FILE NAME

"Report.VCP.v00615.2004-10-20.Habitat_Assessment_Report_Site1_2_3.pdf"

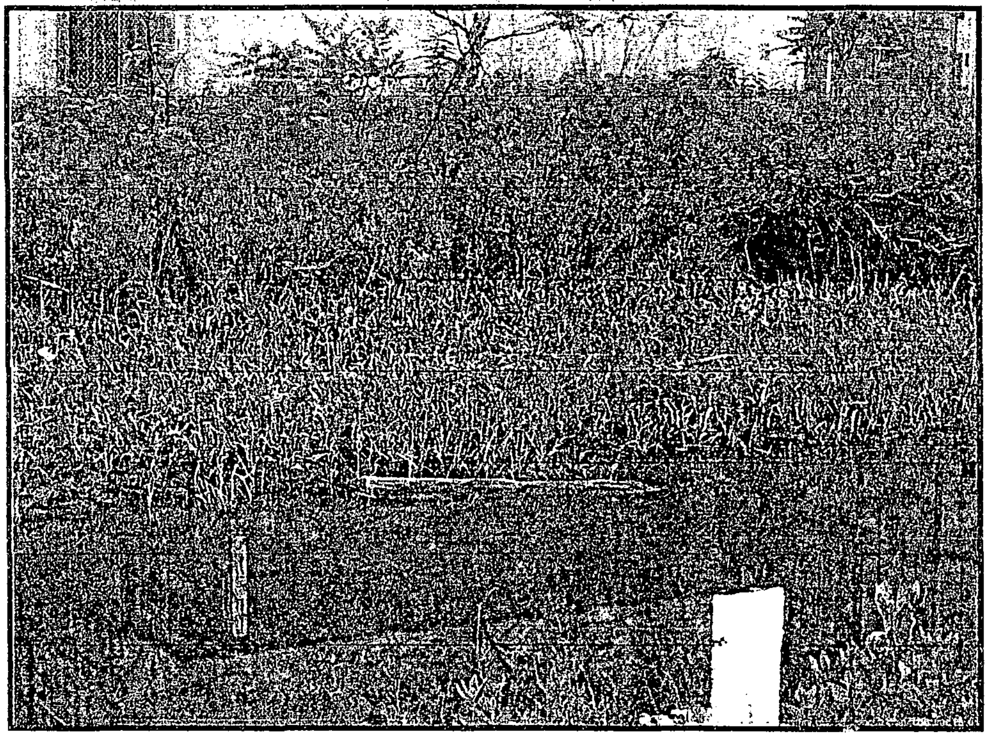
NOTE

- Contains folded images. Images must be copied in their entirety.
- Images may contain color.
- Documents must be returned in the same arrangement in which they were received.

Please return electronic copies to Sally Dewes

HABITAT ASSESSMENT REPORT

The Port Authority of New York-New Jersey Intermodal Facility
Port Ivory
Staten Island, New York



Prepared for:
The Port Authority of New York and New Jersey
One Madison Avenue, 7th Floor
New York, NY 10010

Prepared by:
Maguire Group Inc.
One Court Street
New Britain, CT 06051

August 2004

Table of Contents

List of Tables

List of Figures

Executive Summary

Maguire Group was asked to conduct a habitat assessment of the different areas involved in the development of the former Procter & Gamble manufacturing site in the northeastern area of Staten Island, New York. This study was conducted on behalf of The Port Authority of New York-New Jersey, which is currently undertaking the design of a new intermodal facility at the Port Ivory site. The Port Ivory Intermodal Facility (PIIF) will be a rail transfer activity where containers from the Howland Hook Marine Terminal will be placed on rail cars for distribution. During a field visit in June 2003, wildlife and vegetation were documented through both passive and active searching by the Maguire representative, and this report was prepared after analysis of field and published data.

The proposed project is located in an area of Staten Island that has been intensively impacted by industrial development, and there are resources within the project area that could be affected by the project. For example, Bridge Creek, the small tidal creek that connects to the Arthur Kill Channel, separates the PIIF site from the Howland Hook Marine Terminal area. A bridge is planned, and the bridge or other improvements could have impacts.

Potential impacts to the entire area include both direct and indirect impacts. There will be direct impacts to wetlands as a result of the bridge construction and stormwater outfall improvements. One bridge abutment will be slightly within the wetland limits. Indirect impacts would include physical and chemical stormwater impacts, shading of vegetation under the bridge structure, and potentially, light and noise impacts.

A summary of the assessment results follows below, and details of the findings follow in this report.

- **Habitat Attributes:** The upland portion of the site has been extensively disturbed. As part of the PIIF redevelopment project, the majority of industrial buildings have been removed, and the site has been remediated and regraded. Fill material is being moved and graded to prep the site for eventual development. The only vegetation located on the site itself is within the Creek corridor, and scattered landscaped vegetation in the vicinity of the two remaining buildings (40 and 41).
- **Wildlife Species Impacts:** Construction of the PIIF would require the installation of concrete and pavement over much of the site. Rail lines and access roads would be installed in this paved area. Since the site is currently devoid of vegetation, and since the historical use of the site has been industrial, the redevelopment of the site would not have any negative impacts to land-based wildlife species.
- **Creek Impacts:** Due to the extent of urbanization that has already occurred within the watershed of Bridge Creek, the Creek and adjacent upland habitat have already suffered from many habitat-altering activities. The proposed

project would have minor direct impacts to Bridge Creek. Wildlife and vegetation that continue to utilize the Creek are adapted to this type of disturbance.

- **Creek Water Quality Impacts:** The water quality of the Creek has suffered from pollutant loading. Various exogenous chemicals have historically been or currently are released. Exposure of fish and shellfish to these chemicals can cause various toxicological effects. Despite the impact to water quality from past abuses, however, many marine finfish including federally managed species such as the winter and summer flounders, black sea bass, and bluefish still use these waters.
- **Wetlands Impacts:** The loss of the high marsh habitat and creation of steep banks along segments of Bridge Creek through historical filling have resulted in the loss of optimal microhabitat for tidal creek fish. However, specific mitigation plans will be developed as part of the federal and state permits. As a result, there should be no long-term negative impacts to the wetland resources as a result of the direct temporary and permanent wetland impacts.
- **Lighting and Light Impacts:** The installation of lights in and around the proposed PIIF would increase the amount of light reaching Bridge Creek. Shields should be considered for installation on the lights closest to the Creek. The proposed foot-candle (fc) measurements at Bridge Creek are similar to standards for parking areas. The intensity of light reaching Bridge Creek from the proposed PIIF lights would be well below the minimum requirements for pedestrian areas which typically require less light than most other developed (e.g., industrial and commercial) sites. The light reaching Bridge Creek is almost an order of magnitude less than the lowest criteria value; thus, few negative impacts to wildlife from lighting are expected.
- **Shaded Areas Impacts:** There will be a shaded area over Bridge Creek and thus portions of the Creek and associated banks would always be shaded. Within the Creek, it is unlikely that there would be any negative impact to fauna. The Creek is tidal and mobile species are constantly moving within it. Species that do not find shaded areas suitable would easily relocate to non-shaded areas in other parts of the Creek. Most species will not react adversely to shade over the Creek and in fact, some species may take advantage of this area as a safe zone from predators.
- **Noise Impacts:** Noise-producing machinery associated with the operation of the proposed PIIF could potentially impact breeding activities of avian species in Bridge Creek and its adjacent wetland edge. Although noise sources would be more frequent in the vicinity of the bridge, vehicle activity on the site would be less frequent with distance from the bridge. The result would be minor-to-no impacts to wetland habitats upstream and downstream from the bridge. Bridge vehicle traffic would be more concentrated and thus could have a negative impact on nesting species in wetlands immediately adjacent to the bridge. Considering the bridge would impact a small portion

of the overall wetland resources on the site, noise from bridge traffic would not be considered a negative impact on the entire site, only the wetland areas near the bridge. It is anticipated that noise may have a negative impact on some fauna individuals, but not all fauna individuals on the site.

- **Stormwater Treatment Impacts:** The construction of the proposed PIIF will include an extensive stormwater collection and treatment system. By utilizing integrated treatment techniques, all chemical and physical properties of the existing stormwater would be improved. Although pollutant loading may increase, the greatly improved treatment will offset this. Therefore, stormwater discharged to Bridge Creek will be of similar or higher water quality.

  - **Wildlife Impacts Related to the Bridge and Water Collection and Treatment:** The bridge will be wide enough to allow wildlife to pass beneath along the bank of the Creek. Dry land between the Creek and the bridge abutment (above the high tide line) will allow upland species, which do not utilize water for movement, to continue using this habitat without adverse impact from the new human activities on the PIIF site. Although the east side of the bridge would require partial installation of an abutment below mean higher high water (MHHW), under normal hydrologic conditions, sufficient space would be available for wildlife movement during low tide and up to a point before high tide.

  - **Fauna Impacts Related to the Bridge and Water Collection and Treatment:** Based on the estimated benthic infauna in Bridge Creek, negative impacts are not expected as a result of the proposed PIIF. The estimated assemblages occurring in the Creek are already tolerant of poor sediment and water quality. Since the proposed work at the PIIF is not anticipated to impact either the sediment or water quality of Bridge Creek, these fauna would not be impacted. In fact, it is reasonable to presume that these species could benefit from the project, since stormwater will be subject to increased treatment before discharge to the Creek than what occurs under current conditions.

The proposed design of the bridge structure reflects a consideration of the tidal creek environment, including potential fisheries. The large, single-span structure allows for placement of the bridge piers at a location outside of the channel and above the mean high water elevation, with the exception of one small area. This design consideration avoids degradation of the wetland adjacent to the creek, avoids constricting the channel, and avoids impeding the tidal flow to and from upstream channel segments.

In addition to these design considerations, the **following avoidance, minimization, and mitigation measures should be undertaken within the project area** during construction to avoid or minimize impact to fish habitat (e.g., tidal creek finfish) in those locations:

- The bridge and associated site development should be constructed following best management practices and any specified permit conditions in order to avoid generating excessive amounts of sedimentation that may cause irreversible impacts to marine resources during construction activities.
- No construction activity should occur from within the limits of the Bridge Creek channel.
- Efforts should be made to re-establish cover of any exposed bank areas as soon as possible following construction of the bridge piers.
- No oil, hazardous, or other regulated materials (e.g., paints, fuels, cleaners, etc.) associated with construction activity should be stored or handled within close proximity to the Creek.
- Refueling of construction vehicles should occur at a designated location away from the watercourse and any associated storm drains.
- The applicant should comply with any additional permit conditions specified for the proper removal and disposal of surplus excavated material, in accordance with state law.

****

The assessment report which follows includes documentation of avian, mammalian, herpetofaunal and fish species and their respective habitats within the site, along with an impact analysis for those species. The report also includes documentation and descriptions of the different habitats, including vegetation composition and special habitat attributes.

Introduction

The Port Authority of New York-New Jersey (the Port Authority) is currently undertaking the design of a new intermodal facility at Port Ivory in Staten Island, New York. The intermodal facility is a support activity for the Howland Hook Marine Terminal, located to the west of the site. The Port Ivory Intermodal Facility (PIIF) will be a rail transfer activity where containers from Howland Hook will be placed on rail cars for distribution. The PIIF will generally consist of rail lines and a new paved "tabletop." Figure 1 shows the project location (page 7).

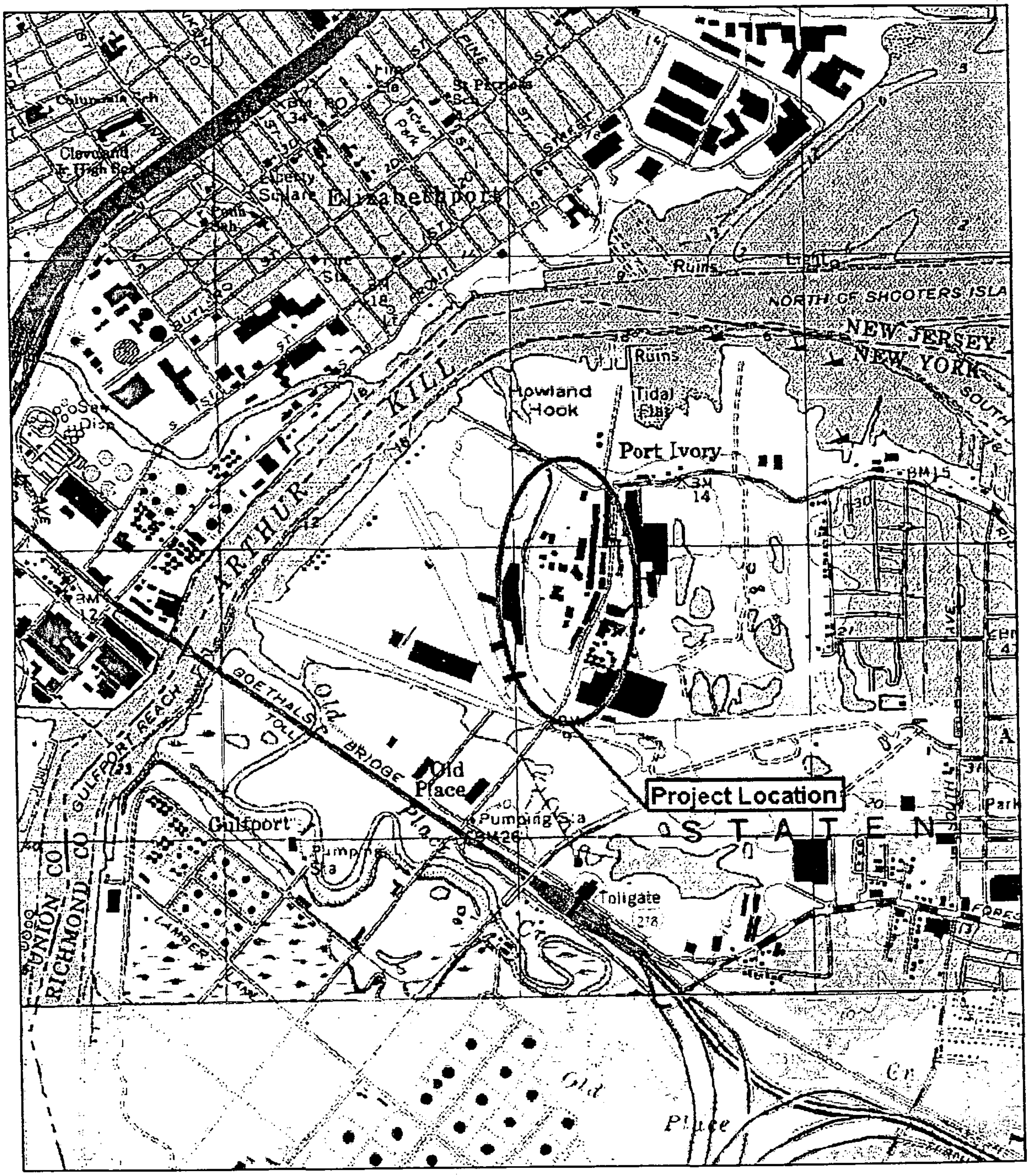
The project site is the former Procter & Gamble's Ivory Soap manufacturing facility located on the Northwest corner of Staten Island. The site is bound by Western Avenue to the south and east, Bridge Creek to the south and west, and Richmond Terrace to the north. A major demolition program was recently undertaken within the site, leaving only two buildings (40 and 41). The site once contained over 30 large manufacturing buildings that have been demolished by the Port Authority for the future PIIF.

The site, currently regraded fill material, will be covered with a thick tabletop consisting of concrete and asphalt. Utilities including stormwater, potable water and electricity will be installed. Stormwater improvements will include reconstruction of existing stormwater outfalls into Bridge Creek. An extensive lighting system will be installed to facilitate 24-hour activities at the site. An extensive fire protection system will also be installed. A rail system will be constructed to facilitate transport of containers. The PIIF will be connected to the existing Howland Hook Marine Terminal by a new bridge over Bridge Creek. Figure 2 shows the overall site plan for the proposed activities (page 8). Figure 3 shows the proposed bridge layout and profile over Bridge Creek (page 9).

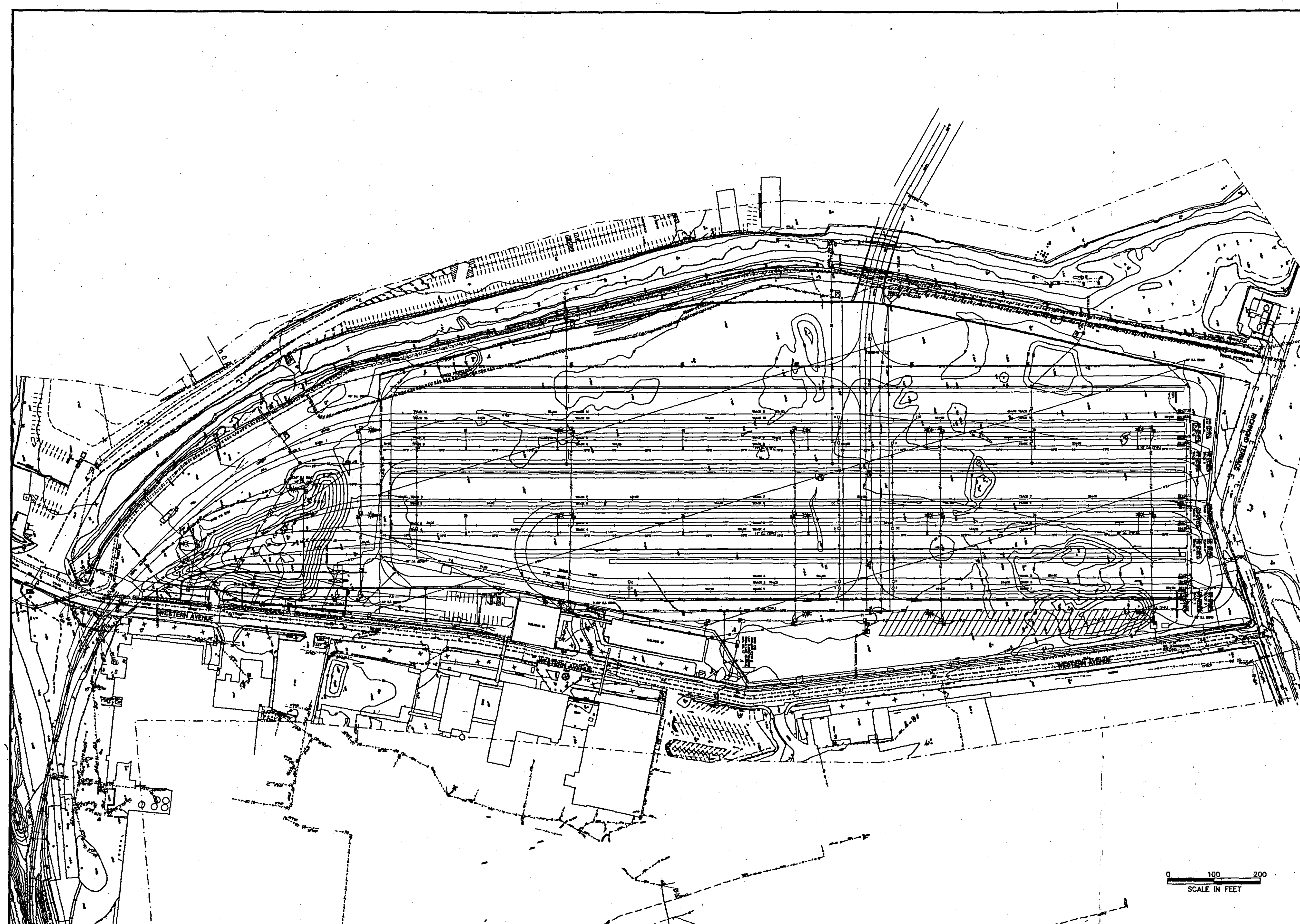
While heavily industrialized, northwest Staten Island is home to one of the area's most extensive wetland systems. Known as the Harbor Herons Complex, this system contains nearly 30 percent of the entire colonial waterbird breeding population along the Long Island-New York City shoreline, and is the single most important rookery for these birds in New York State.

Based on a meeting with the New York State Department of Environmental Conservation (DEC) on June 10, 2003 regarding wetland permits, the Port Authority learned that a habitat assessment must be conducted for the proposed project. Specific issues raised by the DEC include light and noise impacts on wildlife and fish species in and adjacent to Bridge Creek and other habitats. Maguire Group was asked to conduct a habitat assessment that would include documentation of avian, mammalian, herpetofaunal and fish species and their respective habitats within the site, along with an impact analysis for those species. For the assessment, the different habitats, including vegetation composition and special habitat attributes, were to be documented and

Figure 1 – Port Ivory Intermodal Facility Habitat Assessment Location Map



Scale 50,000:1



Sheet of

THE PORT AUTHORITY OF NY & NJ

DMJM HARRIS
AN AECOM COMPANY

Maguire Group Inc.
Architects/Engineers/Planners

ORIGINAL SEALED AND SIGNED BY

N.Y. Professional Engineer #

No.	Date	Revision	Approved

ENGINEERING DEPARTMENT

HOWLAND HOOK MARINE TERMINAL

CIVIL

Title

PORT IVORY INTERMODAL FACILITY PHASE 1A

OVERALL SITE PLAN

JMC	WBH	
Designed by	Drawn by	Checked by

Date

Contract Number HH-234.927

Drawing Number HA-1

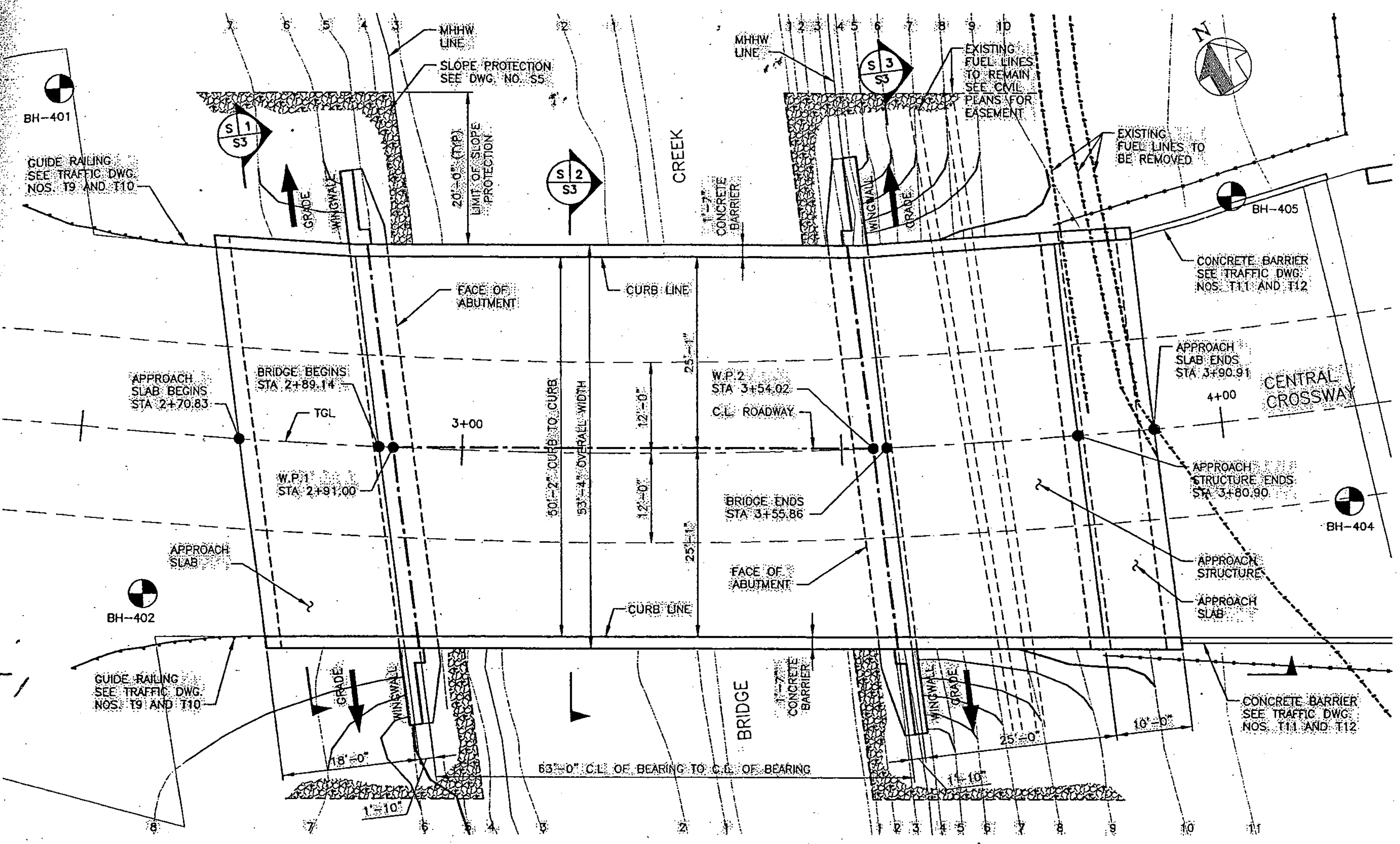
M:\HH\00250005\Civil\MANAGEMENTDOCS\Wetland\Habitat Assessment\C00250005-outfall_11x17.dwg, 04/01/04 09:10:25 AM

NOTES:

1. WORK THIS DWG. WITH DWG. NOS. S3 THROUGH S20.
2. FOR ADDITIONAL HORIZONTAL GEOMETRY, SEE CIVIL PLANS.
3. FOR DETAILS OF CONCRETE BARRIER TRANSITION SEE DWG. NO. S18.
4. FOR GUIDE RAILING DETAILS, SEE TRAFFIC DWG. NOS. T9 AND T10.
5. FOR DETAILS OF GRADING, SEE CIVIL DWGS.
6. FOR BORING INFORMATION, SEE GEOTECHNICAL REPORT.

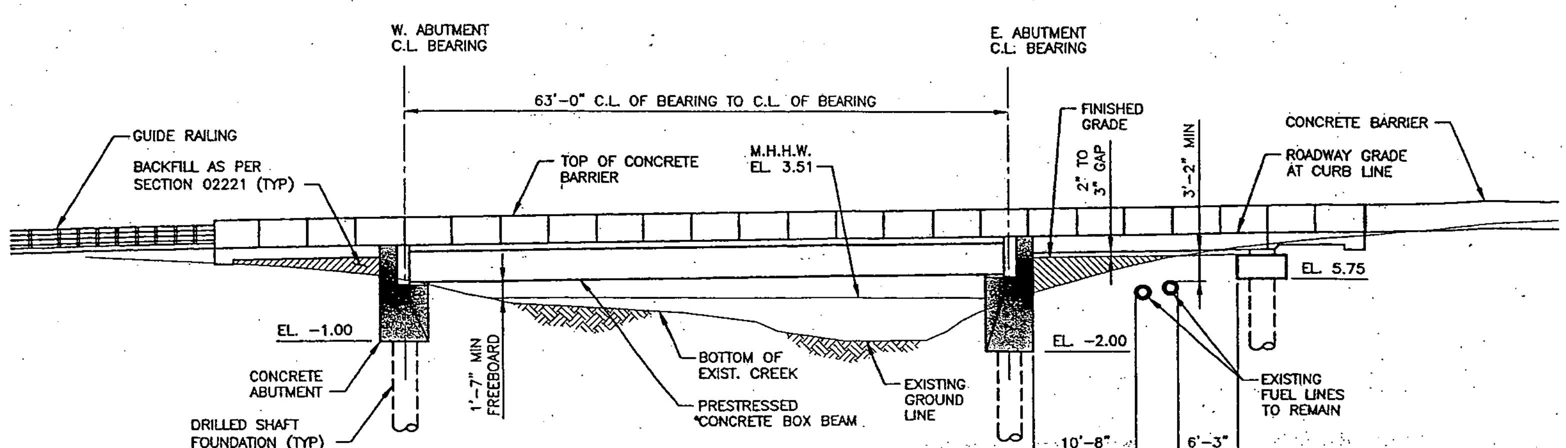
LEGEND

ACTUAL BORING. SEE NOTE 6.



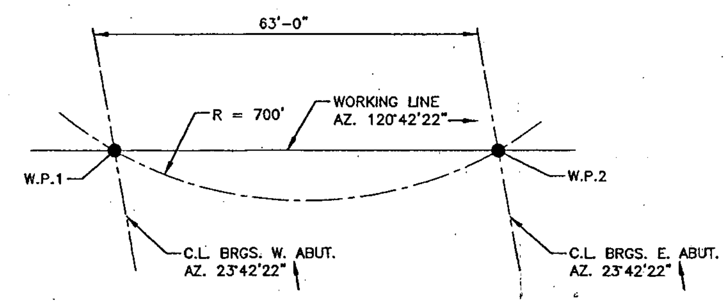
P 1 PLAN

SCALE IN FEET (0, 10, 20)



E 2 ELEVATION

SCALE IN FEET (0, 10, 20)



WORKING POINTS SCHEDULE

W.P.	COORDINATES		STATION
	NORTH	EAST	
1	-6838.38	-39043.94	2+91.00
2	-6870.55	-38989.78	3+54.02

Sheet of

THE PORT AUTHORITY OF NY & NJ

DMJM HARRIS
AN AECOM COMPANY

ORIGINAL SEALED AND SIGNED BY

Chee K. Loi
N.Y. Professional Engineer #071557

100% SUBMISSION
AUGUST 20, 2004

No.	Date	Revision	Approved

ENGINEERING DEPARTMENT

HOWLAND HOOK MARINE TERMINAL

STRUCTURAL

Title

PORT IVORY INTERMODAL FACILITY PHASE 1A

GENERAL PLAN AND ELEVATION

Designed by	Drawn by	Checked by
TC	YC	

Date

Contract Number HH-234.927

Drawing Number S2

Proposed Facility Description

The Port Ivory Intermodal Facility (PIIF) will be a rail-transfer site where containers from the Howland Hook Marine Terminal will be placed on rail cars for distribution. The operation of this facility will occur 24 hours a day, seven days a week.

The site will be **overlain** with a thick bituminous surface, or "tabletop." An extra thick tabletop is required due to the poor bearing capacity of the soils beneath. The tabletop will cover much of the site and consist of multiple layers of material. The tabletop will be tilted toward the western portion of the site (i.e., toward Bridge Creek) to allow for the necessary grading for stormwater collection and profile for the bridge. Bridge Creek is a small tidal creek separating the PIIF site from the Howland Hook Marine Terminal area.

A total of 16 new light posts are planned to be installed on the site, two of which would be **less than or fewer than** 200 feet from Bridge Creek. The light posts would be 120 feet high and support a cluster of lights consisting of nine 1,000-watt, clear MH luminaries on each pole producing 110,000 lumens. The closest lights to the Creek, traveling south to north, are 140 feet, 200 feet, 150 feet, 240 feet, 330 feet, 280 feet, and 220 feet from the edge of the Creek.

A bridge will be located near the middle of the site and connect the PIIF to the existing Howland Hook facility. The bridge must be placed in a location where it can be aligned with an existing roadway at the Howland Hook facility. The bridge structure will have an outside dimension of 59.5 feet, including the travel lanes, shoulders, sidewalk and concrete barriers. The bridge will be super-elevated so water sheds to the north. To meet the surface elevation at Howland Hook, the bridge profile must be approximately one foot higher at the Howland Hook side of the Creek.

Rail tracks will be installed between the container rows on the tabletop. The rail tracks will converge at the southern end of the site, where the trains will exit/enter the site. Eleven rail tracks will extend in a north-south fashion throughout the site.

The stormwater system has been broken down into three separate sub-watersheds. Stormwater would be collected in both grated trenches and standard catch basins, depending on the location within the site. Trench drains will be installed parallel and adjacent to the rail tracks. Catch basins, with 3-foot sumps, will be used to collect stormwater in the peripheral areas of the site. After collection, the stormwater would be conveyed through underground reinforced concrete pipe (RCP) to the outfall structures. Before reaching the outfall structures, however, the stormwater would be treated via an underground treatment structure such as a Vortechnics™ unit, or comparable system. The treatment structure will be fitted with a 10-year storm bypass. This will allow the structure to treat the "first flush," and thereby the majority of pollutants, but pass the major storm flows which typically do not contain high concentrations of pollutants. The outfall structures would consist of a flared-end culvert with wing walls. A riprap splash pad would be installed at the end of the outfall.

Potential Impacts

Although the proposed project is located in an area of Staten Island that has been intensively impacted by industrial development, there are resources within the project area that could be affected by the project. For example, Bridge Creek, the small tidal creek that separates the PIIF site from the Howland Hook Terminal area, acts as the western border, and thus a bridge or other improvements could have impacts.

Potential impacts to the entire area include both direct and indirect impacts. There will be direct impacts to wetlands as a result of the bridge construction and stormwater outfall improvements. One bridge abutment will be slightly within the wetland limits. Indirect impacts would include physical and chemical stormwater impacts, shading of vegetation under the bridge structure, and potentially, light and noise impacts.

Existing Conditions

Methods and Materials

The various wildlife habitats and communities within the site were qualitatively described based on observations and limited sampling made during site visits. During the site visits, the presence or absence of the specific wildlife habitat attributes listed by DeGraaf and Yamasaki (2001) for New England wildlife were noted. Field forms listing these attributes were used in the field as checklists to direct observations of the wildlife habitat during the cursory inspection of the site's wetland habitat types, and to determine if habitat for Special Concern, Threatened, or Endangered species listed by the State of New York or the U.S. Fish and Wildlife Service (i.e., listed species) were likely to be present. A copy of the completed field form is provided in Appendix A.

Visual observations were made from both the shore and within the wetland, where possible. Species heard, seen, or captured during sampling were recorded, whenever identification was possible. Identification was made to the lowest taxonomic classification possible. For vertebrates, this usually resulted in identification to species level. Identification in the field was aided by the use of 10x (10 power) and 16x hand lenses.

Upland habitat areas surrounding the wetlands were also characterized by noting the species of dominant vegetation in each of the major vegetation layers (herb, shrub, herbaceous, liana, moss), and by noting presence of wildlife.

Fieldwork within this resource area was conducted on June 6, 2003. At that time of year, breeding avian species were present and typically still defending territories. Most vegetation was developed enough to identify to the species level.

Habitat Attributes

The habitat attributes of Bridge Creek and its associated tidal wetlands are discussed in this section. The description of these resources is based on existing information and mapping as well as field work at the site.

Site Features

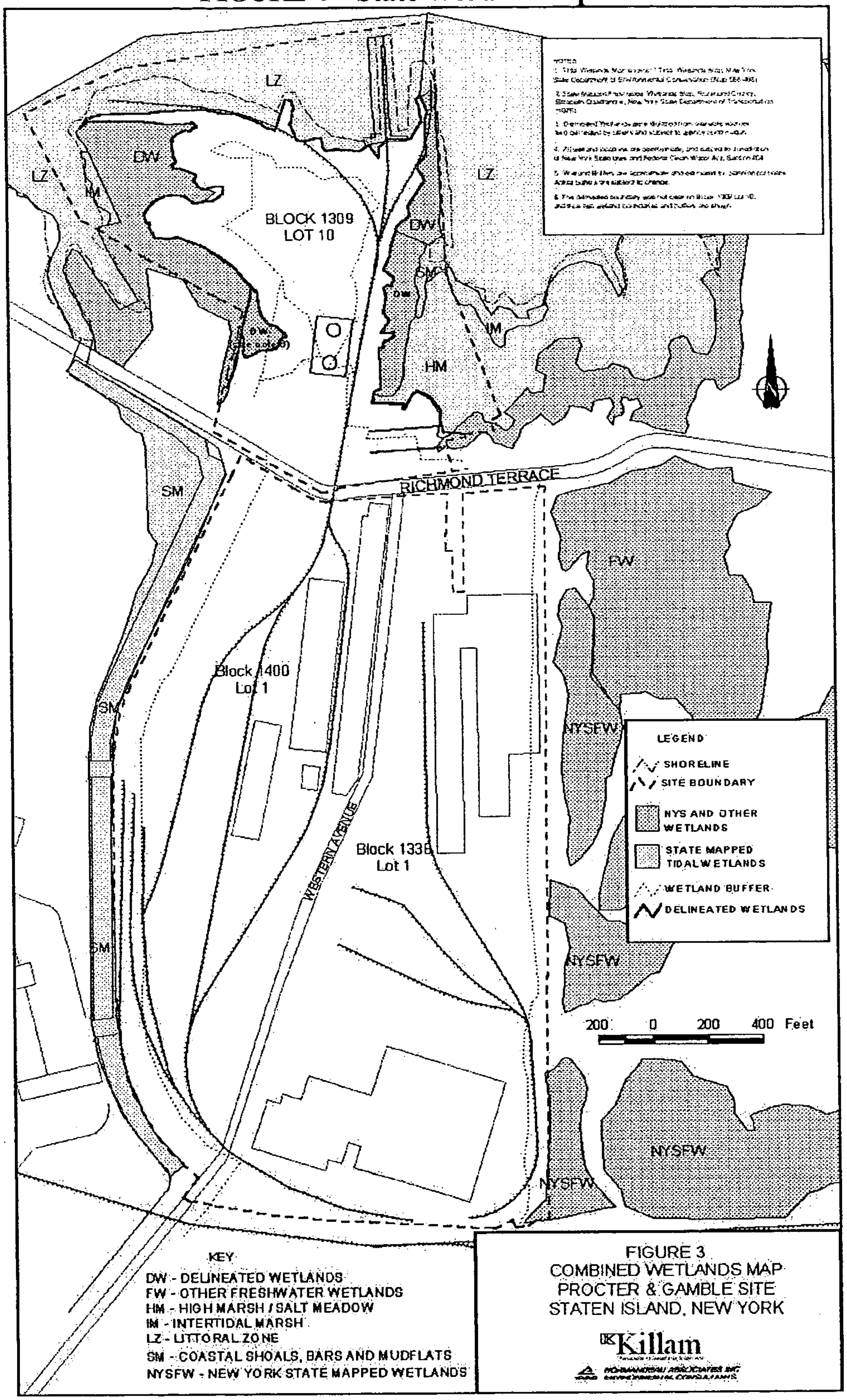
Bridge Creek is a tidal creek connected to the Arthur Kill Channel in the northwest corner of Staten Island. Bridge Creek has been encroached upon by previous development on both the east and west sides. On the west side, where the PIIF is proposed, fill material was placed along the edge of the creek, leaving steep fill banks along the entire creek and wetland system within the project area. In addition to fill material, a stone retaining wall was built at the base of fill areas on the east side of the creek in a number of areas. The wall ranges from 2-to-5 feet in height along its length. On the west side of the creek, the existing Howland Hook Terminal continues to operate with only a small strip of vegetation between the developed portions of the property and the Creek. Portions of the Creek edge contain crushed stone (2"-4" size) apparently for stream protection.

The map presented in Figure 4 on the next page depicts the wetlands on the site, as classified by the State of New York. Bridge Creek is classified as "coastal shoals, bars, and mudflats" (SM). Bridge Creek changes to "littoral zone" (LZ) north of Richmond Terrace. A series of "freshwater wetlands" (FW) is located east of Western Avenue, behind the existing buildings.

Figure 2 depicts the wetlands on the site as delineated by a soil scientist in the field (page 8). There are five outfalls to Bridge Creek from the proposed PIIF site, as shown in Figure 2. Of these five outfalls, three will be used for the proposed PIIF, and the other two will be abandoned in place.

The upland portion of the site has been extensively disturbed. Historically, industrial buildings were erected on the site. Fill material was deposited to the edge of the Creek and structures were built. As part of the PIIF redevelopment project, the majority of structures have been removed, and site has been remediated and regraded. The remaining buildings are located on the eastern side of the site, adjacent to Western Avenue. Fill material is actively being moved and graded to prepare the site for eventual development. The only vegetation located on the site is within the creek corridor, and scattered landscaped vegetation in the vicinity of the remaining buildings.

FIGURE 4 – State Wetland Map



Observed and Expected Wildlife

During a field visit on June 6, 2003, wildlife and vegetation were documented through both passive and active searching. The following text describes the species observed on the site and what additional species are likely to utilize the site, based on the habitat types found there. Comprehensive species lists are attached in Appendix B of this report.

Avian Species

Avian species included both generalist opportunistic species and specialist species. Generalist opportunistic species, such as the European Starling and Rock Pigeon, occur in a multitude of habitats throughout the East Coast and United States and especially thrive in urban or developed landscapes. Other species, such as the Marsh Wren, require specific types of habitat (i.e., herbaceous marsh) and occur only where these habitats are found. According to *The Atlas of Breeding Birds in New York* (Andrle and Carroll, 1988):

> "Habitat destruction has affected local breeding populations throughout New York. Cruickshank (1942) stated that in the New York City Region the Marsh Wren was locally common in reed and cattail beds but indicated that these were being destroyed and this wren becoming rarer. On Staten Island the Marsh Wren formerly nested abundantly in extensive salt marshes but has declined since land filling began about 1950 (Siebenheller, 1981)."

However, with regard to the entire State of New York, Andrle and Carroll (1988) state that the Marsh Wren is fairly common-to-abundant, with no widespread change in abundance. The territories of these birds is often quite small and therefore many birds can be found in suitable habitat. During the field visit, at least three individual March Wrens were noted in different locations. It is suspected that two pairs may have nested in Bridge Creek in 2003 at the PIIF site.

The Black Duck observed on the site appeared to be feeding. No nests were observed; however, based on the habitat type, nesting is likely to occur in the Bridge Creek complex. Other birds that may nest in the project area include the Red-winged Blackbird, Northern Mocking Bird, Gray Catbird, Common Yellow-throat, Song Sparrow, Common Grackle and House Sparrow. These species all tend to nest in either wetland or disturbed habitats.

Other avian species that likely use the site for feeding include the European Starling, Barn Swallow, Rock Pigeon, Mourning Dove, Brown-headed Cowbird and American Goldfinch. Although not observed on the site, it is likely that species such as the Great Blue Heron (*Ardea herodias*), Canada Goose (*Branta canadensis*) and other duck species utilize the site for feeding during various seasons of the year.

Mammals

The only mammal observed on the proposed PIIF site was a muskrat (*Ondatra zibethicus*). This species was observed swimming within Bridge Creek. Due to the high percentage of emergent vegetation, this species likely nests in this wetland system.

Other mammals expected to occur on the site include primarily small mammals. Small mammals, such as the raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), Eastern cottontail (*Sylvilagus floridanus*), woodchuck (*Marmota monax*), house mouse (*Mus musculus*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), Norway rat (*Rattus norvegicus*), and long-tailed weasel (*Mustela frenata*) are expected to occur within the project area. Some of these mammals, such as the raccoon, opossum and gray squirrel, are generalists and are common in urban areas as well as natural landscapes.

Herpetofauna

No herpetofauna were observed on the site during the site visit in June 2003. According to the *New York State Amphibian and Reptile Atlas Project* Website (http://www.dec.state.ny.us/website/dfwmr/wildlife/herp/), there are potentially 26 species that could occur on Staten Island. The majority of these species, however, are associated with fresh water wetlands and relatively undisturbed sites and are not expected to occur on the proposed PIIF site. There are no fresh water wetland or vernal pool habitats located on the site; the majority of amphibians, therefore, would not be expected to occur.

Since no permanent ponded fresh water with suitable habitat exists on the PIIF site, it is unlikely that any of the freshwater turtles exist there. However, the diamondback terrapin (*Malaclemys t. terrapin*) could occur within Bridge Creek. According to Klemens (1993), "This species is tolerant of pollution, thriving in the waters surrounding New York City..." Klemens also states that this species can be found hibernating in depressions at the bottom of tidal creeks, dug into creek banks near the upper tide limit, and beneath undercut banks in the intertidal zone. He further states, "Terrapins inhabit waters polluted by sewage discharge, chemicals, heavy metals, and elevated water temperatures..." The presence of this species on Staten Island was confirmed by the *New York State Amphibian and Reptile Atlas Project.*

Other reptiles which could occur on the site include the Northern brown snake (*Storeria d. dekayi*), Eastern garter snake (*Thamnophis s. sirtalis*) and Eastern milk snake (*Lampropeltis t. triangulum*). All these species are typically found in developed areas with debris and other hiding places. The brown snake feed primarily on slugs, snails, earthworms insects, minnows and small amphibians. The garter snake feeds primarily on earthworms, amphibians, carrion, fish leeches, caterpillars, other insects, small birds, rodents, slugs, mollusks, crayfish and sowbugs. The milk snake feeds primarily on rodents, other snakes, birds, bird's eggs, and slugs (DeGraaf and Yamasaki, 2001).

Invertebrates

The ribbed mussel, common periwinkle and marsh fiddler crab were the only three invertebrates observed on the site, excluding infauna. The ribbed mussel was common within the mud flats and banks of Bridge Creek. Periwinkles were common on rock retaining walls and some vegetation. Marsh fiddler crabs were abundant in the banks of the Creek, where they dug burrows. No sampling was conducted within the Creek or mud flat areas for invertebrates. It is also expected that species such as the common shore shrimp (*Paleamonetes vulgaris*) and mud snail (*Ilyanassa obtusa*) could also occur in this wetland.

Sampling for benthic infauna was not conducted. Based on the impacts to the site and Bridge Creek, however, the benthic infauna community is likely to be dominated by a Stage I community. A Stage I successional benthic community is one in which the community has the attributes of a pioneering seral stage. These attributes include the following (Rhodes and Germano, 1986):

- Species with a high reproductive capacity and short life span are favored;
- There is a high probability for bottom water hypoxia to develop due to a benthoscape which favors the accumulation of labile organic detritus;
- Nutrient recycling is limited to solutes within 0-3 cm depth of bottom sediments; and
- Benthic marine invertebrates are concentrated on or near the sediment surface.

Note: Stage I benthic infauna communities are typically dominated by opportunistic deposit-feeding polychaetes, many of which exhibit a high pollution tolerance.

Llaso et al.,(2002) found salinity to be a major factor influencing the community assemblage of benthic infauna. The salinity within the adjacent Newark Bay area, of which the site is hydrologically connected, is reported to range from 14.1 to 28.1 parts per thousand (%) (USACE, no date). Therefore, the bottom salinity of Bridge Creek most likely lies within a similar high mesohaline-to-polyhaline range salinity regime. Following the habitat classification system defined in the Mid-Atlantic Integrated Assessment (MAIA) Program of the USEPA, high mesohaline systems have a salinity range of 12-18%, while polyhaline systems have a bottom salinity of 18-27%. Based on the community assemblages at various reference sites within the eco-region with similar salinity values and predominantly silt substrates, the numerically abundant benthic infauna are likely to be the annelid polychaetes *Mediomastus ambiseta, Paraprionospio pinnata, Streblospio benedicti,* and *Neanthes succinea* or their sympatric cohorts, and various marine Oligocheates and Nemertines (Llanso et al., 2002).

Fisheries Resources

Staten Island lies within a distinct faunal region in which the finfish community is composed of both cold temperate and warm temperate contingents. This faunal region extends from Cape Cod, south to the entrance of Chesapeake Bay (Robins and Ray 1986). The finfish community of the eco-region is composed of species that represent numerous taxonomic families and various feeding guilds. Representative species of these marine finfish families and guilds would be expected to use Bridge Creek as preferred habitat for feeding, spawning, as cover during various developmental stages, or for a combination thereof.

Information regarding the likely finfish species expected to occur within the tidal creeks of the faunal region, inclusive of Staten Island, was compiled based on various nearshore and inshore seine studies conducted within the Mid-Atlantic Bight. The Mid-Atlantic Bight is a portion of the faunal region that is inclusive of the project area. The various species identified in these studies were then cross-referenced with the documented occurrence and status of those species reported from the marine waters of New York (Briggs and Waldman, 2002), to ascertain their likelihood of occurrence within Bridge Creek. In this way, existing literature was used to characterize the tidal creek fish community. No field sampling of finfish resources was conducted on site.

A review of the literature revealed that the most abundant fish reported from tidal creeks and inshore waters within the Mid-Atlantic Bight tended to be are either lower trophic level fish, or the larvae or young of year (YOY) juveniles of higher trophic level fish. Lower trophic level fish are commonly referred to as "bait fish" by local anglers, or as "forage fish" by researchers. These fish are typically detritivores, herbivores or planktivores. The populations of larval or juvenile higher trophic level fish found in tidal creeks are typically important to the recruitment of adult populations that in turn sustain commercial and recreational stocks. Trends in biomass, abundance, species richness and diversity identified from the literature are discussed below.

- **Total Annual Biomass and Abundance**

Tidal creeks have been shown to contain the highest density of fish among various shallow water habitats in the Northeast (Sogard and Able 1991). The total abundance and biomass of the tidal creek ichthyofaunal community vary seasonally (Rountree and Able, 1992). Annual total biomass typically exhibits a bimodal distribution with peaks occurring first in the spring with the return of spawning adult fish; first, anadromous species, then estuarine residents. A second peak in annual biomass and abundance may occur again in late summer/early fall, with the arrival of migratory predators and before the onset of emigration of YOY fish out of the creek.

- **Species Richness and Diversity**

Species richness varies among tidal creeks, and is a function of drainage size, the productivity of the fringing marsh, the availability of microhabitats, water quality, etc. For instance, "river herring" (*Alosa* spp.) are typically absent from drainages that are lacking a freshwater tidal component (Able and Fahay, 1998). Species richness in estuarine environments is typically lowest during the months of coldest water temperatures, as many fish seek deeper, warmer waters, many times farther offshore. Spring is a time of increasing species richness as both migratory species and spawning estuarine resident species return to the tidal creeks with increasing water temperature. Those creeks with a tidal freshwater component upstream may support runs of *Alosid* species (Able and Fahay, 1998) or other anadromous fish further increasing the species richness of the creek's fauna. Species richness typically peaks when seasonal water temperatures are greatest.

❖ **Community Composition**

Within the estuaries of the central Mid-Atlantic Bight, the ichthyofaunal community is typically comprised of representatives from the families Clupeidae (herrings), Fundulidae and Cyprinodontidae (killifishes), Sciaenidae (drums), and Scophthalmidae and Paralichthyidae (left-eyed flatfishes) (Able and Fahay, 1998). From the analysis of their results of seine and weir sampling in a southern New Jersey tidal marsh, Roundtree and Able (1992) identified distinct seasonal faunal assemblages. Atlantic silverside (*Menidia menidia*), mummichog (*Fundulus heteroclitus*), and the common shore shrimp (*Palaemontes vulgaris*) were numerically dominant catches in both weirs and seines during spring, summer, and fall, while the seven-spine shrimp (*Crangon septemspinosa*), was dominant in all seasons except within fall weir samples. The bay anchovy (*Anchoa mitchilli*) was also frequently caught during all seasons within weir samples, but was not numerically important in seine samples collected during any season.

Aside from those aforementioned species, the faunal composition of spring samples obtained by Rountree and Able (1992) differed from that of summer and fall. Clupeids such as the blueback herring (*Alosa aestivalis*) and Atlantic herring (*Clupea harengus*) were prevelant in the spring, as were the three-spine stickleback (*Gasterosteus aculeatus*), YOY pollock (*Pollachius virens*), and spotted hake (*Urophycis regia*). In summer, catches were domintated by YOY bluefish *(Pomatomus saltatrix)*, summer flounder *(Paralichthys dentatus)*, Atlantic needlefish (*Stronglyura marina*), and white mullet (*Mugil curema*). The dominance of these latter YOY species illustrates the importance of the tidal creek as a finfish nursery. Fall catches revealed a declining abundance of summer species and higher abundance of YOY forage fish such as bay anchovy, mummichog, striped killifish (*Fundulus majalis*), and inland silverside (*Menidia beryllina*). The seasonal patterns in faunal abundance reported by Rountree and Able (1992) were similar to those reported for a New England tidal embayment (Nixon and Oviatt, 1973), and Sogard and Able (1991) reported the fish fauna of their southern New Jersey study site to be similar to those found in New York study sites. In addition, a bimodal distribution of total abundance with peaks occurring first in the spring and then again in summer was reported for two tidal creeks in Virginia (Smith et al., 1984).

The study conducted by Rountree and Able (2002) illustrates the typical community assemblage and seasonal changes exhibited by tidal creek ichthyofauna. However even within the eco-region, local geographic variations can affect fish assemblages. Duffy-Anderson et al.,(2003) found that the most abundant fish species (i.e., those species comprising ≥90% of all captures) collected from fish traps within the Arthur Kill Channel were the silver perch (*Bairdiella chrysoura*), naked goby (*Gobiosoma bosc*), and mummichog (*Fundulus heteroclitus*). However within the adjacent and hydrologically connected Kill Van Kull Channel, six species comprised ≥90% of the total fish collected from benthic traps set in the same habitat types (i.e., pile fields, wrecks and open water). They included winter flounder (*Psuedopleuronectes americanus*), naked goby (*Gobiosoma bosc*), Atlantic silverside, Atlantic tomcod (*Microgadus tomcod*), northern pipefish (*Syngnathus fuscus*), and striped bass (*Morone saxatilis*). Interannual variations in species abundances have also been noted within these waterways (Duffy-Anderson et al., 2003).

Tidal Creek Issues

The existing literature provides sufficient information to predict the general species composition of a typical tidal creek within the site's eco-region. However seasonal fluctuations in finfish populations can impact local annual abundances and distribution of many fish, and some species may be absent from certain waterways despite a hydrologic connection. Human impact directly to the waterway and terrestrial watersheds may also affect the distribution of fish and local community assemblages. Any on-shore activity that disturbs or alters the watershed around the harbor (e.g., land clearing, urbanization, stream relocation, etc.) has the potential to impact fish habitat directly (e.g., via pollutant or sediment inputs) or indirectly by altering watershed processes that affect tributary streams, salt marsh wetlands, shorelines and estuaries. This is typically the case as these alterations tend to be of such magnitude, scale, or duration as to surpass those produced by natural disturbances, or they exceed limits of the natural recovery processes in which the ichthyofauna have adapted.

Activities that may impact the fisheries of tidal creeks and the estuarine environment include those projects, actions or activities that may:

- Alter sediment inputs to the estuary.
- Alter water flows, quantities, cycling, physical or chemical characteristics.
- Impact soil through compaction, or other changes in permeability.
- Alter riparian, or estuarine vegetation.
- Reduce or alter the stability of coastal landforms.
- Alter estuarine wetlands and wetlands along tributary waters.
- Alter predator species' richness and abundance.
- Alter the amount or types of nutrients or prey.
- Alter estuarine or marine habitat (including water quality, vegetation, structure, or conveyances).
- Introduce or transfer exotic organisms and disease.
- Disturb nursery or spawning areas.
- Create a barrier or hazard to fish migration.
- Discharge pollutants, nutrients or contaminants.

Due to the extent of urbanization that has occurred within the watershed of Bridge Creek, the Creek and adjacent upland habitat have already suffered from many of these habitat-altering activities. Evidence of channelization along Bridge Creek is apparent in the steep, linear banks that exist along much of its length. Filling has occurred in many places, most likely initially as historical grading activities during urbanization, and then later through continued refuse disposal. Historical filling, grading, and development of the creek's watershed have likely removed much of the former high marsh habitat that occurred adjacent to Bridge Creek. The high marsh habitat is an important spring and summer spawning and nursery area for resident salt marsh fish (Talbot and Able, 1984). Predators such as juvenile bluefish tend to avoid this area despite occurring in many other inshore habitats (Fahay, 1999). Tidal creek fish suffer higher predation rates in erosional or high-energy areas of the creek as opposed to depositional or lower energy areas such as the high marsh surface (McIvor and Odum, 1988). Therefore, the loss of the high marsh habitat and creation of steep banks along segments of the Creek through historical filling, has likely resulted in the loss of optimal microhabitat for tidal creek fish.

The tidal flow regime of Bridge Creek has also most likely been altered due to the filling of the adjacent high marsh, channelization of the Creek, and the installation of structures within the channel. A box culvert lies along Bridge Creek separating the channelized segment adjacent to the site from freshwater marshes upstream (i.e., east of Western Avenue). The extent that this culvert has altered the historical flow of the Creek was not determined, nor could it be determined if this culvert presented a physical barrier to fish movement to upstream wetlands.

The water quality of the Creek has also suffered from pollutant loading. Various exogenous chemicals have historically been or currently are released through controlled loss, leakage, seepage, spills or deliberate disposal (either permitted or unpermitted), related to industrial, railway, shipping and roadway activities within the Kill Van Kull, its watershed and adjacent waterways in the New York-New Jersey area (BOS 1992a, 1992b; Hydroqual, Inc. 1993; Long et al., 1995). Many of these compounds are ubiquitous in sediments of multi-use estuaries. At elevated concentrations, exposure of fish to these chemicals in the water column or sediment matrices can cause various acute and chronic toxicological effects to fish and shellfish (Sinderman, 1979; Malins et al., 1988; Johnson et al., 1992). [Refer to Sinderman (1979) for a comprehensive review of pollution associated diseases and abnormalities.] Despite the impact to water quality from past abuses, many marine finfish including federally managed species such as the winter flounder, summer flounder, black sea bass (*Centropristus striata*), and bluefish still use these waterways. For instance, Duffy-Anderson et al.,(2003) found winter flounder to comprise 20% of the total number of captures within benthic traps set in the inshore environment within the Arthur Kill and Kill Van Kull channels.

In conclusion, tidal marsh creeks such as Bridge Creek typically serve as important nursery habitat for a variety of fish species. These nursery areas are sought out by larval and juvenile life stages of the estuarine-dependent fish, since the estuaries not only tend to provide relative safety or protection from predators, they also supply an abundant food source (through detrital food chains) with reduced competition at critical trophic levels (Day *et al.*, 1989). Therefore, they are the preferred habitat of many resident estuarine fish, which may numerically dominate the creek fauna.

Table 1 provides a list of typical estuarine fish, their state status, temporal patterns, and life stages typically encountered within estuaries associated with the Hudson River drainage.

Table 1. State Status, Temporal Patterns, and Life Stages of Fish Species Found in NY Estuaries Associated with the Hudson River Drainage

Name	NY Status[1]	Temporal Pattern[2]	Life Stage(s)[2]
Atlantic silverside	Abundant	Transient (seasonal resident)	E, L, J
Atlantic tomcod	Locally common	Resident (migrating spawner)	E, L, J
Bay anchovy	Abundant in all bays	Transient (seasonal resident)	E, L, J
Bluefish	Abundant	Tansient (distant spawner)	E, L, J
Hogchocker	Common in low salinity areas of bays	Resident (migrating spawner)	E, L, J
Mummichog	Abundant	Resident (summer spawner)	E, L, J
Naked goby	Common – routinely found in all bays	Resident (summer spawner)	J
Northern pipefish	Abundant	Transient (seasonal resident)	L, J
Oyster toadfish	Abundant in all bays	Resident (summer spawner)	E, L, J
Silver perch	*Sometimes common*	Transient (seasonal resident)	L, J
Striped bass	Common	Transient (anadromous)	E, L, J
Summer flounder	Abundant from spring to fall	Transient (early user)	E, L, J
Weakfish	Common, but subject to large fluctuations	Transient (facultative estuarine user or seasonal resident)	E, L, J
Winter flounder	abundant	Resident (winter spawner)	E, L, J

Legend: E = Eggs L = Larvae J =Juveniles
[1] Briggs and Waldman (2002)
[2] Able and Fahay (1998)

In the Bridge Creek system (i.e., the tidal creek, adjacent wetlands and estuary) resident species are likely to be those species that are ubiquitous in their occurrences throughout much of their range, most likely as a result of their adaptability to a wide range of environmental conditions. Typically, these species are adapted to survive in a dynamic environment subject to frequent environmental fluctuations, and some species exhibit a high pollution tolerance. Species expected to commonly occur in Bridge Creek include: the Atlantic silverside, mummichog, bay anchovy, the oyster toadfish (*Opsanus tau*), YOY winter flounder, and hogchocker (*Trinectes maculates*) (Able and Fahay, 1998). These fish and abundant invertebrates such as benthic polychaetes, the common shore shrimp (*Palaemontes vulgaris*) or the sand shrimp (*Crangon septemspinosa*), and the blue crab (*Callinectes sapidus*), provide important forage for predatory species known to frequent the area such as summer flounder (Packer et al., 1999), bluefish, striped bass, and weakfish (Bowman et al., 2000). These predatory species of regional economic importance (Mackenzie 1992; Duffy-Anderson et al., 2003) are known to ascend tidal creeks in search of their prey.

Proposed Action and Habitat Avoidance/Minimization Measures

The proposed design of the bridge structure reflects a consideration of the tidal creek environment, including potential fisheries. The large, single-span structure allows for placement of the bridge piers at a location outside of the channel and above the mean high water elevation, with the exception of one small area. This design consideration avoids degradation of the wetland adjacent to the creek, avoids constricting the channel, and avoids impeding the tidal flow to and from upstream channel segments.

In addition to these design considerations, the following avoidance, minimization, and mitigation measures should be undertaken within the project area during construction to avoid or minimize impact to fish habitat in those locations:

- The bridge and associated site development should be constructed following best management practices and any specified permit conditions in order to avoid generating excessive amounts of sedimentation that may cause irreversible impact to marine resources during construction activities.
- No construction activity should occur from within the limits of the Bridge Creek channel.
- Efforts should be made to re-establish cover of any exposed bank areas as soon as possible following construction of the bridge piers.
- No oil, hazardous, or other regulated materials (e.g., paints, fuels, cleaners, etc.) associated with construction activity should be stored or handled within close proximity to the Creek.
- Refueling of construction vehicles should occur at a designated location away from the watercourse and any associated storm drains.
- The applicant should comply with any additional permit conditions specified for the proper removal and disposal of surplus excavated material, in accordance with state law.

These avoidance and minimization techniques would ensure that the impact to tidal creek finfish from the proposed action would be negligible.

Impacts and Minimization

Species Impacts

Construction of the PIIF would require the installation of concrete and pavement over much of the site. Rail lines and access roads would be installed in this paved area. Since the site is currently devoid of vegetation, and since the historical use of the site has been industrial, the redevelopment of the site would not have any negative impacts to land-based wildlife species.

Creek Impacts

The proposed project would have minor direct impacts to Bridge Creek. The reconstruction of four existing substandard stormwater outfalls along Bridge Creek would require excavation of headwalls and pipe waterside of the high tide line. The construction of the proposed bridge would also require placement of one pier partially within the high tide line; however, the area is a narrow sliver parallel to the Creek. The direct impacts to the Creek resulting from outfall improvements would be minor and temporary. Access to the outfalls would be from the upland portion of the site, minimizing construction impacts. The old outfalls would be removed using an excavator. New outfalls would be constructed, likely behind a sheet pile structure so that work could be done in the dry. Best management practices would be incorporated into the construction plans to assure minimization of erosion and sedimentation and disturbance of existing habitat. Once the new outfalls were built, the sheet piling would be removed and all disturbed areas would be regraded and planted with the appropriate vegetation to provide erosion control and to re-establish the impacted habitat.

Wetland Impacts

Specific mitigation plans will be developed as part of the federal and state permits. As a result, there would be no long-term negative impacts to the wetland resources as a result of the direct temporary and permanent wetland impacts.

Impact of Lighting and Lights

The installation of lights in and around the proposed PIIF would increase the amount of light reaching Bridge Creek. Shields should be considered for installation on the seven lights closest to the Creek; however, it is unclear at this time whether this would possible due to safety concerns. The average foot-candle (fc) measurement at the Creek edge (based on a light analysis model) was 0.8 fc, with a maximum of 2.6 fc and minimum of 0.3 fc. This is an average based on all 16 lights being on. The calculation was done in this way because light intensity is cumulative. For purposes of comparison, Table 2 presents illumination standards set by the IESNA Lighting Handbook, 9th Edition, for different spaces. As shown in Table 2, the proposed fc measurements at Bridge Creek are well below lighting standards for building space, and very similar to standards for parking areas.

Based on the criteria shown in Table 2 below, the intensity of light reaching Bridge Creek from the proposed light posts on the PIIF site would be well below the minimum requirements for pedestrian areas. Typically, pedestrian areas require less light than most other developed areas such as industrial and commercial sites. Since the light reaching Bridge Creek is almost an order of magnitude less than the lowest criteria value, few negative impacts to wildlife from lighting are expected.

Table 2. Comparison of Foot Candle Standards and Predicted Light Impacts

Standard Luminance Criteria for Pedestrian Areas[1]		Luminance on Bridge Creek from proposed PIIF lights
Commercial areas	107.6 fc	
Intermediate areas	64.56 fc	
Residential areas	21.52 fc	0.3fc to 2.6 fc; avg. 0.8fc
Walkways, bikeways and stairways	53.8 fc	
Pedestrian tunnels	462.68 fc	

[1] *Taken from IESNA Lighting Handbook, 9th Edition, pp 22-11*
Note: fc = foot candles

According to Pereira, *et. al.* (1999), adult winter flounder are less sensitive to light than YOY and juvenile winter flounder. Winter flounder between 6-9 cm tended to be photophilic while flounder ranging from 12-18 cm tended to be photophobic. Larger flounder, ranging from 28-33 cm responded negatively to bright lights but not to lower levels of illumination. Since YOY winter flounder are expected to occur in Bridge Creek, the larger individuals of this age class could be negatively affected by increased light in the Creek. The important factor not described in Pereira *et al.* (1999), however, is what light levels were used for the experiment. Therefore, it is unclear whether the low levels of light resulting at the Creek would be great enough to cause a negative impact.

Shaded Area Impacts

As a result of bridge construction, there will be a shaded area over Bridge Creek. This shaded area will vary, but will typically be at least 53 ft-4 inches in width, the width of the proposed bridge. Since the bridge is relatively wide and not very high above the Creek, portions of the Creek and associated banks would always be shaded, regardless of the sun's angle. We have estimated this area to be approximately 3,142 square feet of Creek (based on MHHW line) and 103 square feet of bank. Within the Creek, it is unlikely that there would be any negative impact to fauna. The Creek is tidal, and therefore mobile species are constantly moving within it. Species that do not find shaded areas suitable would easily relocate to non-shaded areas in other parts of the Creek. However, it is anticipated that most species will not react adversely to shade over the Creek. In fact, some species may take advantage of this area for a safe zone from predators. For example, some fish species may use the shaded area to avoid predators such as the Great Blue Heron.

Noise Impacts

Noise on the site would be increased over existing conditions (i.e., abandoned inactive site). Noise-producing machinery associated with the operation of the proposed PIIF includes:

- Diesel Trains
- Reed Stackers
- Rubber-tired Gantry (RTG)
- Yard Tractors w/trailers

The noise generated by this equipment could potentially impact breeding activities of avian species in Bridge Creek and its adjacent wetland edge. Although noise sources would be more frequent in the vicinity of the bridge, vehicle activity on the site would be less frequent with distance from the bridge. The result would be minor-to-no impacts to wetland habitats upstream and downstream from the bridge due to the lower frequency of vehicle activity and further distance from the Creek. In the vicinity of the bridge, vehicle traffic would be more concentrated, and could therefore have a negative impact on nesting species in wetlands immediately adjacent to the bridge. Considering the bridge would impact a small portion of the overall wetland resources on the site, noise from bridge traffic would not be considered a negative impact on the entire site, only the wetland areas near the bridge. Therefore, it is anticipated that noise may have a negative impact on some fauna individuals, but not all fauna individuals on the site.

Stormwater Impacts

The construction of the proposed PIIF will include an extensive stormwater collection and treatment system. The system will incorporate catch basins with deep sumps and a Vortechnics™ or similar device before each outfall to treat stormwater. All outfalls to the Creek will be reconstructed, since they are currently in disrepair. As a result, the new stormwater system will subject stormwater to a higher level of treatment than currently exists at the site. By utilizing these integrated treatment techniques, all chemical and physical properties of the existing stormwater would be improved. Although pollutant loading may increase, the greatly improved treatment will offset this. Therefore, stormwater discharged to Bridge Creek will be of similar or higher water quality.

The bridge will be wide enough to allow wildlife to pass beneath along the bank of the Creek. As shown on Figure 3, there will be dry land, above the high tide line, between the Creek and the bridge abutment. This will allow upland species, which do not utilize water for movement, to continue using this habitat without adverse impact from the new human activities on the PIIF site. Although the east side of the bridge would require partial installation of an abutment below MHHW, under normal hydrologic conditions, sufficient space would be available for wildlife movement during low tide and up to a point before high tide.

Based on the estimated benthic infauna in Bridge Creek, negative impacts are not anticipated as a result of the proposed PIIF. These fauna are typically very sensitive to sediment and water quality. The estimated assemblages occurring in the Creek are already tolerant of poor sediment and water quality. Since the proposed work at the PIIF is not anticipated to impact either the sediment or water quality of Bridge Creek, these fauna would not be impacted. In fact, it is reasonable to presume that these species could benefit from the project, since stormwater will be subject to increased treatment before discharge to the Creek than under current conditions.

****

Report Glossary

fc	Foot candle measurement
FW	Freshwater Wetlands
IESNA	Illuminating Engineering Society of North America
LZ	Littoral Zone
NOAA	National Oceanic and Atmospheric Administration
MAIA	Mid-Atlantic Integrated Assessment
MHHW	Mean Higher High Water
PIIF	Port Ivory Intermodal Facility
Port Authority	The Port Authority of New York-New Jersey
RCP	Reinforced concrete pipe
RTG	Rubber-tired Gantry
SM	Shoals and Mudflats
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
YOY	Young of year

References and Literature Cited

Able, K.W. and M.P. Fahay, 1998. The first year in the life of estuarine fishes in the Middle Atlantic Bight. Rutgers University Press. New Brunswick, NJ. 342 pp.

Army Corps of Engineers, no date. Draft Essential Fish Habitat Assessment for Maintenance Dredging Red Hook Flats Anchorage, New York Harbor, New York Federal Navigation Project. Prepared By: U.S. Army Corps of Engineers Operations Division – New York District.

Bowman, Ray E. Charles E. Stillwell, William L. Michaels, and Marvin D. Grosslein, 2000. Food of Northwest Atlantic Fishes and Two Common Species of Squid. NOAA Technical Memorandum NMFS-NE-155.

Briggs, Philip T. and John R. Waldman, 2002. Annotated List of Fishes Reported from the Marine Waters of New York. *Northeastern Naturalist* 9(1):47-80.

Day, John W., Charles A.S. Hall, W.M. Kemp and A. Yanez-Arancibia, 1989. Estuarine Ecology. John Wiley & Sons, Inc. New York. 558 pp.

DeGraaf, Richard M., and Mariko Yamasaki, 2001. New England Wildlife: Habitat, Natural History, and Distribution. University Press of New England. Hanover New Hampshire. 482 pp.

Duffy-Anderson, J.T., and J.P. Manderson and K.W. Able, 2003. A characterization of juvenile fish assemblages around man-made structures in the New York-New Jersey Harbor estuary, U.S.A. Bulletin of Marine Science 72(3): 877-889.

Fahay, Michael P., P.L. Berrien, D.L. Johnson and W.W. Morse, 1999. Bluefish, *Pomatomus saltatrix*, Life History and Habitat Characteristics. NOAA Tech. Memorandum NMFS-NE-144. 32 pp.

http://www.dec.state.ny.us/website/dfwmr/wildlife/herp/ (New York State Amphibian and Reptile Atlas Project – 1999)

http://www.dec.state.ny.us/website/dfwmr/heritage/index.htm (New York State Natural Heritage Program)

Hydroqual, Inc. 1993. Status Report on New York Bight Nutrients Modeling. Final New York Bight Restoration Plan, Attachment 1. September 24, 1993.

IESNA Lighting Handbook, 9th Edition, (Illuminating Engineering Society of North America), 2000.

Johnson, L.L., E. Casillas, T.K. Collier, J.E. Stein and U. Varanasi, 1992. "Contaminant Effects on Reproductive Success in Selected Benthic Fish Species." *Marine Environmental Research* 35: 165-170.

Klemens, 1993. Michael W. Klemens, Amphibians and Reptiles of Connecticut and Adjacent Regions. State Geological and Natural History Survey of Connecticut Bulletin No. 112. 1993

Llanso, Roberto J., Lisa C. Scott, Daniel M. Dauer, Jeffrey L. Hyland, and David Russell, 2002. An Estuarine Benthic Index of Biotic Integrity for the Mid-Atlantic Region of the United States. I. Classification of Assemblages and Habitat Definition *Estuaries* 25 (6A) 1219-1230

Long. E.R., D.A. Wolfe, K.J. Scott, G.B. Thursby, E.A. Stern, C. Peven, T. Schwartz, 1995. Magnitude and Extent of Sediment Toxicity in the Hudson Raritan Estuary. NOAA Technical Memorandum NOS ORCA 88. National Status and Trends Program for Marine Environmental Quality.

MacKenzie, Jr., Clyde L. 1992, Fisheries of Raritan Bay. Rutgers University Press. New Brunswick, NJ. 304 pp.

Malins, D.C., B.B. McCain, J.T. Landahl, M.S. Myers, M.M. Krahn, D.W. Brown, S.L. Chan, and W.T. Roubal, 1988. "Neoplasms and other Diseases in Fish in Relation to Toxic Chemicals: An Overview." *Aquatic Toxicology* 11: 43-67.

McIvor, Carole C. and William E. Odum, 1988. Food, predation risk, and microhabitat selection in marsh fish assemblage. *Ecology* 69(5)1341-1351

Nixon, S. W. and C. Oviatt, 1973. Ecology of a New England Salt Marsh. *Ecological Monographs* 43:463-498.

Packer, David B., S.J. Griesbach, P.L. Berrien, C.A. Zetlin, D.L. Johnson and W.W. Morse, 1999. Summer Flounder, *Paralichthys dentatus* Life History and Habitat Characteristics. NOAA Tech. Memo. NMFS-NE-151. 87 p.

Pereira, Jose J., R. Goldberg, J.J. Ziskowski, P.L. Berrien, W.W. Morse and D.L. Johnson, 1999. Winter Flounder, *Pseudopleuronectes americanus*, Life History and Habitat Characteristics. NOAA Tech. Memo NMFS-NE-138. 39 pp.

Rhoads, D.C. and J.D. Germano, 1986. Interpreting long-term changes in benthic community structure: a new protocol. *Hydrobiologia* 142: 291-308.

Robins, C. Richard and G.C. Ray, 1986. A Field Guide to Atlantic Coast Fishes North America. Houghton Mifflin Company, Boston, MA. 354 pp.

Rountree, Rodney A. and Kenneth W. Able, 1992. Fauna of Polyhaline Subtidal Marsh Creeks in Southern New Jersey : Composition, Abundance and Biomass. *Estuaries* 15(2): 171-185

Sinderman, Carl J., 1979. Pollution-Associated Diseases and Abnormalities of Fish and Shellfish: A Review. *Fishery Bulletin* 76 (4): 717-749.

Smith, S. M., J. G. Hoff, S. P. O'Neil, and M.P. Weinstein, 1984. Community and trophic organization of nekton utilizing shallow marsh habitats, York River, Virginia. *Fishery Bulletin* 82:455-467.

Sogard, Susan. M. and Kenneth W. Able, 1991. A Comparison of Eelgrass, Sea Lettuce Macroalgae, and Marsh Creeks as Habitats for Epibenthic Fishes and Decapods. *Estuarine, Coastal and Shelf Science* 33:501-519.

Talbot, Christopher W. and Kenneth Able, 1984. Composition and Distribution of Larval Fishes in New Jersey High Marshes. *Estuaries* 7(4A): 434-443.

Tiner, Ralph W. A Field Guide to Coastal Wetland Plants of the Northeastern United States. University of Massachusetts Press. 1987.

Weiss, Howard M. Ph.D. Marine Animals of Southern New England and New York – Identification keys to common nearshore and shallow water macrofauna. Bulletin 115, State Geological and Natural History Survey of Connecticut. 1995.

APPENDIX A:
HABITAT ATTRIBUTE FIELD FORM

APPENDIX A:
QUALITATIVE HABITAT ASSESSMENT – SPECIAL HABITAT FEATURES CHECKLIST

(DeGraaf and Yamasaki, 2001)[1]

Site Location: Port Ivory	**Site ID No:** Bridge Creek		**Date:** June 6, 2003
Time: 8 hrs	**Investigators:** D. Hageman		**Weather:** Partly cloudy, warm
Major New England Community Type:			**Access Restrictions:** Some areas of chain link fence
Habitat Attribute	**Explanation of Attribute (where applicable)**	√	**Comments:** Tidal creek with limited tidal marsh
Check (√) here if attribute is present →			
FOREST COMPONENTS NONE (Site not forested, although scattered trees do exist)			
Canopy Closure:			
<15%	very open canopy		
15 – 30 %	open canopy		
31 – 70%	intermediate canopy		
>70%	closed canopy		
Perch Types:			
High exposed	supracanopy nesting and exposed hunting sites	√	Potential for large avian species such as osprey and other raptors to occasionally utilize poles as exposed hunting sites; not signif. function
Low exposed	exposed hawking sites low to the ground	√	Abundant; fences, poles, shrubs, wires, etc.
Overstory Inclusions:			
Deciduous	One tree or group of deciduous trees in a coniferous stand		
Coniferous	One tree or group of coniferous trees in a deciduous stand		
Tree Boles:			
Dead ≥6 in dbh – adjacent to water		√	Scattered small trees near creek
Live ≥12 in dbh – adjacent to water			
Live ≥18 in dbh – adjacent to water			

Dead and soft < 6 in dbh – general forest			
Dead and hard, 6 to 12 in dbh – general forest			
Dead and hard, 12 to 18 in dbh – general forest			
Live, columnar decay, 8 to 12 in dbh – general forest			
Live, broken top, 12 to 18 in dbh – general forest			
Live, broken top/large limb, >18 in dbh – general forest			
Live, hollow > 20 to 24 in dbh – general forest			
Midstory Layer:	Woody vegetation 10 to 30 feet in height	√	Saplings, (tree-of-heaven, sycamore, box elder)
Shrub Layer:	Deciduous seedlings, saplings, shrubs 2-10 ft in height		
	Coniferous seedlings, saplings, shrubs 2-10 ft in height		
	Mixed deciduous and coniferous seedlings, saplings, shrubs 2-10 ft in height		
	Ericaceous shrubs 2-10 ft in height		
	Wetland shrubs	√	High tide bush, groundsel tree, elderberry
Ground Cover:	<30 % Upland herbaceous ground cover 0 to 2 ft – sparse		
	30 to 75 % Upland herbaceous ground cover 0 to 2 ft – intermediate	√	Common ragweed, little bluestem, common mullein, seaside goldenrod
	>75% Upland herbaceous ground cover 0 to 2 ft – abundant		
	Wetland vegetation	√	Common reed, smooth cordgrass, salt meadow grass, marsh orach, common glasswort
Duff and Ground Layer:	Forest litter and moss		
	Exposed soil		
	Rocky forest floor		
	Dead and down woody debris – trees, larger limbs and branches		
	Waterside decaying logs – basking sites adjacent to water	√	Stone retaining walls

Subterranean Habitats:			
Boulder fields	Rapid permeability		
Cobbles	Rapid soil permeability		
Sand and Gravel	Rapid soil permeability		
Loams	Moderate soil permeability		
Silts	Slow soil permeability		
Clays	Slow soil permeability		
Mast and Fruit:			
Hard Mast	Nut Bearing Trees		
Soft Mast	Fleshy fruit producing trees/shrubs	√	Elderberry, Virginia creeper
Miscellaneous Features:	Seeps		
	Vernal/autumnal temp. pools		
	Woods roads (unpaved)		
	Slash piles		
	Gravel pits or exposed soil sites	√	Adjacent site entirely exposed soils
	Log landings		
UPLAND NON-FOREST COMPONENTS			
Opening Type:	Lawns, golf courses, etc.		
	Cultivated cropland		
	Fallow Field		
	Pasture		
	Blueberry field		
	Gravel Pit	√	Adjacent site entirely exposed soils
	Log landing		
	Other:		
WETLAND AND AQUATIC COMPONENT			
System:	Palustrine		
	Lacustrine		
	Riverine		
	Estuarine	√	Tidal creek and associated tidal marsh system

	Marine		
Water Depth:			
Open Water	Limnetic zone >6.5 feet (2m)		
Aquatic Bed	Littoral zone <6.5 feet (2m) – w/*Ceratophylum*, *Nuphar*, and *Nymphaea* present		
Emergent Wetland	Littoral zone <6.5 ft (2m) *Typha* or *Scirpus* present		
Scrub-shrub wetland	Littoral zone <1.5 ft (0.5 m)		
Seasonally wet/flooded			
Intermittent drainage		√	Tidal creek
Bottom Composition:	Bedrock		
	Boulder-Cobble		
	Gravel-Sand	√	Small areas of sand bottom in high velocity portions of creek
	Silt-Organic	√	silt, organic detritus
pH:	Low <5.6		
	Moderate 6.9 to 5.6		
	Neutral 7.0		
	Moderately high 7.1 to 8.4		
	High >8.4		
Water Temperature:	32 to 50 °F (0 to 10 °C)		
	51 to 70 °F (11 to 21 °C)		
	71 to 80 °F (22 to 27 °C)		
	>81 °F (> 27 °C)		
Adjacent Riparian Vegetation (Lotic systems)	Aquatic Bed		
	Unconsolidated Shore		
	Emergent Wetland		
	Moss-Lichen wetland		
	Scrub-shrub wetland		
	Forested wetland		
	Upland non-forest		
Other Attributes Not listed:			

Evidence of existing habitat degradation: Bridge Creek has been extensively encroached upon from both sides within the project area. There is no forested land adjacent to the creek and a very narrow vegetated buffer of shrubs and herbaceous vegetation, much of it considered invasive (i.e., phragmites). A large portion of the east side of the creek has a stone retaining wall at the lower bank. The creek receives stormwater from sites on both the east and west sides of the creek. A large amount of garbage and miscellaneous debris was also observed within the creek and tidal wetlands.

[1] DeGraaf, Richard M., and Mariko Yamasaki. 2001. *New England Wildlife: Habitat, Natural History, and Distribution*. University Press of New England. Hanover, New Hampshire. 482pp.

Appendix B: Comprehensive Faunal Species List for Bridge Creek System
Port Ivory Intermodal Facility, Staten Island, New York

Avifauna

Species	Scientific Name	Date	Notes
Black Duck	*Anas rubripes*	6/6/03	♂ and # in wetland
European Starling	*Sturnus vulgaris*	6/6/03	flyovers
Barn Swallow	*Hirundo rustica*	6/6/03	♂ and # feeding
Rock Pigeon	*Columba livia*	6/6/03	roosting; flyovers
Mourning Dove	*Zenaida macroura*	6/6/03	roosting
Northern Mocking Bird	*Mimus polyglottos*	6/6/03	♂ singing; foraging
Gray Catbird	*Dumetella carolinensis*	6/6/03	♂ singing; foraging
Common Yellow-throat	*Geothlypis trichas*	6/6/03	♂ singing; foraging
Marsh Wren	*Cistothorus palustris*	6/6/03	♂ singing; ♂ and # foraging
Song Sparrow	*Melospiza melodia*	6/6/03	♂ and # foraging
Red-Winged Blackbird	*Agelaius phoeniceus*	6/6/03	♂ and # defending territory
Common Grackle	*Quiscalus quiscula*	6/6/03	foraging, flyovers
Brown-headed Cowbird	*Molothrus ater*	6/6/03	♂ and # present, male displaying
House Sparrow	*Passer domesticus*	6/6/03	♂ and # foraging
American Goldfinch	*Carduelis tristis*	6/6/03	♂ singing; flyovers

Mammals

Muskrat	*Ondatra zibethicus*	6/6/03	swimming in creek

Invertebrates

Common Periwinkle	*Littorina littorea*	6/6/03	Common
Ribbed Mussel	*Geukensia demissa*	6/6/03	Common
Marsh Fiddler Crab	*Uca pugnax*	6/6/03	Abundant

Appendix B: Comprehensive Faunal Species List for Bridge Creek System
Port Ivory Intermodal Facility, Staten Island, New York

Avifauna

Species	Scientific Name	Date	Notes
Black Duck	*Anas rubripes*	6/6/03	♂ and # in wetland
European Starling	*Sturnus vulgaris*	6/6/03	flyovers
Barn Swallow	*Hirundo rustica*	6/6/03	♂ and # feeding
Rock Pigeon	*Columba livia*	6/6/03	roosting; flyovers
Mourning Dove	*Zenaida macroura*	6/6/03	roosting
Northern Mocking Bird	*Mimus polyglottos*	6/6/03	♂ singing; foraging
Gray Catbird	*Dumetella carolinensis*	6/6/03	♂ singing; foraging
Common Yellow-throat	*Geothlypis trichas*	6/6/03	♂ singing; foraging
Marsh Wren	*Cistothorus palustris*	6/6/03	♂ singing; ♂ and # foraging
Song Sparrow	*Melospiza melodia*	6/6/03	♂ and # foraging
Red-Winged Blackbird	*Agelaius phoeniceus*	6/6/03	♂ and # defending territory
Common Grackle	*Quiscalus quiscula*	6/6/03	foraging, flyovers
Brown-headed Cowbird	*Molothrus ater*	6/6/03	♂ and # present, male displaying
House Sparrow	*Passer domesticus*	6/6/03	♂ and # foraging
American Goldfinch	*Carduelis tristis*	6/6/03	♂ singing; flyovers

Mammals

Species	Scientific Name	Date	Notes
Muskrat	*Ondatra zibethicus*	6/6/03	swimming in creek

Invertebrates

Species	Scientific Name	Date	Notes
Common Periwinkle	*Littorina littorea*	6/6/03	Common
Ribbed Mussel	*Geukensia demissa*	6/6/03	Common
Marsh Fiddler Crab	*Uca pugnax*	6/6/03	Abundant

Evidence of existing habitat degradation: Bridge Creek has been extensively encroached upon from both sides within the project area. There is no forested land adjacent to the creek and a very narrow vegetated buffer of shrubs and herbaceous vegetation, much of it considered invasive (i.e., phragmites). A large portion of the east side of the creek has a stone retaining wall at the lower bank. The creek receives stormwater from sites on both the east and west sides of the creek. A large amount of garbage and miscellaneous debris was also observed within the creek and tidal wetlands.

[1] DeGraaf, Richard M., and Mariko Yamasaki. 2001. *New England Wildlife: Habitat, Natural History, and Distribution*. University Press of New England. Hanover, New Hampshire. 482pp.