Appendix E



United States Department of the Interior



FISH AND WILDLIFE SERVICE

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February 12, 2018

Mr. Peter Weppler Chief, New York District U.S. Army Corps of Engineers Jacob K. Javits Federal Building 26 Federal Plaza New York, NY 10278-0090

Attn: Diana Kohtio

Dear Mr. Weppler:

The U.S. Fish and Wildlife Service submits the enclosed document entitled, "Final Fish and Wildlife Coordination Act 2b Report for the Spring Creek Ecosystem Restoration Project Spring Creek Park Brooklyn and Queens, NY" for the U.S. Army Corps of Engineers' review.

If you have any questions or require additional information, please contact Kerri Dikun of the Long Island Field Office at 631-286-0485.

Sincerely,

David A. Stilwell Field Supervisor

Enclosure

cc: NYSDEC, Stony Brook, NY (K. Scarlatelli) NOAA, NMFS, Highlands, NJ (K. Greene) USACE, New York, NY (C. Alcoba; D. Kohtio) USFWS, Long Island Field Office, Shirley, NY

Final Fish and Wildlife Coordination Act Report Spring Creek Ecosystem Restoration Project Spring Creek Park Brooklyn and Queens, NY

Prepared For:
U.S. Army Corps of Engineers
New York District
New York, New York

Prepared By:
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February 2018

EXECUTIVE SUMMARY

This is the U.S. Fish and Wildlife Service's (Service) Final Fish and Wildlife Coordination Act (FWCA) Report for the U.S. Army Corps of Engineers' (Corps) proposed project entitled, "Spring Creek Ecosystem Restoration Project Spring Creek Park Brooklyn and Queens, NY."

The Fish and Wildlife Coordination Act (48 Stat 401; U.S.C. 661 et seq.) provides the basic authority for the Service's involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. In this report, the Service evaluates existing fish and wildlife resources within the Study Area of the Corps' proposed Spring Creek Project and affected areas, provides an analysis of project impacts and minimization plans, and provides recommendations to the Corps regarding anticipated impacts and enhancement opportunities.

The Corps is conducting an alternatives analysis for the restoration of fish and wildlife habitat adjacent to Spring Creek, Queens and Kings Counties, New York. The project would involve a combination of invasive species control, low and high marsh restoration, maritime scrub/shrub and forest restoration, tidal creek creation, and improvements to public access and recreational opportunities.

Currently, the habitat in the 47-acres (ac) project area consists of low marsh dominated by saltmarsh cordgrass (*Spartina alterniflora*), mudflats, scattered pockets of high marsh, salt pannes, disturbed uplands supporting exotic herbaceous and woody plant species, and some disturbed wetland areas dominated by common reed (*Phragmites australis*). Open water habitats consist of two tidal creeks: Spring Creek and Ralph's Creek.

The Corps has evaluated eight design alternatives on the basis of cost, benefits to fish and wildlife, bank and sediment stabilization, uniqueness/heritage, and predicted improvements to water quality. They have designated the Optimized Alternative 3C as their Recommended Plan.

The Recommended Plan would include the restoration of 35 ac of habitat, including approximately 7.6 ac of low marsh, 5.4 ac of high marsh, 1.0 ac of scrub-shrub habitat, 2.1 ac of upland, and 19.0 ac of maritime upland. Turtle mounds are not incorporated into this plan, in order to minimize risk of common reed re-establishment. In order to reintroduce sinuosity back into the creek, the Recommended Plan includes channel realignment. Approximately 98,000 cubic yards of material will be excavated from onsite to achieve designed wetland elevation and the material will be distributed to create upland habitat and maritime forest. The Corps will add a layer of growing medium (clean soil) over all the restored areas: a 1.5-feet (ft) layer of growing medium for the maritime forests and upland habitats within Areas B, E, F, and G and a 1-ft layer of growing medium in all other areas.

In general, the Service supports the Corps' effort to restore fish and wildlife habitat. We have provided the Corps with comments on their plan to improve the habitat for fish and emergent wetland-dependent wildlife species within the project area by restoring tidal marsh, maritime grassland, and upland shrub communities that will be beneficial to many fish and wildlife species.

The Service has requested additional information and provided the following recommendations:

- 1) implementation of an invasive species management plan;
- 2) planting plan recommendations;
- 3) incorporation of best management practices;
- 4) coordination with Port Authority of New York and New Jersey regarding the planting plan;
- 5) removal and relocation of the sewer line;
- 6) species specific recommendations for saltmarsh sparrow (Ammodramus caudacutus) and diamondback terrapin (Malaclemys terrapin);
- 7) implementation of the provided contaminant sampling protocol; and
- 8) further development of an adaptive management plan.

In conclusion, although the proposed actions have the potential to negatively impact fish and wildlife resources in the short-term, the project should result in long-term benefits to fish and wildlife resources if contaminant concerns discussed later in this document are properly addressed. The Service has proposed mitigation recommendations that should assist in ameliorating the short-term impacts and has provided additional measures that will enhance the habitat for specific species of conservation concern over the long-term. The Service's Mitigation Policy is currently being revised relative to whether net conservation benefit should be included as a mitigation goal alongside no net loss. At this time, however, the Service's mitigation goal for this habitat is no net loss.

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AUTHORITY, PURPOSE, AND SCOPE

This is the Fish and Wildlife Service's (Service) final Fish and Wildlife Coordination Act (FWCA) Report for the U.S. Army Corps of Engineers' (Corps) proposed study entitled, "Spring Creek Ecosystem Restoration Project Spring Creek Park Brooklyn and Queens, NY" (Spring Creek North). This final report was developed in support of the Service's FWCA responsibilities (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) in reviewing Corps' water resources development projects. Section 2(b) of the FWCA requires that the final report of the Secretary of the Interior: (1) determine the magnitude of the direct, indirect, and cumulative impacts of proposed projects on fish and wildlife resources, and (2) make specific recommendations as to measures that should be taken to conserve those resources. This report constitutes the final report of the Secretary of the Interior as required by section 2(b) of the FWCA Report.

The Spring Creek North project is authorized under the Continuing Authorities Program, section 1135(b) of the Water Resource Development Act (WRDA) of 1986, as amended (33 U.S.C. 2309[a]). The Water Resource Reform and Development Act (WRDA) of 2014(f), further amended section 1135(d) of WRDA 1986 (33 U.S.C. 2309a [d]) increasing the \$5,000,000 maximum federal expenditure to \$10,000,000. Under the Continuing Authorities Program, section 1135(b) of the WRDA of 1986, as amended (33 U.S.C. 2309[a]), the Corps can partner with a non-federal sponsor to modify existing Corps' projects to restore the environment or construct new projects to restore areas where a Corps' project has contributed to environmental degradation.

The purpose of the Spring Creek Ecosystem Restoration Project, as identified by the Corps (2016), is to rectify the adverse impacts associated with the historic dredge and fill activities executed as part of constructing and maintaining the Jamaica Bay navigation channel and address the associated indirect ecosystem degradation within the Spring Creek Study Area (Study Area). The Corps' goal is to contribute to the National Ecosystem Restoration by restoring degraded ecosystem structure, function, and dynamic processes to less degraded and more natural conditions. The Corps aims to accomplish this goal by excavating and recontouring uplands to intertidal elevations, removing invasive plant species, and replanting with native species. The proposed project would restore around 35 acres (ac) of habitat: approximately 13 ac of inter-tidal saltmarsh, and around 22 ac of maritime forest and upland habitats. The Corps generally aims to improve the environmental quality of Spring Creek and saltmarshes as part of the overall Jamaica Bay system.

The FWCA analysis area will coincide with the delineation of the Study Area in order to incorporate the potential impacts (sedimentation, changes to hydrology) from the proposed actions (Figure 1).

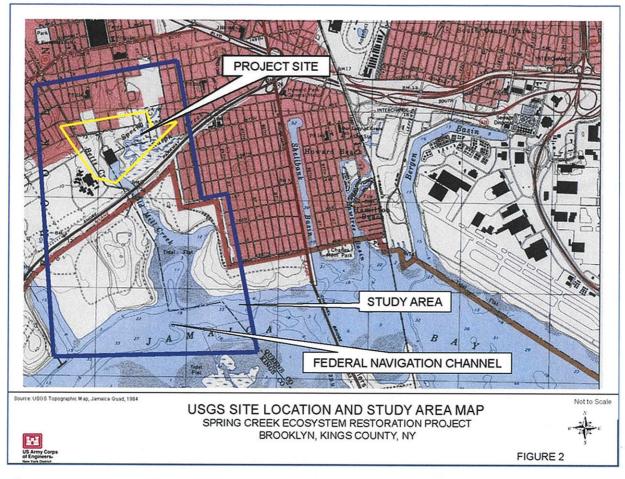


Figure 1. Map showing location of project site and Study Area. From U.S. Army Corps of Engineers (2016a).

The scope of temporal effects will be both temporary and long-term, occurring during the projected 12 months of construction and extending into the future as a result of the proposed habitat modifications.

The non-federal sponsor is New York City Department of Parks and Recreation (NYCDPR).

PRIOR AND ON-GOING STUDIES AND REPORTS RELEVANT TO THE STUDY

Federal Studies and Reports

• Hudson Raritan Estuary Project, Ecosystem Restoration Feasibility Study: The Hudson Raritan Estuary (HRE) is within the boundaries of the Port District of New York and New Jersey, and is situated within a 25-miles (mi) radius of the Statue of Liberty National Monument. The HRE Study Area includes 8 Planning Regions: 1) Jamaica Bay; 2) Lower Bay; 3) Lower Raritan River; 4) Arthur Kill/Kill Van Kull; 5) Newark Bay, Hackensack River and Passaic River; 6) Lower Hudson River; 7) Harlem River, East River, and Western Long Island Sound; and 8) Upper Bay. The study purpose is to

identify the water resources problems, existing conditions and factors contributing to environmental degradation within the estuary in order to develop potential solutions aimed at ecosystem restoration, while building upon existing restoration efforts and management plans. The study developed a Comprehensive Restoration Plan (CRP) that serves as a master plan and blueprint for future restoration in the HRE region. The CRP provides the framework for an estuary-wide ecological restoration program by utilizing restoration targets - Target Ecosystem Characteristics (TECs) developed by the region's stakeholders. The CRP Program goal is to develop a mosaic of habitats that provide society with renewed and increased benefits from the estuarine environment. Each TEC is an important ecosystem property or feature that is of ecological and/or societal value. including restoration of coastal wetlands, shellfish/oyster reefs, eelgrass beds, water bird islands, public access, maritime forest, tributary connections, shorelines and shallow habitat, fish crab and lobster habitat; reduction of contaminated sediments; and improvement of enclosed and confined waters. The CRP provides a strategic plan to achieve the TEC goals, identify potential restoration opportunities, and mechanisms for implementation. Status: Planning/Design. Primary Funder: Corps.

- Spring Creek South: This is a phased Federal Emergency Management Agency-Hazard Mitigation Grant Program (FEMA-HMGP) project to reduce future disaster damages and manage coastal storm risks for the Howard Beach community. The New York State Department of Environmental Conservation (NYSDEC) is managing the project and has hired the Corps as the project engineer, and is working with other New York State and New York City (NYC) agencies, as well as Port Authority of New York and New Jersey (PANYNJ). The majority of the project will be on National Park Service (NPS) land (requiring NPS permits) and some of the project is in Howard Beach. Status: Planning/Design. Primary Funder: FEMA.
- Jamaica Bay Federal Navigation Channel: The existing project provides for an entrance channel 20 feet (ft) deep at mean low water, 1,000 ft wide, about 1.7 mi long, and connecting two interior channels with deep water in the Atlantic Ocean, of suitable hydraulic dimensions to maintain the present tidal prism in the bay. The channel extends from Rockaway Inlet into Jamaica Bay. Dredge material placement occurs along the Rockaway Peninsula. In Fiscal Year (FY) 2016, funding of \$251,000 was provided for engineering and design for the next maintenance dredging cycle. Status: On-going. Primary Funder: Corps.
- Jamaica Bay, Marine Beach, and Plumb Beach Ecosystem Restoration Feasibility Study: Feasibility study to determine the feasibility of improvements for beach erosion control, hurricane protection and environmental improvements in Jamaica Bay. The study is essentially a large-scale ecosystem restoration study, recommending alternatives on seven sites within Jamaica Bay (Brant Point, Spring Creek, Bayswater Park, Dubos Point, Hawtree Point, Fresh Creek, and Dead Horse Bay). Status: Planning/Design. Primary Funder: Corps.

Jamaica Bay Marsh Island Restoration: Between 2006-2014, under the Corps'
Continuing Authorities Program (CAP), the Corps, in partnership with the PANYNJ, the
NYSDEC, the New York City Department of Environmental Protection (NYCDEP), and
the NPS, restored marshes at Elders Point East and West, Yellow Bar Hassock, Black
Wall, and Rulers Bar as a result of the beneficial use of dredged material from the Corps'
Harbor Deepening Project.

Summary of Marsh Island Wetland Acres Restored

The marsh island restoration efforts are being monitored by a project team that is providing valuable data on the cause of problems and assisting to identify optimum effective future restoration options. This program also has significant implications for the future success of restoration activities from beneficially using sand from the Corps' Operations and Maintenance (O&M) Program. Refer to the Corps' website for more information: http://www.nan.usace.army.mil/Missions/Civil-Works/Projects-in-New-York/Elders-Point-Jamaica-Bay-Salt-Marsh-Islands. Status: On-going. Primary Funder: Corps.

- Sunset Cove's Saltmarsh and Upland Habitat: One of U.S. Department of the Interior's (USDOI) Sandy Coastal Resiliency grants administered by the National Fish and Wildlife Foundation (NFWF). The NYCDPR will restore 3 ac of saltmarsh and 7 ac of upland habitat on Sunset Cove, a 12-ac parcel located on a former abandoned and derelict marina in Broad Channel, Queens. Nearly the entire island of Broad Channel was flooded during Hurricane Sandy, with inundation ranging from 3 to 10 feet. The restored saltmarsh will connect to adjacent wetland complexes within Jamaica Bay. The existing hardened shoreline will be rehabilitated and enhanced to improve water quality and provide oyster and shellfish habitat. Public access amenities such as walking trails will be installed. Under-served communities will also have opportunities for increased passive recreation, education, engagement, and empowerment. Overall, the project will restore a vital ecosystem and protect Broad Channel and the larger Jamaica Bay human and ecological community. Status: Planning/Design. Primary Funder: USDOI.
- Jamaica Bay Self-Sustaining Oyster Population: One of the USDOI's Sandy Coastal Resiliency grants administered by NFWF. The NYCDEP will develop several donor and receiver oyster beds across half an acre in the northeastern end of Jamaica Bay at the

Head of Bay. Models from previous studies showed that the location site has ideal conditions that will promote oyster growth, recruitment, and larvae retention potential. Previous oyster restoration efforts focused on smaller-scale projects, whereas this project will evaluate mid-scale recruitment and growth on an ecological habitat scale. Successful establishment of a self-sustaining oyster population could create an oyster larvae source for Jamaica Bay and beyond, thus, benefitting the Hudson Raritan Estuary, and fulfilling goals set in the Comprehensive Restoration Plan for oyster restoration. The oysters would increase substrate complexity and promote habitat use by diverse communities of fish and other aquatic organisms. In addition to filtering the water, the design of the constructed oyster bed structure would provide storm attenuation services and protection to the adjacent shoreline from erosion and future coastal storm surges. Status: Planning/Design. Primary Funder: USDOI.

- West Pond Breach Repair: This project would repair storm damage due to a breach that occurred at the West Pond of the Jamaica Bay Wildlife Refuge at Gateway National Recreation Area (NRA), and make the West Pond embankment and loop trail resilient to coastal storms and flooding and protect environmentally sensitive conditions along the trail that support a diversity of Jamaica Bay habitat, wildlife, and enhanced visitor experience. In February 2016, the NPS selected the preferred alternative (Alternative B) and issued a Findings of No Significant Impact (FONSI) document. Status: Preconstruction. Primary Funder: USDOI.
- Fresh Creek Coastal Protection: This NY Rising project would fund flood protection measures to capture storm surge and rising waters at the most vulnerable areas along Fresh Creek in Canarsie, Brooklyn. The target area is along Fresh Creek and East (108 Street, between Avenues J and N). The New York State Governor's Office of Storm Recovery (NYSGOSR) was working with NYC agencies in early 2016 to define the scope of the project, and to begin design thereafter which may take 6-9 months. Status: Planning/Design. Primary Funder: U.S. Housing and Urban Development (HUD).
- Howard Beach Comprehensive Coastal Protection Study: This project will study the cost
 and feasibility of tide gates at Shellbank and Hawtree Basins and associated coastal
 protection measures. As of January 2016, the modified Memorandum of Agreement
 (MOA) to conduct the work is pending execution with the NYSGOSR, the NYSDEC,
 and the Corps. Status: Planning/Design. Primary Funder: HUD.
- Upper Hawtree Flood Protection and Drainage Improvements: This project will develop targeted protection strategies and drainage improvements along the northern edge of Hawtree Basin to limit flood impact to the community, particularly the Coleman Square area of Old Howard Beach. As of January 2016, the modified MOA to conduct the work is pending execution with the NYSGOSR, the NYSDEC, and the Corps. Status: Planning/Design. Primary Funder: HUD.

State and Local Program, Studies, and Reports

New York/New Jersey Harbor Estuary Program

Documents pertaining to this program can be found on the New York-New Jersey Harbor and Estuary Program: http://www.harborestuary.org/reports.htm.

- NYSGOSR-NY Rising Community Reconstruction (NYRCR)
- Howard Beach: NY Rising Community Reconstruction Plan. March 2014.

A number of completed and on-going projects are outlined in the Jamaica Bay Watershed Protection Plan-2014 Update (New York City Department of Environmental Protection 2014) including Jamaica Bay wastewater treatment plant upgrades and Springfield Gardens, Baisley Pond, and area-wide sewer improvements.

DESCRIPTION OF THE STUDY AREA

The Study Area is located in Spring Creek Park in Queens and Kings Counties, New York. The Study Area is 47 ac and is comprised of low marsh habitat dominated by saltmarsh cordgrass (*Spartina alterniflora*), mudflats, scattered pockets of high marsh habitat, salt pannes, disturbed uplands supporting non-native, invasive herbaceous and woody plant species (*i.e.*, tree-of-heaven [Ailanthus altissima] and mugwort [Artemisia vulgaris]), and some disturbed wetland areas dominated by common reed (Phragmites australis). Within the Study Area are two tidal creeks, Spring Creek and Ralph's Creek, which drain into Jamaica Bay.

The proposed project is located within the Jamaica Bay Watershed and the following discussion will incorporate a description of both the Jamaica Bay watershed and the Study Area. As listed above, there are a number of completed, on-going and proposed projects within the Jamaica Bay Watershed. The purposes of those projects include ecosystem restoration and coastal storm risk management.

Geography

Jamaica Bay and the Study Area lie within the Atlantic Coastal Plain Province, which extends beneath the Atlantic Ocean about 100 mi offshore to the edge of the continental shelf (U.S. Fish and Wildlife Service 1997). Habitats found along the Atlantic coast include barrier beaches, baymouth barriers, barrier spits, tidal inlets, backbarrier lagoon, and marsh system.

Land Cover and Use

The project site is undeveloped New York City parkland. Within the park is a non-operational 20 ac composting facility and the Spring Creek Auxiliary Wastewater Treatment Plant (AWWTP). Adjacent areas are zoned and developed for manufacturing and residential use. The

Study Area is located approximately 2 mi west of John F. Kennedy (JFK) International Airport. Illegal dumping and all-terrain vehicle (ATV) use occur at the site.

Water Quality

Jamaica Bay has experienced extensive modifications to the freshwater and brackish creeks; the filling of saltmarshes (approximately 12,000 ac lost), and the dredging of the subtidal areas of the bay (an estimated 125 million cubic yards [cy] removed) and modifications to the tidal inlet connections with Atlantic Ocean (New York City Department of Environmental Protection 2007). The majority of the bay's water inputs are primarily from the sewage treatment facilities which contribute between 259 million gallons (MG) of treated effluent per day (New York City Department of Environmental Protection 2007) and 287 MG of treated effluent per day (Waldman 2008). Water quality sampling and modeling show that Jamaica Bay is a eutrophic system but in spite of this, water quality indicators suggest that the water quality of the bay remains good with the exception of seasonally specific geographic areas (New York City Department of Environmental Protection 2007). The bay experiences annual algal blooms, depressed dissolved oxygen levels in select areas of the bay, and increased nutrient levels.

Spring Creek is listed on the NYSDEC's section 303(d) List of Impaired/TMDL Waters. The following information was retrieved from the NYSDEC description of Spring Creek and Tributaries last revised February 4, 2002, but contains information dated as recently as 2011. The type of known pollutant is floatables and suspected pollutants include pathogens, and nutrients. The known sources of pollution include combined sewer overflow (CSO), municipal wastewater from Spring Creek Auxiliary wastewater treatment plant/26th Ward (WWTP), urban/storm runoff and other sanitary discharge. When wet weather flows exceed the 20 MG capacity of the Spring Creek Auxiliary water pollution control plant (WPCP), effluent is treated with chlorine disinfection and overflows into Spring Creek. At the head of the basin, circulation and flushing is limited, and DO standards are not met. Water testing as part of the NYCDEP Harbor Survey indicates high chlorophyll a levels indicating a eutrophic condition.

Recent efforts to improve water quality conditions and minimize overflows of CSOs include a NYSDEC issued Consent Order which required the City of New York to address the CSOs of the NYCDEP municipal wastewater system, including the 26th Ward WWTP. The current Jamaica Bay Waterbody/Watershed Facility Plan includes measures applicable to Spring Creek and these include the expansion of the 26th Ward WPCP and upgrading of the Spring Creek Auxiliary WPCP. Another local effort to reduce floatables discharged to NYC waters is the NYCDEP Catch Basin Hooding Program.

Contaminants

Jamaica Bay (Bay) contains "...large quantities of chemicals, including heavy metals, pesticides, polychlorinated biphenyl (PCB), dichlorodiphenyltrichloroethane (DDT), and dioxin..." (U.S. Army Corps of Engineers 2016b). While the concentrations of many contaminants in the Hudson Raritan Estuary (HRE), including Jamaica Bay, have decreased over time, some of the contaminants found within Jamaica Bay are still present in concentrations that are above levels at

which biological effects are observed (*i.e.* they exceed the effects range –median) (Steinberg *et al.* 2004). Sediment contaminant concentrations have improved as historical contaminant inputs have decreased as a result of environmental laws. However, contaminants still enter the HRE, including Jamaica Bay, through modern inputs (*i.e.*, WWTP discharges, CSOs, non-point source discharges, and chemical and oil spills) (Steinberg *et al.* 2004; U.S. Army Corps of Engineers 2016b). Benotti and Brownawell (2007) identified fifteen pharmaceutical compounds in Jamaica Bay at least once, including 12 that were identified in most or all of the 24 sites which were surveyed. These compounds included caffeine, cotinine, nicotine, paraxanthine, acetaminophen, carbamazepine, cimetidine, codeine, diltiazem, ketoprofen, metformin, ranitidine, and salbutamol.

The Corps sampled soils for contaminants in 2002 and 2003 within the Study Area. The results of the analysis are discussed within the Draft Integrated Environmental Review Records/Environmental Assessment (ERR/EA) (U.S. Army Corps of Engineers 2016a). The contaminants of potential concern include: metals (Hg, As, Cd, Cr, Pb) and semi-volatile organic compounds (SVOCs) such as (benzo[a]anthracene, benzo[a]pyrene, benzo[b/k]fluoranthene, indeno[1,2,3-cd]pyrene).

Tidal and Salinity Regimes

Jamaica Bay is saline to brackish and experiences a semidiurnal tidal range averaging 5 ft (U.S. Fish and Wildlife Service 1997). The Corps collected tidal data from April 11, 2003, to July 19, 2003, within the Study Area and identified the gauge locations as Spring Creek, Ralph's Creek and Flatlands (U.S. Army Corps of Engineers 2016a). The Corps documented a tidal range of 4.39 ft and 3.94 ft in Spring Creek and Flatlands, respectively.

DESCRIPTION OF ECOLOGICAL UNIQUENESS

From a watershed perspective, Jamaica Bay is a 31square-mile water body with a broader watershed of approximately 142 square miles, which includes portions of Brooklyn, Queens, and Nassau County (New York City Department of Environmental Protection 2007). Jamaica Bay has been designated by the U.S. Fish and Wildlife Service and the New York State Department of State as Significant Habitat and Habitat Complexes.

Service Significant Habitat and Habitat Complex

The Jamaica Bay and Breezy Point Complex encompasses the entire Jamaica Bay estuarine lagoon, part of the Rockaway Inlet, the western part of the Rockaway barrier beach, Plumb Beach, and most of the tidal creeks and undeveloped uplands adjacent to the bay (U.S. Fish and Wildlife Service 1997). Within this complex lies the Study Area (Figure 2). This habitat complex is of regional importance due to the location and rich food resources found within the complex. The complex contains: beach and dune habitat for nesting bird and rare plant species; foraging areas for waterfowl, shorebirds, and colonial nesting waterbirds; important breeding and juvenile nursery habitat for finfish and shellfish; nesting habitats for gulls, terns, waterfowl, and herons; upland breeding habitat for grassland bird nesting and foraging areas; as well as,

butterfly concentration areas (U.S. Fish and Wildlife Service 1997). The Study Area is designated as both a Significant Land Habitat Complex and Significant Water Habitat Complex (Figure 2).

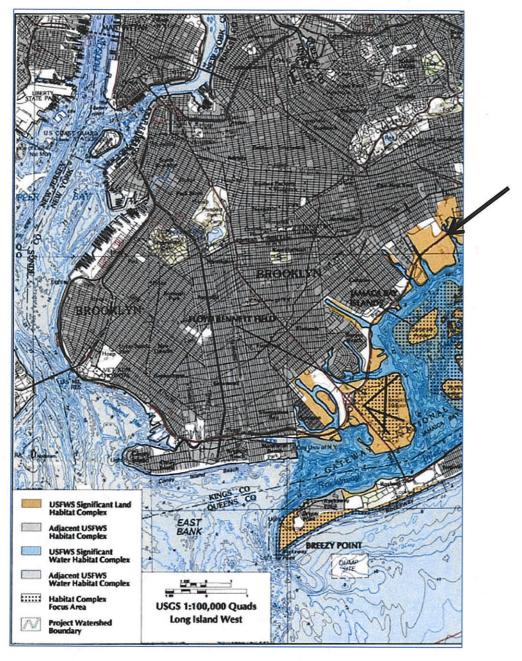


Figure 2. Map of USFWS Significant Land and Water Habitat Complex. The arrow indicates the Study Area. (From U.S. Fish and Wildlife Service 1997).

NYSDOS Significant Coastal Fish and Wildlife Habitats

Jamaica Bay is designated as a New York State Department of State Significant Coastal Fish and Wildlife Habitat. The designated area includes the entire bay, saltmarsh, fringing tidal marsh,

tidal flats, dredge spoil islands and adjacent upland areas which include open field, shrub thicket, developing woodlands, and beach grass dune (New York State Department of State 1992). The designated habitat is of great significance as one of the largest coastal wetland ecosystems in New York State, providing nesting and foraging habitat for a number of state-listed species (endangered, threatened, and special concern) including piping plover (*Charadrius melodus*), common tern (*Sterna hirundo*), northern harrier (*Circus cyaneus*), diamondback terrapin (*Maclemys t. terrapin*), upland sandpiper (*Bartramia longicauda*), barn owl (*Tyto alba*), short eared owl (*Asio flammeus*), and grasshopper sparrow (*Ammodramus savannarum*). It is also a regionally-important recreational fishing and birdwatching site, and hosts a wintering waterfowl concentration of statewide importance, as well as the only population of breeding laughing gulls (*Leucophaeus atricilla*) in New York State.

Audubon Important Bird Areas (IBA)

The Important Bird Areas program identifies, monitors, and protects habitats critical to the success of bird populations (More information about Audubon IBA can be found at: http://ny.audubon.org/conservation/what-important-bird-area). The Jamaica Bay complex is a designated important bird area. The habitats present within the complex include the marine and tidal wetland portions of the bay itself, as well as the barrier beach/dune system and some adjoining upland shrub and grassland. This IBA is an important site for wintering, breeding, and migrating birds. Observations of black-bellied plover (*Pluvialis squatarola*), red knot (*Calidris canutus rufa*), piping plover, laughing gull, roseate tern (*Sterna dougallii*), common tern, Forster's tern (*S. forsteri*), least tern (*Sternula antillarum*), black skimmer (*Rynchops niger*), brant (*Branta bernicula*), greater scaup (*Aythya marila*), and peregrine falcon (*Falco peregrinus*) (National Audubon Society 2013). The IBA includes that part of Spring Creek located south of the Belt Parkway and is therefore outside of the immediate project site but is included in the Study Area.

EXPLANATION OF FISH AND WILDLIFE RESOURCE CONCERNS AND PLANNING OBJECTIVES

Service's Mitigation Policy

Currently, the Service's mitigation policy is no net conservation loss. On November 6, 2017, the Service published a *Federal Register* notice (82 FR 51382) soliciting comments on portions of the existing Mitigation Policy and the Endangered Species Act Compensatory Mitigation Policy. In particular, the notice is soliciting comment on the overall mitigation planning goal of net conservation gain. If, based on public input, it is decided that revisions to the mitigation policy are warranted, they will occur after the public comment period closes on January 5, 2018.

Conservation Goal

The purpose of consultation between the Corps and the Service under the FWCA is to ensure equal consideration of fish and wildlife resources in the planning of water resource development projects. The Service's emphasis in this regard is to identify means and measures to avoid,

mitigate, or compensate for the potential adverse impacts of the proposed project and to make positive contributions to fish and wildlife resources. As this is a restoration project, the Service believes there will be a net conservation benefit.

The Service applied and incorporated our Mitigation Policy (January 23, 1981, Federal Register v. 46 n 15, pp. 7644-7663) in addressing criteria necessary to support the proposed project and has considered its responsibilities under the Endangered Species Act, Migratory Bird Treaty Act, Bald Eagle and Golden Eagle Protection Act, and the National Environmental Policy Act (U.S. Fish and Wildlife Service 1981) in formulation of our recommendations. In developing mitigation recommendations, the Service also relied on professional experience, literature searches, and local, state, and federal conservation plans (e.g., bird conservation plans and local, state, and federal land and water conservation plans) to derive appropriate recommendations for mitigation and fish and wildlife enhancement opportunities.

DESCRIPTION OF EVALUATION METHODS

The descriptions of natural resources are based on previous studies for this and similar projects, relevant grey and peer-reviewed literature, local, state, and federal fish and wildlife reports and plans. As discussed in more detail in the following section, this report discusses fish and wildlife resources which may be found within the Study Area.

DESCRIPTION OF FISH AND WILDLIFE RESOURCE CONDITIONS

The purpose of this section is to establish and identify significant fish and wildlife resources in the Study Area. This information provides the basis for the more detailed discussion of the ecological communities and significant habitats upon which the impacts of the Corps' selected plan and the fish and wildlife enhancement opportunities are subsequently evaluated.

Terrestrial System

Vegetation

Additional species documented by the Corps at the site include black cherry (*Prunus serotina*), black locust (*Robinia pseudoacacia*), several willow (*Salix* spp.) species, common milkweed (*Asclepias syriaca*), and Canada goldenrod (*Solidago canadensis*) (U.S. Army Corps of Engineers 2016a). Byer (2002) documented mugwort with patches of secondary woodland with willow oaks (*Quercus phellos*) throughout the project site and the non-native weeping lovegrass (*Eragrostis curvula*) along Fountain Avenue. The Service also noted tree-of-heaven at the site during a visit on December 30, 2015.

Reptiles and Amphibians

Burke et al. (2002 In Jamaica Bay Ecosystem Research and Restoration Team [JABBERT] 2002) observed snapping turtle (Chelydra serpentina), diamondback terrapin, red-eared slider

(Trachemys scripta), garter snake (Thamnophis sirtalis), brown snake (Storeria dekayi), and Fowler's toad (Bufo fowleri) within the Study Area.

Diamondback terrapins inhabit coastal marshes, tidal creeks, estuaries, bays, and coves where they forage and breed. Breeding and nesting typically occurs in May, June, and July. Nest locations are commonly found on uplands adjacent to estuarine habitats and include dunes, grasslands, shrublands, beaches, and sand/gravel trails (Feinberg and Burke 2004).

Mammals

Terrestrial mammals found within Jamaica Bay and the surrounding mainland may include: black-tailed jackrabbit (Lepus californicus), domestic/feral cat (Felis silvestris), eastern chipmunk (Tamias striatus), eastern cottontail rabbit (Sylvilagus jloridanus), gray squirrel (Sciurus carolinensis), hoary bat (Lasiurus cinereus), house mouse (Mus musculus), little brown bat (Myotis lucifugus), meadow vole (Microtus pennsylvanicus), muskrat (Ondatra zibethicus), Norway rat (Rattus norvegicus), opossum (Didelphis virginiana), raccoon (Pragon lotor), red bat (Lasiurus borealis), silver-haired bat (Lasionycteris noctivagans), and white-footed mouse (Peromyscus leucopus) (U.S. Fish and Wildlife Service 1997). Many of these species were observed during surveys conducted by Burke et al. (2002) including opossum, eastern cottontail, black-tailed jackrabbit, and meadow vole. Other species observed included: starnose mole (Condylura cristata), feral dog (Canis familiaris), and feral cat.

Avian

Jamaica Bay provides important habitat for a number of breeding, migrating, and wintering birds. The list of birds found within the Study Area in Table 1 was compiled from Veit et al. (2002), and NYSDEC Breeding Bird Atlas (2005). Veit et al. (2002 in JABBERT 2002) carried out 21 surveys of Spring Creek and documented 97 species within the project site. Five saltmarsh-dependent species were identified within the Study Area including clapper rail (Rallus longirostrus), willet (Catoptrophorus semipalmatus), Forster's tern, saltmarsh sparrow, and boattailed grackle (Quiscalus major).

Table 1. List of avian species that may, or are known to, breed within the project site. These species are identified as highest priority (a), high priority (b), and moderate priority (c), in the BCR30 Birds of Conservation Concern (2008). Included in this list are several New York State-listed threatened (T) and endangered species (E), as well as species of special concern (SC). Source: Veit et al. (2002) and the NYSDEC Breeding Bird Atlas (2005).

Common Name	Scientific Name	Status	Common Name	Scientific Name	Status
American Black Duck	Anas rubripes	a	Herring Gull	Larus argentatus	
American Coot	Fulica americana		Hooded Merganser	Lophodyets cucullatus	С
American Crow	Corvus brachyrhynchos		House Finch	Carpodacus mexicanus	
American Goldfinch	Carduelis tristis		House Sparrow	Passer domesticus	

¹ Black-tailed jackrabbits are a western U.S. species that is likely present due to an inadvertent introduction at JFK Airport.

American Green-winged Teal	Anas crecca		House Wren	Troglodytes aedon	· ·
American Kestrel	Falco sparverius		Indigo Bunting		
American Robin	Turdus migratorius		Killdeer	Charadrius vociferus	С
American Tree Sparrow	Spizella arborea		Laughing Gull	Larus atricilla	
American Wigeon	Anas americana	С	Least Sandpiper	Calidris minutilla	c
Atlantic Brant	Branta bernicla	a	Lesser Yellowlegs	Tringa flavipes	c
Baltimore Oriole	Icterus galbula	b	Long-billed Dowitcher	Limnodromus scolopaceus	
Barn Swallow	Hirundo rustica		Mallard	Anas platyrhynchos	Ъ
Belted Kingfisher	Ceryle alcyon		Marsh Wren	Cistothorus palustris	ь
Black-and-white Warbler	Mniotilta varia	ь	Mourning Dove	Zenaida macroura	
Black-crowned Night-Heron	Nycticorax nycticorax	c	Mute Swan	Cygnus olor	-
Blue Jay	Cyanocitta cristata	<u> </u>	Myrtle Warbler	Dendroica coronata coronata	
Blue-winged Teal	Anas discors	-	Northern Cardinal	Cardinalis cardinalis	 -
Boat-tailed Grackle	Quiscalus major	 	Northern Flicker		b
Brown Thrasher	Toxostoma rufum	Ъ	Northern Harrier	Colaptes auratus Circus cyaneus	T
Brown-headed Cowbird	Molothrus ater		Northern Mockingbird	Mimus polyglottus	
Bufflehead	Bucephala albeola	ь	Osprey	Pandion haliaetus	SC
Canada Goose (Atl. Pop.)	Branta canadensis	a	Ovenbird	Seiurus aurocapillus	30
Canvasback	Aythya valisineria	<u>a</u>	Peregrine Falcon	Falco peregrinus	E
Cattle Egret	Bubulcus ibis	<u> </u>	Red-breasted Merganser	Mergus serrator	
Cedar Waxwing	Bombycilla cedrorum	·	Red-tailed Hawk	Buteo jamaicensis	С
Chimney Swift	Chaetura pelagica	b	Red-winged Blackbird	· · · · · · · · · · · · · · · · · · ·	
Clapper Rail	Rallus longirostrus	b	Ring-billed Gull	Agelaius phoeniceus Larus delawarensis	
Common Grackie	Quiscalus quiscula	"		<u> </u>	
Common Snipe	Gallinago gallinago		Ring-necked Pheasant	Phasianus colchicus	
Common Tern	Sterna hirundo	b, T	Rock Pigeon	Columba livia	
Common Yellowthroat	Geothlypis trichas	υ, ι	Royal Tern	Sterna maxima	С
Double-crested Cormorant	Phalacrocorax auritus		Ruby-crowned Kinglet	Regulus calendula	
Downy Woodpecker	-		Ruddy Duck	Oxyura jamaicencis	C
<u> </u>	Picoides pubescens	<u> </u>	Saltmarsh sparrow	Ammodramus caudacutus	a
Eastern Kingbird Eastern Phoebe	Tyrannus tyrannus	<u> </u>	Savannah Sparrow	Passerculus sandwichensis	· -
	Sayornis phoebe	1_	Semipalmated Plover	Mergus serrator	ь
Eastern Towhee	Pipilo erythrophthalmus	Ъ	Semipalmated Sandpiper	Calidris pusilla	
Eastern Wood-Peewee	Contopus virens		Sharp-shinned Hawk	Accipiter striatus	
European Starling	Sturnus vulgaris		Short-billed Dowitcher	Limnodromus griseus	Ъ
Fish Crow	Corvus ossifragus	1_	Snowy Egret	Egretta thula	С
Forster's Tern	Sterna forsteri	b	Song Sparrow	Melospiza melodia	
Gadwall	Anas strepera	C L	Spotted Sandpiper	Actitis macularia	С
Glossy Ibis	Plegadis falcinellus	ь	Swamp Sparrow	Melospiza georgiana	
Golden-crowned Kinglet	Regulus satrapa		Tree Swallow	Tachycineta bicolor	
Gray Cathird	Dumatella carolinensis		Western Palm Warbler	Dendroica palmarum palmarum	
Great Black-backed Gull	Larus marinus		White-throated Sparrow	Zonotrichia albicollis	 ,
Great Blue Heron	Ardea herodias		Willet	Catoptrophorus semipalmatus	b
Great Egret	Ardea alba		Willow Flycatcher	Empidonax traillii	b
Greater Yellowlegs	Tringa melanoleuca	ь	Yellow Warbler	Dendroica petechia	
Green Heron	Butorides virescens		Yellow-crowned Night-Heron	Nyctanassa violacea	С
Hermit Thrush	Catharus guttatus		Yellow-shafted Flicker	Colaptes auratus auratus	

Estuarine System

Estuarine Intertidal

Wetlands

The Service defines wetlands as transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. These systems provide a suite of ecosystem services, including primary production, provision of fish and shellfish habitat and nursery areas, biogeochemical cycling of nutrients, carbon sequestration, sediment trapping, and wave attenuation (Currin *et al.* 2010). According to the National Wetlands Inventory, the following wetland habitat types occur within the Study Area: estuarine and marine wetlands, and estuarine and marine deep water (Figure 3).

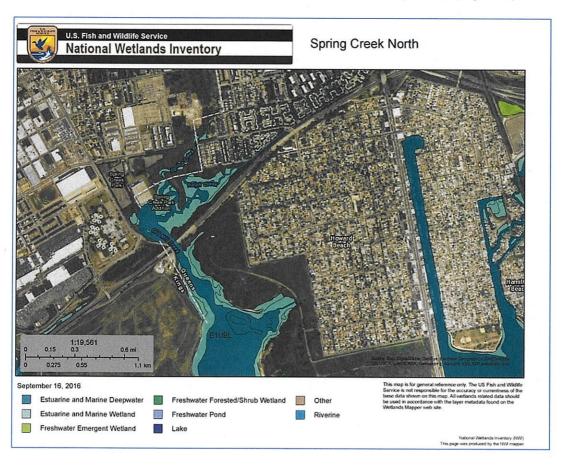


Figure 3. Map of wetlands within the Study Area.

Saltmarshes, or coastal wetlands, are among the most productive communities known, providing important ecological services including wildlife habitat, shoreline erosion control, and water column filtration (Waldman 2008). Since the European colonization, approximately 12,000 ac of 16,000 ac of saltmarsh has been lost within Jamaica Bay (New York City Department of Environmental Protection 2007; U.S. Fish and Wildlife Service 1997; Waldman 2008). The loss

of wetlands is due to a number of factors including: reduced sediment input, shoreline hardening, dredging, and sea-level rise (Waldman 2008). Rates of saltmarsh loss have been estimated based on the analysis of aerial photographs. Between 1924 and 1974, the rate of loss was approximately 0.4 percent annually. Since 1974, the rate has increased to 1.4 percent annually (Hartig *et al.* 2002).

Saltmarsh cordgrass is the dominant species found within low saltmarsh. Dominant species found within the high saltmarsh include: saltmeadow cordgrass (*Spartina patens*), salt grass (*Distichlis spicata*), black grass (*Juncus gerardii*), glasswort (*Salicornia* spp.), and sea lavender (*Limonium carolinianum*). Byer (2002) documented both saltmarsh cordgrass and spike grass (also called salt grass) within the project site. The Corps determined approximately 17 ac of the Study Area is comprised of intertidal marsh and is dominated by smooth cordgrass. There were 3 ac of high marsh dominated by saltmeadow hay and spike grass and 1 ac of scrub/shrub habitat with marsh elder (*Iva frutescens*) and northern bayberry (*myrica pensylvanica*) (U.S. Army Corps of Engineers 2016a). Common reed is found throughout the project site.

Avian

The saltmarsh sparrow is identified as a species of highest priority (U.S. Fish and Wildlife Service 2008) and occurs in New York where it breeds. This species is a secretive and highly localized species. Their breeding ranges extends from Maine to the Delmarva Peninsula where they breed in wet meadows, edges of freshwater marshes, and saltmarshes in recently deglaciated region of interior and Atlantic coast (Greenlaw and Rising 1994). Within New York, most nests are placed in medium height cordgrass growing just below mean high tide level, and in saltmeadow areas above mean high tide. Because of their nesting site location, their breeding success is affected by the timing of nesting in relation to spring high tides and storms which would otherwise flood their nests (Greenlaw and Rising 1994).

Horseshoe Crabs

Within the Study Area, Spring Creek North was not sampled quantitatively for horseshoe crabs during the JABBERT study, however, some limited horseshoe crab (*Limulus polyphemus*) spawning activity was observed at Spring Creek South. Botton and Loveland (*In JABBERT 2002*) concluded that the low abundance of eggs documented in Spring Creek is likely due to poor quality habitat for horseshoe crabs (Botton and Loveland 2002). The authors suggested that due to the similarities between Spring Creek North and South, it is likely that the habitat within Spring Creek North is also of poor quality.

Estuarine Subtidal

Finfish and Shellfish

The waters of Jamaica Bay provide important spawning, foraging, and nursery habitat for many finfish and shellfish species. Common species documented in the bay include: winter flounder (*Pseudopleuronectes americanus*), summer flounder (*Paralichthys dentatus*), windowpane

flounder (Scophthalmus aquosus), weakfish (Cynoscion regalis), bluefish (Pomatomus saltatrix), scup (Stenotomus chrysops), blueback herring (Alosa aestivalis), Atlantic cod (Gadus morhua), black sea bass (Centropristis striata), northern kingfish (Menticirrhus saxatilis), tautog (Tautoga onitis), Atlantic silversides (Menidia menidia), mummichog (Fundulus heteroclitus), striped killifish (Fundulus majalis), Atlantic menhaden (Brevoortia tyrannus), bay anchovy (Anchoa mitchilli), northern pipefish (Syngnathus fuscus), American shad (Alosa sapidissima), Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus), sea robin (Prionotus spp.), striped bass (Marone saxatilis), banded killifish (Fundulus diaphanus), cunner (Tautogolabrus adspersus), inland silversides (Menidia berylinna), striped sea robin (Prionotus evolans), white mullet (Mugil curema), and white perch (Marone americana) (National Park Service 2007; U.S. Fish and Wildlife Service 1997; New York State Department of State 1992).

Abundant species identified during seining efforts in Spring Creek South, an area south of the project included juvenile silversides, and Atlantic menhaden. Less abundant species included: bluefish, winter and summer flounder, striped killifish, tautog, Northern pufferfish (*Phoeroides maculatus*), and Northern pipefish (Kurtzke and Schreibman 2002 *In JABBERT 2002*).

The bay supports shellfish populations of hard clams (Mercenaria mercenaria), soft clams (Mya arenaria), mussels, and rock crabs (Cancer irroratus) (New York State Department of State 1992). At one time, Jamaica Bay supported a large fishery for oyster (Crassostrea virginica), hard clam, softshell clam, and blue crab (Callinectes sapidus) (Waldman 2008). However, due to threats of disease, the fisheries were closed in 1921 (Waldman 2008). Oysters were once an abundant fishery producing upwards of 700,000 bushels of oysters per year at its peak (Grambo and Vega 1984 In Waldman 2008; Franz 1982 In Zarnoch and Schreibman 2012). Due to overfishing, habitat losses from dredging, filling, and pollution have led to a collapse of the fishery (Zarnoch and Schreibman 2012).

Waterfowl

Significant concentrations of wintering waterfowl can be found in Jamaica Bay. Large numbers of greater scaup (Aythya marila), American black duck (Anas rubripes), brant (Branta bernicla), Canada goose (Branta canadensis), bufflehead (Bucephala albeola), canvasback (Aythya valisneria), mallard (Anas platyrhynchos), ruddy duck (Oxyurajamaicensis), red-breasted merganser (Mergus serrator), snow goose (Chen caerulescens), and American wigeon (Anas americana) have been documented since the late 1970's (New York State Department of State 1992; U.S. Fish and Wildlife Service 1997; Waldman 2008). Other species documented within the bay include homed grebe (Podiceps auritus), green-winged teal (Anas crecca), gadwall (Anas strepera), northern shoveler (Anas clypeata), and common goldeneye (Bucephala clangula) (U.S. Fish and Wildlife Service 1997).

Reptiles

Reptiles which may be found within Jamaica Bay include kemp's ridley (*Lepidochelys kempii*), Atlantic green (*Chelonia mydas*), loggerhead (*Caretta caretta*), and leatherback (*Dermochelys coriacea*) sea turtles, as well as diamondback terrapin (U.S. Fish and Wildlife Service 1997; Waldman 2008; Burke *et al. In JABBERT* 2002).

Mammals

Marine mammals that have been observed within the bay include bottlenose dolphin (*Tursiops truncatus*) and harbor seal (*Phoca vitulina*) (Waldman 2008).

Threatened and Endangered Species

Of the six federally-listed species which occur on Long Island, three of these species may have the potential to occur within the Study Area: the red knot (threatened), the roseate tern (endangered), and the piping plover (threatened). There are no records of these species within the Study Area, however they have been seen elsewhere in the Jamaica Bay area, and the Study Area contains habitat types used by these species. The remaining three species (seabeach amaranth [Amaranthus pumilus], sandplain gerardia [Agalinus acuta], and northern long-eared bat [Myotis septentionalis]) are unlikely to be found within the project, as there are no documented observations of these species within the Study Area and the Study Area does not provide the appropriate habitat for these species.

Red knots breed in the Canadian arctic and winters mainly in Tierra del Fuego, northern Brazil or Florida, and migrates through New York, to and from its breeding sites in the spring and fall (U.S. Fish and Wildlife Service 2014). Red knots utilize coastal marine and estuarine habitats during the spring and fall migrations. Red knots show moderate fidelity to particular migration staging areas between years (U.S. Fish and Wildlife Service 2014). These habitats include high energy ocean or bay front shores, tidal flats in sheltered bays, and lagoons (U.S. Fish and Wildlife Service 2014). In North America, red knots are found along sandy, gravel, or cobble beaches, tidal mudflats, saltmarshes, shallow coastal impoundments and lagoons, and peat banks. Red knots use sandy beaches during both the spring and fall migration (U.S. Fish and Wildlife Service 2014). The red knot is a specialized molluscivore, primarily eating hard-shelled mollusks and supplementing with softer invertebrate prey (U.S. Fish and Wildlife Service 2014). Red knots are restricted to foraging in the top 0.8 to 1.2 inches (in.) of sediment due to bill morphology (U.S. Fish and Wildlife Service 2014). Red knots forage on a number of prey, exhibiting preference for specific prey within specific stopovers, during the spring and fall migrations and based on wintering location (U.S. Fish and Wildlife Service 2014). In New York, red knots in Moriches Bay exhibited preference of horseshoe crab eggs during the spring migration (U.S. Fish and Wildlife Service 2014). Red knots also forage on small periwinkles (Littorina spp.), tiny blue mussels and blue mussel spat (Mytilus edulis), gem clams (Gemma gemma) (not preferred), amphipods, naticid snails, polychaeta worms, insect larvae, crustaceans, sand fleas (Haustortids spp.), mole crabs (Emerita talpoida), dwarf surf clams (Mulinia lateralis), small bivalves (Tellina, Maeoma, Donax, Gemmula, Iphigenia, Tivella, and Area spp.), and mud snails (Peringia ulvae) (U.S. Fish and Wildlife Service 2014). The Service is not aware of comprehensive monitoring of red knots on Long Island, New York, or within the Study Area. Some data for Long Island is available from individual birders or associated with horseshoe crab monitoring. However, no observations of red knots have been documented within the Study Area and horseshoe crab monitoring has not been conducted within the site. It is possible that red knots utilize the site and have not been reported to eBird (eBird.org) or it is possible that upon completion of this project, red knots will utilize this site.

Roseate terns are medium-sized, gull-like terns. Roseate terns are specialist feeders eating almost exclusively small fish, primarily the American sand lance in northeastern populations. It captures food mainly by plunge diving, completely submerging its body underwater to catch prey, but it also feeds in shallow waters. Roseate terns are an exclusively marine bird, usually breeding on small islands and occasionally on sand dunes of barrier beaches (U.S. Fish and Wildlife Service 2011). During the breeding season, birds typically forage over shallow coastal waters around the breeding colony. Roseate terns nest on Great Gull Island which is located east of the Study Area. There is no history of nesting within the Study Area; however, it is possible that roseate terns may utilize the waters for foraging.

The piping plover is a small shorebird present along Long Island ocean and bay beaches from the time they arrive to breed in March and April until their departure to wintering grounds in September. Piping plovers nest above the high tide line on coastal beaches, sandflats at the ends of sandspits and barrier islands, gently sloping fore dunes, blowout areas behind primary dunes, sparsely-vegetated dunes, and washover areas cut into or between dunes. Feeding areas include intertidal portions of ocean beaches, washover areas, mudflats, sandflats, wracklines, and shorelines of coastal ponds, lagoons, or saltmarshes (U.S. Fish and Wildlife Service 1996). There is no history of nesting within the Study Area; however, the Study Area contains saltmarsh and mudflat which, at other sites within Jamaica Bay, function as foraging habitat for the species.

FUTURE RESOURCE CONDITIONS WITHOUT THE PROJECT

The description of the Future Without Project Conditions is based on the information contained in U.S. Army Corps of Engineers (2016a). The NYCDPR conducted a multi-tier assessment of New York City saltmarshes, wherein they assessed saltmarsh loss trends by comparing 1974 NYSDEC aerial photo mapping and 2012 (post-Hurricane Sandy) field assessments and aerial photos. The assessment determined that the Spring Creek complex experienced both a large amount and percentage (~50 percent) of waterward marsh loss (U.S. Army Corps of Engineers 2016a). Of the 25 complexes surveyed, Spring Creek ranked among the top 3 worst condition complexes with respect to vulnerability to sea-level rise and marsh loss.

The Corps determined, in the absence of federal action, "...it is anticipated that the degraded conditions recorded within the Spring Creek ecosystem (e.g., increasing abundance of invasive species, increasing fragmentation of and encroachment upon healthy wetland ecosystems, and continuing erosion within certain areas of the saltmarsh) will continue and likely worsen in the future" (U.S. Army Corps of Engineers 2016a).

Land Use

The park contains a 20-ac composting facility, built in 2001. While the facility is not currently operational, without the proposed project, the composting site, which consists of paved lots and gravel, would remain in its current condition. Illegal dumping and all-terrain vehicle (ATV) use would likely also continue to occur.

Sea-level rise

One of the biggest threats to wetlands and coastal habitats is sea-level rise. While there is uncertainty regarding the timing and magnitude of future response to sea-level rise, coastal ecological communities and habitats will be increasingly stressed by climate change impacts due to sea-level rise and increased frequency and intensity of storms (Field *et al.* 2007; Ning *et al.* 2015). Furthermore, the Study Area is bordered to the north by development, which will limit the saltmarshes' natural ability to "retreat".

Fish and Wildlife Resources

In terms of fish and wildlife resources in the Future Without Project Condition, physical and human activities would continue to greatly influence the ecological communities. The invasive species found throughout the project site will likely continue to spread and further degrade the habitat value. The quality of the high marsh habitat will degrade as the common reed spreads. Low marsh will likely be converted to open water as a result of sea-level rise.

PROJECT ALTERNATIVES

Description of Alternatives

During the development of alternatives, the Corps evaluated the following ecosystem restoration measures (U.S. Army Corps of Engineers 2017):

- 1. Existing Pavement Removal: Restore ground permeability and allow for planting of native vegetation.
- 2. Excavation of Material: Excavate historic fill to achieve proper elevations for tidal wetland plantings, and for construction of tidal creek.
- 3. Grading: Re-grade elevations on site to restore low and high marsh and upland habitats (note: upland habitat achieved as cost-effective soil placement; increased acreage of upland habitat is paid 100% non-federal sponsor funds).
- 4. Clean Fill: Place clean fill in over-excavated areas to achieve proper elevations for tidal wetland plantings, and for construction of tidal creek.
- 5. On-Site Disposal: Place excavated material on-site, followed by capping and planting. This action provides both a cost savings and ecological benefit.
- 6. Remove invasive plant species.
- 7. Plant native vegetation.
- 8. Modify the channel.
- 9. Turtle Mounds: Create with clean and graded sand (surrounded by high marsh, and graded to an elevation above MHW to protect them from inundation).

The Corps developed eight restoration alternatives. The following description of the alternatives is summarized directly from the Corps' draft Integrated Ecosystem Restoration Feasibility Report and Environmental Assessment for Spring Creek North (draft Integrated Feasibility

Report and Environmental Assessment) (U.S Army Corps of Engineers 2017). A summary of the design elements is provided in Table 2.

Alternative 0 - No Action Alternative

No federal action would be taken within any of the coves.

Alternative 1

This alternative would result in the restoration of approximately 12.25 ac of smooth cordgrass dominated low marsh, approximately 2.52 ac of scrub/shrub habitat planted as a transition area between marsh and upland communities, and approximately 7.34 ac of maritime upland community. Approximately 190,750 cy of excavated material would be transported off-site.

Alternative 2

Alternative 2 would result in the restoration of approximately 13.34 ac of smooth cordgrass dominated low marsh, 1.84 ac of scrub/shrub transition area planted between the marsh and upland habitats, and 7.34 ac of maritime upland. Approximately 213,500 cy of excavated material would be transported off-site. This alternative includes the removal and relocation of the sewer line that bisects the site.

Alternative 3

The Corps developed three variations of Alternative 3. These three alternatives would retain some of the excavated material on-site.

Alternative 3A

Alternative 3A would result in the restoration of approximately 12.4 ac of low marsh habitat, approximately 2.60 ac of transition area, and approximately 7.34 ac of maritime upland. Approximately 2.92 ac within the Study Area would be newly covered with macadam and returned to use as a composting facility. Approximately 191,500 cy of material would be excavated, of which approximately 107,240 cy would be disposed of off-site, with the remaining 84,260 cy being used on-site in the maritime upland/compost areas.

Alternative 3B

Alternative 3B would result in the restoration of approximately 10.28 ac of smooth cordgrass dominated low marsh, approximately 2.27 ac of saltmeadow hay/spike grass dominated high marsh, 2.43 ac scrub/shrub transition areas, and approximately 7.34 ac of maritime upland. Approximately 2.92 ac within the Study Area would be newly covered with macadam and returned to use as a composting facility. Turtle mounds (.22 ac) would be created with clean sand placed and graded to about 3 ft in depth. Approximately 189,375 cy of material would be excavated, of which approximately 106,050 cy would be disposed of off-site, with the remaining

83,325 cy being used on-site in the maritime upland/compost areas.

Alternative 3C

Alternative 3C (Figure 4) would result in the restoration of approximately 10.24 ac of smooth cordgrass dominated low marsh, approximately 2.17 ac of saltmeadow hay/spike grass dominated high marsh, 2.43 ac of scrub/shrub transition areas, and approximately 7.34 ac of maritime upland. Approximately 2.92 ac within the Study Area would be newly covered with macadam and returned to use as a composting facility. Turtle mounds (.22 ac) would be created with clean sand placed and graded to about 3 ft in depth. Approximately 191,800 cy of material would be excavated, and would be used on-site in the maritime upland/compost areas. This alternative was identified as the 'best buy' plan and was optimized to develop the Recommended Plan (described below).

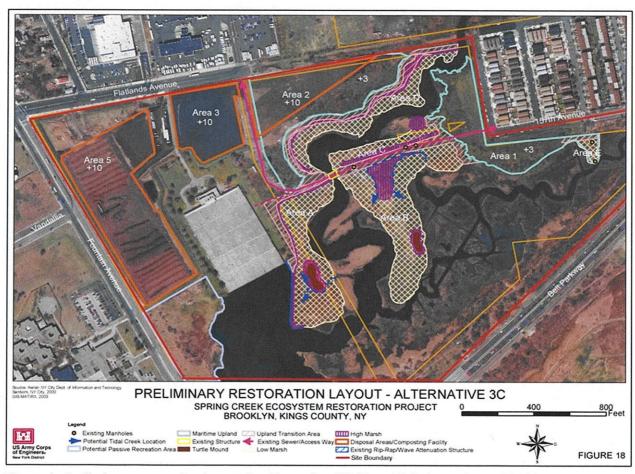


Figure 4. Preliminary restoration layout for Alternative 3C (From U.S. Army Corps 2016a).

Alternative 4

The Corps developed three variations of Alternative 4. In addition to the proposed actions described below, these three alternatives include the removal and relocation of the existing sewer line

Alternative 4A

Alternative 4A would result in the restoration of approximately 13.34 ac of smooth cordgrass dominated low marsh, 1.84 ac of scrub/shrub transition areas, and approximately 7.34 ac of maritime upland. Approximately 2.92 ac within the Study Area would be newly covered with macadam and returned to use as a composting facility. Approximately 213,600 cy of material would be excavated, of which approximately 119,616 cy would be disposed of off-site, with the remaining 93,984 cy being used on-site in the maritime upland/compost areas.

Alternative 4B

Alternative 4B would result in the restoration of approximately 9.39 ac of smooth cordgrass dominated low marsh, approximately 2.57 ac of saltmeadow hay/spike grass dominated high marsh, 1.84 ac of scrub/shrub transition areas, and approximately 7.34 ac of maritime upland. This alternative includes turtle mounds. Approximately 2.92 ac within the Study Area would be newly covered with macadam and returned to use as a composting facility. Approximately 233,360 cy of material would be excavated, of which approximately 130,681 cy would be disposed of off-site, with the remaining 102,879 cy being used on-site in the maritime upland/compost areas.

Alternative 4C

Alternative 4C would result in the restoration of approximately 9.39 ac of smooth cordgrass dominated low marsh, approximately 2.57 ac of saltmeadow hay/spike grass dominated high marsh, 1.84 ac of scrub/shrub transition areas, and approximately 7.34 ac of maritime upland. This alternative includes turtle mounds. Approximately 2.92 ac within the Study Area would be newly covered with macadam and returned to use as a composting facility. Approximately 233,360 cy of material would be excavated, and would be used on-site in the maritime upland/compost areas.

Table 2. Summary of design elements for action alternatives based on information provided by the Corps (2016a and 2017).

Alternatives	Low Marsh	High Marsh	Transition Area	Turtle Mound	Maritime Upland	On Site Disposal	Constructed Tidal Creeks	Sewer Line
0	-	-	-	-	-	-	-	-
1	12.25*	0	2.52	0	7.34	0	If necessary	No action
2	13.34	0	1.84	0	7.34	0	If necessary	Removal and relocation
3A	12.41	0	2.60	0	7.34	2.92	If necessary	No action
3B	10.28	2.27	2.43	0.22	7.34	2.92	unknown	No action
3C	10.24	2.17	2.43	0.22	7.34	14.45	If necessary	No action
4A	13.34	0	1.84	0	7.34	2.92	If necessary	Removal and relocation
4B	9.39	2.57	1.84	0.22	7.34	2.92	unknown	Removal and relocation
4C	9.39	2.57	1.84	0.22	7.34	14.45	unknown	Removal and relocation

Description of Recommended Plan

The Corps selected and optimized alternative 3C in order to develop the Recommended Plan. The plan was optimized with regard to engineering and ecological constraints, for cost effectiveness, and to enhance the design of the restored wetland with regard to better adapting to sea level change (*i.e.* increasing high marsh area and designing transition zones between low and high marsh). As a result of optimization, the acreages shown in Table 2 and the labeling scheme for the plan changed (Figure 5). The following description of the Recommended Plan is based on the information provided by the U.S. Army Corps of Engineers (2017). The Recommended Plan would result in the restoration of approximately 7.6 ac of low marsh, 5.4 ac of high marsh, 1.0 ac of scrub-shrub habitat, 2.1 ac of upland, and 19.0 ac of maritime upland, for a total of 35.1 acres. Turtle mounds are not incorporated into this plan in order to minimize the risk of common reed re-establishment. In order to reintroduce sinuosity back into the creek, this plan includes channel realignment. The optimized plan also includes reduced slopes. The slope rising from high marsh to upland in Area B begins at 1V:3H and then decreases to 1V:5H while approaching maritime forest. The slope rising from high marsh to upland in Area E begins at 1V:5H and then decreases to 1V:10H while approaching the maritime forest elevations.

Approximately 98,000 cy of material will be excavated from onsite to achieve designed wetland elevation and the material will be distributed to create the upland and maritime forest. It is anticipated that approximately 7,100 cy of excavated material will be placed at Area F (see Figure 5) and approximately 22,000 cy of excavated material will be placed at Area G. The Corps will add a layer of growing medium (clean soil) over all the restored areas: a 1.5-ft layer of growing medium for the maritime forests and upland habitats within Areas B, E, F, and G; and a 1-ft layer of growing medium all other areas (wetlands). Approximately 9,300 square yards (1.92 ac) of pavement is required to be removed from Areas F and G, and from the upland portion of Area E. The Recommended Plan will no longer restore the Compositing Facility to its

original use, but instead will restore the area to upland habitat. Excavated material placed in Areas E, F, and G will enable the future conversion of the existing Composting Facility to upland habitat and park.

The Corps has identified additional design features and opportunities that are incorporated in the Recommended Plan (U.S. Army Corps of Engineers 2016a):

- Initial invasive/exotic vegetation removal and control achieved through the application of a glyphosate based systemic herbicide like Rodeo;
- A planting plan that considers the creation of a primary successional community like maritime grassland to set the stage for succession into scrub-shrub or forest by establishing strategic plantings;
- Use, including collection as necessary, of native seed stocks and propagation of native plant material, with a special focus on low marsh and high marsh species (smooth cordgrass (Spartina alterniflora), saltmeadow hay (S. patens), saltwort (Salicornia spp.), spike grass (Distichlis spicata). Developing a planting plan that uses tri-plugs consisting of black grass (Juncus gerardii), saltmeadow hay, and spike grass for high marsh planting. The planting plan should also consider collection and propagation of primary successional species for the high marsh and maritime uplands (e.g., eastern cottonwood [Populus deltoids], water hemp [Amaranthus cannibinus], camphorweed [Heterotheca subaxillaris], and pigweed [Amaranthus albus], etc.); and
- Implementation of a beneficial soil re-use plan to balance proposed cut and fill on-site to the greatest degree possible thus yielding a high degree of cost effectiveness.

Additionally, the Corps recognizes that there are opportunities for the development of public access, walking trails, and education (*i.e.*, interpretive signage), as well as the incorporation of bollards and/or fences to discourage both illegal dumping and the use of ATVs on the site. These opportunities will be further evaluated in the Preconstruction, Engineering, and Design phase of the project.

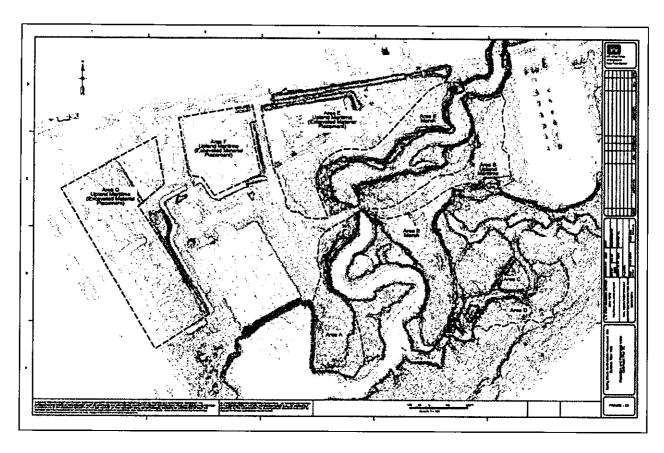


Figure 5. Revised labeling scheme for Optimized Plan 3C (U.S. Army Corps of Engineers 2017)

DESCRIPTION OF IMPACTS OF CORPS' PROPOSED PROJECT

The purposes of the Spring Creek ecosystem restoration project are to rectify the adverse impacts associated with the historic dredge and fill activities executed as part of constructing and maintaining the Jamaica Bay navigation channel and address the associated indirect ecosystem degradation within the Study Area (U.S. Army Corps of Engineers 2016a). The intent of this project is to improve the environmental quality of the Study Area.

The Corps proposes to excavate sediment and debris from existing stands of invasive herbaceous and woody species to create low and high saltmarsh and tidal creek habitat. Adjacent uplands will be enhanced and converted to scrub/shrub and maritime upland habitats. Spoil from the excavation is proposed to be deposited in the maritime upland restoration areas. In the long-term, this project should have beneficial effects on fish and wildlife resources, however, in the short-term, adverse impacts are anticipated as a result of construction activities and a temporary loss of habitat function.

Direct Effects

Habitat Modification/Loss and Restoration

As this is a restoration project, the objective is to restore natural functions that were formerly provided by a wetland and as such, a significant effect of the project would be habitat modification. This form of habitat modification will be a beneficial long-term effect, by restoring the degraded project site, improving habitat conditions and restoring ecological services. The Service anticipates temporary habitat loss will occur during construction as a result of the currently vegetated areas being converted to bare soil until herbaceous plantings become established (U.S. Fish and Wildlife Service 2004). With the establishment of vegetation, we expect that habitat losses will be of short duration and offset by long-term habitat enhancement.

Following restoration, fish and wildlife habitat quality is likely to increase in those areas where stands currently dominated by invasive/exotic plant species are converted to low marsh, high marsh, scrub/shrub or maritime forests. Upland habitats will be enhanced to improve habitat for terrestrial species. Invasive/exotic plant species displace native vegetation communities with monotypic/depauperate stands. The diversity of forage and cover available for wildlife is also reduced. Some species, such as tree-of-heaven, produce allelopathic compounds that inhibit the establishment of other species (Mergen 1959). In saltmarshes where common reed stands have displaced high marsh, numerous studies have found lower species diversity and/or density of birds and mammals in common reed stands relative to low marsh communities (Howe *et al.* 1978; Roman *et al.* 1984; Lapin and Randall 1993; Warren and Fell 1995; Benoit and Askins 1999; Chambers *et al.* 1999). The relative value of these common reed stands to invertebrates is unclear and is being investigated (Niedowski 2000).

Numerous species will benefit from the proposed project, including marsh invertebrates, fish species adapted to shallow tidal and intertidal habitats; wading birds, and shorebirds. The reduction in elevation and resulting increase in tidal flushing will provide feeding and nursery areas within the intertidal zone for species such as fiddler crab, banded killifish, and silversides. Avifauna, such as saltmarsh sparrow and seaside sparrow (Ammodramus maritimus) that use wet meadows, freshwater marshes, and saltmarshes will likely benefit from the increase in breeding and staging habitat. Diamondback terrapins, a unique saltmarsh species that is present in portions of Jamaica Bay, may benefit from the creation of low marsh and tidal creeks.

Most of the proposed modifications should have beneficial impacts once the project is completed; however converting one habitat type to another (e.g., replacing *Phragmites* with *Spartina* spp.) may alter species composition, as all habitats do not perform the same functions for fish and wildlife. For example, *Phragmites* supports a different suite of bird species than native saltmarsh plants (Benoit and Askins 1999). Lewis and Casagrande (1997) describe the following suite of species using *Phragmites*: red-winged blackbird, American goldfinch (*Spinus tristis*), yellow warbler, black-crowned night-heron (*Nycticorax nycticorax*) common yellowthroat (*Geothypis trichas*), and swamp sparrow (*Melospiza georgiana*). It is possible that removing stands of *Phragmites* may impact these species. However, their abundance may not be

impacted if there are other suitable habitats available to them nearby (Yasukawa and Searcy 1995). As stated above, other bird species, such as saltmarsh and seaside sparrows, are more likely to use native saltmarsh plants (Benoit and Askins 1999), and might benefit from the conversion. Marsh size and distance from other marshes have been found to influence species richness, with richness decreasing with greater distance from other marshes and when marsh size is less than 12 acres (Brown and Dinsmore 1986). Different species also have different thresholds for minimum marsh size in which they will be found. Modifying or converting habitat may influence how it is used by fish and wildlife species.

Construction Activity

Impacts resulting from construction activities will likely include temporary increases in turbidity and sedimentation of nearshore areas, temporary habitat loss, and direct mortality of sessile organisms. Temporary turbidity plumes created during dredging can reduce dissolved oxygen and increase the tidal channel's sediment load, may reduce photosynthesis, and can resuspend contaminants into the water column.

Turbidity or the suspension of solids in the water column can also be detrimental to both mobile and sessile organisms, sometimes resulting in mortality. Suspended solids in water can affect fish populations by delaying hatching time of fish eggs (Schubel and Wang 1973), killing fish by coating their gills, and by creating anoxic conditions (O'Connor et al. 1976). Sherk et al. (1974) found that demersal fish are more tolerant of suspended solids than filter-feeding fish, resulting in an advantage to demersal fish and a disadvantage to filter feeders. Excavating material may result in an increase in nutrients and anoxic sediments high in organics and sulfides suspended in the water column. Fish tolerance to suspended solids varies from species to species and by age. Mortality of these organisms may be reduced and recolonization rates increased by reducing disturbance to existing saltmarsh communities through the implementation of best management practices, such as erosion control measures and isolating work areas from existing saltmarsh to the extent practicable. The draft Integrated Feasibility Report and Environmental Assessment indicates that the work will be accomplished during low tidal periods and will use best management practices for erosion and sedimentation control (U.S. Army Corps of Engineers 2017).

Direct disturbance to fish and wildlife resources will also occur during the construction phase of this project. Sessile organisms, or those species/life stages with limited mobility, are likely to suffer direct mortality during excavation and indirect mortality from turbidity/ sedimentation. Impacts to sessile organisms are expected to be temporary and of small scale. Mobile organisms will likely be deterred by utilizing the site. Avoidance during specific season (breeding and foraging) may be detrimental to these organisms if they are prevented from successfully breeding/spawning or are unable to forage during migratory stopovers.

Contaminants

The contaminants of greatest concern in sediments in the Study Area are some of the metals. In particular, cadmium, lead and mercury exceeded the ER-M² in soil collected in 2002 as part of the Corps' Feasibility Study (U.S. Army Corps of Engineers 2017; Long and MacDonald 1992). The metal concentrations in excess of the ER-M would place these soils into Class C sediments per the NYSDEC guidance values for screening and assessing contaminated sediment (http://www.dec.ny.gov/docs/fish_marine_pdf/screenasssedfin.pdf). Class C sediments are considered to be highly contaminated and likely to pose a risk to aquatic life.

Dredging sediments can resuspend contaminants, making them more bioavailable (Knott et al. 2009). Adverse effects can begin at the base of the food chain, accounting for toxicity to phytoplankton and autotrophic bacteria (Nayer et al. 2004). Dredging can also result in sediment resuspension which can enhance the growth of water column bacteria and protozoa through release of nutrients. This establishes a pathway for organic contaminants to be accumulated by microorganisms and higher trophic animals (i.e., filter feeding organisms) (Latimer et al. 1999; Zarull et al. 1999). The degree of contaminant bioavailability is determined by 'the reactivity of each contaminant with the biological interface, the presence of other chemicals that may antagonize or stimulate uptake, and external factors such as temperature that affect the rate of biological or chemical reactions' (Luoma 1983 as quoted in Eggleton and Thomas [2004]).

The use of cap material may also pose issues related to recontamination. For example, caps that do not include geotextile or armored barriers can allow burrowing organisms to bring the contaminants to the surface where other organisms can be exposed (Rohr et al. 2016). Klerks et al. (2007) demonstrated that ghost shrimp (Sergio trilobata and Lepidophthalmus louisianensis) burrowing has been shown to move buried metals to the sediment surface in Tampa Bay, Florida. The planting of vegetation can also mobilize buried metals into the leaf litter (Mertens et al. 2007 In Rohr et al. 2016).

Further discussion of contaminants and a literature review of the impacts of contaminants on fish and wildlife resources of the Hudson Raritan Estuary can be found in the draft Fish and Wildlife Coordination Act Report for the Hudson-Raritan Estuary Comprehensive Restoration Plan and Hudson Raritan Ecosystem Feasibility Study dated March 2017.

Cumulative Effects

As described in the Service's Mitigation Policy (40 CFR 1508.20), the Service must consider project impacts, including: (1) the total long-term biological impact of the project, including any secondary or indirect impacts regardless of location; and (2) any cumulative effects, when viewed in the context of existing or anticipated projects. The Council on Environmental Quality

² An ERM is defined as the median concentration of a substance in sediment among sediment samples that were associated with some level of sediment toxicity (Long and MacDonald 1992).

(CEQ) defined cumulative impacts (40 CFR 1508.7) as "the impacts on the environment which results from the incremental impacts of the action when added to other past, present and reasonably foreseeable future actions...."

The Corps' goal is to contribute to National Ecosystem Restoration by restoring degraded ecosystem structure, function, and dynamic processes to less degraded and more natural conditions. As identified above (prior, ongoing, and proposed projects section), there are a number of efforts that have occurred or will occur within the Jamaica Bay watershed. At this time, the Corps is studying two projects located within Jamaica Bay. Many of these efforts will contribute to the improvement of Jamaica Bay and have had or will have beneficial effects on fish and wildlife resources. However, projects such as the East Rockaway Inlet to Rockaway Inlet and Jamaica Bay Reformulation Study will potentially degrade the habitats, through the construction of hardened structures and storm surge barrier/floodgates. Traditional shoreline stabilization methods, or hard structures, result in adverse modification to natural resources: reduced or degraded habitat for breeding, spawning, nesting, feeding, growing; impaired movement of organisms between aquatic and terrestrial habitat; altered physical structure of the water's edge, with resultant changes to hydrology; increased infestation of invasive plants; local changes in water quality, including changes to temperature and increases in turbidity, nutrients and contaminants; and increased erosion of the adjacent natural shorelines and scouring in front of the structure (New York State Department of Environmental Conservation 2016). In the East Rockaway Inlet to Rockaway Inlet and Jamaica Bay Reformulation Study planning aid letter dated August 28, 2016, the Service requested additional information regarding: the anticipated impacts to the hydrological regime within Jamaica Bay from construction of, and the operation of the storm surge barrier; and a sediment budget for the maritime beach/dune system, as well as for Jamaica Bay, in order to better understand the effects of the project on the watershed.

The U.S. Army Corps of Engineers (2016a) concluded that the "recommended plan will have an overall positive cumulative impact and project related improvements will act additively with those of restoration projects taking place around Jamaica Bay." This assessment does not consider the effects of other projects, such as the East Rockaway Inlet to Rockaway Inlet and Jamaica Bay Reformulation Study, Hudson-Raritan Estuary Feasibility Study, and navigation projects.

REQUEST FOR ADDITIONAL INFORMATION

Clarification on Habitat Conversion

The preliminary draft Feasibility Study Report (U.S. Army Corps of Engineers 2016a) states that the project will result in the restoration of approximately 35 ac of habitat, including approximately 7.6 ac of low marsh, 5.4 ac of high marsh, 1.0 ac of scrub-shrub habitat, 2.1 ac of upland, and 19.0 ac of maritime upland. Currently the site contains 17 ac of intertidal marsh and is dominated by smooth cordgrass and 3 ac of high marsh dominated by saltmeadow hay and spike grass (U.S. Army Corps of Engineers 2016a). Based on the maps, it appears that there will be low marsh that will be unaltered by the proposed action. In the Draft FWCA Report, the Service requested that the Corps clarify whether there is a net gain in low and high marsh habitat

conversion. The Corps provided a response to this request (see full response in Appendix A). However, the Service requested additional clarification on net gain or loss of marsh habitat. To achieve this, the Service requests that the Corps develop a table which includes a summary of the acres of existing marsh (high and low) at the site, acres of high and low marsh to be restored by the project, and the total acres of high and low marsh at the end of the project.

Climate Change/Sea-level rise

The tentatively selected plan was optimized to include more high marsh area as well marsh transition zones in order to facilitate marsh migration in the face of sea-level rise. However, the draft Integrated Feasibility Report and Environmental Assessment did not provide additional discussion regarding sea-level rise in relation to project design. In Jamaica Bay, a total of more than 205 hectares (ha) of marsh were lost from 1924 and 1974, and between 1974 and 1999, approximately 304 ha were lost (Hartig et al. 2002). Loss of marsh during the first 50 years is mainly a result of filling, dredging, or draining activities. However, because these activities were stopped by 1974, the cause of marsh loss from 1974 on may be due to reduced sediment input. dredging for navigation channels, boat traffic, and regional sea-level rise (Hartig et al. 2002). Reduced sediment input, dredging for navigation channels, and boat traffic will likely not change drastically in the near future and will, therefore, continue to impact the marshes within Jamaica Bay. In the Draft FWCA Report, the Service recommended that the Corps evaluate the potential direct and indirect effects of projected future sea level change on the project, in the short- and long-term and the associated habitats. The Corps responded, explaining that feasibility level site elevations were designed from the bio-benchmark report using the higher elevation ranges for low and high marsh. They will incorporate future impacts of local sea-level rise using the most recent version of the Corps' sea level change projection methodology summarized in the United States Army Corps of Engineers Regulation (ER) 1100-2-8162. The analysis will be conducted in the pre-engineering design phase. The Corps' full response can be found in Appendix A. The Service recommends that project designs are amended as needed to incorporate effects of future sea-level rise.

Cumulative Impacts

As discussed above, there are a number of projects occurring within the Jamaica Bay Watershed. In our Draft FWCA, the Service recommended the Corps conduct a comprehensive cumulative impacts assessment and provide a copy to the Service prior to the completion of the Final FWCA. In response to this request (see Appendix A for the Corps' full response), the Corps will provide additional discussion regarding cumulative impacts in the draft Integrated Feasibility Report and Environmental Assessment. The Service supports this addition, but still recommends that the Corps complete a comprehensive cumulative impacts assessment of projects within the Jamaica Bay Watershed.

Contaminants

As discussed within the Corps' preliminary draft document (U.S. Army Corps of Engineers 2016a), Areas A-D will be returned to wetlands and covered with a maximum of 12 in. of

sand. Since tidal flows are the main erosional/depositional drivers in the creek systems, in the Draft FWCA the Service requested additional information on how long it will take the newly placed sand (that will not have an established vegetative root system) to erode away and then expose the remaining sections of Areas A-D that had elevated metal concentrations. Additionally, we requested information on how the newly placed sand (growing medium/cap) in the wetland areas will be monitored to ensure that it remains in place.

In their response, the Corps could not provide data for this request as they have not yet performed hydrologic and hydraulic modeling at the site. The Corps explained, however, that at the feasibility level, the area has been designed to an appropriate grade with select channels filled such that areas currently experiencing significant losses due to tidal erosion are expected to be less vulnerable. The Corps expects that over the course of the five-year monitoring period, the planted vegetation will mature such that it will provide stability to the placed sediment. For additional information on vegetation and soil monitoring and qualitative monitoring of the inundation regime, the Corps referred the Service to their Monitoring and Adaptive Management Report (Appendix J of the draft Integrated Feasibility Report and Environmental Assessment).

The Service acknowledges that the project is currently designed at the feasibility level and that the project will be designed further in later stages of planning. The Corps has expressed that additional contaminant sampling will occur and that the design of the wetland cap will be given further consideration. The service would like to note the importance of designing and monitoring the growing medium/wetland cap such that contaminant bioavailability is reduced. As such, the Service recommends that the integrity (*i.e.*, thickness) of the cap should be assessed to ensure that settlement and compaction and/or erosion are not compromising the ability of the cap to protect against exposure of biota to underlying contamination. If the integrity of the cap appears to be compromised, additional monitoring of pore water contaminant concentrations and/or benthic macroinvertebrate bioaccumulation evaluations may be recommended. Furthermore, the Service recommends that the Corps develop a monitoring plan for the wetland cap to ensure its sustainability. Currently, the Monitoring and Adaptive Management Plan does not address this issue.

Red Knot Surveys

The Service is not aware of comprehensive monitoring of red knots on Long Island, New York, or within the Study Area. However, some data for Jamaica Bay is available from individual birders or associated with horseshoe crab monitoring. Red knots have been documented within Jamaica Bay, primarily at Broad Channel and Plumb Beach (eBird 2015). There is the possibility for red knot to occur within the project site prior to and after the completion of this project. In the Draft FWCA Report the Service recommended the Corps undertake a comprehensive red knot survey effort within Jamaica Bay encompassing all the Corps' proposed project sites (e.g., East Rockaway to Rockaway Inlet and Jamaica Bay Reformulation Study) and that the Service would be interested in partnering with the Corps on this effort. The Corps has agreed to conduct pre-construction, construction, and post-construction red knot surveys in the Study Area and will consult with the Service on developing a protocol. The Service supports this effort at the Study Area and will coordinate with Corps on a protocol accordingly.

MITIGATION RECOMMENDATIONS AND FISH AND WILDLIFE ENHANCEMENT MEASURES

General Recommendations

The Service provided the following recommendations in the Draft FWCA Report:

We recommend that the Corps compare the soil data to NYSDEC 2010 Soil Cleanup Guidance values and not older guidance values, as indicated in the report. We recommend using CP-51 Soil Cleanup Guidance (Date Issued: October 21, 2010) (link below). It replaces TAGM #4046.

http://www.dec.ny.gov/docs/remediation hudson pdf/cpsoil.pdf

We recommend that the metal concentrations at the cut lines in Areas A-D are compared to the Saltwater Sediment Guidance Values (Table 6 in New York State Department of Environmental Conservation 2014, see pdf link, below) since this area will become wetlands.

http://www.dec.ny.gov/docs/fish marine pdf/screenasssedfin.pdf

The Corps has responded to this recommendation and will update the Integrated Feasibility Report and Environmental Assessment to cite NYSDEC 2010 Soil Cleanup Guidance values.

Mitigation Recommendations

Invasive Species Management

The Corps proposes to apply a glyphosate based systemic herbicide like Rodeo during initial invasive/exotic vegetation removal and control. In the Draft FWCA Report, the Service recommended that the Corps consider a multi-prong approach to removing common weed, including other control methods (*i.e.*, non-chemical, biological, and mechanical). We also directed the Corps to Hazelton *et al.* (2014) which provides descriptions of alternative approaches to common reed removal. Additionally, the Service recommended that the Corps and the local partner develop a long-term invasive species management program in order to ensure success of this project element. The monitoring plan guidance developed by Neidowski (2000) includes suggestions and a literature review for common reed monitoring and management.

The Corps' has responded that they will use both physical removal and the use of pesticides in the management of invasive species. The Service has no further comment on the chosen methods of invasive species management at this time. In regard to developing an invasive species management plan, the Corps provided the following response: "Post construction monitoring and management will be performed over a period of five years; at which point it will be turned over to the local sponsor. The team has set a monitoring performance target of at least 85% coverage of target hydrophytes." The Corps also referred to their Monitoring and Adaptive Management Plan for further information pertaining to post-project monitoring and management.

Currently, the Monitoring and Adaptive Management Plan identifies that physical removal and pesticides will be used to remove invasive species, but does not provide additional information about invasive species removal or monitoring. The Service recognizes that the Monitoring and Adaptive Management Plan has been written at a feasibility level and that the Corps intends to revise and add to the plan in future stages of project development. The Service recommends that an invasive species management plan is developed and incorporated into the Monitoring and Adaptive Management Plan as it progresses. In addition to our previously recommended references (Hazelton et al. 2014 and Neidowski 2000), the Corps may also find the New York City Department of Park and Recreation's "2012 Bronx River Riparian Invasive Plant Management Plan" (Yau et al. 2012) a helpful resource in the development of an invasive species management plan. The Service requests the opportunity to review and comment on future revisions of the Monitoring and Adaptive Management Plan.

Design Criteria

The position and extent of vegetation communities in tidally-influenced systems are largely controlled by elevation and salinity. The proximity of the Study Area to Jamaica Bay should ensure that soil and surface water salinities are suitable for supporting high and low marsh systems. Elevation determines the frequency and duration of tidal inundation of biological communities. For example, low marsh areas are typically flooded twice daily by tidal flow, while high marsh communities are usually only flooded during high spring tides associated with full moon and new moon events, or during storm tide events. The tidal wetland design must plan for future tidal and flow regimes, consistent with models that predict sea-level rise associated with climate change. As per recommendations in the Draft FWCA Report, the Corps has agreed to coordinate with the Service in the development of plans and specifications of the project design.

Planting Plan Recommendations

The Corps has agreed to incorporate the following planting plan recommendations that were provided in the Draft FWCA Report. Additionally, in order to ensure local plants of diverse genetic stock, the Service also recommends that the Corps incorporate the recommendations and mitigation measures pertaining to the sourcing of native plants that were provided in the Draft FWCA Act Report for the Hudson-Raritan Estuary Comprehensive Restoration Plan and Hudson Raritan Ecosystem Feasibility Study dated March 17, 2017.

General Information/Best Management Practices

The soil bores indicated that the upper levels of the soil profile consisted largely of historic dredge material with household and construction debris mixing in at depth in some areas. Following the removal of the spoil material, the residual seedbed should be tested for nutrient content and, if needed, the soil should be augmented if needed based on the planting plan.

To minimize short-term increases in turbidity, work should begin from the landward side before "breaking out" into open water areas. Silt fence should be properly installed between disturbed

areas and adjacent wetlands. At least 6 in. of the toe of the silt fence should be buried parallel to the ground surface on the upslope side of the fence. The silt fence should be inspected following installation and after significant storm events to ensure that it is functioning properly. Silt fence is preferable to hay or straw bales as the bales represent a potential undesirable seed source in maritime shrubland or grassland habitats. To the extent possible, local sources of vegetation should be used to help ensure that the species planted are well adapted to the region.

If outside contractors are used for the work, it is generally advantageous to have third-party or Corps inspectors on-site to ensure that proper construction and restoration techniques are used. Although adding to project costs, competent inspectors can greatly increase the chances of successful restoration. Broome (1990) and Niedowski (2000) provide detailed information on establishing various saltmarsh communities. We have summarized their recommendations below.

Low Marsh

Saltmarsh cordgrass can be propagated by bareroot seedlings, plugs, or seedlings in peat pots (Broome 1990). Direct seeding is generally less reliable and there have been incidences when low seed viability reduced successful establishment of this species. Bareroot seedlings or plugs are generally less expensive than potted seedlings. Most low saltmarsh planting plans involve planting plugs on 24-in. or 36-in. centers. We recommend that saltmarsh cordgrass plugs be planted on 18-in. centers along the newly created creek banks and areas subject to wave action. The closer spacing will reduce the time to establish dense cover and will reduce opportunities for erosion. If Canada geese or brant are abundant in the Study Area following planting, they may pose a risk to the successful establishment of dense stands of vegetation. Fencing or frequent disturbance may be necessary to prevent overbrowsing of the freshly-planted marsh areas.

High Marsh

Like saltmarsh cordgrass, saltmeadow hay and spike grass can be propagated by bareroot seedlings and plugs. Seeding is not as effective for this species and would require the collection of mature seed and cold stratification of the seed over the winter and spring months. Fertilization may also be necessary, but the greater interval between tidal flushes allows the use of standard (as opposed to slow-release) fertilizers (Broome 1990). We recommend planting at 24-in. centers to quickly establish a dense cover of vegetation to reduce the opportunity for common reed to become established. Geese and brant may need to be discouraged from using the site until the vegetation becomes established.

Maritime Grassland

The Service recommends that the Corps adhere to establishment protocols designed for native warm season grasses and that they use a native warm season grass mix that is reflective of species that would naturally occur in the Low Coastal Plain Physiographic Zone. Establishment of native warm season grasses is a more complicated process than the use of standard conservation mixes of introduced cool season grasses. Warm season grasses allocate resources

to root systems before significant shoot growth is observed, so most of the above ground growth does not occur until the second growing season. Because of this root system development, they are well adapted to well-drained soils and dry conditions.

Various seed mixes are available for grassland establishment. Typical species adapted to the Low Coastal Plain Physiographic Zone and available commercially include big bluestem (Andropogon gerardii), sweet vernal grass (Anthoxanthium odoratum), sand lovegrass (Egrostis trichodes), little bluestem (Schizacrium scoparium), and Indian grass (Sorghastrum nutans). Detailed information on warm season grass establishment and management can be found in Dickerson et al. (1998). As stated above, measures may have to be implemented to reduce grazing by geese or brant until the vegetation is established and is of sufficient height and vigor.

Transition Zones

Marsh elder (*Iva frutescens*) and groundsel tree (*Baccharis halimifolia*) are two species well adapted to transition zones between low marsh and adjacent uplands. These species are also tolerant of saline conditions and infrequent tidal inundation. Peat pots or bareroot seedlings should be planted on 3-ft (90 centimeter) centers. To stabilize slopes, we recommend a conservation mix containing annual rye (*Lolium* spp.) for quick cover and slope stabilization, and a native grass such as switchgrass (*Panicum virgatum*) that will increase habitat diversity and help prevent common reed colonization.

Upland Enhancement

Upland enhancement consisting of the establishment of woody plant species to improve habitat diversity and aesthetics is proposed for a portion of the Study Area. The Long Island Shore Species seedling mix produced by NYSDEC's Saratoga Tree Nursery may be a suitable mix of species for well-drained portions of the proposed disposal area. Portions of the disposal area with finer-grained sediments and those that are somewhat poorly-drained could be planted with other species such as pin oak (*Quercus palustris*), sweetgum (*Liquidambar styraciflua*), red mulberry (*Marus rubra*), and sassafras (*Sassafras albidium*). The soil conditions in the enhancement areas should be examined and soil fertility should be tested to determine the appropriate species and need for soil augmentation.

Coordination with Port Authority of New York and New Jersey

Wildlife management is a significant issue at airports, including at JFK Airport adjacent to Jamaica Bay. Aircraft colliding with wildlife, particularly birds, can pose a risk to air travel on and around airports. Restoring and managing habitat within the vicinity of airports can have impacts on overall bird populations in the area which may contribute to the likelihood of bird strikes. Due to this concern, the Service recommended in the Draft FWCA Report that the Corps coordinate with the PANYNJ while developing planting plans in order to avoid attracting species that may increase the need for the PANYNJ to carry out wildlife mitigation measures including habitat modification, egg addling, nest removal, and diversion. In their response to the Draft FWCA Report, the Corps has agreed to coordinate with PANYNJ on this issue.

Removal and Relocation of the Sewer Line

The Recommended Plan does not include the removal and relocation of the sewer line. Tidal restrictions may affect saltmarshes resulting in lower sediment supply, reduced drainage upriver of the restriction, and reduced saltmarsh accretion (Correll *et al.* 2016). The reduction in the amount of the tidal constriction at the sewer line crossing may remove these potential impacts. In the Draft FWCA Report, the Service recommended the incorporation of this measure into the recommended plan in order to improve flushing. The Corps acknowledged the merit of this recommendation, but will not be able to add this element to the recommended plan due to budget limitations. If the removal of the sewer line could be done such that the restored flow provides increased resilience to sea-level rise for the marsh and marsh-dependent species, the Service still supports the removal and relocation of the sewer line should funding become available in the future.

Time-of-Year Restrictions

The U.S. Army Corps of Engineers (2016a) stated that construction is likely to take place during winter months. The Service supports this measure as it will avoid the breeding and nesting season of most bird species. Since diamondback terrapin overwinter in the bottom of estuaries, creeks and salt marsh channels the Service recommended in the Draft FWCA Report that the Corps coordinate with the Service and NYSDEC to develop a diamondback terrapin removal and relocation plan in order to reduce mortality during the construction. The Corps has agreed to coordinate with the appropriate agencies on developing the recommended removal and relocation plan.

Species Specific Recommendations

In the Draft FWCA Report, the Service requested the opportunity to coordinate with the Corps on project design specifications for the following species. We provided the following preliminary recommendations for the Corps to consider.

Saltmarsh Sparrow

Saltmarsh sparrows are identified as a species of highest priority on the BCR30 BCC 2008 list. As discussed above, they breed in wet meadows and edges of freshwater marshes and saltmarshes, with most nests located in medium-height cordgrass growing just below mean high-tide level and in saltmeadow areas above mean high tide. Shriver *et al.* (2015 *In* Correll *et al.* 2016) determined that this species was declining at a rate of 9.0 percent annually. On an annual time-frame, tidal restrictions may benefit this species by providing refuge and may have a positive impact on seasonal fecundity, however, over decades, these same sites demonstrated a steeper rate of decline, possibly due to long-term reduction of sediment and the resulting loss of resiliency to sea-level rise (Correll *et al.* 2016). As such, the previous recommendation to remove and relocate the sewer line may result in short-term negative impacts to saltmarsh sparrows but may reduce long-term declines if the removal results in increased sediment supply to the marsh. While restoring tidal flow alone will not create habitat for this species,

incorporating high-elevation marsh into the project design may offset the potential short-term impacts from the removal of the tidal restriction. Prior to the decision to remove the sewer line, its impact on sediment input into the marsh should be fully understood. Additionally, it would be important to carefully design the marsh such that there are sufficient areas of appropriate elevation to function as nesting habitat should tidal amplitude increase after the restriction is removed.

Diamondback Terrapin

Diamondback terrapins utilize *Spartina* marshes for foraging, nursery and overwintering habitats and the adjacent uplands for nesting. The Corps considered the incorporation of turtle mound creation within several of the alternatives but ultimately did not include this design element in the recommended plan, in order to minimize the risk of common reed re-establishment. The Service has some initial concerns regarding the Corps' justification for the elimination of this design element. The Service's position is that the Corps should design this project and carry out monitoring efforts and adaptive management to ensure that common reed does not re-establish.

In general, the Service recommends that the Corps incorporate measures to enhance/promote and/or protect terrapin nesting habitat.

The Corps responded that, in the current state of planning, they have recommended restoration alternatives that fulfill their requirements for environmental benefits and cost effectiveness. They explained that they will have the opportunity to optimize their designs as the planning process is advanced into the preconstruction, engineering, and design stage, and will coordinate any optimization, to the extent possible, with the Service. The Service will continue to coordinate with the Corps in the development of project elements for these species and the planning for this project proceeds.

Monitoring and Management

We recommend that The Corps develop a plan to fully characterize contaminants in the Study Area as part of project design. Additional soil and sediment sampling should be conducted to identify current concentrations of chemicals in surface soil/sediment or soil/sediment that is likely to be exposed as a part of dredging operations. A sufficient number of sampling locations should be selected to fully characterize the Study Area. Earlier soil sampling conducted in 2002/2003 (U.S. Army Corps of Engineers 2017) identified some metals (particularly arsenic, cadmium, lead and mercury) and polycyclic aromatic hydrocarbons (PAHs) to be of the greatest concern. We have compared the concentrations of metals and PAHs detected in soil to guidance values for sediment, based on the assumption that these soils are or may become part of the aquatic environment.

At several soil sampling sites, the metals were elevated above the ER-M (Effects Range Median – Long and MacDonald 2004) and would be classified as Class C sediments per the NYSDEC document "Screening and Assessment of Contaminated Sediments" (New York State Department of Environmental Conservation 2014). Class C sediments are considered to be

highly contaminated and likely pose a threat to aquatic life (Figure 6). We note that the lead concentration in a number of soil samples from 2002/2003 well exceeded the Class C sediment guidance value of 220 milligrams (mg)/killigrams (kg), with concentrations as high as 7,100 mg/kg. In addition, a few soil samples from 2002 had concentrations of total PAHs in excess of the NYSDEC Class C sediment guidance value of 45 mg/kg (determined by summing the concentrations of PAH analytes). The goal should be to remove these highly contaminated soils, using care to minimize off-site transport.

Table 6. Saltwater Sediment Guidance Values. Class A sediments are considered to be of low risk to aquatic life. Class B sediments are slightly to moderately contaminated and additional testing is required to evaluate the potential risks to aquatic life. Class C sediments are considered to be highly contaminated and likely to pose a risk to aquatic life. All values are dry weight values rounded to two significant digits.

Compound	Class A	Class B	Class C	Derivation
Metals, mg/kg or PPM				
Arsenic	< 8.2	8.2 – 70	> 70	4
Cadmium	< 1.2	1.2 - 9.6	> 9.6	4
Chromium	< 81	81 – 370	> 370	4
Соррег	< 34	34 – 270	> 270	4
Lead	< 47	47-220	> 220	4
Mercury	< 0.15	0.15 - 0.71	> 0.71	4
Nickel	< 21	21 - 52	> 52	4
Silver	< 1.0	1.0 – 3.7	> 3.7	4
Zinc	< 150	150-410	>410	4

Figure 6. Saltwater Sediment Guidance Values, Excerpted from NYSDEC (2014).

The NYSDEC recommends that Class C sediment be removed or dredged in such a way as to isolate them from the adjacent areas and minimize loss of sediment (New York State Department of Environmental Conservation 2004). For soil contaminated at these concentrations, we recommend the use of silt curtains and avoidance of soil removal during wet weather conditions that may wash contaminated soil into adjacent waterways. Any soil or sediment classified as Class C should be disposed at an upland site and capped with clean fill.

During design, the Corps should evaluate soil contaminant data and develop a plan to remove or isolate contaminated soil and sediment to minimize its bioavailability and impact to fish and wildlife resources.

Additionally, the Service also recommended that the Corps develop an adaptive management plan to ensure the success of this restoration project. The Corps has provided a Monitoring and Adaptive Management Plan as an appendix to their draft Integrated Feasibility Report and Environmental Assessment. As previously discussed, the Monitoring and Adaptive Management Plan has been developed at a feasibility level and the Corps has explained it will be revised in the future as the project progresses. The Service requests the opportunity to continue to review and comment on the Monitoring and Adaptive Management Plan as it develops.

Public Access

The Corps recognized the opportunity to enhance wildlife-dependent public use of the site including the development of public access, walking trails, and education (i.e., interpretive signage). The Service supports these efforts as they will allow the general public to view these species and gain an understanding of the significance of this habitat

SUMMARY OF FINDINGS AND SERVICE POSITION

In general, the Service supports the Corps' effort to restore fish and wildlife habitat. We have provided the Corps with comments on their plan to improve the habitat for fish and emergent wetland-dependent wildlife species within the project area by restoring tidal marsh, maritime grassland, and upland shrub communities that will be beneficial to many fish and wildlife species. Specifically, the Service has made recommendations regarding invasive species. adaptive management, and monitoring plans. The Service has also provided guidance and protocols for vegetative plantings, target wildlife species, and contaminant sampling. Temporary impacts resulting from the project will include localized increases in turbidity, loss of vegetated areas, and disturbance to fish and wildlife species using the adjacent areas. These impacts are expected to be short-term. Resuspension of contaminants and recontamination of restored areas may have more long-term effects if not addressed adequately. Long-term benefits will be realized by fish species that require low marsh habitat for foraging and/or nursery areas provided all concerns regarding contaminants and sea-level rise have been addressed. Wildlife species that will likely benefit include birds, reptiles, and mammals that require maritime uplands (including scrub/shrub and forest habitats), open grasslands, and flooded emergent marsh habitat. The Service has provided recommendations in this report which will help to avoid or minimize project related impacts and provides additional recommendations for enhancement opportunities. The Corps should fully consider the potential effects of sea-level rise on project designs.

REFERENCES

- Benoit, L.K., and R.A. Askins. 1999. Impact of the Spread of *Phragmites* on the Distribution of Birds in Connecticut Tidal Marshes. Wetlands. 19:1-42.
- Benotti, M.J., and B.J. Brownawell. 2007. Distributions of Pharmaceuticals in an Urban Estuary during both Dry- and Wet-Weather Conditions. Environmental Science Technology 41:5795-5802.
- Botton, M.L., and R.E. Loveland. 2002. Suitability of Habitats in Jamaica Bay for Horseshoe Crabs. *In Jamaica Bay Ecosystem Research and Restoration Team Final Report.*National Park Service, Division of Natural Resources, Gateway National Recreation Area, Staten Island, NY.
- Broome, S.W. 1990. Creation and Restoration of Tidal Wetlands of the Southeastern United States. Pages 37-72 *In J.A.* Kusler and M.E. Kentula (*eds.*) Wetland Creation and Restoration: The Status of the Science. Island Press, Washington, D.C.
- Brown, M. and J.J. Dinsmore. 1986. Implications of Marsh Size and Isolation for Marsh Bird Management. Journal of Wildlife Management 50: 392-397.
- Burke, R.L., S. Ner, and G.W. Frame. 2002. Inventory of Mammals, Reptiles, and Amphibians at Jamaica Bay, New York, May 2000 through May 2001. *In Jamaica Bay Ecosystem Research and Restoration Team Final Report.* National Park Service, Division of Natural Resources, Gateway National Recreation Area, Staten Island, NY.
- Byer, M.D. 2002. Report on Vegetation. *In Jamaica Bay Ecosystem Research and Restoration Team Final Report.* National Park Service, Division of Natural Resources, Gateway National Recreation Area, Staten Island, NY.
- Chamber, R.M., L.A. Meyerson, and K. Saltonstall. 1999. Expansion of *Phragmites australis* into Tidal Wetlands of North America. Aquatic Botany 64:261-273.
- Correll, M.D., W.A. Wiest, T.P. Hodgman, W.G. Shriver, C.S. Elphick, B.J. McGill, K.M. O'Brien, and B.J. Olsen. 2016. Predictors of Specialist Avifaunal Decline in Coastal Marshes. Conservation Biology. DOI:10.1111/cobi.12797.
- Currin, C.A., W.S. Chappell, and A. Deaton. 2010. "Developing Alternative Shoreline Armoring Strategies: the Living Shoreline Approach in North Carolina." H. Shipman, M.N. Deithier, G. Gelfenbaum, K.L. Fresh, RS Dinicola, *eds.* (2010): 91-102.
- Dickerson, J., B. Wark, D. Burgdorf, T. Bush, C. Miller, R. Maher, and B. Poole. 1998. Vegetating with Native Grasses in Northeastern North America. U.S. Department of Agriculture, Natural Resources Conservation Service, Washington, D.C., and Ducks Unlimited Canada, Winnipeg, Manitoba.

- eBird. 2015. eBird: An Online Database of Bird Distribution and Abundance [web application]. eBird, Ithaca, NY. [Available online at: http://www.ebird.org]
- Eggleton, J., and K.V. Thomas. 2004. A Review of Factors Affecting the Release and Bioavailability of Contaminants during Sediment Disturbance Events. *Environment International* 30: 973–980.
- Feinberg, J., and R. Burke. 2004. The Diamondback Terrapin Gateway's Salt Marsh Turtle. Accessed on June 22, 2016. [Available online at: https://people.hofstra.edu/faculty/Russell_L_Burke/gateway_brochure3.html]
- Field, C.B., L.D. Mortsch, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running, and M.J. Scott. 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.), Cambridge University Press, Cambridge, UK, 617-652.
- Franz, D. R. 1982. An Historical Perspective on Mollusks in Lower New York Harbor, with Emphasis on Oysters. *In G. F. Meyer*, ed. Ecological Stress and the New York Bight: Science and Management. Columbia, SC: Estuarine Research Federation. pp. 181–197.
- Grambo, G., and Vega, C. 1984. Jamaica Bay: A Site Study. U.S. Geological Survey, Long Island Division, Coram, NY.
- Greenlaw, J.S., and J.D. Rising. 1994. Saltmarsh Sharp-tailed Sparrow (Ammodramus caucacutus), The Birds of North America Online (A. Poole, ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: https://birdsna.org/Species-Account/bna/species/sstspa/introduction
- Hartig, E.K., V. Gornitz, A. Kolker, F. Mushacke, and D. Fallon. 2002. Anthropogenic and Climate-change Impacts on Salt Marshes of Jamaica Bay, New York City. *Wetlands* 22: 77-89.
- Hazelton E.L. G., T.J. Mozdzer, D.M. Burdick, K.M. Kettenring, and D.F. Whigham. 2014. *Phragmites australis* Management in the United States: 40 Years of Methods and Outcomes. AoB PLANTS 6: plu001; doi:10.1093/aobpla/plu001.
- Howe, M.A., R.B. Clapp, and J.S. Weske. 1978. Marine and Coastal Birds. Marine Ecosystem Analysis (MESA) Program, MESA New York Bight Atlas Monograph 31. SeaGrant Institute, Albany, NY.
- Klerks P.L., D.L. Felder, K. Strasser, and P.W. Swarzenski. 2007. Effects of Ghost Shrimp on Zinc and Cadmium in Sediments from Tampa Bay, FL. *Marine Chemistry* 104:17-26.

- Knott N.A., J.P Aulbury, T.H. Brown, and E.L. Johnston. 2009. Contemporary Ecological Threats from Historical Pollution Sources: Impacts of Large-Scale Resuspension of Contaminated Sediments on Sessile Invertebrate Recruitment. *Journal of Applied Ecology* 46:770–781.
- Kurtzke, C.D. and M. Schreibman. 2002. Jamaica Bay Ecological Research and Restoration Team (JABBERT) Fisheries Data. *In Jamaica Bay Ecosystem Research and Restoration* Team Final Report. National Park Service, Division of Natural Resources, Gateway National Recreation Area, Staten Island, NY.
- Lapin, B., and J. Randall. 1993. *Phragmites australis (Phragmites communis)*. Element Stewardship Abstract, The Nature Conservancy, Arlington, VA.
- Latimer, J.S., W.R. Davis, and D.J. Keith. 1999. Mobilization of PAHs and PCBs from In-Place Contaminated Marine Sediments during Simulated Resuspension Events. *Estuarine Coastal and Shelf Science* 49: 577-595.
- Lewis, C., and D.G. Casagrande. 1997. Using Avian Communities to Evaluate Salt Marsh Restoration. Restoration of an Urban Salt Marsh: an Interdisciplinary Approach. New Haven, CT. Yale School of Forestry and Environmental Studies Bulletin 100: 204-236.
- Long, E.R., and D.D. MacDonald. 1992. National Status and Trends Program Approach. . pp. 14-1-14-7. In: Sediment Classification Methods Compendium. EPA 823-R-92-006, EPA Office of Water (WH-556), Washington, D.C
- Luoma, S.N. 1983. Bioavailability of Trace Metals to Aquatic Organisms a Review. Science of the Total Environment 28:1-22.
- Mergen, F. 1959. A Toxic Principle in the Leaves of Ailanthus. Botanical Gazette 121:32-36
- Mertens, J., L. Van Nevel, A. De Schrijver, F. Piesschaert, A. Oosterbaan, F.M.G. Tack, and K. Verheyen. 2007. Tree Species Effect on the Redistribution of Soil Metals. Environmental Pollution 149:173-181.
- National Audubon Society. 2013. Important Bird Area: Jamaica Bay Site Profile. Accessed on August 8, 2016. [Available online at: http://www.audubon.org/bird/iba]
- National Park Service. 2007. Data from the 2007 Jamaica Bay Bioblitz. Accessed on August 8, 2016. [Available online at: http://www.ciesin.org/jamaicabay/stakeholder/fed_nps.j sp]
- Nayer, S., B.P. Goh, and L.M. Chou. 2004. Environmental Impact of Heavy Metals from Dredged and Resuspended Sediments on Phytoplankton and Bacteria Assessed in *in situ* Mesocosms. *Ecotoxicology and Environmental Safety* 59(3): 349-369.

- Neidowski, N.L. 2000. New York State Salt Marsh Restoration and Monitoring Guidelines. New York State Department of State, Albany. 136 pp.
- New York City Department of Environmental Protection. 2007. Jamaica Bay Watershed Protection Plan. [Available online at: http://www.nyc.gov/html/dep/html/dep projects/jamaica bay.shtml#plan]
- _____. 2014. Jamaica Bay Watershed Protection Plan: 2014 Update. [Available online at: http://www.nyc.gov/html/dep/html/dep projects/jamaica bay.shtml#plan]
- New York State Department of Environmental Conservation. 2004. In-Water and Riparian Management of Sediment and Dredged Material. Technical & Operational Guidance Series (TOGS) 5.1.9. Division of Water.
- . 2005. The Second Atlas of Breeding Birds in New York State.

 NYSDEC, Fish, Wildlife and Marine Resources, Albany, NY. [Available online at: http://www.dec.ny.gov/animals/7312.html]
- . 2014. Screening and Assessment of Contaminated Sediment. New York State Department of Environmental Conservation Division of Fish, Wildlife and Marine Resources, Bureau of Habitat.
- ______. 2016 Shoreline Stabilization: Ecological Importance of Natural Shorelines and Proper Shoreline Stabilization. Accessed on 08/17/16. [Available online at: http://www.dec.ny.gov/permits/50534.html]
- New York State Department of State. 1992. Jamaica Bay Significant Coastal Fish and Wildlife Habitats, NYS Department of State Office of Planning and Development, Accessed on August 8, 2016. [Available online at: http://www.dos.ny.gov/opd/programs/consistency/Habitats/nyc/Jamaica_Bay.pdf]
- Ning, L, E.E. Riddle, and R.S. Bradley. 2015. Projected Changes in Climate Extremes over the Northeastern United States. American Meteorological Society, April 2015. [Available online at: https://doi.org/10.1175/JCLI-D-14-00150.1]
- O'Connor, J.M., Neumann, and J.A. Sherk, Jr. 1976. Lethal Effects of Suspended Sediments on Estuarine Fish. TP 76-20. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA.
- Rohr, J.R., A.M. Farag, M.W. Cadotte, W.H. Clements, J.R. Smith, C.P. Ulrich, and R. Woods. 2016. Transforming Ecosystems: When, Where, and How to Restore Contaminated Sites. *Integrated Environmental Assessment and Management* 12(2): 273–283.
- Roman, C.T., W.A. Neiring, and R.S. Warren. 1984. Salt Marsh Vegetation Change in Response to Tidal Restriction. Environmental Management 8:141-150.

- Schubel, J.R., and D.P. Wang. 1973. The Effects of Suspended Sediment in Northern Chesapeake Bay. Powder Technology 6:9-16.
- Sherk, J.A., J.M. O'Conner, and D.A. Neumann. 1974. Effects of Suspended and Deposited Sediments on Estuarine Organisms, Phase II. Reference No. 74-02, National Research Institute, Solomons, MD.
- Steinberg, N., D.J. Suszkowski, L. Clark, and J. Way. 2004. Health of the Harbor: The First Comprehensive Look at the State of the NY/NJ Harbor Estuary. A Report to the NY/NH Harbor Estuary Program. Hudson River Foundation, New York, NY. 82 pp.
- U.S. Army Corps of Engineers. 2016a. Preliminary Draft Integrated Ecosystem Restoration Report and Environmental Assessment Spring Creek Ecosystem Restoration Project Spring Creek Park Brooklyn and Queens, NY. New York District, New York, NY. . 2016b. Atlantic Coast of New York, East Rockaway Inlet to Rockaway Inlet and Jamaica Bay: Draft Hurricane Sandy General Reevaluation Report and Environmental Impact Statement: Volume III: Environmental Appendix. Dated June 17, 2016. New York District, New York, NY. . 2017. Draft Integrated Ecosystem Restoration Feasibility Report and Environmental Assessment Spring Creek Ecosystem Restoration Project Spring Creek Park Brooklyn and Queens, NY. New York District, New York, NY. U.S. Fish and Wildlife Service. 1981. U.S. Fish and Wildlife Service Mitigation Policy. Federal Register, Friday, January 23, 1981. 46:7644-7663. . 1996. Piping Plover (Charadrius melodus), Atlantic Coast Population, Revised Recovery Plan. Hadley, MA. 258 pp. . 1997. Significant Habitats and Habitat Complexes of the New York Bight Watershed. U.S. Fish & Wildlife Service, Southern New England, New York Bight Coastal Ecosystems Program, Charlestown, RI. . 2004. Final Fish and Wildlife Coordination Act Report on Spring Creek Ecosystem Restoration Project Borough of Queens and Borough of Brooklyn, New York. U.S. Fish & Wildlife Service, New York Field Office, Cortland, NY. 12pp. . 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird

http://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf]

Management, Arlington, VA. 85 pp. [Available online at:

- . 2011. Roseate Tern: North American Subspecies Fact Sheet.

 U.S. Fish and Wildlife Service, Hadley, MA. [Available online at: https://www.fws.gov/northeast/pdf/roseatetern0511.pdf]

 . 2014. Rufa Red Knot Background Information and Threats

 Assessment Supplement to Endangered and Threatened Wildlife and Plants; Final
 Threatened Status for the Rufa Red Knot (Calidris canutus rufa). Federal Register No 1.
 79 No. 238,50 CFR Part 17 [Docket No. FWS-R5-ES-2013-0097;4500030113]
- Veit, R.R., A. Bernick, and J. Santora. 2002. Birds of the Jamaica Bay Ecosystem. *In Jamaica* Bay Ecosystem Research and Restoration Team Final Report. National Park Service, Division of Natural Resources, Gateway National Recreation Area, Staten Island, NY.
- Waldman. J. 2008. Research Opportunities in the Natural and Social Sciences at the Jamaica Bay Unit of Gateway National Recreational Area. Prepared for the National Park Service, Jamaica Bay Institute. Biology Department, Queens College, Flushing, NY.
- Warren, R.S., and P.E. Fell. 1995. Tidal Wetland Ecology of Long Island Sound. *In G.D.*Dreyer and W.A. Neiring, *eds.* Tidal Marshes of Long Island Sound, Bulletin No. 34.
 Connecticut College Arboretum, New London, CT.
- Yasukawa, K., and W.A. Searcy. 1995. Red-winged Blackbird (*Agelaius phoeniceus*). In A. Poole and F. Gill (*eds.*). The Birds of North America, no 184. Washington, DC.
- Yau, F., M. Larson, K. McCarthy, K. Bounds, A. Thornbrough, and D. Doroski. 2012. 2012 Bronx River Riparian Invasive Plant Management Plan. New York City Department of Parks and Recreation, National Resources Group. Prepared in partnership with the Bronx River Alliance and New York Botanical Garden.
- Zarull, M. A., Hartig, J. H., and Maynard, L. 1999. Ecological Benefits of Contaminated Sediment Remediation in the Great Lakes Basin. International Joint Commission (IJC) Digital Archive. [Available online at: https://scholar.uwindsor.ca/ijcarchive/542]
- Zarnoch, C.B., and M.P. Schreibman. 2012. Reproduction of Eastern Oysters, *Crassostrea Virginica*. *In* a New York City Estuary: Implications for Restoration. Urban Habitats. ISSN 1541-7115.

APPENDIX A

The United States Army Corps of Engineers Response to the Draft Fish and Wildlife Coordination Act Report for the Spring Creek Ecosystem Restoration Project (August 2016)

November 22, 2017

The United States Army Corps of Engineers (USACE), New York District (District) provides this response to the United States Fish and Wildlife Service's (USFWS) Draft Fish and Wildlife Coordination Act Report (FWCAR), dated August 2016, for the Spring Creek Ecosystem Restoration Project, and serves as ongoing coordination with USFWS.

Comment Responses:

Request for Additional Information:

1. Clarification of habitat conversion: The Service requests information of if there a net gain in low and high marsh habitat conversion? Based on the maps, it appears that there will be low marsh that will be unaltered by the proposed action.

Response: The proposed activity purpose is to restore the Spring Creek Study Area's adverse impacts associated with the historic dredge and fill activities executed as part of constructing and maintaining the Jamaica Bay navigation channel. This will be accomplished by removing the material and re-contouring the Area to near historic conditions (based on adjacent land use).

2. The Service has made a request for a Sea Level Rise analysis.

Response: One of the goals of the Spring Creek project is to create a resilient tidal wetlands in the face of sea level rise. To support the project design, the District will incorporate future impacts of local sea level rise using the most recent version of the USACE sea level change projection methodology summarized in United States Army Corps of Engineers Engineering Regulation (ER) 1100-2- 8162. This analysis will be conducted in the pre engineering design phase. Current, feasibility level site elevations were designed from the biobenchmark report using the higher elevation ranges for low and high marsh.

3. The Service recommends the District conduct a comprehensive cumulative impacts assessment to include the East Rockaway to Rockaway Inlet and Jamaica Bay Reformulation Study and navigation projects.

Response: The following section will be added to the Cumulative Impacts Section of the FR/EA (please note: the Reformulation Study Team is no longer recommending a storm surge barrier for construction).

Maintenance dredging of the entrance channel of the Jamaica bay Federal Navigation Channel at Rockaway Inlet occurs approximately every 2 years and is scheduled to occur in the fall/winter 2018. The channel was last dredged under the Operations and Maintenance Dredging Program in 2012, with the removal of approximately 271,250 cubic yards (CY) of sand, which was used in a beneficial manner as beach nourishment placed along the Rockaway Beach shoreline.

The Atlantic Coast of New York, East Rockaway Inlet to Rockaway Inlet and Jamaica Bay Reformulation Study is currently analyzing the feasibility of providing discrete coastal storm risk management features to address high frequency flooding in the communities surrounding Jamaica Bay. The determination of feasibility will depend on which features are independently justified economically and can function separably to address high frequency flooding in densely populated low-lying areas. The current measures to address coastal flood risk under consideration are: flood walls, revetment, flood gates, and berms; the project delivery team is looking for opportunities to include natural and nature-based features and built-in mitigation for any environmental impacts caused by CSRM features wherever possible.

The future actions considered will modify their respective study areas through modification of the waterways and flood risk management measures such as the addition of hard structures, removal and placement of sediment along bay bottom, clearing of vegetation, and alteration of hydrology. Dredging of the Rockaway Inlet navigation channels may be act as sediment sinks and the increased wave energy and sediment flushing time caused by a deeper average depth may affect sediment accretion in Jamaica Bay overall. However, dredging of the interior channels nearer to the study area rarely occur, decreasing any cumulative effects when combined with the Spring Creek project. While these actions will result in both temporary and long term impacts to biological resources and water quality locally, it is not expected that they will act cumulatively with the TSP to negatively affect Jamaica Bay.

4. The Service requests additional information on how long it will take the newly places sand to erode away and then expose the remaining sections of Areas A-D that have elevated metal concentrations? Additionally a request is made for information on how the newly placed sand in the wetland area will be monitored to ensure that it remains in place?

Response: The District has not performed H&H modeling on the site to provide data for this specific request. The area has been designed, at a feasibility level, to an appropriate grade with select channels filled such that areas currently experiencing significant losses due to tidal erosion are expected to be less vulnerable. It is expected that over the course of the 5 year monitoring period the planted vegetation will mature to a place where it will provide stability to the placed sediment. See Monitoring and Adaptive Management Report (attached) for information on vegetation and soil monitoring as well as qualitative monitoring of the inundation regime.

5. The Service recommends the Corps undertake a comprehensive Red Knot survey effort within Jamaica Bay encompassing all the proposed project sites.

Response: The District will conduct pre-construction, construction, and post construction Red Knot surveys in the Study Area. The district will consult with USFWS on protocol.

Mitigation Recommendations:

1. The Service requests revisions to the Feasibility Report/ Environmental Assessment to include current soil cleanup guidance values.

Response: The District will update the report to cite NYSDEC 2010 Soil Cleanup Guidance values.

2. Invasive Species: The Service recommends that the District consider a multipronged approach to removing common reed and develop a long term invasive species management program.

Response: Invasive species will be managed via physical removal and the use of pesticides. The Corps has prepared a Monitoring and Adaptive Management Plan (attached) that addresses invasive species management. Post construction monitoring and management will be performed over a period of five years; at which point it will be turned over to the local sponsor. The team has set a monitoring performance target of at least 85 percent coverage of target hydrophytes.

3. Design Criteria and Planting Plan Recommendations-

Response: During development of the plans and specifications stage, the District will coordinate with the Service and reference specific recommendations made in the draft FWCAR for best management practice, low marsh, high marsh, maritime grassland, transition zones, and upland enhancement. Additionally, the District will coordinate with PANYNJ, as requested, during development of the planting plans in the plans and specifications stage.

As part of the specification it will be noted that a wetland specialist will be on call and present on site for inspections during key stages of construction.

4. The Service has recommended that removal and relocation of the sewer line be carried out as part of the recommended plan.

Response: While the District does recognize the merit in removal and relocation of the sewer line, it does not fit into the budget limitation of the Continuing Authorities Program. As such, it was not included in the recommended plan.

5. Time-of-Year Restrictions: Diamondback terrapins overwinter in the bottom of the estuaries, creeks and salt marsh channels. Due to a planned winter construction schedule the Service has recommended that the District develop and Diamondback Terrapin removal and relocation plan in order to reduce mortality during construction.

Response: The District will coordinate with the appropriate agencies and develop a removal and relocation plan for Diamondback Terrapins.

- 6. Species Specific Recommendations:
 - a. Saltmarsh Sharp-tailed Sparrow The Service requests the opportunity to coordinate with the District on design features to benefit this species.
 - b. Diamondback Terrapin The District considered the incorporation of turtle mound creation within several alternatives but ultimately did not include this design element in the recommended plan. The Service supports this design feature and has some initial concerns regarding the justification for the elimination of this design element and requests future coordination on this issue.

Response: In the current state of planning the District has recommended restoration alternatives that fulfill our requirements for environmental benefits and cost effectiveness. The District will have the opportunity to optimize these designs as the planning process is advanced into PED and will coordinate any optimization, to the extent possible, with the Service.

7. Green Infrastructure: The Service recommends that the District consider integrating the following features into the project design to the greatest extent practicable in order to improve the water quality and increase habitat value. Pre-treatment of waste-water from the treatment plant through biofiltration basins/swales, green roofs, Bio-retention, permeable pavement.

Response: N/A.

8. Monitoring and Management: The Service is developing a contaminants monitoring protocol for the District to use during this and other projects located within the New York Bight Area. The Service also recommends that the Corps develop and adaptive management plan to ensure the success of this restoration.

Response: The Monitoring and Adaptive Management Plans are attached. Contaminant sampling will be conducted as part of the additional HTRW analyses in Preconstruction, Engineering and Design. It is anticipated that any potential exposed contaminated soil would be isolated via the clean growing medium that is being placed as cover on the project site.