and Other. These categories are consistent with the affected populations requiring study under Executive Order 12898.

- **Percentage of Minority Population—**Persons of Hispanic origin characterized themselves as White, Black or African American, American Indian and Alaska Native on the long-form of the U.S. Census. Persons of Hispanic origin who identified themselves as White were included in the calculation of minority population for the purposes of this analysis.

- **Low-Income Population—**The Percentage of Persons Living Below the Poverty Level, as defined in the census, is the key indicator used to identify the low-income population in a given census block or census tract. Median Household Income is the second measure that has been used to characterize income levels within the Study Area.

4.5.6.3 New Jersey

Communities and Neighborhoods with Greater Minority and Low-Income Populations

Persons of Hispanic origin account for 44.7 percent of the New Jersey portion of the Goethals Bridge Study Area population (see Table 5 of Appendix D.3). The percentage of persons of Hispanic origin was found to be much higher than the corresponding percentages within Linden (14.4 percent) and Union County (19.7 percent) but lower than in Elizabeth (49.5 percent). Hispanic Whites comprised the single largest minority within the census blocks of the Study Area at 23.1 percent. Persons from the "Other" group, which is a combination of multiple minority groups, often including persons of Hispanic origin, accounted for 17.1 percent of the population, while Black or African-Americans comprised 5.1 percent. Overall, the percentage of minorities in the Study Area (53.3 percent) was found to be higher than the percentage in Linden and Union County, but lower than the percentage of minorities in Elizabeth. Figure 1 of Appendix D.2 shows the spatial distribution of minorities in the New Jersey portion of the Study Area.

Within the census block groups, 17.6 percent of persons have incomes below the poverty level (see Table 5 of Appendix D.3). This poverty level is notably higher than the levels observed in Linden and Union County, but slightly lower than in Elizabeth. Per-capita income of the New Jersey portion of the Goethals Bridge Study Area residents was $15,187, which is lower than the per-capita income reported in Linden ($21,314) and Union County ($26,992), but slightly higher than the per-capita income reported in Elizabeth ($15,114). The median household income in the Goethals Bridge Study Area ($36,590) is

lower than the corresponding incomes in Linden ($46,345) and Union County ($55,339), but higher than the median household income found in Elizabeth ($35,175).

Based on 2000 U.S. Census data, minority and low-income areas are concentrated in the northern and western portions of the New Jersey portion of the Goethals Bridge Study Area. In Elizabeth, areas located west of Pulaski Street and north of Myrtle Street appear to have a higher concentration of minority and low-income residents when compared to the Study Area. Figure 2 of Appendix D.2 shows the spatial distribution of low-income populations in the Study Area. Most of the residential units in these areas were built between 1940 and 1955. Nearly all of the residential units in these areas were reported as occupied. Census data for the block groups in these areas indicate that more than 50 percent of the households in this segment resided in the same house in 1995.

In Linden, the area between Bedle Place and Linden Avenue is characterized by minority and low-income persons. Other portions of the Study Area in this jurisdiction did not exhibit concentrations of minority and low-income persons higher than the County threshold for these indicators. Most of the residential units in this area were built in the mid-1950s and nearly 70 percent of the residents reported that they were living in the same residential unit in 1995.

Census Block Groups with High Concentrations of Minority/Low-Income Persons

The Union County average for minority residents and for persons living below the poverty level was used as the threshold to identify concentrations of minority persons or persons living below poverty in the New Jersey portion of the Goethals Bridge Study Area. Block groups that exceed the county average for either indicator are identified in Table 6 of Appendix D.3.

In Elizabeth, 11 of the 12 block groups have a higher proportion of minority residents than the Union County average, while ten block groups had a greater percentage of persons in poverty than the Union County average. In Elizabeth, block groups exhibiting high percentages of persons below poverty also reflected high minority percentages. In Linden, two of the three block groups exhibited a proportionately greater minority concentration than the Union County average, one of which also exhibited a percentage of persons below poverty higher than that of the County.

There were 32 census blocks in the New Jersey portion of the Goethals Bridge Study Area that exhibited a higher percentage of minority residents than Union County as a whole (see Table 7 of Appendix D.3). Nearly all of these blocks (26 of 32) were located in Elizabeth. At the census block level, minority residents in Elizabeth were concentrated in two locations, i.e. west of Pulaski Street and north of Allen Street.

Based on 2000 U.S. Census data, the share of minority persons range between 70 percent and 95 percent of the population in these areas. Smaller pockets of minority residents were also reported west of Carteret Street between Arnett Street and Broad Street. Similarly, the census block located in the vicinity of Krakow Street and Bay Way reported a high concentration of minority persons. The share of minority persons was reported to be between 70 percent and 85 percent of the population in this area. In Linden, the area located east of Route I-278 and bound by Allen Street exhibited a high concentration of minority persons.

Based on the demographic profiles of the New Jersey portion of the Goethals Bridge Study Area, there exists areas where low-income and minority households exceed the percentages of low-income and minority households at the county level. As a result, concentrations of low-income and minority households are present that will need to be addressed and considered in order to identify the potential for disproportionate project impacts.

4.5.6.4 New York

Communities and Neighborhoods with Greater Minority and Low-Income Populations

The New York portion of the Goethals Bridge Study Area has a significantly higher percentage of minority persons (45.7 percent) than Staten Island as a whole (28.7 percent). As shown in Table 8 of Appendix D.3, Hispanics comprise the single largest race or ethnic minority, representing 21.6 percent of the total population. This percentage is higher than reported for Staten Island as a whole (12.1 percent). Black or African-American (12.8 percent) represented the second largest race or ethnic minority in the Study Area, followed by "Other" (9.4 percent) and Asian (8.5 percent). Figure 1 of Appendix D.2 shows the spatial distribution of minorities in the New York portion of the Goethals Bridge Study Area.

Census block groups in the New York portion of the Goethals Bridge Study Area indicate that 6.6 percent of persons have incomes below the poverty level (see Table 9 of Appendix D.3). This level of poverty is lower than that for the Borough of Staten Island as a whole. Per-capita income of residents in the Study Area was $22,614, which was slightly lower than the per capita income reported in the Borough of Staten Island as a whole ($23,905). Figure 2 of Appendix D.2 shows the spatial distribution of low-income populations in the Study Area.

Median household income in the Study Area and the Borough exhibited generally similar patterns, although the Study Area residents had a slightly higher median household income ($55,666) than that of Staten Island as a whole ($55,039).

The New York portion of the Goethals Bridge Study Area is not characterized by formal neighborhoods or neighborhood associations. Based on 2000 U.S. Census data, minority and low-income persons are concentrated in the northern and eastern portions of the Goethals Bridge Study Area. Areas located between Western Avenue and South Avenue exhibited higher concentrations of minority persons than Staten Island as a whole. Pockets of minority residents were also reported between Forest Avenue and Goethals Road North. Low-income residents were also concentrated in these areas and reported poverty levels higher than the Borough of Staten Island threshold of 10 percent. Based on 2000 U.S. Census data, nearly all the housing units were reported as being occupied. Most of the residential units were constructed in the early 1970s. Census data for the block groups in these areas indicate that more than 50 percent of the households resided in the same house in 1995.

Census Block Groups with High Concentrations of Minority/Low-Income Persons

County averages for minority residents and persons in the New York portion of the Goethals Bridge Study Area living below poverty were used as the basis for determining areas with higher concentrations of minority persons or persons living below poverty. Block groups that exceed the county threshold for either indicator are identified in Table 9 of Appendix D.3. In the Goethals Bridge Study Area, the percentage of minorities exceeded the county average in three of the block groups. However, none of the block groups exhibited a higher share of persons living below poverty when compared to the County threshold.

Table 10 of Appendix D.3 presents the location and number of census blocks that exhibit a higher percentage of minority persons when compared to the county threshold. In all, 36 blocks in the Goethals Bridge Study Area exhibited a higher percentage of minorities than the Borough of Staten Island as a whole.

At the census block level, minority residents were concentrated north and east of I-278. Census blocks east of Western Avenue and those blocks located on either side of South Avenue exhibited the highest concentrations of minority persons. Based on 2000 U.S. Census data, the share of minority persons range

between 50 percent and 90 percent of the total population in these areas. These areas comprise some of the most heavily populated areas in this portion of the Goethals Bridge Study Area.

In the New York portion of the Goethals Bridge Study Area, some neighborhoods have been identified where concentrations of low-income or minority populations exceed the county threshold. As a result, concentrations of low-income and minority households are present that will need to be addressed and considered in order to identify the potential for disproportionate project impacts.

4.5.6.5 Public Outreach for Minority and Low-Income Populations

The USCG conducted a public participation program that included meaningful outreach to a diverse group, including minority and low-income populations. Major components of the program include: public scoping meetings in Elizabeth and Staten Island; input from three technical and stakeholder advisory committees; public open houses held in Elizabeth and Staten Island; informational materials provided via a project web site and newsletters; and public hearings held in Elizabeth and Staten Island. Public Scoping meetings and Open Houses were publicized through meeting flyers mailed to the project mailing list (including local residents), and posted at libraries and community centers. Paid advertisements announcing the meetings were also placed in local and regional newspapers, both in English and Spanish, in both Elizabeth and Staten Island. The public participation program is described in detail in Section 6.0, Agency and Public Involvement.

4.5.6.6 Summary of Minority and Low-Income Populations

The New Jersey and New York portions of the Goethals Bridge Study Area both exhibit higher percentages of minority residents than their respective counties as a whole. Some census block groups and blocks within the Study Area surpass the relevant county thresholds. These areas contain “populations of concern” with respect to Environmental Justice which require further consideration during the impact phase. Key questions for the impact assessment phase concern whether there are adverse effects and, if so, if they would be predominately borne by the minority or low-income populations. Additionally, if there are adverse effects, it would be necessary to determine if they would be appreciably more severe or greater in magnitude for the subject “populations of concern” than for non-minority or non-low-income populations.

4.6 Community Facilities

4.6.1 Introduction

This section provides an inventory and description of existing community facilities and public services, within the Goethals Bridge Study Area. The section also discusses any future or planned community facilities. For the purpose of this analysis, “community facilities” are defined as public schools, religious institutions, public libraries, hospitals, police protection and fire protection.

4.6.2 Methodology, Approach, and Data Sources

The list of community facilities and services was compiled using the following resources:

- Staten Island Community District 1 and 2 Profiles, New York City Department of City Planning
- BYTES of the BIG APPLE: Selected Facilities and Program Sites, 2005.1, New York City Department of City Planning
- Cities of Linden and Elizabeth master plans
- 1997 SIBP FEIS

Figure 4.6.1 depicts the locations of the community facilities and public services that serve the Goethals Bridge Study Area.

4.6.3 New Jersey

Table 4.6-1 provides a list of community facilities within the New Jersey portion of the Goethals Bridge Study Area

4.6.3.1 Fire Protection

Fire protection in the City of Elizabeth is provided by the Elizabeth Fire Department. The department operates seven engine companies, three ladder companies and a heavy rescue company from eight firehouses located throughout the city. The closest engine company to the Study Area is Engine Company No. 2, which is located on South Broad Street. The closest ladder company is Ladder Company No. 2, located on Elizabeth Avenue. The Elizabeth Fire Department maintains a mutual aid agreement with the other municipalities in Union County and with New York City.

Fire protection in the City of Linden is provided by the Linden Fire Department, which operates five engine companies and one ladder company from four firehouses in the city. The closest engine company to the Linden portion of the Study Area is Engine Company No. 1, which is located on East Elizabeth Avenue. The Linden Fire Department maintains a mutual aid agreement with the other municipalities in Union County. Route I-278, a major interstate highway passing through the Study Area, serves as a key emergency evacuation route to area residents[8]. This particular roadway provides connectivity to other major highways in the area, such as Route I-95 (the New Jersey Turnpike) and US Route 1/9, as well as with other regional and local roads. In times of major emergencies or natural disasters, additional local roads in the area are designated as emergency routes by local law enforcement agencies.

4.6.3.2 Police Protection

In the New Jersey portion of the Goethals Bridge Study Area, police protection is provided by the cities of Elizabeth and Linden, although there are no police stations physically located in the Goethals Bridge Study Area. The Elizabeth Police Headquarters is located approximately two miles to the north of the Goethals Bridge Study Area, while Linden Police Headquarters is located approximately three miles beyond the limits of the Study Area.

4.6.3.3 Hospitals and Healthcare Facilities

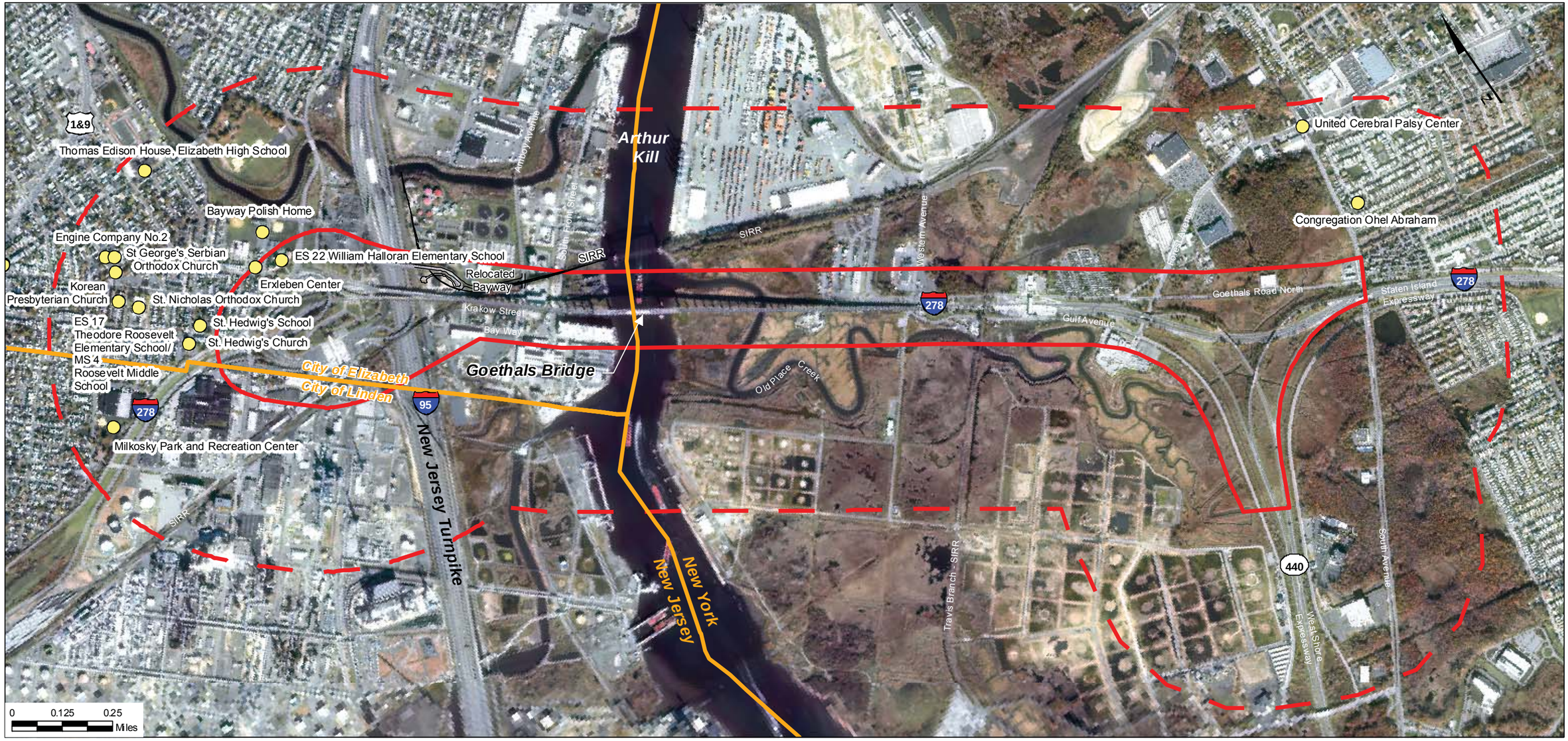
No hospitals or healthcare facilities are located in the New Jersey portion of the Goethals Bridge Study Area. Trinatas Hospital, located in Elizabeth approximately three-quarters of a mile from the Goethals Bridge Study Area, is the closest. The facility is operated by the Sisters of Charity of St. Elizabeth and contains over 300 beds. There are no hospitals located in the city of Linden.

8 Staten Island Hurricane Evacuation Zone, NYC Office of Emergency Management. 2006. NJ State Police, Union County Evacuation Routes. 2006. Accessed at http://www.state.nj.us/njoem/plan/evacuation-routes.html

TABLE 4.6-1
EXISTING COMMUNITY FACILITIES/SERVICES WITHIN THE GOETHALS BRIDGE STUDY AREA, NEW JERSEY

Municipality/ Borough	Community Facility/Service Name	Type of Community Facility/Service	Location
Elizabeth	Engine Company No.2	Fire Protection	655 South Broad Street
Elizabeth	Engine Company No.5 and Truck Company No.2*	Fire Protection	141 Elizabeth Avenue
Elizabeth	City of Elizabeth Police – Police Headquarters*	Police Protection	One Police Plaza
Elizabeth	Trinatas Hospital*	Healthcare Services	225 Williamson Street
Elizabeth	ES 22 William Halloran Elementary School	Elementary School	447 Richmond Street
Elizabeth	ES 17 Roosevelt Elementary School	Elementary School	650 Bay Way
Elizabeth	MS 4 Roosevelt Middle School	Middle School	650 Bay Way
Elizabeth	Thomas Edison House, Elizabeth High School	High School	625 Summer Street
Elizabeth	Erxleben Center	Community Center	513-516 Richmond Street
Elizabeth	Bayway Polish Home	Community Center	625 Pulaski Street
Elizabeth	St. Hedwig's School/Church	Religious Institution	Myrtle Street and Clarkson Avenue
Elizabeth	St. George's Serbian Orthodox Church	Religious Institution	654 South Broad Street
Elizabeth	St. Nicholas Orthodox Church	Religious Institution	668 South Broad Street
Elizabeth	Korean Presbyterian Church	Religious Institution	700 Bay Way
Linden	Fire House No.3*	Fire Protection	Elizabeth Avenue and Chandler Street
Linden	City of Linden Police – Police Headquarters*	Police Protection	301 North Wood Avenue
Linden	School No.4*	Elementary School	1602 Dill Avenue
Linden	Soehl Middle School*	Middle School	301 East Elm Street
Linden	Linden High School*	High School	121 West St. Georges Avenue
Linden	Milkosky Park and Recreation Center	Community Center	McGillvray Place west of Bedle Place

Source: Berger/PB, 2008.
Notes: * Located outside of the Goethals Bridge Study Area, but service to the Goethals Bridge Study Area is provided.



Legend

- Primary Study Area
- Secondary Study Area
- Community Facility and Public Services

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.6-1

Community Facilities and Public Services

United States Coast Guard

4.6.3.4 Schools, Libraries and Community Centers

Four schools are located in the New Jersey portion of the Goethals Bridge Study Area, all in the city of Elizabeth. These include two elementary schools, a middle school and one high school. P.S. 22, an elementary school, is the closest school to the Goethals Bridge and has a student population of approximately 350 students in grades 4 through 6. P.S. 17, an elementary school, and P.S. 4, a middle school, are adjacent to one another and together have a student population of approximately 900 students in grades K through 8. Elizabeth High School (Thomas A. Edison High School), which is located about three-quarters of a mile from the Goethals Bridge Study Area, enrolls approximately 5,000 students in grades 9 through 12.

Two community centers are located in the Goethals Bridge Study Area in Elizabeth. These include the Erxleben Center and the Bayway Polish Home. The Erxleben Center has a 500-seat gymnasium, an exercise facility, game rooms, services for senior citizens, and shower and locker facilities. The facility also houses nurses from the City's Public Health Department. The Bayway Polish Home, which is located on Pulaski Street between Richmond and Clifton Streets, has been at its current location since the late 1960s. The facility has a dance hall and hosts live music and other special events (e.g., family picnic days) on a regular basis.

There are no schools, libraries or community centers located in the Goethals Bridge Study Area in the City of Linden.

4.6.3.5 Religious Institutions

Four churches are located in the secondary Study Area, all of which are in Elizabeth. These include St. Hedwig's Roman Catholic Church, St. George's Serbian Orthodox Church, St. Nicholas Orthodox Church and the Korean Presbyterian Church.

4.6.4 New York

Table 4.6-2 provides a list of community facilities within the New York portion of the Goethals Bridge Study Area.

4.6.4.1 Fire Protection

In Staten Island, the Fire Department of New York (FDNY) operates 17 engine companies, 12 ladder companies and 1 heavy rescue company. Although not physically located in the Study Area, two engine companies, a ladder company and a brush fire unit provide service to the Study Area. Engine Company 158 is located at 65 Harbor Road, approximately one-half mile outside of the Study Area in Arlington, while Engine Company 166, Ladder Company 86 and Brush Fire Unit 2, which are all located at 1400 Richmond Avenue, are located approximately one-quarter mile outside the Study Area. FDNY maintains a mutual aid agreement with municipalities in New Jersey.

TABLE 4.6-2
EXISTING COMMUNITY FACILITIES/SERVICES, NEW YORK

Community Facility/Service Name	Type of Community Facility/Service	Location
Engine Company 166, Ladder Company 86 and Brush Fire Unit 2*	Fire Protection	1400 Richmond Avenue
Engine Company 158*	Fire Protection	65 Harbor Road
120th Precinct*	Police Protection	78 Richmond Terrace
122nd Precinct*	Police Protection	2320 Hylan Blvd.
United Cerebral Palsy Center	Healthcare Services	Forest Avenue near South Avenue
St. Vincent's Medical Center*	Hospital	355 Bard Avenue
PS 44 Thomas C. Brown*	Elementary School	80 Maple Parkway
PS 22 Graniteville*	Elementary School	1860 Forest Avenue
PS 60 Alice Austen*	Elementary School	55 Merrill Avenue
IS 72 Rocco Laurie*	Intermediate School	33 Ferndale Avenue
Port Richmond High School*	High School	85 St. Josephs Avenue
Susan E. Wagner High School*	High School	1200 Manor Road
Congregation Ohel Abraham	Religious Institution	136 Amador Street

Source: Berger/PB, 2008.
Notes: * Located outside of the Goethals Bridge Study Area but service to the Goethals Bridge Study Area is provided.

4.6.4.2 Police Protection

Two New York City police precincts serve the Goethals Bridge Study Area. The 120th Precinct is located at 78 Richmond Terrace and serves the area north of I-278. The 122nd Precinct is located at 2320 Hylan Boulevard and serves the mid-island communities and the portion of the Goethals Bridge Study Area south of the Staten Island Expressway.

4.6.4.3 Hospitals and Healthcare Facilities

In Staten Island, there are no hospitals located within the Goethals Bridge Study Area. St. Vincent's Hospital is the closest hospital to the Goethals Bridge Study Area. It is located at 355 Bard Avenue, approximately three miles to the east, and provides inpatient and outpatient services to Staten Island and the nearby region.

There is one healthcare facility located within the New York portion of the study area and an additional facility that serves the study area. The United Cerebral Palsy Center is located at 2324 Forest Avenue on the northeast edge of the Goethals Bridge Study Area. The Center features a day treatment facility, which serves clients from Staten Island and Brooklyn, and a medical clinic, which serves all boroughs of New York City.

4.6.4.4 Schools, Libraries and Community Centers

Three elementary schools, one intermediate school and two high schools serve the New York portion of the Goethals Bridge Study Area, though none are located within the actual Study Area. The elementary schools, which serve grades pre-kindergarten through 5th, include PS 44 (student enrollment: 873), PS 22 (student enrollment: 1,187) and PS 60 (student enrollment: 944). Intermediate School (IS) 72 serves grades 6th-8th and has an enrollment of 1,869 students. The two high schools, which serve grades 9th-12th are Port Richmond (student enrollment: 2,578) and Susan E. Wagner (student enrollment: 2,873). There are no public libraries or community centers located within the Goethals Bridge Study Area. Although facilities such as these are located outside of the Goethals Bridge Study Area, such services are provided to its residents. The closest public library is the Port Richmond Branch, which is located approximately 1½ miles outside the area.

4.6.4.5 Religious Institutions

Congregation Ohel Abraham, located on Amador Street near South Avenue in Graniteville, is the only religious institution located in the New York portion of the Goethals Bridge Study Area. Religious institutions that are located near the Study Area include the Eastern Orthodox St. Irenaeus Chapel, Sts. Cosmos and Damian Home for the Elderly and St. Michael's Roman Catholic Church.

4.7 Parklands and Recreational Facilities

4.7.1 Introduction

Within the Goethals Bridge Study Area are several parklands and public recreational areas for active or passive use. The active facilities are designed for activities such as field sports, jogging, and children's play, whereas the passive facilities are intended for activities such as strolling, reading, sunbathing, sitting, bird watching, or dog walking. In many cases, the parklands and public recreation areas can be used for either active or passive recreation.

4.7.2 Methodology, Approach and Data Sources

An inventory of parklands and recreational facilities located within one-half mile of the Goethals Bridge, its approaches and connecting roadways was compiled using the following resources:

- Staten Island Community District 1 and 2 Profiles, New York City Department of City Planning
- Online database, New York City Department of Parks and Recreation
- BYTES of the BIG APPLE: Selected Facilities and Program Sites, 2005.1, New York City Department of City Planning
- City of Linden and Elizabeth master plans
- 1997 SIBP FEIS

4.7.3 New Jersey Parklands and Recreational Facilities

4.7.3.1 Elizabeth

In Elizabeth there are four parklands and/or public recreational facilities located within the Goethals Bridge Study Area (see Table 4.7-1). Together, Drotar Field and Erxleben Center combine as an 8.7-acre public recreation facility along Richmond Street. The facility also houses nurses from the City's Public

TABLE 4.7-1
EXISTING PARKLANDS AND PUBLIC RECREATION AREAS, NEW JERSEY

Municipality / Borough	Parkland / Public Recreation Area	Size (Acres)	Use	Location
Elizabeth	Drotar Field and Erxleben Center	8.7	Drotar Field is an active recreation park and Erxleben Center is an active recreational facility. Drotar Field includes a lighted baseball field, basketball court, an Olympic-size swimming pool, and playground. The Erxleben Center includes a 500-seat gymnasium, exercise facility, game rooms, services for senior citizens, and shower and locker facilities.	On Richmond Street bounded by Clifton Street to the north and Pulaski Street to the east
Elizabeth	Mattano Park	39.7	An active and passive public recreational space, including a baseball field, tennis and basketball courts, a horseshoe game area, a playground, a picnic area, and a building for the distribution of recreational equipment during the summer months.	North of Clifton Street and bisected by the Elizabeth River
Elizabeth	Williams Field	11.5	Williams Field is an active recreation park. The facility includes a football field, a running track and a baseball field.	At the western edge of the Study Area behind the Thomas Edison House north of Summer Street between Green Street and Clarkson Avenue
Linden	Milkosky Park and Recreation Center	4.1	Active recreation park and facility. The facility includes a softball field, basketball court, a supervised play area and playground, an ice skating rink, a recreation center.	West of I-278 along Bedle Place
Linden	McGillvray Place Park	0.8	A small active recreation park which serves as a neighborhood play area	On McGillvray Place west of Bedle Place

Source: Berger/PB, 2008.

Health Department. Williams Field, located behind the Thomas Edison House north of Summer Street between Green Street and Clarkson Avenue, is an 11.5-acre facility that includes a football field, a running track and a baseball field. This facility is operated and maintained by the City of Elizabeth's Recreation Department.

Mattano Park, bisected by the Elizabeth River, is the largest park in the Goethals Bridge Study Area. It is approximately 40 acres in size and provides active public recreational space. This facility is maintained and operated by the Union County Parks Department. The park received funding through the Land and Water Conservation Fund Act (LWCFA) in the late 1970s and early 1980s and from the New Jersey Green Acres Program.

4.7.3.2 Linden

In Linden, two city-owned parkland and/or public recreational facilities located within the Goethals Bridge Study Area (see Table 4.7-1). Milkosky Park and Recreation Center (also known as 8th Ward Park) is located just west of Route I-278 along Bedle Place. McGillvray Place Park is a small 0.8-acre play arealocated on McGillvray Place west of Bedle Place. The park received funding through the LWCFA in 1967 and the New Jersey Green Acres Program.

Figure 4.7.1 depicts the existing parklands and public recreation facilities in the New Jersey portion of the Goethals Bridge Study Area.

There are no new parklands or public recreation areas planned within the Goethals Bridge Study Area in Elizabeth or Linden. However, based on discussions with local officials, most of the existing facilities will be maintained and/or improved over the next several years. For example, the City of Linden recently received funding from the Green Acres Program for enhancements to McGillvray Park to ensure compliance with American Disability Act (ADA) standards.

4.7.4 New York Parklands and Recreational Facilities

There are four parks/public recreational areas located within the New York portion of the Goethals Bridge Study Area. These include: Graniteville Swamp Park, Father Macris Park, Forest Grove, and Joseph Manna Park. In addition, there is a 226-acre corporate park that provides passive recreation in a natural setting. These facilities are listed in Table 4.7-2. Figure 4.7.1 graphically depicts the location of the parks and recreation areas in the New York portion of the Goethals Bridge Study Area.

Graniteville Swamp Park is a natural preserve that has broad expanses of both wetlands and upland forest, in addition to marshes and creeks. The park has been designated an area of protection by the Harbor Herons Wildlife Refuge. The park is 8.1 acres and is located north of Goethals Road North between Meeker Avenue and Morrow Street. It is assigned to the New York City Department of Parks and Recreation. Graniteville Swamp Park covers only a fraction of the approximately 45-acre Graniteville Swamp area. Graniteville Swamp serves many vital ecological functions, such as recharging ground water, filtering runoff from surrounding areas, storing storm water to prevent flooding, and stabilizing water levels.

Father Macris Park consists of softball and soccer fields and bleachers, as well as walkways and plantings. The centerpiece of the park is an ornamental fountain decorated with dolphin sculptures. The park is located in the Graniteville section of Staten Island and is named for Reverend Spyridon Macris (1932-1989), the late pastor of Holy Trinity-Saint Nicholas Greek Orthodox Church in Bulls Head. The park is 12.4 acres in size and is located south of the Staten Island Expressway and is bound by Fahy Avenue and Lamberts Lane.

Forest Grove is a natural area consisting of forest and wetlands. The site includes maple and oak trees and marsh flora and is a habitat for ducks. New York City acquired this property in May 1938 from New York State and immediately assigned it to the City's park inventory. The park is 0.1 acres in size and is bound by Forest Avenue and Elizabeth Grove Road.

Joseph Manna Park is a passive recreation park with a sitting area, and World War II memorial monuments that honor Seaman First Class Radioman Joseph Manna (1924-1942) who served and died on the United States Navy destroyer *USS Duncan* during World War II. The park is 0.1 acres and is located on Forest Avenue between Meeker Avenue and Goethals Road North.

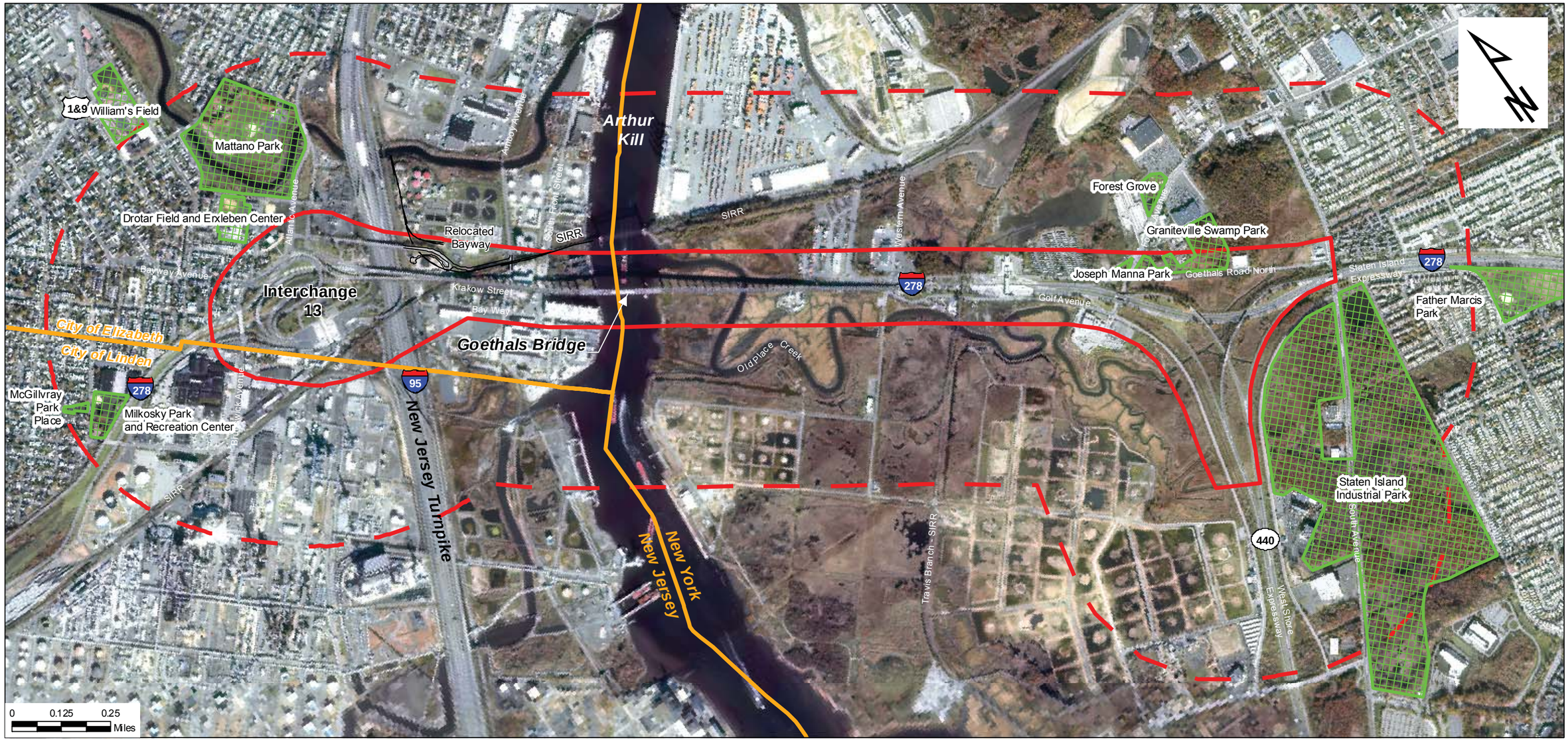
TABLE 4.7-2
EXISTING PARKLANDS AND PUBLIC RECREATION, NEW YORK

Municipality / Borough	Parkland / Public Recreation Area	Size (Acres)	Use	Location
Staten Island	Joseph Manna Park	0.9	Passive recreation park with a sitting area, mall, and World War II memorial monuments honoring war veterans.	On Forest Avenue between Meeker Avenue and Goethals Road.
Staten Island	Forest Grove	0.4	Natural land that consist of forest and wetlands.	Bound by Forest Avenue and Elizabeth Grove Road.
Staten Island	Staten Island Industrial (Corporate) Park	226.3	The park consists of both passive recreational areas and large natural areas that surround 1,530,000 square feet of office space. The park includes gardens, ponds, trails, and 130 acres of wetlands.	Adjacent to the Staten Island Expressway, Merrill Avenue, Teleport, and South Avenue.
Staten Island	Father Macris Park	12.4	An active recreation park that consist of softball and soccer fields and bleachers.	South of the Staten Island Expressway bounded by Fahy Avenue and Lamberts Lane
Staten Island	Graniteville Swamp Park	8.1	Preserved natural land that contains broad expanses of both wetlands and upland forest, in addition to marshes and creeks.	North of Goethals Road North between Meeker Avenue and Morrow Street.

Source: Berger/PB, 2008.

Staten Island Industrial Park (also know as Staten Island Corporate Park) is part of the NYCDPR-designated urban Renewal Area designed to develop vacant land into an attractive and controlled industrial and office environment. The 226.3-acre park is adjacent to the Staten Island Expressway, Merrill Avenue, Teleport, and South Avenue. It consists of both passive recreational areas and large natural areas that surround 1,530,000 square feet (or about 35 acres) of office space, and it also includes gardens, ponds, trails, and 130 acres of wetlands.

Within the Goethals Bridge Study Area, the New York State Department of Environmental Conservation (NYSDEC) is proposing to expand recreational access opportunities for passive outdoor recreation along the Old Place Creek, through the proposed project known as the Old Place Creek Site Access. This 12-acre property, formerly known as Saperstein property and located southeast of the Goethals Bridge Toll Plaza along Gulf Avenue, was acquired in 2003 by NYSDEC in assistance with the Trust for Public Land and was added to the Old Place Creek Wetland System, which in turn is part of the Harbor Herons Wildlife Complex. Upon the receipt of funds in 2007, the NYSDEC is proposing the development of an improved access plan, which would include an on-site parking area (8-10 cars), walk-in only trails with educational signage, as well as a kayak launch area, fishing areas, and a viewing platform. Start of construction is planned for mid- to late-2008, and the parcel will remain owned by NYSDEC.



Legend

- Primary Study Area
- Secondary Study Area
- Parks and Recreational Facilities

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.7-1

Parklands and Recreational Facilities

United States Coast Guard

There are no other planned parklands or public recreation facilities planned; however and few miles south of the Goethals Bridge Study Area, there are plans to redevelop the Fresh Kills site into a park and recreation area. This site, which is more than 2.5 times the size of Central Park at 2,200 acres, is located approximately one mile south of the Study Area. On April 6, 2006, the Draft Master Plan was released by the New York City Department of City Planning. The plan, produced in conjunction with the New York City Department of Parks and Recreation, offers a footprint of what will be New York City's most expansive new open space. It envisions how the park will one day look and be experienced, and identifies a broad variety of activities, such as kayaking and mountain biking, that would make Fresh Kills unique among New York City parks.

4.8 Historic Resources

4.8.1 Regulatory Setting

This section presents a description of the project area as it relates to historic resources, specifically historic architectural resources. The section includes a general description of the methods employed to identify and evaluate historic resources. The historic architectural investigations are described in greater details in separate reports prepared for the Proposed Project (see Appendices E.1, E.2 and E.3).

Potential impacts to historic resources are required to be analyzed under Section 106 of the National Historic Preservation Act of 1966, the New Jersey Register of Historic Places Act of 1970, and the New York State Historic Preservation Act of 1980. Requirements of Section 106 are outlined in the Advisory Council on Historic Preservation's regulations implementing Section 106, *Protection of Historic Properties* (36 CFR 800). Section 106 of the National Historic Preservation Act requires that federal agencies or applicants for federal funding, permits and authorizations take into account the effects of their undertaking on historic properties (defined as properties that are listed on or eligible for listing on the National Register of Historic Places, or simply, the National Register).

The implementing regulations require federal agencies to consult with the respective state's State Historic Preservation Office (SHPO) to identify historic resources potentially affected by the undertaking, to assess the undertaking's effects on properties listed on, or eligible for listing on the National Register, and to avoid, minimize, or mitigate any adverse effects on historic properties. The responsible state agency in New Jersey is the New Jersey Historic Preservation Office (NJHPO). Consultation and review of historic architectural issues in New Jersey is conducted under authority of the New Jersey Register of Historic Places Act of 1970 (N.J.S.A. 13:1B-15.1328 et. seq.). In New York, the New York State Office of Parks, Recreation, and Historic Preservation (NYSOPRHP) serves as the SHPO. Consultation and review of historic architectural issues in New York is conducted under authority of the New York State Historic Preservation Act of 1980 (Chapter 354 of Parks, Recreation and Historic Preservation Law). Section 106 consultation with the NJHPO and the NYSOPRHP regarding the Proposed Project began in June 2005. Key Section 106 correspondence is included in Appendix E.7.

4.8.2 Methodology, Approach and Data Sources

The historic resources survey consisted of research, field survey and documentation, and the evaluation of resources identified within the project's Area of Potential Effect (APE). This report identified any historic properties within the APE that are: 1) designated as National Historic Landmarks; 2) listed on the State and National Registers of Historic Places; 3) that have determinations of eligibility from the Keeper of the National Register; and/or 4) that have SHPO determinations or opinions of eligibility. The survey also identified properties in the APE that are 50 years of age or older and evaluated the potential eligibility of these resources for listing on the State and National Register of Historic Places.

Historic properties of national, state, and local significance may qualify for listing on the National Register of Historic Places following evaluation in accordance with an established set of criteria for determining the significance of potential historic and/or archaeological properties as set forth in the guidelines (36 CFR 60):

> *The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:*
>
> *A. That are associated with events that have made a significant contribution to the broad patterns of our history;*
> *B. That are associated with the lives of persons significant in our past;*
> *C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*
> *D. That have yielded, or that may be likely to yield, information important in prehistory or history.*

Background research included an examination and analysis of selected historical maps and secondary histories available at the New York City Public Library, the Staten Island Institute of Arts and Sciences, the St. George Library Center in Staten Island, the New Jersey State Library in Trenton, Rutgers University Library in New Brunswick, the Union County Courthouse, and the New Jersey Department of Transportation, as well as local historical societies and municipal offices. Additional historic maps were collected from online-digital historic cartographic clearinghouses such as the American Memory Map Collection of the Library of Congress and the Davis Rumsey Historical Map Collection. Historic architectural site survey files were reviewed at the offices of the NJHPO and the NYSOPRHP. This review revealed that 32 historic resources within the APE had been previously documented and/or possessed a SHPO opinion of National Register eligibility. Of these, two resources exist within both the New Jersey and the New York APEs, 29 resources exist exclusively within the New Jersey APE, and one resource is exclusively within the New York APE.

This EIS and its associated documents supplement and expand upon the survey that was conducted as part of the previously-proposed Staten Island Bridges Program Modernization and Capacity Enhancement Project (1997). As part of that study, 24 historic resources were identified in the area immediately adjacent to the bridge. At that time, New Jersey survey forms were submitted and the resources were evaluated as part of the Section 106 consultation (SHPO opinions of 7/11/1995). However, due to the fact that the *Staten Island Bridges Program Modernization and Capacity Enhancement Project Historic Resources Survey* was conducted more than 10 years ago, the resources reviewed as part of that study have been re-evaluated and new survey forms have been completed as compliance with the current NJHPO's *Guidelines for Architectural Surveys*. Survey forms were not prepared for previously-identified historic properties where a survey was conducted within the past 10 years.

According to 36 CFR 800.16(d), the Area of Potential Effect (APE) is the geographic area in which the undertaking may directly or indirectly cause changes in the character or use of historic properties should any historic properties exist. The APE for historic architectural resources was determined in consultation with the New Jersey and New York SHPOs. The study conducted for the previously-proposed project, the *Staten Island Bridges Program Final Environmental Impact Statement* (FEIS), utilized an APE for historic architecture consisting of a one-half mile corridor surrounding the proposed improvements to the Goethals Bridge (USCG 1997). The APE for the current project also proposed a one-half mile corridor corresponding with the combined Primary and Secondary Study Areas (i.e., the Goethals Bridge Study Area) as defined in Section 4.2; this APE was originally identified during the scoping process for the current project.

In June 2005, the APE was submitted to the NJHPO and the NYSOPRHP for review and concurrence as part of the Section 106 consultation process for the Proposed Project. The NJHPO review of the APE then determined that, owing to broader viewshed concerns, the use of a larger APE for historic architecture in New Jersey would be required for the current project. In October 2005, a field review of the Goethals Bridge Study Area and its environs was conducted to develop an appropriate APE that addressed the potential viewshed resulting from the Proposed Project. Following further consultation, a revised APE was submitted to the NJHPO on March 10, 2006. The revised APE considered the nature and scale of the proposed project, the existing built environment in which the project will occur, and the various ways in which the project could reasonably be demonstrated to affect historic properties. As a result, the New Jersey APE is bounded by the Arthur Kill on the east, the Elizabeth River and Mattano Park on the north, Clifton and Pulaski Streets on the west, Interchange 13 and associated ramps on the southwest, and Morses Creek on the south. The New Jersey and New York portions of the APE for the Proposed Project are depicted on Figures 4.8-1a and 4.8-1b.

A field survey was conducted in July 2006, with a supplementary field survey in New Jersey conducted in the Fall of 2007. These surveys consisted of a pedestrian examination of all historic properties (50 years of age or older) within the respective APEs. Photographs and narrative field notes were prepared to document and describe the form, fabric, condition and integrity of each historic resource identified within the APE. A total of 89 historic architectural properties within the APE were documented as a result of these surveys, including three in both New Jersey and New York, 71 exclusively in New Jersey and 15 exclusively in New York. The field surveys also re-examined previously identified historic resources to determine if any had undergone substantial change since the time of their initial documentation/survey in the 1990s. Subsequent consultation with NYSOPRHP resulted in the identification of an additional historic property (i.e., SIRR's Travis Branch bridges over Old Place Creek, Gulf Avenue, I-278 and Goethals Road North), for a final total of 90 historic architectural properties within the APE, including 16 that are exclusively in New York. Figures 4.8-1a and 4.8-1b also depict the locations of all historic architectural resources identified within the APE, including 32 previously identified historic resources and 58 newly identified historic resources. Table 4.8-1 summarizes the results of the historic resource survey and the National Register eligibility recommendations. The complete Section 106 architecture survey reports and associated survey forms are provided in Appendices E.1, E.2 and E.3. Key Section 106 correspondence is also included in Appendix E.7.

4.8.3 Findings

4.8.3.1 New Jersey APE

A review of the records and site files maintained by the NJHPO indicated that 31 historic architectural resources within the New Jersey APE had been previously identified by earlier surveys. Five of these 31 resources were considered to be eligible for the National Register of Historic Places by NJHPO opinions, while 21 were considered to be not eligible for the National Register of Historic Places by NJHPO opinions. Four of the 31 previously-identified historic architectural resources were recommended eligible for the National Register of Historic Places by previous surveys but no official NJHPO opinion was issued. One additional historic architectural resource was previously considered to be not eligible for the National Register of Historic Places by NJHPO opinion and was subsequently demolished between 1995 and 2005.

Nine of the 31 previously-identified resources in New Jersey are eligible for listing on the National Register. In addition, the current study included a survey of 43 previously-unidentified resources, two of which are eligible for the National Register. The NJHPO concurred on the eligibility of these eleven resources, as well as the ineligibility of the remaining properties surveyed and evaluated in New Jersey, on May 21, 2008. The eleven historic properties are discussed briefly below.

The ***Goethals Bridge*** retains a high degree of integrity and is recommended eligible for listing in the National Register of Historic Places under Criteria A and C. The Goethals Bridge consists of a high 672-foot-long main span formed by a cantilever steel through truss and long elevated steel girder approaches supported by concrete piers, with a total length of one mile (Criterion C). The bridge was built in 1928 and designed by J.A.L. Waddell with Othmar Ammann, and was intended by the Port Authority of New York and New Jersey to alleviate the congested ferry system to Staten Island as well as provide the first link for vehicular traffic between Staten Island and the New Jersey mainland (Criterion A).

The New Jersey portion of the ***Staten Island Railroad Historic District*** (within the Union County municipalities of Cranford Township, Roselle Borough, Roselle Park Borough, and the City of Elizabeth) is recommended eligible under Criterion A as a critical link in the Baltimore and Ohio Railroad freight service between Baltimore and Manhattan via Staten Island. The ***Staten Island Railroad Lift Truss Bridge*** is recommended eligible under Criterion C as a well-preserved example of a proprietary bridge type and has the distinction of being the longest span in the world. The bridge, which has a main span length of 558 feet, is the longest by about seven feet. The al-Firdan Bridge over the Suez Canal in Egypt (1963) and the Cape Cod Canal Railroad Bridge in Massachusetts (1933-1935) are close in length. In addition, the bridge is a key contributing element to the eligible Staten Island Railroad Historic District.

The ***Perth Amboy and Elizabethport Branch of the Central Railroad of New Jersey*** is recommended eligible under Criterion A for its history of: transporting passengers to vacation and excursion destinations in Monmouth and Ocean counties and Atlantic City; commuters to Newark and New York from Monmouth and Ocean counties; as well as the transport of labor from Elizabethport to southern New Jersey. Freight shipments carried on the line included agricultural, industrial, and manufactured products moving between northern and southern New Jersey, as well as glass and construction sand shipped north by rail.

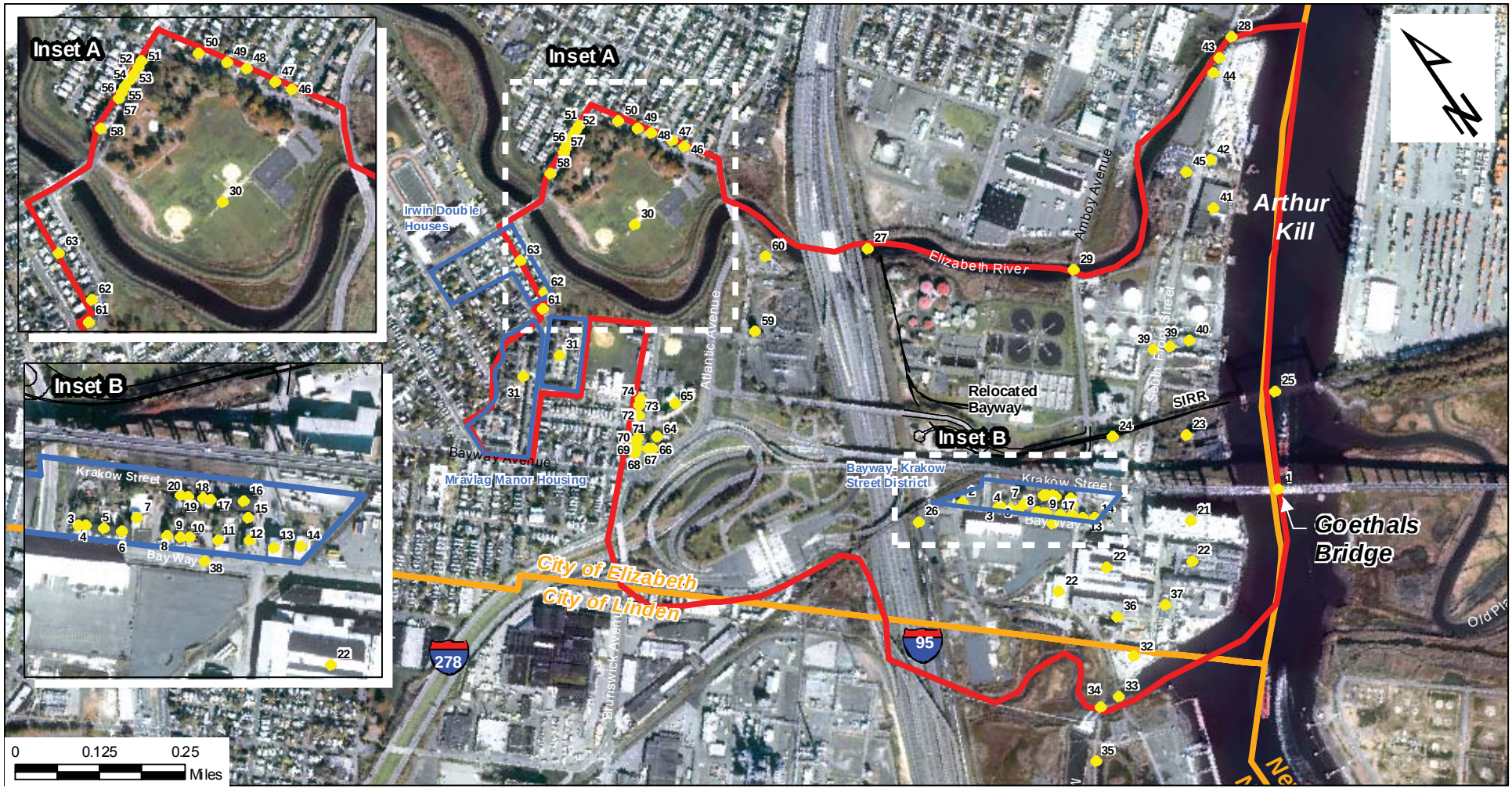
The ***Elizabeth River Bridge, Central Railroad of New Jersey***, is recommended eligible under Criterion C as a bridge which embodies the distinctive characteristics of a design that figured prominently in the development of the modern bascule bridge. The Bridge is also a contributing resource to the Perth Amboy and Elizabethport Branch of the Central Railroad of New Jersey.

South Front Street over Elizabeth River was previously recommended as eligible for listing on the National Register in the NJDOT Historic Bridge Survey conducted in 1994. No formal concurrence was generated as part of the survey. South Front Street over Elizabeth River is recommended eligible under Criterion C as a well-preserved example of a proprietary bridge type that is not common in New Jersey. South Front Street over Elizabeth River is one of only two documented heel trunnion bridges to carry a roadway in the State of New Jersey (NJ 7 over the Passaic River in Bergen County is the second).

South First Street over Elizabeth River was previously recommended as eligible for listing on the National Register in the NJDOT Historic Bridge Survey conducted in 1994. No formal concurrence was generated as part of the survey. South First Street over Elizabeth River is recommended eligible under Criterion C as a well-preserved example of a proprietary bridge type that is not common in New Jersey.

Mattano Park is a contributing element to the Union County Park System and is recommended eligible under Criterion A for its contribution to the broad patterns of history in the areas of Community Planning, Entertainment/Recreation, and Landscape Architecture on the national level; and in the area of Conservation on the state level. Under Criterion C, it is significant for its association with the nationally renowned Olmsted Brothers Landscape Architecture Firm of Brookline, Massachusetts.

The ***Mravlag Manor Housing Project***, constructed in 1939, is recommended eligible under Criterion A as the first large-scale federal housing project constructed in Elizabeth, New Jersey, in the context of publicly-assisted housing in New Jersey that predates 1952. As one of two similar projects constructed at



Legend

- Area of Potential Effect
- Historical Resource
- Historic Districts

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: The Louis Berger Group, 2004.

Goethals Bridge Replacement EIS

Figure 4.8-1a

Documented Historical Resources in the APE Study Area - New Jersey

United States Coast Guard

Legend

- Area of Potential Effect
- Historical Resource

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: The Louis Berger Group, 2004.

Goethals Bridge Replacement EIS

FIGURE 4.8-1b

Documented Historical Resources in the APE Study Area - New York

United States Coast Guard

TABLE 4.8-1
HISTORIC RESOURCES IDENTIFIED WITHIN THE AREA OF POTENTIAL EFFECT – NEW JERSEY AND NEW YORK

MAP NO.	NAME/ADDRESS	BLOCK/ LOT	DATE BUILT	ELIGIBILITY STATUS
Previously Identified Historic Resources – New Jersey				
1**	Goethals Bridge	N/A	1928	**Eligible** (NJHPO Opinion 2/14/1995)
2	167 Bayway, Elizabeth	4/179	ca. 1915	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
3	147 Bayway, Elizabeth	4/177	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
4	145 Bayway, Elizabeth	4/176	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
5	137-143 Bayway, Elizabeth	4/175	ca. 1917	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
6	135 Bayway, Elizabeth	4/174	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
7	133 Bayway, Elizabeth	4/173	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
8	123 Bayway, Elizabeth	4/172	ca. 1910	Not Eligible (NJHPO Opinion 7/11/1995); Demolished between 1995-2005
9	119 Bayway, Elizabeth	4/171	ca. 1950	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
10	117 Bayway, Elizabeth	4/170	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
11	109 Bayway, Elizabeth	4/167	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
12	100-103 Bayway, Elizabeth	4/163	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
13	93-95 Bayway, Elizabeth	4/162	ca. 1903	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
14	89 Bayway, Elizabeth	4/159	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
15	663 Amboy Avenue	4/51	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
16	100-106 Krakow Street, Elizabeth	4/51	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
17	112 Krakow Street, Elizabeth	4/833	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
18	114 Krakow Street, Elizabeth	4/834	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
19	118 Krakow Street, Elizabeth	4/835	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
20	120 Krakow Street, Elizabeth	4/836	ca. 1922	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
21	Bayway Terminal Storage Warehouse, 666 South Front Street, Elizabeth	4/1471	1927	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)
22	Phelps Dodge Complex, Elizabeth	4/55 & 4/1457	ca. 1903-1950	Not Eligible (NJHPO Opinions 7/11/1995 and 5/21/2008)

TABLE 4.8-1 (CONTINUED)

MAP NO.	NAME/ADDRESS	BLOCK/ LOT	DATE BUILT	ELIGIBILITY STATUS
Previously Identified Historic Resources – New Jersey (Continued)				
23	Borne Scrymser Company, 632-650 South Front Street, Elizabeth	4/1469	1917-1941	Not Eligible (NJHPO Opinion 7/11/1995 and 5/21/2008)
24**	Staten Island Railroad Historic District, (New Jersey Portion: Elizabeth to Cranford Junction)	N/A	1889-1959	**Eligible** (NJHPO Opinions 6/11/1991 and 2/27/1995)
25**	Staten Island Railway Lift Truss Bridge over Arthur Kill	N/A	1959	**Eligible** (NJHPO Opinion 6/11/1991)
26	Perth Amboy and Elizabethport Branch of the Central Railroad of New Jersey (CNJ), Elizabeth	N/A	1871	**Eligible** (NJHPO Opinion 8/30/2000)
27	Central Railroad of New Jersey Bridge over the Elizabeth River, Elizabeth	N/A	ca. 1912	**Eligible** (NJHPO Opinion 4/9/1990)
28	South Front Street over Elizabeth River, Elizabeth Bridge # 2004001	N/A	1920	**Eligible** (NJHPO Opinion 5/21/2008) (NJDOT Survey 1994)
29	South First Street over Elizabeth River, Elizabeth	N/A	1908	**Eligible** (NJHPO Opinion 3/23/1998) (NJDOT Survey 1994)
30	Mattano Park, Elizabeth (Union County Park System)	4-59, 5/453.B, 5/1262, 7/968	1921-1964	**Eligible** (NJHPO Opinion 5/21/2008) (Union County Park System Cultural Landscape Survey 10/29/2004)
31	Mravlag Manor Housing Project 635-681 & 640-664 Clarkson Avenue, Elizabeth	4/361	1939	**Eligible** (NJHPO Opinion 5/21/2008) (Public Housing in New Jersey Historic Context Study 2001)
32	2710 Allen Street Extension, Linden	586/4	ca. 1920	Not Eligible (NJHPO Opinion 5/21/2008)
33	Carringer Road Bridge over Morses Creek, Linden	586/5	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
34	Sound Shore Bridge over Morses Creek, Linden	586/10	ca. 1920	**Eligible**. See Sound Shore Railroad (No. 35 below) (NJHPO Opinion 5/21/2008)
35	Sound Shore Railroad	N/A	ca. 1895	**Eligible** (NJHPO Opinion 5/21/2008)
36	735-757 South Front Street, Elizabeth	4/1458	ca. 1919	Not Eligible (NJHPO Opinion 5/21/2008)
37	760-766 South Front Street, Elizabeth	4/1472	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
38	Bayway-Krakow Street District, Elizabeth	See Map Nos. 2-19	ca. 1901-1923	Not Eligible (NJHPO Opinion 5/21/2008)
39	534-538 and 529-539 South Front Street, Elizabeth	4/1466 & 4/1447	1954 1923	Not Eligible (NJHPO Opinion 5/21/2008)
40	346-532 South Front Street, Elizabeth	4/1464 & 4/1445	ca. 1948 ca. 1923	Not Eligible (NJHPO Opinion 5/21/2008)
41	76-78, 80-312 and 314-344 South Front Street, Elizabeth	4/14614/1462 & 4/1463	ca. 1920	Not Eligible (NJHPO Opinion 5/21/2008)
42	2-74 South Front Street, Elizabeth	4/1459	ca. 1930	Not Eligible (NJHPO Opinion 5/21/2008)
43	1-13 South Front Street, Elizabeth	4/1436	ca. 1875	Not Eligible (NJHPO Opinion 5/21/2008)
44	15-21 South First Street, Elizabeth	4/1438.B	ca. 1923	Not Eligible (NJHPO Opinion 5/21/2008)
45	65-85 South Front Street, Elizabeth	4/1438.A	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
46	437 Doyle Street, Elizabeth	5/241.I	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
47	436 Redcliffe Street, Elizabeth	5/1153.I	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
48	437 Redcliffe Street, Elizabeth	5/1144.D	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)

TABLE 4.8-1 (CONTINUED)

MAP NO.	NAME/ADDRESS	BLOCK/ LOT	DATE BUILT	ELIGIBILITY STATUS
Previously Identified Historic Resources – New Jersey (Continued)				
49	436 Loomis Street, Elizabeth	5/859.E	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
50	475 Fifth Avenue, aka 439 Loomis Street, Elizabeth	5/895	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
51	505 South Fifth Street, Elizabeth	5/1251	ca. 1945	Not Eligible (NJHPO Opinion 5/21/2008)
52	507 South Fifth Street, Elizabeth	5/1252	ca. 1930	Not Eligible (NJHPO Opinion 5/21/2008)
53	511-513 South Fifth Street, Elizabeth	5/1253	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
54	515 South Fifth Street, Elizabeth	5/1254	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
55	517 South Fifth Street, Elizabeth	5/1256	ca. 1920	Not Eligible (NJHPO Opinion 5/21/2008)
56	521 South Fifth Street, Elizabeth	5/1257	ca. 1900	Not Eligible (NJHPO Opinion 5/21/2008)
57	525 South Fifth Street, Elizabeth	5/1258	ca. 1900	Not Eligible (NJHPO Opinion 5/21/2008)
58	539 South Fifth Street, Elizabeth	5/1261	ca. 1940	Not Eligible (NJHPO Opinion 5/21/2008)
59	Bayway Switching Station, 530-614 Trenton Avenue, Elizabeth	4/1582	ca. 1942	Not Eligible (NJHPO Opinion 5/21/2008)
60	Bayway Switching Station, 530-614 Trenton Avenue, Elizabeth	4/1582.A	ca. 1950	Not Eligible (NJHPO Opinion 5/21/2008)
61	630 Clarkson Avenue, Elizabeth	4/378.A	ca. 1939	Not Eligible (NJHPO Opinion 5/21/2008)
62	627 Arnett Street, Elizabeth	4/58	ca. 1958	Not Eligible (NJHPO Opinion 5/21/2008)
63	Irwin Double Houses 605-625 Arnett Street and 584-586 Summer Street, Elizabeth	4/57.A – 4/57.H	ca. 1948	Not Eligible (NJHPO Opinion 5/21/2008)
64	442 Richmond Avenue, Elizabeth	4/455	ca. 1923	Not Eligible (NJHPO Opinion 5/21/2008)
65	Halloran School, Elizabeth	4/1278	1950	Not Eligible (NJHPO Opinion 5/21/2008)
66	445 Fern Place, Elizabeth	4/456	ca. 1930	Not Eligible (NJHPO Opinion 5/21/2008)
67	447 Fern Place, Elizabeth	4/457	ca. 1910	Not Eligible (NJHPO Opinion 5/21/2008)
68	663 Pulaski Street, Elizabeth	4/300	1924	Not Eligible (NJHPO Opinion 5/21/2008)
69	659 Pulaski Street, Elizabeth	4/299	1924	Not Eligible (NJHPO Opinion 5/21/2008)
70	655 Pulaski Street, Elizabeth	4/298	1924	Not Eligible (NJHPO Opinion 5/21/2008)
71	653 Pulaski Street, Elizabeth	4/297	1923	Not Eligible (NJHPO Opinion 5/21/2008)
72	501 Richmond, Elizabeth	4/1280.A	1957	Not Eligible (NJHPO Opinion 5/21/2008)
73	641 Pulaski Street, Elizabeth	4/294.K	1957	Not Eligible (NJHPO Opinion 5/21/2008)
74	637 Pulaski Street, Elizabeth	4/294.J	1957	Not Eligible (NJHPO Opinion 5/21/2008)
Previously Identified Historic Resources – New York				
1**	Goethals Bridge	N/A	1928	**Eligible** (NYSOPRHP Determination 1/24/1995; Not LPC Eligible 2008)
24**	Staten Island Railroad Historic District, (New York Portion)	N/A	1889-1959	Not Eligible (NYSOPRHP Determination 7/26/1989; 11/15/1990)
25**	Staten Island Railway Lift Truss Bridge over Arthur Kill	N/A	1959	**Eligible** (NYSOPRHP Determination 6/4/2008; NYC Landmark Designation LPC Environmental Review 12/02/1996)
75	Texas Eastern Transmission Corporation District Center 2949 Goethals Road North, Staten Island	1394/101	ca. 1940	Not Eligible (NYSOPRHP Concurrence 11/16/2007; Staten Island Bridge Program 1994)
76	17 Lilac Court, Staten Island	1707/5	ca. 1915	Not Eligible (NYSOPRHP Determination 11/16/2007)
77	11 Lilac Court, Staten Island	1707/38	ca. 1940	Not Eligible (NYSOPRHP Determination 11/16/2007)
78	881 Morrow Street, Staten Island	1384/1	ca. 1915	Not Eligible (NYSOPRHP Determination 11/16/2007)
79	885 Morrow Street, Staten Island	1384/3	ca. 1915	Not Eligible (NYSOPRHP Determination 11/16/2007)

TABLE 4.8-1 (CONTINUED)

MAP NO.	NAME/ADDRESS	BLOCK/ LOT	DATE BUILT	ELIGIBILITY STATUS
Previously Identified Historic Resources – New York (Continued)				
80	856 Morrow Street, Staten Island	1717/56	ca. 1940	Not Eligible (NYSOPRHP Determination 11/16/2007)
81	834 Morrow Street, Staten Island	1717/67	ca. 1920	Not Eligible (NYSOPRHP Determination 11/16/2007)
82	830 Morrow Street, Staten Island	1717/72	ca. 1920	Not Eligible (NYSOPRHP Determination 11/16/2007)
83	851 Morrow Street, Staten Island	1380/41	ca. 1915	Not Eligible (NYSOPRHP Determination 11/16/2007)
84	2437 Forest Avenue, Staten Island	1348/96	ca. 1915	Not Eligible (NYSOPRHP Determination 11/16/2007)
85	2431 Forest Avenue, Staten Island	1348/102	ca. 1915	Not Eligible (NYSOPRHP Determination 11/16/2007)
86	2409 Forest Avenue, Staten Island	1290/15	ca. 1931	Not Eligible (NYSOPRHP Determination 11/16/2007)
87	15 Kinsey Place, Staten Island	1290/66	ca. 1915	Not Eligible (NYSOPRHP Determination 11/16/2007)
88	17 Kinsey Place, Staten Island	1290/64	ca. 1920	Not Eligible (NYSOPRHP Determination 11/16/2007)
89	19 Kinsey Place, Staten Island	1290/63	ca. 1920	Not Eligible (NYSOPRHP Determination 11/16/2007)
90	SIRR's Travis Branch bridges over Old Place Creek, Gulf Avenue, I-278 and Goethals Road North	N/A	ca. 1917-1937	Not Eligible (NYSOPRHP Determination 12/19/2008)

Source: Berger/PB, 2008.
Note:
*** Resources identified within both the New Jersey and New York APEs*

the time and with the loss of Pioneer Homes, Mravlag Manor is also significant as the only extant example of public housing built during the late 1930s era in Elizabeth.

The ***Sound Shore Railroad*** was completed in 1896 to service the industries along the Arthur Kill. The Sound Shore Railroad is recommended eligible for listing on the National Register of Historic Places under Criterion A as an important component of the industrial history of the coastal area of the Arthur Kill from Elizabeth, Union County, to Carteret, Middlesex County. The ***Sound Shore Railroad Bridge over Morses Creek*** does not have sufficient architectural or engineering significance to meet the eligibility criteria for individual listing on the National Register of Historic Places and is not historically or technologically significant on its own merit; however, it is a feature of the Sound Shore Railroad and is therefore recommended eligible as a contributing element to the Sound Shore Railroad.

4.8.3.2 New York APE

A review of the NYSOPRHP historic architectural files indicated that three historic resources were previously identified within the New York portion of the historic architecture APE. Two of these resources, the Goethals Bridge and the Staten Island Railroad District, were also previously-identified within the New Jersey APE (discussed above). The third previously-identified resource, the Texas Eastern Transmission Corporation District Center at 2949 Goethals Road North, had previously been recommended as not eligible. A pump house associated with this resource has also been surveyed as part of the current study, and is likewise recommended to be not eligible. Fourteen additional historic architectural resources that had not been previously surveyed were also identified and evaluated by the current survey. These 14 resources consist of 13 early twentieth century dwellings and a small yard office building at 2409 Forest Avenue, all of which display poor integrity. The NYSOPRHP concurred that none

of the newly identified historic architectural resources within the New York APE, including the pump house at 2949 Goethals Road North, are National Register eligible (NYSOPRHP, November 16, 2007).

Subsequent to the preparation of the Section 106 architecture survey reports and associated survey forms (as provided in Appendices E.1, E.2 and E.3), additional follow-up consultation (as presented in the correspondence included in Appendix E.7) was conducted with NYSOPRHP regarding other specific resources. In this regard, a survey form (blue form) for the Staten Island Railway Lift Truss Bridge over Arthur Kill was submitted separately to the NYSOPRHP for evaluation and concurrence. The NYSOPRHP determined that the Staten Island Railway Lift Truss Bridge over Arthur Kill is eligible for listing on the National Register on June 4, 2008. In addition, further consultation with the NYSOPRHP in late 2008 confirmed that the four SIRR's Travis Branch bridges over Old Place Creek, Gulf Avenue, I-278 and Goethals Road North (a.k.a., the "Travis Branch Railroad Overpass," whose structures over I-278 and local city streets would be replaced under the Proposed Project as detailed in Section 3.4.8) do not meet the criteria for listing to the National Register, and are therefore not eligible (NYSOPRHP, December 19, 2008).

4.8.4 Summary

After applying the National Register eligibility criteria to the 90 historic resources within the combined New Jersey and New York APEs, it was recommended that 11 of the 90 properties surveyed within the APE meet National Register significance criteria for listing on the National Register.

4.9 Archaeological Resources

4.9.1 Regulatory Setting

All consultation and review of archaeological issues in New Jersey was conducted under authority of the New Jersey Register of Historic Places Act of 1970 (N.J.S.A. 13:1B-15.1328 *et. seq.*). In addition, all work must conform to the *Guidelines for Archaeological Investigations* established by the NJHPO.

All consultation and review of archaeological issues in New York was conducted under authority of Article 14 of the New York State Historic Preservation Act of 1980 (Chapter 354 of Parks, Recreation and Historic Preservation Law). In addition, all archaeological work must comply with the New York Archaeological Council Standards (NYACS) (1994) and the *Cultural Resource Standards Handbook (2000)* prepared by the New York Archaeological Council Standards Committee.

Pursuant to the New York City Landmark Preservation Law (Landmarks Law), the New York City Landmarks Preservation Commission (NYCLPC) has the authority to designate City Landmarks, Interior Landmarks, Scenic Landmarks, and Historic Districts, and to regulate any construction, reconstruction, alteration, or demolition of such Landmarks and Districts. The NYCLPC also has established procedures with respect to archaeological resources that must be followed. These procedures are outlined in NYCLPC's publication, *Landmarks Preservation Commission Guidelines for Archaeological Work in New York City (2002).*

Preliminary consultation and coordination with the NYSOPRHP and the NJHPO was initiated in July 2004 with the submission of a briefing package for the Goethals Bridge EIS. This was followed by a meeting with the NYSOPRHP on August 11, 2004 to discuss archaeological resources and fieldwork strategies. In June 2005, the USCG initiated formal consultation with the NYSOPRHP and NJHPO pursuant to Section 106. Additional consultation with each of the SHPOs has continued to the present. The NYSOPRHP and NJHPO coordination communication is provided as part of the Phase I Archaeological Report that is included as Appendix E.4. Key Section 106 correspondence is included in Appendix E.7.

4.9.2 Methodology, Approach and Data Sources

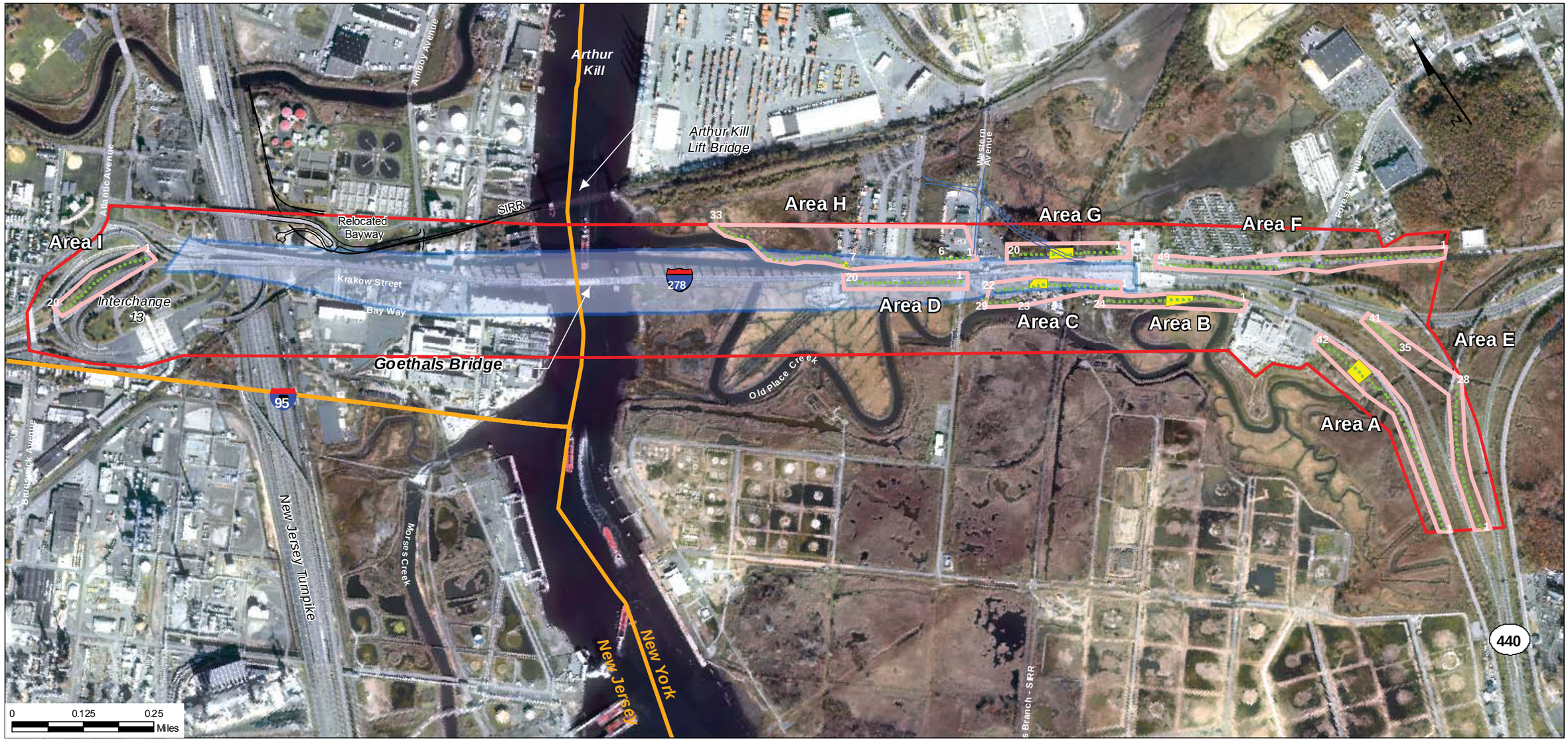
The Goethals Bridge Study Area has a long history of Native American occupation and European settlement and growth. The earliest archaeological evidence for human occupation in what is now New York and New Jersey dates to approximately 12,000 years ago and occurred along the western shores of Staten Island. Native American occupation and use of this diverse environmental setting continued until shortly after European settlement in the mid-1600s.

An assessment of the Goethals Bridge Study Area's potential to contain prehistoric and/or historic archaeological resources is being conducted to identify archaeological resources and to provide a preliminary assessment of their age, integrity, and extent as well as their National Register eligibility. The following section characterizes the archaeological sensitivity of the Goethals Bridge Study Area, utilizing a combination of information sources, including previously identified archaeological sites in the vicinity of the Study Area, historic cartographic sources, and archaeological field data. A detailed Phase I Archaeological Study, including Phases IA and IB, has been prepared for the Proposed Project (see Appendix E.4).

The four bridge alternatives and their approaches are located immediately north or south of the existing bridge and connect to New Jersey Turnpike Interchange 13 to the west and the Staten Island Expressway to the east, consistent with the existing crossing's termini. Based on the proposed alternatives and consideration of potential construction-related impacts, the archaeological APE was defined as 500 feet north and south from the centerline of the existing I-278 and Goethals Bridge, extending west 500 feet from the edge of the overall footing of the interchange system in New Jersey and including the I-278 and West Shore Expressway (SR-440) Interchange in Staten Island as its eastern boundary. The archaeological resources APEs for the proposed project in New Jersey and New York are roughly comparable to the Primary Study Area as identified and described in Section 4.2 (see Figure 4.9-1). The actual limits of ground disturbance associated with all four alternatives, however, represent a significantly smaller portion of the APE and do not extend beyond the existing toll plaza on Staten Island.

The Phase I archaeological survey consisted of background research, field reconnaissance, and subsurface testing to investigate the archaeological sensitivity of the APE. Supplemental background research was conducted between September and December, 2004 to update the cultural resource sensitivity models developed in 1992 and further refined as part of the Staten Island Bridges Program (SIBP) EIS in 1997 (Berger 1992; USCG 1997). This background research included an examination and analysis of selected historical maps and secondary histories available at the New York City Public Library in Manhattan, the Staten Island Institute of Arts and Sciences (SIIAS), the St. George Library Center in Staten Island, and the New Jersey State Library in Trenton, New Jersey. Additional historic maps were collected from online-digital historic cartographic clearinghouses such as the American Memory Map Collection of the Library of Congress and the Davis Rumsey Historical Map Collection. Archaeological site files and previous cultural resource studies and EIS documents were reviewed at the following institutions: the New Jersey State Museum (NJSM) in Trenton, New Jersey; the New Jersey Historic Preservation Office, also in Trenton, New Jersey; the NYSOPRHP and the New York State Museum (NYSM) in Albany, New York; and the New York City Landmarks Preservation Commission. This research provided an inventory of known prehistoric and historic archaeological sites within and adjacent to (within a one-mile radius) the APE, and also provided information about regional patterns of prehistoric settlement from which a model of prehistoric and historic site potential within the APE could be determined.

A field reconnaissance of the archaeological APE was conducted on May 12, 2004. The purpose of this field reconnaissance was to augment information derived from previous cultural resource studies and EIS documents conducted within and in the vicinity of the APE through a re-evaluation of the archaeological potential of the APE. This field reconnaissance included the documentation of changes to the natural



Legend

- Excavated Shovel Test Pits
- Areas of Archeological Sensitivity
- Archaeologically Testable Areas
- Area of Potential Effect/Primary Study area
- Revised Archaeological APE Based upon Consultation with NYSOPRHP

	Area	# of Shovel test Pits Excavated
New York	A	40
	B	27
	C	39
	D	13
	E	41
	F	44
	G	24
	H	33
New Jersey	I	20

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.9-1
Archaeologically Tested and Sensitive Areas within the APE Study Area

United States Coast Guard

landscape of the APE that have occurred within the APE since the initial Staten Island Bridges Program FEIS was completed in 1997. These modifications included disturbances resulting from additional construction, the creation of impervious surfaces such as parking lots, or other such landscape modifications; disturbances which were not previously documented and which might affect the archaeological sensitivity of the APE.

To further supplement the available documentary information regarding the archaeological sensitivity of the APE, Phase IB systematic subsurface testing was conducted in October 2004 in accordance with the New York Archaeological Council Standards (NYACS) of 1994 and the NJHPO archaeological guidelines. The purpose of the subsurface survey involved the collection of the following data: the presence or absence of archaeological deposits within the APE and areas of ground disturbance; an assessment of the degree of disturbance within the APE; and a determination of the presence or absence of fill and its depth. The archaeological fieldwork conducted for the Phase IB survey involved a surface inspection and subsurface survey in those parts of the APE not obscured by impervious surfaces and disturbed/contaminated soils. Since much of the APE contains topographic obstructions, such as wetlands and standing water, as well as impervious impediments, such as buildings and roadways, the APE was divided into nine archaeologically testable Areas (Areas A through I), each with one transect (see Figure 4.9-1).

Ancillary improvements included as part of the several Build Alternatives include proposed roadway relocations (i.e., Gulf Avenue for all four alternatives and Goethals Road North for the Northern Alternatives). These areas of proposed ground disturbance have not been assessed for archaeological potential nor investigated for the presence of archaeological resources.

As such, if Build Alternatives are selected that include roadway relocations that have not been assessed for archaeological potential or investigated for the presence of archaeological resources, then these areas may require an archaeological assessment and/or investigation as well as continued consultation with the NYSOPRHP.

Areas/transects A and E were located along the western side of Gulf Avenue and the eastern side of West Shore Expressway (SR-440), respectively, in Staten Island, New York; Areas/transects F, G, and H were located on the northern and southern sides of Goethals Road North in Staten Island, New York; Area H also extended northward along the banks of Old Place Creek in Staten Island; Areas/transects B, C, and D were located on the southern side of I-278 and service road in Staten Island; and Area/transect I was located within a grassy portion of the median at NJ Turnpike Interchange 13 in New Jersey. These transects were largely contiguous along an east-west axis throughout most of the APE. Areas E and C are exceptions, however, as existing roadway configurations in those areas necessitated the excavation of shovel test pits along two parallel transects with the same letter designation, one on either side of the roadway crossing each area.

The subsurface archaeological survey involved the excavation of 287 shovel test pits which included 265 shovel test pits at 15-meter (50-foot) intervals along nine (9) transects within nine testable areas of the APE and twenty-two additional shovel test pits that were excavated at five of the original shovel test pit locations to further investigate the presence of prehistoric artifacts. Each shovel test was positioned using tape and compass and were assigned a codified nomenclature referencing the location of the shovel tests and sequential number designation; for example shovel test pit E-10 is the tenth shovel test that was excavated in Area E. The shovel tests measured approximately 0.46 meters (1.5 feet) in diameter and were excavated into sterile soils, the water table, or impenetrable impasses. Average depth of excavation was approximately 3.0 feet below the ground surface. During excavation, changes in soil color, composition, and texture were used to determine stratigraphic levels. In every subsurface test, each soil stratum was assigned a letter from an alphabetic sequence reflecting its relative position in the test profile. Thus, three strata encountered in a single shovel test would be designated respectively as Stratum A, Stratum B, and Stratum C, with Stratum A located at the top of the profile.

The results of the individual shovel tests were recorded on standardized field forms developed for this project. All soils were described in terms of color and texture using Munsell color designations and USDA textural classifications. All soils were screened through 0.25-inch (0.01-meter) hardware mesh for systematic artifact recovery. When artifacts were recovered, they were bagged by shovel test according to stratigraphic provenience. In accordance with the NYACS (1994), a minimum of four additional shovel test pits were excavated in the vicinity of isolated shovel test pits that contained prehistoric artifacts.

Small quantities of modern artifacts, such as bottle glass, amorphous metal objects, wire, and plastic, were deemed not to be significant if derived from surface strata, construction fill, or other disturbed layers. Such artifacts were either sampled to provide a temporal marker or discarded in the field, and in either case, were noted in the field records. Artifacts retained for analysis during subsurface testing were placed into mylar bags with detailed provenience information. All shovel test pit excavations were backfilled and the ground surface restored as nearly as possible to its original condition.

4.9.3 Archaeological Sensitivity within the Project Area APEs

4.9.3.1 New Jersey APE

During the background research stage of the Phase I archaeological survey, it was noted that there is a wide discrepancy between the available data on prehistory for the New Jersey and New York APEs; numerous prehistoric sites have been identified and excavated in western Staten Island, but none have been documented in the vicinity of the Arthur Kill in New Jersey. This pattern can not be entirely explained by the relatively greater urbanization and long industrial development of the New Jersey side of the waterway; however, it is possible that environmental characteristics made the New Jersey APE less hospitable for Native American settlement. A review of the records of the NJSM indicates that no known archaeological sites are present within a one-mile radius of the New Jersey APE. The salt marshes that were originally present on the New Jersey side would not have been favorable for prehistoric occupation. Any prehistoric settlement in this region would probably have occurred on higher areas near streams, such as the Elizabeth River.

The only reference to sites in the New Jersey APE were made by Skinner and Schrabisch (1913), who mention that artifacts were said to be found in the area. Cross (1941) does not mention any sites in the area. One favorable area would have been the rise to the north of the APE that is crossed by Elizabeth Avenue and the New Jersey Turnpike. This is near the area from which Skinner and Schrabisch (1913) reported prehistoric finds. If there were prehistoric sites in this region of New Jersey, they have most likely been destroyed by historic construction. Therefore, the New Jersey section of the APE has little or no potential for prehistoric sites.

During the May 2004 field reconnaissance, recent changes to the natural landscape in the New Jersey APE were noted, as was the probable effect these changes would have on the archaeological potential of the APE. Changes to the landscape were noted on the north side of the New Jersey approach to the Goethals Bridge in a roughly rectangular area bounded by the bridge roadway to the south, relocated Bayway Avenue to the west, a sewage treatment plant to the north and First Street to the east. At the time of the field reconnaissance, heavy equipment was observed excavating several feet of soil in advance of the construction of a new railroad station. This activity effectively removed any potentially culture-bearing strata from examination.

Based upon the available primary and secondary historic resources collected during the background research stage of this survey, the historic archaeological sensitivity of the New Jersey APE is minimal. An analysis of historic maps, dating from 1781 through 1950, shows steady development occurring within the New Jersey APE; from an open meadow to a heavily industrialized area which includes large industrial complexes situated along the Arthur Kill and numerous railroad lines and a street grid, creating

a labyrinth of features that, by the early twentieth century, had removed any vestiges of the early nineteenth-century shoreline meadows.

Although the New Jersey APE was sparsely developed by European colonists as early as 1697, the gradual shift from seventeenth and eighteenth century scattered agricultural/residential communities to an industrial/transportation corridor in the nineteenth and twentieth centuries resulted in the removal of the majority of the early domestic structures within the New Jersey APE. Early to mid-twentieth century industrial development and the construction of the Goethals Bridge further removed earlier mid-to-late nineteenth century industries and residences.

In summary, the lack of archaeological sensitivity within the New Jersey APE is encapsulated by the following observation made by Herbert Kraft in 1977:

> "With few exceptions, our survey, both archaeological and archival, has revealed that the Elizabeth River from Arthur Kill to near the Kean Estate in Hillside and Union Townships, has been so thoroughly destroyed and its attendant river banks so excessively modified in the three centuries since colonization... an essentially devastated environment" (Kraft 1977:25).

The results of the Phase IB subsurface testing in the New Jersey APE included the excavation of 20 shovel test pits in the only area available for testing in the New Jersey section of the APE (defined as Area I) located within a median formed by NJ Turnpike Interchange 13 and roadway approaches to Goethals Bridge. The results of the subsurface survey conducted within Area I indicate that a significant amount of fill was imported to construct a large berm that covers almost half of the parcel in this portion of the APE. Much of this fill consisted of clayey soils with large boulders or broken concrete/asphalt. However, shovel tests in the extreme eastern portion of the transect indicate that the fill is thinnest in this portion of the median and that natural soils are present at a depth of approximately 2.0 feet.

The recovery of a total of 153 historic and/or modern artifacts from either fill or non-feature natural soil contexts indicates that these materials do not represent intact or significant historic archaeological deposits and are recommended not eligible for the New Jersey Register of Historic Places (NJRHP) or the National Register of Historic Places (NRHP). Additionally, no prehistoric archaeological deposits or features were recovered or noted within the New Jersey APE. As a result, the Phase IB subsurface testing within the New Jersey APE confirmed the hypothesis that this portion of the APE possesses minimal-to-no archaeological sensitivity. The NJHPO concurred that no further archaeological investigations are recommended within the New Jersey APE (NJHPO September 28, 2007).

4.9.3.2 New York APE

Research conducted at the NYSOPRHP indicates that numerous prehistoric and historic archaeological sites have been documented on Staten Island, including prehistoric intermittent hunting camps, lithic production centers, shell middens, burial grounds and historic farmsteads. Many of these prehistoric sites date from the Paleo-Indian through the historic contact periods and are characteristically situated on tidal inlets, coves, and bays found throughout the island (see Boesch 1994:115; Greenhouse Consultants, Inc. 1994:5-6; Jacobson 1980; Parker 1922; Silver 1984; Skinner 1909). All of the historic archaeological sites date from the colonial period through the early twentieth century. Specific to the New York APE, the records of the NYSOPRHP and the NYSM list eight primarily prehistoric sites and six primarily historic sites within a one-mile radius of the Staten Island section of the APE (Table 4.9-1). Many of the prehistoric sites within a one-mile radius of the APE are multi-component, reflecting the repeated occupation of preferred habitats, such as sandy uplands overlooking streams and wetlands. Although most of the prehistoric archaeological sites did not yield diagnostic and dateable materials, the Old Place Creek Site (NYSM #7215; NYSOPRHP #s A085-01-2366 and A085-01-0134), a large portion of which may be located within the New York section of the APE, dates to the Early Archaic (10,000 to 8000 BP) through the Late Woodland periods (AD 700 to 1600) (Ritchie and Funk 1973:39). The historic sites located

TABLE 4.9-1
PREHISTORIC AND HISTORIC ARCHAEOLOGICAL SITES WITHIN A ONE-MILE RADIUS OF THE NEW YORK APE

NYSOPRHP Site #	Additional Site #	Approximate Distance From APE M (ft)	Time Period	Site Type
	NYSM 7216; ACP-RICH	Within APE	Archaic	Traces of Occupation
A085-01-2372		Within APE	Historic; 1790	Domestic Site
A085-01-2374		Within APE	Historic; 1680	Domestic Site; Tunissen House
A085-01-2373		Within APE	Historic; 1790	Unidentified Structure Probably Associated with 1790 Structure
A085-01-2369		Within APE	Historic; 1790	Domestic Site
A085-01-2368		Within APE	Historic; 1790	Domestic Site; Possibly the Haughwout House
A085-01-2366	A085-01-0134; NYSM 7215	Within APE	Early Archaic through Late Woodland	Multi-Component Camps
A085-01-2375		600 ft North of the APE	Prehistoric; Historic; 18th Century	Traces of Prehistoric Occupation; Revolutionary War Skirmish, Barracks, Euro-American Burials
	NYSM 4595; ACP-RICH-05	3,000 ft North of the APE	Prehistoric; Historic Native American, Possibly Iroquoian	Large Village
	NYSM 732	3,500 ft Northeast of the APE	Archaic	Traces of Occupation
	NYSM 8503	Within One Mile North of the APE	Prehistoric; No Information	Camp
	NYSM 8504	Within One Mile North of the APE	Prehistoric; No Information	Traces of Occupation
	NYSM 7324	Within One Mile North of the APE	Transitional Archaic	Traces of Occupation
	NYSM 6496	Within One Mile North of the APE	Late Woodland	Triangular projectile points, four fire pits

Source: NYSOPRHP (NY State office of Parks, Recreation and Historic Preservation); NYSM (the NY State Museum).

within a one-mile radius of the New York section of the APE date to the latter decades of the eighteenth century and include the locations of a Revolutionary War skirmish, barracks, and burials and domestic sites. All of the historic archaeological sites that were recorded within a one-mile radius of the APE are clustered along North Washington Avenue west of Western Avenue. These sites were recorded by Payne and Baumgardt in 1986 and have been impacted by construction associated with the Howland Hook Marine Terminal facility.

The majority of the previously documented prehistoric sites are based on information and descriptions from the turn of the twentieth-century. Early avocational archaeologists such as Alanson Skinner and A.C. Parker often gave general information such as "traces of occupation" and "small lithic scatters" to the sites. While this provides an overview of the presence/absence of prehistoric settlement in a given area, it often gives little information regarding the temporal and spatial attributes of a site.

The Old Place Creek Site, portions of which may be located within the APE, is located approximately 0.5 mile to the east of Goethals Bridge on Black Point (Tunissen's Neck), just north of Old Place Creek and north of the Staten Island Expressway. Skinner (1909) described the Old Place Creek Site as a large village with shell pits, refuse pits, and fireplaces. Prehistoric ceramics from the Old Place Creek Site were compared to Iroquoian pottery. In addition, a brass arrow point, gun flints, lead bullets, a pewter ring, and trade pipe fragments indicated early contact period settlement. Archaeological investigations in this area by Anderson (1964) provided diagnostic lithic artifacts that represent prehistoric occupation from the Early Archaic through Late Woodland periods, including substantial Late Archaic, Transitional, and Early Woodland components.

The long sequence of Native American occupation at this site, from ca. 7000 BC to the eighteenth century, is probably the result of the upland location surrounded by productive wetlands. Archaeological investigations associated with the Howland Hook Marine Terminal Expansion identified prehistoric remains north of Old Place Creek, on what was Black Point. Recovered artifacts included lithic tools, debitage and fire-cracked rock (Payne and Baumgardt 1986). Despite the amount of documentation involving the Old Place Creek Site that has taken place over the past century, the precise boundaries of the Old Place Creek Site have not been established, and as stated above, portions of this site may be located within the New York APE.

A field reconnaissance was conducted in May 2004 to document recent changes to the natural landscape that might have affected the archaeological potential of the New York APE. One of the most significant disturbances observed during that field reconnaissance was the addition of the KeySpan complex on the south side of the New York approach to the Goethals Bridge. This construction resulted in the addition of numerous buildings and paved surfaces in an area that was previously open land. It is likely that construction of this magnitude would have necessitated the importation of significant amounts of fill, and as a result, areas within the complex not covered by impervious surfaces would have been capped by fill of varying depths and densities. Another, albeit minor, change appears to have occurred in an area located south of the bridge roadway under the New York approach. A large debris pile at the R.T. Baker site recorded in 1997 appears to have expanded slightly (Berger 2004:4). This debris pile is located adjacent to and east of a large tract of open marshland. No further changes to the Staten Island APE were apparent.

The *Archaeological Evaluation and Sensitivity Assessment of Staten Island, New York* by Eugene Boesch (1994) lists the following criteria to assess prehistoric archaeological sensitivity: (1) proximity of known sites or surface artifacts from the immediate vicinity; (2) freshwater source nearby; (3) proximity of marsh, shoreline, river or stream mouth, or ridge; (4) high ground overlooking water with slopes less than 30 percent; and (5) well-drained soil. As a result and according to this model (Boesch 1994), the New York APE is considered to have a high archaeological sensitivity because it is situated near the Arthur Kill and Old Place Creek and their associated wetlands, and it is in proximity to previously recorded sites. Additionally, the wetlands and stream margins in New York would have provided extensive resources for prehistoric populations; the sandy ridges overlooking the tidal wetland system, such as Black Point (Tunissen's Neck), provided ideal environments for prehistoric settlement. Prehistoric sites and remains have been located in this general vicinity of the Staten Island APE and may be preserved in locations within that have not been heavily disturbed by historic and modern developments.

Based upon the available primary and secondary historic resources collected during the background research stage of this survey, the historic archaeological sensitivity of the Staten Island APE is minimal.

The earliest historic settlement of the New York APE dates to around 1680, although the first structure, the Tunnisen House (NYOPRHP # A085-01-2374), which is believed to be located in the vicinity of the Howland Hook Marine Terminal west of Western Avenue, does not appear on a map until the time of the American Revolution. The APE remained largely agricultural after the Revolution until the early twentieth century. The few industrial enterprises that did develop within the Staten Island section of the APE during the mid-nineteenth century included the Kreischer Brick Works, the Tottenville Copper Company, the American Linoleum Manufacturing Company and the Atlantic Terra Cotta Company (Brighton 1997:11). Development within the APE during the second half of the nineteenth century was limited to the area along Western and Washington Avenues.

Although the New York APE was developed by European colonists as early as 1680, the gradual shift from scattered seventeenth and eighteenth century agricultural/residential communities to an industrial/transportation corridor throughout the nineteenth and twentieth centuries resulted in the removal of the majority of the early domestic structures within the APE by the middle of the twentieth century. Early to mid-twentieth century industrial development and the creation of the Staten Island Expressway and the Goethals Bridge further removed mid-to-late nineteenth century industries and residences. Based on the background research, the historic archaeological potential of the Staten Island APE is, therefore, characterized as low.

The results of the Phase IB subsurface testing within the New York section of the APE included the excavation of 267 shovel test pits in the portion of the APE defined as Areas A through H. These shovel test pits revealed fairly undisturbed soils underlying approximately 1 to 2 feet of fill. A total of 1,006 artifacts were recovered from the New York portion of the APE, including historic and modern period artifacts (N=997), one clamshell fossil, two small fragments of hematite, and prehistoric artifacts (N=7). The historic period artifacts included architectural/industrial debris (N=296), bottle/vessel glass (N=363), historic ceramics (N=235), faunal materials (N=85), personal items (N=17) such as buttons, cloth, doll fragments, and shoes, and one gun flint fragment. Although some of these historic artifacts, including, but not limited to, creamware, pearlware, yellowware, whiteware, and machine cut nails/spikes, date to the period between 1762 and 1850 (N=271), these early artifacts were recovered from fill and natural non-feature soil contexts in association with more recent debris and were found scattered throughout the APE. As a result, these historic period artifacts do not represent significant historic archaeological resources and are recommended not eligible for either the New York Register of Historic Places (NYRHP) or the National Register of Historic Places (NRHP). The prehistoric artifacts were recovered from Areas A (N=1), Area B (N=2), Area C (N=2), Area G (N=1), and Area H (N=1). These prehistoric artifacts include non-diagnostic lithic waste material from stone tool production including flakes (N=5) and block shatter (N=2).

The presence of these scattered prehistoric artifacts within well-stratified contexts, with little or no overlying fill, were used to define distinct areas of sensitivity within the following archaeologically tested areas of the Staten Island APE: Areas A, B, C, G, and H (see Figure 4.9-1). All five of these loci are in portions of the APE that have experienced little or no modification by the various episodes of development that has occurred within the Goethals Bridge Study Area and APE since the bridge was opened in 1928. Although five distinct loci have been identified, all may be related to a single, larger site, identified historically as the Old Place Creek Site. The boundaries of this site have never been defined and may extend over the entire Staten Island APE. Nevertheless, additional subsurface testing in the vicinity of these finds within the APE yielded no prehistoric features or dense prehistoric artifact deposits. As a result, the few scattered prehistoric materials discovered within the New York APE do not represent significant prehistoric archaeological deposits within the APE and are recommended not eligible for the NYRHP/NRHP. The NYSOPRHP concurred that no National Register eligible archaeological resources were identified within the areas investigated within the New York APE (NYSOPRHP November 16, 2007 and NYSOPRHP December 18, 2007). The NYSOPRHP, however, requested additional information regarding the relationship of tested areas and the actual proposed limits of ground disturbance. This information was supplied to the NYSOPRHP on November 28, 2007.

The shovel test pit transects that were excavated for this project are representative of where the ground disturbances would occur within each of these four alternatives, with the exception of the proposed relocation of Goethals Road North that is associated with both of the Northern Alternatives being considered. As such, the NYSOPRHP would require that additional archaeological testing be conducted along the proposed route of the relocation of Goethals Road North if one of the Northern Alternatives was to be selected as the environmentally preferred option (NYSOPRHP December 18, 2007).

4.9.4 Summary of Archaeological Potential

Field reconnaissance and background research, including primary and secondary historic sources, and the examination of the archaeological site files and cultural resource reports on file at the New Jersey State Museum (NJSM), indicated that the large majority of the New Jersey APE possessed no prehistoric or historic archaeological potential since much of the New Jersey APE has been affected by road construction, residential and commercial development, and/or previously consisted of salt marshes which was a largely unattractive setting for prehistoric populations, or a combination of these factors.

Field reconnaissance and background research, including primary and secondary historic sources and an examination of the archaeological site files and cultural resource reports on file at the NYSOPRHP, revealed much less overt disturbance to the natural landscape within the Staten Island APE. The presence of fourteen previously documented archaeological sites within a one-mile radius of the Staten Island APE suggested that portions of the Staten Island APE possessed at least a moderate potential to contain prehistoric, and, to some extent, historic archaeological resources.

The Phase IB subsurface testing conducted within areas of archaeological potential suggests that previous land use in the New Jersey APE included filling and grading activities that resulted in the alteration of the original surface contours. The one area available for testing within the New Jersey APE, Area I, consisted only of imported fill and/or heavily disturbed natural soils. The presence of 153 mixed historic and modern artifacts within the New Jersey APE does not represent a significant archaeological resource and is recommended not eligible for the NJRHP/NRHP. The lack of intact natural soils and the absence of prehistoric features or artifacts also indicate that the New Jersey APE possesses no archaeological sensitivity. The NJHPO concurred that no further archaeological investigations are recommended within the New Jersey APE (NJHPO September 28, 2007).

The Phase IB testing conducted within the New York APE yielded scattered evidence of prehistoric occupation, and scattered-mixed historic and modern refuse throughout these segments of the APE. It also indicated that portions of the APE survived intact despite substantial highway, commercial, residential and utility construction activities. Historic period artifacts were recovered from fill and non-feature natural soil contexts throughout the New York APE. Those historic materials, however, were recovered in association with modern disturbances and recent rubbish and do not reflect the presence of intact subsurface historic archaeological deposits or sites. Moreover, the recovered historic artifacts do not represent significant archaeological resources and are recommended not eligible for the NYRHP/NRHP.

The portions of the New York APE that yielded prehistoric artifacts, including Areas A, B, C, G, and H, contained prehistoric lithic material from well-stratified contexts with little or no overlying fill. All five loci are in areas of the APE that have been minimally altered or unmodified by the various episodes of development that has occurred in the vicinity of the Goethals Bridge since the bridge was opened in 1928. Although five distinct loci of archaeological sensitivity have been identified within the APE, all may be related to a single, larger site, identified historically as the Old Place Creek Site, the boundaries of which have never been defined. Nevertheless, additional subsurface testing in the vicinity of these finds within the New York APE yielded no prehistoric features or dense prehistoric artifact deposits. As a result, the few scattered prehistoric materials discovered within the APE indicate that these portions of the New

York APE are archaeologically sensitive. These materials and sensitive loci, however, do not represent significant prehistoric archaeological deposits within the APE and are recommended not eligible for the NYRHP/NRHP. The NYSOPRHP concurred that no National Register eligible archaeological resources were identified within the areas investigated within the New York APE (NYSOPRHP November 16, 2007 and NYSOPRHP December 18, 2007). The NYSOPRHP, however, requested additional information regarding the relationship of tested areas and the actual proposed limits of ground disturbance. The shovel test pit transects that were excavated for this project are representative of where the ground disturbances would occur within each of these four alternatives, with the exception of the proposed relocation of Goethals Road North that is associated with both of the Northern Alternatives being considered. As such, the NYSOPRHP would require that additional archaeological testing be conducted along the proposed route of the relocation of Goethals Road North if one of the Northern Alternatives was to be selected as the environmentally preferred option (NYSOPRHP December 18, 2007).

4.10 Visual Quality and Shadows

4.10.1 Methodology, Approach and Data Sources

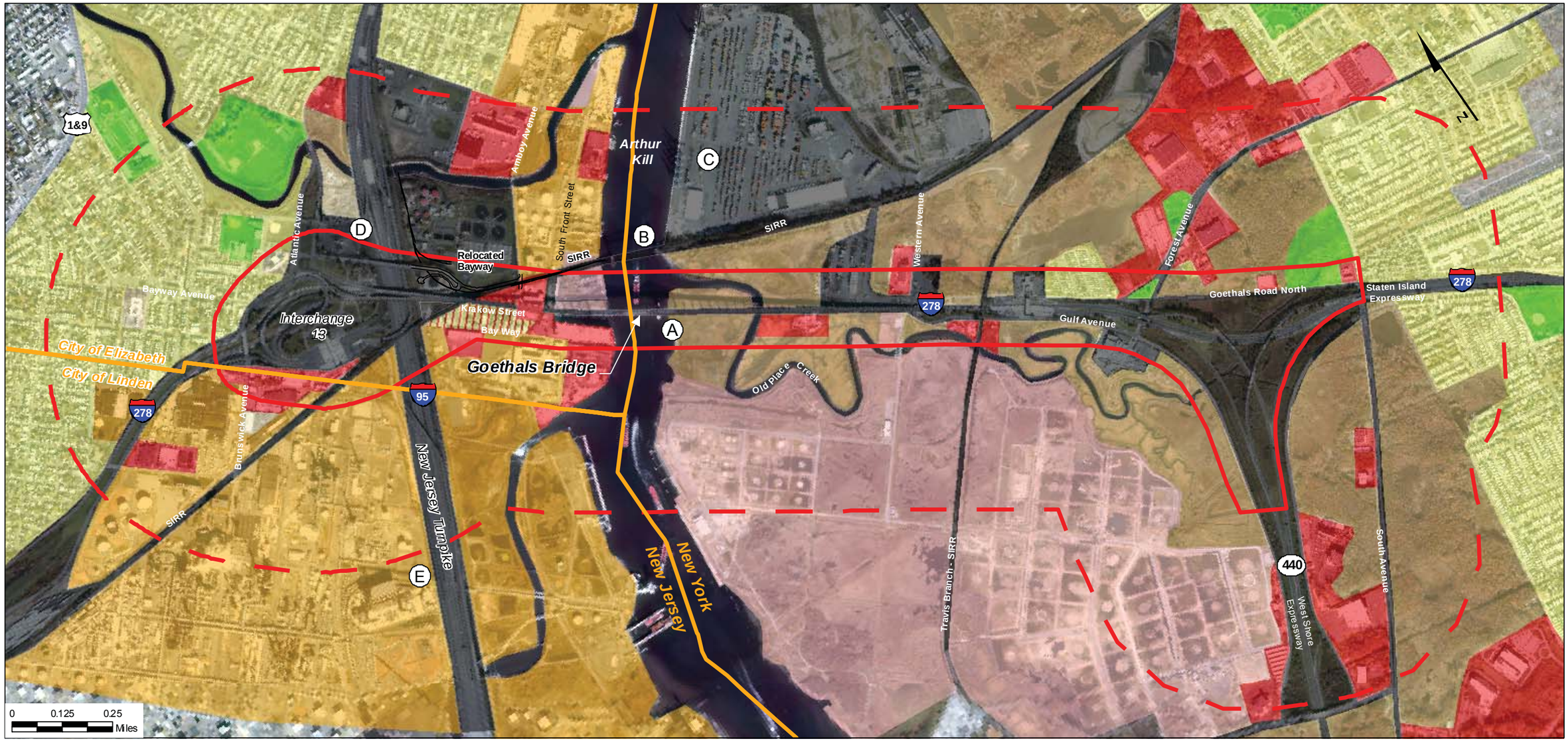
The analysis of existing visual resources follows the Federal Highway Administration's FHWA-HI-88-054 and American Society of Landscape Architects' guidelines for assessing the visual character of an affected area. Field investigations and photographs were used to inventory the visual resources and visual characteristics of the Goethals Bridge Study Area, as defined in Section 4.2. The inventory focuses on viewsheds within which the proposed project would be visible. The Goethals Bridge is a prominent structure in the Study Area, and its replacement would likely be one as well.

The first step in the visual analysis entails identifying potential viewers of the existing and proposed bridge alternatives and the visual resources that appear within their viewshed, or angle of view. Visual resources consist of land forms, such as tidal and freshwater wetlands, water courses, and land cover, including vegetation and human-made development. These visual resources all serve to determine the Study Area's visual character.

Field visits and research were conducted and topographical maps were analyzed to evaluate regional landscape characteristics and identify areas potentially within the viewshed of the Goethals Bridge. A reconnaissance survey of the Study Area provided field notes and photographs of visual resources that were evaluated and recorded, including important views and vistas, public parks, natural vegetation, topography, and visual and historic landmarks. Because the proposed project is expected to affect views of those who cross the Goethals Bridge, existing views from the bridge were also evaluated. Additional information was gathered through research of historic and current maps, aerial photographs, and from the historic resources survey conducted as part of this EIS.

Figure 4.10-1 presents the landscape characteristics of the Study Area, while Figure 4.10-2 provides the key to visual quality photographs of the New Jersey and New York portions of the Study Area. It includes the area's natural and man-made landscape characteristics, visual landmarks, and land uses which were considered in identifying the potential viewer groups likely to be affected by the proposed project.

From this analysis, four general viewer groups and their respective sensitivity to the project-related changes to the visual environment were identified:



Legend

Primary Study Area

Secondary Study Area

Land Use

- Commercial
- Cemetery
- Industrial
- Park
- Public Facility
- Residential
- Mixed Use (Residential/Commercial)
- Transportation, Communication and Utilities
- Undeveloped
- Vacant Industrial

(A) Goethals Bridge

(B) SIRR Arthur Kill Lift Bridge and Approaches

(C) NYCT at Howland Hook (Gantry Cranes)

(D) Transmission Towers

(E) Refinery and Tanks

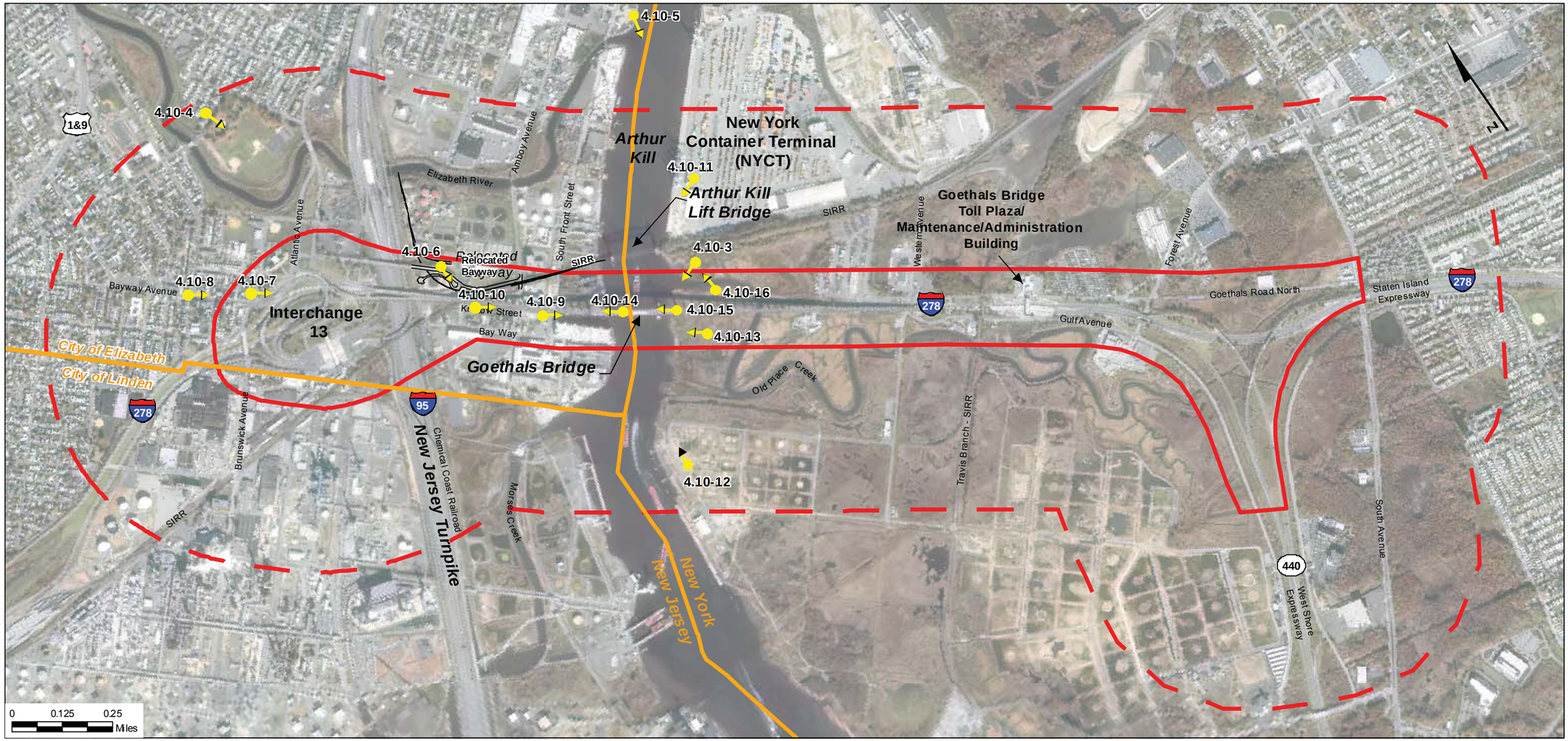
Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.10-1

Regional Landscape Characteristics

United States Coast Guard



Legend

- Primary Study Area
- Secondary Study Area
- Photo location with respective figure number, and direction

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.10-2

Key to Visual Quality Photographs

United States Coast Guard

- Recreational users of parks and open spaces with high sensitivity to visual resource changes;
- Residents, also with high sensitivity;
- Motorists with moderate sensitivity; and
- Workers in utility, shipping, and industrial facilities with low sensitivity.

Figure 4.10-3 depicts the general landscape characteristics of the Study Area from an oblique aerial perspective.

4.10.2 Visual Resources

4.10.2.1 New Jersey

The visual environment in the New Jersey portion of the Goethals Bridge Study Area is comprised primarily of industrial complexes, large commercial facilities, public utilities (including steel transmission towers), a mix of elevated and at-grade transportation-related facilities, and scattered low-rise residential areas.

The New Jersey Turnpike, Goethals Bridge, the Chemical Coast Secondary Line and the Staten Island Railroad Line strongly influence the visual environment in this portion of the Study Area. Of particular note are the New Jersey Turnpike and its Interchange 13. The Turnpike is a prominent feature of the Elizabeth and Linden landscapes due of its size, elevated configuration, and associated network of on- and off-ramps. Interchange 13 is an amalgam of curving and connecting roadways that dominates the visual environment in this portion of the Study Area.

Within this largely developed portion of the Study Area, the Goethals Bridge itself is a dominant feature of the urban landscape. Its western approach, which is elevated, and the steel trusses of the superstructure are visible throughout most of the Study Area and beyond, as is the Arthur Kill Lift Bridge, located immediately to the north. The tall wooden trestle of the Arthur Kill Lift Bridge weaves under the Goethals Bridge approach in Elizabeth from the south and descends to a relatively low profile just north of the Goethals Bridge.

North of the Goethals Bridge

In the area north of the Goethals Bridge, users of neighborhood parks constitute a sensitive viewer group. Open, distant views of the Goethals Bridge and the Arthur Kill Lift Bridge are visible from the relatively flat and undeveloped Mattano Park, as are the steel transmission towers of the PSE&G facility lining the Arthur Kill, directly north of the bridge (see Figure 4.10-4). Veteran's Memorial Waterfront Park offers distant views of the shipping operations at Howland Hook, the Arthur Kill, the Goethals Bridge, and the Arthur Kill Lift Bridge (see Figure 4.10-5). Unobstructed views of the Goethals Bridge are also realized from the local streets immediately surrounding the industrial waterfront buildings (see Figure 4.10-6), as well as inland near Interchange 13 (see Figure 4.10-7) and Bayway Avenue (see Figure 4.10-8).

South of the Goethals Bridge

South of the Goethals Bridge, motorists on the New Jersey Turnpike have unobstructed views of the bridge. These motorists are the primary viewer group in this area, as both northbound and southbound lanes have unobstructed eastern views of the industrialized waterfront and the two bridges. The concrete arches supporting the western bridge approach are also prominent visual features in the areas adjacent to the bridge. In addition to the concrete piers, partial views of the superstructure are also visible in the areas immediately south of the bridge (see Figure 4.10-9). Along Bayway, Amboy Avenue and Krakow Street, the presence of the established neighborhoods and the older homes adjacent to the Goethals Bridge

Figure 4.10-3 Aerial View of the Goethals Bridge Looking Southwest Toward the City of Elizabeth

Figure 4.10-4 View from Mattano Park Looking Southeast Toward the Goethals Bridge and the Arthur Kill Lift Bridge

Figure 4.10-5 View of the Arthur Kill Looking South From Veterans Memorial Waterfront Park

Figure 4.10-6 View of Goethals Bridge Western Approach from Relocated Bayway

Figure 4.10-7 View of the Goethals Bridge (center of photo) Looking East from Elizabeth in the Vicinity of Interchange 13

Figure 4.10-8 Distant View of Goethals Bridge Looking East from Bayway Avenue

Figure 4.10-9 View of the Goethals Bridge Looking East from South Front Street (Bayway Industrial Center is on the right)

Figure 4.10-10 View of Goethals Bridge Looking East from Krakow Street

approach and near the Staten Island Railroad trestle adds further visual diversity to the otherwise bulky industrial and infrastructure-dominated environment (see Figure 4.10-10).

Within this area, views of the Arthur Kill and Staten Island are limited to the industrialized waterfront. Although the Arthur Kill and the Staten Island shoreline are visible from complexes such as the Bayway Industrial Center (which include the former Joseph Cory warehouse on the waterfront), the massing and location of buildings prevent similar views from publicly accessible inland locations. From the waterfront industrial complexes and warehouses south of the Goethals Bridge, the view toward Staten Island is of an open expanse of the natural landscape. Aside from a partial view of the Goethals Bridge and its eastern approach, water and marshland comprise most of the view. Vistas of the water and of the two bridges spanning the Arthur Kill can be viewed from the water as well.

4.10.2.2 New York

North of the Goethals Bridge

The Staten Island portion of the Goethals Bridge Study Area north of the bridge contains shipping facilities, industrial uses, open marshland, and residences. The New York Container Terminal (NYCT) at Howland Hook occupies most of the waterfront area almost immediately north of the bridge along the Arthur Kill, and extends east to Western Avenue. Just east of Western Avenue lies the Arlington rail yards, situated alongside Goethals Bridge Pond. The low-lying elevation of the area provides expansive views of the Goethals Bridge and its approach to those working in the area, and the recently refurbished Arthur Kill Lift Bridge, which is located approximately 500 feet north of the Goethals Bridge (see Figure 4.10-11).

The dominant visual features identified in the area are the Goethals Bridge and the nearby Arthur Kill Lift Bridge. Both of these bridges have been found eligible for listing on the National Register of Historic Places. The 558-foot-long steel lift bridge was recently restored and painted a royal blue. It is a single-span railroad bridge, flanked by two 215-foot-tall latticework towers. The bridge was reactivated in Spring 2007 and carries rail containers from Howland Hook to the Chemical Coast line in New Jersey, rail cars transporting solid waste and paper recycling handled south, near Fresh Kills.

The visual prominence of the two bridges is heightened because there are few vertical structures nearby, with the exception of gantry cranes lining the Arthur Kill at the western edge of the Howland Hook Marine Terminal. The 187-acre terminal is characterized by colorful stacks of containers and several low-rise support buildings. The property affords excellent views of the Goethals Bridge, the Arthur Kill lift bridge, and the Arthur Kill as well. The gantries in Howland Hook are prominent when viewed from the city of Elizabeth; however, their visibility from Staten Island is limited.

The area formerly occupied by Port Ivory is currently being developed as a new 38-acre intermodal rail terminal. Most of the former manufacturing complex has been demolished, although some of the three- and four-story red brick structures are being leased for warehousing and distribution uses. The only nearby residences north of the Goethals Bridge are largely within the Goethals Garden Homes Community, a complex composed of well-maintained modular homes of little visual distinction. Views of the Study Area from the residential complex are limited by vegetation, structures, and an acute line of sight.

South of the Goethals Bridge

The Study Area south of the Goethals Bridge is similarly characterized by minimal topographic variation. The area is characterized primarily by large expanses of open marshland, tidal creeks and a complex system of tidal ditches.

Although it occupies a large piece of land, the now vacant and overgrown former GATX oil refinery and storage complex permits expansive northward views of the Goethals Bridge and Arthur Kill Lift Bridge (see Figure 4.10-12). Looking west toward New Jersey, the industrial structures of the Elizabeth waterfront are visible across the Arthur Kill (see Figure 4.10-13), and the five-story warehouses that comprise Bayway Industrial Center. Because of their high visibility from areas south of the Goethals Bridge, the Goethals Bridge and the Arthur Kill Lift Bridge serve as primary visual landmarks in the area. Viewers in this area are typically motorists, on the limited number of roadways in the area.

4.10.2.3 Views from the Goethals Bridge

Although the west and east approaches to the bridge provide views of the surrounding areas, they do not constitute major viewsheds. Side walls topped with chain link fencing on the bridge largely obscure lateral visibility, and side views from the approaches are mostly of roadways and barriers (see Figure 4.10-14). Travelers across the bridge have close views of the bridge's steel truss superstructure (see Figure 4.10-15) and partial views of the Arthur Kill Lift Bridge to the north (see Figure 4.10-16).

4.10.3 Shadow Studies

4.10.3.1 Methodology, Approach and Data Sources

The incidence of shadows cast by the existing Goethals Bridge provides a context for assessing the extent of possible shadows that would be cast by the proposed project. Specific focus has been placed on the potential shadow effects on parks, open spaces, and other sun-sensitive receptors (e.g., stained glass in historic structures, etc.).

The existing terrain in the Goethals Bridge vicinity is relatively flat and low-lying and was modeled, therefore, as a flat plane. All existing buildings and structures were modeled in three dimensions. The shadow studies were performed using IBM's Architectural and Engineering Series (AES) software to illustrate the shadows cast by the existing Goethals Bridge and Arthur Kill Lift Bridge at three times of day (9:00 AM, Noon, and 3:00 PM) for four days of the year: the winter solstice (December 21), the spring equinox (March 22), the summer solstice (June 21) and the fall equinox (September 21).

The shadow studies assume the latitude and longitude of New York City. Two sets of shadow studies were executed. The first set consists of shadow "snapshots" which show the shadow at that instant in time (e.g., 9:00 AM at the winter solstice). The second set consists of shadow "sweeps" which show the individual snapshots for a particular time of year superimposed on each other (e.g., 9:00 AM, Noon, and 3:00 PM at the winter solstice) to illustrate the path of the sun from 9:00 AM through 3:00 PM.

4.10.3.2 Existing Shadow Conditions

During the summer solstice (June 21), the bridge casts limited southwesterly shadows. Shadows from the bridge do not affect the Krakow Street residences in Elizabeth or their yards, immediately southwest of the bridge and adjacent to the westerly approach. At this hour, shadows are limited and fall principally on non-populated areas beneath and directly southwest of the bridge, as well as on the Arthur Kill, and, in Staten Island, on wetland areas. At 12 Noon, the bridge's shadow is similarly limited and falls northeasterly of the bridge, casting a short shadow on industrial uses there. At 3:00 PM, the sun casts shadows northeast of the existing Goethals Bridge on the industrial uses. No shadows are cast on the Krakow Street residences in Elizabeth or on the Goethals Garden Homes Community in Staten Island.

Figure 4.10-11 View of Arthur Kill Lift Bridge and Goethals Bridge Looking South from NYCT at Howland Hook

Figure 4.10-12 Views from the Former GATX Terminal Looking North Toward the Goethals Bridge

Figure 4.10-13 View of the Goethals Bridge Looking West Toward the New Jersey Waterfront

Figure 4.10-14 View of the Elizabeth and Linden Landscape Looking West from the Goethals Bridge

Figure 4.10-15 Westbound View of Goethals Bridge Steel Trusswork

Figure 4.10-16 View of the Arthur Kill Lift Bridge Looking North from the Goethals Bridge

Shadows during the fall equinox (September 21) represent the midpoint between the summer and winter solstice shadows. While the fall and spring equinox are identical, the fall shadows occur one hour later due to the observance of Daylight Savings Time; Eastern Standard Time is in effect in the spring equinox. At 9:00 AM, the existing Goethals Bridge casts minimal shadows north of the bridge approaches and center span; none fall on the Krakow Street residences and yards. No shadow is cast on public open spaces. At 12 Noon and 3:00 PM, the Krakow Street and the Goethals Garden Homes Community residences, as well as public open spaces, are free of shadows cast by the bridge. During this period, shadow effects fall on manufacturing and industrial uses, the Arthur Kill, and the Staten Island wetlands. During the spring equinox, shadow effects are cast north of the existing Goethals Bridge, with no effect on residential or park uses. Similar to the fall equinox, shadow effects are limited to industrial and manufacturing facilities, the Arthur Kill, and the Staten Island wetlands.

The shadow effects of the longest duration are cast on the winter solstice (December 21), when the sun is at its lowest point in the sky. During the winter solstice, at 9:00 AM, 12 Noon, and 3:00 PM, shadow effects are cast north of the existing bridge, falling far short of existing residential and publicly accessible open space in Elizabeth and Staten Island, where most of the shadow effects fall on industrial and manufacturing facilities.

Shadow sweeps of the existing Goethals Bridge are provided in Appendix F.

4.11 Topography, Geology and Soils

4.11.1 Methodology, Approach and Data Sources

The existing conditions of topography, geology and soils in the Goethals Bridge Study Area were characterized based on existing data sources, including surveys conducted by the U.S. Department of Agriculture's Natural Resources Conservation Service, the U.S. Army Corps of Engineers, the U.S. Geologic Survey, and other secondary sources. Project-specific data were also obtained from earlier studies conducted for the Staten Island Bridges Program by The Louis Berger Group and the Port Authority (USCG 1997).

4.11.2 Topography

The proposed project is located in the Piedmont physiographic province, near its intersection with the Atlantic Coastal Plain and the Manhattan Prong of the New England Uplift. The topography of the Staten Island approach to the Goethals Bridge is low lying, with ground-surface elevations ranging from 3 to 10 feet above mean sea level. The elevation of the New Jersey approach ranges from 5 to 12 feet above mean sea level (see Figure 4.11-1). The meandering courses of Old Place Creek in Staten Island and Morses Creek in Elizabeth indicate the low surface relief of the Goethals Bridge Study Area.

4.11.3 Geology

Staten Island is underlain by consolidated rocks (bedrock) and unconsolidated deposits. Bedrock in the Study Area is comprised of Paleozoic metamorphic rocks and sedimentary and igneous rock (LBA, 1992). The sedimentary rocks are part of the Newark Supergroup, undivided, consisting of brownish and reddish shales and sandstones (Soren, 1988). The rocks in the Newark Supergroup are softer and less resistant to erosion than other bedrock formations found on Staten Island. Bedrock along the western shoreline of Staten Island is overlain by unconsolidated upper Pleistocene deposits of Wisconsin glacial drift. Holocene shore and salt marsh deposits overlie these deposits along the shoreline and low-lying areas (Soren, 1988).

The shoreline of the Arthur Kill is a complex of stratified drift, wash from glacial till, and tidal marsh (LBA, 1992). Unconsolidated deposits within the region include outwash, marsh deposits, and artificial fill. Outwash deposits consist chiefly of stratified fine to coarse sand and gravel, while shore and marsh deposits consist of sand and organic clays and silts (Soren, 1988). These deposits are generally thin and probably no thicker than 10 feet (Soren, 1988).

Exploratory borings performed by the Port Authority in 1989 and 1993 identified six soil and rock strata in the Primary Study Area (Port Authority, 1994). These strata include: (1) Artificial Fill, Sand, Silt, Clay and Gravel in a generally loose condition covering most of the Primary Study Area to a maximum thickness of about 12 feet; (2) Organic Clays and Peats, soft and highly compressible tidal marsh deposits to a maximum thickness of approximately 25 feet adjacent to the Arthur Kill; (3) Sand Deposits, loose to medium dense sand from marine deposits or glacial origin extending eastward from the Arthur Kill and ranging in thickness from 5 to 16 feet; (4) Glacial Clay, Silt, Sand and Gravel, deposits primarily of clay and silt ranging in thickness from less than 10 feet at the Arthur Kill to greater than 40 feet near the east abutment of the approach span; (5) Weathered Shale, partially decomposed or weathered shale; and (6) Generally Sound and Unweathered Shale, located at depths of 40 to 53 feet below sea level (Port Authority, 1994).

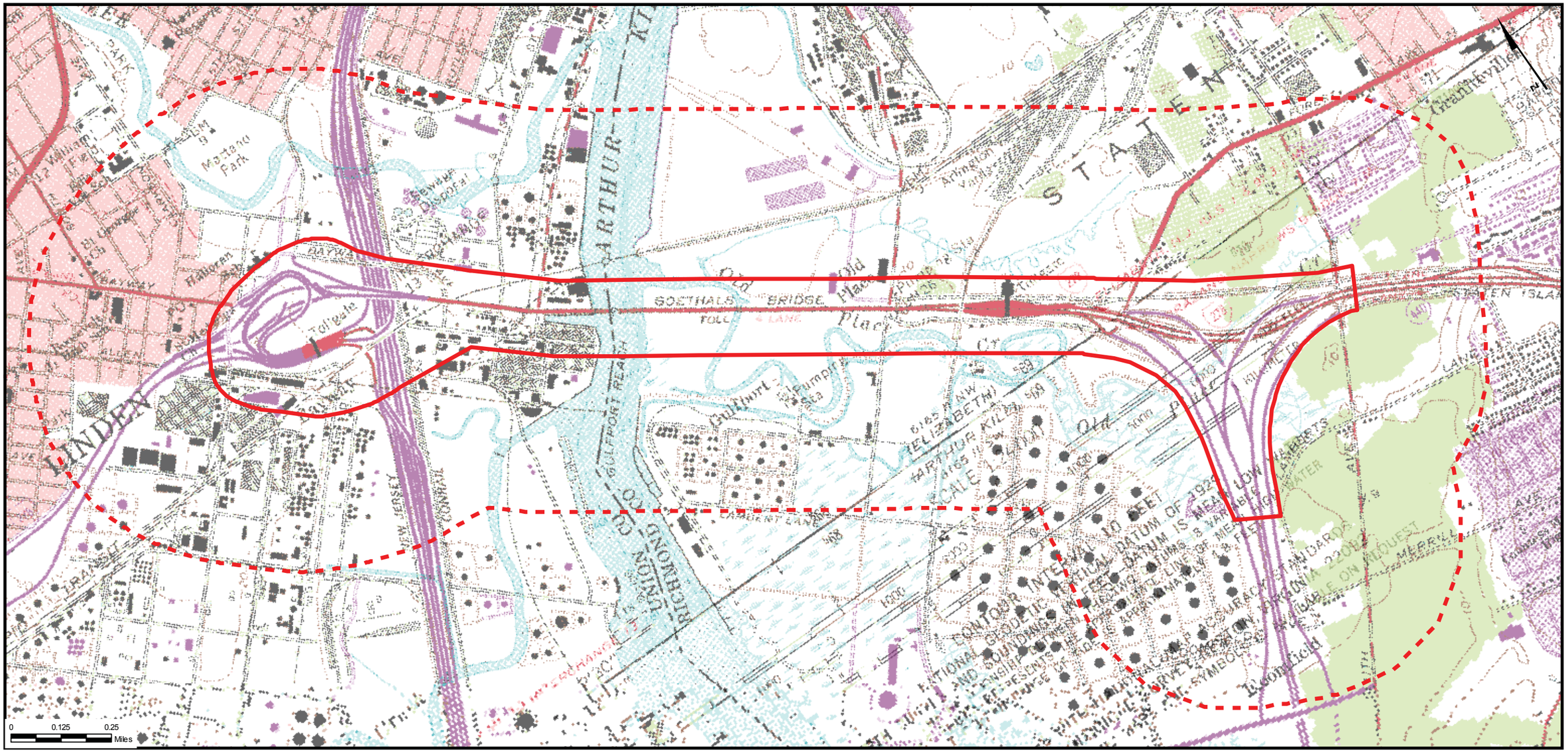
The New Jersey side of the Primary Study Area is similar to that of Staten Island. Bedrock consists of shales and sandstones of the Newark Supergroup. These thin-bedded shales and sandstones are reddish-brown to gray with ripple marks and mudcracks indicating that they were deposited in a shallow water environment. The unconsolidated deposits overlying the bedrock are glacial drift, consisting of unstratified clay, silt, sand, gravel and boulders. Poorly sorted unstratified drift and till covers the Study Area and is composed predominantly of clay with lesser amounts of sand (Nemickas, 1976). Exploratory borings conducted by the Port Authority (1994) identified similar soil and rock strata to those found along the Staten Island side, with the exception of organic clays and peat (stratum 2).

According to the U.S. Geologic Survey, northeastern New Jersey and Staten Island are in a region susceptible to an earthquake-generated peak acceleration of 0.2g with a two percent probability of exceedance in 50 years (USGS 2003). However, according to the design seismic criteria from the NYSDOT, design of the new bridge is required to meet two (2) seismic Levels; the Functional Evaluation/Design Level Earthquake (500 yr event) and the Safety Evaluation/Level Earthquake (2500 yr event). The peak ground acceleration for the rock is 0.06g and 0.244g for 500-yr event and 2500 –yr event, respectively. Under these conditions, potential liquefaction and movement of the loose to medium dense, marine/glacial sand should be evaluated. Most of the Primary Study Area is relatively flat and low lying, with no potentially unstable slopes sensitive to disturbance. There are no known active rock quarries, mines, or unique geologic features within the Primary Study Area.

4.11.4 Geology and Sediments of the Arthur Kill

A sediment boring sample collected by the Port Authority in May 1993 along the Staten Island shoreline indicated that bottom sediments were composed of 60.9 percent sand, 32.8 percent silt, and 6.3 percent clay (PA, 1994), while sediments from two samples collected along the New Jersey shoreline averaged 36.9 percent sand, 46.7 percent silt, and 17.3 percent clay. Percent moisture was greater than 60% for all three samples. Observations made during the benthic sampling program in the spring, summer, and fall of 1994 identified sediment textures for both the New Jersey and Staten Island sides of the Arthur Kill as fine and claylike, with some organic material present. Benthic sampling in the spring and fall of 1994 indicated the presence of brick and brick-like material in the upper reaches of Old Place Creek. Brick material is also present in the interpier basin south of the Goethals Bridge along the New Jersey shoreline, most likely the result of dumping in Old Place Creek and the interpier basin.

The bottom of the Arthur Kill consists of glacial till overlying bedrock. Very soft to soft Holocene silt and clay overlies Pleistocene dense to very dense, fine to medium grained, red-brown silty sand with



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Primary Study Area

Secondary Study Area

Source: USGS Topographic Quadrangle,

Goethals Bridge Replacement EIS
FIGURE 4.11-1 USGS Topographic Map of the Goethals Bridge Study Area
United States Coast Guard

gravel. These sediments are underlain by sedimentary bedrock. Dredging feasibility studies conducted by the U.S. Army Corps of Engineers (USACE) in 2004 reported sediments within the Arthur Kill channel as very soft, dark gray silts underlain by weathered and distressed red shale, which is exposed along the channel floor along most of the channel. This weathered shale was underlain by bedrock (sound and unweathered shale) of the Passaic Formation. Channel sides were steep and composed primarily of black silt. The upper sections of the Holocene sediments often have a petroleum odor and contain manmade debris including toxic chemicals and heavy metals.

Because the Arthur Kill was dredged to its current depth prior to 1975, much of the black silt that covers the channel floor has been deposited within the last forty years and is, for the most part, contaminated.

4.11.5 Soils

The shore of the Arthur Kill is made up of a complex intermingling of stratified drift, wash from glacial till, recent alluvia, tidal marsh, filled land, and some glacial ground moraine. Numerous soil types and associations have developed on these deposits to form unique landscapes with complex relationships of soils, relief, drainage and parent material. A large percentage of soils have been altered by excavation or filling for residential, commercial or industrial purposes. Along much of the Arthur Kill shoreline, large land areas were reclaimed by filling in the tidal marsh and other low-lying areas with a variety of materials including various soils, dredged material, construction debris, cinders, ash, and garbage. The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) has mapped six general soil mapping units or soil complexes in the Primary Study Area. These mapped soils are presented in Figures 4.11-2a and 4.11-2b. A detailed discussion of the Primary Study Area soils is presented below, while Table 4.11-1 presents a summary of the Primary Study Area soils, their drainage characteristics and their hydrologic groups.

TABLE 4.11-1
MAPPED SOILS IN THE PRIMARY STUDY AREA

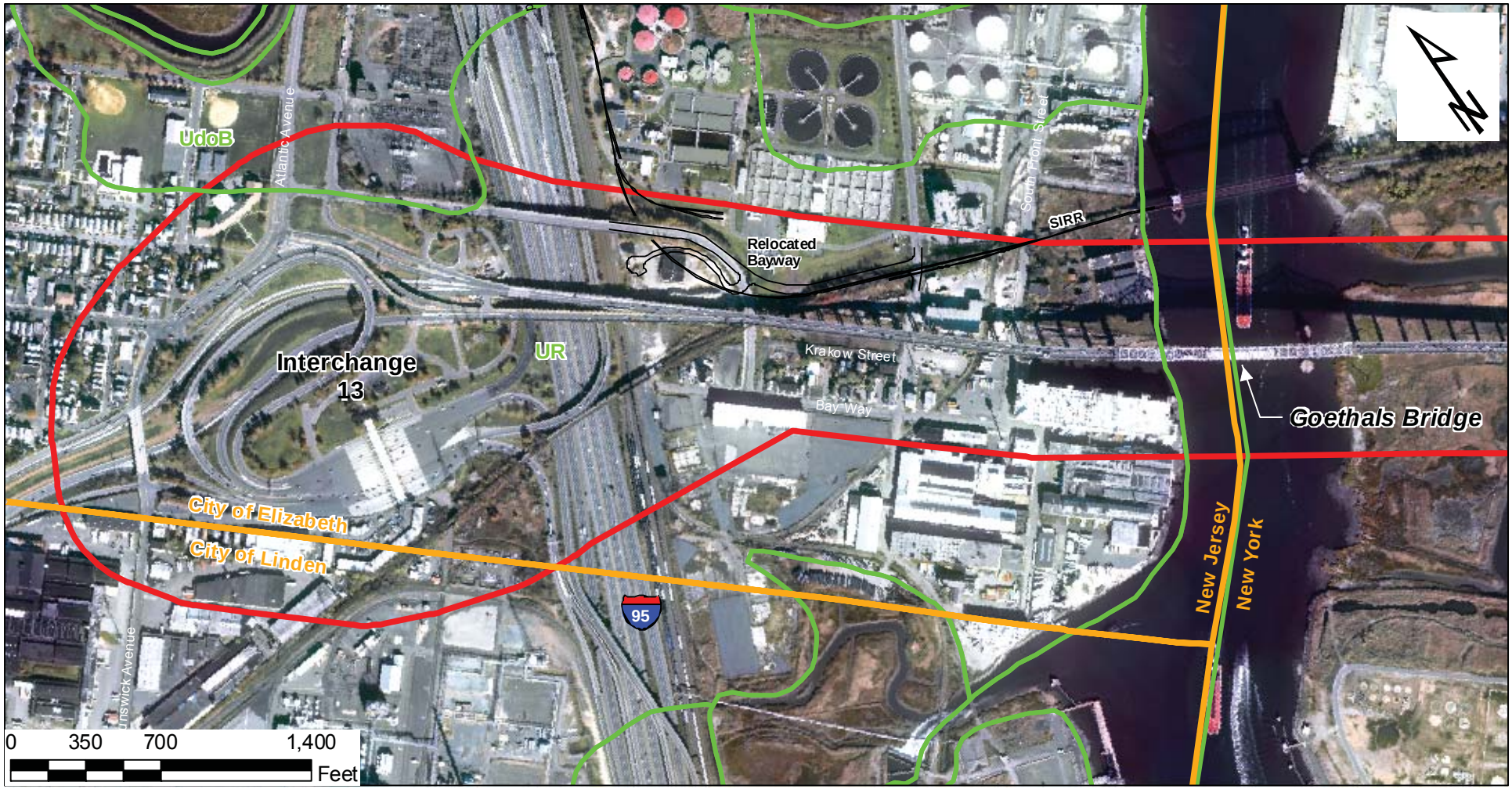
Map Unit Symbol	Area	Soil Name	Drainage Characteristics	Hydrologic Group
UR	NJ	Urban land	na	Impervious
UdoB	NJ	Udorthents with organic substratum	na	na
6	NY	Ipswich-Pawcatuck-Matunuck mucky peats	very poorly drained	D
101	NY	Pavement and buildings complex	na	Impervious
246	NY	Wareham-Deerfield complex	Poorly/moderately well drained	D/B
370	NY	Boonton-Haledon complex	Moderately well/well/poorly drained	C/D

Source: Natural Resources Conservation Service, New Jersey and New York.

4.11.5.1 New Jersey

Soils in the New Jersey portion of the Primary Study Area consist of Urban land (UR), with small areas composed of Udorthents with organic substratum (UdoB). A description of these soil units follows:

The Urban land unit is nearly level or gently sloping. More than 90 percent of the surface of this unit is covered by asphalt, concrete, buildings, and other impervious surfaces. Examples are parking lots, shopping and business centers, and industrial parks. Included with this unit are Udorthents, loamy, and



Legend

Primary Study Area

Soil Boundary

UR - Urban Land
UdoB - Udorthents, Organic substratum, 0 to 8 percents slopes

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: United States Department of Agriculture, Natural Resources Conservation Service, 2005.

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FIGURE 4.11-2a

Soils Map - New Jersey

United States Coast Guard

Legend

Primary Study Area

Soil Boundary

6 Ipswich-Pawcatuck-Matunuck mucky peats

101 Pavement & buildings, wet substratum-Laguardia-Ebbetts complex, 0 to 8 percent slopes

246 Wareham-Deerfield complex, 0 to 8 percent slopes

370 Boonton-Haledon complex, 0 to 8 percent slopes

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: United States Department of Agriculture, Natural Resources Conservation Service, 2005.

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FIGURE 4.11-2b

Soils Map - New York

United States Coast Guard

small areas of undisturbed soils. The undisturbed soils are similar to the soils in the surrounding or nearby units and they make up about 10 percent of this map unit.

The Udorthents, organic substratum unit consists of areas along the Arthur Kill where various types of material have been used to fill tidal marsh. Dredged material makes up a considerable portion of this unit. Included with this unit are sanitary landfills, areas of undisturbed tidal marsh, Udorthents, loamy, and Urban land. These soils make up about 20 percent of this map unit. Oil refineries, Newark Airport, and Port Authority facilities are also in this map unit.

4.11.5.2 New York

Soils in the New York portion of the Primary Study Area consist of Ipswich-Pawcatuck-Matunuck mucky peats (6), pavement and buildings, wet substratum-Laguardia-Ebbetts complex (101), Wareham-Deerfield complex (246), and Boonton-Haledon complex (370). These soil units and complexes occur on slopes of 0 to 8 percent. A description of these soil units follows.

Ipswich-Pawcatuck-Matunuck mucky peats: The Ipswich series consists of very deep to bedrock, very poorly drained soils formed in thick organic deposits greater than 51 inches in depth. The Pawcatuck series consists of very deep to bedrock, very poorly drained soils formed in sandy sediments and have an organic surface layer ranging from 16 to 51 inches. The Matunuck series consists of very deep to bedrock, very poorly drained soils formed in thick sandy sediments and have a thin organic surface layer ranging from 8 to 16 inches. The soils of these three series are inundated by saltwater at high tide.

Pavement and buildings complexes consist of areas in which 80 percent or more of the surface is covered by asphalt, concrete, buildings or other impervious materials. For the most part, the soil is composed of impervious material. A wet substratum phase indicates a high probability of a water table between 40 and 80 inches.

The Wareham series consists of very deep to bedrock, poorly drained soils that have formed in glaciofluvial deposits of sand derived mainly from granite, gneiss and quartzite. These soils have a water table within six inches of the soil surface for a significant period of time during the growing season. Solum thickness ranges from 6 to 30 inches. Coarse fragments, mostly gravel, range from 0 to 15 percent in the solum and 0 to 60 percent below the solum. Permeability is moderately rapid throughout. The Deerfield series consists of very deep to bedrock, moderately well drained soils that have formed in glaciofluvial deposits of sand derived mainly from granite, gneiss and quartzite. These soils have a water table between 18 and 40 inches below the surface for a significant period of time during the growing season. Solum thickness ranges from 15 to 40 inches. Coarse fragments, mostly gravel, range from 0 to 15 percent in the solum and 0 to 20 percent in the substratum. Permeability is moderately rapid or rapid in the solum and rapid or very rapid in the substratum; Hydrologic Soil Group is B.

The Boonton series consists of deep or very deep, moderately well and well drained soils formed in glacial till, with a fragipan, or dense soil horizon, beginning at a depth of 20 to 36 inches. These soils have a perched water table in or slightly above the fragipan horizon for a significant period of time during the growing season. Solum thickness ranges from 36 to 60 inches or more; rock fragments, derived mainly from red shale and sandstone, basalt and diabase, range from 0 to 35 percent. Permeability is moderate or moderately rapid above the fragipan, slow or very slow in the fragipan, and moderate to very slow in the substratum. The Haledon series consists of very deep to bedrock, somewhat poorly drained soils that have formed in glacial till, with a fragipan, or dense soil layer beginning at a depth between 24 to 36 inches. These soils have a perched water table above the fragipan horizon for a significant period of time during the growing season. Solum thickness ranges from 40 to 60 inches; rock fragments, derived from basalt, shale, sandstone and gneiss, range from 5 to 25 percent in the solum and from 15 to 35 percent in the substratum. Permeability is moderately rapid or moderate above the fragipan, and slow or very slow in the fragipan.

4.12 Water Resources

4.12.1 Introduction

Major water resources in the immediate vicinity of the Goethals Bridge consist of the Arthur Kill and its tributaries, Old Place Creek, Goethals Bridge Pond and groundwater.

The Arthur Kill is a major shipping route and, along with its tributaries, provides cooling water for power generating stations. It receives large volumes of municipal wastewater, industrial discharges, combined sewer overflows, and stormwater. These uses have resulted in varying degrees of pollution to the surface waters, sediments and groundwater in the vicinity of the bridge and the nearby region. Numerous water and sediment contamination studies have been undertaken in recent years, allowing a detailed characterization of the status of pollution of these resources. These studies have also provided the background for assessing and understanding reasons for the water and sediment contamination that has resulted in the closure of shellfishing and the implementation of stringent fish and blue crab consumption advisories in the Arthur Kill. Even with this contamination, these water reserves support diverse fish and benthic communities and other water-dependent wildlife, including protected species and heron rookeries.

4.12.2 Methodology, Approach and Data Sources

Water resources in the vicinity of the Goethals Bridge are described based on numerous data sources. Characterizations of surface water, hydrology, tributaries, and anthropogenic uses are based on information from the National Oceanic and Atmospheric Administration (NOAA), U.S. Geologic Survey (USGS), New Jersey Department of Environmental Protection (NJDEP), New York State Department of Environmental Conservation (NYSDEC), New York State Department of State (NYSDOS), and EIS studies conducted for the never-constructed Staten Island Bridges Program's Modernization and Capacity Enhancement Project (USCG, 1997). Water and sediment quality characterizations are based on studies undertaken by the Port Authority, the U.S. Army Corps of Engineers (USACE), the New York City Department of Environmental Protection (NYCDEP) Harbor Survey, the NYSDEC Contaminant Assessment and Reduction Project (CARP), and the EPA Regional Environmental Monitoring and Assessment Program (REMAP). Water quality standards for water resources are based on the various NJDEP, NYSDEC, and EPA regulations and guidelines. Groundwater resources are characterized based on the previous studies conducted in the Goethals Bridge Study Area.

4.12.3 Regulatory Setting

Activities in and discharges to surface waters are regulated by federal, state, and local agencies through a number of permits and approvals, reflecting legislation and regulations promulgated at all levels of government. At the federal level, a number of programs address activities in navigable waters and protect the environment of these waters, such as the federal Clean Water Act of 1987. The States of New York and New Jersey classify water quality for their surface water resources, identify and protect wild, scenic, and recreational rivers, and oversee their Coastal Zone Management Programs.

The National Pollutant Discharge Elimination System (NPDES) regulates point-source discharges of industrial waste through a permit process administered within each state's jurisdiction. New Jersey and New York City both regulate discharges to their sewer systems, which ultimately discharge to surface water bodies. Fish consumption advisories are established by the NJDEP and New York State Department of Health (NYSDOH), and are regularly updated based on ongoing tissue contaminant studies. New York and New Jersey have adopted some of NOAA's Effects Range-Low and –Medium sediment guidance criteria, while both states have established their own contaminant criteria for surface waters and groundwater.

In the context of the Goethals Bridge Study Area, groundwater in New Jersey is classified as Class II-A; i.e., potable water at current water quality with conventional treatment (NJAC 7:9-6.5). However, groundwater in Staten Island is not used for drinking water purposes due to saltwater intrusion.

4.12.4 Surface Water

The Arthur Kill is a tidal strait that connects Raritan Bay to the south with Newark Bay to the north and separates Staten Island from New Jersey (see Figure 4.12-1). The Kill Van Kull completes the connection from Newark Bay to Upper New York Bay. The Arthur Kill is approximately 13 miles long and varies in width from approximately 800 to 2,800 feet. The total surface water area is approximately 4.4 square miles. A federal shipping channel, approximately 35 feet deep below mean low water (MLW) and 600 feet wide, runs the entire length of the Kill and is maintained through periodic dredging by the U.S. Army Corps of Engineers (USACE). The Elizabethport and Gulfport reaches are located north and south of the Study Area, respectively. The shorelines of both reaches have been extensively hardened with riprap and pilings. An interpier basin is located immediately to the south of the Goethals Bridge along the New Jersey shore. Depths within this basin area are between 2 and 7 feet mean low water (MSL[9]).

Old Place Creek, in Staten Island, is a meandering tidal creek that enters the Arthur Kill just north of the Goethals Bridge. The low topographic relief and tidal currents helped create this tidal creek with turns and oxbows that passes under and runs alongside the bridge up to the intersection of the Staten Island and West Shore Expressways. Water depths of Old Place Creek range from more than 15 feet MSL at the mouth to less than 3 feet MSL in portions upstream.

Goethals Bridge Pond, located just north of Goethals Road North in Staten Island, is listed as a Significant Coastal Fish and Wildlife Habitat by the New York State Department of State (NYSDOS). Goethals Bridge Pond is one of the major feeding areas for the heron rookeries located along the Arthur Kill and is the only known breeding site on Staten Island for pied-billed grebe and American coot (HHR, 1990). Twenty-two acres of land adjacent to Goethals Bridge Pond were purchased on November 3, 1994 by the State of New York for preservation.

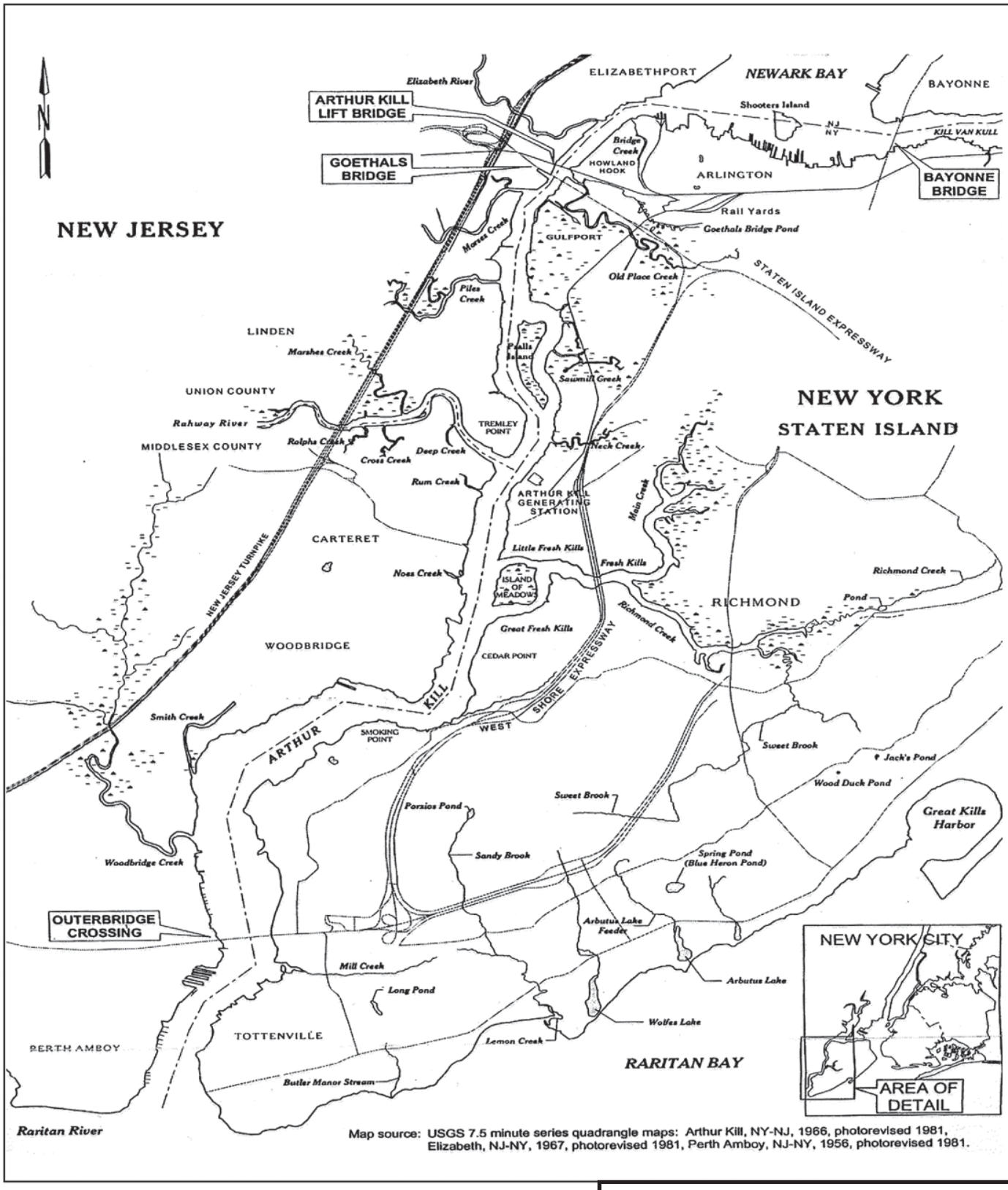
4.12.4.1 Hydrology

Tides and Tidal Circulations

The hydrology of the Arthur Kill is dominated by semidiurnal tides from Newark Bay and Raritan Bay. Tides in the Arthur Kill generally flood from Raritan Bay to Newark Bay and ebb in the reverse direction. Mean tide level in the Kill ranges from 0.1 to 0.3 feet above MSL, with a mean tidal range of 5.0 to 5.3 feet, and a spring tidal range of 5.8 to 6.4 feet (NOAA, 2004a). The total tidal prism is estimated at 522.7 to 784.1 million cubic feet of water (EA, 1989). Tidal currents in the Arthur Kill are moderate, with maximum flood and ebb currents ranging from 0.7 to 2.1 knots (1.2 to 3.5 feet/second), depending on location (NOAA, 2004b). Maximum depth-averaged flood and ebb velocities measured in the vicinity of the Goethals Bridge ranged from 1.4 and 1.8 feet per second, respectively, to 0.8 feet per second during near slack tides (LMS, 1989). Table 4.12-1 lists the tide heights and current velocities for various locations along the Arthur Kill.

The hydrodynamics of the Arthur Kill are complex due to the interconnection of two primary tidal bodies. Tides in Newark Bay are not in phase with those of Raritan Bay and may differ by more than an hour, resulting in slack water and tidal currents that are later in the northern reaches than in the southern reaches. Tidal excursions in the Arthur Kill are significantly shorter than the length of the tidal strait, and

9 The difference between Mean Sea Level (MSL) and Mean Low Water (MLW) at Elizabeth Port, Newark Bay is 2.605 ft. Therefore, to convert a water depth at MLW to MSL, subtract 2.605 ft to a depth at MLW.



Map source: USGS 7.5 minute series quadrangle maps: Arthur Kill, NY-NJ, 1966, photorevised 1981, Elizabeth, NJ-NY, 1967, photorevised 1981, Perth Amboy, NJ-NY, 1956, photorevised 1981.

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FIGURE 4.12-1

Arthur Kill and Surrounding Tributaries

United States Coast Guard

TABLE 4.12-1
ARTHUR KILL TIDAL DATA

Location	Mean Tide Level[a]	Mean High Water[b]	Mean Low Water[b]	Mean Tide Range[c]	Spring Tide Range[c]	Extreme Low Water[b]	Maximum Flood[d]	Maximum Ebb[d]
Perth Amboy	2.8	3.26	-1.94	5.1	6.3	-6.24	-	-
Tottenville	2.8	-	-	5.3	6.4	-	1.0	1.1
Carteret	2.8	3.12	-1.99	5.1	6.2	-6.29	-	-
Port Elizabeth	2.6	3.00	-1.9	5.1	6.1	-6.20	1.4	1.1

Sources:

[a]Tide elevations in feet above or below mean low water (NOAA 1993a)

[b]Tide elevations in feet above or below mean sea level (USACE 1986)

[c]Tide elevations in feet (NOAA 1993a)

[d]Average current velocity in knots (NOAA 1993a)

thus tides do not generate complete transfer of water between Newark and Raritan Bays (Geyer and Chant, 2003). Tidal action spreads to the deep-water areas of the channel whereas the shallow regions provide storage volume with little motion (Oey et al., 1985). The interaction of tide-induced flows and freshwater inputs over the length of the tidal strait results in a net flow of water south toward Raritan Bay.

In addition, wind can drive net flows into or out of the Kill, even to the point of negating the effect of tides (NYCDEP, 2003).

Bathymetry

The Arthur Kill varies in width from 800 to 2,800 feet. The majority of the western shoreline has been altered by the placement of bulkheads and piers. Approximately 18 percent of the eastern shoreline has also been altered by structures and human activities (EA, 1989). The predominant feature of the Kill is the Federal navigation channel maintained through periodic dredging by the USACE to approximately 35 feet in depth and 600 feet in width. The channel is part of the New York and New Jersey Channels and runs the entire length of the Arthur Kill, connecting navigation channels in Newark and Raritan Bays. Maintenance dredging and propeller wash from ship traffic maintain the channel bottom as hard sand. However, shoaling and sedimentation of silt and organic matter occur in localized areas of low flow. Relatively broad shoal areas occur at the northern limit of the Arthur Kill in the vicinity of Shooters Island, with widths up to 1,500 feet and depths about 3.4 feet (MSL). Other shallow water areas (depths <7.4 feet MSL) are located along the western shore of Staten Island, east of Pralls Island, and farther south between Smoking Point and Mill Creek. Numerous wrecks, derelict vessels, and debris from bulkheads and piers litter these shallow water areas.

The bathymetry of the Arthur Kill in the immediate vicinity of the Goethals Bridge and Old Place Creek is shown in Figures 1 and 2 of Appendix G.1. The Arthur Kill channel is currently being deepened from 35 feet to 41 feet (MLW) from Shooters Island to the Goethals Bridge and will be deepened to 40 feet south of the bridge. The interpier basin on the New Jersey side is shallow, ranging in depth from less than 3 feet (MSL) on the northern edge to 6~7 feet (MSL) on the southern edge.

4.12.4.2 Tributaries

Fresh water enters the Arthur Kill predominantly from tributaries in New Jersey on its western shore. The largest tributaries, the Rahway and Elizabeth Rivers, enter the Kill in the vicinity of Tremley Point Reach and Elizabethport Reach, respectively. Reaches of the Elizabeth River, Kings Creek, and the Rahway

River and three of its major tributaries have been included on the State's 303(d) List 5 as "moderately to severely impaired." The poor water quality in these tributaries is caused by ineffective tidal flushing of pollutant discharges. The use impairments of the Arthur Kill result from major shipping vessel traffic and the heavy industry situated along stream and river banks within the watershed (WMA7, 2004).

Mean monthly flows from the Rahway River, at Rahway, New Jersey, range from 29.4 cubic feet per second (cfs) during October to 79.2 cfs during March (USGS, 2004) (mean monthly flow calculated from water years[10] 1921 through 2003). The average monthly flow is 49.2 cfs. The main stem of the Rahway River is 24 miles long and drains an area of 41 square miles, including densely populated areas of Middlesex, Union, and Essex Counties (NJDEP, 1990). Flow from the Rahway River is tidal from the Pennsylvania Railroad Bridge at Rahway to its mouth at the Arthur Kill. According to State's 2002 Integrated List 5 Priority Ranking, Total Phosphorus (TP), Total Dissolved Solids (TDS), Fecal Coliform (FC), and metals such as arsenic, copper, lead and zinc, do not meet the water quality standards in some sections of the Rahway River, and the priority rankings are medium for TP and TDS and high for FC and metals (NJDEP 2002).

The Elizabeth River extends for 11 miles and drains approximately 21 square miles of highly developed areas in Union County. The average monthly flow at Ursino Lake at Elizabeth, New Jersey, is 26.0 cfs, ranging from 20.5 cfs during October to 32.3 cfs during March (USGS, 2004) (mean monthly flow calculated from water years 1921 through 2003). Much of the river has been extensively channelized for flood-control purposes and water quality is described as severely degraded and chronically polluted over its entire length. According to the State's 2002 Integrated List 5 Priority Ranking, TP, TDS and FC in the Elizabeth River do not meet the water quality standards, and their priority rankings are medium to high (NJDEP 2002).

Both permitted discharges and urban runoff are believed to have severely affected the water quality and use of the Rahway and Elizabeth Rivers. There are 181 New Jersey Pollutant Discharge Elimination System (NJPDES)-permitted discharges identified in the watersheds of these two rivers (96 discharges in the Rahway River watershed; 85 discharges in the Elizabeth River watershed). Landfill leachate is also believed to have contributed to the degradation of the tidal portions of the Rahway River and adjacent Arthur Kill, Marshes Creek, and Kings Creek (NJDEP, 1990). Water quality and flow monitoring stations located in the Rahway and Elizabeth River watersheds are shown in Figure 3 of Appendix G.1.

Fresh Kills, located along the western shore of Staten Island, is the third largest tributary entering the Arthur Kill. Located just north of Cedar Point, Fresh Kills drains an extensive wetland complex that includes Main Creek and Richmond Creek. Average freshwater flow from Fresh Kills into the Arthur Kill is 12 cfs (USACE, 1986).

In addition to these three major tributaries, a number of minor tributaries are located along the eastern and western shores of the Arthur Kill. These include Old Place Creek, Sawmill Creek, Neck Creek, and Mill Creek in Staten Island; and Morses Creek, Piles Creek, Smith Creek, and Woodbridge Creek in New Jersey.

Freshwater flow from these minor tributaries typically follows the seasonal precipitation pattern for this area, with higher flows in early spring and lower flows in late summer and fall. Additional freshwater flow is contributed to the Arthur Kill by municipal sewage treatment plants (STPs) and combined sewer outfalls (CSOs).

[10] The water year starts on October 1 and ends on September 30 in the following year.

4.12.4.3 Anthropogenic Uses

The Arthur Kill has been altered significantly by human activities, dating from the 19th century. The impacts of these activities are most clearly seen in the decline of the oyster fishery during the early 20th century. Water pollution, along with an oyster-related typhoid fever outbreak in 1918, resulted in the closure and ultimate demise of the fishery (EA, 1989). Changing land use patterns, dredging, and increased water pollution resulted in the elimination of oystering grounds in the Arthur Kill.

Rapid industrialization of the New York metropolitan area during the 20th century converted the Arthur Kill into a major industrial and transportation center. Both the western and eastern shorelines of the Kill contain bulk storage facilities and oil refineries. Petroleum products constitute the majority of cargo shipped through the Arthur Kill. The Federal navigation channel maintained by the USACE connects the Arthur Kill to the New York/New Jersey Harbor system. The Arthur Kill channel serves the Linden-Rahway-Woodbridge area of New York Harbor. As previously stated, the USACE dredges the Federally-maintained channel to a width of 600 feet and a nominal depth of 32.4 ~ 34.4 feet below MSL. A substantial area outside the Federally-maintained channel is also dredged by a number of private concerns to maintain private bulkheads and shipping berths.

Both the New Jersey and Staten Island shorelines have been affected by development activities. The building of piers and bulkheads has irreversibly altered much of both shorelines, leaving little or no undisturbed natural shoreline. Much of the wetland areas remaining along the Arthur Kill have been invaded by monoculture stands of *Phragmites*.

Since industrialization in the early 20th century, the Arthur Kill and its tributaries have received discharged waste effluents, including municipal and commercial discharges. Industries have also withdrawn water from the Arthur Kill for use in industrial processes, primarily as coolant. Since the passage of the Clean Water Act of 1972, which established the National Pollutant Discharge Elimination System (NPDES), point-source discharges of industrial waste have been regulated through a permit process administered within each state's jurisdiction.

Among the permitted discharges in the Arthur Kill are those associated with cooling water intakes related to power generating stations. Three electric generating stations are located along the Arthur Kill: the Linden and Sewaren stations, owned and operated by Public Service Electric and Gas (PSE&G), and the Arthur Kill station, owned and operated by NRG Energy. Additional industries with water intakes used for industrial processing include the Tosco Bayway Refinery, DuPont, GAF, and FMC Corporation. The Tosco Bayway Refinery withdraws approximately 140 million gallons per day (MGD) of saltwater from the Arthur Kill and discharges it back into Morses Creek.

Major point discharges located on the Arthur Kill also include a number of municipal wastewater treatment plants. Major sewage treatment plant discharges (> 10 MGD) include the Linden Roselle Sewerage Authority, Rahway Valley Sewerage Authority, and the Joint Meeting of Essex and Union Counties. In 2003, they combined for an average discharge of 114.3 million gallons per day (MGD) (IEC, 2004).

Combined sewer outfalls (CSOs) also contribute a large portion of effluent discharges along the Arthur Kill, as much as 13.6 cfs of fresh water flow annually (EA, 1989). CSOs discharge a mixture of sanitary flow and stormwater runoff when storm events exceed capacities of sewer systems. CSO flow is highly variable and dependent upon rainfall events.

4.12.4.4 Water Quality

Compared to conditions in the early 19th century, when typhoid-causing bacteria and other human pathogens polluted the Arthur Kill, and the early 20th century, when industrial and shipping spills

characterized conditions in the Kill, water quality today has improved dramatically. However, the Arthur Kill is still subject to loadings of pollutants from municipal wastewater discharges, industrial discharges, and shipping traffic. The construction and updating of water pollution control plants together with CSO abatement programs continues to improve overall water quality in the general New York/New Jersey Harbor area and the Arthur Kill. Elevated concentrations of metals, polychlorinated biphenyls (PCBs), dioxins, and pesticides continue to persist in the sediments of the NY/NJ Harbor and its tributaries.

Water quality information from ongoing and past studies was used to describe the present water quality condition of the Arthur Kill and Old Place Creek. Water and sediment quality sampling sites in the Arthur Kill and within the immediate vicinity of the Study Area from several different projects are shown in Figure 4 of Appendix G.1. Water and sediment quality data from three sources are presented in this report: the NYCDEP Harbor Survey, the NYSDEC Contaminant Assessment and Reduction Project (CARP) and the USEPA Regional Environmental Monitoring and Assessment Program (REMAP).

Water Quality Standards

The Arthur Kill is classified as SD, SE3 and B2 by the NYSDEC, NJDEP, and IEC (Interstate Environmental Commission), respectively. Table 4.12-2 lists surface water classifications and descriptions for the water bodies in the Goethals Bridge Study Area. Classification of surface waters allows state agencies to define best use categories (e.g., drinking, bathing, etc.) for specific water bodies.

Classifications can then be used to set standards for water quality parameters and toxics to ensure that best use classifications for specific water bodies are not impaired. State water quality standards and criteria for waters with the same classifications as the Arthur Kill are listed in Table 1 of Appendix G.2.

Table 1 of Appendix G.2 includes the criteria of *Surface Water Quality Criteria Applicable to New Jersey* issued by NJDEP that reflect EPA's ruling. High levels of PCBs, pesticides, dioxins, and mercury have resulted in the closure of commercial and recreational fish and shellfish fisheries in the New York Harbor area as well as in the Arthur Kill. The New York State Department of Health (NYSDOH) and NJDEP regularly issue fish consumption advisories which recommend limitations on the consumption of some species of fish and crustaceans in state waters because of risks to human health. Both states suggest extreme restrictions on eating fish and shellfish caught in the Arthur Kill and NJ/NY Harbor. Specific health (fish consumption) advisories issued for the Arthur Kill are listed in Table 4.12-3.

Water Temperature

Water temperature is an important environmental factor that affects aquatic biota. The temperature of the surrounding environment controls the physiological processes of aquatic organisms unable to regulate their own body temperature. Each species has a preferred temperature range within which survival, growth, and reproduction occur most efficiently. Lethal temperatures are either warmer or cooler than these preferred ranges. Organisms capable of strong directed movement, such as fish and large macroinvertebrates like crabs, are able to sense and avoid areas of lethal temperatures so long as sufficient area with non-lethal temperature is available nearby. Given other factors (e.g., food and oxygen) consistently within the preferred range, warmer temperatures increase metabolic functions and cause faster growth and shorter time for egg and larval development, and cooler temperatures slow metabolism, resulting in less demand for food and longer development periods. Temperature, often in combination with other factors, such as the length of the day or photoperiod, may also trigger specific behavioral responses, such as spawning and migration.

In the Arthur Kill and the surrounding New York Harbor, temperature varies temporally (seasonally and daily) and spatially over the length, width, and depth of the Arthur Kill as well as its tributaries. Temperatures tend to show a greater range in diurnal variation in shallow water areas than in deeper areas. The greatest variation occurs during spring and fall; compared to seasonal variations, year-to-year

variation is small. Surface water temperatures range between 0°C and 25°C annually in the Arthur Kill, with annual lows occurring in January and highs in August. Daily average surface water temperatures in 2005 measured by NOAA at the Bergen Point West Reach, New York Station near the Arthur Kill are presented in Figure 5 of Appendix G.1.

TABLE 4.12-2
SURFACE WATER CLASSIFICATIONS
WITHIN THE GOETHALS BRIDGE STUDY AREA

Surface Water	NYSDEC	NJDEP	IEC
Arthur Kill	SD	SE3	B2
Old Creek Place[a]	SD	-	-
Bridge Creek	SD	-	-
Goethals Bridge Pond[a]	SD	-	-
Elizabeth River	-	SE3	-
Morses Creek[b]	-	SE3	-
NYSDEC Class SD	Best usage is fishing. These waters shall be suitable for fish survival. This classification may be given to those waters that, because of natural or man-made conditions, cannot meet the requirements for primary and secondary contact recreation and fish propagation.		
NJDEP Class SE3	Designated uses are: 1. Secondary contact recreation; 2 Maintenance and migration of fish populations; 3 Migration of diadromous fish; 4. Maintenance of wildlife; and 5. Any other reasonable uses.		
IEC Class B2	Suitable for passage of diadromous fish and maintenance of fish life. Shall be of such quality and condition that they will be free from floating solids, settleable solids, oil, grease, sludge deposits, color, or turbidity to the extent that would render the waters unsuitable for their respective use.		

Notes:
[a] Tidal portion.
[b] Classification in saline portions (> 3.5 parts per thousand [ppt] at mean high tide)
Sources: NYSDEC, 1998, 2006; NJDEP, 2005; IEC, 2005.

Salinity

Salinity influences the species present in the Arthur Kill and interacts with other variables, such as temperature, to influence the solubility of chemicals, including dissolved oxygen; as salinity increases, the amount of oxygen that can be dissolved in water decreases. Salinity is expressed in parts per thousand. Although it is conventionally viewed as salt concentrations, salinity is actually a complex measure of many dissolved substances.

By definition, an estuary is a portion of a waterbody where fresh and marine waters mix. Within the estuary, salinity influences the distribution and abundance of species along the gradient ranging from fresh water to marine or polyhaline waters. The Arthur Kill is composed of polyhaline waters, i.e., with salinity between 18 and 30 parts per thousand (ppt). Estuarine organisms are adapted to live within various salinities and survive successfully over a range of salinity. The Arthur Kill, although a tidal strait open to tidal influence at both ends, exhibits some of the salinity diversity that is characteristic of a partially mixed estuary. This occurs because the water input from the north, the Passaic and Hackensack

Rivers through Newark Bay and the northern tributaries, is less saline than the input from the south through Raritan Bay. Because saline waters are heavier than fresh waters, a two-layer flow develops in the Arthur Kill, with the more saline waters from Raritan Bay flowing in along the bottom of the channel

TABLE 4.12-3
HEALTH (FISH CONSUMPTION) ADVISORIES WITHIN THE ARTHUR KILL AND NY/NJ HARBOR AREA

Species	Eat No More Than	
	General Population	High Risk Individuals[a]
NEW YORK		
General	Eat no more than one meal (one-half pound) per week	
American eel, Gizzard Shad, striped bass and white perch	Eat none	
Atlantic needlefish, bluefish, and rainbow smelt	Eat no more than one meal per month	
Blue Crab	Eat no more than 6 crabs per week; eat no hepatopancreas (mustard, tomalley, liver) or cooking liquid	
NEW JERSEY		
Blue Crab[b]	Do not eat or harvest	
Striped Bass[b]	Eat no more than four meals per year.	
American eel[b], white perch	Do not eat	Do not eat
White catfish	One meal[c] per year	Do not eat

Sources: NYSDOH 2006; NJDEP 2006.
Notes:
[a] High-risk individuals include infants, children, pregnant women, nursing mothers and women of childbearing age.
[b] Selling any of these species from Newark Bay Complex water bodies (including Newark Bay, tidal Hackensack River, Arthur Kill, Kill Van Kull and tidal tributaries) is prohibited in New Jersey.
[c] One meal is defined as an eight-ounce serving.

while a slightly fresher layer flows seaward on the surface. This stratification occurs from the southern tip of the Arthur Kill to approximately six miles south of the Goethals Bridge Study Area, south of Fresh Kills (USACE, 1986). Top and bottom salinities in the northern reaches of the Arthur Kill remain more uniform than in the southern reach. The NYCDEP has been collecting water quality data in the entire NY/NJ Harbor since 1909. Sampling locations in the Arthur Kill are at Shooters Island, the B&O Railroad Bridge, Fresh Kills, and Tottenville. Figure 6 of Appendix G.1 presents the surface and bottom salinity data collected during 2005 at these four stations. This salinity gradient through the depth of the water column may be highly variable and locally disturbed by the input of fresh water from tributaries or discharges.

Dissolved Oxygen

Dissolved oxygen (DO) is required for aquatic life. Fish and invertebrates, such as crabs, clams, and zooplankton, require dissolved oxygen for respiration. DO is commonly used as an overall water quality indicator.

The concentration of DO in a waterbody is determined by the interaction of biological and physical processes, including photosynthesis, tidal mixing, respiration, decomposition, and chemical oxidation. Other parameters, including temperature, salinity, and atmospheric pressure, influence DO indirectly by regulating the solubility of oxygen in water. These factors together result in seasonal patterns of DO, with highest concentrations during the winter and lowest concentrations during the summer. In some systems there is a daily pattern of higher DO during daylight hours and lower DO at night. In stratified systems, there may be higher oxygen levels in surface waters and less oxygen in the lower portion of channels. This is due to the reduced interchange between freshwater flow on the surface, where DO may be enhanced by photosynthesis, and seawater along the bottom, where DO is reduced by biological respiration and chemical oxidation in the sediments. Historically, the Arthur Kill has experienced very low DO levels. Water pollution control efforts since the 1960s have improved the DO conditions in the Kill, primarily by upgrading municipal and industrial wastewater treatment to secondary treatment, which effectively removes approximately 85% of the biochemical oxygen demand (BOD). Historical surface and bottom dissolved oxygen data from 1990 to 2005 in the Arthur Kill at the four NYCDEP Harbor Survey locations mentioned above, are shown on Figure 7 of Appendix G.1. After dramatic improvements in DO since enactment of the Clean Water Act (1972), DO levels in the Arthur Kill remained steady until 2005.

During the NYCDEP 2003 New York Harbor Survey, the minimum DO concentration sampled in the Arthur Kill was 3.0 mg/l, collected at the Tottenville and Fresh Kills station (NYCDEP, 2003). As presented in Table 1 of Appendix G.2, NYSDEC and NJDEP DO water quality criteria for the Arthur Kill water classification are not less than 3.0 mg/l; hence the NYCDEP 2003 data indicate that the Arthur Kill is meeting the DO criteria for its New York and New Jersey classifications.

Nutrients

Nutrient loadings in both fresh water and estuarine water bodies are closely linked with the primary productivity of the system. High nutrient concentrations are often associated with increases in oxygen demand, toxicity, excess primary productivity, and eutrophication. Nitrogen and phosphorus are the two main limiting nutrients for primary productivity. Both nutrients undergo cyclic transformation between inorganic and organic states through bacterial reductions. In the New York Harbor area, excess concentrations of nitrogen and phosphorus are often associated with increases in phytoplankton concentrations (red, green, and brown tides), decreases in water clarity, and low DO.

Although nutrient concentrations in the Hudson-Raritan estuary have historically been high, phytoplankton concentrations have been moderate. Concentrations of dissolved inorganic nitrogen and soluble orthophosphate in the New York Harbor area are usually greater than concentrations considered to limit primary productivity. During the summer months (June through September), algal growth appears to be light-limited, due to turbidity from suspended solids, flushing cycles, zooplankton populations, and weather. Table 4.12-4 summarizes surface concentrations of dissolved inorganic nitrogen, soluble orthophosphate, and chlorophyll A in the Arthur Kill during the 2005 NYCDEP Harbor Survey.

Nutrient sources to the Hudson-Raritan estuary include tributaries, regeneration from coastal sediments, atmospheric deposition, CSOs, storm water, and sewage treatment plant effluents. Long-term trends in ammonium and nitrate-nitrite nitrogen concentrations show decreases throughout the estuary. This increase is attributed to continued construction and upgrading of water treatment plants. Short-term trends in nutrient concentrations have been relatively insignificant in comparison to long-term changes.

Metals

Trace concentrations of metals are a natural component of the aquatic ecosystem; however, high concentrations of many metals are toxic. The primary source of metals in natural waters is runoff from weathering of soils and minerals. Wastewater discharges from municipalities and industries as well as

leachate from landfills contribute substantial loads of metals to the waters that comprise the New York/New Jersey Harbor system. New York Harbor has appeared on the 304(l) list of the Clean Water Act largely on the basis of historical metals data (NYCDEP, 1991). These data indicate potential exceedances of New York State standards or EPA criteria for metals.

TABLE 4.12-4
NITROGEN, PHOSPHATE AND CHLOROPHYLL A 2003 SURFACE CONCENTRATIONS IN THE ARTHUR KILL

	Stations	Shooters Island (K2)	B&O Railroad Bridge (K3)	Fresh Kills (K4)	Tottenville (K5)
Ammonium (mg/L)	Minimum	0.02	0.02	0.08	0.03
	Maximum	0.87	0.55	1.07	0.87
	Average	0.45	0.35	0.46	0.32
Nitrate, Nitrite (mg/L)	Minimum	0.04	0.01	0.07	0.05
	Maximum	0.60	0.47	0.52	0.61
	Average	0.20	0.33	0.25	0.28
Total Phosphorous (mg/L)	Minimum	0.11	0.04	0.12	0.11
	Maximum	0.40	0.26	0.37	0.40
	Average	0.25	0.19	0.23	0.21
Ortho Phosphorous (mg/L)	Minimum	0.04	0.02	0.08	0.04
	Maximum	0.26	0.20	0.27	0.23
	Average	0.16	0.15	0.17	0.13
Chlorophyll A (ug/L)	Minimum	2.56	0.70	1.95	1.88
	Maximum	67.39	12.10	41.77	94.90
	Average	24.27	2.60	15.71	35.15

Source: NYCDEP Harbor Survey (2005)

Metals that enter the Harbor system are often associated with particulates in the water column. These particulates tend to accumulate in bottom deposits through sedimentation and may be resuspended in the water column through tidal actions, storm events and dredging activities. Recent studies of the sediments in Newark Bay and its adjacent waterways revealed that the sediment in the Arthur Kill was contaminated by a variety of metals, including mercury, arsenic, zinc, cadmium, and lead. Reported concentrations of metals within the water column have been highly variable, both spatially and temporally. Some of this variability may be due to differences in the analytical techniques (NYCDEP, 1993).

The Contaminant Assessment and Reduction Program (CARP) was established in the late 1990s to characterize levels of toxic pollutants and their source inputs throughout the New York/New Jersey Harbor. The CARP collected water column samples and analyzed them for metals (cadmium, lead, mercury, methylmercury and silver) at two locations in Arthur Kill (Northern Arthur Kill and Mill Creek) between 1998 and 2000. Table 4.12-5 presents the CARP metal data in the water column (see Figure G4 of Appendix G.1 for the station locations).

Toxic Organic Chemicals in Water

Toxic organic chemicals generally refer to polychlorinated biphenyls (PCBs), dioxin/furans, chlorinated pesticides, and polycyclic aromatic hydrocarbons (PAHs) that might exist in a water body. The New York/New Jersey Harbor has a long history of elevated concentrations of toxic organic chemicals due to the industrial and urban development that has occurred in the adjacent areas. For more than ten decades, these contaminants have accumulated in the sediments of the Arthur Kill and adjacent harbor waters, posing major threats to aquatic life and human populations.

TABLE 4.12-5
WATER COLUMN METAL CONCENTRATIONS IN THE ARTHUR KILL

Contaminants	Northern Arthur Kill	Mill Creek at Arthur Kill Rd
Cadmium (ug/l)		
Dissolved	0.077	0.057
Total	0.091	0.077
Lead (ug/l)		
Dissolved	0.126	0.191
Total	-	3.620
Mercury (ug/l)		
Dissolved	0.00072	0.00181
Total	0.02944	0.02580
Methylmercury (ug/l)		
Dissolved	0.000025	-
Total	0.000045	-
Silver (ug/l)		
Dissolved	-	0.0292
Total	-	0.0620

Source: Contaminant Assessment and Reduction Project (CARP), 2003.

Dioxin and PCB contamination in the Passaic and Hudson Rivers, resulting from industrial facilities operating during the mid-1900s, has served as a "toxic chemical reservoir" in the New York/New Jersey Harbor. These contaminants are usually associated with sediments which are transported to receiving waters during rainfall events. They can then be resuspended into the water column by physical processes, such as tides and storm events. Besides toxic chemical inputs to the New York/New Jersey Harbor from tributaries, there are other possible sources of contaminants including: municipal and industrial wastewater discharges, combined sewer overflows (CSOs), landfill leachates, atmospheric inputs, non-point source runoff and accidental spills.

For dioxins and furans, concentrations are presented as toxic equivalents (TEQs). Individual congeners (a congener is one of many variants on configurations of a common chemical structure) differ in their toxicity and carcinogenicity and TEQs allow comparisons of the toxicity of different combinations of dioxins and dioxin-like compounds. A toxicity equivalent factor (TEF) is assigned to each member of the family of dioxins and furans. The TEF is a ratio of the toxicity of a congener to that of the most toxic congener, 2,3,7,8-TCDD. TEQs are calculated by multiplying measured concentrations by the established TEFs. Therefore, the sum of the TEQs of all dioxin and furan congeners is equivalent, in terms of toxicity, to the same concentration of 2,3,7,8-TCDD (EPA 2003). TEFs for each congener are presented in Table 4.12-6. Dioxin and furan concentrations (as TEQs) in the water column of the Arthur Kill as measured by CARP are presented in Table 4.12-7, while the sampling locations are provided on Figure 4 of Appendix G.1. The NYSDEC surface water quality standard for dioxins and furans only applies to 2,3,7,8-TCDD. The concentrations of 2,3,7,8-TCDD measured by CARP at all stations in the Arthur Kill exceed this standard, as does the sum TEQ for all congeners. The chemicals contributing to the total dioxin TEQs in the Arthur Kill suggest sources beyond the Newark Bay-Passaic River- Hackensack River complex (Litten and Fowler 2001).

TABLE 4.12-6
TOXICITY EQUIVALENCY FACTOR (TEF) AND BIOACCUMULATION EQUIVALENCY FACTOR (BEF) FOR DIOXIN/FURAN

Congener	TEF	BEF
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1	1
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	0.5	0.9
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0.1	0.3
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	0.1	0.1
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	0.1	0.1
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	0.01	0.05
Octachlorodibenzo-p-dioxin	0.001	0.01
2,3,7,8-Tetrachlorodibenzofuran	0.1	0.8
1,2,3,7,8-Pentachlorodibenzofuran	0.05	0.2
2,3,4,7,8-Pentachlorodibenzofuran	0.5	1.6
1,2,3,4,7,8-Hexachlorodibenzofuran	0.1	0.08
1,2,3,6,7,8-Hexachlorodibenzofuran	0.1	0.2
2,3,4,6,7,8-Hexachlorodibenzofuran	0.1	0.7
1,2,3,7,8,9-Hexachlorodibenzofuran	0.1	0.6
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.01	0.01
1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.01	0.4
Octachlorodibenzofuran	0.001	0.02

Source: NYSDEC, Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations (http://www.dec.state.ny.us/website/regs/part703.html#703.5)

PCB concentrations in the surface waters of the Arthur Kill as measured by CARP are presented in Table 2 of Appendix G.2. Concentrations are presented by homologue group, being all congeners with the same number of chlorine substituents. The PCB concentrations are well above the NYSDEC surface water quality standards. Greater proportions of PCBs, dioxins and furans are associated with suspended solids (particulates) than are dissolved in the water column. Both groups of compounds are distributed throughout the Arthur Kill.

Table 3 of Appendix G.2 presents pesticide concentrations in water column at three sampling stations in the Arthur Kill. The water samples were collected and analyzed by CARP between 1998 and 2003. The analyzed pesticide concentrations were well below the respective water quality standards except for Chlorodane, Hexachlorobenzene and Mirex, all of which exceed the NYSDEC health (bioaccumulation)-based standard.

4.12.4.5 Sediment Quality

Sedimentation and Sediment Compositions

The Arthur Kill receives suspended sediment loads from a variety of sources. These sources include the Hackensack and Passaic Rivers, which discharge into Newark Bay, and the Rahway and Elizabeth Rivers, Morses Creek and small tributaries which discharge directly to the Arthur Kill. Anthropogenic sediment sources include municipal waste treatment facilities, industrial discharges and CSOs. Other portions of the interconnected Newark Bay system including Newark Bay and Kill Van Kull, as well as shoreline erosion and resuspension of bottom sediments, also contribute to suspended sediment loads in the Arthur Kill.

TABLE 4.12-7
DIOXIN/FURAN IN WATER COLUMN AT STATIONS IN ARTHUR KILL

PARAM	Concentration (µg/L, TEQ)		
	Mill Creek at Arthur Kill Rd	Northern Arthur Kill	Southern Arthur Kill, Tow
1,2,3,4,6,7,8-HpCDD	1.37E-08	2.81E-09	1.47E-09
1,2,3,4,6,7,8-HpCDF	4.74E-09	3.43E-10	1.29E-10
1,2,3,4,7,8,9-HpCDF	4.37E-08	1.12E-09	3.76E-10
1,2,3,4,7,8-HxCDD	2.91E-08	2.38E-09	1.31E-09
1,2,3,4,7,8-HxCDF	1.52E-07	5.77E-09	1.86E-09
1,2,3,6,7,8-HxCDD	2.81E-08	3.73E-09	1.70E-09
1,2,3,6,7,8-HxCDF	1.70E-07	6.21E-09	2.19E-09
1,2,3,7,8,9-HxCDD	2.75E-08	2.81E-09	1.47E-09
1,2,3,7,8,9-HxCDF	8.14E-08	1.05E-09	5.96E-10
1,2,3,7,8-PeCDD	3.44E-07	3.28E-08	1.89E-08
1,2,3,7,8-PeCDF	9.74E-08	2.14E-09	1.06E-09
2,3,4,6,7,8-HxCDF	5.09E-07	1.87E-08	6.30E-09
2,3,4,7,8-PeCDF	5.03E-06	2.51E-07	9.41E-08
2,3,7,8-TCDD*	4.36E-07	7.91E-07	2.52E-07
2,3,7,8-TCDF	7.08E-07	3.05E-08	1.89E-08
OCDD	4.03E-09	7.11E-10	3.43E-10
OCDF	1.31E-09	1.29E-10	3.82E-11

Note: * 2,3,7,8-TCDD is the most toxic form of dioxin and furan congeners. NYSDEC Surface Water Quality Standard for Chlorinated dibenzo-p-dioxins and Chlorinated dibenzofurans (dioxin/furan) only applies to 2,3,7,8-TCDD, and the limit is 3.1 x 10^{-9} µg/L.
Source: CARP, 2003.

Sediment loadings from the various sources are difficult to isolate because of the complexity of the estuarine system. Dredging feasibility studies conducted by the USACE in 1986 concluded that the principal sources of sediment input to the Arthur Kill in the vicinity of the Study Area are the Kill Van Kull, the lower portions of the Arthur Kill, and local tributary streams.

Surface sediments within the New York Harbor estuary are usually dominated by muddy (<63 micrometer (µm) diameter) small particulates, with sand (>63 µm diameter) generally making up less than 15 percent (by weight) of the surface sediment (Olsen et al., 1984). The Newark Bay area is generally composed of silt-sized (0.005 - 0.05 mm) sediments. However, coarser material from relict or reworked deposits is found in regions where current scour exceeds over deposition, such as in the lower portion of Newark Bay and the Kill Van Kull (Suszkowski, 1978 in Olsen et al., 1984).
The 1987 USACE dredging feasibility studies reported sediments within the Arthur Kill channel as very soft, dark gray silts underlain by weathered and distressed red shale. This weathered shale was underlain by bedrock (sound and unweathered shale) of the Passaic Formation. Channel sides were steep and composed primarily of black silt.

A sediment boring sample collected in May 1993 by the Port Authority along the Staten Island shoreline indicated that bottom sediments were composed of 60.9 percent sand, 32.8 percent silt, and 6.3 percent clay (PA, 1994). Sediments from two samples collected along the New Jersey shoreline averaged 36.9 percent sand, 46.7 percent silt, and 17.3 percent clay. Percent moisture was greater than 60 percent for all three samples.

Observations made during the benthic sampling in the spring, summer, and fall of 1994 reported sediment textures for both sides of the Arthur Kill as fine and claylike, with some organic material present. Benthic

sampling in spring and fall 1994 indicated the presence of brick and brick-like material in the upper reaches of Old Place Creek. Brick material is also present in the interpier basin south of the Goethals Bridge along the New Jersey shoreline, probably the result of dumping in Old Place Creek and the interpier basin.

The USEPA Regional Environmental Monitoring and Assessment Program (REMAP) reported in the "Sediment Quality of the New York/New Jersey Harbor System" (EPA, 2003) that average percent silt-clay in sediments of the entire Harbor System was 34.3%. The Lower Harbor was the sandiest with only 27.2% silt-clay. The Upper Harbor and Newark Bay were the muddiest sub-basins with 50.4% and 46.9% silt-clay, respectively. The percent silt-clay composition of sampling stations near the Goethals Bridge was 44%. Based on the REMAP sampling events, which were separated by about five years (1993/1994 and 1998), the mean silt-clay is nearly identical for the Harbor System from 1993/1994 to 1998, except for Newark Bay, which was significantly different in 1998 (46.4%) versus 1993/1994 (68.1%). The possible reason for the difference was the influence of dredging in Newark Bay and reduction of fine sediment input from land drainage.

Toxic Chemicals in Sediments

Sediment contaminant concentrations are not easily related to pollutant sources because of the differences in circulation patterns, chemical sorption and desorption, sediment size, and sedimentation rates. The National Oceanic and Atmospheric Administration (NOAA) related contaminant concentration differences to particle size differences in a nationwide sampling of estuaries, with muddy sediments revealing greater contaminant concentrations than sandy coarse sediments (NOAA, 1988). Metal and toxic chemical pollutants generally have a greater affinity for fine-grained particles relative to coarser particles because fine-grained particles have greater surface areas (for binding sites and organic and manganese coatings) (Olsen et al., 1984).

Sedimentation in the New York/New Jersey Harbor System reflects the differences in flow and circulation patterns that exist throughout the entire Harbor. Sediments are often trapped in low energy areas (low-flow areas), with deposition most pronounced in coves or channels. Localized areas that are not in equilibrium with waves, currents, and flow regimes may serve as fine-particle and reactive-pollutant traps (Olsen et al., 1984). Olsen et al. (1984) estimated that fine-grain sedimentation rates for dredged (channels) and non-dredged (shoals) areas differed by approximately 6 centimeters per year (cm/yr). This localization of sediment type and differences in accumulation result in hot spots of chemical contamination and widespread variability.

Contaminated toxic sediments are directly related to issues of dredged material disposals. According to the revised USEPA Region 2 Guidance Manual, 66% of dredged materials from the New York/New Jersey Harbor System are classified as Category III (not suitable for ocean disposal) (NYSDEC, 2003). Category III material requires post-treatment before disposal, resulting in more than ten times higher disposal costs than Category I material.

Although sediment quality standards are not yet established at a state or federal level, New York and New Jersey have adopted some of the NOAA's Effects Range-Low (ERL) and Effects Range-Medium (ERM) sediment guidance criteria (NOAA, 1998). ERLs and ERMs are aquatic effects-based guidelines developed by Long et al. (1995) to evaluate sediment contamination for a variety of pollutants (except for dioxin and furans). The ERL value is the concentration at which adverse biological effects begin to be seen but are not expected to cause adverse ecological effects. The ERM value is the concentration that is usually associated with adverse biological effects. Concentrations above the ERM value are likely to be very toxic (EPA 2003). Tables 4 and 5 of Appendix G.2 list the ERL and ERM limits for metals in sediments and 19 organic analytes and associated ERL and ERM values, respectively.
REMAP conducted sediment sampling during two periods (1993/1994 and 1998) in the NY/NJ Harbor System, which was divided into four sub-basins: Upper Harbor (lower portion of Hudson River); Newark

Bay (Passaic, Hackensack and Raritan Rivers and Arthur Kill, Kill Van Kull and Newark Bay); Lower Harbor (includes Raritan and Sandy Hook Bay to Atlantic Ocean); and Jamaica Bay. REMAP sampling stations in the Arthur Kill appear in Figure 4 of Appendix G.1.

REMAP (EPA, 2003) reported that chemical contamination is pervasive in the Harbor System. The mean values for 7 of 10 trace elements for which ERL and ERM thresholds exist were at or above ERL levels. Of the Harbor sub-basins, Newark Bay had the highest average concentration of all the metals measured, except for silver, manganese and aluminum, which were higher in the Upper Harbor. Newark Bay had a mean concentration of parent DDT that was 200 times higher and a mean total DDT that was 50 times higher than the next highest sub-basin.

Within the Harbor System, Newark Bay had the most widespread and diverse contaminant problems, with 96% of its area exceeding an ERM value for at least one chemical. Mercury had the highest percent area of all the metals exceeding an ERM in the Harbor (42%); 100% of Newark Bay was contaminated with mercury (EPA, 2003). Historically, an industrial source of mercury was located along the Hackensack River and affected sediments in the river and Newark Bay. The pattern of mercury distribution in the Harbor System is that the concentrations were elevated in the Arthur Kill across Raritan Bay to Sandy Hook Bay, following the circulation pattern for this part of the Harbor System.

REMAP (EPA, 2003) also identified that among dioxins and furans, the mean concentration of the most toxic dioxin congener, 2,3,7,8-TCDD, was highest in Newark Bay. Historically, an industrial source of dioxin was located along the Passaic River and affected sediments in the river and Newark Bay. Incorporating all congeners into the calculation of TEQs also resulted in Newark Bay having a significantly higher mean of 2,3,7,8-TCDD equivalents than the other three sub-basins. The comparison of 2,3,7,8-TCDD levels in 1993/1994 and 1998 showed that, while levels in some sub-basins appear to be declining, these changes were not statistically significant.

Tables 6 and 7 of Appendix G.2 present metals and toxic organic chemical data collected for REMAP at stations in Arthur Kill (see Figure 4 of Appendix G.1 for sampling stations). Metal concentrations fall in between ERL and ERM levels, except for mercury. Mercury concentrations in Arthur Kill stations are well above ERM level, and mercury concentrations at two stations (NB211 and NB219) are almost 8 times higher than the ERM value.

Metals and organic chemical data collected in sediments of the Arthur Kill by CARP from 1998 to 2000 are presented in Tables 8, 9 and 10 of Appendix G.2 for metals, PCBs and PAHs/pesticides, respectively. Among the sampling stations in the Arthur Kill, toxic chemical concentrations at the stormwater overflow station in East Jersey Street and Front Street, and Woodbridge Creek outlet ranked by far the highest, suggesting that runoff from neighboring land drainage and industrial discharges are the possible major sources of the toxic chemicals in the Arthur Kill. CARP data suggested that the total PCB concentration in the sediments of Arthur Kill stations are twenty times higher than the ERM level, whereas most PAHs and pesticides concentrations are in between respective ERL and ERM values, except for stations between Morses Creek and Piles Creek, and the East Jersey Street and Front Street Stormwater Overflow, and near Woodbridge Creek outlet. All of these CARP sampling stations are located downstream of the Primary Study Area, and the degree of sediment contamination is localized based on input source locations. Table 11 of Appendix G.2 presents dioxin/furan concentrations (as TEQs) in Arthur Kill sediments, collected by CARP. There are no sediment quality guidance levels for dioxins/furans, although dioxins/furans pose a high level of toxicity on biota.

4.12.5 Groundwater

4.12.5.1 New Jersey

The Goethals Bridge Study Area lies in the Piedmont Plain province. Bedrock on the New Jersey side of the Arthur Kill consists of shales and sandstones of the Newark Supergroup and is part of the Passaic Formation. These thin-bedded shales and sandstones are reddish-brown to gray with ripple marks and mudcracks indicating that the Formation was deposited in a shallow water environment. Water is stored and moved along fractures and joints in these consolidated deposits, under both confined and unconfined conditions. The unconsolidated deposits overlying the bedrock are glacial drift, consisting of unstratified clay, silt, sand, gravel and boulders. Poorly-sorted unstratified drift and till covers the area and is composed predominantly of clay with lesser amounts of sand. Because of low permeability, these deposits are not considered an important aquifer in Union County (Nemickas, 1976).

Local precipitation supplies nearly all groundwater in Union County (Nemickas, 1976), with mean annual precipitation at 48 inches (Anderson, 1961). Recharge is provided by infiltration from precipitation through the soil and percolation to the water table. Some recharge may occur along stream banks. Saltwater intrusion may occur along the Arthur Kill and the tidal Rahway River. Groundwater north of Carteret is subject to saltwater intrusion. Saltwater contamination was reported in groundwater wells in the Newark and Rahway River areas (Anderson, 1961).

Groundwater levels ranged from 0.0 to 11.0 feet below the surface (surface elevations ranged from 3.6 to 12.1 feet above MSL (USCG, 1994). A 1992 study prepared for the Port Authority reported poor surface water drainage on the New Jersey side where low surface relief is required in the meandering of the Elizabeth River and Morses Creek (Berger, 1992).

Groundwater in New Jersey is defined under three general classifications: Class I, Special Ecological Significance; Class II, Potable Water Supply; and Class III, Uses Other Than Potable Water Supply (NJAC 7:9-6.5). Class II groundwater is further separated into Class II-A (potable water at current water quality with conventional treatment) or Class II-B (of potable quality subsequent to the enhancement or restoration of regional water quality with conventional water supply treatment). All groundwater in New Jersey is classified as Class II-A unless designated otherwise. Current groundwater classification within the Goethals Bridge Study Area is Class II-A. Several analyses exceeded the criteria for Class II-A water, including xylene; methylene chloride; a pesticide, beta BHC; and two metals, manganese and lead. There are currently no Class II-B groundwaters in New Jersey (Port Authority, 1994).

4.12.5.2 New York

Hydrogeology

The streams and groundwater of Staten Island are supported primarily by precipitation (Soren, 1988). Average precipitation measured in north central Staten Island is 44 inches, with a recorded range of 28.2 inches in 1965 and 55.2 inches in 1955. During dry periods, streams such as Old Place Creek are maintained by groundwater seepage.

Fresh groundwater occurs in both bedrock and unconsolidated deposits and is surrounded on all sides by saline groundwater. Similar to the geology on the New Jersey side of the Arthur Kill, bedrock in the area (Newark Supergroup) primarily holds water in bedding-plane separations but also gains porosity in spaces developed by fractures (e.g., joints and faults). Water in the Newark Supergroup of Staten Island can be under unconfined or confined conditions, depending on the degree of confinement in the overlying deposits and the hydraulic interconnections within the shales and sandstones (Soren, 1988). Groundwater

occurrence in unconsolidated deposits depends on the sand, silt, and clay composition of the glacial outwash and fill. Outwash deposits generally contain water under unconfined conditions.

Movement of fresh groundwater on Staten Island is seaward, toward the saline groundwater. A curvilinear groundwater divide surrounds the northeastern portion of Staten Island, from which groundwater flows laterally away along water-level contours toward streams and tidewater areas. Although the unconsolidated deposits and bedrock are hydraulically connected, most of the flow occurs within the glacial deposits due to their greater hydraulic conductivity (Soren, 1988). It is estimated that the rate of horizontal flow ranges from a small fraction of an inch per day to approximately 1.5 feet/day in glacial deposits comprised of sand and gravel.

Staten Island's fresh groundwater is recharged mainly by precipitation, but leaking water mains, sewers, and septic systems may also contribute significant amounts (Soren, 1988). The amount of recharge on Staten Island is not known; however, annual recharge on Long Island, which has a similar rainfall, is about 20 inches yielding about one million gallons per day per square mile (MGD/mi^2) (Soren, 1988). Staten Island's topography, however, is hillier and less permeable than that of Long Island. Recharge rates on Staten Island are estimated to be more comparable to Kings and Queens Counties, with approximately 0.25 to 0.5 million gallons per day per square mile. The presence of salt marshes indicates the area is poorly drained (LBA, 1992). Depths to groundwater range from 0.0 to 6.5 feet below the surface (surface elevations ranged from 2.1 to 10.3 feet above mean sea level (MSL) (Port Authority, 1994). The high water table and poor drainage of the area are due to the low relief and presence of fine-grained unconsolidated deposits.

All fresh groundwater in New York State is classified as GA (NYCRR Title 6, 701.15) unless designated otherwise. Best usage of Class GA waters is as a source of potable water supply. Monitoring well locations in Staten Island are shown in Figure 8 of Appendix G.1. Groundwater is not used for public water supply on Staten Island. Before 1970, the surface water supply from upstate New York was supplemented by pumping a maximum of 5 MGD of groundwater. Higher pumping rates induced saline groundwater infiltration.

4.13 Floodplains

Flooding is a common occurrence in coastal wetlands. Tidal events bring about daily flooding of wetland areas. Less frequent flood events which, on the average, are expected to be equaled or exceeded during any 100- or 500-year period (referred to as 100- and 500-year floods, respectively) are mapped by the Federal Emergency Management Agency (FEMA). The Base Flood Elevation (BFE) is the elevation associated with the “100-year flood,” or a flood with a 1% chance of occurrence in any given year. To identify the flood elevations within the Goethals Bridge Study Area, hydrologic and hydraulic models developed by the USACE were analyzed and applied.

In the Goethals Bridge Study Area, both shores of the Arthur Kill and Old Place Creek are included in 100-year flood zones. The base flood elevations for these areas vary from eight to nine feet (referenced to the National Geodetic Vertical Datum of 1929). Generally, the eight-foot level reflects the waterways and the nine-foot level reflects wetland regions. On the New Jersey shore, the 100-year flood area extends as far landward as the NJ Turnpike Interchange 13 toll plaza.

Five-hundred year flood levels occur on the higher elevation portions of Old Place Creek, especially along the berm which separates Old Place Creek’s channel from the GATX facility property to the south. Figure 4.13-1 depicts the flood hazard zones and base elevations for the Goethals Bridge Study Area.

4.14 Biotic Communities

4.14.1 Introduction

The Primary Study Area for the Goethals Bridge Replacement EIS effort (as defined in Section 4.2) and adjacent environs have undergone intense coastal development and urbanization. A variety of urban and industrial modifications to the nearshore zone of the Arthur Kill have altered flow conditions, water quality and the types of flora and fauna inhabiting the ecosystem. This area, however, still contains tidal and non-tidal marshes, mudflats, and creeks (Old Place Creek) typical of a natural setting.

The Primary Study Area is a convergence of different types of ecosystems: the channels and shoals of the Arthur Kill and Old Place Creek, adjacent upland areas, and intervening wetland complexes that range from tidal marsh to seasonally-inundated palustrine communities. Superimposed on the continuum of ecosystems is a convergence of aquatic habitats ranging from the saltwater regime of the Arthur Kill to tidal creeks and freshwater wetlands. This complex landscape provides a wide range of chemical, physical, and biological habitat conditions.

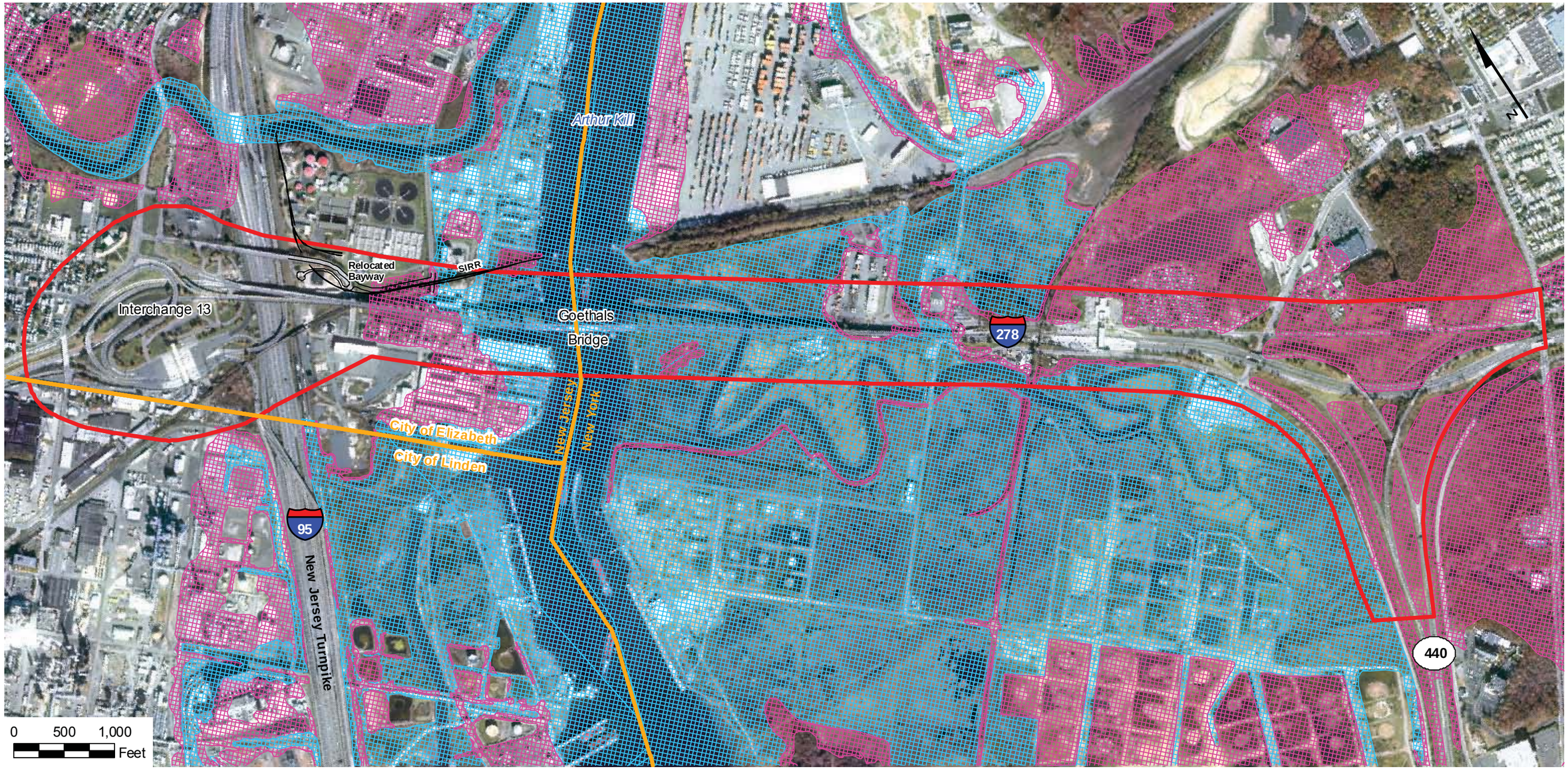
4.14.2 Methodology, Approach and Data Sources

Aquatic communities in the Arthur Kill and Old Place Creek have been characterized utilizing entrainment and impingement studies conducted for power plants and through surveys performed for the never-completed Staten Island Bridges Program Modernization and Capacity Enhancement Project Final Environmental Impact Statement (USCG, 1997), while vegetation mapping is based upon field studies that were conducted by LMS in 1994 and refined through field surveys in September 2004. Wetlands were delineated in the field in August 2004 and mapped. Wildlife in the Primary Study Area was described based on numerous sources, including field surveys conducted in 1994 for the formerly-proposed Staten Island Bridges Program Modernization and Capacity Enhancement Project and in 2004 for the currently proposed project. Data were also obtained from the New Jersey Department of Environmental Protection (NJDEP) and New York State Department of Environmental Conservation (NYSDEC) file searches, NJDEP Landscape Project databases, the New York State Amphibian and Reptile Atlas Project, the U.S. Fish and Wildlife Service's (USFWS) Birds of Conservation Concern, the New York City Department of Parks and Recreation (NYCDPR) Salt Marsh Restoration Team (SMRT) 1993-1994 breeding bird survey, the Harbor Herons Project, the NYSDEC Breeding Bird Atlas, and personal communications with staff of NYCDPR and the Staten Island Institute.

Information on threatened, endangered, or otherwise protected species was compiled from USFWS, NYSDEC and NJDEP records and the Natural Heritage Program database for both states. Additionally, the New York and New Jersey Natural Heritage Programs, which maintain listings of sightings of federally- and state-protected species and special habitats, were contacted for a list of endangered and threatened plants and animals and critical habitats. Field surveys in 1994 and 2004 supplemented this information.

Wetland descriptions and evaluations are based on National Wetlands Inventory (NWI) maps, NYSDEC Wetlands maps, NJDEP Wetland maps, previous studies conducted by The Louis Berger Group, Inc. in 1990, 1992 and 1995 for the previously proposed project, and site visits conducted during the 2004 growing season. In September and October 2004, the limits of ACOE, NJDEP and NYSDEC jurisdictional wetlands were delineated and surveyed within the Primary Study Area in Elizabeth and Staten Island. The delineated wetlands in the Primary Study Area and their boundaries are depicted on Figures 4.14-1a and 4.14-1b.

The wetlands adjacent to the Arthur Kill and its tributaries (Old Place Creek, Sawmill Creek, and Richmond Creek) have been subjected to numerous industrial and development activities. Portions of



Legend

Primary Study Area

Flood Zones

Zone AE - An area inundated by 100-year flooding for which BFEs have been determined.

Zone X500 - An area inundated by 500-year flooding

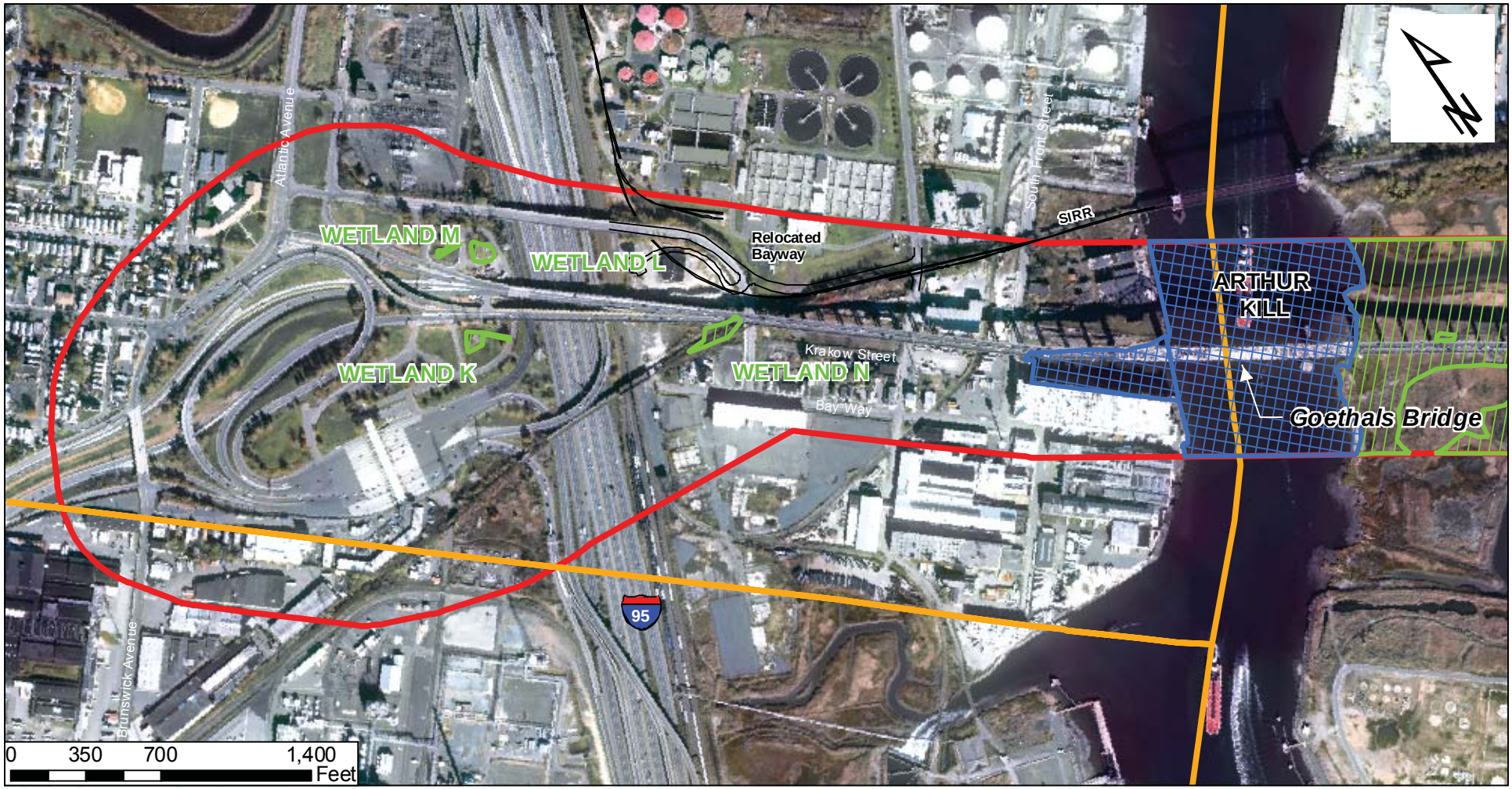
Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.13-1

FEMA Map

United States Coast Guard



Legend

- Primary Study Area
- Delineated Wetland
- Open Water

Goethals Bridge Replacement EIS

FIGURE 4.14-1a

Delineated Wetlands - New Jersey

United States Coast Guard

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: The Louis Berger Group, 2004.

these wetlands have been filled, traversed by utility lines and/or roadways, channelized to enhance stormwater flow and/or mosquito control, and used as a dumping area for construction debris, tires, and refuse. Although the salt marshes along the Arthur Kill exhibit evidence of human disturbance, these areas are still functional, valuable wetlands.

The USFWS's NWI mapping (see Figure 4.14-2), the NJDEP wetlands mapping (Figure 4.14-3), and the NYSDEC wetlands mapping (Figure 4.14-4) are based on aerial photographs of the Goethals Bridge Study Area taken in the 1970s, the 1980s, and 1990s, respectively. Because changes to the wetlands communities have occurred since these maps were produced, observations made during the 2004 site visits serve as an update to the information contained on these maps. Other sources of information used for the wetland delineation include delineation mapping from GATX, Inc. (former tank farms located south of the Staten Island toll plaza), and the Staten Island Bridges Program Modernization and Capacity Enhancement Project Final Environmental Impact Statement (USCG, 1997).

The delineations encompassed jurisdictional wetlands regulated by state and federal agencies. Based upon a July 29, 2004 interagency meeting that was held for the proposed project, one wetland line was delineated in the field. The wetland delineation line encompassed freshwater and tidal wetlands under the jurisdiction of the U.S. Army Corps of Engineers (USACE), the NJDEP and the NYSDEC. The limits of the wetland boundaries were marked in the field with sequentially numbered flags or stakes in accordance with the 1987 Federal Manual for Delineating Wetlands, as required by the USACE; the 1989 Federal Wetland Manual procedures as required by the NJDEP; and NYSDEC procedures and mapping for delineating tidal wetland extent. The location of wetland markers were surveyed via a Global Positioning System (GPS) and plotted on the project maps. Only wetlands occurring within the Primary Study Area as defined in Section 4.2 were field delineated (see Figures 4.14-1a and 4.14-1b).

All field-delineated wetlands have been reviewed and approved by the relevant regulatory agencies. The USACE provided a Jurisdictional Determination of wetlands in both states on November 6, 2007. The NYSDEC issued a Wetland Boundary Confirmation for all New York State wetlands on October 23, 2007. The NJDEP issued a Letter of Interpretation for all New Jersey wetlands on October 23, 2006. It should be noted that some areas were not field inspected due to limited site access. For these areas, background and previous wetland delineation information was used to identify the approximate wetland-upland boundaries.

Field observations were used to develop the preliminary wetland base map, and to assess the functions performed by each wetland. Wetland types and their boundaries were identified and mapped during September and October 2004. This identification consisted of pedestrian and canoe inspections of the wetlands; determination of plant dominance; inspection of soils; and observations of hydrology, wildlife use and human impacts (e.g., recreation, dumping, fencing). The wetlands were identified based upon field investigations and assessments of conditions, with an emphasis on the identification of wetland vegetation and the presence of surface water inundation or high ground water. Dominant vegetation was categorized by wetland indicator status as described in the USFWS document entitled "National List of Plant Species that Occur in Wetlands: Northeast (Region 1)." Observations of hydrology included debris lines, hydric soils, sediment deposits on plant stems, and observed inundation at high tide.

Data on species and ecological communities within the Primary Study Area were reviewed and compared with the descriptions and associations defined in *Ecological Communities of New York State* (NYSDEC, 2002). Since the majority of the ecological communities within the Primary Study Area are in New York State, and because the community types throughout the Study Area fit within the categories described in the *Ecological Communities of New York State* document, the descriptions provided were used to describe and categorize the communities found in both the New Jersey and New York portions of the Primary Study Area.

Legend

- Primary Study Area
- Delineated Wetland
- Open Water

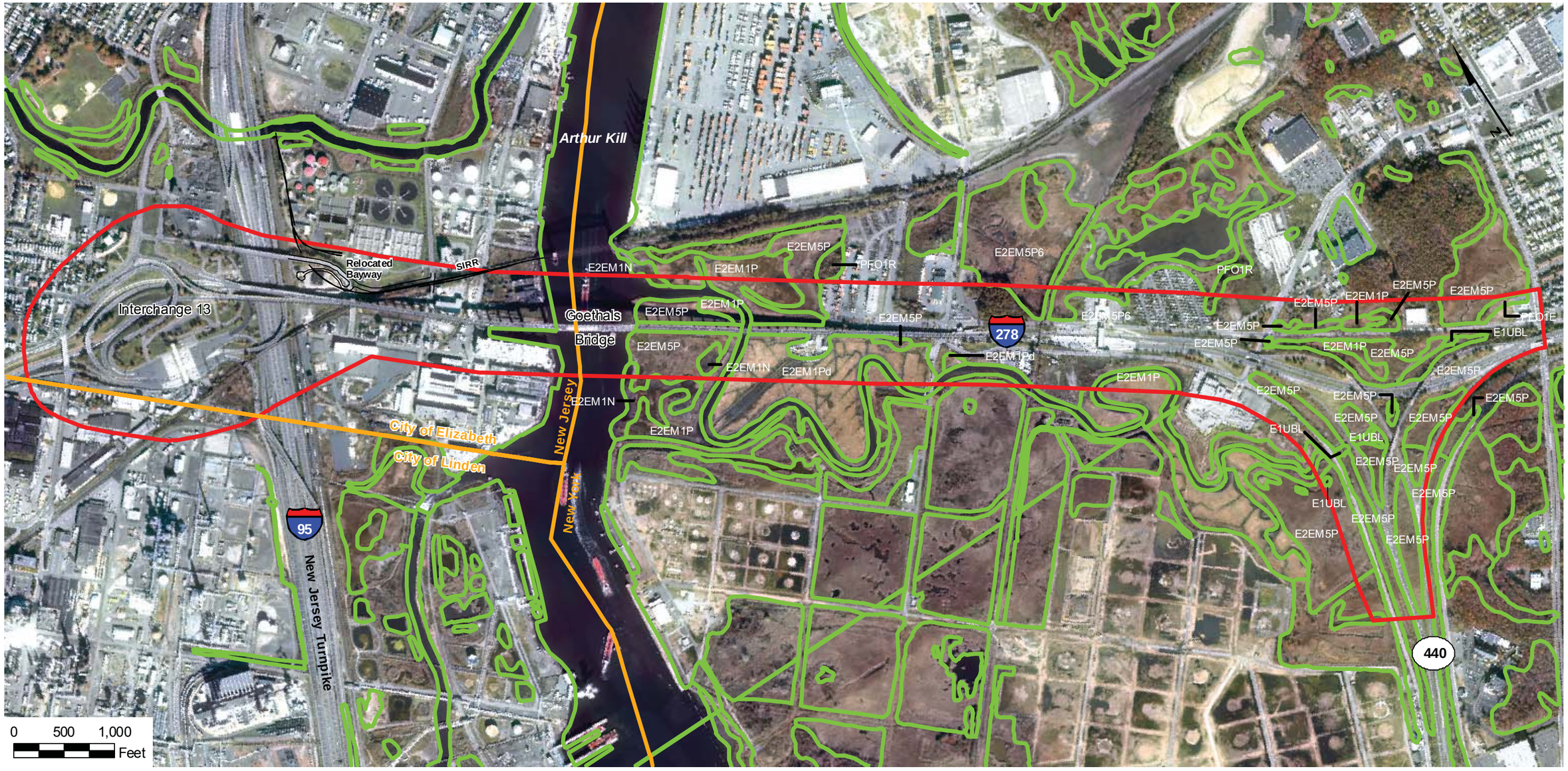
Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: The Louis Berger Group, 2004.

Goethals Bridge Replacement EIS

FIGURE 4.14-1b

Delineated Wetlands - New York

United States Coast Guard



Legend

Primary Study Area

NWI Wetlands Boundary

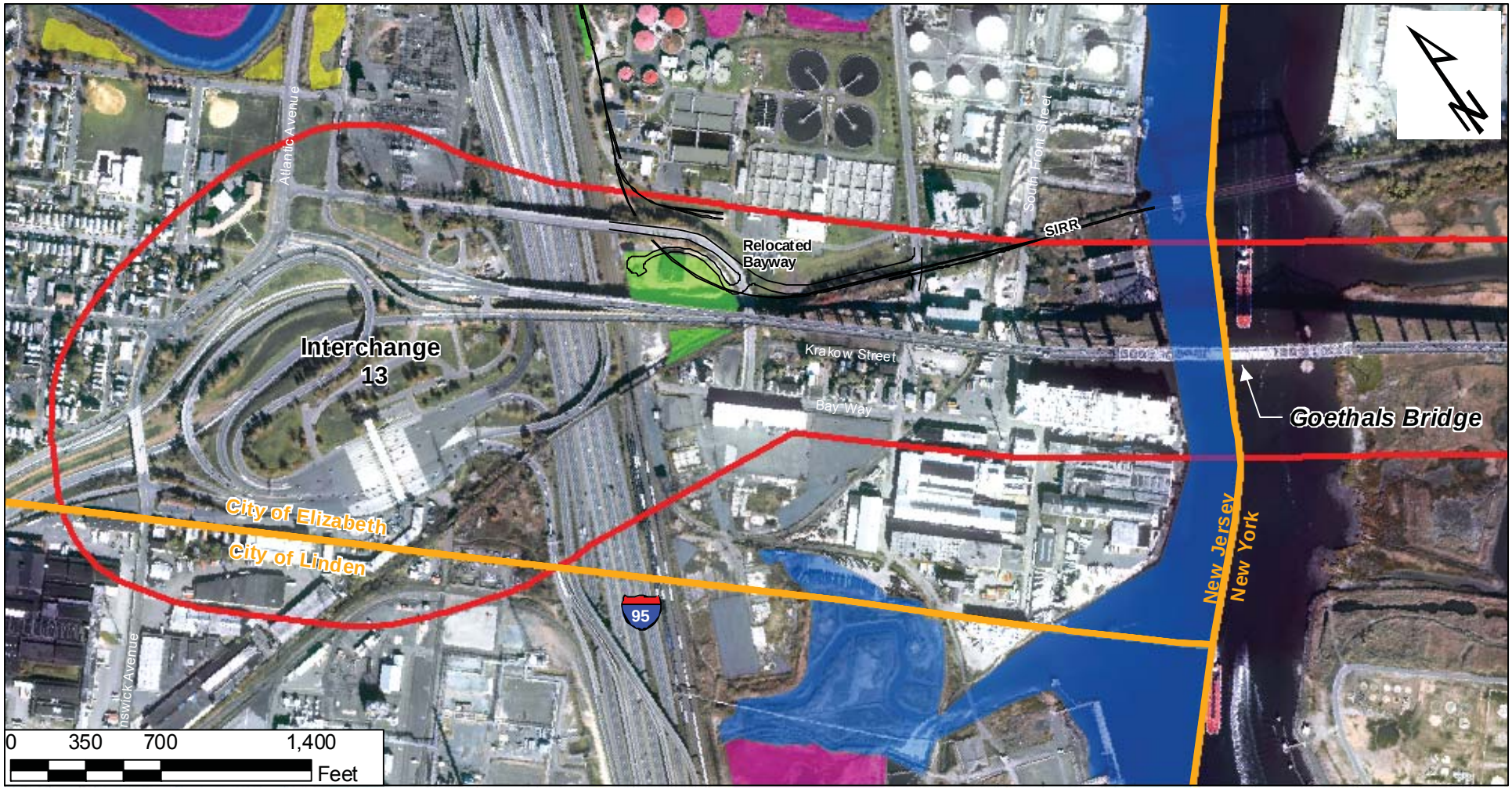
E1UBL	Estuarine, Subtidal, Unconsolidated Bottom, Subtidal water regime
E2EM1N	Estuarine, Intertidal, Emergent, Persistent, Regular water regime
E2EM1Pd	Estuarine, Intertidal, Emergent, Persistent, Irregular water regime, partially drained/ditched
E2EM1P	Estuarine, Intertidal, Emergent, Persistent, Irregular water regime
E2EM1P6	Estuarine, Intertidal, Emergent, Persistent, Irregular water regime, Oligohaline
E2EM5P	Estuarine, Intertidal, Emergent, Narrow-leaved Persistent
E2EM5P6	Estuarine, Intertidal, Emergent, Narrow-leaved Persistent, Oligohaline
PFO1R	Palustrine, Forested, Broad-leaved Deciduous, Seasonal Tidal
PFO1E	Palustrine, Forested, Broad-leaved Deciduous, Seasonal Saturated

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: National Wetlands Inventory, US Fish and Wildlife Services.

Goethals Bridge Replacement EIS

FIGURE 4.14-2
NWI Wetlands

United States Coast Guard



Legend

Primary Study Area

Wetlands

- HERBACEOUS WETLANDS
- MANAGED WETLANDS (MODIFIED)
- SALINE MARSHES
- TIDAL WATER

Goethals Bridge Replacement EIS

FIGURE 4.14-3

NJDEP Tidal Wetlands

United States Coast Guard

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: NJDEP Freshwater Wetlands.

Vegetation mapping was based upon field studies that were conducted in July 1994 to identify plant species in the Primary Study Area, evaluate habitat potential for endangered and threatened plants, and identify plant communities. The 1994 vegetation surveys were conducted over a three-day period and included pedestrian surveys through marsh and upland communities, as well as shoreline surveys conducted from a small boat. Vegetation layers (tree canopy, subcanopy, shrub layer, vines, groundcover) were identified and the dominant species within each layer identified (USCG, 1997). The locations and extent of the vegetation communities were verified with aerial photographs and a field survey which was conducted in September 2004. The ecological communities mapping effort was used to determine the potential impacts of bridge construction on wildlife and to serve as guidance for mitigation development.

4.14.3 Regulatory Setting

Federal and state agencies have jurisdiction over elements of the aquatic and terrestrial environment and are charged with protecting and regulating the use of natural resources. These include, but are not limited to, the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries Service, New York State Department of Environmental Conservation and New Jersey Department of Environmental Protection.

4.14.3.1 Wetlands

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers is responsible for authorizing discharges of dredged or fill material into "Waters of the United States" pursuant to Section 404 of the Clean Water Act (CWA). The term "Waters of the United States" is defined as: all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; all other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters; and wetlands adjacent to "Waters of the United States" (other than waters that are themselves wetlands).

N.J. Department of Environmental Protection

The NJDEP regulates freshwater and tidal wetlands, and transition areas around freshwater wetlands up to 150 feet. Tidal wetlands and water courses do not contain regulated transition areas. Freshwater wetlands and transition areas in New Jersey are regulated under the 1988 Freshwater Wetlands Protection Act (N.J.A.C 7:7A). Coastal wetlands and development are regulated under several laws (N.J.A.C 7:71-1), including: the 1914 Waterfront Development Law; the Wetlands Act of 1970; and the 1973 Coastal Area Facility Review Act (CAFRA). Of these, only the Waterfront Development Law specifically applies to the Goethals Bridge Study Area.

New York State Department of Environmental Conservation

Tidal wetlands in New York are defined by the New York State Department of Environmental Conservation (Part 661, Title 6, Codes, Rules and Regulations of the State of New York) as falling into several categories (littoral zone, coastal shoals/mudflats, intertidal or low marsh, high marsh, and formerly connected marsh), all of which are found in the Primary Study Area. The NYSDEC regulates both the wetland areas and a buffer zone of up to 150 feet of adjacent area upland of the wetland boundary within the City of New York.

Legend

Primary Study Area

NYSDEC Tidal Wetlands

- FC - Formerly Connected Wetland
- High Marsh
- IM - Intertidal Marsh
- LZ - Littoral Zone
- SM - Coastal Shoals, Bars and Mudflats

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: NYSDEC Tidal Wetlands, 1974.

Goethals Bridge Replacement EIS

FIGURE 4.14-4

NYSDEC Tidal Wetlands

United States Coast Guard

The littoral zone is defined by NYSDEC (New York's Environmental Conservation Law, Article 25, entitled - Tidal Wetlands Act) as the permanently inundated area seaward of the low tide mark to a depth of six feet. The coastal shoals/mudflats which correspond to Reschke's (1990) marine intertidal mudflat community zone is defined as tidally inundated, exposed (dry) at low tide or is covered by water to a maximum depth of approximately one foot and is unvegetated. Both mudflats and wetlands are identified as special aquatic sites by the USEPA in its Section 404(b) (1) guidelines and are subject to provisions of the Clean Water Act.

4.14.3.2 Essential Fish Habitat

In 1996, amendments to the Magnuson-Stevens Fishery Conservation and Management Act established Essential Fish Habitat (EFH) provisions to protect and enhance important habitats of federally managed marine and anadromous (fish that migrate up rivers from the sea to breed in freshwater) fish species. Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." Federal agencies that fund, permit, or undertake activities that may adversely affect EFH must consult with the National Marine Fisheries Service (NMFS) about the potential impacts of their actions on EFH.

4.14.3.3 Threatened and Endangered Species

The Endangered Species Act of 1973 describes several categories of protected status for plants and animals designated by the U.S. Fish and Wildlife Service (USFWS). The regulations are contained in 50 CFR 17. The USFWS has jurisdiction over terrestrial and freshwater species; the NMFS is responsible for any endangered or threatened marine species found in the Study Area. Plants and animals can be listed as endangered or threatened, thereby receiving protection under federal law. Under Section 7 of the Endangered Species Act, any federal agency that is sponsoring or assisting a project must coordinate with the USFWS for a determination of impacts on protected plants and animals. The NYSDEC maintains a list of plant and animal species that are considered rare, threatened, endangered, or of special concern in New York State. Similarly, the NJDEP maintains a list of special status plant and animal species in New Jersey. Resource Agency correspondence regarding listed threatened and endangered species is presented in Appendix H.4.

Fish Species of Concern

Several fish species that may occur in the project area are Species of Concern or Candidate Species. Species of Concern are those species about which NOAA's National Marine Fisheries Service (NMFS) has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (ESA), while Candidate Species are those petitioned species that are actively being considered for listing as endangered or threatened under the ESA, as well as those species for which NMFS has initiated an ESA status review that it has announced in the *Federal Register* (NOAA 2007) Neither "candidate species" nor "species of concern" carries any procedural or substantive protections under the ESA.

In an agency response letter dated November 8, 2004, the NJDEP noted that the Candidate Species Atlantic sturgeon *(Acipenser oxyrinchus)* may potentially be present within the proposed Primary Study Area. Atlantic sturgeon is a long-lived and highly migratory species that spends most of its adult life at sea along the Atlantic coastline from Labrador to Florida. Atlantic sturgeon reach maturity between 12 and 15 years of age before migrating into coastal rivers to spawn every 2-5 years (Everly & Boreman, 1999). Mature males typically enter the Hudson-Raritan estuary starting in April and at least some may remain as late as November (Bain, 1997). Adult females enter the estuary in mid-May and migrate directly to the spawning grounds, which are often deep channel or off-channel habitats, before quickly returning to marine waters (Bain, 1997). In the Hudson River, spawning occurs upstream of the salt-front as larvae are thought to be intolerant of saline environments (Everly & Boreman, 1999).

Atlantic sturgeon eggs are demersal and adhesive, and the larvae remain close to the river bottom for some time (Everly & Boreman, 1999). The first years of life are marked by rapid growth and development with juvenile Atlantic sturgeon typically migrating to marine waters after two to six years of residence in the estuary (Bain, 1997).

Recent surveys in the Arthur Kill indicate that adult and juvenile Atlantic sturgeon are either highly uncommon or non-existent within the proposed Primary Study Area. Atlantic sturgeon eggs and larvae were absent from the Arthur Kill ichthyoplankton samples during the USACE surveys between 1998 and 2005. Atlantic sturgeon was not collected during the USACE's trawl surveys in the Arthur Kill from 1998 through 2005 (USACE 1999, 2002 2003a, 2003b, 2005, 2006) and was not collected during the PANYNJ's 1995-1996 Newark Bay trawl survey (LMS, 1996).

In an agency response letter dated November 8, 2004, the NJDEP noted that the Species of Concern alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) may potentially be present within the proposed Primary Study Area. Termed collectively by fishermen as "river herring" because of the difficulty in distinguishing them, alewife and blueback herring spend most of the year in coastal Atlantic waters before migrating into nearshore rivers and tributaries to spawn in the spring. In general, blueback herring have a more southern distribution than alewife (Mullen et al., 1986). Alewife usually enter the Hudson-Raritan Estuary first, between late-February and mid-May, preferring to spawn in freshwater tributaries in relatively shallow water with a slow current (Everly & Boreman, 1999). Blueback herring usually spawn about a month later and in different habitat, preferring deep freshwater tributaries with swift currents over hard gravel or sand substrates (Everly & Boreman, 1999). The eggs of both species are pelagic and adhesive. Alewife larvae and juveniles remain in their freshwater nurseries until June (bluebacks follow about one month later) before moving downstream into the lower estuary and out into the ocean (Everly & Boreman 1999). Juvenile blueback herring are largely planktivorous, feeding on copepods, chironomids and cladocerans while the juvenile alewife diet is primarily composed of amphipods and chironomids (Waldman, 2006).

No river herring eggs or yolk sac larvae were captured in ichthyoplankton tows during USACE's 1998 through 2005 surveys. Post yolk sac larvae of *Alosa* spp. were collected during June 2001, but they were not identified to species level (USACE 1999, 2002, 2003a, 2003b, 2005, 2006). Larval clupeids were collected during 2000 – 2001 and 2001 – 2003 surveys (USACE 2002, 2003a, 2003b) but were not identified to species. Both alewife and blueback herring were captured in low to moderate numbers at Arthur Kill stations during the USACE's 1998 through 2005 trawl surveys (USACE 1999, 2002, 2003a, 2003b, 2005, 2006). A single alewife was collected in October, and several blueback herring were collected in June/July during the PANY/NJ's 1995-1996 Newark Bay trawl survey (LMS, 1996).

Aquatic Threatened and Endangered Species

In an agency response letter dated November 8, 2004, the NJDEP noted that shortnose sturgeon (*Acipenser brevirostrum*) may potentially be present within the proposed Primary Study Area. The shortnose sturgeon is listed as both a state and federally endangered species. Within the Hudson River, shortnose sturgeon move upriver to spawn in April and May when water temperatures reach 8-9°C (Bain, 1997). Eggs of the shortnose sturgeon are demersal and adhesive with the newly hatched larvae remaining close to the bottom within the deep channels of the river (Everly & Boreman, 1999). After spawning, adults distribute throughout the deepest channels of the estuary to forage on benthic invertebrates. As water temperatures decline in the late fall, adults typically concentrate in a few over-wintering areas near Kingston and Haverstraw Bay (Bain, 1997). Shortnose sturgeon may live up to 70 years (Waldman, 2006).

Recent surveys conducted in the Arthur Kill indicate that shortnose sturgeons are unlikely to occur within the proposed Primary Study Area. Shortnose sturgeon eggs/larvae were not collected from Arthur Kill ichthyoplankton tows during the USACE 1998 through 2005 surveys (USACE 1999, 2002, 2003a, 2003b,

2005, 2006). No shortnose sturgeon were captured in trawl surveys performed by the USACE in the Arthur Kill from 1998 through 2005 (USACE 1999, 2002, 2003a, 2003b, 2005, 2006) or during the PANY/NJ's 1995-1996 Newark Bay trawl survey (LMS, 1996).

The National Marine Fisheries Service (NMFS) has indicated that the loggerhead (*Caretta caretta*), Atlantic (Kemp's) ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and green turtle (*Chelonia mydas*), all listed as state and federally endangered, might be seasonal transients in the vicinity of the Primary Study Area. Juvenile Kemp's ridley and large loggerhead sea turtles regularly enter NY/NJ Harbor during summer and fall. The other two species may also enter the higher salinity areas of the Harbor. Habitat descriptions of these four sea turtles are provided below.

The loggerhead sea turtle is the most abundant sea turtle occurring in the United States (NYSDEC, 2004). Loggerheads forage along the inshore and coastal waters of the Gulf of Mexico, the Florida Keys and north along the eastern seaboard as far as New England. Their primary nesting sites are along the east coast of Florida, with additional sites in Georgia, the Carolinas, and occasionally Virginia. In a few instances, loggerhead nests have been documented along southern New Jersey beaches. Juvenile loggerheads regularly inhabit Long Island Sound and the eastern bays. Some adults can be found along the ocean shore and in New York Harbor. Loggerheads may become stranded on New York City and Long Island beaches during summer migration. (NYSDEC, 2004). The loggerhead turtle was listed as threatened throughout its range in 1970.

Atlantic (Kemp's) ridley sea turtle is the second most abundant endangered sea turtle found in the New York Bight area, occurring from late June into October (NYSDEC, 2004). Adults are found primarily in the Gulf of Mexico, but juvenile and subadult Kemp's ridleys are widely distributed throughout coastal waters of the U.S. from Texas to Maine (Lutcavage and Musick 1985, Keinath et al., 1996). Most nesting by this species is restricted to a 20-mile stretch of Gulf beach near Rancho Nuevo, Mexico. Waters off of Long Island have been identified as critical habitat for Kemp's ridleys ranging in age from two to five years (NYSDEC 2004). Kemp's ridley sea turtles have also been observed in Jamaica Bay (USFWS 2004). The Kemp's ridley was listed as endangered throughout its range in 1970.

Leatherback sea turtles range along the U.S. Atlantic coast from the Gulf of Maine south to east-central Florida. Nesting occurs from Georgia to the U.S. Virgin Islands. Leatherbacks are found in the waters off of Long Island (NYSDEC, 2004) from May through November.

Green turtles are primarily found around the U.S. Virgin Islands, Puerto Rico, and the continental U.S. from Texas to Georgia. Green turtles rarely nest north of Georgia. However, during summer – early fall, juveniles and adults range north to Long Island Sound and the New York Bight (Lutz and Musick, 1996, USFWS, 2004). On Long Island, juvenile green sea turtles can be found entrapped in fishing gear during the summer. The green turtle was listed as endangered in Florida and the Pacific coast of Mexico and threatened throughout the rest of its range in 1978.

Inshore embayments along the eastern Atlantic seaboard appear to provide important foraging habitat for juvenile sea turtles in the summer and into the fall (typically May to November). The occurrence of sea turtles is seasonal in the temperate waters of NY/NJ Harbor. The majority of sea turtles regularly caught in commercial fishing gear (pound nets) in this area are loggerhead and Kemp's ridley turtles as well as a few green turtles. Leatherback and green sea turtles are less likely to occur in the relatively low-salinity waters of the Primary Study Area. There is no nesting activity in NY/NJ Harbor, and the turtles are not year-round residents. As a result, sea turtles are not likely to occur in the Primary Study Area except as occasional seasonal transient individuals.

4.14.3.4 Migratory Birds

The Migratory Bird Treaty Act (16 USC §§703-712, July 3, 1918, U.S. as amended 1936, 1960, 1968, 1969, 1974, 1978, 1986, and 1989), implements the U.S. commitment to four bilateral treaties, or conventions (between the U.S. and Canada, Japan, Mexico and Russia) for the protection of a shared migratory bird resource. Each of the treaties protects selected species of birds and specifies basic closed and open seasons for hunting game birds. The Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase or barter, any migratory bird, or the parts, nests, or eggs of such a bird, except under the terms of a valid permit issued pursuant to federal regulations. Title 50, Section 10.13, of the Code of Federal Regulations (50 CFR 10.13) lists the bird species protected under the Migratory Bird Treaty Act.

4.14.4 Aquatic Communities

In many aquatic systems, primary production is provided by phytoplankton, which are consumed by zooplankton and herbivorous fish and benthos that, in turn, are consumed by carnivorous fish and invertebrates. The water in the Arthur Kill is very turbid, limiting primary productivity by phytoplankton; however, the suspended organic solids and bacteria responsible for this turbidity provide carbon sources for primary consumers. Organic matter originating outside of the Arthur Kill also provides food for primary consumers. Outside sources of organic material in urban aquatic systems have been shown to be linked with runoff from the surrounding terrestrial ecosystem (Howarth et al., 1991; Lints et al., 1992). In the Arthur Kill, inputs of both sediment and carbon come from urban watersheds and wetland complexes such as those surrounding Old Place Creek. The organic carbon entering the system is associated with suspended particulates that are deposited on the bottom sediment and are the food sources for the benthic invertebrates living in the seabed.

The Arthur Kill is part of a larger ecosystem within the New York/ New Jersey Harbor System. There have been extensive biological studies on the fish and the lower trophic communities of the Harbor's ecosystem. Because many of the taxa found in the Arthur Kill are found throughout the Harbor, data from the surrounding area relate to the aquatic ecology of the Study Area.

4.14.4.1 Aquatic Habitats

Marine Subtidal. This community includes areas of the Arthur Kill and Old Place Creek which are below the lowest tide and are permanently covered with water. This community is considered part of the marine ecosystem, as the ambient salinities reflect the surrounding saline waters that are not heavily influenced by groundwater influx or surface runoff. A variety of substrate types occur in the marine subtidal community, including mud, silt, sand, gravel, and bedrock. Some macroalgae may occur in shallow areas with hard substrate, but generally, this community is unvegetated. These substrates, together with the water column, support diverse benthic, epibenthic, and fish assemblages. This community also provides feeding habitat for waterfowl.

Marine Intertidal Mudflats. This community is located on the shoreline of the Old Place Creek marsh. The mudflats extend from the mouth of Old Place Creek southward under the Goethals Bridge. The sediments consist of soft mud and sand mixed with gravel, brick, cobbles, and glass. The mudflats have no rooted or attached (i.e., rockweed, algae) vegetation present. Pilings and pieces of metal are scattered throughout the intertidal area. These objects provide cover for benthic organisms such as mud crabs and polychaetes and habitat for sessile organisms such as barnacles. The flats are exposed twice daily at low tide and provide a feeding area for shorebirds and herons. Much of the intertidal zone in the Arthur Kill tends to be covered by debris, flotsam, and wrack, reducing utilization and availability of this habitat. Mudflats are regulated as wetlands by NYSDEC and are also considered Special Aquatic Sites, in accordance with 40 CFR 230.42 Section 404(6)(i).

Tidal Creek. This community, also part of the marine ecosystem, includes Old Place Creek and its adjacent tributaries. The creek meanders; water exchange to the creek is hastened by a number of interconnected drainage ditches, while its banks are relatively steep and provide a limited foraging area for shorebirds and herons at low tide. There are no rooted aquatic or emergent plants in the lower intertidal area in the creek channels due to the high tidal velocities within the creek and the steep banks. Fish species that were collected in 1994 in the creek included striped bass, Atlantic silverside, and mummichog. Blue crabs were also collected in 1994; recreational crabbing was observed at several access points throughout the summer and early fall of 1994 and during 2004 field surveys. Salinities in the creeks are variable and dependent on tidal action, surface runoff and groundwater infiltration.

4.14.4.2 Phytoplankton

Phytoplankton are microscopic aquatic plants. Phytoplankton sequester carbon, making it available for higher trophic levels. The environmental factors influencing phytoplankton growth are temperature, light, and nutrient availability. Phytoplankton growth is limited to the light-penetrating zone. Some major groups of phytoplankton include:

- diatoms
- blue-green algae
- green algae
- golden-brown algae
- dinoflagellates
- cryptomonads
- microflagellates

The phytoplankton community found in the Arthur Kill is comprised of marine and estuarine species typical in the NY/NJ Harbor System. In the Arthur Kill, phytoplankton production is supplemented by phytoplankton entering through water exchange between Newark Bay and Raritan Bay. Phytoplankton abundances and dominant taxa vary seasonally. In the spring, Cryptophyta (cryptomonads) dominate the algal community (LMS, 1986), while in the fall and winter, the dominant algal group is Chrysophyta (golden algae). The abundance of *Skeletonema costatum*, and other dinoflagellates is continuous throughout the seasons. Green and blue-green algae are abundant in the fall but are minor contributors to the phytoplankton community during other seasons. Highest densities of algae tend to occur during the summer, when numbers are about 800 – 3,000 cells/ml. A second peak occurs during February, and is produced by chrysophytes and pyrrophytes (dinoflagellates) (LMS, 1986).

Engineering, Science, and Technology (EA, 1989), on behalf of Public Service Electric and Gas Company, identified 26 algal taxonomic groups in the Arthur Kill (see Table 1 of Appendix H.1), and found that total phytoplankton density was highest in June. Minimum densities occurred in October at Raritan Bay and the southern portion of the Arthur Kill. Diatoms, cryptophytes and dinoflagellates were seasonally abundant in the Arthur Kill, while non-diatoms were abundant in Raritan Bay (EA, 1989).

4.14.4.3 Zooplankton

Zooplankton are small aquatic animals ranging in size from single-cell protozoa to fish larvae several millimeters in length. Zooplankton link the primary producers with higher trophic level organisms. The zooplankton community is composed of both primary consumers (which eat phytoplankton) and secondary consumers (which feed on other zooplankton). In general, zooplankton have limited mobility and are transported primarily by currents. Zooplankton distribution within the NY/NJ Harbor System is also governed by salinity, temperature and availability of food. Zooplankton are divided into two size classes: microzooplankton (retained in 0.07-0.08 mm mesh) and macrozooplankton (retained in 0.5 mm mesh).

Microzooplankton and macrozooplankton surveys that were conducted for electric generating stations in the Arthur Kill during April, June, August and October 1988 (EA, 1989) identified a total of 22 taxonomic groups (see Table 2 of Appendix H.1). Microzooplankton abundance was highest in April and June. Copepods and barnacle nauplii were the most dominant organisms collected. Microzooplankton abundance was highest in the middle of the Arthur Kill and lowest where the Arthur Kill meets Newark and Raritan Bays, which is probably due to the higher rate of flushing and water exchange in those two areas (EA, 1989).

A total of 44 taxa were collected during macrozooplankton sampling in the Arthur Kill. The most common species were brachyuran crabs, shrimp and on a seasonal basis, the mysid *Neomysis americana* (Table 3 of Appendix H.1). Macrozooplankton abundance was highest in August. Overall, patterns of zooplankton species abundance and composition found in the Arthur Kill were typical for marine and estuarine waters along the northeast Atlantic coast (EA, 1989; Studholme 1988).

4.14.4.4 Benthos

The benthic community consists of a wide variety of small aquatic invertebrates which live burrowed into or in contact with the bottom, such as worms and snails. Polychaetes, oligochaetes, amphipods, crabs, snails, and shellfish feed on the organic soup created by decomposing grasses of the lower and higher marshes and decomposing organic material from runoff (Dreyer and Niering, 1995). Because they are suspension and deposit feeders, benthic organisms cycle nutrients from the sediment and water column to higher trophic levels. The sediment is modified by the benthos through bioturbation and formation of fecal pellets (Wildish and Kristmanson, 1997). Sediment grain size, chemistry and physical properties determine benthic community composition. Benthic organisms can provide information about local environmental conditions because they are slow moving or sedentary, live and feed on the sediment, and cannot avoid exposure. The abundance, diversity, and composition of benthic species and their relative pollution tolerance are indicators of habitat quality.

The benthic communities in the Arthur Kill and Old Place Creek are comparable and similar to those found throughout the NY/NJ Harbor System in areas of similar water quality and sediment type. There have been a number of benthic inventories conducted in the NY/NJ Harbor System, including the Arthur Kill and Old Place Creek, as well as in Newark Bay and Raritan Bay (Studholme 1988; LBA, 1992; LMS, 1996; USCG, 1997). Overall, the benthic community in the Arthur Kill is comprised of polychaete worms, amphipods, and bivalves. Abundance varies seasonally, although polychaete worms generally dominate the benthic community throughout the year. *Streblospio benedicti*, *Scoloplos* sp., and *Phyllodoce arenae* are generally the most abundant polychaete species (see Table 4 of Appendix H.1). Oligochaetes and the cumacean *Leucon americanus* may also be present in high numbers (LMS, 1996).

LMS found that worms (polychaetes and oligochaetes) and isopods were the dominant benthic organisms in Old Place Creek, where bottom sediments are comprised of both sand and clay (USCG, 1997). *Streblospio benedicti*, *Polydora ligni*, and Paraonidae were the most abundant polychaetes; however, their numbers varied seasonally. Oligochaete worms were also abundant in about 80 percent of the samples collected. The isopod *Cyathura polita* and bivalves were present in all samples collected throughout the creek; however, their abundance varied according to sediment type (USCG, 1997). The majority of benthic invertebrate species found in the Study Area are tolerant of highly variable conditions.

Epibenthic Community

Epibenthos include sessile suspension feeders (mussels), free swimming crustaceans (amphipods, shrimp, and blue crabs) and tube-dwelling polychaete worms found in sediments collected around the base of attached organisms (e.g., mussels). The epibenthic community is a highly complex community whose distribution is limited by the amount of hard surface available for settlement, species interactions, and

water exchange rates. In the Study Area, pier piles and bulkheads provide the majority of underwater substrates that can support epifaunal communities. The epifaunal communities living on underwater structures influence the ecology of the nearshore zone. The suspension feeding organisms continuously filter large volumes of water, removing seston (particulate matter which is in suspension in the water) and releasing organic particles to the sediment. This flux of organic particles enriches the infaunal community living in the sediment below piers, through the production of organic particles from feeding, feces and pseudofeces (rejected non-food particles) (Zappala, 2001).

There is little historical published data on the epibenthic community associated with underwater bridge structures in the Goethals Bridge Study Area. However, epibenthic communities living on submerged concrete and steel structures in the NY/NJ Harbor System have been investigated (Zappala, 2001; EEA, 1989). Zappala (2001) investigated the epibenthic community associated with underwater pier structures by scraping pier piles and bulkheads throughout the Upper Bay of the NY/NJ Harbor System. EEA (1989) used concrete blocks as test surfaces to measure colonization of epibenthic organisms at five locations off southern Manhattan and northern Brooklyn. The epibenthic communities in the Arthur Kill and Old Place Creek would be comparable to those found throughout the NY/NJ Harbor System because substrate and salinity are similar. Both studies found that the epibenthic community living on the underwater structures was diverse and comprised of sponges, worms, crustaceans and mollusks. A total of 73 taxa were reported during these studies. Pier pilings and bulkheads were found to support an average of 20 taxa, and concrete test blocks supported an average of 14 taxa (see Table 5 of Appendix H.1). The blue mussel (*Mytilus edulis*) and the slipper limpet (*Crepidula fornicata*) were the dominant mollusks. Crustaceans were abundant and were dominated by *Microdeutopus gryllotalpa*, *Jassa*, *Corophium* and *Caprellid* amphipods. The polychaete, *Polydora cornuta* was the most common worm. The tunicates *Molgula manhattensis* and *Botryllus schlosseri* were also abundant (EEA, 1989).

4.14.4.5 Fish Community

Estuaries are highly productive environments, with about 75 percent of the commercial fish and shellfish species of the United States living in estuaries during some part of their life cycle (Chambers, 1992). Despite its location in a highly urban landscape, the NY/NJ Harbor System estuary is a productive ecosystem that supports 100 or more species of finfish for some portion of their life cycle. A number of fish reside and spawn in the Harbor, while others use the Harbor as a migratory pathway or seasonal residence. Resident fish species, such as winter flounder, use the Harbor throughout the year as feeding, spawning and nursery grounds. Anadromous fish, including striped bass and shad, move through the estuary during their spawning migrations and once hatched, the larvae and juvenile fish spend their first summer in the Harbor System estuarine waters (Able and Fahay, 1998). Northern Atlantic fish populations, such as Atlantic herring, overwinter in the Harbor waters. A number of tropical fish species, transported northward by the Gulf Stream, can be found in the Harbor during summer months.

Several fish community studies have been conducted within the Goethals Bridge Study Area. Fish have been collected from the main channel of the Arthur Kill (LBA, 1992; LMS, 1996; USCG, 1997), the interpier basin on the west shore just south of the existing bridge piers (USCG, 1997), and Old Place Creek (LBA, 1992; USCG, 1997). Overall, the fish species collected in the Primary Study Area were typical of the inshore areas in the New York/New Jersey Harbor System. A total of 24 species were collected in the main channel of the Arthur Kill (see Table 4.14-1). Winter flounder, Atlantic tomcod, weakfish, striped bass, and grubby were the dominant fish species collected. The abundance of these species varied seasonally, especially winter flounder. Species diversity also varied seasonally, with the lowest species diversity occurring in the winter. Eight species were caught in the interpier basin (see Table 4.14-2) (USCG 1997). Atlantic silversides, bay anchovy, and winter flounder comprised most of the catch in this area. Overall, catches in the interpier basin show that this area is of relatively limited use

TABLE 4.14-1
PERCENT COMPOSITION OF FISH SPECIES COLLECTED IN THE ARTHUR KILL

Species	Common Name	% of Total (LBA 1992) [1]	% of Total (LMS 1996) [2]	% of Total (USCG 1997) [2]
Alosa pseudoharengus	Alewife	1		0.9
Alosa sapidissima	American shad			0.3
Anchoa mitchilli	Bay anchovy	7.2	0.9	
Anguilla rostrata	American eel	0.3		
Brevoortia tyrannus	Atlantic menhaden	5.9		
Cynoscion regalis	Weakfish	31.2	0.9	3.3
Dorosoma cepedianum	Gizzard shad			0.3
Fundulus heteroclitus	Mummichog	0.2		
Leiostomus xanthurus	Spot	13	0.9	
Menidia menidia	Atlantic silverside			0.3
Microgadus tomcod	Atlantic Tomcod	25.1	12	7.6
Morone americana	White perch		8	2.4
Morone saxatilis	Striped bass	0.5	11	8.7
Myoxocephalus aenaeus	Grubby		13	6.9
Peprilus tricanthus	Butterfish	0.7		
Pomatomus saltatrix	Bluefish	0.3		
Prionotus evolans	Striped searobin	1		
Pseudopleuronectes americanus	Winter flounder	6.4	39	67.1
Scopthalmus aquosus	Windowpane	4.6	2	
Sphoeroides maculatus	Northern Puffer	0.2		
Syngnathus fuscus	Northern Pipefish	0.2		0.9
Tautogolabrus adspersus	Cunner			0.6
Trinectes maculatus	Hogchoker	0.2		
Urophycis regia	Spotted Hake	1.8	12	0.9
	Total number of fish collected	613	350	331

Notes: [1] Fish were collected using a gill net, a double-ended minnow trap and an otter trawl
[2] Fish were collected using a flat bottom otter trawl
Source: LBA, 1992; LMS, 1996; USCG, 1997.

TABLE 4.14-2
PERCENT COMPOSITION OF FISH SPECIES COLLECTED IN THE INTERPIER BASIN

Species	Common Name	% of Total (USCG 1997) [2]
Alosa sapidissima	American shad	1.7
Anchoa mitchilli	Bay anchovy	25.9
Leiostomus xanthurus	Spot	3.4
Menidia menidia	Atlantic silverside	36.2
Morone saxatilis	Striped bass	10.3
Pomatomus saltatrix	Bluefish	3.4
Pseudopleuronectes americanus	Winter flounder	17.2
Syngnathus fuscus	Northern Pipefish	1.7
	Total number of fish collected	58

Notes: [2] Fish were collected using a trap net, a minnow trap and a bottom trawl
Source: SIBP, 1997.

to most fish species in comparison with the Arthur Kill channel. Fish may use the interpier basin on a limited basis either for protection from predators and water currents or as a foraging area.

A total of 12 fish species were collected from Old Place Creek (see Table 4.14-3) (LBA, 1992; USCG, 1997). Fish use of Old Place Creek seems to be limited, relative to the Arthur Kill, as catches consisted of small numbers of just a few species. The striped mullet and the striped killifish were the only species collected in Old Place Creek that were not collected in the Arthur Kill, while mummichogs dominated the catches in Old Place Creek. Among the abundant species present, the mummichog is one of the few species that remains in the Goethals Bridge Study Area throughout its life cycle (USCG, 1997).

The Arthur Kill and Old Place Creek provide resident and transient fish populations with spawning, nursery, over wintering and foraging habitats. Old Place Creek has vegetated shorelines consisting of cordgrass and *Phragmites,* which may provide spawning and feeding habitat for several estuarine fish species and shelter for larval and juvenile fish.

TABLE 4.14-3
PERCENT COMPOSITION OF FISH SPECIES COLLECTED IN OLD PLACE CREEK

Species	Common Name	% of Total (LBA 1992) [1]	% of Total (USCG 1997) [2]
Anchoa mitchilli	Bay anchovy		2
Anguilla rostrata	American eel		0.7
Fundulus heteroclitus	Mummichog	74	85
Fundulus majalis	Striped Killifish	2	
Leiostomus xanthurus	Spot		0.7
Menidia menidia	Atlantic silverside	2	1.2
Microgadus tomcod	Atlantic Tomcod	9	
Morone americana	White perch		4
Morone saxatilis	Striped bass	2	5
Mugil cephalus	Striped Mullet	2	
Pomatomus saltatrix	Bluefish		0.7
Pseudopleuronectes americanus	Winter flounder	9	0.7
Total number of fish collected		53	170

Notes: [1] Fish were collected using a gill net, a double-ended minnow net and an otter trawl
[2] Fish were collected using a trap net, a minnow trap and a bottom trawl
Source: SIBP, 1997.

4.14.4.6 Marine Mammals

Several species of small marine mammals occasionally venture into the Arthur Kill. The bottlenose dolphin (*Tursiops truncatus*), harbor porpoise (*Phocoena phocoena*) and harbor seal (*Phoca vitulina*) have been sighted in the Arthur Kill in recent years (Tursiops.org 2006; NYSCEC 2006; NOAA 2006; NJAS 1990). Based upon these sightings, it appears that these species are most likely to be present in the area during the winter. All marine mammals are protected under the Marine Mammal Protection Act (MMPA) of 1972 (16 USC Chapter 31). The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. “Take”, as defined under the MMPA means to "harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect".

4.14.5 Terrestrial and Wetland Communities

Over the last 200 years, the vegetation of the Goethals Bridge Study Area has been altered by human activities, including upland clearing, wetland ditching and filling, residential and industrial development, introduction and spread of invasive species (including royal paulownia, common reed, poison ivy, and fire cherry), obstructions of surface water movement, and other less physically intrusive disturbances such as noise from airports and automobile traffic. Industrial development has increased the potential for spills of industrial fuels and chemicals and illegal dumping, which can damage the environment by causing destruction of habitat and loss of species. These actions have directly or indirectly changed and shaped the historical ecological communities to their present state.

Although much of this area has been subject to heavy industrialization and urban use, portions of this Study Area have remained open areas, dominated by tidal salt marshes and creeks. These natural areas provide habitat for blue crabs and mussels as well as providing nursery areas for fish and forage for wading birds. Portions of the wetlands in the Study Area have been replanted and restored by the New York City Department of Parks and Recreation's (NYCDPR) Salt Marsh Restoration Team (SMRT). This effort focused on restoring low salt marsh areas on publicly-owned lands along the western shore of Staten Island and on the islands in the Arthur Kill and Kill Van Kull that were impacted by the January 1, 1990 Exxon oil spill (approximately 567,000 gallons of No. 2 heating oil). In total, two NYCDPR marsh restoration sites are located within the Primary Study Area, one along the eastern bank of the Arthur Kill south of Old Place Creek, which is called the Old Place Creek Marsh Site, and the other at the mouth of Old Place Creek, which is called the Old Place Creek Inlet Site. These sites are discussed in greater detail in Section 4.14.5.4

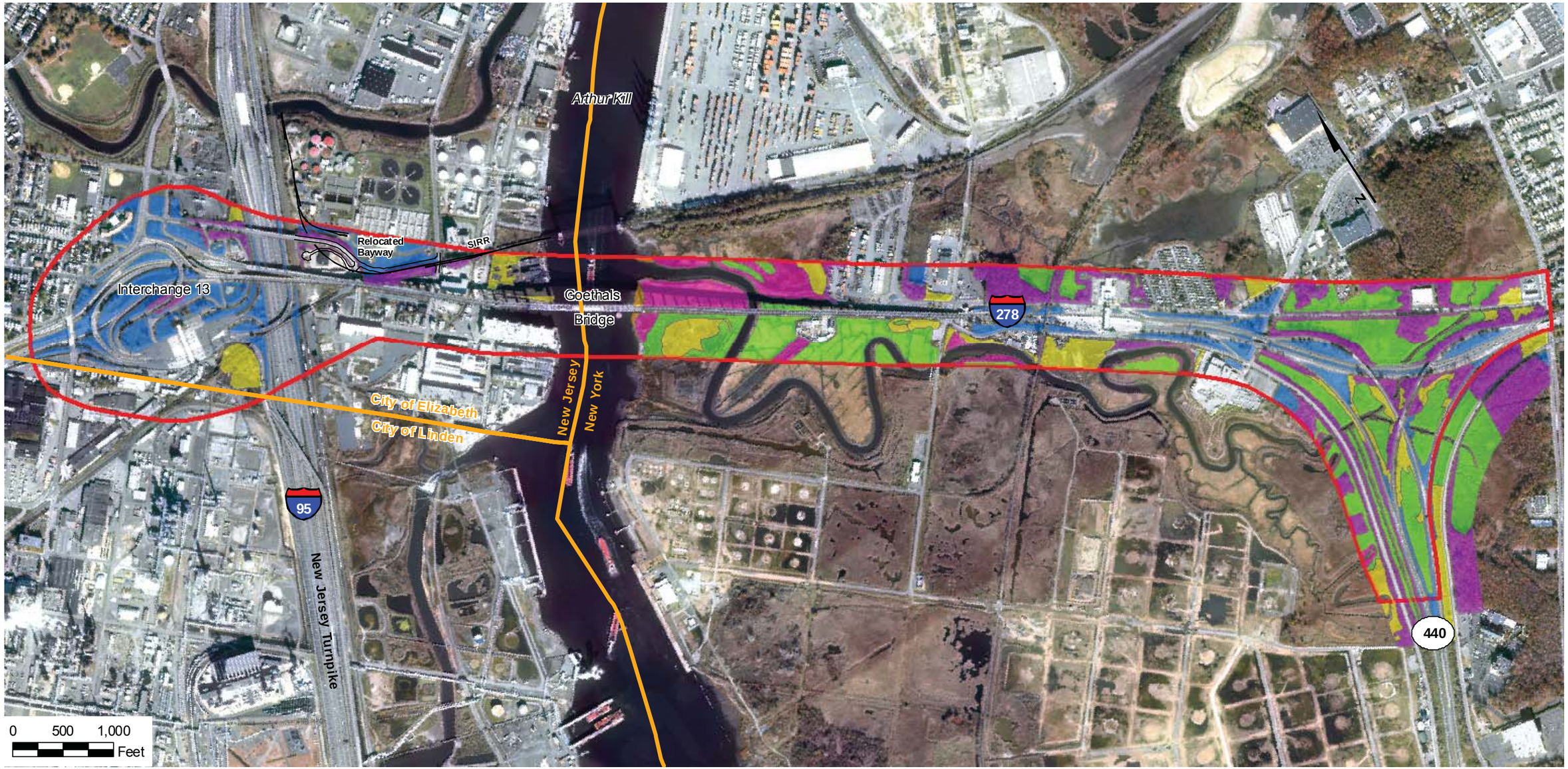
In addition, the U.S. Army Corps of Engineers (USACE), in association with the Port Authority, is proceeding with the restoration of an intertidal salt marsh site at the former Brooklyn Union Gas site (a.k.a. BUG site) on Staten Island, which is now occupied by KeySpan. The BUG site was selected as a restoration project in order to mitigate for unavoidable impacts resulting from the dredging and deepening of the Arthur Kill Channel in the NY/NJ Harbor. This $5.3 million project was awarded to a contractor in late 2005 and was completed in 2006. This site is also discussed in greater detail in Section 4.14.5.4.

Additional wetland restoration sites are also located in or around the Goethals Bridge Primary Study Area. These sites are also discussed in greater detail in Section 4.14.5.4.

The defined communities, although influenced by human development and/or invasion by non-native plant species, support a variety of plant species and provide habitat for area wildlife. Each community and its dominant vegetation, observed alterations, and dominant wildlife are described below. Locations of each community within the Primary Study Area are depicted in Figure 4.14-5.

4.14.5.1 Vegetative Habitats

High Salt Marsh. This community is found east of the Arthur Kill north and south of the Goethals Bridge, encompassing a zone above the mean high tide line up to the limit of spring or storm tides. The high salt marsh and low salt marsh are considered by NYSDEC (2002) to be part of the estuarine ecosystem as the salinities are highly variable, being dependent on tidal exchange, groundwater influx, and surface runoff. An area several acres in size north and east of the berm that is located north of Old Place Creek features a dense growth of saltmeadow cordgrass (*Spartina patens*) with several dense stands of common reed also present (see Figure 4.14-5). Table 6 of Appendix H.1 identifies plant species observed in the Primary Study Area. Several unvegetated, open-water pockets are present within the high marsh. Dominant wildlife observed included the marsh wren, and fiddler crab, both of which are associated with high salt marsh communities.



Legend

Primary Study Area

Ecological Communities

- High Salt Marsh
- Low Salt Marsh
- Mud Flat
- Mowed Lawn
- Reedgrass/Purple Loosestrife Marsh
- Successional Shrubland
- Urban Non-native Forest

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.14-5
Ecological Communities

United States Coast Guard

Dominant vegetation elsewhere in the high marsh includes saltmeadow cordgrass, spike-grass, black-grass, spearscale, and marsh elder. Areas where the marsh elder is dominant (at the upper edge of the extreme tidal range) resemble the salt shrub community. Large expanses of the high salt marsh have been invaded by monocultures of *Phragmites*.

Low Salt Marsh. This community occurs adjacent to Old Place Creek and its tributaries and adjacent to the Arthur Kill in the Study Area. This community is represented by a dense monoculture of saltmarsh cordgrass (*Spartina alterniflora*) that is either completely or partially inundated at high tide. The community ranges from a narrow (10 to 20 foot) band parallel to the tidal creek and down-gradient from the high salt marsh to a broad, level plain along portions of the Arthur Kill. Down-gradient growth appears limited by the steep banks of the tidal creeks, and up-gradient expansion is prevented by the dense, tall (9 to 12 feet) monoculture of *Phragmites*. Herons and egrets feed in the low salt marsh and fiddler crabs are often present in the marsh sediments. Wetland restoration efforts have been undertaken adjacent to Old Place Creek to increase the size and value of the low salt marsh. The Primary Study Area contains four wetland restoration sites, which are described in detail in Section 4.14.5.4.

Estuarine Riprap/Artificial Shore. This community exists along the west shore of the Arthur Kill, both north and south of Goethals Bridge and along the interpier basin located immediately to the south of the Goethals Bridge along the New Jersey shore. This community includes areas of constructed shoreline where the substrate is composed of broken rocks and construction debris (i.e., concrete) or the shoreline has been bulkheaded to prevent erosion. This community is sparsely vegetated and has low species diversity. (Estuarine Riprap does not appear on Figure 4.14-5 because it is too small to map at the scale of the figure.)

Phragmites/Purple Loosestrife Marsh. This wetland community consists of freshwater wetland areas located in New Jersey. This wetland community includes those areas typically created and maintained by human activities or which have been modified such that the composition of the resident community is substantially different from what may have previously existed. These small (less than 1 acre) wetlands are located in roadside depressions created during highway construction and are subject to stormwater runoff from adjacent roadways. This community exists both east and west of the New Jersey Turnpike. The wetlands have been disturbed by filling and dumping and are dominated by monoculture stands of *Phragmites*. These wetland areas are isolated from other water sources.

Mowed Roadside/Pathway. This community is found in 5- to 40-foot-wide strips parallel to highways and secondary roads, including the median strip of some of the divided highways. This is a "culturally-influenced" community; the plant species present and their coverage have been and continue to be influenced by human activities. Dominant vegetation observed includes timothy, goldenrod, mugwort, *Phragmites*, and seedlings of tree-of-heaven, mulberry, and black locust. The highway medians may be mowed weekly during the growing seasons, whereas the borders of some of the secondary roads may be mowed annually. Dominant wildlife in this community includes birds tolerant of human disturbance, such as European starling, house sparrow, mockingbird, house finch, and mourning dove. This community is generally bordered by high marsh or successional shrubland in the Primary Study Area.

Urban Vacant Lot. This community consists of recently cleared or disturbed areas on both the New York and New Jersey sides of the Arthur Kill where soils have been disturbed (coal cinders are often a major soil constituent). Vegetation consists of tolerant, often introduced, species. Vegetation is present in scattered patches, offering little cover for wildlife, particularly in winter. Garbage and debris items are present in the vacant lots/fields. Typical plant species include goldenrod, mugwort, raspberry, Asian bittersweet, pokeweed, and saplings of royal paulowina, mulberry, tree-of-heaven, and black locust. Typical wildlife observed includes mourning dove, northern mockingbird, European starling, American kestrel, and field sparrow. See Section 4.11.5 for further discussion of Urban Vacant land and Figures 4.11-2a/b for a depiction of the Urban Vacant land.

Urban Non-native Forest. This community is not listed by NYSDEC. The description is used for the forested areas adjacent to and on the railroad grade north of the existing bridge in New York. It also applies to several isolated wooded patches on the New York side of the Primary Study Area. These forested areas are characterized by a moderate to dense growth of non-native trees, including mulberry, tree-of-heaven, Norway maple, and royal paulownia. The trees range from 20 to 40 feet in height and up to one foot in diameter. The trees provide cover for birds such as American robin, northern mockingbird, mourning dove, and ring-necked pheasants. The mulberry provides a seasonal food supply for birds. Soils in this habitat consist of miscellaneous fill composed of gravel and coal cinders.

Successional Shrubland. This community is found adjacent to some of the roadsides and formerly cleared areas in New York. Succession has progressed past the vacant lot/mowed roadside community and could be expected to progress to the urban non-native forest if left undisturbed. The community is defined as having at least a 50 percent cover of shrubs; pockets of goldenrod and mugwort are also present. Common shrubs include sumac, multiflora rose, Russian olive and raspberry. This community provides nesting habitat and a seasonal food source for passerine birds. The sumac and Russian olive provide a winter food source for species such as the dark-eyed junco, chipping sparrow, European starling, and yellow-rumped warbler.

4.14.5.2 Summary of Ecological Communities

The tidally-influenced communities appear relatively stable with respect to plant succession and wildlife use. One ongoing impact on the marsh communities is the spread of *Phragmites*, which reduces plant diversity and, potentially, wildlife use of a given habitat. Two human-related effects on the tidal community are the effects of boat wakes and oil spills.

Despite prior disturbance, the uplands and wetlands provide food, cover, nesting, and resting habitat for the resident mammals and birds as well as birds that utilize the Arthur Kill as a migratory corridor. Many of the bird species common in the area are tolerant of some degree of human presence/disturbance and are "generalists" with regard to habitat requirements, i.e., they are able to utilize several of the habitats present for feeding, cover, and so on. However, several habitat-specific species are also present that utilize only one of the described habitats. An example is the marsh wren, which is specific to the dense stands of *Phragmites* in the high marsh community.

The wildlife value of the existing communities is enhanced by their interconnected nature. North of the Goethals Bridge, the intertidal marsh merges with the high marsh, which then merges with the upland non-native forest. This mosaic of communities increases the amount of "edge" between habitats, increasing utilization opportunities for habitat-specific and generalist wildlife species.

In addition to the mosaic of community types in the Study Area, the proximity of Goethals Bridge Pond adds to the value of existing communities by providing additional foraging grounds and habitat. The pond is located north of the existing Goethals Bridge toll plaza. The pond is a permanent, but seasonally fluctuating freshwater (or slightly brackish) pond that is fed primarily by groundwater seepage and run-off (USCG, 1997). Goethals Bridge Pond is a New York State Department of State designated Significant Coastal Fish and Wildlife Habitat. The fish and wildlife habitat is approximately 50 acres centered around a large, shallow pond with a well-developed fringe of emergent wetland vegetation. The pond is one of the only known breeding sites for pied-billed grebe and American coot in the New York City-Long Island region. It also offers important breeding habitat for migratory birds (NYSDOS, 2004). It offers shallow water foraging habitats in close proximity to islands with suitable nesting habitat, and minimal disturbance from humans and predators.

4.14.5.3 Regulated Wetlands

Wetlands dominate the Primary Study Area east of the Arthur Kill in Staten Island but are limited in New Jersey west of the Arthur Kill. Table 4.14-4 contains a summary of delineated wetlands within the Primary Study Area.

TABLE 4.14-4
SUMMARY OF DELINEATED WETLANDS WITHIN THE PRIMARY STUDY AREA

Location	Wetland Line	Size (Acres)	Wetland Cover Type(1)	Comments
NY	A, D, C (LESS I & J)(2)	55.8	E1UBL, E2EM1N, E2EM1Pd	Tidal wetland associated with Old Place Creek & Arthur Kill; north, south and under the Goethals Bridge.
	B, E, F	14.49	E1UBL, E2EM1Pd	Tidal wetland associated with Old Place Creek; south and east of the Goethals Bridge
	G	1.01	E2EM1N6	Tidal wetland north of Port Authority Tunnels, Bridges & Terminals Department building (i.e. Goethals Bridge Pond)
	H	0.95	E2EM5P6	Tidal wetland west of Travis Branch of the Staten Island Railroad Company (west of the Goethals Bridge Pond)
NJ	K	0.01	PEM1	Isolated wetland, NJ Turnpike Area
	L	0.18	PEM1	Isolated wetland, NJ Turnpike Area
	M	0.04	PEM1	Isolated wetland, NJ Turnpike Area
	N	0.28	PEM1/PSS1	Isolated wetland under Goethals Bridge in New Jersey; adjacent to the Conrail Chemical Coast Secondary Line railway.
NY	O	--	E1UBL	Bulkhead along Arthur Kill under Goethals Bridge in New Jersey.
	P	5.19	E2EM5P	Tidal wetland connected by culvert under Goethals Road North to Wetland R
	Q	6.34	E2EM5P	Tidal wetland connected by culvert under Gulf Avenue to Old Place Creek
	R	4.97	E2EM5P	Tidal wetland connected by culvert under I-278 to Wetland T
	S	3.45	E2EM5P	Tidal wetland connected by culvert under Route 440 to Wetland Q
	T	3.24	E2EM5P	Tidal wetland connected by culvert under Route 440 to Wetland Q

Notes:
(1) Classification of wetlands based on field examination following Cowardin (1984).

E1UBL	Estuarine, Subtidal, Unconsolidated Bottom, Subtidal water regime
E2EM1N	Estuarine, Intertidal, Emergent, Persistent, Regular water regime
E2EM1Pd	Estuarine, Intertidal, Emergent, Persistent, Irregular water regime, partially drained/ditched
E2EM1P	Estuarine, Intertidal, Emergent, Persistent, Irregular water regime
E2EM5P	Estuarine, Intertidal, Emergent, Narrow-leaved Persistent
E2EM5P6	Estuarine, Intertidal, Emergent, Narrow-leaved Persistent, Oligohaline
PEM1	Palustrine, Emergent, Persistent
PSS1	Palustrine, Scrub-shrub, Broad-leaved Deciduous

(2) Areas I & J are upland islands adjacent to Old Place Creek & Arthur Kill, created by apparent placement of dredged material.
(3) Source: 1994 Union County, New Jersey Soil Survey. USDA; unpublished NYC Soil Survey, USDA.
Source: Berger/PB, 2006.

The intertidal marsh is defined as a vegetated tidal wetland zone lying generally between the average high and low tidal elevations. The area is generally inundated twice daily by the high tide. The high marsh is defined by NYSDEC as the uppermost tidal wetland zone; periodically floatable (styrofoam, plastic) garbage generally marks the uppermost limit of the high marsh in the Primary Study Area. The line between the high marsh and intertidal marsh is less distinct, and is generally represented by a band 5-30 feet wide (dependent on slope) in which the density and vigor of the dominant high marsh plants, such as common reed (*Phragmites australis*), saltmeadow cordgrass (*Spartina patens*), groundsel-bush (*Baccharis halimifolia*) and marsh elder (*Iva fruescens*) increase as the size and vigor of the dominant intertidal marsh plant, saltmarsh cordgrass (*Spartina alterniflora*), decreases.

Because of its low elevation and proximity to the tidal Arthur Kill, no freshwater wetlands were identified within the Primary Study Area in Staten Island.

Regional Wetlands Surrounding the Goethals Bridge

Beyond the Primary Study Area, wetlands consist of tidal wetlands that are associated with the open waters of the Arthur Kill, Newark Bay, and Upper New York Bay. Regional tidal wetlands include several creeks and tidal marshes along the Arthur Kill, north and south of the Goethals Bridge.

To the north of the Goethals Bridge in New Jersey, the area is developed primarily for industrial use. The Elizabeth River enters the Arthur Kill northwest of the Goethals Bridge and is urbanized at its outlet. Fringe tidal marsh along the Elizabeth River exists upstream of its outlet. North of the Elizabeth River along the Arthur Kill, bulkheads and fill extend to Newark Bay.

To the south of the Goethals Bridge in New Jersey is Morses Creek, whose outlet to the Arthur Kill contains bulkheads and piers for docking cargo ships. Upstream of Morses Creek's outlet, the water's edge contains tidal marshes similar to those of Old Place Creek. South of Morses Creek is a small tributary to the Arthur Kill, known as Piles Creek. Similar to Morses Creek, the Piles Creek outlet contains a bulkhead or fill at its water's edge and fringe tidal wetlands upstream of the outlet. South of the Goethals Bridge, the Arthur Kill shoreline along the New Jersey side is dominated by bulkheads, shipping piers and fill.

On Staten Island, north of the Goethals Bridge and Old Place Creek outlet, is the bulkhead of Howland Hook Marine Terminal. North of the terminal is Howland Hook which contains a small tributary and associated tidal wetlands that discharges to the Arthur Kill. Beyond Howland Hook is Newark Bay, into which piers and tidal wetlands extend from Staten Island.

South of the Goethals Bridge are the Pralls and Sawmill Creeks. Pralls Creek separates Staten Island from Pralls Island, which contains tidal wetlands. East of Pralls Island is Sawmill Creek, containing a network of tidal ditches flowing from the tidal wetlands along the sides of Pralls Creek.

New Jersey

Freshwater Wetlands - Within the Primary Study Area, four (4) small (approximately one acre or less) freshwater wetland areas (Wetlands K, L, M and N) exist within the Goethals Bridge corridor west of the Arthur Kill (see Figure 4.14-1a). Water exiting these wetlands flows into stormwater collection systems/street drains prior to discharge into the Arthur Kill. There is no surface water connection between these wetlands and the Arthur Kill. Three (3) wetlands (Wetlands K, L and M) are located west of the New Jersey Turnpike within the vicinity of Interchange 13; the fourth wetland (Wetland N) occurs east of the New Jersey Turnpike between the Goethals Bridge and the railroad bridge. These small wetland areas are not shown as wetlands on the USFWS National Wetlands Inventory mapping, nor on the NJDEP Wetland Mapping. These wetlands are, however, regulated under the jurisdiction of the

NJDEP. This entire area is highly developed with commercial and residential uses and transportation facilities.

Dominant vegetation within the freshwater wetlands consists of a monoculture of common reed. Other species present include: winged sumac, Japanese honeysuckle, mugwort, dogbane, and grass. Soils were observed to be a disturbed gravely, sandy loam, containing low chroma values, and were found to be saturated. Standing water was present within the depressional area of Wetland N.

Tidal Wetlands - There are no tidal wetlands in the New Jersey portion of the Primary Study Area.

Staten Island

Freshwater Wetlands - There are no freshwater wetlands in the New York portion of the Primary Study Area.

Tidal Wetlands - Wetlands east of the Arthur Kill consist of a mixture of tidal creeks, intertidal marsh, and high marsh. The intertidal marsh consists of a dense monoculture of saltmarsh cordgrass that is either completely or partially inundated twice daily by high tides. The soil consists of saturated organic muck and peat stabilized by the cordgrass roots and rhizomes. The high marsh consists of a mixture of common reed, saltmeadow cordgrass, spike-grass, black-grass, spearscale, and marsh elder that is periodically inundated by spring or storm tides. Descriptions of the plant communities found in the Old Place Creek complex are discussed in Section 4.14.5, Ecological Communities. The soil consists of wet organic loam and peat.

Tidal wetlands associated with Old Place Creek (Wetlands A, B, C, D, E and F) cover much of the Primary Study Area (see Figure 4.14-1b). Historically, several tidal ditches were dug to drain the wetlands to the creek. The tidal ditches speed the exchange of water from the intertidal marsh to the Arthur Kill. The majority of the ditches are completely exposed at low tide, while the bed of Old Place Creek remains inundated.

Recreational use of these wetlands appears to be limited to crabbing at several access points along Old Place Creek. Human access to the wetland for other activities (hiking, bird watching) is limited; security fences, ditches, soft sediments, and dense stands of common reed prevent or hinder access. The restricted access has also eliminated the amount of dumping (e.g., appliances, tires) in and adjacent to the wetlands. Where the wetlands or streams are accessible (i.e., bridges, fence breaks), dumping is evident.

The coastal shoal areas contain degraded mudflats as the edge of the intertidal marsh is moderately to severely eroded by wave action. In 1993, an area south of the bridge in New York was fenced and planted with saltmarsh cordgrass plugs. A large amount of driftwood and other debris has been deposited in this portion of the intertidal marsh. During storm events and spring tides, this debris is moved by the waves and high water, often digging into the substrate and destroying the plants. As the high water subsides, the debris is deposited on the intertidal marsh, where it smothers additional vegetation. The dominant vegetation in the intertidal marsh is saltmarsh cordgrass. Other species of vegetation observed at the edge and within the intertidal marsh include glasswort, spearscale, and rockweed. Rockweed is limited to rocky shorelines and was observed along the bulkhead and rocky shoreline in the area of the Arthur Kill Lift Bridge.

Intertidal marsh constitutes most of the tidal wetlands located between Old Place Creek and the railroad berm, including those mapped by NYSDEC as formerly connected wetlands (see Figure 4.14-3). Barriers that originally separated these wetlands from daily inundation have been breached, and water is exchanged during every tidal cycle. The berm that served as the barrier, along with several other slightly elevated areas within this zone, is characterized as upland.

Intertidal marsh forms a strip that ranges from approximately 150 to 300 feet in width along the south side of Old Place Creek. The remainder of the wetlands between I-278 and Old Place Creek is high marsh. Vegetation in the high marsh includes saltmeadow cordgrass, spike grass, black grass, and common reed. Saltmeadow cordgrass and black grass are the native dominant species in the area. Common reed is an invasive species that has replaced the native species in much of the high marsh wetlands in the upper reaches of Old Place Creek (adjacent to Gulf Avenue and roadway areas), resulting in a common reed monoculture. However, high marsh areas dominated by saltmeadow cordgrass still remain in areas adjacent to the Arthur Kill and Old Place Creek. Marsh elder is common in the high marsh. Red-winged blackbirds and marsh wrens were the dominant birds observed during the site visits.

The tidal wetlands north of the Goethals Bridge, between the bridge and the Travis Branch of the Staten Island Railroad Company railroad berm, cover an area of approximately 107 acres in size. These wetlands are contiguous with approximately 185 acres of similar wetlands that lie south of the Goethals Bridge and I-278 within the Primary Study Area. Together, they provide for approximately 292 acres of wetland/open water habitat in the midst of a highly urbanized area.

Wetland Functions and Values

The functions and values of the wetlands within the Primary Study Area were identified using a descriptive methodology, developed by the U.S. Army Corps of Engineers, New England Regulatory Division (USACE, 1995) for use with highway planning and engineering and the National Environmental Policy Act (NEPA). The method considers eight wetland functions and five wetland values that are part of the USACE's Section 404 wetland permit process (see Table 1 of Appendix H.3). A number of function-specific considerations (ranging from eight to 32, depending on the function or value) are used to identify whether the function or value is occurring within the wetland. Once identified, the dominant or principal functions are determined. Functions and values are considered principal if they are an important physical component of a wetland ecosystem, and/or are considered of special value to society, from a local, regional, and/or national perspective (USACE, 1995). Identifying dominant wetland functions within a given wetland complex can be used to guide future mitigation efforts to replace those functions lost or diminished as a result of construction activities.

The wetland function-value evaluation forms were prepared using field notes, site photographs, wetland maps, prior site investigations, and additional information (e.g., NYCDPR SMRT data) to identify wetland functions and values of the wetland areas in the Primary Study Area (data forms are provided in Appendix H.2). Each form identifies which function(s)/value(s) occur, listing the components of the wetland function(s)/value(s), and identifying the principal function(s)/values(s) present. Comments were also included citing specific reasons (e.g., sightings of threatened or endangered species) why each function or value is or is not performed by the wetland. The functions and values identified for wetlands in the Primary Study Area are summarized below and discussed in detail in Appendix H.3.

Habitat. The principal observed and documented function of the Primary Study Area wetlands is habitat for resident and migratory wildlife. This is particularly true of the intertidal marshes. These marshes, where dominated by saltmarsh cordgrass, provide high-quality wildlife habitat that includes a good food supply, access to open water, and nesting areas for wading and shorebirds. The value of some of the high marsh areas has been diminished by the invasion of common reed that has replaced the saltmeadow cordgrass. Where this replacement has become a monoculture, the area's diversity and richness is reduced. Because these tidal wetlands have a channel network, the portions below mean high water provide valuable habitat to aquatic organisms. Areas between the mean high tide and the spring tide marks are also valuable because they export biomass to support fish and invertebrates such as mummichogs, Atlantic silversides, sand shrimp, and blue crabs.

Water Quality. Another function of the Primary Study Area wetlands is the assimilation and storage of runoff from roadways, parking lots, and other impervious surfaces. Typical constituents of stormwater

runoff include metals, bacteria, chlorides (from road salt), suspended solids, and petroleum hydrocarbons (LIRPB, 1982). Metals and petroleum hydrocarbons typically absorb onto organic matter or clay; suspended solids are filtered and retained by plant detritus, stems, and leaves. Chlorides are typically flushed through the wetland by tidal action and tidally influenced fluctuations in the water table. Nutrients are assimilated by wetland vegetation during the active growing season.

Flood Attenuation. Other functions performed by these wetlands include providing flood storage and flood-flow alteration, sediment stabilization, water quality enhancement, recreation, and an aesthetically pleasing area in this urban setting (see Section 4.12.4). The Old Place Creek wetland complex provides the largest contiguous expanse of vegetation within the Primary Study Area, to the north or south as viewed from the existing bridge. The value of the flood storage and flood-flow alteration function of these wetlands is low to moderate. The wetland complex also functions in human food production directly, as it supports young-of-the-year of commercially valuable species (striped bass and bluefish) and indirectly, as it supports several species of forage fish (mummichog, bay anchovy, Atlantic silverside) that are a food source for commercially valuable species.

Education/Recreation. The Old Place Creek wetland also functions as a site for education and research due to the ongoing wetland creation and restoration effort currently being conducted by the NYCDPR salt marsh restoration team (SMRT). The Primary Study Area was subjected to oil spills in 1990 and 1991. Old Place Creek and the adjacent intertidal wetlands were categorized as areas of "high impact" (defined as "heavily oiled areas containing free product, mousse and/or emulsions") as a result of the oil contamination. The information gathered in the restoration process is valuable and can be applied to similar restoration efforts. However, site access limitations and security requirements pose significant constraints to public use of this area.

Nutrient Retention. Water quality enhancement functions include sediment stabilization and retention of sediments, toxicants, and nutrients. Because the Old Place Creek wetlands are well vegetated, they trap sediments and chemical contaminants, deposit them, and either bury or incorporate them in plant tissue, effectively removing contaminants from the water column. Similarly, wetland vegetation removes nutrients from the water column during the growing season, thus moderating the amount of nitrogen and phosphorus in the water column. This reduces algal blooms and the attendant sags in dissolved oxygen that adversely affects fish communities.

The size, configuration, and diversity of these wetlands enhance their function as habitat despite the invasion by common reed. The New York State Department of State, Division of Coastal Resources recognizes the Goethals Bridge Pond as “Significant Coastal Fish and Wildlife Habitat in New York”. The U.S. Fish and Wildlife Service has designated the Howland Hook/Goethals Bridge wetlands as priority wetland sites under the federal Emergency Wetlands Resources Act of 1986. This indicates that the wetlands community is becoming more diverse for wildlife as environmental cleanup and wetland mitigation continue along the Arthur Kill.

4.14.5.4 Wetland Restoration/Preservation Sites

Wetland Restoration Sites

As noted previously, wetland restoration efforts have been undertaken adjacent to Old Place Creek to increase the size and value of the low salt marsh (see Figure 4.14-6). Four restoration sites are included in the Primary Study Area, including two sites by NYCDPR, one by USACE, and one by the Port Authority. The larger NYCDPR site is located south of Goethals Bridge adjacent to the Arthur Kill, and is called the Old Place Creek Marsh Site. This site was initially planted with saltmarsh cordgrass seedlings and transplants from adjacent existing marsh in the spring of 1993. Additional seedlings and transplants were added to the site during the late summer and fall of 1993. These plantings, however, did not survive the first winter, likely due to the timing of the planting (C. Alderson, personal

communication). The area was subsequently replanted in the spring of 1994 (NYCDPR, 1994). Following the 1994 plantings, the restoration effort was successful, achieving 66% survival of seedlings and 80% survival of transplants by 1996 (Bergen et al. 2000). The fringes of the restored marsh along the Arthur Kill have eroded slightly since the restoration effort, but overall, the low marsh remains a functioning ecosystem that provides habitat for wildlife (C. Alderson, personal communication).

The smaller NYCDPR restoration site, which is called the Old Place Creek Inlet Site, is located along the northern banks of Old Place Creek at its mouth, which is just north of the Goethals Bridge. This site was planted with saltmarsh cordgrass during the spring of 1994. The NYCDPR-SMRT has reported success in most of their restoration efforts with only minimal plant mortality (NYCDPR, 1994). The restoration effort has been quite successful in areas of the marsh not exposed to ship wakes and wind-generated waves. Some planted areas of low marsh adjacent to the Arthur Kill appear to be heavily scoured by tidal action and boat wakes.

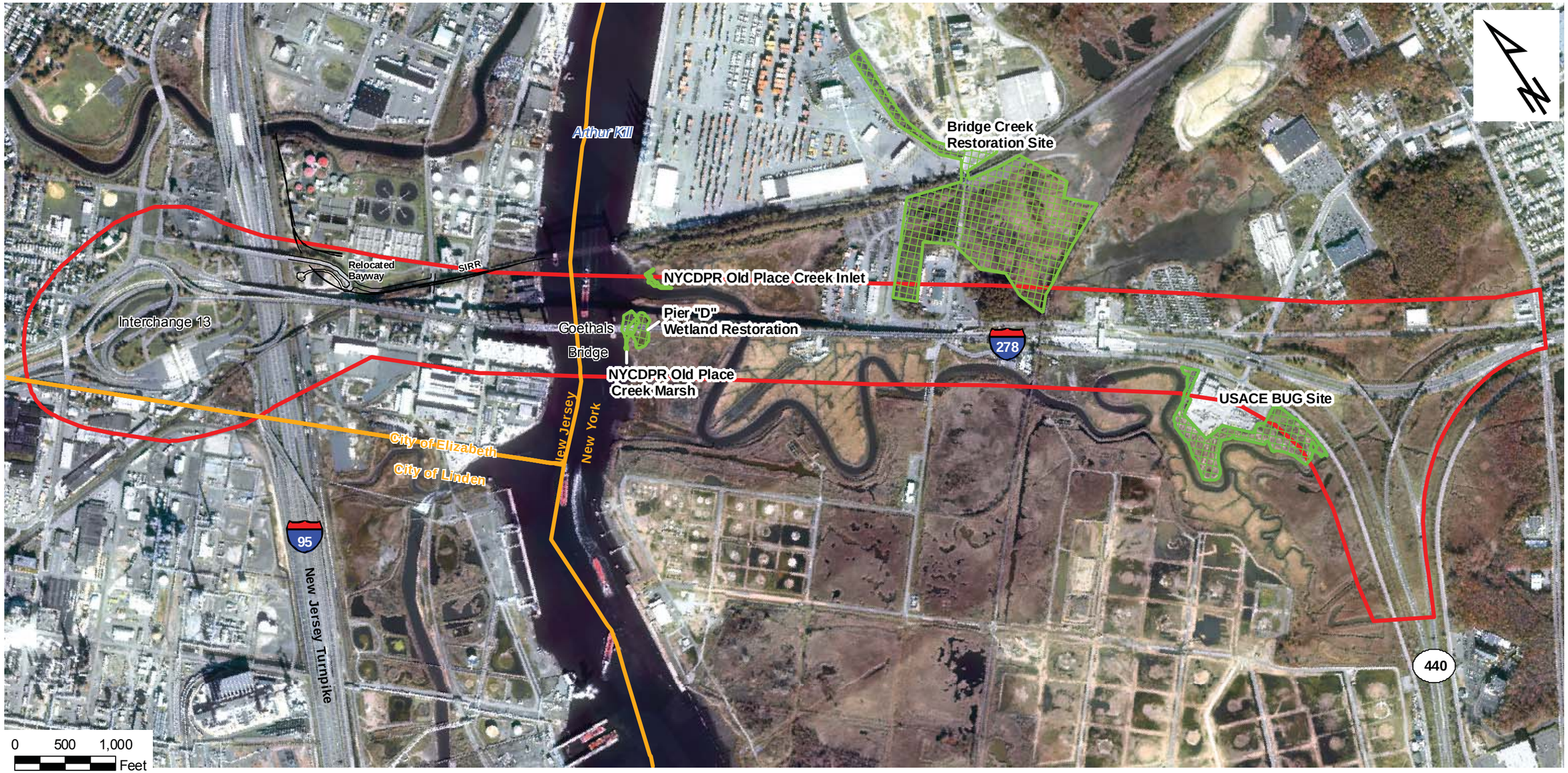
The USACE site, known as the Brooklyn Union Gas ("BUG") site, is located southeast of the Goethals Bridge toll plaza along the northern banks of Old Place Creek abutting the KeySpan facility (see Figure 4.14-6). The BUG site is actually larger than the two NYCDPR sites combined, with approximately nine acres of intertidal salt marsh restoration. According to a press release of the USACE – NY District dated November 21, 2005, the restoration effort includes: (1) the removal and grading of appxoimately 32,200 cubic yards of materials; (2) the removal of *Phragmites* and debris, re-grading the marsh surface to promote the growth of *Spartina* grass, and the limited placement of clean soil; and (3) the replacing of native wetland species including, at a minimum, 194,891 square feet (sq. ft.) of *Spartina alterniflora* in the low marsh area, 4,175 sq. ft. of shrubs in the high marsh area, and 27,660 sq. ft. of herbaceous plants in the maritime zone.

The Port Authority wetland restoration site is a mitigation site created in 2002 as compensation for temporary and permanent wetland impacts associated with structural repairs to Pier D of the Goethals Bridge in Staten Island (see Figure 4.14-6). Repairs to Pier D, which is adjacent to the Arthur Kill, resulted in the permanent filling of 0.02 acres of wetlands and temporary impacts to 0.71 acres of wetlands and mudflats. The restoration site is adjacent to Pier D, and involved regrading of 1.21 acres encompassing the temporary fill area and replanting 0.83 acres with *Spartina alterniflora*, with the remaining 0.38 acres as mudflat creation. The project also included the installation of a low stone breakwater to protect the mitigation site and a mud flat habitat seaward of the restored marsh from scour and boat wakes.

One additional wetland restoration site is located just beyond the limits of the Primary Study Area (see Figure 4.14-6). The 2005 Bridge Creek Restoration Project, located north of Goethals Road North, west of the Staten Island Railroad, and both west and east of Western Avenue, compensates for damages resulting from the Exxon Bayway oil spill of 1990. The 13-acre saltmarsh restoration project was sponsored and constructed by the NYSDEC and the New York Harbor Oil Spill Trustees (New York State Department of Environmental Conservation, U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration Restoration Center). The Project also required the participation of the Port Authority of NY and NJ to reshape a half-mile leg of Bridge Creek into a broader channel bank to bank. The channel work improved the limited tidal connection to the marsh and allowed the restoration of 13 acres to proceed.

Wetland Preservation Sites

Old Place Creek is one of six NYSDEC-recognized wetland complexes in Staten Island. The NYSDEC acquired approximately 12 acres of Old Place Creek wetlands in March, 2003, which is part of the Harbor Herons Wildlife Complex. This acquisition expanded opportunities for passive outdoor recreation and preserves valuable fish and bird habitat. The Harbor Herons Wildlife Complex consists of 2,196 acres of



Legend

Primary Study Area

Wetland Restoration Sites

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.14-6

Wetland Restoration Sites

United States Coast Guard

undeveloped land along the western shore of Staten Island and supports the largest breeding population of colonial water birds in the northeastern United States.

4.14.5.5 Wildlife

Methodology, Approach and Data Sources

Information on the wildlife species in and near the Primary Study Area was obtained through field observations in the summer of 2004, and was supplemented with data from previous surveys and natural resource regulatory agencies. A description of the data sources is provided below.

The New York State Amphibian and Reptile Atlas Project.

The NYSDEC Amphibian and Reptile Atlas Project was a ten-year survey that was designed to document the geographic distribution of New York State's herpetofauna. Maps that display the distribution of each species of amphibian and reptile throughout New York State are available on the NYSDEC website. The Atlas listed five frog and toad species, seven species of lizards and snakes, four species of salamanders, and eight species of turtles as having been observed in western Staten Island, which includes the Study Area.

June-July 2004 Field Surveys in the Primary Study Area.

In June and July of 2004 (June 29-30; July 7) early morning field surveys were conducted to identify wildlife species utilizing the Primary Study Area. These surveys were designed to detect the presence (i.e., calls, observations) of bird, mammal, amphibian, and reptile species. Fourteen observation stations were selected to represent the variety of habitat types available to wildlife (see Figure 4.14-7). The stations were selected to view the salt marsh communities adjacent to Old Place Creek, the non-native forest community located north of the bridge, forest/field edges and maritime shrubland communities. The ground was searched and logs and rocks were overturned to detect the presence of reptiles and amphibians and evidence of mammals (e.g., scat, hair, runways). During the three-day field effort, 59 species of terrestrial and semiaquatic vertebrates were identified.

1994 LMS Seasonal Wildlife Surveys (USCG, 1997).

In 1994, seasonal wildlife surveys were conducted in northwestern Staten Island for the Staten Island Bridges Program. This survey included the Primary Study Area, as well as Goethals Bridge Pond. The area was surveyed in December 1993, and April, May, July, August, and September 1994. Surveys conducted in April and May also included evening surveys for calling amphibians, and during the May survey ponds and pools were checked for amphibian eggs and/or larvae. Over 110 species of terrestrial and semiaquatic vertebrates were identified in the Primary Study Area during seasonal and special surveys (USCG, 1997).

The Salt Marsh Restoration Team (NYCDPR SMRT) 1993-1994 Breeding Bird Surveys.

The SMRT conducted breeding bird surveys within Old Place Creek in 1993 and 1994. Surveys were conducted on eight dates between May 10 and August 5, 1993, and eight dates between June 2 and August 11, 1994. In addition, a survey of wintering birds at Old Place Creek was conducted on a weekly basis between December 7, 1993 and March 25, 1994.

The Harbor Herons Project (HHP, 1990; Kerlinger, 1999, 2001, and 2004).

The New York City Audubon Society has monitored wading bird, gull and cormorant nesting attempts on islands within the New York/New Jersey Harbor System since 1984. The number of nests of various

heron and egret species, glossy ibis, and double-crested cormorants were counted on varying numbers of islands between 1984 and 2007. While no heron nesting has occurred at Pralls Island, Shooters Island, and the Isle of Meadows in the past several years, herons are believed to use foraging habitat within the Primary Study Area.

The New York State Department of Environmental Conservation Breeding Bird Atlas (2000-2004).

The NYSDEC Breeding Bird Atlas is a statewide survey of all known breeding bird species in New York. The study is based on the presence of nests, observed courtship behaviors, the presence of adult birds during the breeding season and fledged young for all bird species. The state is divided into 5,335 blocks, each measuring 5 square kilometers.

The Primary Study Area is located within Block 5649A, which includes northwestern Staten Island. The block includes the Richmond/Union County lines on the Arthur Kill from the southern end of Pralls Island north to the Kill Van Kull. The eastern limit is approximately the interchange of Route I-278 and Route 440 on Staten Island. Block 5649A includes Goethals Bridge Pond and the Primary Study Area. The Atlas lists 73 species of birds for Block 5649A. Fifty-four of these species are listed as confirmed breeders because nests, eggs, fledglings, and/or nesting behaviors were observed. Seven of the species are considered probable breeders because pairs of birds were observed in the area during the breeding season, and some displayed courtship behaviors, and the remaining twelve species are considered possible breeders because unpaired individuals of the species were observed in the area during the breeding season.

The U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern (2002).

The USFWS has identified species, subspecies and populations of all migratory birds that are likely to become candidates for listing under the Endangered Species Act of 1973. These bird species are listed in *Birds of Conservation Concern 2002*, which lists species specific to seven regions within the United States. The Study Area is located within USFWS Region 5, the Northeastern Region (USFWS, 2002).

Natural Resource Agency File Searches.

The U.S. Department of the Interior Fish and Wildlife Service (USFWS), the NJDEP Office of Natural Lands Management Natural Heritage Program, and the NYSDEC Natural Heritage Program were contacted to provide information on the occurrence of federally or state listed threatened, endangered species and species of Special Concern, as well as on Critical Habitats within the Study Area.

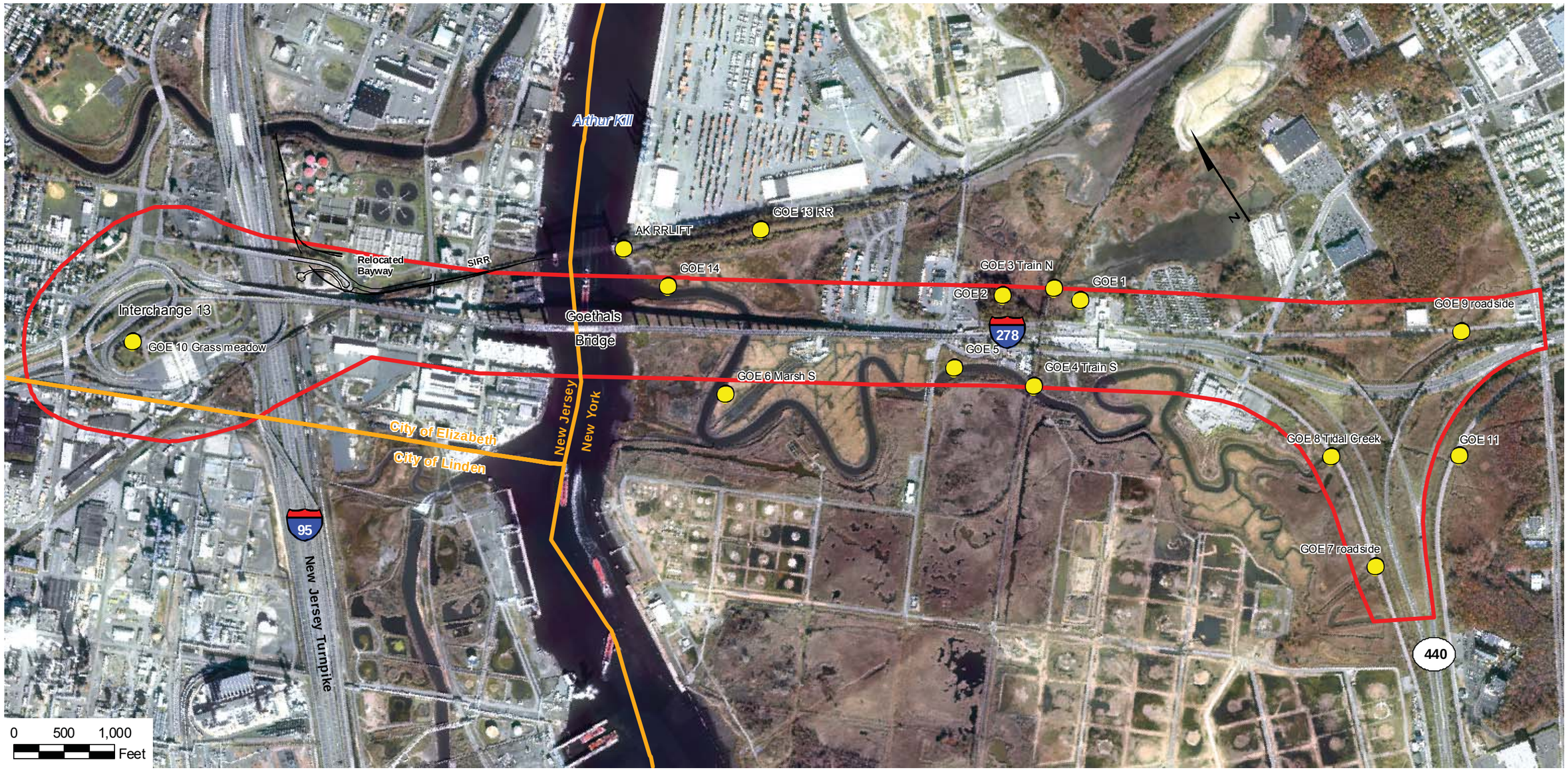
Personal Communications with Staff of New York City Department of Environmental Protection (NYCDEP); the Staten Island Institute.

Mr. Chris Nadareski, a wildlife biologist for NYCDEP was contacted several times to obtain information on the nesting pair of peregrine falcons in the Study Area (1994; 12 July 2004; 23 November 2004; 14 December 2004; 17 August 2006; 27 November 2007, and 11 September 2008). Information collected on the peregrine falcon is discussed in the Endangered and Threatened Wildlife Species and Critical Habitats section.

Mr. Edward Johnson, Curator of Science for the Staten Island Museum of Arts and Sciences was contacted twice (9 December 2004; 12 December 2004) to obtain information on the presence of birds, amphibians, and reptiles that may use habitat in the Primary Study Area.

NJDEP Landscape Project Databases

The NJDEP Landscape Project mapped foraging habitat for bald eagles, emergent wetlands, forested wetlands, forests, as well as wood turtles and urban peregrine falcon habitat throughout New Jersey. GIS



Legend

Primary Study Area

Observation Station

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.14-7

Observation Stations for Terrestrial and Wetland Communities

United States Coast Guard

data showing the results of the mapping is available for download. This data was overlain across the New Jersey portion of the Primary Study Area.

Mr. Andrew Bernick, a Ph.D. student at the College of Staten Island, conducted research on the foraging behavior of herons in the NYC metropolitan area, with a special emphasis on black-crowned night herons. He conducted night-time and early morning surveys around Staten Island, including areas in the vicinity of the Goethals Bridge Primary Study Area (Goethals Bridge Pond, Old Place Creek and Bridge Creek) and gathered information on the presence and activities of herons in these areas. Observations of other species at these sites, including birds, reptiles, amphibians, mammals and fish, were also recorded.

Invertebrates

NYSDEC and NJDEP did not identify any protected invertebrates in the Primary Study Area. Common upland invertebrates included carpenter ants, crickets, termites, grasshoppers, yellow jackets, mosquitoes, dragonflies, and honeybees. Butterflies are not common in the Study Area; black and tiger swallowtails were present only during the summer surveys. Aquatic marine invertebrates found in the marsh included fiddler crabs and mud dog whelks. A detailed discussion of aquatic marine invertebrates is provided in Section 4.14.4.4.

Amphibians

Amphibians, including frogs and toads (anurans) and salamanders, prefer fresh water and moist upland conditions not found in the Primary Study Area. The New York State Amphibian and Reptile Atlas Project lists nine amphibian species that have been observed in western Staten Island, including three salamanders, one newt, and five toads and frogs (NYSDEC, 2004). However, the amphibians most likely to occur in the Primary Study Area would be red-backed salamanders, green frogs, spring peepers, Fowler's toads, and southern leopard frogs (E. Johnson, personal communication).

No amphibians were observed during the June-July 2004 surveys. However, other observations indicate that the spring peeper and the Fowler’s toad are relatively common throughout the Primary Study Area (USCG, 1997; Bernick, 2005). The spring peeper has been observed throughout the Primary Study Area and the Fowler's toad has been observed numerous times at the Goethals Bridge Pond and at Old Place Creek.

NJDEP has no records of threatened or endangered amphibians in the Primary Study Area. The New Jersey Natural Heritage Program lists the longtail salamander as present in Union County. However, as the species prefers small freshwater bodies where fish are absent or present in low abundance, it is not believed to be present in the Primary Study Area. Table 4.14-5 presents the list of amphibian species likely to use and inhabit the Primary Study Area.

Reptiles

Reptiles (snakes, lizards and turtles) typically prefer freshwater or upland habitat to brackish waters, with a few exceptions (including the diamondback terrapin, common snapping turtle and the eastern mud turtle). The New York State Amphibian and Reptile Atlas Project lists fifteen reptile species that have been observed in western Staten Island, including eight turtles, six snakes and one lizard (NYSDEC, 2004).

One reptile species, the northern diamondback terrapin, was identified in the Primary Study Area during the 2004 wildlife surveys. The northern brown snake and snapping turtle have also been observed in the Primary Study Area (USCG, 1997). Other reptiles that may occur in the Primary Study Area include snapping turtles, painted turtles, box turtles, eastern mud turtles, garter snakes, and northern water snakes (E. Johnson, personal communication).

TABLE 4.14-5
AMPHIBIAN SPECIES LIKELY TO USE THE PRIMARY STUDY AREA

Common Name	Scientific Name	LMS (2004) Individuals Observed	LMS (1994) Individuals Observed	Harbor Herons (1990) Individuals Observed	Bernick (2002-2004) Individuals Observed
Red-backed salamander	*Plethodon cinereus*			x	
Green frog	*Rana clamitans*			x	
Bullfrog	*Rana catesbeiana*			x	
Eastern grey tree frog	*Hyla versicolor*			x	
Southern leaopard frog	*Rana sphenocephala*			x	
Spring peeper	*Hyla crucifer*		x	x	x
American toad	*Bufo americanus*			x	
Fowler's toad	*Bufo woodhousei fowleri*		x	x	x
Woodland salamander	*Plethodon sp.*			x	
Four-toed salamander	*Hermidactylium scutatum*			x	
	Number of species:	0	2	10	2

Sources: Bernick 2005, LMS Data (2004; 1997), NYSDEC 2004, The Trust for Public Land 1990.

The eastern mud turtle was reported in Old Place Creek during the early 1900s, but no mud turtles were found during the June-July 2004 or 1994 seasonal surveys of the shoreline of Old Place Creek. However, habitat is present for this species. The NJ Natural Heritage Program lists the wood turtle (NJ-T) and bog turtle as present in Union County. The eastern mud turtle is discussed below in further detail. Table 4.14-6 presents the list of reptiles likely to use and inhabit the Primary Study Area.

Birds

One hundred and seventy-one bird species have been observed in the vicinity of the Primary Study Area since 1990. These observations include year-round residents, as well as birds using the area for breeding, overwintering, and migratory stopovers. These species include those found within the Primary Study Area as well as adjacent to Goethals Bridge Pond. Fifty-six of these species were seen or otherwise identified in the Primary Study Area in the summer of 2004. Table 7 of Appendix H.1 presents a list of the bird species observed during each of the surveys and likely to use and inhabit the Primary Study Area.

The number of species and individuals found indicate that the area, although modified over the years, provides habitat for many species, especially during migrations. Birds in migration, especially during the fall, were observed foraging on various seed-producing plants along the abandoned railroad bed. Other species were observed foraging in the areas of Goethals Bridge Pond and Old Place Creek. During the summer and winter, fewer species and numbers were observed using these areas than in the spring and fall (USCG 1997).

The NYSDEC 2000-2004 Breeding Bird Atlas results for Bock 5649A, which includes the Primary Study Area, lists 72 species of birds known or suspected to breed in the area. These species include passerines, wading birds, shorebirds, waterfowl, raptors, and rails. The NYCDPR SMRT identified 20 species of breeding birds in Old Place Creek marsh during 1993 and 22 species of breeding birds in 1994.

Table 7 of Appendix H.1 also presents the number of bird species identified from each of sixteen groups during five studies conducted in the Primary Study Area between 1990 and 2004. Endangered, threatened, and special concern species identified in these surveys are discussed separately.

Passerines. Passerines are small perching songbirds of the order Passeriformes. Passeriformes, the largest order of birds, contains about one-half of all bird species. Correspondingly, passerines are the most common species of birds in the Primary Study Area. Of the 171 species observed since 1990, 76 were passerines (see Table 8 of Appendix H.1). Most passerines were observed along the old railroad corridor leading to the Travis Spur railroad bridge. Few passerines, except marsh wrens, red-winged blackbirds, and song sparrows were observed in or adjacent to the marsh. Starlings and house sparrows were common around the access road below the Goethals Bridge, other roads, the toll plaza, and buildings. Blue jay, American crow, European starling, American goldfinch, and song sparrow were present in all seasons (resident species). Summer residents arriving in the spring and leaving in the fall included marsh wrens, gray catbirds, American robins, common yellowthroats, and Eastern towhees. The majority of species were spring and fall migrants passing through the area, using the narrow, wooded corridor along the railroad track leading to the Arthur Kill.

Passerines are among the bird species that are most sensitive to changes or loss of habitat because many of these species are habitat specific. Several passerines, such as the seaside and saltmarsh sharp-tailed sparrows are limited to breeding habitat specific to coastal salt marshes. The seaside and saltmarsh sharp-tailed sparrows have been confirmed breeding in Saw Mill Creek. These species were studied in greater detail and are described below.

Saltmarsh Sharp-tailed Sparrow. Siebenheller (1981) cited the sharp-tailed sparrow as a common nesting species in the salt marshes of Staten Island until about 1955, when their numbers declined. Three breeding pairs of saltmarsh sharp-tailed sparrows were confirmed in Old Place Creek marsh during the

TABLE 4.14-6
REPTILE SPECIES LIKELY TO USE THE PRIMARY STUDY AREA

Common Name	Scientific Name	LMS (2004) Individuals Observed	LMS (1994) Individuals Observed	Harbor Herons (1990) Individuals Observed	Bernick (2002-2004) Individuals Observed
Northern brown snake	*Storeria dekayi*		x		
Eastern black racer	*Coluber constrictor*			x	
Common garter snake	*Thamnophis sirtalis*			x	
Snapping turtle	*Chelydra serpentina*		x	x	
Painted turtle	*Chrysemys picta*			x	
Diamondback terrapin	*Malaclemys terrapin*	x	x	x	
Eastern fence lizard	*Sceloporus undulatus*			x	
	Number of species:	1	3	6	N/A

Sources: Bernick 2005, LMS Data (2004; 1997), NYSDEC 2004, The Trust for Public Land 1990.

NYCDPR SMRT 1993 breeding bird survey and one breeding pair was found in 1994 (NYCDPR SMRT, 1994). The NYSDEC 2000-2004 Breeding Bird Survey also listed the saltmarsh sharp-tailed sparrow as breeding in Block 5649A, which includes the Primary Study Area and adjacent salt marshes. No saltmarsh sharp-tailed sparrows were observed in the Primary Study Area during the 1994 or 2004 LMS surveys. The saltmarsh sharp- tailed sparrow is listed by USFWS as a bird of conservation concern in Region 5, (the northeastern United States), which includes the Primary Study Area (USFWS, 2002).

Old Place Creek marsh provides both foraging and nesting habitat for sharp-tailed sparrows. They are found most commonly in the drier, grassy portions of salt marshes (Bull, 1985). Although the sharp-tailed sparrow may occur inland near freshwater marshes, it is generally limited to patchy distributions in coastal areas. Considered a semi-colonial inhabitant of coastal marshes, saltmarsh sharp-tailed sparrows typically breed in the high salt marsh among dense patches of saltmeadow cordgrass and inland saltgrass (Andrle and Carroll, 1988; Reinert and Mello, 1995). Nests are difficult to find and are typically located on or within a few inches of the marsh surface. Elliot (1962) observed nests being built on the drier areas of the marsh surface, sometimes in saltmarsh-elder or clumps of saltmeadow cordgrass.

Seaside Sparrow. The seaside sparrow is listed as a bird of conservation concern in the northeastern United States by USFWS (2002) and as a species of special concern in New York by the NYSDEC. Old Place Creek marsh may provide breeding and foraging habitat for the seaside sparrow. Numerous breeding pairs of seaside sparrows were observed at nearby Saw Mill Creek between 1993 and 1994, which provides similar habitat to Old Place Creek. The 2000-2004 NYSDEC Breeding Bird Atlas lists seaside sparrow as breeding in Block 5649A, which includes the Primary Study Area as well as the surrounding marshes and Saw Mill Creek. Seven breeding pairs of seaside sparrows were confirmed as breeders at Saw Mill Creek during the NYCDPR SMRT, 1993 breeding bird survey (NYCDPR SMRT, 1994), and eight pairs were confirmed breeding during 1994 (NYCDPR SMRT, 1994). One seaside sparrow was observed at Old Place Creek during the 1993 NYCDPR SMRT breeding bird survey, but none were observed during 1994. No seaside sparrows were observed in the Primary Study Area during the 1994 or 2004 LMS surveys.

The Old Place Creek marsh provides both breeding and foraging habitat for the seaside sparrow. Seaside sparrows nest in medium-height *Spartina* between the high marsh and edge of the low marsh (Leukering, 1995). Although they prefer the wetter areas of the marsh (Elliot, 1962), nests are only a few inches to 4 ft above the ground. Seaside sparrows feed along the ground in relatively open mudflat areas. Each pair of seaside sparrows feeds on separate plots of shoreline less than 75 yards long and less than 20 feet wide (Wolfenden, 1956). Wolfenden (1956) found nest sites not located in foraging areas were connected to foraging areas by a corridor forming a dumbbell-shaped territory. This corridor could be up to 200 yards long (Austin, 1983).

Shorebirds. Shorebirds are a diverse group that includes sandpipers, plovers, stilts, avocets, snipes, oystercatchers, turnstones, and phalaropes. They generally have small bodies, long, thin legs and no webbing on their feet. There are no known breeding colonies of shorebirds in Staten Island, as the area provides no suitable, undisturbed habitat for colonial nesting shorebirds. Solitary nesting shorebirds such as killdeer and spotted sandpipers find areas for nesting in the vicinity of the Goethals Bridge and Shooters Island, including river margins above high tide and abandoned dirt and gravel parking lots. Killdeer may occasionally use flat gravel rooftops in the absence of other suitable habitat for nesting. Disturbance by humans, dogs, cats, commercial traffic on roads and waterways, and commercial jets reduces the suitability of the remaining habitats left for nesting.

Seventeen species of shorebirds have been observed in the Study Area since 1990 (see Table 8 of Appendix H.1). Four of these shorebird species breed in northwestern Staten Island, including killdeer, American woodcock, Wilson's snipe, and spotted sandpiper (NYSDEC, 2004). During 2003 and 2004, American woodcocks were observed performing courtship displays at both Bridge Creek and Old Place Creek; in 2004 they were also displaying at Goethals Bridge Pond (Bernick, 2005). Greater yellowlegs

and lesser yellowlegs were the most common shorebirds observed at the Old Place Creek marsh (USCG, 1997). The Goethals Bridge Pond provides habitat for several species of shorebirds. Lesser yellowlegs, killdeer, spotted sandpiper, and least sandpiper have been observed in the Goethals Bridge Pond (Bernick, 2005; USCG, 1997). No shorebirds were observed in the Primary Study Area during the winter (USCG, 1997).

Gulls and Terns. Nine species of gulls and terns have been observed in the vicinity of the Goethals Bridge since 1990 (see Table 8 of Appendix H.1). Five of these species (herring gull, great black-backed gull, ring-billed gull, laughing gull, and black skimmer) were observed in the Primary Study Area during the June-July 2004 survey. One species of gull (herring gull) has been confirmed breeding in the area (NYSDEC, 2004). A Caspian tern was observed in 1990 on the New Jersey side of the Primary Study Area in the Arthur Kill between Elizabeth River and Morses Creek (Kane et al, 1990). Black skimmers, a species of special concern in New York and an endangered (breeding populations)/threatened (non-breeding populations) species in New Jersey, were observed foraging at Goethals Bridge Pond in 2003 and 2004; in 2003 they were observed foraging at Old Place Creek (Bernick, 2005). The black skimmer is discussed in detail in the Endangered and Threatened Species section below.

Waterfowl. Twenty species of waterfowl (ducks, geese and swans) have been observed in the habitat adjacent to the Goethals Bridge since 1990 (see Table 8 of Appendix H.1). Although nesting habitat is limited in the area, six waterfowl species (Canada goose, mallard, black duck, gadwall, wood duck, and mute swan) breed in northwestern Staten Island. With the exception of the gadwall, these waterfowl are expected to nest in the Study Area (NYSDEC, 2004). However, gadwalls were observed with young at Goethals Bridge Pond in 2004 (Bernick, 2005).

Of the species observed in the Primary Study Area, gadwall, mallards, black duck, and Canada geese are most common and are present year-round. The green-winged teal and the blue-winged teal were observed mostly during migration periods; neither was observed during the breeding bird survey or the winter seasonal survey in the Study Area (USCG, 1997). However, green-winged teal were seen foraging and performing courtship displays at Goethals Bridge Pond in 2004 (Bernick, 2005). The hooded merganser was observed only during winter (USCG, 1997).

The Study Area and adjacent habitats (Goethals Bridge Pond, Old Place Creek and the Arthur Kill) provide overwintering habitat for waterfowl. The Atlantic flyway funnels waterfowl migrating along the Atlantic Coast through this area (Upper New York/New Jersey Harbor). The Arthur Kill is not as important a habitat for waterfowl as many of the larger interpiers and bays in the New York Harbor area because of disturbance from ship traffic and habitat quality. Better habitat would offer a combination of protection, shallow water, feeding areas, and increased distance from ship traffic.

Herons. This group includes long-legged wading birds that feed in shallow waters, such as herons, egrets, ibises, and bitterns. Many wading bird species nest in groups known as rookeries and forage in aggregations. Wading birds require specific and different habitat for foraging, nesting, and roosting. Suitable foraging habitat must be located within close proximity to rookeries to ensure energy-efficient foraging (Jenkins and Gelvin-Innvaer, 1995).

Old Place Creek is located within three miles of three historically productive wading bird rookeries (Shooters Island, Pralls Island, and Isle of Meadows), and provides foraging and resting habitat for a variety of wading bird species. First discovered in the early 1970s (HHR, 1990), the Arthur Kill/Kill Van Kull rookeries produced large numbers of young to be recruited into the Atlantic coastal populations. Over 1,100 nesting pairs of wading birds were observed on Shooters Island, Pralls Island, and Isle of Meadows in 1990 and 1994 (Parsons, 1994). In recent years, the numbers of wading birds nesting on these islands have decreased and no successful breeding has been reported by the Harbor Herons Project. No wading bird nesting was observed on Shooters Island between 1998 and 2007 (Kerlinger, 2001; Kerlinger, 2004; Bernick, 2007). The number of wading bird nests on the Isle of Meadows decreased

from about 600 in 2000 to 250 in 2001, and no successful wading bird nesting occurred there from 2004 to 2007. No successful wading bird nesting has occurred on Pralls Island since 1996 (Kerlinger, 2001; Kerlinger, 2004; Bernick 2007). In recent years, periodic Black-crowned and Yellow-crowned Night-Heron nesting attempts have been noted in dense areas of gray birch trees on the northern end of Prall's Island, however, efforts to control Asian Longhorned Beetle populations on the island in March-April 2007 resulted in the removal of most suitable nesting trees (Bernick 2007). Black-crowned night herons have been observed foraging at Old Place Creek between 2002 and 2004 (Bernick, 2005). Numbers of nesting pairs indicating potential recruitment from these rookeries at Shooters Island, Pralls Island and the Isle of Meadows are presented, respectively in Tables 9 through 11 of Appendix H.1.

There are several theories relating to the abandonment of rookeries by wading birds, most of which correlate the abandonment with a disturbance. Bowman and Siderius (1984) state that the removal of trees or shrubs in or around a rookery can leave the nests exposed and vulnerable to predation and human disturbance. The response of the herons to disruption is unpredictable because the extent of the response does not always correspond to the magnitude of the disturbance (Bowman and Siderius, 1984).

According to research conducted by the Washington State Department of Fish and Wildlife (2004), a heronry may remain occupied for many years, although an increase in predation on eggs and young can prompt relocation. The agency also states that herons may move the colony if there is a decline in the trees that support the nest structures. Decline in available food sources, and changing water levels have also been listed as possible reasons for rookery abandonment (Dankert, 2003). According to Blanchard et al., (2001), a human encampment including a fire pit was found on Shooter's Island in 1998. It was determined that it had been present for more than a year, corresponding to the period of major declines in the Island's nesting bird populations.

Although the three nearby rookeries are not currently active, Old Place Creek still provides valuable foraging habitat for wading birds. Five wading bird species (great egret, snowy egret, black-crowned night heron, yellow-crowned night heron, and glossy ibis) identified foraging in Old Place Creek during the June-July 2004 surveys are known to nest in the rookeries on Hoffman and Swinburne islands.

Thirteen species of wading birds have been observed in the Primary Study Area since 1990 (see Table 8 of Appendix H.1). Seven of these species (great blue heron, green heron, great egret, snowy egret, yellow-crowned night heron, black-crowned night heron and glossy ibis) were observed at Old Place Creek. Three of these species (green heron, black-crowned night heron and yellow-crowned night heron) are known to breed in the area (NYSDEC, 2004).

Observations of great egrets, snowy egrets, black-crowned night herons, yellow-crowned night herons, and glossy ibis recorded during the June-July 2004 survey, the 1994 seasonal surveys, and the 1993 and 1994 NYCDPR SMRT breeding bird surveys were used to determine habitat use, distribution, and foraging patterns of wading bird species in Old Place Creek. Observations at Saw Mill Creek and Goethals Bridge Pond were used to provide comparison of habitat types and potential use.

Great Egret and Snowy Egret. Both the great egret and snowy egret are breeding migrants in the New York/ New Jersey Harbor Estuary. Early accounts described both species as locally common to abundant along coastal areas of New York State (Bull, 1985). Numbers steadily increased during the late 1940s and early 1950s when both species were first confirmed breeding on Long Island (Andrle and Carroll, 1988). Siebenheller (1981) noted that the great egret was common during the summer along the west shore marshes of Staten Island and was seen daily at Goethals Bridge Pond. Both species were also confirmed breeding on Shooters Island, Pralls Island, and the Isle of Meadows between 1991 and 1994 (Kerlinger, 2001; Kerlinger, 2004). The snowy and great egrets are the wading birds most commonly observed at Old Place Creek (USCG 1997).

Near the northern limit of their range, both species nest in mixed rookeries, using small- to medium-sized trees. Andrle and Carroll (1988) reported that most colonies of great egrets are found in dense greenbriar, bayberry, and poison ivy thickets, often erecting nests in taller cherry, shadbush, or sumac trees. The smaller snowy egret nests slightly closer to the ground, with nests commonly placed in wild cherry, sumac, elderberry, catbrier, and the vines of wild grape and poison ivy (Bull, 1985). The breeding season for both species is similar, ranging from mid-April through June. Both males and females are involved in feeding the fledglings, which can remain in the nest from five to six weeks after hatching (Andrle and Carroll, 1988).

Changes in water levels, tides, and prey abundance may affect foraging locations for both the snowy and great egret (Berger et al., 1982). Both species may travel large distances for suitable habitat. Custer and Osborn (1978) observed great egrets traveling between a nesting colony and foraging areas in a North Carolina estuary and found travel distances significantly different between tides. Great egrets traveling between nesting and foraging areas flew a mean distance of 2.8 km (1.7 miles) at low tide and a mean distance of 4.3 km (2.7 miles) at high tide (Custer and Osborn, 1978). The maximum flight distance observed was 27.8 km (17.3 miles). Flight distances for snowy egrets from the same area were not tide dependent and averaged 3.7 km (2.3 miles) with a maximum distance observed of 18.3 km (11.4 miles) (Custer and Osborn, 1978).

The tidal marsh of Old Place Creek may not be optimum foraging habitat for snowy or great egrets. These species, which rely primarily on forage fish for prey, may select permanently flooded or seasonally fluctuating areas such as Goethals Bridge Pond. Maccarone and Parsons (1994) suggested that during high tides, deeper water and dense stands of cordgrass may impede foraging of snowy egrets. The deeper water and relatively small size of snowy egrets may limit their range or impede their active pursuit of prey (Rodgers, 1983).

Black-crowned Night Heron. Black-crowned night herons generally breed in mixed colonies. Nests may be placed on or up to 60 ft above the ground in the middle and upper layers of tall trees (Bull, 1985; Andrle and Carroll, 1988). First confirmed breeding on Shooters Island in 1974 (HHR, 1990) and on Pralls Island in 1981, the black-crowned night heron has been listed as a breeding species on Staten Island since 1886 (Siebenheller, 1981). Black-crowned night heron are listed by NYSDEC as local breeders by the 2000-2004 Breeding Bird Atlas (Block 5649A) (NYSDEC, 2004). However, Kerlinger (2004) and Bernick (2007) describe nesting attempts on the Arthur Kill/Kill Van Kull islands as unsuccessful between 2000 and 2007.

Black-crowned night herons may travel some distance to find suitable foraging habitat depending on tide levels, prey availability, and competition from other species. Custer and Osborn (1978) reported mean flight distances of black-crowned night herons from the nesting colony to foraging areas of 1.9 km (1.2 miles) at low tide and 4.5 km (2.8 miles) at high tide. The maximum flight distance recorded was 7.2 km (4.5 miles). Although not presently breeding on the Arthur Kill/Kill Van Kull islands, the large populations of black-crowned night herons that nest on nearby Hoffman Island may use the Primary Study Area as foraging habitat (Kerlinger, 2004).

The black-crowned night heron takes a variety of prey, both invertebrate and vertebrate (Kushland, 1978). Palmer (1962) noted that the prey of young black-crowned night herons in the New York City region consisted of killifish, eel, herring, and sunfish (Allen, 1938 cited in Palmer, 1962). Black-crowned night herons use open-water habitat for foraging. Due to their small size, black-crowned night herons may be excluded from foraging habitat by water depth, and may be forced to feed in other areas. Custer and Osborn (1978) noted that the availability of feeding sites for black-crowned night herons declined as the tide rose, and the birds traveled significantly greater distances from the nesting colony at high tide than at low tide.

Black-crowned night herons were observed foraging or resting at Old Place Creek during each of the surveys conducted in the vicinity of the Primary Study Area between 1990 and 2004. Observations of black-crowned night herons at Old Place Creek during the 1994 LMS seasonal surveys were generally recorded along tidal ditches and creek banks south of the existing Goethals Bridge (USCG, 1997; Bernick, 2005).

Yellow-crowned Night Heron. First reported nesting on Long Island in 1938 (Bull, 1985), the yellow-crowned night heron was regarded as a rare to casual visitor to the New York City area (Andrle and Carroll, 1988). Breeding in mixed colonies, in association with black-crowned night herons, or in isolated pairs (Andrle and Carroll, 1988), the yellow-crowned night heron usually nests in low coastal shrublands and dredged material islands, as well as dry woodlands near swamps, rivers, and harbors (Bull, 1985).

Yellow-crowned night herons historically nested on Shooter's Island in large numbers but these numbers began to decline in the 1990's (Blanchard et al., 2001). In 1996 there were only 7 nests (Blanchard et al., 2001). This species is largely restricted to coastal areas with the highest densities occurring in areas of extensive salt marsh (Andrle and Carroll, 1988). The last reports by the New York Harbor Herons project of yellow-crowned night heron nesting attempts for the Arthur Kill/Kill Van Kull islands were in 2001, when one nest may have been found on the Isle of Meadows (Kerlinger, 2001). In 1999, one nest was confirmed on the Isle of Meadows and one nest may have been present on Shooters Island (Kerlinger, 1999).

The yellow-crowned night heron forages almost exclusively on crustaceans, particularly fiddler crabs (Kushland, 1978). Both the yellow-crowned and black-crowned night heron are found foraging in the low marsh, along the edge of adjacent ditches and streams. Rodgers (1983) observed yellow-crowned night herons foraging along vegetated and unvegetated shoreline but never in open water.

Yellow-crowned night herons were observed during all surveys conducted in or near the Study Area between 1990 and 2004. During the 1993 and 1994 NYCDPR SMRT breeding bird surveys, observations of foraging were limited to the edge and intertidal banks of Old Place Creek and the Arthur Kill. The suitability of Old Place Creek as foraging habitat for yellow-crowned night herons may be higher than it is for other waders in these rookeries.

Glossy Ibis. Listed as a rarity on Staten Island prior to the 1960s (Siebenheller, 1981), glossy ibis were first confirmed breeding on Shooters Island in 1977 (Parsons, 1994) and on Pralls Island in 1981 (HHR, 1990). No glossy ibis nests have been found on the Arthur Kill/Kill Van Kull islands since 2001, when 23 nests were found on the Isle of Meadows (Kerlinger, 2001). Glossy ibis breed in mixed rookeries, nesting in cherry, poplar, willow, bayberry, sumac, and often in thick tangles of vines (Bull, 1985). This species has been very successful in expanding its range into the northeast and is establishing a large stable population in New York (Peterson, 1988).

Glossy ibis may travel some distance to suitable foraging habitat. Custer and Osborn (1978) reported a maximum flight distance between nesting colonies and foraging areas of 12.4 km (7.8 miles), so even though they do not presently use the Study Area as nesting habitat, Old Place Creek and surrounding habitats may still be important foraging grounds. Breeding populations of glossy ibis were found on nearby Hoffman Island in 2004 and 2007 (Kerlinger, 2004; Bernick, 2007).

The glossy ibis feeds by probing in mudflats and holes of crayfish and crabs (Palmer, 1962). Prey includes crayfish, crabs, insects, worms, snakes, salamanders, and fish (Palmer, 1962; Terres, 1980). Glossy ibis were observed in the Primary Study Area during the June-July 2004, and the 1994 seasonal surveys and during the 1993-1994 NYCDPR SMRT breeding bird surveys (USCG, 1997; NYCDPR SMRT, 1994). During the 1994 seasonal surveys, glossy ibis were observed feeding in shallow ponds and pools south of the Primary Study Area in the vicinity of the fuel storage facilities (USCG, 1997).

Primary foraging areas of this species appear to be outside the Study Area. Custer and Osborn (1978) observed glossy ibis foraging in impoundments, pond holes, and freshwater mud pools. Maccarone and Parsons (1994) suggest that, due to their smaller body size, glossy ibis preferentially feed in shallow waters, and may feed at Goethals Bridge Pond or other shallow waters during mid- to high tide.

New World Vultures. New world vultures are large birds with blunt claws and naked heads that feed primarily on carrion. The turkey vulture is the only new world vulture observed in the Primary Study Area. The turkey vulture is listed by NYSDEC as a confirmed breeder in the 2000-2004 Breeding Bird Atlas (Block 5649A) (NYSDEC, 2004). It was observed during both the 1994 and 2004 LMS surveys.

Raptors. Raptors (hawks, and falcons) are carnivorous hunting birds. Nine species of raptors have been observed in the vicinity of the Goethals Bridge since 1990. Of these species, six have been observed breeding in or near the Study Area between 2000 and 2004. Confirmed breeders are Cooper's hawk, red-tailed hawk, northern harrier, osprey, peregrine falcon, and American kestrel (NYSDEC, 2004). Two active osprey nests were observed near the Study Area during the 2004 Harbor Herons survey, one at the northeast end of Shooter's Island and the other northeast of Prall's Island (Kerlinger, 2004). The rough-legged hawk and Cooper's hawk were also identified in the Old Place Creek marsh by NYCDPR SMRT during their 1994 overwintering bird survey (NYCDPR SMRT, 1994).

The peregrine falcon is listed by New York State as endangered and the northern harrier is listed as threatened. The peregrine falcon is also endangered in New Jersey, as are breeding populations of the northern harrier. The peregrine falcon and northern harrier are discussed further in the Endangered and Threatened Species section, below.

Owls. Five species of owls have been observed in the vicinity of Goethals Bridge since 1990. Four of these species (great-horned owl, eastern screech owl, snowy owl, and short eared owl) were only observed during the 1990 Harbor Herons survey. The common barn-owl is the only owl listed as possibly breeding in the area by the 2000-2004 breeding bird atlas (NYSDEC, 2004).

Grebes. The pied-billed grebe is the only species of grebe that was observed near the Primary Study Area since 1990. They were not observed in the Study Area in June-July 2004 and were only observed during the fall in 1994 (USCG, 1997). Pied-billed grebes were observed only in Old Place Creek, whereas cormorants were observed in more open waters, including the Arthur Kill. There is more information on the pied-billed grebe in the endangered and threatened wildlife section.

Cormorants. Double-crested cormorants were commonly observed using habitats near the Goethals Bridge. During the 1994 seasonal surveys, double-crested cormorants were present during every season except winter (USCG, 1997). Although they are not listed as confirmed breeders by the NYSDEC Breeding Bird Atlas, cormorants nest on Shooter's Island, and on channel markers on the Arthur Kill (Kerlinger, 2004; Bernick, 2007).

Gamebirds. The ring-necked pheasant was the only gamebird observed near the Primary Study Area since 1990. Although not observed near the Goethals Bridge during the June-July 2004 surveys, they were observed in the Primary Study Area in 1994 (USCG, 1997). They are a year-round, resident species and most likely breed on-site. They have been confirmed breeding in northwestern Staten Island between 2000 and 2004 (NYSDEC, 2004). In 1994, pheasant were observed primarily along the edge created by the intersection of upland and marsh areas (USCG, 1997).

Woodpeckers. Three species of woodpeckers (northern flicker, downy and hairy woodpeckers) have been observed in or near the Primary Study Area since 1990. The downy woodpecker and the northern flicker have been confirmed breeding in northwestern Staten Island between 2000 and 2004 (NYSDEC, 2004). These two species were observed in the Study Area during the June-July 2004 surveys. During

the 1994 seasonal surveys, the northern flicker was common during the fall surveys and the downy woodpecker was observed during every season (USCG, 1997).

Pigeons and Doves. The pigeon (or rock dove) and mourning dove are abundant in the Primary Study Area. They have been observed throughout the year and may provide a significant prey base for peregrine falcons.

Cuckoos. Two species of cuckoos, the yellow-billed and black-billed cuckoos, have been observed in the vicinity of the Primary Study Area since 1990. The black-billed cuckoo was confirmed breeding in the area between 2000 and 2004 (NYSDEC, 2004). The yellow-billed cuckoo was observed in the Primary Study Area during the 1994 seasonal surveys (USCG, 1997).

Hummingbirds and Swifts. The ruby-throated hummingbird was observed in the Primary Study Area in 1990 during the Harbor Heron surveys (HHR, 1990). No other reports of hummingbirds in or near the Primary Study Area have been identified.

The chimney swift is the only swift species that breeds in New York State. It has been confirmed to breed in the vicinity of the Primary Study Area (NYSDEC, 2004). This species was observed in the Primary Study Area during the June-July 2004 and the 1994 seasonal surveys (USCG, 1997).

Kingfisher. The belted kingfisher was observed in the Primary Study Area during the June-July 2004 surveys, the 1994 seasonal surveys, and the 1990 Harbor Heron Surveys (USCG, 1994; HHR, 1990). This species has been confirmed breeding in or near the Study Area between 2000 and 2004 (NYSDEC, 2004). During the 1994 seasonal surveys, the belted kingfisher was present throughout the Study Area and was observed most often foraging for food along Old Place Creek, the Arthur Kill, and Goethals Bridge Pond (USCG, 1997).

Rails, Gallinules and Coots. Six species of rails, gallinules and coots have been observed in or near the Primary Study Area since 1990. The king, clapper, and Virginia rails, sora, the common moorhen, and the American coot have been reported near the Goethals Bridge. Three species, the clapper rail, Virginia rail and common moorhen were confirmed breeding in northwestern Staten Island between 2000 and 2004 (NYSDEC, 2004). Although no rails, gallinules or coots were observed during the June-July 2004 surveys, they are likely to be present in the Primary Study Area. Rails are very secretive birds and are more often heard than seen. Clapper rails were heard at Goethals Bridge Pond in 2004 and at Old Place Creek in 2003 (Bernick, 2005). Virginia rails were heard at Goethals Bridge Pond and at Old Place Creek in 2003 and 2004; they were also heard at Bridge Creek in 2004 (Bernick, 2005). Four breeding pairs of clapper rail were identified in areas adjacent to Old Place Creek by the NYCDPR SMRT during their 1993 breeding bird census. Two breeding pairs were identified in 1994 (Aquila, 1994). Although the range of clapper rail in New York State is diminishing, it is considered a fairly common bird of New York's coastal salt marshes (Andrle and Carroll, 1988). Clapper rails use high and low marsh areas for nest sites but have also been found nesting on slightly higher ground such as levees or spoil deposits (Andrle and Carroll, 1988).

Mammals

Two species of mammals (the gray squirrel and the meadow vole) were observed within the Primary Study Area in 2004. Muskrats were observed at Goethals Bridge Pond, Old Place Creek and Bridge Creek in 2003 and 2004 (Bernick, 2005). During the 1994 survey, mammals were infrequently observed, the most common species being muskrat, Norway rat, and meadow vole. These species were usually identified by sign (muskrat lodges, muskrat and meadow vole runways, and rat tracks) along Old Place Creek. Signs and observations of other species, including white-footed mice, raccoon, opossum, unidentified species of bats, eastern cottontail rabbit, gray squirrel, house mice, and white-tailed deer were also observed within or in the vicinity of the Primary Study Area (USCG, 1997). During the 1994

seasonal surveys, the feeding habits of the barn owl inhabiting the Arthur Kill Lift Bridge provided evidence of species that could occur in the area. However, this owl can hunt beyond the Study Area. The numbers of small mammal species identified from approximately 30 owl pellets found over four seasonal visits consisted of Norway rats (11 skulls), meadow voles (24 skulls), and house mice (two skulls) (USCG, 1997). The small number of species identified from these pellets suggests limited diversity of small mammals in the area. Since barn owls will feed on other species, such as shrews, the absence of these species in pellets indicates that they may be uncommon or nonexistent at this site. The white-footed mouse and the house mouse may also be uncommon, as only a few observations of these species were made. Table 4.14-7 presents the list of mammal species likely to use the Primary Study Area.

TABLE 4.14-7
MAMMAL SPECIES LIKELY TO USE THE PRIMARY STUDY AREA

Common Name	Scientific Name	LMS (2004) Individuals Observed	LMS (1994) Individuals Observed	Harbor Herons (1990) Individuals Observed	Bernick (2002-2004) Individuals Observed
Virginia opossum	*Didelphis virginiana*		x	x	
Eastern mole	*Scalopus aquaticus*			x	
Unidentified bat	---		x	x	x
Red bat	*Lasiurus borealis*			x	
Hoary bat	*Lasiurus cinereus*			x	
Little brown bat	*Myotis lucifugus*			x	
Eastern cottontail	*Sylvilagus floridanus*		x	x	
Grey squirrel	*Sciurus carolinensis*	x	x	x	
White-footed mouse	*Peromyscus leucopus*		x		
Meadow vole	*Microtus pennsylvanicus*	x	x	x	
Muskrat	*Ondatra zibethica*		x	x	x
Norway rat	*Rattus norvegicus*		x	x	
House mouse	*Mus musculus*		x		
Raccoon	*Proyon lotor*		x	x	
White-tailed deer	*Odocoileus virginianus*		x		
	Number of species:	2	11	12	2

Sources: Bernick 2005, LMS Data (2004; 1997), NYSDEC 2004, The Trust for Public Land 1990.

4.14.5.6 Endangered and Threatened Species

USFWS, NOAA Fisheries, NYSDEC and NJDEP records and the Natural Heritage Program database for each state were reviewed to determine the potential and probability of state and/or federally endangered and threatened or otherwise protected plant and wildlife species occurring in or adjacent to the Primary Study Area.

Plants

One plant species, persimmon (*Diospyros virginiana*), recognized as a species of concern by the Natural Heritage Program, was cited as a resident of the New York portion of the Primary Study Area (USGS Arthur Kill and Elizabeth quadrangles). Two groups of persimmon tree groves were listed in the Primary Study Area by the NYSDEC Natural Heritage Program. This species is classified by the New York State Natural Heritage Program as threatened (“S2”) in the state and demonstrably secure ("G5") in global abundance. The state rank of "S2" indicates that the species is very vulnerable in New York State because there are typically six to 20 occurrences, few remaining individuals, or other factors. The global rank of "G5" indicates the persimmon is secure, though it may be rare within parts of its range,

particularly at its periphery. This is the case for the persimmon on Staten Island, which is at or near the northern edge of its range (Brockman et al., 1968; Sargent, 1965).

Due to the intensity and duration of upland and shoreline development in the New Jersey portion of the Primary Study Area, the potential for protected plant species to occur is extremely low, based on data from the New Jersey Natural Heritage Program, species descriptions, habitat requirements, and site inspections. The New Jersey Natural Heritage Program found no records of endangered or threatened plant species existing in the Primary Study Area. However they listed several rare plant species that are documented in Union County. Based on the habitat requirements for each species, it is unlikely that they occur in the Primary Study Area. Table 12 of Appendix H.1 lists the protected species that have been found in Union County, New Jersey and the habitat requirements for these species.

The New Jersey Natural Heritage Program lists the traprock glade/rock outcrop community as a rare community present in Union County, but it is not present within or in the vicinity of the Primary Study Area.

Wildlife Species and Critical Habitats

Information on endangered, threatened, or special concern species was reviewed to confirm the presence or absence of protected species and suitable habitats in the Primary Study Area. Federally-listed endangered species are defined as native species in imminent danger of extirpation or extinction in the United States, although the species may be demonstrably secure in other countries. Federally-listed threatened species are those native species likely to become endangered within the foreseeable future. State endangered species are defined as native species in imminent danger of extirpation or extinction in New York or New Jersey and include those listed as endangered by the USFWS. State threatened species are native species likely to become endangered within the foreseeable future in New York or New Jersey and include those listed as threatened by the USFWS. The NYSDEC defines special concern species as "any native species for which a welfare concern or risk of endangerment has been documented in New York State." The NJDEP defines special concern species as those that "warrant special attention because of some evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming threatened." The USFWS was contacted for a list of federally-protected plants, wildlife and critical habitats. The New York and New Jersey Natural Heritage Programs, which list sightings of federally- and state-protected species and special habitats, were contacted for a list of endangered and threatened plants and animals and critical habitats. Table 13 of Appendix H.1 lists the state and federally-protected terrestrial species that were observed in the Primary Study Area and Goethals Bridge Pond, along with their preferred habitats.

No federally-listed terrestrial wildlife species are expected to use the Primary Study Area, but the roseate tern was observed in western Staten Island during the 1990 Harbor Herons Survey. One New York State endangered species, the peregrine falcon, has been reported in the Primary Study Area. Two New York State threatened species, the pied-billed grebe and the northern harrier, were observed in the Primary Study Area by LMS in 1994. No New Jersey state-listed species are expected to be found in the New Jersey portion of the Primary Study Area, with the exception of the peregrine falcon, which has been identified on the New York side of the Goethals Bridge.

The New York Natural Heritage Program files indicate the presence of the peregrine falcon in 2004 and the eastern mud turtle in 1900. These files did not indicate the presence of the northern harrier, a New York State threatened bird species. However, the northern harrier was observed in the Primary Study Area in 1994, and is listed by NYSDEC as breeding in northwestern Staten Island (Block 5649A) between 2000 and 2004 (NYSDEC, 2004). Although not located within the Primary Study Area, the Goethals Bridge Pond is considered a critical waterfowl area. Goethals Bridge Pond is one of the feeding areas for the heron rookeries located along the Arthur Kill and is the only known breeding site for pied-billed grebe and American coot on Staten Island (HHR, 1990).

The New Jersey Natural Heritage Program had no records of endangered and threatened species, or their critical habitats on the New Jersey side of the Primary Study Area. However, the Program did provide a list of protected species that have been identified in Union County, New Jersey. These species and their preferred habitats are listed in Table 12 of Appendix H.1. Based on their habitat preferences and the limited habitat within the New Jersey portion of the Primary Study Area, it is unlikely that these protected species occur in the Primary Study Area.

The New Jersey Natural Heritage Program also noted protected colonial waterbird foraging habitat as occurring within ¼ mile of the Primary Study Area (Letter, 2004). Several New Jersey state-listed threatened and endangered species have been observed on the New York side of the Primary Study Area since 1990, including pied-billed grebe (E), American bittern (E – breeding population only [BR]), northern harrier (E – BR; T – non-breeding population), black skimmer (E – BR; T – non-breeding population), least tern (E), black-crowned night heron (T – BR), yellow-crowned night heron (T), osprey (T – BR), and savannah sparrow (T – BR). Most of these birds are not likely to regularly use the New Jersey side of the Primary Study Area where the majority of habitat is upland or densely vegetated freshwater wetland habitat. With the exception of the peregrine falcon observations, all observations of protected species occurred in the New York portion of the Primary Study Area.

During the 2004 project surveys, peregrine falcons were identified within the Primary Study Area. During the 1994 surveys, peregrine falcons and northern harriers were observed near the bridge (USCG, 1997). The roseate tern was identified in the western Staten Island Area by the Harbor Herons survey in 1990. These species are discussed in the following sections. The eastern mud turtle was the only species not observed; it has not been reported in the area since 1900.

Pied-billed Grebe. The pied-billed grebe is a threatened species in New York. In New Jersey, breeding populations are considered endangered while non-breeding populations are listed as special concern. Pied-billed grebe was last seen in the vicinity of the Primary Study Area during a 1994 LMS survey.

The habitat preferences and feeding habits of the pied-billed grebe are presented in Table 13 of Appendix H.1. Goethals Bridge Pond is the most suitable habitat for this species, although in winter, pied-billed grebes will occasionally use salt water for foraging (Ehrlich et al., 1988).

The loss of habitat is the greatest threat facing this species. Pied-billed grebes breed primarily in palustrine emergent wetlands, which are one of the most threatened types of wetland in the U.S. (Beans and Niles, 2003). Pied-billed grebes are also adversely affected by pesticides, herbicides, and runoff from roads (Beans and Niles, 2003). Disturbances during the incubation period can cause pied-billed grebes to to leave the nest for prolonged periods, leaving their eggs vulnerable to weather and predation (Beans and Niles, 2003).

Roseate Tern. The roseate tern is federally listed as an endangered species by the USFWS, NYSDEC, and NJDEP. The roseate tern was observed by the Harbor Herons survey in 1990, but no indication is given to the exact location of the sighting. The Harbor Herons Study Area included a much larger area than that of the Primary Study Area. No sightings of roseate terns were made in any subsequent studies in the area.

Roseate terns usually breed on offshore islands with sandy, pebble beaches, and in open bare or grassy areas (Ehrlich et al, 1988). Roseate terns are colonial breeders. In New York State they are almost always found nesting with common terns (Beans and Niles, 2003). The nesting colonies are often located within dense dune vegetation and are always above the high-tide line (Beans and Niles, 2003). Roseate terns lay 1-2 eggs in a shallow scrape depression nest, which is often concealed in beach grass, herbaceous plants, or hidden among rocks, driftwood or sand (Ehrlich et al, 1988). According to the NYSDEC, New York roseate terns only breed in a few locations on Long Island.

Optimal foraging areas for roseate terns are shallow coastal waters, inlets, and offshore seas (Beans and Niles, 2003). They feed primarily on small fish and sand eels (Beans and Niles, 2003). Roseate terns often gather in areas where larger fish drive small fish to the surface where the terns can hover and dive into the water (Ehrlich et al., 1988). The Old Place Creek marsh provides suitable habitat for this species. The largest threat posed to roseate terns is the destruction of their habitat, particularly their breeding grounds (Beans and Niles, 2003). Ground-nesting species often face increased predation rates due to the easy accessibility of the nests by predators. In the northeast, the main predator of the roseate tern is the Norway rat (USFWS, 2005).

Black Skimmer. Breeding populations of the black skimmer are listed as endangered in New Jersey, and non-breeding populations are listed as threatened. The black skimmer is also listed as a species of special concern in New York. The black skimmer was observed in the Primary Study Area during the June-July 2004 field surveys. A single black skimmer was also observed during the 2004 foraging in Goethals Bridge Pond (Bernick, 2005).

Black skimmers nest on open sandy beaches, inlets, offshore islands, and dredged material disposal islands (Beans and Niles, 2003). Between mid-May and early June, two to six eggs are lain and are incubated by both the male and female (Beans and Niles, 2003). Due to the high exposure of the nests, the eggs and young are highly vulnerable to predation (Beans and Niles, 2003). Suitable nesting habitat does not exist within the Study Area. No suitable breeding habitat for the black skimmer exists in the Primary Study Area, but they may use the site for foraging.

Black skimmer populations are heavily impacted by the deterioration of suitable nesting habitat, including increased use of recreational beaches (Beans and Niles, 2003). Other problems are posed by tidal flooding and predation (Beans and Niles, 2003). There is a long list of potential predators that feed on skimmer eggs and chicks including Norway rats, gull species, raptors, cats and raccoons (Beans and Niles, 2003).

Savannah Sparrow. The savannah sparrow is listed as threatened in New Jersey and has no listing in New York. It was last seen on the New York side of the Primary Study Area during the 1994 LMS survey. Savannah sparrows breed in grasslands, meadows, marshes, bogs, and cultivated grassy areas (Ehrlich et al, 1988). Breeding habitat must include a mix of grasses of varying heights, a thick layer of litter, dense ground vegetation, and scattered shrubs, saplings or forbs (Beans and Niles, 2003). When not breeding, savannah sparrows can be found in a variety of other habitats including roadside edges, agricultural fields, airports and golf courses (Beans and Niles, 2003).

Breeding territories are usually approximately 1-2 acres in size and are located within large grassland areas that average 20-40 acres in size (Beans and Niles, 2003). The female builds a cup-shaped nest in a natural or excavated depression on the ground (Ehrlich et al, 1988). The nest is usually concealed by vegetation (Ehrlich et al, 1988). Four to five eggs are lain from mid-May to late June and are guarded by both the male and female (Beans and Niles, 2003). Savannah sparrows may breed twice in one season (Beans and Niles, 2003).

The savannah sparrow has been impacted by the decline of farming and land development, which have seriously decreased the amount of optimal breeding habitat (Beans and Niles, 2003). Habitat fragmentation increases the risk of nest predation also affecting breeding success (Beans and Niles, 2003). Modern day agricultural practices such as the creation of monocultures and frequent mowing decrease the quality of existing habitat (Beans and Niles, 2003). The habitat requirements of this species make it unlikely to be found in the Primary Study Area (see Table 12 of Appendix H.1).

Peregrine Falcon. The Primary Study Area provides critical habitat for a pair of peregrine falcons that utilize the bridge structure and/or a nesting box on the bridge tower for nesting and the adjacent area for

the daily activity of the falcons and their fledglings. The peregrine falcon is listed as a New York and New Jersey endangered species as a result of reproductive failure caused by DDT (Andrle and Carroll, 1988). Their numbers declined greatly from the 1940s to the 1960s to the point where they were considered extirpated from New York and the eastern United States. Reintroduction began in 1974 and peregrine falcons are now nesting successfully in portions of the Adirondack Mountains in upstate New York and on bridges and buildings throughout New York City.

In New York City, peregrines nest on the superstructures beneath and above bridge roadways, either directly on the structure or in nesting boxes that have been provided for them. Populations in the northeast can be highly migratory, traveling as far as southern South America during the winter. Local populations, such as those found in New York City, are year-round residents. New York City was also regarded as a historical wintering ground for migratory peregrines (Herbert and Herbert, 1965; USDOI, 1996). NYCDEP and NYSDEC staffs have observed both resident breeding peregrines and migratory peregrines wintering throughout New York City (USDOI, 1996).

The peregrine falcon was first observed in the Primary Study Area during the mid-1980s. A nest box was placed on the eastern main abutment of the Goethals Bridge after a pair of falcons was observed exhibiting territorial behavior in 1990. Successful nesting produced the first clutch on the bridge in 1993 (four young fledged); in 1994 three young were fledged (C. Nadareski, personal communication). Between 1993 and 1997, a total of 10 young hatched and successfully fledged from the bridge (USDOI, 1996). However, during the 1996 breeding season, the peregrines attempted nesting, but failed and remained at the bridge through the rest of the season. Interference with peregrine courtship and egg-laying during this period is believed to be the cause of the nesting failure (USDOI, 1996).

Because the peregrines are year-round residents, courtship behavior can be observed from the post-breeding period (August) up through egg-laying (March) in the subsequent year (USDOI, 1996). Courtship behavior includes 'scrapes' or depressions dug in the gravel or stone within the nest box in preparation for egg-laying; courtship flights and food presentation by the male; and copulation. Egg-laying occurs from March through mid-April. Egg incubation begins when a full clutch of eggs is laid (generally four), and requires continuous (24 hours/day) incubation for approximately 33 days (USDOI, 1996). When hatched, young are naked and blind and require continuous warmth or brooding by adults for approximately one week. The young develop rapidly and reach adult size by 5 to 6 weeks after hatching (USDOI, 1996). During this period the adult peregrines spend most of their time hunting (within a couple miles of the nest) and protecting the young and the nest.

During the 1994 seasonal surveys, falcons were observed perching on the Arthur Kill railroad lift bridge and hunting over the Arthur Kill north and south of the Goethals Bridge. Observations indicate that more hunting is conducted south of the bridge over the marsh and the Gulfport petroleum storage facility (C. Nadareski, personal communication) where more habitat is available. Observations by NYSDEC and NYCDEP staff also indicate that the railroad lift bridge is important as a resting and hunting perch. This area may be more important when young are in the nest and hunting can be conducted from a perch close to the nest. Seasonally, the railroad lift bridge may be important as a hunting perch during the spring and fall migrations when passerines and woodpeckers move along the railroad corridor and cross the Arthur Kill. During these times, there would be many opportunities to take prey in the open. Recently fledged young may also use the railroad bridge because of its proximity to the nest.

The fledging process generally occurs in early June but is dependent on when eggs are laid (USDOI, 1996). Young attempt first flights approximately 40 to 50 days after hatching, sometimes earlier. The young peregrines are often awkward during the first two weeks of flight as they learn to fly and land safely. Although the fledglings are just learning to fly and hunt, much of their experience is gained in the vicinity of the bridge. The adults will provide food and protection for the fledglings during this time for about an eight-week period. After this, the young tend to disperse from the nest site while the adults

maintain their nesting territory. Adults defend their territory with much less aggression after the young have dispersed (USDOI, 1996).

As part of planning for regular deck maintenance on the Goethals Bridge, the Port Authority has consulted with a falcon specialist with the NYCDEP with regards to measures for habitat management during routine maintenance activities. Following recommendations by NYCDEP, an alternate nest box has been constructed on a tower on the north side of the Goethals Bridge, on an island in the Arthur Kill. A box on each side of the bridge provides an alternate nesting site for the falcons when potentially disturbing maintenance activities are planned in proximity to one of the nest boxes. The nesting falcons used the tower consistently until their nest was predated by a raccoon in 2002, and the falcons have not returned to the tower to nest. Since 2004, the center of peregrine activity has been the nesting box on the Arthur Kill railroad lift bridge, though nesting has not been successful there. Only one adult peregrine falcon was sighted at the Goethals Bridge in 2008, and no nesting occurred there, or at the Arthur Kill railroad lift bridge or the tower in 2008 (C. Nadareski, personal communication).

Northern Harrier. The northern harrier is a winter resident and spring and fall migrant throughout the Primary Study Area. The marshes within this area provide foraging habitat for this species, which arrives in the fall and departs in the spring. Northern harriers were also observed hunting in marshes farther from the Primary Study Area. The northern harrier was considered to be a common to occasionally very common migrant, generally uncommon inland during winter but locally numerous overwintering in coastal marshes (Bull, 1985). Northern harriers use a variety of open areas for breeding, including cattail marshes, grassy meadows, and hayfields where their nests are usually placed on the ground or on hummocks (Bull, 1985; Smith, 1988). Nesting harriers frequently select fields adjacent or near estuaries instead of marsh areas, avoiding areas subject to tidal flooding (Dunne, 1995). In New Jersey, Dunne (1995) suggests that there may be a tendency to select marsh habitats because of their inaccessibility and remoteness from humans.

As ground nesters, northern harriers are vulnerable to predators and scavengers. If nests are discovered, the birds may abandon the site (Dunne, 1995). Nests placed in salt marshes are frequently situated between high and low marsh vegetation or adjacent shrubs (Dunne, 1995). Although the 2000-2004 Breeding Bird Atlas lists northern harriers as breeding in northwestern Staten Island (NYSDEC, 2004), no nesting was observed at Old Place Creek or at nearby Saw Mill Creek during either the 1993 or 1994 breeding bird surveys (NYCDPR SMRT, 1994). During the same surveys, observations of foraging northern harriers were recorded over Saw Mill Creek while none were made over Old Place Creek (NYCDPR SMRT, 1994). A pair of nesting northern harriers has been observed in the marshes near the GATX site in 2004 (C. Aldersen, personal communication).

Northern harriers may travel 3 miles (5 km) from nest to foraging area (Dunne, 1995). Approximately 20 to 30 nesting pairs of northern harriers occur in New Jersey (Dunne, 1995). In New York, Bull (1985) found most northern harriers breed inland and leave these inland areas to overwinter in coastal marshes. In winter, northern harriers commonly roost communally on the ground (Dunne, 1995). These roosts are located in grassy areas which offer concealment, isolation and protection from wind. Marshes within the Primary Study Area provide foraging habitat primarily for overwintering birds which arrive in the fall and depart in the spring. Northern harriers were observed at Old Place Creek and Saw Mill Creek foraging during migrations and overwintering periods (August/October through late March/early May; Dunne, 1995).

Northern harriers feed primarily on small mammals (mostly rats and mice) and birds, but may supplement their diet with frogs, snakes, crayfish, and insects (Craighead and Craighead, 1969; Terres, 1980). Foraging areas include fresh and salt marshes, meadows, fields and hayfields (Craighead and Craighead, 1969; Dunne, 1995). Northern harriers may cover up to 5.5 miles (8.9 km) while foraging/moving from one area to another (Craighead and Craighead, 1969); however, these foraging distances can vary largely from year to year. Changes in size of foraging areas may reflect prey availability and/or predator density.

Marshes located within the Primary Study Area provide foraging habitat needed for the winter population of northern harriers in this area. Up to four northern harriers were observed hunting at Old Place Creek at the same time during the 1994 seasonal surveys. Northern harriers were also observed hunting in marshes farther from the Primary Study Area (NYCDPR SMRT, 1994) and were most likely hunting for meadow voles and passerine birds in the Primary Study Area.

Eastern Mud Turtle. The eastern mud turtle was last observed in Old Place Creek in 1900 (NYSDEC Natural Heritage Program); none have since been confirmed in this creek. Surveys conducted during June, July, and August 1994 did not find eastern mud turtles in the creek and they are not expected to occur there today, though some suitable habitat still exists. During a conversation with Edward Johnson of the Staten Island Museum of Arts and Sciences, it was established that there have been no reports of an eastern mud turtle in the Primary Study Area since the sighting in 1900. It is possible that the eastern mud turtle is still present in Old Place Creek because it is a secretive species. However, habitat fragmentation, loss of upland nesting areas, highway mortality, predation, and oil spills are possible reasons for their apparent extirpation.

Fish Species of Concern

Several fish species that may occur in the project area are Species of Concern or Candidate Species. Species of Concern are those species about which NOAA's National Marine Fisheries Service (NMFS) has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (ESA), while Candidate Species are those petitioned species that are actively being considered for listing as endangered or threatened under the ESA, as well as those species for which NMFS has initiated an ESA status review that it has announced in the *Federal Register* (NOAA 2007) Neither "candidate species" nor "species of concern" carries any procedural or substantive protections under the ESA. Table 4.14-8 lists the fish species of concern that may occur in the Primary Study Area.

In an agency response letter dated November 8, 2004, the NJDEP noted that the Candidate Species Atlantic sturgeon (*Acipenser oxyrinchus*) may potentially be present within the proposed Primary Study Area. Atlantic sturgeon is a long-lived and highly migratory species that spends most of its adult life at sea along the Atlantic coastline from Labrador to Florida. Atlantic sturgeon reach maturity between 12 and 15 years of age before migrating into coastal rivers to spawn every 2-5 years (Everly & Boreman, 1999). Mature males typically enter the Hudson-Raritan estuary starting in April and at least some may remain as late as November (Bain, 1997). Adult females enter the estuary in mid-May and migrate directly to the spawning grounds, which are often deep channel or off-channel habitats, before quickly returning to marine waters (Bain, 1997). In the Hudson River, spawning occurs upstream of the salt-front as larvae are thought to be intolerant of saline environments (Everly & Boreman, 1999).

Atlantic sturgeon eggs are demersal and adhesive, and the larvae remain close to the river bottom for some time (Everly & Boreman, 1999). The first years of life are marked by rapid growth and development with juvenile Atlantic sturgeon typically migrating to marine waters after two to six years of residence in the estuary (Bain, 1997).

Recent surveys in the Arthur Kill indicate that adult and juvenile Atlantic sturgeon are either highly uncommon or non-existent within the proposed Primary Study Area. Atlantic sturgeon eggs and larvae were absent from the Arthur Kill ichthyoplankton samples during the USACE surveys between 1998 and 2005. Atlantic sturgeon was not collected during the USACE's trawl surveys in the Arthur Kill from 1998 through 2005 (USACE 1999, 2002 2003a, 2003b, 2005, 2006) and was not collected during the PANY/NJ's 1995-1996 Newark Bay trawl survey (LMS, 1996).

In an agency response letter dated November 8, 2004, the NJDEP noted that the Species of Concern alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) may potentially be present within

TABLE 4.14-8
AQUATIC ENDANGERED, THREATENED, OR SPECIES OF CONCERN IN THE PRIMARY STUDY AREA

Common Name	Scientific Name	Federal	New York	New Jersey	Comments
Alewife	*Alosa pseudoharengus*	SC	-	-	Occurs in Arthur Kill
Blueback Herring	*Alosa aestivalis*	SC	-	-	Likely to occur in Arthur Kill
Atlantic Sturgeon	*Acipenser oxyrinchus*	SC*	-	-	Unlikely to occur except as transient individuals
Shortnose Sturgeon	*Acipenser brevirostrum*	E	E	E	Unlikely to occur except as transient individuals
Loggerhead Sea Turtle	*Caretta caretta*	T	T	E	Unlikely to occur except as transient individuals
Atlantic Kemp's Rridley Sea Turtle	*Lepidochelys kempii*	E	E	E	Unlikely to occur except as transient individuals
Green Sea Turtle	*Chelonia mydas*	T	T	T	Unlikely to occur except as transient individuals
Leatherback Sea Turtle	*Dermochelys coriacea*	E	E	E	Unlikely to occur except as transient individuals

Notes:
E = Endangered
T = Threatened
SC = Species of Concern (*denotes Candidate Species)

the proposed Primary Study Area. Termed collectively by fishermen as "river herring" because of the difficulty in distinguishing them, alewife and blueback herring spend most of the year in coastal Atlantic waters before migrating into nearshore rivers and tributaries to spawn in the spring. In general, blueback herring have a more southern distribution than alewife (Mullen et al., 1986). Alewife usually enter the Hudson-Raritan Estuary first, between late-February and mid-May, preferring to spawn in freshwater tributaries in relatively shallow water with a slow current (Everly & Boreman, 1999). Blueback herring usually spawn about a month later and in different habitat, preferring deep freshwater tributaries with swift currents over hard gravel or sand substrates (Everly & Boreman, 1999). The eggs of both species are pelagic and adhesive. Alewife larvae and juveniles remain in their freshwater nurseries until June (bluebacks follow about one month later) before moving downstream into the lower estuary and out into the ocean (Everly & Boreman 1999). Juvenile blueback herring are largely planktivorous, feeding on copepods, chironomids and cladocerans while the juvenile alewife diet is primarily composed of amphipods and chironomids (Waldman, 2006).

No river herring eggs or yolk sac larvae were captured in ichthyoplankton tows during USACE's 1998 through 2005 surveys. Post yolk sac larvae of Alosa spp. were collected during June 2001, but they were not identified to species level (USACE 1999, 2002, 2003a, 2003b, 2005, 2006). Larval clupeids were collected during 2000 – 2001 and 2001 – 2003 surveys (USACE 2002, 2003a, 2003b) but were not identified to species. Both alewife and blueback herring were captured in low to moderate numbers at Arthur Kill stations during the USACE's 1998 through 2005 trawl surveys (USACE 1999, 2002, 2003a, 2003b, 2005, 2006). A single alewife was collected in October, and several blueback herring were collected in June/July during the PANY/NJ's 1995-1996 Newark Bay trawl survey (LMS, 1996).

Aquatic Threatened and Endangered Species

In an agency response letter dated November 8, 2004, the NJDEP noted that shortnose sturgeon (*Acipenser brevirostrum*) may potentially be present within the proposed Primary Study Area. The shortnose sturgeon is listed as both a state and federally endangered species. Within the Hudson River, shortnose sturgeon move upriver to spawn in April and May when water temperatures reach 8-9°C (Bain, 1997). Eggs of the shortnose sturgeon are demersal and adhesive with the newly hatched larvae remaining close to the bottom within the deep channels of the river (Everly & Boreman, 1999). After spawning, adults distribute throughout the deepest channels of the estuary to forage on benthic invertebrates. As water temperatures decline in the late fall, adults typically concentrate in a few over-wintering areas near Kingston and Haverstraw Bay (Bain, 1997). Shortnose sturgeon may live up to 70 years (Waldman, 2006). Table 4.14-8 also lists the state and federally-protected aquatic species that may occur in the Primary Study Area.

Recent surveys conducted in the Arthur Kill indicate that shortnose sturgeons are unlikely to occur within the proposed Primary Study Area. Shortnose sturgeon eggs/larvae were not collected from Arthur Kill ichthyoplankton tows during the USACE 1998 through 2005 surveys (USACE 1999, 2002, 2003a, 2003b, 2005, 2006). No shortnose sturgeon were captured in trawl surveys performed by the USACE in the Arthur Kill from 1998 through 2005 (USACE 1999, 2002, 2003a, 2003b, 2005, 2006) or during the PANY/NJ's 1995-1996 Newark Bay trawl survey (LMS, 1996).

The National Marine Fisheries Service (NMFS) has indicated that the loggerhead (*Caretta caretta*), Atlantic (Kemp's) ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and green turtle (*Chelonia mydas*), all listed as state and federally endangered, might be seasonal transients in the vicinity of the Primary Study Area. Juvenile Kemp's ridley and large loggerhead sea turtles regularly enter NY/NJ Harbor during summer and fall. The other two species may also enter the higher salinity areas of the Harbor. Habitat descriptions of these four sea turtles are provided below.

The loggerhead sea turtle is the most abundant sea turtle occurring in the United States (NYSDEC, 2004). Loggerheads forage along the inshore and coastal waters of the Gulf of Mexico, the Florida Keys and

north along the eastern seaboard as far as New England. Their primary nesting sites are along the east coast of Florida, with additional sites in Georgia, the Carolinas, and occasionally Virginia. In a few instances, loggerhead nests have been documented along southern New Jersey beaches. Juvenile loggerheads regularly inhabit Long Island Sound and the eastern bays. Some adults can be found along the ocean shore and in New York Harbor. Loggerheads may become stranded on New York City and Long Island beaches during summer migration. (NYSDEC, 2004). The loggerhead turtle was listed as threatened throughout its range in 1970.

Atlantic (Kemp's) ridley sea turtle is the second most abundant endangered sea turtle found in the New York Bight area, occurring from late June into October (NYSDEC, 2004). Adults are found primarily in the Gulf of Mexico, but juvenile and subadult Kemp's ridleys are widely distributed throughout coastal waters of the U.S. from Texas to Maine (Lutcavage and Musick 1985, Keinath et al., 1996). Most nesting by this species is restricted to a 20-mile stretch of Gulf beach near Rancho Nuevo, Mexico. Waters off of Long Island have been identified as critical habitat for Kemp's ridleys ranging in age from two to five years (NYSDEC 2004). Kemp's ridley sea turtles have also been observed in Jamaica Bay (USFWS 2004). The Kemp's ridley was listed as endangered throughout its range in 1970.

Leatherback sea turtles range along the U.S. Atlantic coast from the Gulf of Maine south to east-central Florida. Nesting occurs from Georgia to the U.S. Virgin Islands. Leatherbacks are found in the waters off of Long Island (NYSDEC, 2004) from May through November.

Green turtles are primarily found around the U.S. Virgin Islands, Puerto Rico, and the continental U.S. from Texas to Georgia. Green turtles rarely nest north of Georgia. However, during summer – early fall, juveniles and adults range north to Long Island Sound and the New York Bight (Lutz and Musick, 1996, USFWS, 2004). On Long Island, juvenile green sea turtles can be found entrapped in fishing gear during the summer. The green turtle was listed as endangered in Florida and the Pacific coast of Mexico and threatened throughout the rest of its range in 1978.

Inshore embayments along the eastern Atlantic seaboard appear to provide important foraging habitat for juvenile sea turtles in the summer and into the fall (typically May to November). The occurrence of sea turtles is seasonal in the temperate waters of NY/NJ Harbor. The majority of sea turtles regularly caught in commercial fishing gear (pound nets) in this area are loggerhead and Kemp's ridley turtles as well as a few green turtles. Leatherback and green sea turtles are less likely to occur in the relatively low-salinity waters of the Primary Study Area. There is no nesting activity in NY/NJ Harbor, and the turtles are not year-round residents. As a result, sea turtles are not likely to occur in the Primary Study Area except as occasional seasonal transient individuals.

4.14.6 Ecosystem Relationships

Old Place Creek and Marsh function as a wetland unit that is part of a complex regional ecosystem. Energy is exchanged among many pathways. Two hypothetical food webs were selected to more fully describe the Old Place Creek Marsh by interrelating the ecological community and their wildlife. One, oriented to the aquatic wetland component, ends with several top consumers including raptors, herons, egrets, and falcons, while the other, oriented to wetland vegetation, is simpler and ends with raptors as top consumers. These food webs are based on some of the community interactions observed during the field surveys and literature reviewed. Raptors, wading birds, shorebirds, waterfowl, and gulls were the most common groups of birds identified using the Old Place Creek and Marsh habitat. Two groups of species were selected as indicators. The raptors, including the barn owl, northern harrier, and red-tailed hawk (but excluding the peregrine falcon because of different food habitats), were selected because of widespread concern for all raptors. Wading birds, including egrets and herons, were selected because they use the Old Place Creek and Marsh area for foraging and because there are three rookeries located nearby. Details of the food webs are discussed below.

4.14.6.1 Aquatic-Based Food Webs

Wading birds utilize marsh habitats to forage for prey for both themselves and for feeding their young. Fledgling wading birds will also depend on these areas once they can make the flight. The main fish forage base which is present year round in the Old Place Creek and Marsh is the mummichog. Among killifish species resident within salt-marsh areas, the mummichog (*Fundulus heteroclitus*) is considered one of the most abundant, with a wide geographical distribution ranging from the Gulf of St. Lawrence to northern Florida (Meredith and Lotrich, 1979). The abundance and productivity of mummichog in estuarine systems suggests that it may be an important part of the ecological food web. Mummichog and other small forage species utilize various portions of the salt marsh habitat.

The mummichog moves into the high marsh areas during high tides to feed on small crustaceans and polychaetes and returns to tidal creeks during low tide (Kniweb and Stiven, 1978). Mummichog, as well as other killifish species, also utilize the high salt marsh areas for spawning and larval growth. Talbot and Able (1984) found mummichog larvae present in a variety of high marsh habitats (tidal and nontidal ponds and ditches and the marsh surface), but were most abundant in tidal areas. Taylor et al. (1977) also found eggs of mummichog in a narrow band high along the banks of ditches and creeks on the inner surface of the primary leaves of saltmeadow cordgrass (*Spartina patens*). The marsh was drained by a network of ditches and creeks and dominated by saltmeadow cordgrass. The eggs of mummichogs are highly resistant to desiccation (Taylor et al., 1977), providing enhanced capability of hatching. The high marsh is preferred as a nursery area for resident killifish providing food and protection for young and increasing survival and overall production (Talbot et al., 1977). Ditches cut into the marsh allow for increased habitat utilizations by forage fish and may increase the survival of mummichogs. Smith and Able (1994) found mummichogs prefer marsh habitat with salt marsh tidal pools which are used as winter refuges. These pools warm up rapidly during the day and may allow the mummichog to begin feeding and moving around, possibly providing prey for other wildlife.

Black-crowned night herons, great egrets and snowy egrets stalk fish, mostly mummichogs, in the Primary Study Area. Maccarone and Parsons (1994) also found the common mummichog to be the most important prey species for snowy and great egrets, comprising 78 percent of all fish taken in the Arthur Kill area. Parsons (1994) also found snowy egrets to rely heavily on mummichog for prey. Mummichog accounted for 72 percent of prey items found in nestling regurgitations of snowy egrets nesting on Shooters Island. Great and snowy egrets forage mainly on fish, though they are opportunistic feeders taking a variety of aquatic vertebrates and invertebrates. Both species have been found to feed on snakes, frogs, salamanders, small mammals, snails, crustaceans (including shrimp, fiddler crabs and crayfish), insects, and worms (Palmer 1962).

Great blue herons and black-crowned night herons feed primarily on fish. Great blue herons are very opportunistic, preying heavily on small mammals (including meadow voles), reptiles, and amphibians (Palmer, 1962). Great blue herons also feed on birds, various insects, crustaceans, and leeches (Palmer, 1962). The black-crowned night heron feeds mainly on fish but may also take amphibians and invertebrates (Palmer, 1962). Yellow-crowned night herons eat primarily crustaceans including fiddler crabs, but rarely take fish (Andrle and Carroll, 1988). Fiddler crabs are very common in Old Place Creek and Marsh.

4.14.6.2 Wetland Habitat-Based Food Web

Both the northern harrier and red-tailed hawk hunt in Old Place Creek Marsh areas. Seasonal surveys indicated the dominant small mammal is the meadow vole. These two species hunt the marsh during the day while the barn owl hunts at night. The northern harrier hunts the marsh by hovering and diving on its prey while the red-tailed hawk may either hunt from a perch or by soaring over the marsh.

The meadow vole prefers dense low vegetation with areas of higher ground to escape the spring tides. Meadow vole may benefit from isolated islands above spring high water levels where they could take refuge during high tide periods. Tall grasses provide areas to hold during periods of extreme high tides while lower grasses provide the food and cover needed to survive and reproduce. These areas of higher ground with taller vegetation are often found along ditches; thus, they provide access to more marsh habitat. Meadow voles not only provide a solid prey base for some raptors, but they also facilitate energy flow through the marsh by clipping vegetation which is decomposed faster than if left standing. Meadow voles' digested materials also help recycle nutrients and speed energy flow.

The common barn owl forages in marshes, meadows, fields, barnyards, brushy areas and garbage dumps (DeGreaf and Rudis, 1987). Their diet consists mainly of small mammals, including rats, mice, shrews, voles, small rabbits, and may also include birds, reptiles, amphibians, insects, and occasionally carrion (DeGreaf and Rudis, 1987). Wallace (1948) found 80 to 90 percent of the common barn owl's diet in Michigan consisted of meadow voles. Examination of pellets from the common barn owl present in the Primary Study Area indicates that meadow voles are the primary prey species taken, with a large percentage of Norway rats also taken. The northern harrier and red-tailed hawk have also been found to feed primarily on meadow vole in other studies (Craighead and Craighead, 1969). In Michigan, Craighead and Craighead (1969) found 93.2 percent and 98.0 percent of the prey taken by overwintering northern harriers were meadow voles in 1942 and 1948, respectively. Craighead and Craighead (1969) found a similar trend with red-tailed hawks in Michigan, 89 and 84 percent of their prey consisting of meadow roles in 1942 and 1948, respectively.

4.15 Wild, Scenic, and Recreational Rivers

Both the NJDEP's Division of Parks and Forestry, Office of Natural Lands Management and the NYSDEC's Division of Lands and Forests, Bureau of Preserve Protection and Management have documented that no such rivers are present in or near the Goethals Bridge Study Area.

4.16 Navigation and Airspace

4.16.1 Introduction

This subsection describes marine and air traffic in the vicinity of the Goethals Bridge, based on data and information obtained to characterize the Arthur Kill and connecting waterways, channel conditions, requirements for ship movements, vessel traffic and vessel sizes, physical restrictions on marine traffic, and air traffic operations at Newark Liberty International Airport.

4.16.2 Methodology, Approach and Data Sources

Information concerning navigation and airspace was obtained from various sources, including navigation charts, publications, reports, and through personal communication with the local harbor pilots, marinas, and Port Authority personnel. While some of the marine and air traffic data received from these sources are approximations, the full set of information provides an adequate basis for characterizing marine navigation and air traffic in the vicinity of the Goethals Bridge.

The following information sources were consulted:

1. Nautical Charts: These charts are published by the National Ocean Service (NOS) of the U.S. Department of Commerce. They maintain and provide detailed mapping of New York Harbor and the associated waterways, including water depths, channels, bridges, landmarks, and aids to navigation. The following charts were used:

- Chart 12331: Raritan Bay and Southern Arthur Kill (31st Edition, July, 2005)
- Chart 12333: Kill Van Kull and Northern Part of Arthur Kill (33rd Edition, September, 2003)

2. Maritime Association of the Port of New York and New Jersey: This association compiles reports on ship arrivals and departures from the harbor for all U.S.- and foreign-flagged vessels that were manned by a harbor pilot, including information such as vessel name, vessel flag, cargo, deadweight tonnage, length overall, breadth, berth(s), date of arrival and departure. Data used for this DEIS are for the year 2004

3. Waterborne Commerce Statistics Center: Run by the U.S. Army Corps of Engineers, the Center provides custom vessel reports with information including vessel type, length overall, breadth, draft, and number of trips for U.S.-flagged vessels and barges. Traffic counts for foreign-flagged vessels are indicated, although vessel particulars are not available. The data used in this DEIS are for the year 2003.

4. Captain Henry Mahlmann, Sandy Hook Pilots Association: Capt. Mahlmann provided information regarding vessel traffic patterns and operations in the Arthur Kill and Kill Van Kull.

5. Bayway Refinery: Personnel from the Bayway Refinery provided insight to current and future operations of ships on the Arthur Kill.

6. Marinas: Personnel from the City of Elizabeth Marina (Elizabeth, NJ) and the Port Atlantic Marina (Staten Island, NY) provided information about the number of slips at each marina and the general operation of recreational vessels on the Arthur Kill.

7. Energy Information Administration: The Energy Information Administration (EIA) is part of the U.S. Department of Energy. Information obtained from the EIA's website includes published data and statistics and the Annual Energy Outlook. The Annual Energy Outlook makes future projections of U.S. energy markets, based on expected supply and demand and other factors that could affect market conditions through the year 2030.

8. Port Authority of New York and New Jersey: Personnel from the Port Authority provided information about the Arthur Kill Railroad Lift Bridge and future navigation conditions around the Goethals Bridge. In addition, the Port Authority provided Goethals Bridge clearance information at a maritime operators meeting held on January 31, 2005. The Port Authority was also consulted regarding existing operations at Newark Liberty International Airport (EWR), which is managed and operated by the agency, regarding the applicable Federal Aviation Administration (FAA) standards used to determine take-off weight (governed by the obstacle accountability area (OAA) along the path projected from the departure runways).

4.16.3 Navigation

4.16.3.1 Arthur Kill

The Arthur Kill is a tidal strait that is approximately 14 miles long that extends from Raritan Bay, near the mouth of the Raritan River, to a confluence with Newark Bay and the Kill Van Kull immediately east of Shooters Island. The federal navigation channel in the Arthur Kill has depths of 41 feet below mean lower low water (MLLW) from its confluence with the Newark Bay and Kill Van Kull federal navigation channels to the southern limit of the New York Container facility at Howland Hook and 35 feet below MLLW thereafter for its entire length as indicated on NOS Charts 12331 and 12333. The width of the navigation channel in the Arthur Kill varies from approximately 500 to 800 feet, as indicated by these

charts and by the U.S. Army Corps of Engineers, New York District Project Maps. The Arthur Kill is crossed by several overhead obstructions, which include the following:

- Arthur Kill Railroad Lift Bridge: Located immediately north of the Goethals Bridge, the lift bridge has a vertical clearance of 131 feet in the open position and 31 feet in the closed position. Until recently, this bridge was inoperative and was maintained in the full open position. With rehabilitation of the bridge, as part of the reactivation of Staten Island Railroad freight service, the bridge is now fully operational. Horizontal clearance is 500 feet between the lift towers. The lift bridge is owned by the City of New York.

- Goethals Bridge: The Goethals Bridge has an actual vertical clearance of 134.9 feet above MHW and horizontal clearance of 600+/- feet measured between piers.

- Overhead Power Cables: Owned by East Coast Power, these power cables are located north of Pralls Island and have a vertical clearance of 165 feet above MHW over the main channel.

- Outerbridge Crossing: The Outerbridge Crossing has an actual vertical clearance of 141.5 feet above MHW and horizontal clearance of 675 feet measured between piers.

The mean tide range of the Arthur Kill is approximately 5 feet. The flood current in the Arthur Kill flows from Raritan Bay to Newark Bay, with the ebb current flowing in the opposite direction. The current speed varies with location but is usually between 1 and 1.5 knots.

The Arthur Kill will eventually be dredged to 50 feet to the southern limit of the New York Container facility at Howland Hook as part of the U.S. Army Corps of Engineers' Harbor Deepening Project. For approximately one mile south of New York Container Terminal, the Corps plans to deepen the channel from 35 feet MLLW to 40 feet MLLW.

Numerous sunken and visible wrecks lie adjacent to both sides of the navigation channel along the length of the Arthur Kill.

4.16.3.2 Kill Van Kull

The Kill Van Kull is a tidal strait approximately 4 miles long that separates the southern shore of Bayonne, New Jersey from Staten Island< New York and connects the Upper Bay of New York Harbor with Newark Bay and the Arthur Kill (NOS Chart 12333). It has factories, storage facilities, parks and residential areas on both shores, and several shoals and wrecks along both sides of the navigation channel. The federal navigation channel in the Kill Van Kull extends the entire length of the waterway and has a minimum width of 800 feet. The Bayonne Bridge is the only crossing of the Kill Van Kull, with a vertical clearance of 138 feet above MHW at the northern edge of the channel, 151 feet at the center of the channel, and 144 feet at the southern edge of the channel. The Bayonne Bridge has a horizontal clearance of 800 feet commensurate with the channel width.

The mean tidal range of the Kill Van Kull is approximately 4.5 feet. The flood current flows westward from the Upper Bay of New York Harbor towards Newark Bay while the ebb current flows in the opposite direction.

As part of the ongoing U.S. Army Corps of Engineers' Harbor Deepening Project, the Kill Van Kull channel is being deepened to a depth of 50 feet MLLW from its existing depth of 45 feet MLLW.

4.16.3.3 Vessel Traffic

Vessel traffic in New York Harbor is a mix of both commercial and pleasure craft. There is a wide range of commercial traffic, including cargo ships, tankers, barges, tugs, ferries, and passenger ships. Some of these vessels are transient while others stay within the harbor moving from berth to berth and from berth to anchorage.

The closest marina to the Goethals Bridge is the City of Elizabeth Marina, located approximately 0.9 miles northeast of the bridge. Conversations with marina personnel indicate that it has slips and dry-storage facilities for approximately 60 recreational vessels. Two larger marinas, the Port Atlantic Marina and the Perth Amboy Municipal Marina, are located along the southern portion of the Arthur Kill. The Port Atlantic Marina is located on Staten Island, approximately one-half mile south of the Outerbridge Crossing. Conversations with marina personnel indicate that Port Atlantic is a large facility, with 260 boat slips, shower facilities, a restaurant, and a pool. The Perth Amboy Municipal Marina, located in Perth Amboy, New Jersey, at the confluence of the Arthur Kill with Raritan Bay, has 144 boat slips. According to personnel at the Port Atlantic Marina, recreational vessels often use the Arthur Kill in lieu of the rougher open waters around Staten Island in order to access Upper New York Harbor, the Statue of Liberty, and the Hudson River. Peak use of the Arthur Kill by recreational vessels occurs during the summer, particularly on weekends and during August, (i.e., peak vacation time). Although exact numbers were not available from the marina, a substantial number of recreational vessels use the Arthur Kill during these peak times. However, according to both the marina personnel and a pilot from the Sandy Hook Pilots Association, recreational and commercial vessels on the Arthur Kill are respectful of each other and their co-use of the waterway does not cause navigational concern. Additionally, most recreational vessels are small enough that they are not restricted by available channel width, depth, and bridge clearances.

The commercial vessel traffic in the Arthur Kill is characterized by tanker vessels and barges, which carry a variety of cargo, including petroleum and other refined products. Because vessel traffic data were not available from the U.S. Coast Guard Vessel Traffic Service, data from the Maritime Association and the Waterborne Commerce Statistics Center were used to characterize vessel traffic in the vicinity of the Goethals Bridge.

There are several vessel traffic patterns in New York Harbor, depending on cargo type and berth location. Most container and dry-cargo vessels (e.g., general cargo, bulk, ro-ro, etc.) entering New York Harbor are bound for Port Newark and Port Elizabeth in New Jersey. These vessels arrive and leave Newark Bay via the Kill Van Kull and do not pass under the Goethals Bridge. Vessels berthing at Howland Hook, Elizabethport, and May's Ship Yard (located on the north shore of Staten Island by Shooters Island) also arrive and leave via the Kill Van Kull and do not pass under the Goethals Bridge.

Tanker vessels entering New York Harbor are typically bound for the oil and product terminals located along the Arthur Kill, the Bayonne terminals (IMTT, Gordon, and Hess), and the BP and Wilson Avenue Terminals in Newark.

Vessels berthing in Bayonne and Newark do not pass under the Goethals Bridge unless they also have destinations at other terminals located along the Arthur Kill. Vessels heading to additional terminals along the Arthur Kill pass under the Goethals Bridge if they are not limited by air-draft or other logistical considerations, such as reprovisioning at Stapleton. When limited by air-draft or logistics, vessels sail around the north, east and southern coasts of Staten Island and head up the southern reaches of the Arthur Kill, known as the Southway, particularly if the next berth is at one of the southern Arthur Kill terminals.

Vessels whose first berth is a northern Arthur Kill terminal, such as Bayway, BP Tremley Point or Graselli Point, usually enter the Kill Van Kull and proceed south in the Arthur Kill, passing under the

Goethals Bridge. These vessels can then head south to additional terminals along the Arthur Kill or leave the harbor via the Arthur Kill.

Vessels whose first destination is at a southern Arthur Kill terminal, such as KMI Outerbridge Terminal, Chevron Perth Amboy, Port Reading or Motiva Sewaren, usually head up the Southway to their first berth. If these vessels are heading to a northern Arthur Kill, Newark, or Bayonne terminal, they proceed up the Arthur Kill and pass under the Goethals Bridge, unless limited by air-draft. If air-draft or other logistical considerations such as re-provisioning at Stapleton warrant a trip around the east side of Staten Island, ships at the southern terminals may turn and head south to go around Staten Island. If the southern Arthur Kill terminal is the vessel's only berth, the ship will usually enter and exit via the Southway and not pass under the Goethals Bridge.

An analysis of the data supplied by the Maritime Association and the U.S. Army Corps of Engineers indicates that approximately 800 larger and 800 smaller vessels pass under the Goethals Bridge per year. Between 60 and 79 larger-sized vessels passed under the Goethals Bridge per month in 2004 (see Table 4.16-1).

TABLE 4.16-1
BREAKDOWN OF LARGER-VESSEL TRAFFIC, BY MONTH, IN 2004

Month	Approx. Number of Larger Vessels
January	60
February	64
March	76
April	75
May	79
June	69
July	63
August	73
September	59
October	69
November	53
December	57

Source: U.S. Army Corps of Engineers and Maritime Association.

The larger vessels, defined as those being generally longer than 330 feet, consist mostly of tankers. The largest vessels (as measured by deadweight tonnage) passing under the Goethals Bridge are 155,000 deadweight ton (DWT) tankers bound for the Bayway terminal. These tankers are 900 feet in length, 150 feet in breadth, and have a maximum summer-draft of 57 feet when fully loaded, which means that the Arthur Kill channel depths prevent these tankers from operating at full capacity. Due to the vertical clearance of both the Arthur Kill Railroad lift bridge and the Goethals Bridge, these tankers are also restricted by the available air draft along the Arthur Kill.

The majority (68 percent) of the larger vessels are under 50,000 DWT. These vessels are typically 600 to 700 feet in length, have a breadth of 105 feet, and a draft of approximately 40 feet. Table 4.16-2 presents the breakdown by DWT of the larger vessels that passed under the Goethals Bridge in 2004.

The smaller vessels are local vessels that carry bunker, lube oil, and water around the harbor and are less than 330 feet in length. While these vessels contribute to marine traffic on the Arthur Kill, they do not cause major navigational concerns due to their relatively small size. Barge traffic, as reported by the U.S. Army Corps of Engineers, comprise approximately 4,700 tanker barge trips and 1,250 cargo barge trips per year.

TABLE 4.16-2
BREAKDOWN OF LARGER VESSEL SIZES PASSING UNDER GOETHALS BRIDGE IN 2004
(Thousands of DWT)

Size in DWT	< 25	25 - 50	50 - 75	75 - 100	100 - 125	125 - 150	> 150
Number of Vessels	58	486	54	136	47	16	1
% of Total	7%	61%	7%	17%	6%	2%	<< 1%

Source: Based on data provided by the Maritime Association.

The New York Harbor area has a refined-product storage capacity of over 40 million barrels, making it the largest and most important petroleum product hub in the Northeast, interconnecting several refined-product pipelines with both waterborne (tanker and barge) and land transportation (rail and truck). The Northeast Heating Oil Reserve's largest storage site is located in the New York Harbor area. The harbor acts as a central distribution center for the region and many of the petroleum products delivered to NY Harbor are redistributed to smaller ports in order to supplement local supplies. New York Harbor serves as an important supplement for local supplies of heating oil and other refined products in parts of New England since the regional New England pipelines do not interconnect with the nationwide pipeline system.

One of the main navigation concerns in the vicinity of the Goethals Bridge is tankers bound for the Bayway terminals. After a tanker passes under the Goethals Bridge, it makes a right turn into the Bayway terminal. During this maneuver, the tanker's stern swings toward Staten Island near the dolphins located at the bridge's east tower foundation for protection against collisions. This difficult maneuver requires precise coordination between the tanker and the assisting tugs.

Due to the limited depth of the Arthur Kill and the physical size and operational constraints of larger vessels, these vessels' operations are limited to periods of high-tide so they can carry larger cargos or they must lighter some of their cargo to a barge to reduce the vessel draft. Lightering is a process in which a vessel with a draft deeper then the available channel depth off-loads some of its cargo to a barge or smaller vessel in deeper water to reduce its draft. Then the vessel and the barge or smaller vessel proceed to the final berth and off-load their cargos at the terminal. Even at high-tide, the Arthur Kill is only about 40 feet deep, which means the largest vessels still cannot carry a full load of cargo.

4.16.4 Airspace

The Goethals Bridge is located less than 3 miles from the southern boundary of Newark Liberty International Airport (EWR). Based on the runway configuration at EWR, the bridge lies within the obstacle accountability area (OAA) of two departure runways, 22L/4R and 22R/4L. Under FAR Part 121, departing aircraft must meet take-off requirements that the plane's weight not exceed that listed in the *Airplane Flight Manual*, which allows "a net takeoff flight path that clears all obstacles either by a height of at least 35 feet vertically, or by at least 200 feet horizontally within the airport boundaries and by at least 300 feet horizontally after passing the boundaries." It is assumed that the airplane is not banked before reaching a height of 50 feet, and that the maximum bank is not more than 15 degrees thereafter. The takeoff path extends from a standing start to a point in the takeoff at which the airplane is 1,500 feet above the takeoff surface, or at which the transition from the takeoff to the en route configuration is completed and velocity at final takeoff (V_{FTO}) is reached, whichever point is higher (FAR Part 25.111). V_{FTO} is the speed at which the plane would climb (after reaching acceleration altitude) following an engine failure or single engine go-around.

In general, additional obstacle-protection area is provided to allow for greater airspeeds in the climb for those aircraft requiring them. For two-engine airplanes that have one engine inoperative (OEI), the steady gradient of climb must be positive with landing gear extended, may not be less than 2.4 percent with landing gear retracted, and, at the end of the takeoff path, may not be less than 1.2 percent. Under the basic requirement of FAR Part 121, aircraft must be able to take off and climb at 2.4 - 0.8 percent, or 1.6 percent (62.5:1) gradient with OEI.

At a height of 238.09 feet above mean sea level (MSL), the maximum elevation of the existing superstructure trusswork of the Goethals Bridge does not affect the allowable weights for boarded, loaded and fueled airplanes departing EWR. This assessment is based on the Part 121 OAA, defined as a constant 600-foot total width, i.e., 300 feet to each side of the runway centerline, along the path projected from a runway.

4.17 Infrastructure

4.17.1 Introduction

This section presents infrastructure information related to water supply, sanitary sewerage, stormwater, communication and electric utilities, and petroleum and natural gas pipelines. Each of these types of infrastructure facilities and services is presented separately for the New Jersey and New York portions of the Primary Study Area.

4.17.2 Methodology, Approach and Data Sources

Information on the Primary Study Area's infrastructure was developed from mapping provided by the Port Authority, previous reports, and information obtained from relevant utility providers and municipal agencies, including the Elizabeth Engineering Department and the New York City Department of Environmental Protection's Bureau of Water and Sewer Operations.

4.17.3 Water Supply

4.17.3.1 New Jersey

Operation and management of Elizabeth's water distribution system – including all maintenance, repairs, customer service, billing, and regulatory reporting – is performed under contract by the New Jersey American Water Company. New Jersey American's sources include the Raritan River, the Delaware and Raritan Canal and groundwater. The company operates two water treatment facilities. Treated water from both plants is distributed to customers through the same system. The Raritan-Millstone Treatment Plant produces 165 million gallons of treated water a day (mgd), while production at the three-year-old, state-of-the-art Canal Road Water Treatment Plant is usually 40 mgd.

Within the city, a grid of underground distribution mains distributes water to consumers. Large transmission mains feed smaller distribution mains, such as 20, 12, 8 and 6-inch mains, which distribute water to individual locations. These mains also provide water to fire hydrants along the city's streets. Water pressure throughout the city water supply system is controlled by pressure regulators. Water mains that are located in the Primary Study Area are summarized in Table 4.17-1.

4.17.3.2 New York

The water supply system of New York City is operated by the City's Department of Environmental Protection (NYCDEP) out of three watersheds: Croton, Delaware, and Catskill. The system relies primarily on gravity to supply approximately 1.2 billion gallons per day (gpd) of water, via a system of

TABLE 4.17-1
WATER MAINS LOCATED IN THE NEW JERSEY PORTION OF THE PRIMARY STUDY AREA

Street	Facility
Bay Way, from South Front Street to former Woodbridge Avenue*	2 x 12-inch mains
Bay Way, from South Front Street to the Arthur Kill	4-inch main
Bay Way, from Pulaski Street west	12-inch main 6-inch main
Relocated Bayway, from Cole Place to New Jersey Turnpike	2 x 12-inch mains
Trenton Avenue, from Clifton Street to Elizabeth River	6-inch main
Brunswick Avenue, from Bay Way south	10-inch main
Rockefeller Street, entire length	10-inch main 6-inch main
Krakow Street, from Amboy Avenue west to midblock	6-inch main
Amboy Avenue, from Carringer Street to Bay Way	8-inch main
Amboy Avenue, from Bay Way to Staten Island Railroad overpass	10-inch main 6-inch main
Amboy Avenue, from Staten Island Railroad overpass to former Clifton Street**	8-inch main
Former Clifton Street, from Amboy Avenue to South Front Street	8-inch main
Carringer Street, entire length	8-inch main
South Front Street, from southern terminus to Myrtle Street	12-inch main
South Front Street, from Myrtle Street to Bay Way	12-inch main 10-inch main
South Front Street, from Bay Way north	2 x 10-inch mains

Source: New Jersey American Water Co., 2006.

Notes:

* Woodbridge Avenue no longer exists, having been vacated for the construction of Interchange 13 of the New Jersey Turnpike.

** This section of Clifton Street no longer exists.

reservoirs, aqueducts, and tunnels. A citywide underground distribution network further distributes water to consumers and fire hydrants. The water supply is primarily channeled via three tunnels, City Tunnel Nos. 1, 2 and 3 (Stage 1).[11] City Tunnel No. 2 travels through the Bronx, Queens and Brooklyn, and finally through the Richmond Tunnel in order to reach Staten Island. The Catskill/Delaware watershed is the primary source of the water that is distributed to Staten Island consumers. Within the city, a grid of underground mains distributes water to consumers and to fire hydrants. Water pressure throughout the city is controlled by pressure regulators. Water mains in the Primary Study Area are summarized in Table 4.17-2.

[11] While Stage 1 of City Tunnel No. 3 is complete, the extension of this tunnel is currently under construction in Brooklyn and Queens

TABLE 4.17-2
WATER MAINS LOCATED IN THE NEW YORK PORTION OF THE PRIMARY STUDY AREA

Street	Facility
Goethals Road North, from Western Avenue east	12-inch main
Gulf Avenue, from Western Avenue to Forest Avenue	12-inch main
Western Avenue, from Gulf Avenue north	12-inch main
Forest Avenue, from Gulf Avenue north	12-inch main
South Avenue, entire segment within Study Area	16-inch main 8-inch main

Source: NYCDEP, Bureau of Water and Sewer Operations, 2006.

4.17.4 Sanitary Sewerage

4.17.4.1 New Jersey

There are approximately 175 miles of sewers in the City of Elizabeth, approximately 90 percent of which are combined sewers, in that they carry both sanitary sewage and stormwater loads. The majority of the system is between 70 and 100 years old and is of brick construction.

The main components of the system are the Trenton Avenue Pumping Station, the Westerly Interceptor, the Easterly Interceptor, and the treatment plant of the Joint Meeting of Essex and Union Counties. The Trenton Avenue Pumping Station receives sewage from the city's two principal interceptors and delivers it to the north influent flume of the Joint Meeting Treatment Plant. The Trenton Avenue Pumping Station has a maximum pumping capacity of 36 mgd.

The Easterly Interceptor is relatively new. Completed in 1958, it starts at U.S. Route 1, follows Dowd Avenue to the New Jersey Turnpike, and winds its way through Elizabethport, terminating at the Trenton Avenue Pumping Station. Constructed of reinforced concrete pipe, it has a capacity of two to three times that required by the peak dry weather flow. The two interceptors drain approximately 93 percent of the city's sewers. The remaining seven percent, located mostly west of Elmora Avenue, drain directly to the Joint Meeting trunk sewers which pass through the city.

The treatment plant is owned and operated by the Joint Meeting of Essex and Union Counties. Created in 1898 by state statute, the Joint Meeting is comprised of 12 municipalities within the two counties. The treatment plant, which is located at 500 South First Street, borders the northern edge of the primary Study Area. The plant has a capacity of 65 mgd and an average annual flow of 55 mgd. The plant was upgraded to secondary treatment in 1979. Treated wastewater (effluent) is discharged into the Arthur Kill.

Sewers located in the New Jersey portion of the Primary Study Area are listed in Table 4.17-3. In addition to the local facilities listed, several major regional facilities are located near the Study Area. These include two 7-foot, 3-inch x 6-foot, 6-inch trunk sewers running from the Joint Meeting treatment plant to the Arthur Kill and a 24-inch sludge force main which runs from the treatment plant to South Front Street, then turns north within South Front Street.

4.17.4.2 New York

The municipal sewer system in New York City is comprised of a network of underground sewers that move wastewater to 14 treatment plants known as water pollution control plants, or WPCPs. Most of the city's sewer network is combined, although portions of the system collect stormwater and sanitary sewage separately. The municipal sewer network, via gravity, discharges to the final conveyance pipe, an

interceptor sewer that conveys its contents to the closest pump station, and from that point, to the WPCP via force main.

Staten Island is served by two WPCPs, Oakwood Beach and Port Richmond. The Port Richmond facility serves the North Shore and is located at 1801 Richmond Terrace. The Primary Study Area is entirely within the service area of the Port Richmond WPCP; thus, sanitary sewage and stormwater in the Primary Study Area are treated at the Port Richmond WPCP. Treated effluent is discharged into the adjacent waters of the Kill Van Kull. The Port Richmond WPCP is designed to treat a monthly flow of 60 mgd. The average flow to this facility, approximately 35 mgd, is historically much less than the design flow.[12]

TABLE 4.17-3
SEWERS LOCATED IN THE NEW JERSEY PORTION OF THE PRIMARY STUDY AREA

Street	Facility
Municipal Facilities	
Bay Way, from Rockefeller St. to the Arthur Kill	72-inch combined, brick
Bay Way, from Rockefeller St. to former Woodbridge Ave.*	66-inch combined, brick
Bay Way, from former Woodbridge Ave. west*	42-inch combined, brick
Relocated Bayway, from Bay Way to Trenton Ave.	18-inch combined, reinforced concrete
Trenton Ave., from Relocated Allen St. to Bay Way	10-inch combined, tile
Trenton Ave., from Bay Way to Richmond St.	12-inch combined, tile
Relocated Allen St., from former Pulaski St. to Brunswick Ave.*	8-inch combined, tile
Former Mack St., from Bay Way to Relocated Allen St.*	10-inch combined, tile
Fern Place, from Trenton Ave. to Brunswick Ave.	10-inch combined, tile
Former Franz Josef Ave., from Trenton Ave. to Brunswick Ave.*	10-inch combined, tile
Former Myrtle St., from Trenton Ave. to Brunswick Ave.*	10-inch combined, tile
Former Woodbridge Ave., from Bay Way to former Richmond St.*	42-inch combined, brick
Brunswick Ave., east from Relocated Allen St.	10-inch combined, tile
Former Richmond St., from the west to the former Bay Way/Woodbridge Ave. intersection*	42-inch combined, brick
Rockefeller St., south of Bay Way	15-inch combined, tile
Krakow St., from Amboy Ave. west to midblock	10-inch combined, tile
Amboy Ave., from Myrtle to Krakow Streets	12-inch combined, tile
South Front St., from Bay Way to former Clifton St.	24-inch sanitary, vitrified clay pipe
South Front St., south of Bay Way	12-inch combined, brick
South Front St., from former Clifton St. north	15-inch sanitary, vitrified clay pipe
Regional Facilities	
From Joint Meeting Treatment Plant to Arthur Kill	7-foot, 3-inch x 6-foot, 6-inch trunk sewers
From Joint Meeting Treatment Plant to S. Front St., then north	24-inch sludge force main

Source: Elizabeth Engineering Department.
Notes:
* - When denoted by the word "former" the street no longer exists, having been vacated by the construction of Interchange 13 of the New Jersey Turnpike.

12 USEPA Clean Water Needs Survey, 1996.

Sanitary sewers include a 24-inch reinforced concrete pipe located along Forest Avenue and a 36-inch reinforced concrete pipe located along South Avenue. The Port Authority's Goethals Bridge Administration Building and adjacent Maintenance Building are not currently serviced by sewer, but plans were submitted to NYCDEP in the late 1990s for extension of a sewer line from Forest Avenue to the Administration Building. As of July 2006, there has been no action taken on this application. Port Authority officials have indicated that they do not anticipate any sewer hookup for at least three years. The Port Authority previously operated a private sewage treatment plant for these two buildings.

At present, the sewage generated in these two buildings is conveyed to an above-ground tank in the old sewage treatment plant located outside the Maintenance Yard. An 8-inch sewer pipe conveys the sewage from the administration building to the tank. This sewage is collected five times a week by a private septic contractor for disposal.

4.17.5 Stormwater

4.17.5.1 New Jersey

In addition to the combined sewers as listed in Table 4.17-3, a 24-inch brick storm sewer extends along Trenton Avenue, north of Relocated Bayway, and a 12-inch brick storm sewer extends along South Front Street from the Goethals Bridge to the former Clifton Street and a 24-inch brick storm sewer along South Front Street from the former Clifton Street north.

On the New Jersey bridge approach, stormwater is dispersed through scuppers (openings in the curbs) onto the ground below, much like rain. Between Amboy Avenue and Bay Way, runoff collects in an existing isolated shallow. Over the New Jersey Turnpike, runoff is collected in the Turnpike's drainage system. For the ground level portions, the stormwater is discharged into open vegetated areas or stone-lined ditches where it percolates into the ground. At the New Jersey approach to the bridge, there is a Teleport Communicative vault located on Amboy Avenue.

4.17.5.2 New York

In Staten Island, the area immediately around the bridge is served by a stormwater system that is not combined with sanitary sewerage. Stormwater runoff from the bridge is discharged directly into the Arthur Kill. Collected stormwater flows from the approaches and toll booth are conveyed to Old Place Creek. The sewer lines consist of a 15-inch line that drains Goethals Road North and the area where the span reaches grade. This discharges through an 18-inch line to the west of the existing railroad bridge. Additional storm sewers of 15- to 24-inch-diameter cross I-278 east of the toll plaza. An 18-inch pipe that runs along Gulf Avenue connects to this system. A second connecting pipe begins at Forest Avenue and runs westward along I-278 to the toll plaza. An 18-inch stormwater pipe runs along Forest Avenue. On the main span of the bridge, stormwater is discharged directly into the Arthur Kill through scuppers. Additional facilities include a 96-inch x 83-inch storm sewer and twin 16-foot x 6-foot, 6-inch reinforced concrete pipes, all located along South Avenue.

4.17.6 Communication and Electric Utilities

4.17.6.1 New Jersey

Electricity in the City of Elizabeth is provided by the Public Service Electric & Gas Company (PSE&G). At present, there are over 40,000 residential meters, as well as numerous commercial and industrial meters within the city. Power is provided by seven steam-generating stations with a total capacity of 4,312 megawatts and four nuclear generating stations with a total capacity of 2,842 megawatts, most of which are located outside the Primary Study Area. During times of peak demand, additional power is purchased from neighboring utility systems.

Major facilities in the Primary Study Area include the Bayway Substation, located at the intersection of Relocated Bayway and Trenton Avenue and two 138 kV overhead transmission lines that run south from the substation across Interchange 13 of the New Jersey Turnpike. At the New Jersey approach to the bridge, there is a Teleport Communications vault located on Amboy Avenue.

4.17.6.2 New York

On the New York side, Consolidated Edison has below-grade and overhead electric lines of varying voltages in the vicinity of the bridge toll plaza and in the surrounding local streets. A fiber optic cable from the Port Authority's nearby Teleport Business Park crosses the bridge into New Jersey.

4.17.7 Petroleum and Natural Gas Pipelines

4.17.7.1 New Jersey

Major petroleum and natural gas pipelines in the Primary Study Area include a 30-inch Transcontinental (Transco) natural gas transmission line that runs parallel to the New Jersey Turnpike on the west (southbound) side. This line, installed in 1950, supplies much of the natural gas needs of the state of New Jersey.

Natural gas service in the city of Elizabeth is provided by the Elizabethtown Gas Company. At present there are over 38,000 gas customers in the city. Gas is purchased by Elizabethtown from the Transco, Texas Eastern, Tennessee, and Columbia Gas Transmission companies and is piped directly from the gas fields. Additional gas is also obtained through spot market purchases.

In the Primary Study Area, Elizabethtown's distribution facilities include a 10-inch low pressure cast iron main which extends along Bay Way, from Brunswick Avenue west; a 4-inch low pressure cast iron main extends along Pulaski Street, from Bay Way to Richmond Street and a 12-inch high pressure steel main extends along Brunswick Avenue. This main runs from south of Bay Way to Relocated Bayway, then in a southeasterly direction south of Relocated Bayway to the Turnpike toll plaza access road. From this point, it runs within the access road to just south of the Route I-278 eastbound approach, where it connects to a high-pressure regulator station. From the regulator station, a 12-inch elevated pressure steel main runs to a point beneath Turnpike Ramp NT, where it turns east and crosses the Turnpike as a 16-inch elevated pressure steel main. West of the Turnpike, the 16-inch elevated pressure steel main becomes a 12-inch elevated pressure steel main which extends along Bay Way and runs east to the Arthur Kill. Additional facilities include 6-inch and 4-inch elevated pressure polyethylene mains within Amboy Avenue, a 2-inch elevated pressure polyethylene main within Krakow Street and a 6-inch elevated pressure steel main within South Front Street.

4.17.7.2 New York

In the Primary Study Area, Texas Eastern has three natural gas pipelines (two 12-inch and one 30-inch line) entering the Study Area from the south, along the extension of Western Avenue within the former GATX property. These pipelines extend beneath the Goethals Bridge and enter a metering station located in the northeast corner of the intersection of Goethals Road North and Western Avenue. Two pipelines then proceed north from the metering station within Western Avenue. KeySpan has two parallel gas pipelines from this metering station; one is a 10-inch pipeline, and the other is a 30-inch main that serves as a main distribution line for the entire KeySpan system in New York City. These pipelines run within Goethals Road North to Forest Avenue.

A number of petroleum pipelines run under the Goethals Bridge. The Coastal Corporation has a 12-inch pipeline and the Colonial Pipeline Company has two 14-inch pipelines. In addition, two 12-inch

petroleum pipelines (one finished product and one crude) also run under the Goethals Bridge. All of the natural gas and petroleum pipelines run under Western Avenue and its southern extension. Finally, Exxon/Mobil has a petroleum pipeline that runs under Old Place Creek and the marsh about halfway between Arthur Kill and Western Avenue. All of these pipelines are important components of the gas and petroleum transmission and distribution systems that serve the metropolitan area and the northeast region.

4.18 Contaminated Materials

4.18.1 Introduction

This section discusses the potential for the presence of contaminated materials, resulting from previous or existing uses, within the Proposed Project alignments and in adjacent areas. Potential sources of contaminated materials were identified for a study area extending 500 feet on either side of the alignments. The assessment is based on a Contaminated Materials Screening Study (Screening Study) that was prepared in 2005 and subsequently updated in 2008 (see Appendix I). The purpose of this assessment is to determine whether soil or shallow groundwater that would be disturbed by construction of a new crossing could contain hazardous constituents requiring special handling or disposal. This section presents the findings of the assessment and identifies potential areas and constituents of concern in the Primary Study Area.

4.18.2 Methodology, Approach and Data Sources

For properties located within the Primary Study Area, the Screening Study included the examination of available historical maps, directories, and other documents to determine past land uses; examination of NYSDEC and NJDEP records for information on chemical and petroleum storage tanks; examination of USEPA, NYSDEC, and NJDEP records (including online records) regarding releases or spills of toxic materials, known hazardous substance disposal sites, and facilities that generate, treat, or store hazardous wastes; inspection of the area to identify current uses and assess existing conditions; and review of data on soil and groundwater testing performed in the area. Soil and groundwater testing has been performed on three properties in the Primary Study Area where contamination is known to exist. In addition, the Port Authority has performed some testing in the Primary Study Area as part of its preliminary evaluation of possible designs for the south crossing alternative that was evaluated as part of the Staten Island Bridges Program FEIS (1997). A visual inspection (windshield survey) of the Primary Study Area was also conducted in 2008 to validate the data and mapping and to identify on-site conditions that could be potential areas of concern.

4.18.3 Land Use History

4.18.3.1 New Jersey

The waterfront area along the New Jersey approach has been occupied by heavy industrial facilities since the beginning of the 20th Century. The major industries have been chemical manufacturing, metal products fabrication, and petroleum products processing and storage.

Examination of historic maps indicates that, by 1889, the Bowker Fertilizer Company had a manufacturing plant at the northeast corner of Bay Way and South Front Street. This business later became the Bowker Chemical Company, manufacturers of fertilizers and chemicals. In addition to fertilizer and other agricultural chemicals, the Bowker Company manufactured sulfuric acid at the site. The company later evolved into a leading manufacturer of insecticides and fungicides in the country. The Bowker plant was removed sometime before 1950 and replaced by the existing boat slip and Bayway Terminal warehouse. This later became the Bayway Industrial Center. The area to the south of Bay Way has been used for copper products manufacturing since at least 1903, when the Waclark Wire Company

plant was on the site. This later became the American Copper Products Corporation and finally the Phelps Dodge Corporation.

The waterfront area north of the bridge was occupied by oil companies since at least 1903. By 1922, the Borne-Scrymser Company, manufacturers of lubricating oils, occupied a site between South Front Street and the waterfront extending from the current bridge location to Clifton Street, about 600 feet to the north. Borne-Scrymser became the Borne Chemical Company and remained on the site until the 1980s.

The portion of the study area extending from South Front Street to Burlington Avenue has not been occupied by significant industrial uses. The area south of the Goethals Bridge, between the bridge approach and Bay Way, has been occupied by residences and commercial establishments. The area north of the bridge was largely vacant until the expansion of the Joint Meeting Sewage Treatment Plant and the construction of the Bayway Metals facility on the west side of South Front Street. The adjacent areas further from the existing bridge alignment, north of Relocated Bayway Avenue and south of Clifton Street, have long histories of industrial uses, including chemical and pesticide manufacturing, petroleum products manufacturing and storage, and metal foundries.

The portion of the study area between Burlington Avenue and the New Jersey Turnpike toll plaza has been occupied by two industrial facilities. In 1922, the area north of the bridge alignment and west of the railroad tracks (currently part of the NJ Turnpike) was occupied by the Atlantic Chemical Works, manufacturers of coal tar products. This facility was removed before 1950. The area south of the bridge and east of the railroad tracks was occupied in 1922 by Byron Heffernan & Company, manufacturers of coal tar and inorganic chemicals. This later became the National Solvent plant and operated as a chemical manufacturing facility until the 1960s.

4.18.3.2 New York

Examination of historic maps and aerial photographs determined that the Staten Island portion of the study area is largely wetlands that remained undeveloped through the 1960s, with the exception of the Howland Hook Marine Terminal that was developed to the north and the Gulf Oil terminal to the south of the Goethals Bridge corridor. However, by 1950, the northeast corner of North Washington and Western Avenues was occupied by a Texas Eastern pipeline pressure station. By 1974, a truck terminal was operating at the corner of Goethals Road North and Western Avenue and scrap yards were located near the intersection of Gulf Avenue and Western Avenue and at the western end of Goethals Road North. In 1977, an expanded Goethals Bridge toll plaza and administration building were shown.

4.18.4 Current Conditions

4.18.4.1 New Jersey

The former Olympia Trails Bus Company facility had previously been operated as a bus depot and maintenance garage. The property is currently a vacant lot that is owned by the Port Authority. An access road and sign structure are present onsite and the property is located adjacent to the former Bryon Heffernan & Co. site. The former Olympia Trails Bus Company property just north of the New Jersey approach is listed by NJDEP as a known contaminated site. Based on a review of the NJDEP case files, the NJDEP has received and approved a Remedial Action Workplan (RAW) and addenda to address soil and groundwater contamination at the site. The presence of historic fill across the site has been confirmed. Soil remediation at the site will be addressed through “hot spot” removal in the area of the oil-water separator, capping and the implementation of a site-wide deed notice. Groundwater contamination at the site will be addressed by the establishment of a Classification Exception Area (CEA). Other actions to be conducted at the site include the closure-in-place of three existing underground storage tanks (USTs). The RAW approval was issued by the NJDEP on December 29, 2005.

The Borne Chemical property north of the Goethals Bridge is vacant, but there are currently plans for the property to be redeveloped into a dredged material processing facility as part of the NJDEP's Elizabethport Brownfields Development Area (BDA) in Elizabeth. The Borne site is listed by the NJDEP as a known contaminated site and was listed on the CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Information System) database. A 1987 USEPA evaluation of the site indicated that soil contamination was present, including petroleum hydrocarbons, metals, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs). According to the USEPA report, in the period between 1959 and 1979, Borne Chemical leased space in their tank farm to several other companies, including Coastal Environmental Services, a chemical waste disposal firm. A variety of petroleum products and wastes were stored on the site. Improper storage resulted in a number of spills, and waste materials were abandoned on the site. In 1989, all above-ground and underground storage tanks and piping were removed, and proper disposal of the tank contents was performed by the potential responsible parties.

As part of this Goethals Bridge Replacement EIS effort, the Berger/PB JV team reviewed a Remedial Investigation and Risk Assessment Report prepared by Golder Associates for the Borne Chemical Company property in Elizabeth. The report, dated September 1999, identified several issues with respect to the need for further evaluation of the site's environmental conditions. The main contamination issues at the site are soil contamination, historic fill material, separate phase product on the water table and groundwater contamination. These issues are discussed below.

- *Historic Fill Material*: According to the Golder report, the site consists entirely of manmade land and historic fill material. Elevated levels of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), PCBs and metals are present in soils. SVOCs (primarily PAHs) are widespread throughout the site. VOC exceedances are primarily found in the former tank farm area and are generally limited to the southern portion in the former tank farm. TPH exceedances are found throughout the site; however, the highest TPH concentrations are located in the interior of the site, southwest of the Staten Island Railroad right-of-way. There are a limited number of exceedances for PCBs, which are generally located in the center and southern portion of the site. Metal exceedances are generally concentrated in the former operations area on the southwestern lot.

- *Groundwater Contamination*: VOCs and metals were detected in the groundwater beneath the Site. The groundwater beneath the former tank farm was impacted by VOCs. The highest VOC concentrations were found at the sample site nearest to the former Clifton Street. However, no exceedances of the groundwater quality standards were found for SVOCs, PCBs, or TPH. The report recommended further investigation to assess the source and extent of VOC impacts.

- *Separate Phase Liquid*: Separate phase liquid was identified in monitoring wells located in the northeastern corner of the site. The thickness was greatest adjacent to Clifton Street (former), which, according to the report, indicated a possible off-site source to the north. Further investigation was recommended of the source and extent of the separate phase liquid in this area of the site, as well as the off-site location to the north.

The risk assessment in the Golder report concluded that, for the exposure scenarios evaluated, adverse human health effects are not expected to exceed the carcinogenic and non-carcinogenic risk targets established by USEPA for the protection of human health.

As mentioned earlier, the Borne Chemical Co. Site is part of the Elizabethport Brownfields Development Area (BDA) in Elizabeth. Under the Brownfields Development Area (BDA) approach, NJDEP works with selected communities to design and implement remediation and reuse plans for these properties

simultaneously. The BDA approach enables remediation and reuse to occur in a coordinated fashion. According to the NJDEP Case Manager, Mr. Anthony Findley, the NJDEP has received a Remedial Action Workplan (RAW) to address soil contamination at the site (Findley, Anthony, April 9, 2008 and September 24, 2008, personal communication); a RAW for groundwater is to be submitted at a future date. Mr. Findley indicated that the soil remediation at the site will be addressed through a combination of "hot spot" removal and capping. The most contaminated soils, "hot spots", will be excavated and disposed of off-site. Any remaining contaminated soils in excess of NJDEP standards will be left in place, covered by an impermeable cap, and a deed notice will be implemented. As of September 2008, the NJDEP had not yet approved the RAW.

According to Mr. Findley, a RAW is required in the future to address groundwater and separate phase product remediation; however, site redevelopment can proceed without an approved groundwater RAW. This groundwater RAW will need to include the removal of separate phase product from the water table as well as long-term groundwater monitoring. Groundwater contamination will be contained onsite through the installation of a water-tight sheet piling enclosure which will be driven through the unconsolidated overburden material and into the top of bedrock. Once the separated phase product is removed, groundwater contamination (dissolved in the groundwater) will be monitored through long-term groundwater water sampling of onsite monitoring wells. An onsite pilot test was being conducted in April 2008 to evaluate separate phase product recovery methods at the site.

There is one solid waste facility located in the New Jersey portion of the Primary Study Area. A Waste Management, Inc. transfer station is located at 629-647 South Front Street, adjacent to the existing bridge on the north. The facility is currently allowed to accept and process 2,000 tons per day of solid waste and/or source-separated recyclable materials. The facility is also authorized to accept municipal waste (household, commercial and institutional), bulky waste, construction and demolition debris, vegetative waste, animal and food processing waste and dry industrial waste. The solid waste operations take place within a 29,000-square foot enclosed building.

The Phelps Dodge Specialty Copper property is an active industrial facility located at 48-94 Bay Way utilizing numerous hazardous compounds. Properties of this type typically are locations of spills, many of which are unreported. The Phelps Dodge Specialty Copper is located approximately 400 feet south of the existing bridge.

The area between South Front Street and Burlington Avenue south of the bridge is still occupied by stores and residences. To the north of the bridge are the Bayway Metals property and the Joint Meeting Sewage Treatment Plant. Bayway Metals is a metal recycling junkyard located at 645 Amboy Avenue and is a potential source of contamination, since such operations often release waste oil and other fluids from scrapped vehicles and machinery onto the ground. The NJDEP underground storage tank list shows nine registered tanks at the sewage treatment plant, including leaded and unleaded gasoline and No. 2 fuel oil tanks. However, there are no records of any petroleum releases at this facility.

The Interpier Basin / Boat Slip Area is a man-made rectangular embayment of the Arthur Kill shoreline, partially located beneath the Goethals Bridge and just north of the former Cory Warehouse (currently part of Bayway Industrial Center) in Elizabeth. The former Cory Warehouse Boat Slip was formerly used to accommodate warehouse loading and unloading operations along the bulkheads. Water depths within the boat slip range between two and eight feet. As part of the Port Authority's 1993-1994 sampling program, shallow sediment samples from the basin were collected in areas immediately adjacent to and contiguous with the boat slip. The sampling results indicated that organic contaminants are present in the sediments at concentrations above National Oceanic and Atmospheric Administration (NOAA) sediment quality standards and NJDEP sediment quality guidelines for assessing the effects to aquatic biota. Elevated levels of PCBs, DDT and its derivatives, as well as PAHs were identified. Dioxins were also detected within the sediments. Based on the sediment results, it is expected that the contaminants identified during the previous sampling in the boat slip area are still likely to be present.

The Phelps Dodge Wire & Cable property is an undeveloped triangular-shape parcel located along South Front Street immediately adjacent to the Borne Chemical Co. The Phelps Dodge Wire & Cable property is designated as Block 4 Lot 1470A and is not contiguous with the Phelps Dodge Specialty Copper property at 48 to 94 Bay Way in Elizabeth. Historic fill is depicted at this property in a Historic Fill Map of the Elizabeth Quadrangle along the western shoreline of the Arthur Kill in New Jersey (NJDEP, 2004). The mapped historic fill is indicated to be non-indigenous material placed on the site in order to raise the topographic elevation of the site. Given the long industrial history of the Elizabeth area and knowledge of the contaminated sites in the study area, the fill present along the shoreline is likely to be contaminated. Historic fill material typically contains elevated levels of PAHs, PCBs and metals.

The Bayway Industrial Center south of the bridge along the Arthur Kill includes the main warehouse building and a portion of the former Cory Warehouse Boat Slip to the north. As part of the Port Authority's 1993-1994 sampling program, shallow sediment samples were collected from the basin, indicating the presence of elevated levels of PCBs, DDT and its derivatives, and PAHs in the boat slip area. Dioxins were also detected in the sediments. The facility is at the location of the former Bowker Chemical Company Site and is mapped as an area where historical fill is present beneath the site. Because the former Bowker facility was in operation when there were few to no environmental regulations, it is possible that on-site operations have led to soil and/or groundwater contamination. In addition, this area where the facility is located is mapped as an area where historic fill may be present, which typically contains elevated levels of PAHs, PCBs and metals.

The remainder of the area in Elizabeth between Burlington Avenue and the New Jersey Turnpike toll plaza is occupied by the Turnpike, a portion of the Conrail Bayway rail yards, a parking lot, and a tavern. This area includes the former site of the Byron Heffernan/National Solvent chemical manufacturing plant, as well as the former Olympia Trails Bus Company, located at 200 Relocated Bayway Avenue, which has confirmed soil and groundwater contamination. An Exxon Service Station, No. 3-6181 located at 507 Bayway Avenue, is an active site with confirmed soil and groundwater contamination. This site is located far enough away from the existing bridge that any contamination at this site should not be an issue at the Goethals Bridge.

4.18.4.2 New York

The western portion of the Staten Island study area remains largely undeveloped wetlands. The metal scrap yard located immediately south of the bridge approach at the west end of Washington Avenue remains in operation. This facility, R.T. Baker & Son Machinery Salvage Company, is listed by NYSDEC on its registry of inactive hazardous waste disposal sites. In 1977, it was discovered that R.T. Baker was dismantling PCB-oil-filled transformers to salvage copper wire. A site assessment performed at that time confirmed that PCBs had been released on the site. A Phase II investigation performed in 1985 found PCBs in a shallow on-site well and in a deeper downgradient bedrock well. PCBs were also found in sediments up to 190 feet west of the site. NYSDEC has classified the R.T. Baker property as a Class 2 site, indicating a "Significant Threat to the Public Health or Environment – Action Required." The site has been assigned a medium priority by NYSDEC (Priority 2). NYSDEC records show that no remedial action has been performed at this site.

In 1994, negotiations with the Port Authority were made to investigate and remediate the R.T. Baker property as part of their Staten Island Bridges Program. Under this program, the area south of the bridge was investigated and included two borings at the Baker site. Low levels of PCBs were found in the soils and groundwater. Another investigation followed in 1995-96 and involved several borings and groundwater wells. The highest concentration of PCBs (22 ppm) was detected in a sample collected from the top of the peat layer, 14 feet below the surface of the fill beneath the site. Peat contains large amounts of organic material which typically binds PCBs. The same sample also contained high levels of VOCs. Three other subsurface soil samples contained PCB levels over 10 ppm, and eight surface soil samples

contained PCB levels over 1 ppm. No PCBs were found in the groundwater at that time. Elevated levels of metals were also present in the soil samples from the R.T. Baker site, notably copper, lead, and zinc. A work plan to investigate the on-site impacts of the PCBs was then agreed upon with the Port Authority, but the bridge project was later put on hold.

Groundwater contaminants from the Baker site have the potential for entering the Arthur Kill by way of shallow groundwater and via Old Place Creek. The unsaturated soil at the site contains relatively high concentrations of PCBs and several metals. These contaminants have migrated into the shallow aquifer and onto the wetland surface, but may not have contaminated the deeper bedrock aquifer. Exposures to contaminated groundwater are not expected because Staten Island is served by public drinking water. The site has no public water or sanitary utilities. Unauthorized access is restricted by a chain-link fence and gate only at the entrance to the site. Trespassing is unlikely due to the site's isolated location.

The NYSDEC Superfund Program will be conducting future investigations and remediation activities at the R.T Baker site (personal communication September 29, 2008 with NYSDEC Acting Section Chief, Ms. Sally Dewes). According to Ms. Dewes, additional investigations are not likely to begin until sometime in 2009 and remediation at the site is not likely to commence until sometime between 2010 and 2013. It is unlikely that the remediation of this site will be completed by the time the Goethals Bridge construction is underway. Future investigation and remediation activities at this site may impact the construction of the Goethals Bridge Project.

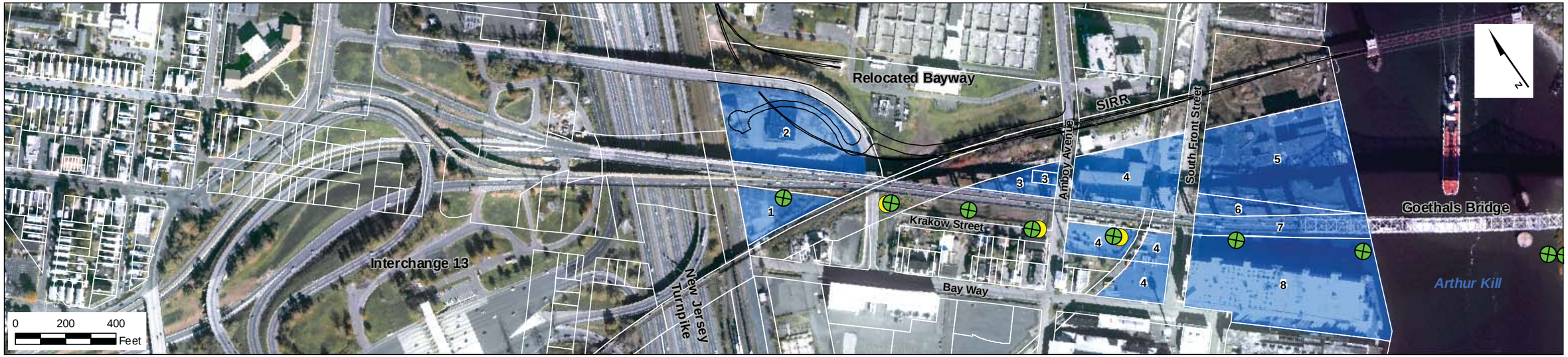
Farther to the east of R.T. Baker near Western Avenue are a Coca-Cola distribution warehouse and a natural gas pipeline terminal. Four underground diesel fuel tanks were observed at the Coca-Cola distributor warehouse. On the south side of the alignment are two more scrapyard-type operations (i.e., Frank Liquori Plumbing and Heavy Equipment Rentals).

To the east of the Travis Branch Railroad and on the north side of the bridge is the Goethals Garden Homes (mobile-home park) and the Port Authority's Goethals Bridge administration building and maintenance facility. NYSDEC records show three tank-test failures at the maintenance facility (i.e., gasoline tanks failed in 1988 and 1989, and a diesel tank failed in 1992). According to NYSDEC records, three leaking tank incidents occurred at the Goethals Bridge administration building/maintenance facility and involved either a tank test failure or the spill of an unknown amount of waste oil. Corrective action was taken in all three cases.

4.18.5 Previous Testing Results

During the period December 1993 through January 1994, the Port Authority collected soil and groundwater samples from boring locations south of the Goethals Bridge as part of preliminary design studies for the 1997 Staten Island Bridges Program FEIS. The sampling locations are shown on Figure 4.18-1. Supplemental sampling was performed from November 1995 through January 1996. This sampling program focused particularly on the R.T. Baker property, with 58 of the 76 soil samples analyzed coming from the Baker site. Samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and metals. Soil samples collected along Western Avenue in New York was also analyzed using the toxic characteristic leaching procedure (TCLP), one of the criteria applied in classifying wastes as hazardous for lead. Soil samples from the area in Staten Island immediately adjacent to the Arthur Kill and from the R.T. Baker property were also analyzed for chlorinated dioxins and dibenzofurans. Elevated levels of several types of substances were detected. The types of substances detected in the two testing programs' soil and groundwater analyses are summarized below:

- VOCs include constituents of gasoline and many organic solvents. Two common solvents, methylene chloride and acetone, were detected in many soil samples, but were also present in



NEW JERSEY

NEW YORK

Legend

- Soil/Sediment Sample Location (Approximate), 1993-1994 Port Authority Sampling
- Groundwater Sample Location (Approximate), 1993-1994 Port Authority Sampling
- Known or Potential Areas of Contamination

New Jersey – Elizabeth

1 Former Byron Heffernan & Co./National Solvent
2 Former Olympic Trails Bus Co.
3 Bayway Metals
4 Waste Management
5 Borne Chemical Co.
6 Phelps Dodge Wire & Cable
7 Interpier Basin/Boat Slip Area
8 Bayway Industrial Center

New York – Staten Island

9 Shoreline area
10 R.T. Baker & Son
11 Former GATX Property
12 Coca-Cola distributor
13 Heavy Equipment Rentals
14 Frank Liquori Plumbing
15 Goethals Bridge Administration/Maintenance Facility
16 Saperstein Properties

Source: Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

Figure 4.18-1
Sampling Locations &
Areas of Potential Contamination

United States Coast Guard

blanks and are believed to be the result of laboratory contamination. Soil and groundwater samples from one area contained volatile organic compounds typical of petroleum products.

- SVOCs detected in soil and groundwater samples were principally PAHs. PAHs are a class of compounds found in coal tar and ash, in creosote, and in some petroleum products, such as black top material. Several PAHs, notably benzo(a)pyrene (BaP), are known or suspected carcinogens. Because PAHs can be formed during the combustion of wood, coal, and oil, they are widespread in the environment. Semi-volatile organic compounds other than PAHs were only found on the R.T. Baker site. The compounds detected were primarily chlorinated aromatic compounds.
- Pesticides detected in soil samples included 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE. DDT and DDD were widely used insecticides until their general use was banned in the 1970s. DDE is a decomposition product of DDT.
- PCBs, a class of compounds formerly used in electrical equipment, in the manufacture of plastics, and many other applications, were detected in soil and groundwater samples from the R.T. Baker site. PCBs are very persistent in the environment.
- Metals are found as natural constituents in both soil and groundwater, but may also be present as contaminants from waste disposal or industrial activity. A number of different metals were detected. Several metals, including lead, mercury, and arsenic, are known to cause health effects.

There are no standards for acceptable levels of chemicals in soil in New York. New York and the USEPA, have developed "action levels" that are used as guidance to determine whether remedial action may be required. These values vary depending on the use of the site, local background levels, depth to groundwater, and whether the soil is on the surface or subsurface. In the discussion below, concentrations are identified as elevated when they exceed state-recommended clean-up levels and/or usual background levels for urban soils. On June 2, 2008, New Jersey adopted requirements that established minimum residential direct contact and non-residential direct contact soil remediation standards. Impact to groundwater soil remediation standards will be developed on a site-by-site basis using guidelines established by the NJDEP.

Groundwater analyses were compared to New York Class GA standards and New Jersey Class II-A standards. These standards are for potable water supplies, but are generally applied to all groundwater in the both states.

4.18.5.1 New Jersey

During the 1993-1994 sampling program in Elizabeth, eight soil samples were collected from five boring locations while groundwater samples were collected from three monitoring wells. In the supplemental 1995-1996 sampling program, ten soil samples were collected from five boring locations. In this sampling event, all analytes were either not detected or were detected at concentrations below NJDEP cleanup levels. Elevated levels of TPH were detected at a location between South Front Street and Amboy Avenue, and at a location west of Burlington Avenue. Soil samples from the boring location between South Front Street and Amboy Avenue also contained elevated levels of PAHs. Elevated metals (lead and manganese) levels were detected in the groundwater above the Class II-A standards.

Supplemental sampling was performed from November 1995 through January 1996. Samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and metals. Several of the sediment samples were also analyzed for dioxins. Ten soil samples were collected from five boring locations and all of the analytes were either not detected or were detected at concentrations below NJDEP cleanup levels.

4.18.5.2 New York

In the 1993-1994 sampling program, 32 soil samples were collected from 17 boring locations, and groundwater samples were collected from 6 monitoring wells along the Staten Island approach. In the supplemental 1995-1996 sampling program, 66 soil samples were collected from 22 boring locations, and groundwater samples were collected from 8 monitoring wells. Elevated concentrations of contaminants were detected at several locations. Results of the sampling were as follows:

- Two soil samples from borings near the shoreline contained elevated levels of pesticides. One sample contained 120 ppm of 4,4'-DDT and 71 parts per million (ppm) of 4,4'-DDD. The second sample contained 58 ppm of 4,4'-DDE. NYSDEC recommended soil cleanup objectives for these compounds are 2.9 ppm for 4,4' DDD and 2.1 ppm for 4,4' DDE and 4,4' DDT. One or more samples from the same area contained elevated levels of total petroleum hydrocarbons (14,200 ppm) and of metals, including arsenic (137 ppm), cadmium (6.3 ppm), chromium (230 ppm), copper (2,770 ppm), lead (1,760 ppm), mercury (26.7 ppm), nickel (105 ppm), vanadium (303 ppm), and zinc (603 ppm). NYSDEC recommends that soil cleanup objectives for metals be based on site background levels. General regional background levels used by NYSDEC are: arsenic, 3 to 12 ppm; cadmium, 0.1 to 1 ppm; chromium, 1.5 to 40 ppm; copper, 1 to 50 ppm; lead, 200 to 500 ppm; mercury, 0.001 to 0.2 ppm; nickel, 0.5 to 25 ppm; vanadium, 1 to 300 ppm; and zinc, 9 to 50 ppm.
- Soil samples, from an area just south of where the existing viaduct crosses Old Place Creek, contained elevated levels of total petroleum hydrocarbons (up to 6370 ppm) and several metals, notably arsenic (up to 336 ppm).
- Elevated levels of PCBs exceeding NYSDEC clean-up levels (1 ppm for surface soil, and 10 ppm for subsurface soil were detected at 9 of 19 boring locations and in 12 of 60 soil samples from the R.T. Baker site. By far the highest concentration of PCBs, 8,900 ppm, was detected in a sample collected from the top of the peat layer, 14 feet below the surface of the fill on the site. Peat contains high concentrations of organic material which binds PCBs and similar organic contaminants tightly. This is the only soil sample from the site which would be classified as hazardous waste under the Toxic Substances Control Act (TSCA). The same sample also contains high levels of 1,2,4-trichlorobenzene (1,400 ppm) and 1,4-dichlorobenzene (560 ppm). Three other subsurface soil samples contained PCB levels over 10 ppm, and eight surface soil samples contained PCB levels over 1 ppm. The highest PCB concentration detected in surface soil was 22 ppm. No PCBs were detected in any of the samples taken in 1996 from the eight monitoring wells. Elevated levels of metals were also present in the soil samples from the Baker site, notably copper (10,000 ppm), lead (4,100 ppm), and zinc (17,000 ppm).
- Soil and groundwater samples from the area along Gulf Avenue, east of Western Avenue, contained elevated levels of several VOCs, SVOCs and metals. Most of the soil samples from this area contained elevated levels of total petroleum hydrocarbons (greater than 1000 ppm). Ethylbenzene, xylene, and naphthalene, which are compounds found in gasoline and other petroleum products, were detected in both soil and groundwater samples from one location. Elevated levels of PAHs were also present. One soil sample from this area exceeded the regulatory level for lead as measured using TCLP. Wastes that exceed the toxic characteristic standards are subject to state and federal hazardous waste regulations.

4.18.6 Potential Site Contamination

4.18.6.1 New Jersey

Figure 4.18-1 identifies areas where site history and/or current conditions indicate potential soil or groundwater contamination within the study area. Further details about each site are provided below.

- The former Byron Heffernan & Co./National Solvent site (Site 1 on Figure 4.18.1) was occupied by a chemical manufacturing plant from before 1922 until the 1960s. Coal tar products, inorganic chemicals, and later solvents were manufactured here. Leaks, spills, and improper disposal of wastes may have contaminated the soil in this area.
- The former Olympia Trails Bus Company facility (Site 2 on Figure 4.18.1) had previously been operated as a bus depot and maintenance garage. The property is currently a vacant lot that is owned by the Port Authority. An access road and sign structure are present onsite and the property is located adjacent to the former Byron Heffernan & Co. site. Prior to development as the Olympic Trails facility, the property was historically vacant, except for a portion of a building extending from the Heffernan site, and a railroad that traversed the site from the mid-1920s through the 1960s. Soil and groundwater contamination, as well as historic fill, have been confirmed at the site. VOCs, SVOCs, TPH, metals, PCBs and pesticides contamination have been identified in soil. VOCs, pesticides and metals have been identified in the groundwater.
- Bayway Metals (Site 3 on Figure 4.18.1) is a metal recycling junkyard located at 645 Amboy Avenue where poor housekeeping and deferred maintenance was observed. The types of operations are of concern because of the machinery used and contamination resulting from processing operations. Chemicals of concern associated with salvage yards include VOCs, SVOCs, PCBs and metals.
- Waste Management, Inc. (Site 4 on Figure 4.18.1) is located at 629-647 South Front Street and operated as a transfer station for solid waste and/or recyclable materials. The types of operations are of concern because of the machinery used and the contamination resulting from processing the materials. Chemicals of concern associated with the transfer station would likely include VOCs, SVOCs, PCBs and metals.
- Borne Chemical property (Site 5 on Figure 4.18.1) was occupied by an oil-blending and storage operation from about 1900 until the 1980s. The soil, groundwater and separated phase product contamination has been confirmed. VOCs, SVOCs, TPH, metals, and PCBs contamination have been identified. VOCs and metals have been identified in the groundwater.
- Phelps Dodge Wire & Cable (Site 6 on Figure 4.18.1) is an undeveloped triangular-shaped site located immediately adjacent to the Borne Chemical site along South Front Street. The Phelps Dodge Wire & Cable property is mapped as an area with historic fill, which could potentially contain elevated PAHs, PCBs and metals. Also the site is adjacent to the Borne Chemical site where soil, groundwater and separate phase product contamination has been confirmed. The concern would be whether contaminants at the Borne Chemical property also are present at the Phelps Dodge Wire & Cable property.
- Interpier Basin / Boat Slip Area (Site 7 on Figure 4.18.1) is a man-made rectangular embayment partially located beneath the Goethals Bridge which was formerly used as a boat basin to accommodate the Cory Warehouse loading and unloading operations along the bulkheads. Shallow sediment samples collected from the same contiguous basin indicate that elevated SVOCs, PCBs, DDT and metal levels were identified and dioxins were also detected. As a result, contaminated sediments would also be anticipated in the Interpier Basin / Boat Slip Area.
- The Bayway Industrial Center (Site 8 on Figure 4.18.1) is located on property formerly occupied by Bowker Fertilizer/Chemical Company Site. The Bowker Company had manufactured fertilizers, pesticides, insecticides and other agricultural chemicals, as well as sulfuric acid. Because the facility was in operation when there were few to no environmental regulations, it is possible that on-site operations have led to soil and/or groundwater contamination. This property is also in an area mapped as historic fill. As part of the Port Authority's 1993-1994 sampling program, shallow sediment samples were taken from the Interpier Basin / Boat Slip Area in the northern portion of the property, as discussed above. Contaminants identified within the sediments include SVOCs, PCBs, DDT and metals; dioxins were also detected in the sediments.

Other potentially contaminated sites in New Jersey were also identified, including the Exxon Service Station (507 Bay Way), Phelps Dodge Special Copper (48-94 Bay W), and the Joint Meeting Sewage Treatment (north of the alignment). These sites are located far enough away from the existing bridge that impacts to/from them are not likely.

4.18.6.2 New York

Figure 14.18-1 identifies areas on the New York side of the study area where site history and/or current conditions indicate potential soil or groundwater contamination, which are within the proposed bridge alignments. Four areas have a high potential for contamination as discussed below:

- The Shoreline Area along the Arthur Kill beneath the Goethals Bridge in Staten Island (Site 9 on Figure 4.18.1) consists of three parcels that are owned by the Port Authority and the NYC Department of Small Business Services. The area, which consists of undeveloped marshland, is designated as Block 1895, Lot 1, Lot 50 and Lot 100 on the Staten Island tax map. Portions of this area were filled with dredged materials in the 1940s to 1950s. Subsequent soil and sediment sampling conducted by the Port Authority between 1993 and 1996 indicate that elevated concentrations of SVOCs, TPH and/or metals have been detected in the soils. Dioxin furan was also detected in some of the soils.
- The R.T. Baker & Son site (Site 10 on Figure 4.18.1) was used to salvage PCB-containing transformers. Contamination of soil by PCBs has been confirmed. PCBs, which were formerly used in electrical equipment and for many other applications, are known carcinogens and extremely persistent in the environment. PCBs have been identified in nearby wetlands and stream sediments. Elevated levels of VOCs and metals were also detected in onsite soils.
- The former GATX property (Site 11 on Figure 4.18.1) was operated as a petroleum storage and transfer facility from 1929 until 1999. The soil and groundwater sampling conducted by the Port Authority in 1993-1994 indicated that elevated pesticides were detected in the groundwater, in excess of the NYSDEC's guidelines, beneath an undeveloped portion of the former GATX facility adjacent to Interstate Route 278 (Port Authority's 1993-1994 sampling).
- Several scrap yards are located along Gulf Avenue, east of Western Avenue. Soil and groundwater samples from this area contained elevated levels of several volatile and semi-volatile organic compounds and metals, including gasoline constituents, PAHs, and lead. This area encompasses Heavy Equipment Rentals (Site 13 on Figure 4.18.1), Frank Liquori Plumbing (Site 14 on Figure 4.18.1) and the Saperstein properties (Site 16 on Figure 4.18.1).

Sites with lower potential for contamination include the Coca-Cola distributor at the corner of Western Avenue and Goethals Road North (Site 12 on Figure 4.18.1) and the Goethals Bridge administration / maintenance facility (Site 15 on Figure 4.18.1). There are no records of discharges from the USTs at the Coca Cola distributor, and the discharges at the Goethals Bridge administration/maintenance facility have already been addressed.

4.18.7 Lead-Based Paint – Existing Goethals Bridge

In the past, the Goethals Bridge has been painted with lead-based paint. Peeling and chipping of lead-based paint can release lead into the environment, where it poses a potential hazard to human health and wildlife. In 2001, the Port Authority began work to repaint the 750,000 square feet of structural steel on the truss structure of the Goethals Bridge. Old coats of lead-based paint were removed and a three-coat system that includes a zinc primer, epoxy intermediate coat and a urethane topcoat was applied. The project was completed in 2003. Lead-based paint was removed from the structural steel as part of the lead abatement program that was implemented.

Should additional lead-based paint be determined to exist on the bridge or other impacted structures, the Port Authority's protocol for lead-based paint abatement on bridges and other structures will be implemented. The protocol will comply with all applicable laws and regulations; it will include specifications for proper containment and disposal of dust and debris from paint removal operations and for monitoring to detect releases of airborne lead-containing particulate matter.

4.18.8 Future Remedial Actions

Remedial actions for soil and groundwater contamination are expected to occur at three locations within the study area, regardless of whether the Proposed Project is constructed. These are:

- The former Olympia Trails Bus Company property is listed by the NJDEP as a known contaminated site located at 200 Relocated Bayway Avenue which had previously been occupied by a bus depot and maintenance garage. Soil and groundwater contamination, as well as historic fill, have been confirmed at the site. The NJDEP has approved a RAW and Addendum for the site. Soil remediation at the site will be addressed through "hot spot" removal and capping. The most contaminated soils, "hot spots", will be excavated and disposed of off-site. Any remaining contaminated soils in excess of the standards will be left in place will be addressed by engineering (soil cap and perimeter fencing) and institutional controls (Deed Notice). Remedial activities were conducted during the week of November 10, 2008 which included limited excavation of contaminated soils, as well as the removal of three USTs, an oil/water separator, and a hydraulic lift. The need to conduct additional investigation and remediation activities this site will be determined pending the findings of these remedial action activities. A report summarizing the results and findings will be submitted to the NJDEP in 2009. Groundwater contamination will likely be addressed through natural attenuation and the establishment of a Classification Exception Area (CEA). Future investigation and remediation activities at this site may impact the construction of the Goethals Bridge Project.

- The Borne Chemical property on the waterfront just north of the New Jersey approach is listed by NJDEP as a known contaminated site. NJDEP has reached an agreement with the responsible parties and will be redeveloped as part of the Elizabethport Brownfields Development Area (BDA) in Elizabeth. The BDA approach enables remediation and reuse to occur in a coordinated fashion. According to the NJDEP Case Manager, Mr. Anthony Findley, the NJDEP has received a Remedial Action Workplan (RAW) to address soil contamination at the site. Mr. Findley indicated that the soil remediation at the site will be addressed through "hot spot" removal and capping. The most contaminated soils, "hot spots" will be excavated and disposed of off-site. Any remaining contaminated soils in excess of NJDEP standards will be left in place, covered by an impermeable cap, and a deed notice will be implemented. It is anticipated that the soil remediation could potentially be completed by the time of the Goethals Bridge construction.

- The R. T. Baker & Son Machinery Salvage Company scrap-yard located immediately south of the Staten Island bridge approach at the west end of Washington Avenue is listed by NYSDEC on its registry of inactive hazardous waste disposal sites because of confirmed contamination of soil and groundwater by PCBs. NYSDEC classifies this site as a "Significant Threat to the Public Health or Environment – Action Required." It is NYSDEC's policy to either remediate, or require responsible parties to remediate, all sites that are so classified. There has been no action on the R.T. Baker site since the site was investigated in 1986. The NYSDEC Superfund Program will be conducting future investigations and remediation activities at the R.T Baker site (personal communication September 29, 2008 with NYSDEC Acting Section Chief, Ms. Sally Dewes). According to Ms. Dewes, additional investigations are not likely to begin until sometime in 2009 and remediation at the site is not likely to commence until sometime between 2010 and 2013. It is unlikely that the remediation of this site will be completed by the time the Goethals Bridge construction is underway. Future

investigation and remediation activities at this site may impact the construction of the Goethals Bridge Project.

4.19 Traffic and Transportation

4.19.1 Introduction

The Regional Study Area, as described in Section 4.3.1, its characteristics, and the analytical methodologies used to evaluate existing traffic conditions are described below. Also included are descriptions of the project's traffic data collection program and existing transportation conditions within the Regional Study Area.

The Port Authority's Staten Island bridges (i.e., the Goethals Bridge, the Outerbridge Crossing, and the Bayonne Bridge) are vital links in the New York/New Jersey metropolitan area's transportation network. These bridge crossings facilitate mobility between New York and New Jersey within the larger context of the trans-Hudson bridges and tunnels, and serve as a primary route for traffic traveling along the I-278 corridor between central New Jersey and Staten Island, Brooklyn, Queens and Long Island.

These Staten Island Bridges, in combination with the Verrazano-Narrows Bridge (operated by the Metropolitan Transportation Authority's Triborough Bridge and Tunnel Authority), comprise the region's Southern Corridor. This corridor is one of four main travel axes within the greater New York / New Jersey metropolitan region that motorists can use to travel across the Hudson River and New York Harbor. The other three corridors are:

- The Port Authority's Lincoln Tunnel providing trans-Hudson crossings in the Midtown New York City corridor;
- The Port Authority's Holland Tunnel, providing trans-Hudson crossings in the Downtown New York City corridor; and
- The Tappan Zee Bridge (owned and operated by the New York State Thruway Authority) and the Port Authority's George Washington Bridge providing crossings in the Northern Corridor.

Vehicles traveling to and from Manhattan tend to use the Midtown and Downtown Corridor crossings. Drivers passing through the region tend to use the Northern and Southern Corridor crossings. The Southern Corridor crossings also serve drivers making trips between southern New Jersey and Brooklyn, Queens, and other points on Long Island, as these crossings provide the most direct route between these locations.

The primary function of the Goethals Bridge, as well as the Port Authority's two other Staten Island bridges, is to provide direct access between Staten Island and New Jersey and to facilitate the regional traffic movement of people and goods between New Jersey, New York City, and Long Island. These three bridges are key components in the overall highway network and play a particularly critical role along the southern tier of the New York City metropolitan area, which is split by several large waterways.

The major roadways within the network directly served by the Goethals Bridge include the following:

- The Staten Island Expressway (I-278) is primarily a six-lane, limited-access facility. It is the primary east-west highway on Staten Island, connecting Staten Island to New Jersey on the west via the Goethals Bridge and Brooklyn on the east via the Verrazano-Narrows Bridge. On the New Jersey side of the Goethals Bridge in Elizabeth, the approach roadways encompass Route 1/9, Bayway Avenue, Brunswick Avenue, Bayway Circle, and Interchange 13 of the NJ Turnpike. On the New York side of the Goethals Bridge, the Staten Island Expressway continues as I-278, with

interchanges at Forest Avenue and the West Shore Expressway before continuing east to the Verrazano-Narrows Bridge.

- The West Shore Expressway (State Route 440) is a four-lane, limited-access facility, and is the major north-south highway on Staten Island. It can be accessed from the Goethals Bridge via its interchange with I-278. It provides access to the southern areas of the borough, and to New Jersey via the Outerbridge Crossing.
- The New Jersey Turnpike (Interstate Route 95) is the major north-south, limited-access roadway serving the eastern portion of New Jersey. It is a critical link in the interstate highway system providing linkage between Maine and Florida.
- U.S. Route 1/9 is a major arterial highway that runs from Woodbridge, New Jersey (where two separate routes from further south in New Jersey converge) to New York City. It is a surface roadway with jug handles and traffic circles to allow turns to and from cross streets. It generally has two to three lanes in each direction.

These routes, in conjunction with Routes 434 and 169 in New Jersey, and Victory Boulevard, Richmond Avenue, Korean War Veterans Memorial Parkway (formerly Richmond Parkway), and Hylan Boulevard on Staten Island, form an interconnected network of roadways that facilitate the movement of vehicles between New Jersey and Staten Island.

4.19.2 Methodology, Approach and Data Sources

Within the Regional Study Area, fourteen (14) Primary Traffic Study Areas were defined along major roadways in the vicinity of the proposed project and other major travel routes in the region to determine whether project-related localized impacts would occur, as discussed in Section 5.0. The Primary Traffic Study Areas include:

- Elizabeth, New Jersey – Bayway Circle, North Avenue/ Newark Avenue, and New Jersey Turnpike Interchange 13 Toll Plaza;
- Union, New Jersey – Morris Avenue/Salem Road;
- Woodbridge, New Jersey – Route 1/Garden State Parkway;
- Perth Amboy, New Jersey – State Route 440/Amboy Avenue;
- Jersey City, New Jersey – Holland Tunnel Toll Plaza;
- Brooklyn, New York – 92nd Street/Gowanus Expressway;
- Manhattan, New York – Canal Street/Holland Tunnel;
- Staten Island, New York – Goethals Bridge Toll Plaza; Richmond Avenue/Staten Island College; Richmond Avenue/Victory Boulevard; Verrazano-Narrows Bridge Toll Plaza; and Outerbridge Crossing Toll Plaza.

Comprehensive traffic data collected and assembled for these Primary Traffic Study Areas within the Regional Study Area included: intersection turning movement counts; classification counts; automatic traffic recorder (ATR) counts; and travel time and delay. These traffic data are summarized below and are also presented in Appendix J.1.

4.19.2.1 Intersection Turning Movement Counts

Vehicle counts of each intersection movement were recorded every 15 minutes, by vehicle class (i.e., autos, trucks and buses). The turning movement counts conducted in Spring 2004 were carried out during the 6:00 AM - 10:00 AM and 3:00 PM - 7:00 PM peak periods. The Fall 2004 turning movement counts were carried out during the 7:00 AM - 9:00 AM and 4:00 PM - 6:00 PM peak periods, as the Goethals Bridge peak hours for the analyses had already been determined from the Spring counts as 7:30 AM -

8:30 AM and 5:00 PM - 6:00 PM. The turning movement counts were conducted only on Tuesdays, Wednesdays or Thursdays.

4.19.2.2 Classification Counts

At select locations, more detailed vehicle classification counts (autos, sport utility vehicles (SUV), light trucks (up to two axles and six tires), medium trucks (three axles), heavy trucks (four or more axles), and buses) were conducted continuously for 13 hours, with the exception of the NJ Turnpike Interchange 13 locations, which were counted for the two AM and two PM peak hours due to safety restrictions. Classification count data were collected throughout the Primary Traffic Study Areas to identify the vehicle mix at specific locations.

4.19.2.3 Automatic Traffic Recorder (ATR)

Continuous 24-hour traffic volumes were collected through the placement of pneumatic tubes across roadways, which were attached to counters that recorded the passage of vehicles over the tubes. The ATRs were in place for a minimum of eight days and, in some cases, up to two weeks, to obtain representative weekday and weekend data.

4.19.2.4 Travel Time and Delay Data

Travel time and delay runs were conducted along the I-278 corridor from Route 1/9 in Elizabeth to the east side of the Verrazano-Narrows Bridge in Brooklyn. The route included the Goethals Bridge, the Staten Island Expressway and the Verrazano-Narrows Bridge. Travel time runs were also conducted along South Elmora Avenue, Bayway Avenue, Brunswick Avenue, and Route 1/9. The travel time and delay runs were performed using the “floating car method”, whereby a vehicle drives with the general traffic flow and travel times and delays are recorded.

4.19.3 Traffic Patterns and Conditions

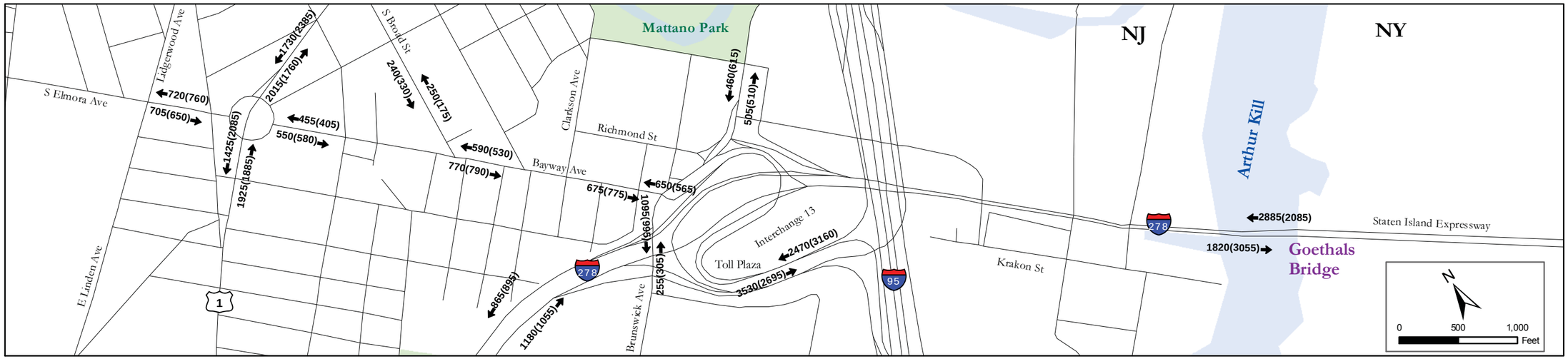
4.19.3.1 Staten Island Bridges

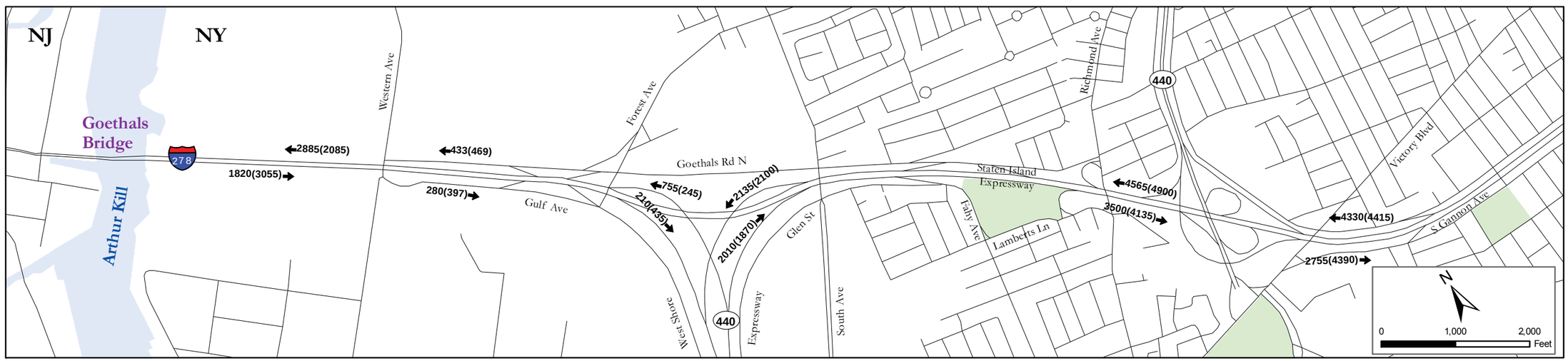
The peak traffic hours for the Goethals Bridge Corridor were defined as 7:30 AM – 8:30 AM for the AM peak hour and 5:00 PM – 6:00 PM for the PM peak hour; these periods were used for all three bridges to determine peak hour traffic flow conditions. The Goethals Bridge carries just over 1,800 vehicles per hour (vph) eastbound and just over 2,800 vph westbound in the AM peak hour. In the PM peak hour, the bridge carries over 3,100 vph in the eastbound direction and over 2,000 vph in the westbound direction.
The Outerbridge Crossing carries over 2,500 vph in both the eastbound and westbound directions in the AM peak hour. In the PM peak hour, the Outerbridge carries just over 3,000 vph in the eastbound direction and fewer than 2,500 vph in the westbound direction.

The Bayonne Bridge carries the least amount of traffic of the three bridges, with about 500 vph in the southbound direction and just over 1,000 vph in the northbound direction in the AM peak hour. In the PM peak hour, the southbound traffic is slightly over 1,200 vph while the northbound roadway carries about 400 vph.

4.19.3.2 Goethals Bridge Approaches

Existing (2004) AM and PM peak hour balanced traffic flows were developed for the major approaches in New Jersey and New York. These volumes are shown for key locations on Figure 4.19-1. (A more detailed set of existing [2004] AM and PM peak hour traffic flow maps for the areas around Bayway Circle, NJ Turnpike Interchange 13, I-278 from Route 1/9 to east of West Shore Expressway, and Staten Island Expressway east to Slosson Avenue can be found in Appendix J.2). In the vicinity of the Goethals





Legend

2470 - AM Peak Hour Vehicles (One-Way)
(3160) - PM Peak Hour Vehicles (One-Way)

Goethals Bridge Replacement EIS

FIGURE 4.19-1

Existing Traffic Volumes
(2004) Peak Hour

United States Coast Guard

Bridge in Elizabeth, the approach roadways encompass Route 1/9, Bayway Avenue, Brunswick Avenue, Bayway Circle, and Interchange 13 of the NJ Turnpike. Route 1/9 carries 1,500 to 2,000 vph in the peak direction during the AM peak hour, and 2,000 to 2,500 vph in the peak direction in the PM peak hour. Bayway Avenue, which connects the Goethals Bridge and NJ Turnpike Interchange 13 with Bayway Circle, carries 500 to 800 vph in each direction during both the AM and PM peak hours. South Elmora Avenue, the continuation of Bayway Avenue to the west of the Bayway Circle, also carries 500 to 800 vph in each direction during the peak hours.

Approximately 700 vehicles (10% of which are trucks) exit the NJ Turnpike to Bayway Avenue during the AM peak hour, while about 600 vehicles exit during the PM peak hour. Between 40 - 45% of the vehicles exiting the NJ Turnpike at Bayway Avenue continue west on Bayway Avenue. Approximately 600 vehicles exit the Goethals Bridge at Atlantic Avenue during the AM peak hour, while about 400 exit during the PM peak hour. A majority of these vehicles turn south onto Atlantic Avenue, with about half going to Bayway Avenue. Over 700 vehicles enter the NJ Turnpike from Brunswick Avenue during both the AM and PM peak hours with 15% trucks in the AM and 10% in the PM.

On the New York side of the Goethals Bridge, the Staten Island Expressway continues as I-278 and interchanges with Forest Avenue and the West Shore Expressway before continuing east to the Verrazano-Narrows Bridge. For the interchange with Forest Avenue, the highest volumes in the peak direction occur on the on-ramp from Forest Avenue to the Staten Island Expressway westbound in the AM peak hour and the Staten Island Expressway eastbound off-ramp to Forest Avenue in the PM peak hour. The on-ramp from Forest Avenue to the Staten Island Expressway westbound carries just under 350 vph in the AM peak direction while the Staten Island Expressway eastbound off-ramp to Forest Avenue carries just over 360 vph in the PM peak direction. For the interchange with West Shore Expressway, the highest volumes in the peak direction occur on the Staten Island Expressway westbound off-ramp to the West Shore Expressway southbound in the AM peak hour and on the on-ramp from the West Shore Expressway northbound to the Staten Island Expressway eastbound in the PM peak hour. The Staten Island Expressway westbound off-ramp to the West Shore Expressway southbound carries over 2,100 vph in two lanes in the AM peak direction while the on-ramp from the West Shore Expressway northbound to the Staten Island Expressway eastbound carries over 1,800 vph in the PM peak direction.

4.19.3.3 Vehicle Classifications

Vehicle classification counts were taken during the peak AM and PM periods. Vehicles were classified into autos, light trucks (two axles and six tires), medium trucks (three axles), heavy trucks (four or more axles) and buses. Table 4.19-1 presents the percentage of the different vehicle classes for the Goethals Bridge in each direction for both peak periods. In the morning, nearly 19% of the eastbound vehicles are trucks and buses while 11% of the westbound vehicles are trucks and buses. Table 4.19-2 shows the percentage for Bayway Avenue while Table 4.19-3 shows the percentage for the NJ Turnpike ramps. Both on Bayway Avenue and at the Turnpike interchanges, truck percentages are very high, generally between 15% and 20% in the morning.

4.19.3.4 Major Origins and Destinations

In Fall 2002 and Spring 2003, the Port Authority carried out travel surveys at their three Staten Island bridges. Basic origin and destination travel data were collected. During the highest volume period through the toll plaza, which occurs during the PM peak, the majority (over 68 percent) of people using the Goethals Bridge originate from just five counties in New Jersey, Essex, Union, Middlesex, Bergen and Morris Counties. In terms of destinations, the majority of the trips end in Staten Island, with Brooklyn, Long Island and Queens providing the remainder of the destinations. The trip percentages by origin and destination are listed in Table 4.19-4.

TABLE 4.19-1
PEAK PERIOD
GOETHALS BRIDGE VEHICLE CLASSIFICATION

Vehicle Classification	AM Peak Period		PM Peak Period	
	EB	WB	EB	WB
	Vehicle Percentage	Vehicle Percentage	Vehicle Percentage	Vehicle Percentage
Auto	81.2%	89.0%	93.4%	88.1%
Light Truck	5.3%	2.7%	2.1%	3.9%
Medium Truck	2.0%	1.6%	0.7%	1.7%
Heavy Truck	10.2%	4.9%	2.6%	5.9%
Bus	1.3%	1.8%	1.2%	0.4%

Source: Berger/PB, 2006.

TABLE 4.19-2
PEAK PERIOD
BAYWAY AVENUE VEHICLE CLASSIFICATION

Vehicle Classification	AM Peak Period		PM Peak Period	
	EB	WB	EB	WB
	Vehicle Percentage	Vehicle Percentage	Vehicle Percentage	Vehicle Percentage
Auto	83.9%	83.8%	93.8%	89.8%
Light Truck	4.6%	5.4%	2.8%	3.4%
Medium Truck	2.5%	1.4%	0.4%	1.2%
Heavy Truck	7.4%	7.8%	2.5%	4.5%
Bus	1.6%	1.6%	0.5%	1.1%

Source: Berger/PB, 2006.

TABLE 4.19-3
PEAK PERIOD
NEW JERSEY TURNPIKE RAMPS VEHICLE CLASSIFICATION

Vehicle Classification	AM Peak Period		PM Peak Period	
	On-ramps	Off-ramps	On-ramps	Off-ramps
	Vehicle Percentage	Vehicle Percentage	Vehicle Percentage	Vehicle Percentage
Auto	83.3%	80.1%	82.3%	87.8%
Light Truck	4.6%	6.0%	9.0%	4.8%
Medium Truck	2.3%	2.8%	1.5%	1.8%
Heavy Truck	7.7%	10.5%	7.1%	4.8%
Bus	2.1%	0.6%	0.1%	0.8%

Notes:
AM Peak period was only recorded from 7:00 AM - 9:00 AM
PM Peak period was only recorded from 4:00 PM - 6:00 PM
On-ramps is a combination of the on-ramps from the Toll Plaza to the Turnpike NB and SB
Off-ramps is a combination of the NB and SB Turnpike off-ramps to the Toll Plaza
Source: Berger/PB, 2006.

TABLE 4.19-4
PM PEAK PERIOD EASTBOUND DIRECTION
MAJOR TRIP ORIGINS AND DESTINATIONS

Major Trip Origin	Trip Percentage
Essex County	29.3%
Union County	17.0%
Middlesex County	9.3%
Bergen County	6.4%
Morris County	5.5%
Major Trip Destination	**Trip Percentage**
Staten Island	56.7%
Brooklyn	24.7%
Long Island	9.5%
Queens	6.9%

Source: Berger/PB, 2006.

4.19.3.5 Trip Purpose

Similarly, the Port Authority travel survey also asked about trip purpose. Trip purpose deals with why the people were making the trip. The categories were broken down as follows: work/commuting (traveling to/from the office); company business (traveling to/from a meeting, making a sales or service call); shopping; school (includes traveling to college and universities); recreation (going to a restaurant, going to a movie, on vacation); personal business (going to a doctor or dentist, visiting friends, picking up/dropping off at the airport); and other (if none of the above categories applies). As shown on Table 4.19-5, the majority of the trips during the PM peak were work or business related, which comprised over 68 percent of the trips.

TABLE 4.19-5
PM PEAK PERIOD EASTBOUND DIRECTION
TRIP PURPOSE

Trip Purpose	Trip Percentage
Work/Commuting	64.6%
Company Business	3.5%
Shopping	3.5%
School	0.6%
Recreation	9.0%
Personal Business	17.4%
Other	1.4%

Source: Berger/PB, 2006.

4.19.4 Overall Levels of Service

Analysis of traffic conditions in urban areas, such as the Goethals Bridge Regional Study Area, is generally based on peak conditions at intersections and roadway segments that are defined in terms of level of service (LOS), ranging from LOS A (free-flow condition) to LOS F (breakdown in vehicular flow or excessive delay). Typically, LOS E and LOS F are considered to be operationally unacceptable. Definitions of the various LOS conditions for signalized intersections, unsignalized intersections, freeway segments and ramp segments based on the 2000 *Highway Capacity Manual* (HCM) are provided in Appendix J.3.

4.19.4.1 Staten Island Bridges

For each of the three Staten Island bridges, a mid-span analysis was done to determine the LOS. Table 4.19-6 presents the results of the mid-span analysis. The Goethals Bridge is operating at close to capacity at LOS E during both the AM and PM peak direction. The Outerbridge also operates close to capacity in the AM peak direction. The Bayonne Bridge generally operates at acceptable levels.

4.19.4.2 Local Street Traffic Operations

As part of the analysis of existing traffic conditions, the signalized and unsignalized intersection analyses were performed for the intersections within the vicinity of the Goethals Bridge. Table 4.19-7 presents the results of these intersection analyses.

TABLE 4.19-6
LEVELS OF CONGESTION AT THE THREE MAJOR BRIDGES - EXISTING (2004) CONDITIONS

Location	Direction	AM Peak	PM Peak
		LOS	LOS
Goethals Bridge	EB	C	E
	WB	E	D
Outerbridge Crossing	EB	D	E
	WB	D	D
Bayonne Bridge	SB	A	B
	NB	B	A

Source: Berger/PB, 2006.

As Table 4.19-7 shows, the majority of the intersections are operating at acceptable levels of operations for both of the Goethals' peak hours, based on existing level of service. However three signalized intersections in Elizabeth are already operating at LOS D or worse during either the AM or PM peak hours: South Elmora Avenue at Edgar Road; South Elmora Avenue at Lidgerwood Avenue; and Bayway Avenue at Bayway Circle. Two unsignalized intersections are operating at LOS D or worse: the eastern intersection of South Broad Street and Bayway Avenue and the intersection where Bayway Avenue meets the Bayway Circle.

4.19.4.3 I-278 Traffic Operations

As part of the analysis of existing conditions, freeway segment analyses were performed for sections of I-278 in New Jersey, the Goethals Bridge and the Staten Island Expressway. Table 4.19-8 presents the results of the freeway segment analyses. Generally along the I-278 corridor, traffic congestion is caused by ramp merges and weaving sections along the mainline. (The full set of LOS tables for all locations can be found in Appendix J.4)

The freeway analyses indicate that generally-acceptable LOSs are found in both directions on I-278 in New Jersey and on the Staten Island Expressway in New York in the vicinity of Goethals Bridge for both peak hours. However, several sections in both directions are beginning to approach capacity, operating at LOS D, with one segment (I-278 from the Richmond Avenue off-ramp to the South Avenue off-ramp) already at LOS E in the PM peak hour.

Table 4.19-9 presents the results of the weaving section analyses. The analyses indicate that one eastbound weaving section between the West Shore Expressway on-ramp and the Richmond Avenue off-ramp operates at LOS F, while one westbound weave between the Martin Luther King Expressway on-ramp and the Richmond Avenue off-ramp operates at LOS D during the PM peak hour.

Table 4.19-10 presents the results of the ramp junction analysis. As shown below, many of the merges and diverges along the corridor operate at LOS D or worse during one or both peak hours. Several operate at LOS F and tend to cause the queuing that occurs along the I-278 mainline

TABLE 4.19-7
EXISTING TRAFFIC LEVELS OF SERVICE AT INTERSECTIONS IN THE VICINITY OF GOETHALS BRIDGE

Intersection	AM Peak	PM Peak
	LOS	LOS
Signalized Intersections		
Bayway Circle WB at Route 1/9	C	C
Bayway Circle EB at Route 1/9	C	C
South Elmora Ave. at Edgar Rd.	D	D
South Elmora Ave. at Lidgerwood Ave.	D	D
Bayway Ave. at Grier Ave.	C	C
Bayway Ave. at South Broad St. (western leg)	C	C
Summer St. at South Broad St.	C	C
Summer St. at Grier Ave.	B	B
Grier Avenue at Route 1/9	B	B
Bayway Ave./ Goethals off-ramp at Atlantic Ave.	C	D
Goethals on/ off-ramps at Atlantic Ave.	C	C
Unsignalized Intersections		
Bayway Circle WB at Summer St.	B	B
Bayway Ave. at Bayway Circle	C	D
South Elmora Ave. at New York Ave.	C	C
Bayway Ave. at South Broad St. (eastern leg)	D	C
Edgar Rd./ Spofford Ave. at Route 1/9	B	B
Bayway Ave. at Thomas St.	B	B
Bayway Ave. at Polonia Ave.	B	C
Relocated Bayway Ave. at Atlantic Ave.	B	A
On-ramp to I-278 WB at Brunswick Ave.	B	A
I-278 EB off-ramp at Brunswick Ave.	B	C
Allen St. at Brunswick Ave.	B	B
Bayway Ave. at McKinley St.	B	A

Source: Berger/PB, 2006

TABLE 4.19-8
STATEN ISLAND EXPRESSWAY SEGMENT ANALYSIS
EXISTING (2004) CONDITIONS

Segment	AM Peak	PM Peak
	LOS	LOS
Eastbound SIE Mainline		
I-278 mainline from Route 1/9 to the Goethals Bridge	B	B
West Shore Exp. SB off-ramp - West Shore Exp. NB on-ramp	B	C
Richmond Ave. off-ramp - Richmond Ave. on-ramp	B	C
South Gannon Ave. on-ramp - Bradley Ave. off-ramp	C	D
Westbound SIE Mainline		
Bradley Ave. on-ramp - Victory Blvd. off-ramp	D	D
Richmond Ave. off-ramp - South Ave. off-ramp	D	E
West Shore Exp. SB off-ramp - West Shore Exp. NB on-ramp	C	B
I-278 mainline from Route 1/9 to the Goethals Bridge	B	B

Source: Berger/PB, 2006.

TABLE 4.19-9
STATEN ISLAND EXPRESSWAY WEAVING SECTION ANALYSIS
EXISTING (2004) CONDITIONS

Weaving Section	AM Peak	PM Peak
	LOS	LOS
Eastbound SIE Mainline		
West Shore Exp. NB on-ramp - Richmond Ave. off-ramp	C	F
Richmond Ave. on-ramp - Victory Blvd. off-ramp	B	C
Westbound SIE Mainline		
Martin Luther King Exp. SB on-ramp - Richmond Ave. off-ramp	C	D

Source: Berger/PB, 2006.

TABLE 4.19-10
STATEN ISLAND EXPRESSWAY RAMP ANALYSIS
EXISTING (2004) CONDITIONS

LOCATION	AM Peak	PM Peak
	LOS	LOS
Staten Island Expressway Eastbound		
West Shore Exp. SB off-ramp diverge	B	B
Bradley Ave. on-ramp merge	F	F
Todt Hill/ Slosson Ave. off-ramp diverge	F	F
Richmond Rd. on-ramp merge	F	D
Lily Pond Ave. off-ramp diverge	F	F
Staten Island Expressway Westbound		
Lily Pond Ave. on-ramp merge	C	F
Richmond Rd. off-ramp diverge	C	F
Clove Rd. on-ramp merge	D	F
Todt Hill/ Slosson Ave. off-ramp diverge	F	F
West Shore Exp. SB off-ramp diverge	C	C
West Shore Exp. NB on-ramp merge	C	B

Source: Berger/PB, 2006.

4.19.4.4 Travel Time and Delay

Travel time and delay runs were conducted along the I-278 corridor from Route 1/9 in Elizabeth to the east side of the Verrazano-Narrows Bridge in Brooklyn. The route included the Goethals Bridge, the Staten Island Expressway and the Verrazano-Narrows Bridge. Travel time runs were also conducted along South Elmora Avenue, Bayway Avenue, Brunswick Avenue and Route 1/9. These speeds and delays are more indicative than level of service of actual operating conditions in the corridor and better depict actual congestion conditions. Table 4.19-11 presents a summary of the travel time and delay data for the peak periods for the I-278 corridor.

Tables 4.19-12 and 4.19-13 provide the peak period speeds along the local arterial network in New Jersey.

Generally during the AM peak period, speeds on eastbound I-278 remain above 40 mph until traffic reaches east of the Goethals Bridge at the off-ramp to Bradley Avenue. The only exception is the area of the Goethals Bridge Toll Plaza where speeds are restricted by the Toll Plaza and decrease to 35 mph or less. Speeds through the Toll Plaza vary depending on the use of the E-ZPass lanes and the toll collection lanes. In the PM peak period, speeds are below 30 mph eastbound along I-278 from the on-ramp from the West Shore Expressway to the Bradley Avenue off-ramp and also in the vicinity of Lily Pond Avenue. Similar to the AM peak period, speeds in the Goethals Bridge Toll Plaza area average just over 30 mph.

TABLE 4.19-11
I-278 PEAK PERIOD SPEEDS

From	To	AM Existing Average Speed (MPH)	PM Existing Average Speed (MPH)
Eastbound			
Route 1 & 9	Brunswick Ave. off-ramp	53	52
On-ramp from Atlantic Ave.	Goethals Bridge Toll Plaza	43	38
Goethals Bridge Toll Plaza	Forest Ave. off-ramp	34	32
Forest Ave. off-ramp	West Shore Exp. off-ramp	50	46
On-ramp from West Shore Exp.	Richmond Ave. off-ramp	53	26
On-ramp from Richmond Ave.	Victory Blvd. off-ramp	49	13
Victory Blvd. off-ramp	Martin Luther King Exp. NB off-ramp	48	14
On-ramp from South Gannon Ave.	Bradley Ave. off-ramp	28	23
On-ramp from Bradley Ave.	Slosson Ave. off-ramp	29	35
On-ramp from Slosson Ave.	Clove Rd. off-ramp	40	52
On-ramp from Richmond Rd.	Lily Pond Ave. off-ramp	41	52
Verrazano-Narrows Bridge Toll Plaza	Belt Pkwy. off-ramp	43	37
Westbound			
On-ramp from 92nd St.	Verrazano-Narrows Bridge Toll Plaza	45	20
Verrazano-Narrows Bridge Toll Plaza	Lily Pond Ave. off-ramp	20	17
Lily Pond Ave. off-ramp	Fingerboard Rd. off-ramp	43	6
Fingerboard Rd. off-ramp	On-ramp from Lily Pond Ave.	49	10
On-ramp from Lily Pond Ave.	Richmond Rd. off-ramp	53	21
On-ramp from Slosson Ave.	Bradley Ave. off-ramp	58	47
Victory Blvd. off-ramp	Martin Luther King Exp. NB off-ramp	57	56
On-ramp from South Ave.	West Shore Exp. off-ramp	51	39
On-ramp from West Shore Exp. NB	On-ramp from Forest Ave.	49	53
Western Ave. off-ramp	Goethals Bridge Toll Plaza	46	49
Goethals Bridge Toll Plaza	NJ Turnpike/ Atlantic Ave. off-ramps	43	45
On-ramp from Brunswick Ave.	Route 1/9 SB	50	56

Source: Berger/PB, 2006.

TABLE 4.19-12
SOUTH ELMORA/BAYWAY AVENUE
PEAK PERIOD SPEEDS

From	To	AM Existing Average Speed (MPH)	PM Existing Average Speed (MPH)
Lidgerwood Ave.	Edgar Rd.	13	12
Edgar Rd.	Route 1 & 9/ Bayway Circle	3	3
Route 1 & 9/ Bayway Circle	Grier Ave.	14	13
Grier Ave.	South Broad St.	16	15
South Broad St.	Maple Ave.	12	15
Maple Ave.	South Broad St	12	19
South Broad St.	Grier Ave.	17	14
Grier Ave.	Route 1 & 9/ Bayway Circle	6	7
Route 1 & 9/ Bayway Circle	Edgar Rd.	11	11
Edgar Rd.	Lidgerwood Ave.	15	13
Lidgerwood Ave.	New York Ave.	30	37

Source: Berger/PB, 2006.

TABLE 4.19-13
ROUTE 1/9 BAYWAY CIRCLE AREA
PEAK PERIOD SPEEDS

From	To	AM Existing Average Speed (MPH)	PM Existing Average Speed (MPH)
Southbound			
Myrtle St.	Bayway Circle	30	9
Bayway Circle	Grier Ave.	23	36
Northbound			
Grier Ave.	Bayway Circle	13	27
Bayway Circle	Mrytle St.	32	36

Source: Berger/PB, 2006.

Westbound speeds along I-278 during the AM peak period generally remain above 45 mph between the Verrazano-Narrows Bridge in Staten Island and Route 1/9 in New Jersey. In the PM peak period, speeds remain below 30 mph from the Verrazano-Narrows Bridge to Slosson Avenue and then rise to 45 mph or better for the remainder of the length of I-278.

Even though the levels of service seem to be in the acceptable range, speeds along Brunswick, Bayway, and South Elmora Avenues generally fall well below the 25 mph to 30 mph speed limits in both directions during both peak periods. Sections of Bayway and Brunswick Avenues even fall below 10 mph, and are heavily congested due to the volume of trucks, the multiple access points along the streets and the delays at the signals.

Along Route 1/9 northbound, speeds generally are higher than 30 mph for most of the day. The exceptions are the sections between Edgar Road and Bacheller Avenue in the AM peak period and the approach to Bayway Circle in the PM peak period. Route 1/9 southbound has similar characteristics. The congestion occurs on the approach to Bayway Circle in the AM peak period and in the section between Myrtle Street and Bacheller Avenue in the PM peak period.

4.19.5 Crashes (Accidents) on the Goethals Bridge

An analysis of crash characteristics and trends for the Goethals Bridge was conducted for the years 2000 through 2007. The crash data, obtained from the Port Authority, provide a summary of crash reports filed by the Port Authority Police at the Bridge during each of the eight analysis years. A summary of the data is provided in Table 4.19-14. The calculated rates presented in the table represent the bridge span only and do not include the toll plaza area, approach ramps, or departure ramps. Crash rates were calculated using annual traffic volumes and bridge centerline miles provided by the Port Authority.

TABLE 4.19-14
GOETHALS BRIDGE CRASH SUMMARY
(INCLUDING "DAMAGED WHILE PARKED" AND "OFF-FACILITY" CRASHES)

Year	Total Crashes	Bridge Span Crashes	Volume (millions)	Crash Rate (per MVM)	Statewide Average Crash Rate (per MVM)	
					NJ	NY
2000	205	119	27.778	3.18	4.35	1.09
2001	224	141	28.472	3.68	3.50	1.09
2002	220	106	31.364	2.51	3.75	1.09
2003	173	85	28.486	2.22	3.78	Not Avail.
2004	151	90	28.292	2.36	3.73	Not Avail.
2005	158	82	28.072	2.17	3.51	0.79
2006	143	90	26.050	2.57	3.08	0.89
2007	155	101	28.446	2.64	2.99	0.89

Notes:

- MVM – million vehicle miles.
- The Goethals Bridge elevated structure length of 7,109 ft was used to obtain a centerline length of 1.35 miles (http://www.panynj.gov/CommutingTravel/bridges/html/goethals.html#stats).
- The Goethals Bridge and NY Statewide Crash Rates shown are for four-lane, divided roadways with shoulders less than six feet wide, mainline only.
- The NJ Statewide Crash Rates shown are for four-lane, divided roadways with shoulders less than six feet wide, but include mainline and junctions (e.g., ramps, intersections, etc.).

Source: Port Authority, 2008.

During the 8-year period, approximately 55 percent (more than 2,400) of the total crashes recorded for the Port Authority's three Staten Island bridges occurred at the Goethals Bridge. A large portion of these (40 percent) occurred during midday between the AM and PM peak periods of travel; Friday was the weekday with the highest number of crashes. Most of the recorded crashes were rear-end and sideswipe incidents (each representing about 40 percent of the total), which generally relate to the Bridge's narrow lanes and lack of shoulders. Nearly 85 percent of the crashes occurred in good weather, with dry roadway pavement, which also indicates that the crashes were related to Bridge conditions and were not weather-related. Approximately 85 percent of the crashes resulted in property damage only.

4.19.6 Railroads

4.19.6.1 New Jersey

On the New Jersey side of the Goethals Bridge Study Area, the former Staten Island Railroad (SIRR) between Linden and Cranford has been rehabilitated by Union County for rail freight services in mid-2008. Upon such restoration, the designated operator, the Morristown & Erie (M&E) Railway, now provides freight rail services to businesses in Linden, Roselle and Cranford with a connection to the Conrail Shared Assets Operating Area's (CSAO) Lehigh Line and New Jersey Transit's Raritan Valley Line, both in Cranford.[13] Furthermore, Union County has plans to restore the remaining segment to the Rahway Valley Line, from Cranford northwest to Summit, in order to provide freight rail services in the center of the county; but such work was suspended indefinitely in 2006 due to lack of funding. As of the end of 2007, New Jersey State and Union County officials had noted that restoration of the final link to Summit may be years from completion.

In addition to the SIRR reactivation, a connection between the SIRR and CSAO's Chemical Coast Secondary Line was constructed by the Port Authority in 2007. Known as the Chemical Coast Northern Connector, the project connects the SIRR from the Arthur Kill (AK) Lift Bridge to the Chemical Coast Secondary Line in a northbound direction, providing rail access from the New York Container Terminal (NYCT) to the railroad yards of Elizabeth - Port Authority Marine Terminal and Port Newark in northern New Jersey[14].

4.19.6.2 New York

Concurrent to the above-stated rail improvements in New Jersey, the SIRR network in Staten Island was also recently re-activated for intermodal freight rail services between 2006 and 2008, which in turn provides a key component of New York City's Rail Access Program. Such re-activation effort in Staten Island included the Arthur Kill Lift Bridge, the NYCT's intermodal rail yards at Port Ivory (also known as the ExpressRail Staten Island facility), the Arlington Rail Yards, and the Travis Branch. Together, this re-activated rail network resembles the number "7", with the top comprised of a main east-west segment about three miles long to the Arlington Yards and the vertical component being a four-mile long segment of the Travis Branch. All rail traffic to and from Staten Island enter the left side of the top of the "7" at a newly-constructed connection with the Chemical Coast Secondary Line (see Section 4.19.6.1 above). Just east of this new connection, the SIRR crosses the Arthur Kill on the Arthur Kill Lift Bridge, a 558-foot span vertical lift bridge that raises 100 feet to provide 135 feet of clearance to marine traffic. The middle portion of the east-west segment contains the newly renovated Arlington Yards, the operational center of the railroad. The east segment lies within a cut with many overhead bridges. The Travis Branch diverges at the east end of Arlington Yard in a southwesterly direction before turning south to Travis. This line

[13] Connection to the Raritan Valley Line also allows the M&E to interchange with both CSX and Norfolk Southern in Bound Brook.

[14] This continuous network of interconnected railyards is also known as the Port Authority's ExpressRail Intermodal System.

crosses the Staten Island approach of the Goethals Bridge approximately 400 feet west of the bridge toll plaza. More details on this recent re-activation effort can be found in Section 3.0 of Appendix C.

4.19.7 Mass Transit Services

The regional roadway network is augmented by a regional mass transportation system consisting of commuter rail, heavy rail, subway, light rail, bus, and ferry transit services. However, these transit services do not parallel or directly assist the Southern Corridor roadway connections since these modes serve different purposes and are generally not used as alternate modes or routes for these service routes. Similarly, freight rail transport for goods movement (such as the Arthur Kill movable-lift freight railroad bridge, constructed parallel to and north of the Goethals Bridge in 1959) is served by infrastructure dedicated to that purpose.

The Goethals Bridge carries MTA NYCT's express bus routes X17, X22, X23, X24, X30 and X31. (The X23 and X24 are operated by Atlantic Express.) These routes provide the following services to the Goethals Bridge Study Area:

- Three services run as the X17 (Richmond/Huguenot/Arden Avenues). One service runs between Drumgoole and Annadale Roads and Lower Manhattan during the rush hours. Another rush hour service runs between Woodrow Road and Huguenot Avenue and Midtown Manhattan. X17 off-peak service runs between Arden Heights and Lower and Midtown Manhattan. AM service operates from Drumgoole/Annadale Roads to Church/Worth Streets, Manhattan. PM service operates from Church/Worth Streets, Manhattan to Arthur Kill Road/Richmond Avenue on weekdays. The X17 also operates between Woodrow Road/Huguenot Avenue and East 57th Street/3rd Avenue, Manhattan, on weekdays and Saturdays.
- The X22 (Bloomingdale/Amboy Roads) operates on weekdays between Hylan Boulevard/Page Avenue and East 57th Street/3rd Avenue, Manhattan, via New Jersey.
- The X23 (Seguine Av/ Foster Rd/ Woodrow Rd) operates on weekdays between Huguenot Avenue/Drumgoole Road and East 59th Street/Madison Avenue, Manhattan, via New Jersey.
- The X24 (Huguenot/Arden Avenues) operates on weekdays between Hylan Boulevard/Tysens Lane and East 59th Street/Madison Avenue, Manhattan, via New Jersey.
- The X30 (Forest Avenue/Victory Boulevard) operates on weekdays between Victory Boulevard/Clove Road and West 57th Street/11 Avenue, Manhattan, via New Jersey.
- The X31 (Travis Avenue/Forest Hill Road) operates between Arthur Kill Road/Richmond Avenue and East 57th Street/3rd Avenue, Manhattan, via New Jersey, on weekdays.
- Private express bus service from this area of Staten Island operates on the Bayonne Bridge serving the downtown Jersey City area. Other than this route there are no routes that connect Staten Island with communities in New Jersey

4.20 Air Quality

4.20.1 Introduction

The air quality analysis of the proposed project was conducted in accordance with the procedures outlined in several guidance documents, including: the U.S. Environmental Protection Agency's (USEPA) *Intersection Modeling Guidelines;* USEPA's *Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas;* USEPA's *United States Green Book – Air Quality Planning and Standards*, which is available online; the New Jersey Department of Environmental Protection's (NJDEP) *Air Quality Analysis for Intersections Guidelines;* the New York

State Department of Transportation's (NYSDOT) *Environmental Procedures Manual (EPM)*; and New York City's *City Environmental Quality Review (CEQR) Technical Manual*. These documents were used to determine whether the proposed project would result in violations of ambient air quality standards or health-related guideline values.

4.20.1.1 Relevant Air Pollutants for Analysis

Various air pollutants have been identified by USEPA as being of nationwide concern: carbon monoxide (CO); hydrocarbons (HC); nitrogen oxides (NO_x); photochemical oxidants; particulate matter (PM_{10} and $PM_{2.5}$); sulfur oxides (SO_x); and lead (Pb). Ambient concentrations of CO, HC, and photochemical oxidants in and around the Goethals Bridge Study Area, as well as the Regional Study Area, are predominantly influenced by motor vehicle activity, while NO_x emissions are from both mobile and stationary sources. Emissions of SO_x are associated mainly with stationary sources. Emissions of particulate matter are associated with stationary sources and, to a lesser extent, diesel-fueled mobile sources (heavy trucks and buses). Lead emissions, which historically were influenced principally by motor vehicle activity, have been substantially reduced due to the elimination of lead from gasoline. These pollutants of concern are each discussed below.

Carbon Monoxide

CO is a colorless and odorless gas that is generated in the urban environment primarily by the incomplete combustion of fossil fuels in motor vehicles. Prolonged exposure to high levels of CO can cause headaches, drowsiness, loss of equilibrium, or heart disease. Relatively high concentrations of CO are typically found near congested intersections, along heavily used roadways carrying slow-moving traffic, and in areas where atmospheric dispersion is inhibited by urban "street canyon" conditions.

Hydrocarbons, Nitrogen Oxides, and Photochemical Oxidants

Hydrocarbons include a wide variety of volatile organic compounds, emitted principally from the storage, handling, and use of fossil fuels. NO_x constitute a class of compounds that include nitrogen dioxide (NO_2) and nitric oxide, both of which are emitted by motor vehicles and stationary sources. Both hydrocarbons and NO_x are of concern primarily because most of those compounds react in sunlight to form photochemical oxidants, including ozone. This reaction occurs comparatively slowly and ordinarily takes place far downwind from the site of actual pollutant emission. The effects of these pollutants are examined on an areawide, or mesoscale, basis.

Particulate Matter

Particulate matter is a broad class of air pollutants that exist as liquid droplets or solids, with a wide range of sizes and chemical composition. Particulate matter is emitted by a variety of sources, both natural and man-made. Natural sources include the condensed and reacted forms of natural organic vapors; salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and debris from live and decaying plant and animal life; particles eroded from beaches, desert, soil and rock; and particles from volcanic and geothermal eruptions and forest fires. Major man-made sources of particulate matter include the combustion of fossil fuels, such as vehicular exhaust; power generation and home heating; chemical and manufacturing processes; all types of construction (including equipment exhaust and re-entrained dust); agricultural activities; and wood-burning fireplaces. Fine particulate matter is also derived from combustion material that has volatilized and then condensed to form primary particulate matter (often after release from a stack or exhaust pipes) or from precursor gases reacting in the atmosphere to form secondary particulate matter. It is also derived from mechanical breakdown of coarse particulate matter, e.g., from building demolition or roadway surface wear. Of particular health concern are particles that are smaller than or equal to 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) in size. The principal health effects of airborne particulate matter are on the respiratory system.

Sulfur Oxides

High concentrations of SO_2 affect breathing and may aggravate existing respiratory and cardiovascular disease. SO_2 emissions are generated from the combustion of sulfur-containing fuels (oil and coal), largely from stationary sources such as coal and oil-fired power plants, steel mills, refineries, pulp and paper mills, and nonferrous smelters. In urban areas, especially in the winter, smaller stationary sources, such as space heating, contribute to elevated SO_2 levels. Ambient SO_2 levels recorded in the New York/New Jersey Metropolitan Area have complied with ambient air quality standards for over 20 years.

Lead

Lead emissions are principally associated with industrial sources and motor vehicles using gasoline-containing lead additives. Since the leaded gasoline has been eliminated from use, motor vehicle-related lead emissions have decreased, resulting in a significant decline in concentrations of lead. Atmospheric lead concentrations in the NY/NJ metropolitan area are well below national standards.

4.20.1.2 National and State Ambient Air Quality Standards

National ambient air quality standards (NAAQS) are concentrations set for each of the criteria pollutants specified by USEPA that have been developed primarily to protect human health. The secondary goal is to protect the nation's welfare and account for the effect of air pollution on soil, water, vegetation and other aspects of general welfare. For the most part, New York and New Jersey have adopted the NAAQS as state ambient air quality standards. Timeframes, based on ways that these pollutants adversely affect health, have also been established. These standards, together with their health-related averaging periods, are presented in Table 4.20-1.

4.20.1.3 Significant Impact Criteria

In addition to federal and State standards, incremental impact criteria have been established by the New Jersey Department of Environmental Protection (NJDEP), the New York State Department of Environmental Conservation (NYSDEC) and the New York City Department of Environmental Protection (NYCDEP) to measure the impact significance of project-related concentration increases. Both the NYSDEC and the NJDEP impact thresholds apply to projects that would generate more than 15 tons per year of $PM_{2.5}$ and, since the proposed project would not generate any increase in regional $PM_{2.5}$ emissions, the values are not applicable to this analysis. NYCDEP's PM2.5 Interim Guidelines apply to projects that could significantly increase traffic volumes in $PM_{2.5}$ non-attainment areas by establishing incremental significant threshold values (STVs) to measure the impact significance of project-related concentration increases. Project-related impacts less than these threshold values are not considered to be significant by these agencies. The methodology and quantitative evaluation is presented in Section 5.0.

The standards shown in Table 4.20-1 include the changed standards referenced above. For $PM_{2.5}$, EPA is in the process of re-designating non-attainment areas for $PM_{2.5}$ based on the new 24-hour $PM_{2.5}$ standard, and compliance with the recently adopted $PM_{2.5}$ 24-hour standard will not be required until this process is complete. As such, the currently applicable 24-hour standard (65 $\mu g/m^3$) is considered for the proposed Goethals Bridge Replacement project. However, while the 65 $\mu g/m^3$ standard is applicable for demonstrating compliance with regulatory requirements (and has been used in this analysis to determine compliance with regulatory requirements), compliance with the 35 $\mu g/m^3$ standard is also presented for purposes of disclosure.

TABLE 4.20-1
NATIONAL AND NEW YORK/NEW JERSEY AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Period	National and NY/NJ State Standards	
		Primary	Secondary
Ozone	8 Hour	0.08 ppm (157 μg/m^3)	Same as Primary
Carbon Monoxide	8 Hour	9 ppm (10 mg/m^3)	Same as Primary
	1 Hour	35 ppm (40 mg/m^3)	Same as Primary
Nitrogen Dioxide	Annual Average	0.053 ppm (100 μg/m^3)	Same as Primary
Sulfur Dioxide	Annual Average	80 μg/m^3 (0.03 ppm)	-
	24 Hour	365 μg/m^3 (0.14 ppm)	-
	3 Hour	--	1,300 μg/m^3 (0.5 ppm)
Coarse Particulate Matter (PM_{10})	24 Hour	150 μg/m^3	Same as Primary
Fine Particulate Matter ($PM_{2.5}$)	24 Hour	65 μg/m^3*	Same as Primary
	Annual Neighborhood	15 μg/m^3	Same as Primary
Lead	Calendar Quarter	1.5 μg/m^3	Same as Primary

Source: U.S. Environmental Protection Agency, New Jersey Department of Environmental Protection, New York State Department of Environmental Conservation, and New York City Department of Environmental Protection

Notes:

* EPA recently revised the 24-hour $PM_{2.5}$ standard from 65 μg/m^3 to 35 μg/m^3, but the previous standard is currently applicable.

ppm: parts per million

μg/m^3: micrograms per cubic meter

Qualitative $PM_{2.5}$/PM_{10} Analysis

On March 10, 2006, USEPA issued a Final Rule regarding the localized or "hotspot" analysis of $PM_{2.5}$ and PM_{10} (40 CFR Part 93). The rule requires that hotspot analyses be performed for federally funded or approved transportation projects with significant diesel traffic in areas not meeting $PM_{2.5}$ or PM_{10} air quality standards. This assessment of localized impacts (i.e., "hotspot analysis") examines potential air quality impacts on a scale smaller than an entire nonattainment or maintenance area. Such an analysis is a means of demonstrating that a transportation project meets Clean Air Act conformity requirements to support state and local air quality goals.

As stated in this rule, however, a quantitative hotspot analysis is not required until USEPA issues a new motor vehicle emissions model capable of estimating local emissions, as well as future hotspot modeling guidance. As an alternative, a qualitative analysis following USEPA's *Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (EPA420-B-06-902), dated March 2006, was conducted.

It should be noted that while this approach applies only to projects subject to the Transportation Conformity Rule (i.e., projects that require approval or funding from either the Federal Highway Administration [FHWA] or the Federal Transit Administration [FTA]), and that it is uncertain at this time whether the project will be subject to the Transportation Rule or the General Conformity Rule, this qualitative analysis was used for this project as it is the only other approach that is currently approved by USEPA for estimating localized $PM_{2.5}$ or PM_{10} impacts.

4.20.1.4 Regulatory Setting and Compliance with Standards

The federal Clean Air Act (CAA) defines nonattainment areas as geographic regions that have been designated as not meeting one or more of the NAAQS. The CAA requires that a State Implementation Plan (SIP) be prepared for each non-attainment area, and a maintenance plan be prepared for each former non-attainment area that subsequently demonstrated compliance with the standards. The SIP is a state's plan for how it will meet the NAAQS by the deadlines established by the CAA. EPA's Transportation Conformity Rule requires SIP conformity determinations on transportation plans, programs, and projects before they are approved or adopted. Conformity is defined as conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards. The Conformity Rule also establishes the process by which federal agencies determine conformance of proposed projects. Federal activities may not cause or contribute to new violations of air quality standards, exacerbate existing violations, or interfere with timely attainment or required interim emissions reductions towards attainment.

New Jersey

The proposed Goethals Bridge Replacement project is a regionally significant project, which requires that project-level compliance with USEPA's Conformity Rule be demonstrated. If the proposed project is either funded or approved by the FHWA or FTA, then Transportation Conformity requirements apply; if the proposed project requires funding or approvals from any other federal agency, such as the U.S. Coast Guard, it is subject to the General Conformity Rule requirements.

The affected Study Area in New Jersey is currently designated as maintenance for CO and nonattainment for both ozone and $PM_{2.5}$. When a determination is made as to whether the Transportation or the General Conformity Rule applies, the lead federal agency must demonstrate project level compliance with the Conformity Rule for each of these pollutants.

A Transportation Improvement Program (TIP) is a staged, multiyear, intermodal program of transportation projects covering a metropolitan planning area, consistent with that area's Transportation Plan (also known as a Long Range Transportation Plan or LRTP). A TIP includes projects (planned and future) anticipated within 3 to 5 years. Since the Build alternative for this project has a longer time horizon, it is not included in the *2005 Regional Transportation Plan Update* and the *FY 2006-2008 Transportation Improvement Program* for the North Jersey Transportation Planning Authority (NJTPA) portions of the New York-Northern New Jersey-Long Island, NY-NJ-CT region. It is, however, included in NJTPA's *2030 Access and Mobility Regional Transportation Plan* and *Air Quality Conformity Determination for Northern New Jersey* (construction of a new parallel structure south of the existing bridge), which was approved by the NJTPA Board of Trustees on September 12, 2005.

New York

As stated above, the proposed project is required to demonstrate project-level compliance with USEPA's Conformity Rule. Since the project area in New York is currently designated as maintenance for CO and nonattainment for both ozone and $PM_{2.5}$, and Manhattan is classified as nonattainment for PM_{10}, the lead federal agency must demonstrate project-level compliance with the Conformity Rule, following either the Transportation or General Conformity Rule requirements for each of these pollutants.

While the 2008-2012 TIP for the New York Metropolitan Transportation Council (NYMTC) was approved by FHWA and FTA on December 10, 2007, the Goethals Bridge Replacement project was recently amended to the July'08 Update for the 2008-2012 TIP for the New York City portion of the region. Under the TIP, the project is known as "Modernization of the Goethals Bridge" (project # X770.46) to reflect current design standards, modern structural and seismic codes, national security safeguards, and technology enhancements. The project is also included in the NYMTC's 2030 LRTP and Plan Conformity Update (as a modernization and expansion project), which was approved by FHWA and FTA on September 30, 2005.

4.20.2 Ambient Air Quality

4.20.2.1 New Jersey

Representative monitored ambient air quality data for the New Jersey portion of the Regional Study Area are shown in Table 4.20-2. Data were compiled using NJDEP and EPA's AirData databases for 2005, the latest calendar year for which data are available. With the exception of the recently promulgated annual $PM_{2.5}$ standard, monitored levels for the criteria pollutants do not exceed National and State ambient air quality standards in the Study Area.

TABLE 4.20-2
REPRESENTATIVE POLLUTANT DATA – NEW JERSEY (2006)

Pollutant	Location (County)	Averaging Time	Value[1,2]	NAAQS
Carbon Monoxide	Elizabeth (Union)	8 hour	2.9 ppm	9 ppm
		1 hour	4.5 ppm	35 ppm
Nitrogen Dioxide	Elizabeth (Union)	Annual	0.030 ppm	0.053 ppm
Ozone	Bayonne (Hudson)	8 hour	0.086 ppm*	0.08 ppm
Sulfur Dioxide	Elizabeth (Union)	Annual	0.005 ppm	0.03 ppm
		24 hour	0.022 ppm	0.14 ppm
		3 hour	0.040 ppm	0.5 ppm
$PM_{2.5}$	Elizabeth (Union)	Annual	14.7 $\mu g/m^3$	15 $\mu g/m^3$
		24 hour	46 $\mu g/m^{3**}$	65 $\mu g/m^3$
PM_{10}	Jersey City (Hudson)	24 hour	59 $\mu g/m^3$	150 $\mu g/m^3$

Source: EPA AirData (http://oaspub.epa.gov/airdata).
Notes:
* Denotes an exceedance of an NAAQS.
** Denotes an exceedance of the recently adopted standard of 35 $\mu g/m^3$.
1. Values shown correspond to NAAQS time periods and standard definitions.
2. If data are available from more than one monitoring station in a county, the highest values are provided

4.20.2.2 New York

Representative monitored ambient air quality data for the New York portion of the Regional Study Area are shown in Table 4.20-3. Data were compiled by NYSDEC for 2005, the latest calendar year for which data are available. With the exception of the recently promulgated 8-hour ozone and annual $PM_{2.5}$ standards, monitored levels for the criteria pollutants do not exceed National and State ambient air quality standards in the Study Area.

4.20.3 Mobile Source Analysis Methodology

A microscale modeling analysis was conducted to estimate CO levels and potential project-related PM_{10} and $PM_{2.5}$ impacts near analysis sites in the Regional Study Area that are anticipated to be affected by the proposed project. Evaluations were conducted for existing (2004) conditions and predicted future conditions with and without the proposed project. The following section describes the methodology used in this analysis.

TABLE 4.20-3
REPRESENTATIVE POLLUTANT DATA – NEW YORK (2005)

Pollutant	Location	Averaging Time	Value[1,2,3]	NAAQS
Carbon Monoxide	302 Gold Street, Bklyn	8 hour	2.5 ppm	9 ppm
		1 hour	5.4 ppm	35 ppm
Nitrogen Dioxide	Gravett Road, Queens	Annual	0.024 ppm	0.053 ppm
Ozone	Susan Wagner HS, S.I.	8 hour	0.092 ppm	0.08 ppm
Sulfur Dioxide	Gravett Road, Queens	Annual	0.005 ppm	0.03 ppm
		24 hour	0.024 ppm	0.14 ppm
		3 hour	0.039 ppm	0.5 ppm
$PM_{2.5}$	Pt. Richmond Ave, S.I.	Annual	12.2 $\mu g/m^3$	15 $\mu g/m^3$
		24 hour	36.0 $\mu g/m^3$	65 $\mu g/m^3$
	Susan Wagner HS, S.I	Annual	10.4 $\mu g/m^3$	15 $\mu g/m^3$
		24 hour	32.0 $\mu g/m^3$	65 $\mu g/m^3$
PM_{10}[3]	Susan Wagner HS, S.I.	24 hour	15 $\mu g/m^3$	150 $\mu g/m^3$

Source: EPA AirData (http://epa.gov/airdata).
Notes:
* Denotes an exceedance of an NAAQS.
** Denotes an exceedance of the recently adopted standard of 35 but not the currently applicable.
1. Values shown correspond to NAAQS time periods and standard definitions.
2. If data are available from more than one monitoring station in a county, the highest values are provided.
3. 2005 data are presented because PM_{10} monitoring on Staten Island has been discontinued.

4.20.3.1 Site Selection Criteria

Guidelines established by New Jersey and New York State and by New York City agencies specify criteria to determine whether detailed air quality analyses are required for a proposed project. These criteria are described below.

New Jersey

NJDEP's *Air Quality Analysis for Intersections* guidelines for determining critical intersections indicate that signalized intersections with future levels of service (LOS) of D, E or F that will be affected by project-generated vehicles (or signalized intersections that would change to LOS D, E or F due to the proposed project) should be considered for detailed analysis.

New York

NYSDOT's *EPM* specifies a site-selection process that includes an initial screening of potentially affected sites, followed by a ranking of those sites to determine which require detailed analysis. These guidelines include LOS screening of project-affected intersections with a LOS of D or greater, followed by application of the following capture criteria to rank and select sites for detailed analysis:

1) 10 percent or more reduction in source-receptor distances;
2) 10 percent or more increase in traffic volumes on the affected roadways;
3) 10 percent or more increase in vehicle emissions;
4) Any increase in the number of queued lanes; and
5) 20 percent reduction in speeds, when the estimated average speed in the Build condition is 30 mph or less.

The NYSDOT *EPM* also states that if a SIP intersection, which is an intersection identified and analyzed in New York State's 1995 CO SIP attainment demonstration, is located within ½ mile of the project, the thresholds for all project-induced increases at these intersections are reduced by half from the criteria cited above.

New York City

The *CEQR Technical Manual* specifies that a detailed mobile source air quality analysis is required for:

Locations in the Staten Island and Brooklyn portions of the Regional Study Area where the project-generated number of vehicular trips through any affected intersection is greater than the threshold value of 100 per hour for any peak period; and

Locations in the Lower Manhattan portion of the Regional Study Area where the project-generated number of vehicular trips through any affected intersection is greater than the threshold value of 75 per hour for any peak period.

Result of Applying Site-Selection Criteria

Since traffic estimates for this project indicate that changes in traffic volumes and levels of service will be above the thresholds specified above at a number of intersections in both the New York and New Jersey portions of the regional Study Area, a detailed mobile sources analysis was conducted.

4.20.3.2 Analysis Sites

New Jersey

Selection of analysis sites in New Jersey was based on a screening analysis that was conducted using criteria outlined in NJDEP's *Air Quality Analysis for Intersections* guidelines to determine where air quality levels would most be affected by the proposed project. In order to select these analysis sites, traffic volumes, the levels of service and vehicular speeds at the major signalized intersections were evaluated with and without the proposed project. They include locations adjacent to the major roadways that may be affected by the project alternatives, creating the potential for exceeding air quality standards at nearby sensitive land uses. Field visits were conducted during the fall of 2004 and the spring of 2005 to field-verify these locations. The intersection sites that were selected for analysis are shown in Table 4.20-4 and on Figure 4.20-1.

TABLE 4.20-4
MICROSCALE ANALYSIS SITES – NEW JERSEY

Site Number	Site Location	City/County
1	Routes 1&9 at Bayway Circle	Elizabeth / Union
2	Bayway Avenue/Atlantic Ave & NJ Turnpike Interchange 13	Elizabeth / Union

New York

Site selection in the New York portion of the Regional Study Area was based on a screening analysis that was conducted using *NYSDOT EPM* guidelines and *CEQR Technical Manual* screening threshold criteria to determine where air quality levels would most be affected by the proposed project. In order to select these analysis sites, traffic volumes, the levels of service and vehicular speeds at the major signalized intersections were evaluated with and without the proposed project. They include locations adjacent to the major roadways that may be affected by the project alternatives creating the potential for exceeding air quality standards at nearby sensitive land uses. Field visits were also conducted during the fall of 2004 and the spring of 2005 to field-verify these locations. The intersection sites that were selected for analysis are shown in Table 4.20-5 and on Figure 4.20-1.

TABLE 4.20-5
MICROSCALE ANALYSIS SITES – NEW YORK

Site Number	Site Location	County
1	Goethals Bridge Toll Plaza Area	Richmond
2	Verrazano-Narrows Bridge Toll Plaza Area	Richmond

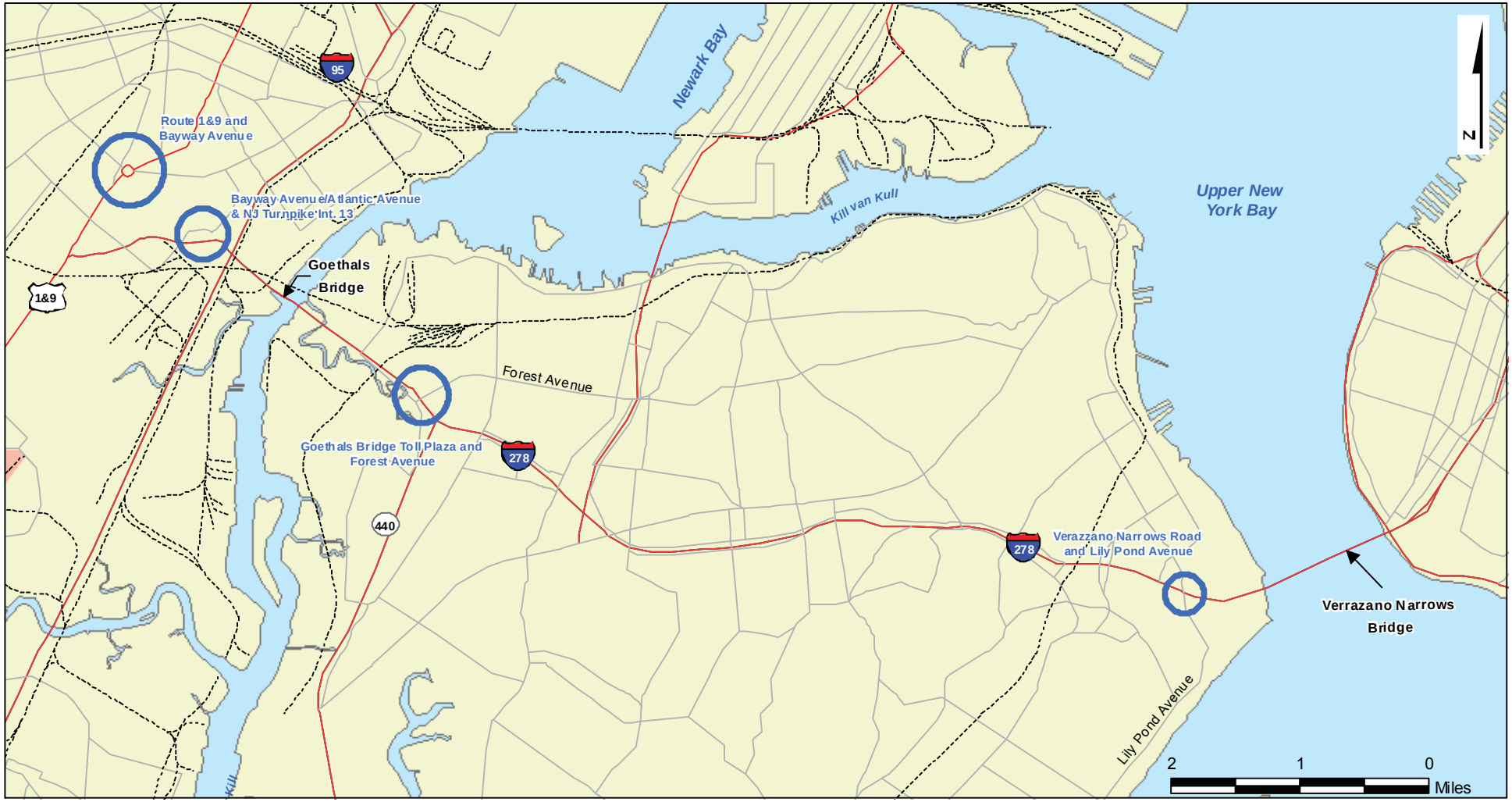
4.20.3.3 Receptors

The locations at which pollutant concentrations are estimated are known as "receptors." Following guidelines established in USEPA's *Intersection Modeling Guidelines*, receptors were located where the maximum concentration is likely to occur and where the general public is likely to have access. For this analysis, receptor locations were distributed along sidewalks to which the general public has access on a more-or-less continuous basis. Multiple receptor locations were considered near each analysis site.

The exact placement of these receptors was determined on a site-by-site basis, based on traffic conditions (e.g., high volumes and low speeds), roadway geometry (including the potential cumulative impacts from emissions generated on several roadway links), the location of queued traffic (based on existing and projected volume-to-capacity (V/C) ratios), and the location of existing and future sensitive land uses.

4.20.3.4 Traffic Data

Traffic data for the air quality analysis were derived from traffic counts and other information developed as part of the traffic studies conducted for this DEIS (see Appendix J). The weekday AM and PM peak traffic periods were considered. These are the periods when the maximum changes in pollutant concentrations would be expected, based on overall traffic volumes and anticipated changes in traffic patterns due to the project alternatives.



Legend

Air Quality Analysis Site

Roads

Highways

Secondary Roads

Railroad

Goethals Bridge Replacement EIS

FIGURE 4.20-1
Air Quality Microscale Analysis Sites

United States Coast Guard

Modeling conducted for this DEIS with the GTM, which was developed for study of the Goethals Bridge corridor, was the basis for determining changes in vehicular traffic patterns with the project alternatives. Together with the *2000 Highway Capacity Manual* and HCS 2000 software, these tools were used to develop the traffic data necessary for the air quality analysis. Existing vehicle speeds were obtained from field measurements at analysis sites in the New Jersey and New York portions of the Regional Study Area, and adjusted to estimate future free-flow speeds.

4.20.3.5 Vehicle Classification Data

Vehicle classification data required to determine composite emission factors were based on traffic survey data for the following categories: light duty gasoline vehicles (LDGVs), sport utility vehicles (SUVs), light-duty trucks, heavy-duty trucks, and buses.

Light-duty gasoline trucks were divided into four groups (LDGT 1, 2, 3, and 4), based on NYSDEC and NJDEP registration data. Based on data from the NYSDEC and NJDEP, the registered split between LDGT 1 and 2 and LDGT 3 and 4 used in this analysis is 71 percent to 29 percent, respectively. As recommended in the NYSDOT *EPM,* SUVs were classified as light-duty gasoline trucks, with 75 percent of emissions considered as LDGT 1 and LDGT 2, and 25 percent as LDGT 3 and LDGT 4. The split between heavy-duty gasoline vehicles (HDGVs) and heavy-duty diesel vehicles (HDDVs) was based on NYSDEC's and NJDEP's registration data, as appropriate, for each analysis year. All buses were considered to be heavy-duty diesel vehicles (HDDVs), and all SUVs were assumed to have the same engine-operating parameters as automobiles.

4.20.3.6 Vehicle Emissions

CO emission factors were estimated using USEPA's MOBILE 6.2.03 (EPA420-R-03-010), the most current version of the mobile emission factor algorithm model. This version includes the effects of the new vehicle standards, vehicle turnover, and emission factors for particulate matter. The following modeling inputs were applied:

New Jersey

- NJDEP input files with 2003 New Jersey State registration distribution by age, as provided by NJDOT;
- New Jersey inspection/maintenance, anti-tampering and low emission vehicle (LEV) programs;
- EPA default diesel sales fractions, mileage accumulation rates and natural gas vehicle fractions;
- A minimum/maximum wintertime temperature of 26.7 and 41.2 degrees Fahrenheit to estimate CO and PM_{10} emission factors;
- A minimum/maximum summertime temperature of 71 and 95 degrees Fahrenheit to estimate VOC and NOx emission factors;
- Winter as the evaluation season;
- January as the evaluation month; and
- In estimating PM emissions from diesel engines, the following sulfur contents were used: 400 ppm for 2004 (i.e., existing conditions), and 15 ppm for future analysis years (to account for the future required use of ultra-low sulfur diesel (ULSD) diesel fuel).

New York

- NYSDEC input files, with engine-operating start and distribution parameters and vehicle miles traveled (VMT) for Richmond, Kings and New York counties;

- New York State inspection/maintenance, anti-tampering and LEV programs;
- New York State 2006 vehicle registration and national default mileage accumulation data;
- New York State 2006 diesel sales fraction data;
- An average winter temperature of 50 degrees Fahrenheit for New York county;
- An average winter temperature of 42 degrees Fahrenheit for Richmond and Kings counties;
- Winter as the evaluation season;
- January as the evaluation month; and
- In estimating PM emissions from diesel engines, the following sulfur contents were used: 400 ppm for 2004 (existing conditions), and 15 ppm for future analysis years (to account for the future required use of ULSD diesel fuel).

4.20.3.7 Analysis Years

Following New Jersey and New York guidelines for a project located in a CO maintenance area, the microscale analysis was conducted for the baseline condition (2004) as well as for two future analysis years, the project's estimated time of completion (2014) and the project's design year (2034). This section only presents the baseline condition, as the future analysis conditions for both No-Build and Build are discussed in Section 5.0.

4.20.3.8 Dispersion Analysis

Mobile-source dispersion models are the basic analytical tools used to estimate pollutant concentrations from the emissions generated by motor vehicles that would be expected under given conditions of traffic, roadway geometry, and meteorology. CAL3QHC Version 2 is a line-source dispersion model that predicts pollutant concentrations near congested intersections and heavily traveled roadways. CAL3QHC input variables include free-flow and calculated-idle emission factors, roadway geometries, traffic volumes, site characteristics, background pollutant concentrations, signal timing, and meteorological conditions. CAL3QHC predicts inert pollutant concentrations, averaged over a 1-hour period near roadways. This model was used to predict concentrations at affected Study Area intersections.

CAL3QHC predicts peak 1-hour pollutant concentrations using assumed meteorology and peak-period traffic conditions. Different emission rates occur when vehicles are stopped (idling), accelerating, decelerating, and moving at different average speeds. CAL3QHC simplifies these different emission rates into the following two components:

Emissions when vehicles are stopped (idling) during the red phase of a signalized intersection; and
Emissions when vehicles are in motion during the green phase of a signalized intersection.

CAL3QHCR, which is a refinement to CAL3QHC in that it uses actual meteorological data (versus an assumed worst-case set of meteorological conditions), was used in all mobile source analyses. Five years of actual meteorological data from Newark International Airport were used in this analysis to estimate 8-hour CO concentrations.

The analyses followed USEPA's *Intersection Modeling Guidelines* (EPA-454/R-92-005) for CO modeling methodology and receptor placement. All major roadway segments (links) within approximately 1,000 feet of each analysis site (i.e., congested intersection) were considered. A mixing height of 1,000 meters and a surface roughness factor of 180 centimeters were included in all calculations.

A conservative analysis, which assumes that peak-period vehicular emissions, traffic volumes, and intersection-operating parameters occur every hour of each analysis year, was utilized. Use of peak-hour

baseline and project-generated conditions results in conservative predictions of pollutant levels and project impacts.

4.20.3.9 Background Values

In estimating total pollution concentrations with and without the proposed project, it is necessary to include consideration of the background pollutant levels in the Regional Study Area. The background level is the component of the total concentration not accounted for through the microscale modeling analysis. Applicable background concentrations were added to the modeling results to obtain total pollutant concentrations at each receptor site for each analysis year. The CO background values, which are based on the most recent ambient monitoring data and future decreases in vehicular emissions due to federally mandated emission-control programs and vehicle turnover, were provided by NYCDEP and NJDEP. The background values used in the analyses are provided in Table 4.20-6.

TABLE 4.20-6
POLLUTANT BACKGROUND CONCENTRATIONS (ppm)

Pollutant	Averaging Time	New Jersey (All Counties)	New York (Richmond/Kings)	New York (Manhattan)
CO	8-hour (Downtown CBD)	3.5	-	2.9
	8-hour (Suburban)	2.1	2.3	-

Source: NJDEP "Air Quality Analysis for Intersections," March 2004; NYSDOT's *EPM*, 2001; NYCDEP.

4.20.3.10 Predicted Existing Air Pollutant Concentrations

New Jersey

Results of mobile-source air quality modeling for existing (2004) conditions are shown in Table 4.20-7. Values are the maximum pollutant concentrations predicted near each selected site in the timeframes that correspond to the NAAQS. Predicted existing carbon monoxide levels do not exceed the 8-hour CO standard of 9 ppm. The highest estimated concentration (7.07 ppm) occurs near the intersection of Route 1&9 at Bayway Circle in Elizabeth (Analysis Site 1) during the PM peak period.

TABLE 4.20-7
EXISTING CONDITIONS (2004) – NEW JERSEY
MAXIMUM 8-HOUR CO LEVELS

Site	Intersection	8-hr CO Level (ppm)	Maximum Time Period
1	Routes 1&9 at Bayway Circle	7.07	PM
2	Bayway Avenue/Atlantic Ave & NJ Turnpike Interchange 13	5.43	AM

Source: Berger / PB JV, 2006.
Notes:
1. These are the maximum results of both time periods analyzed.
2. All values include appropriate background concentration.
3. 8-hour CO background concentration = 3.5 ppm

AM - AM peak period (8-9 AM) PM - PM peak period (5-6 PM)

New York

Results of mobile-source air quality modeling for existing (2004) conditions are shown in Table 4.20-8. Values are the maximum pollutant concentrations predicted near each selected site in the timeframes that correspond to the NAAQS. Predicted existing carbon monoxide levels do not exceed the 8-hour CO standard of 9 ppm. The highest estimated concentration (5.49 ppm) occurs near the Verrazano-Narrows Bridge Toll Plaza area (Analysis Site 2) during the AM peak period.

TABLE 4.20-8
EXISTING CONDITIONS (2004) – NEW YORK
MAXIMUM 8-HOUR CO LEVELS

Site	Intersection	8-hr CO Level (ppm)	Maximum Time Period
1	Goethals Bridge Toll Plaza Area	3.79	PM
2	Verrazano-Narrows Bridge Toll Plaza Area	5.49	AM

Source: Berger / PB JV, 2006.
Notes:
1. These are the maximum results of both time periods analyzed.
2. All values include appropriate background concentration.
3. 8-hour CO background concentration = 2.9 ppm

AM - AM peak period (8-9 AM) PM - PM peak period (5-6 PM)

4.21 Noise

4.21.1 Introduction

Noise is basically defined as unwanted sound. It is emitted from many sources including airplanes, factories, railroads, power generation plants, and highway vehicles. Highway noise, or traffic noise, is usually a composite of noises from engine exhaust and tire-roadway interaction.

The magnitude of noise is usually described by its sound pressure. Since the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, usually the decibel (dB). Sound pressures described in decibels are called sound pressure levels and are often defined in terms of frequency-weighted scales (A, B, C, or D).

The A-weighted decibel scale is used almost exclusively in vehicle noise measurements because it reflects the frequency range to which the human ear is most sensitive (1000-6000 Hertz). Sound levels measured using A-weighted decibel scales are generally expressed as dBA. Throughout this report, all noise levels are expressed in dBAs. Several examples of noise pressure levels in dBA scale are listed in Table 4.21-1.

Table 4.21-1 indicates that most individuals in urbanized areas are exposed to fairly high noise levels from many sources as they go about their daily activities. The degree of disturbance or annoyance of unwanted sound depends essentially on three factors:

1) The amount and nature of the intruding noise;
2) The relationship between background noise and the intruding noise; and
3) The type of activity occurring where the noise is heard.

TABLE 4.21-1
EXAMPLES OF COMMON SOUNDS

A-weighted Sound Level in Decibels (dBA)

A-weighted Sound Level (dBA)	Overall Level	Noise Environment
120	Uncomfortably loud (32 times as loud as 70 dBA)	Military jet airplane takeoff at 50 feet
100	Very loud (8 times as loud as 70 dBA)	Jet flyover at 1000 feet Locomotive pass-by at 100 feet
80	Loud (2 times as loud as 70 dBA)	Propeller plane flyover at 1000 feet. Diesel truck 40 mph at 50 feet
70	Moderately loud	Freeway at 50 feet from pavement edge at 10 a.m. Vacuum cleaner (indoor)
60	Relatively quiet (1/2 as loud as 70 dBA)	Air condition unit at 100 feet. Dish washer at 10 feet (indoor)
50	Quiet (1/4 as loud as 70 dBA)	Large transformers Small private office (indoor)
40	Very quiet (1/8 as loud as 70 dBA)	Birds calls. Lowest limit of urban ambient sound
10	Extremely quiet	Just audible (1/64 as loud as 70 dBA)
0		Threshold of hearing

Source: Federal Agency Review of Selected Airport Noise Analysis Issues, 1992.
Modified by: The Louis Berger Group, Inc., Oct. 1998.

In considering the first of these factors (i.e., amount and nature of the intruding noise), it is important to note that individuals have different sensitivity to noise. Loud noises bother some more than others and some patterns of noise also enter into an individual's judgment of whether or not a noise is offensive. For example, noises occurring during sleeping hours are usually considered to be more of a nuisance than the same noises in the daytime.

With regard to the second factor (i.e., the relationship between background noise and the intruding noise), individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). For instance, the blowing of a car horn at night when background noise levels are typically about 45 dBA would generally be more objectionable than the blowing of a car horn in the afternoon when background noises are likely to be 60 dBA or higher.

The third factor (i.e., the type of activity occurring where the noise is heard) is related to the interference of noises with activities of individuals. In a 60 dBA environment, normal work activities requiring high levels of concentration may be interrupted by loud noises, while activities requiring manual effort may not be interrupted to the same degree.

Since sound is described in logarithmic scale (i.e., dBAs), sound levels cannot be added by ordinary arithmetic means. In fact, a doubling of the noise source produces only a 3 dBA increase in the sound pressure (noise) level. Studies have shown that this increase is barely perceptible to the human ear, whereas a change of 5 dBA is readily perceptible. As a general rule, an increase or decrease of 10 dBA in noise level is perceived by an observer to be a doubling or halving of the sound, respectively.

Attempts have been made to regulate many of these types of noises, including airplane noise, factory noise, railroad noise, and highway traffic noise. In relation to highway traffic noise, methods of analysis and control have been developed by the Federal Highway Administration (FHWA) and adapted by state transportation agencies, such as the New Jersey Department of Transportation (NJDOT) and New York State Department of Transportation (NYSDOT), which is described below.

4.21.2 Noise Measurement Program Methodology and Approach

Noise measurements were conducted in accordance with techniques described in the FHWA Report Number FHWA-DP-96-046, *Measurements of Highway-Related Noise*, May 1996. Precision Sound Level Meters (SLM), including Bruel&Kjaer 2236, Bruel&Kjaer 2260, and Rion NL-22, were used to monitor ambient long-term (24-hour) and short-term (20-minute) noise levels using the established FHWA procedures. The SLMs meet or exceed the requirements set forth in the ANSI S1.4-1983 Standards for Type I or II quality and accuracy. Acoustical calibrators (Bruel&Kjaer 4230 and 4231) were used to calibrate the SLMs for each measurement interval.

The SLMs were operated on the A-weighting network and slow response per the FHWA guidelines. Measurements were not collected if the roadway pavement was wet, or if wind speed exceeded 12 miles per hour. A porous windscreen was used on the sound level meter during the measurement periods. All of the measurements were taken by mounting the sound level meters approximately five feet above the sidewalk or ground surface at each receptor. This height is generally considered representative of the ear level of an average person. Wherever possible, measurement sites were located in open areas away from buildings or other potentially reflective surfaces, but which were representative of the outdoor use area of a given receptor.

Long-term and short-term noise measurements were conducted in March of 2005. The noise measurements were conducted at sites representing noise sensitive uses, such as residential and institutional land uses, in close proximity to the proposed project (i.e., within the Primary Study Area). Multiple short-term measurements during the peak and midday traffic periods were conducted to reflect noise variations during different periods of the day. The primary noise source for all measurement sites was traffic along the existing Goethals Bridge, access ramps, and local roads with major access to the bridge. Secondary noise sources included neighborhood activities and overhead aircraft.

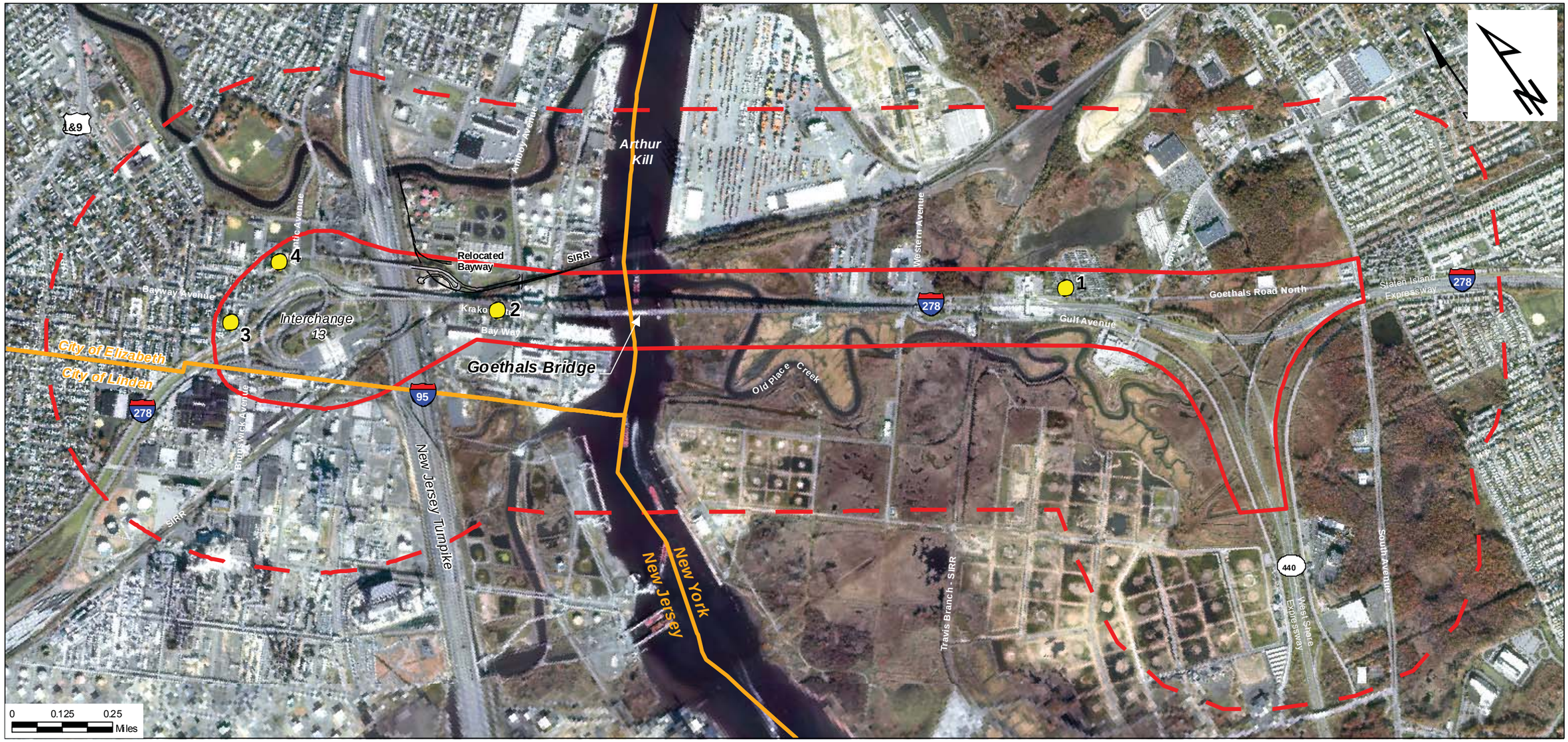
Noise measurement sites were selected after a review of the proposed project alternatives, aerial photographs and field reconnaissance. Residences or property owners at the selected measurement sites were subsequently informed and solicited via certified mail and telephone calls prior to the noise measurements. A total of four sites, including one long-term (24-hour) and three short-term (20-minute) measurement sites, were monitored in the Primary Study Area. Of the four sites, three are existing residential sites (No. 1 in New York and Nos. 2 and 3 in New Jersey) and one is a school (No. 4 in New Jersey). The locations of the noise measurement sites are presented in Figure 4.21-1.

4.21.3 Existing Noise Levels

The results of the short-term noise measurements and the long-term 24-hour noise measurements are presented in Appendix K and summarized below:

Noise measurement results at the 24-hour site (Site No. 1) are presented in Figure 4.21-2, while the short-term noise measurement results (Site Nos. 2, 3 and 4) are presented in Table 4.21-2.

Site No. 1 is a 24-hour measurement site adjacent to the westbound lanes of I-278, or the Staten Island Expressway (SIE), and immediately east of the Goethals Bridge Toll Plaza in Staten Island. Because of access and security reasons, Site No. 1 was placed in the Port Authority property immediately next to the



Legend

- Primary Study Area
- Secondary Study Area
- Noise Measurement Site

24 - Hour Measurement Site:

1. PANYNJ property adjacent to Goethals Garden Homes residential community

Short - Term Measurement Sites:

2. 134 Krakow Street
3. 729 McKinley Street
4. PS 22 William F. Halloran Elementary School

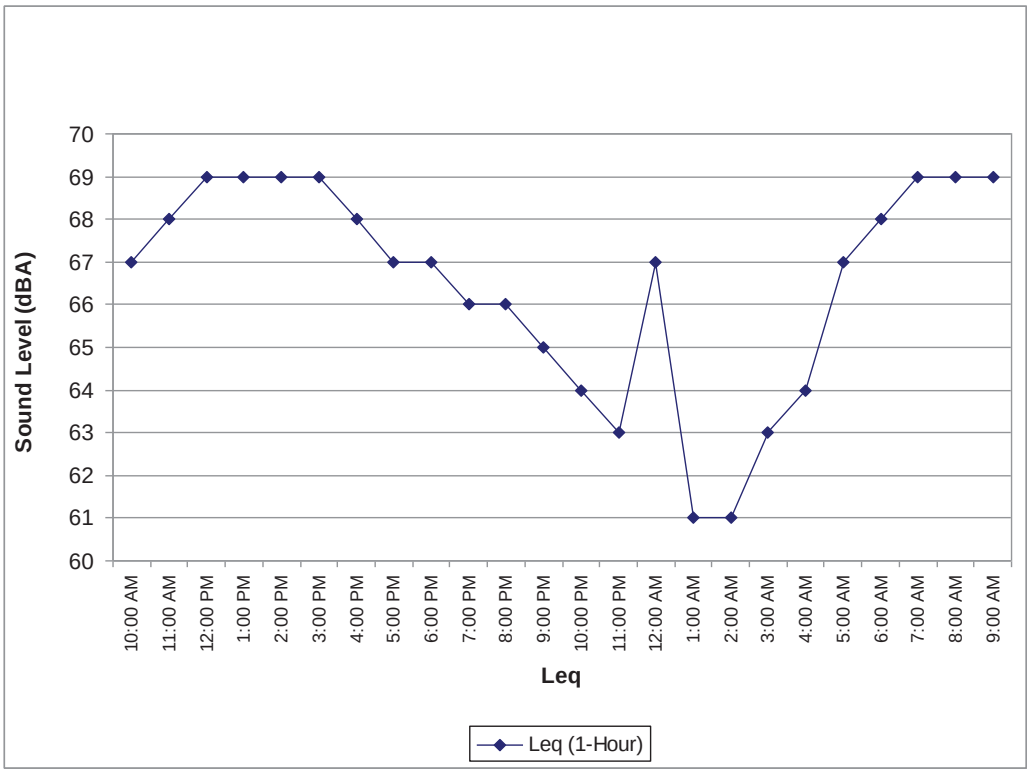
Source:
Basemapping: Port Authority of New York and New Jersey, 2002.

Goethals Bridge Replacement EIS

FIGURE 4.21-1
Location of Noise Measurement Sites

United States Coast Guard

Figure 4.21-2: Long-Term Noise Measurement Results (Site No. 1)



Notes: Peak at 12:00 AM midnight was attributed to the on-going Port Authority construction activities on the Goethals Bridge during night time between 9:30 PM to 5:00 AM.
Source: Berger/PB, July 2005.

Goethals Garden Homes community on Goethals Road. The SLM was placed along the existing fence line of the Port Authority parking and storage area. It is identified that a MTA bus stop is stationed close to the measurement site. Noise levels ranged between 61 dBA and 69 dBA. The greatest hourly L_{eq} noise levels were at 69 dBA during AM peak hours (7:00 AM to 10:00 AM), while the PM (5:00 PM to 7:00 PM) peak hourly L_{eq} noise levels were 67 dBA (see Figure 4.21-2). Predominant noise sources were vehicular traffic on SIE (I-278) traffic entering and leaving the toll plaza. Secondary noise sources were local truck and bus traffic on Goethals Road and the occasional airplane and helicopter flying overhead.

Short-term noise levels were measured at *Site No. 2*, in front of an empty lot at 134 Krakow Street in a residential neighborhood south of the Goethals Bridge in Elizabeth. The SLM was placed on Krakow Street. The highest noise level was measured during the AM peak and midday hours. The measured L_{eq} levels during the peak hours were 68 dBA (see Table 4.21-2). Predominant noise sources were vehicular traffic on the bridge and heavy trucks on Bayway Avenue, and airplanes flying overhead.

Short-term noise levels were measured at *Site No. 3*, on the residential property located at 729 McKinley Street immediately to the north of I-278 in Elizabeth. The SLM was placed approximately six feet from the property fence line. The highest noise level was measured during the AM and PM peak hours. The measured L_{eq} levels during those hours were at 65 dBA (see Table 4.21-2). Predominant noise sources were vehicular traffic on I-278. Secondary sources included local traffic on McKinley Street and airplanes flying overhead.

Site No. 4 represents P.S. 22 - William F. Halloran Elementary School located on 447 Richmond Street. The SLM was placed in front of the school building facing Atlantic Avenue and Brunswick Avenue. The highest noise level was measured during the AM and PM peak hours. The measured L_{eq} levels during those hours were at 66 dBA (see Table 4.21-2). Predominant noise sources were vehicular traffic on Atlantic Avenue and Brunswick Avenue, and airplanes flying overhead.

TABLE 4.21-2
SHORT-TERM MEASUREMENTS

Site	Address	Date	Period	Leq
2	134 Krakow St	4/5/2005	AM Peak	68
		4/5/2005	Midday	68
		4/5/2005	PM Peak	66
3	729 McKinley St	4/5/2005	AM Peak	65
		4/5/2005	Midday	63
		4/5/2005	PM Peak	65
4	PS 22 - 447 Richmond St	4/5/2005	AM Peak	66
		4/5/2005	Midday	64
		4/5/2005	PM Peak	66

Source: Berger/PB, July 2005.