A. INTRODUCTION

The preceding chapters of the GEIS discuss the potential for significant adverse impacts to result from the proposed project. Potential significant adverse impacts have been identified in the area of natural resources, based on reasonable worst-case development scenarios that were used for the purposes of programmatic impact analyses in this GEIS. Provided below are programmatic mitigation measures that would minimize or eliminate the anticipated impacts. As lead agency, DEP will ensure that this mitigation is incorporated into capital projects as the amended drainage plans are implemented, including the additional information and studies that are needed to develop final designs.

B. NATURAL RESOURCES

VEGETATION AND TREES

Under the proposed amended drainage plans, BMPs are designed to preserve, to the extent possible, important upland woods and high quality wetland habitats (i.e., wetlands predominantly comprised of contiguous stands of native vegetation). In the New Creek watershed, the footprint of proposed BMP NC-11: Last Chance Pond was designed to remove stands of *Phragmites* (common reed) and preserve valuable woodlands and wet wood habitat. Proposed downstream BMPs, such as NC-13 and NC-14, were also expanded to increase floodwater storage volume thereby minimizing the clearing and grading necessary at proposed BMP NC-11. Despite these design objectives and other measures to preserve and enhance natural resources, substantial tree removal is expected at proposed BMP NC-6: Boundary Avenue and proposed BMP NC-11: Last Chance Pond (about 239 trees at NC-6 and 617 trees at NC-11). See Chapter 4.9, "Natural Resources of the New Creek Watershed," and Chapter 2.1, "Methodology," for additional information regarding tree removal and the methodology used to estimate tree losses. Of all the BMPs proposed, those two sites in New Creek are the only ones where major tree impacts are expected, which is why detailed tree surveys were performed along with the preliminary designs.

Detailed surveys and designs would be developed for each of the proposed BMPs. As part of the final design process, a detailed tree survey would be conducted for proposed BMP sites to determine the actual number of trees to be removed and the area of affected habitat. Survey results and additional natural resources data would be reviewed with DPR for the purposes of identifying opportunities to further avoid particular large trees, dense stands of native trees, and important wooded and wetland habitats.

Final design of the proposed BMPs would preserve these natural resources, to the extent possible, and impacts to trees or high quality woodland or wetland habitats would be minimized. Proposed final BMP designs would also maintain perimeter trees and include tree plantings to both preserve and restore wooded habitat and woodlands that may need to be cleared or graded

for the proposed BMPs. All planting designs would be coordinated with DPR and be consistent with their planting guidelines. The Bluebelt Program also includes monitoring to ensure tree and plant establishment and growth. In addition, several measures would be implemented during project construction to protect existing and remaining trees such as installation of construction-limiting fencing and tree barrier protections. (See Chapter 6.1, "Impacts During Construction," for additional information on construction-related measures of the proposed project.)

The large land areas and diversity of habitats at the proposed BMPs NC-6 and NC-11 allows for the restoration and creation of multiple habitats at these sites including expanded open water and emergent marsh wetlands. The capital projects for the Mid-Island watersheds would include clearing and grading, debris clean-ups and planting of diverse wetland flora that would attract equally diverse fauna. In addition to the planting program, habitat values would be increased by the design of the proposed BMPs which would include a variety of irregularly shaped and sized wetland pools, coves and islands at the different sites. This would increase wetland edge area preferred by many waterfowl species. Located along the Atlantic flyway, these large proposed wetlands would add significant habitat for migratory birds within the New York City area.

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES AND COMMUNITIES

Rare, threatened, endangered, or special concern species have been reported within each of the Mid-Island watersheds, based on NYSDEC's Natural Heritage Program, literature sources, and site survey data. (See Chapters 3.9, 4.9, and 5.9, "Natural Resources of the Oakwood Beach, New Creek and South Beach Watershed," respectively. See also Appendix C, "Natural Resources Data Inventory.") Based on current conditions, some species have been observed during field investigations, others have been recently reported in the watershed, and some are suspected of being in the watershed. Observations to date of wildlife (avian) species have included flyover species, which does not involve any specific use of a BMP proposed site. Given the 2043 build year of the proposed project, some identified species may make use of certain proposed BMP sites, or could be present in adjacent areas, while others may no longer be present. **Table 8.1.-1** lists all species of interest and the BMP locations where they may exist in all three watersheds.

Table 8.1-1
Endangered, Threatened and Special Concern Species Potentially within Proposed BMP Sites

1. Oakwood Beach		
Vegetation		
Species	**Habitats**	**BMP Sites**
Slender blue iris (threatened)	Fresh, brackish and salt marshes	OB-1 (a)
Turks-cap-lily (exploitably vulnerable)	Wet meadows and woods	OB-1 (a)
Northern gamma grass (threatened)	Ditches, depressions swales and salt marshes	OB-1, OB-2 and OB-3 (a)
Cinnamon fern (exploitably vulnerable)	Streambanks	OB-1, OB-2 and OB-3 (a)
Royal fern (exploitably vulnerable)	Streambanks	OB-1(a), OB-2 and OB-3 (b)
Wildlife		
Osprey (special concern)	Dead trees, platform and perches along the coast	OB-1 through OB-3 (d)
Northern Harrier (threatened)	Fields, meadows marshes and grasslands	OB-1 through OB-3 (d)
Coopers Hawk (special concern)	Woodlands and fields	OB-1 through OB-3 (b)

Table 8.1-1, cont'd
Endangered, Threatened and Special Concern Species
Potentially within Proposed BMP Sites

2. New Creek		
	Vegetation	
Species	**Habitats**	**Sites**
Purple milkweed (special concern)	Dry to moist woods	NC-9, NC-11 (d)
Green milkweed (threatened)	Multiple habitats	NC-9, NC-11 (d)
Lowland fragile fern (endangered)	Moist wooded slopes	NC-1 through NC-3 (d)
Jacob's Ladder (endangered)	Moist woods	NC-1, NC-2 NC-3, NC-9, NC-11(d)
Marsh fern (exploitably vulnerable)	Coastal marshes	NC--17 (b)
Royal fern (exploitably vulnerable)	Streambanks and wet meadows	NC-1 through NC-3, N-6 through NC--17 (b)
Cinnamon fern (exploitably vulnerable)	Streambanks	NC-1 through NC-3, N-6 through NC--17 (b)
Spinulose wood fern (exploitably vulnerable)	Streambanks and wet meadows	NC-1 through NC-3, N-6 through NC--17 (b)
	Wildlife	
Peregrine Falcon (endangered)	Nest on ledges or cliffs or human tall human structures (1) use coastal marshes for foraging	NC-7 through NC-19 (b)
3. South Beach		
	Vegetation	
Species	**Habitats**	**Sites**
Green milkweed (threatened)	Multiple habitats	SBE-1A, 1B-1C(d)
Hop sedge (threatened)	Coastal sands and meadows	SBE-1A, 1B-1C(d)
Fringed Bonset (threatened)	Coastal sands and meadows	SBE-1A, 1B-1C(d)
Seaside knotweed (threatened)	Sandy beaches and shores	SBE-1A, 1B-1C(d)
Globose flatsedge (endangered)	Sandy coastal plains	SBE-1A, 1B-1C(d)
Butterfly milkweed (exploitably vulnerable)	Coastal plains	SBE-1A, 1B-1C (a)
Slender rose gentian (endangered)	Brackish marshes	SBE-1A, 1B-1C (a)
Nodding ladies tresses (exploitably vulnerable)	Coastal bogs	SBE-1A, 1B-1C (a)
Needlepod rush (endangered)	Shallow pools damp sandy soils	SBE-1A, 1B-1C
Cinnamon fern (exploitably vulnerable)	Streambanks	SBE-1A, 1B-1C (a)
Royal fern (exploitably vulnerable)	Streambanks	SBE-1A, 1B-1C (b)
	Wildlife	
Osprey (special concern)	Coastal marshes and islands	SBE-1A, 1B-1C (b)
Northern Harrier (special concern)	Coastal marshes and islands	SBE-1A, 1B-1C (d)
Peregrine Falcon (endangered)	Nest on ledges or cliffs or human tall human structures (1) use coastal marshes for foraging	SBE-1A, 1B-1C (c)

Notes:
(a) Observed by DPR in 2008/2009; (b) Field observations 2009/2010; (c) NYSDEC, August 2011; (d) recorded evidence from NYSDEC Natural Heritage Program, USFWS, NMFS, Breeding Bird Atlas or other sources.
(1) Reported at Verrazano-Narrows Bridge
See also Appendix C.2 for a description of the species and their potential to be present in each watershed or at a BMP site.

To mitigate the potential for impacts on these species, pre-construction investigations would be completed at each proposed BMP site listed in Table 8.1-1. These investigations would be performed during the appropriate season (see Appendix C.2 for the general habitats, foraging, and nesting characteristics of each species) or time of year and designed specific to the spawning, nesting, foraging, and breeding characteristics of each plant or animal species. The investigations would inform final BMP designs to support wildlife and wetland permitting and construction. If any of the endangered, threatened, or special concern species are observed,

design modifications, construction controls, and other protective measures would be implemented as part of the proposed project to avoid these species and minimize impacts. In addition, DEP would coordinate with NYSDEC to obtain any necessary incidental take permits for endangered and threatened species of fish and wildlife and species of special concern in accordance with Environmental Conservation Law 11-0535 Part 182 it mitigation measures are not sufficient to avoid incidental takings.

For vegetation, avoidance of habitat or plant salvage and rescue would be performed, where feasible. Plant salvage involves harvesting or storing plants or seeds for replanting after construction completion. Bluebelt planting plans have routinely reintroduced plant species that have been extirpated from Staten Island. Consistent with this objective, DPR employs an active plant salvage operation and relocates plants to protect them from construction or other impacts. DEP would continue to coordinate with DPR and NYSDEC during the final design process to maintain important habitats in the Mid-Island watersheds in addition to the tree preservation and planting measures described above.

TIDAL WETLAND RESTORATION

As described in the three natural resources chapters of this GEIS (Chapters 3.9, 4.9 and 5.9), three new outfalls are proposed as part of the amended drainage plans and five existing outfalls may need to be expanded. The added and expanded outfalls would extend these structures out into Lower Bay and a portion of these outfalls would occupy what is currently tidal wetlands. A preliminary, planning-level analysis assuming a reasonable worst case scenario (i.e., all new and expanded outfalls are built as per the proposed drainage plans) indicates that approximately 1.2 acres of tidal wetland creation is necessary to compensate for the tidal wetland area that would be occupied by the proposed outfall structures (i.e., the footprints of the proposed outfalls). This area does not include temporary and adjacent area impacts associated with construction, which would be addressed separately and restored onsite as part of the proposed construction.

This 1.2 acre figure is calculated by adding estimated areas of permanent impact from all outfall structures contained in the following three tables of the FGEIS: Table 3.9-8, 4.9-20, and 5.9-9. For the Oakwood Beach watershed, the permanent tidal wetland impact is 12, 955 square feet; for the New Creek watershed it is 3,900 square feet; and for the South Beach watershed it is 9,360 square feet. The total for all three watersheds is 26,215 square feet or 0.60 acres.

Under the proposed project, these affected wetland areas are assumed to be restored at a 2:1 ratio (i.e., restoration at twice the size of the wetland area affected by the proposed outfall structure). That results in the total of 1.2 acres of wetland mitigation needed. DEP would minimize structural impacts as much as possible during final design by reducing or eliminating outfall expansions, where feasible. Therefore, a smaller wetland restoration area may be identified.

DEP, working together with DPR and the New York City Department of Design and Construction (DDC), identified tidal wetland opportunities at Crescent Beach Park in conjunction with proposed park enhancements and drainage improvements including the proposed Robinson Avenue Sewer Improvement Project. Crescent Beach Park, a 68-acre park (with about 10 land acres and 58 acres in the water), is located in the Great Kills section of Staten Island, just southwest of the Oakwood Beach watershed and west of Great Kills Park. DPR is proposing an enhancement of the park, with footpaths, areas for active recreation, and wet meadow and emergent woodland natural areas. In addition, the Department of Design and Construction (DDC) is proposing an expansion of the DEP outfall at Robinson Avenue, which would also require wetland mitigation.

Preliminary coordination between DEP and DPR has identified areas for potential tidal wetland creation at this site that could provide the restoration opportunities for the proposed outfall and would also support the DPR-proposed natural resources restoration and enhancements at Crescent Beach Park. Currently there is an existing low-lying area that is experiencing tidal influence due to a deteriorated concrete bulkhead. There is also a deteriorated road surface and fill materials are present. A conceptual restoration for this area would involve excavation to create approximately 0.42 acres of intertidal wetland, regrading of the tidal edge and stabilizing it with the planting of *Spartina alterniflora* in an area of the site that is protected from wave action and situated between the mean high water line and mean sea level (0.2 and -2.4 ft Staten Island Datum, respectively).

Since issuance of the Draft GEIS and in the wake of Sandy, DPR is now advancing the construction of a sand dune in virtually the same location as the proposed wetland mitigation site. There does not appear to be sufficient space to set the dune back in order to allow wetland development on its seaward side. The dune is designed to provide some protection for residences adjacent to the park from another storm surge. At this time, a tidal wetland project at this location does not appear to be possible.

Another potential tidal wetland mitigation site would be at the mouth of the Oakwood Beach creek system at the confluence of the east and west branches. This area is between the Oakwood Beach Wastewater Treatment Plant and the ocean outfall across the beach. The land is owned by the National Park Service (NPS) as part of the Gateway National Recreation Area or by DPR. As in the case of Crescent Beach, this work would have to be coordinated with any shoreline protection measures proposed by the USACOE.

All these areas could possibly be subject to regular tidal inundation if the ground elevation is properly set. All are on the seaward side of the levee and tide gate that prevents excessive tidal flows into the East Branch of the Oakwood Beach system. One site was actually a wetland mitigation site for the adjacent flood levee and tide gate project. However, the *spartina* planting failed to establish and the site is now a mudflat. There are also additional candidate sites in the area although a sanitary sewer running through them (and parallel to the levee) poses a utility interference that would have to be overcome.

DEP will further develop this concept at Oakwood Beach by coordinating with DPR and NPS. DEP will also continue to coordinate with NYSDEC and USACE to obtain the necessary permits and approvals to ensure consistency with the related programs such as USACE's shoreline protection program. Finally, other wetland mitigation sites will be identified to supplement or replace the Oakwood Beach site if the need for additional mitigation requirements is determined during permitting.

C. PRE-DESIGN PROTOCOL FOR MITIGATION IMPLEMENTATION

There is the potential for significant impacts to natural resources and DEP has therefore incorporated several mitigation measures into the proposed project. The detailed final designs of the proposed BMPs will incorporate these mitigation measures.

Table 8.1-2 identifies the additional natural resource data to be collected and analyses to be performed prior to the final BMP designs. This data collection and analyses would be completed based on coordination with involved agencies, and prior to the initiation of the capital project so that the assessments are timely, relevant, and meaningful. The table is a checklist of natural resource technical areas that would be further evaluated and is a pre-design protocol for the

development and implementation of appropriate mitigation measures. With regards to groundwater monitoring, DEP has made a commitment that levels will be recorded at the 11 monitoring wells (3 in Oakwood Beach, 5 in New Creek and 3 in South Beach) on a quarterly basis for the foreseeable future until the data is no longer valuable in the BMP design process.

This pre-design protocol was developed based on coordination with NYSDEC and USACE. Further strategies may be developed during the required permitting processes for the proposed BMPs. Every effort was made to fully mitigate potential significant adverse impacts. Appendix E provides the data inventory that has been performed for the first Mid-Island capital project, restoration of the West Branch in the New Creek watershed.

D. MITIGATION FOR LOSS OF FORESTED WETLANDS

DEP has been coordinating with USACE and USEPA on a Regional General Permit that would authorize a number of Bluebelt projects on Staten Island including those in the proposed project. A requirement of that permit is a wetland mitigation plan that ensures there will no net loss of forested wetlands within Richmond County due to activities authorized by the permit. The proposed project does involve the conversion of a total of 5.46 acres of forested wetlands into other wetland types. All such impacts are associated with work in the New Creek watershed. The construction of the following BMPs will result in the listed loss of forested wetlands:

- NC-1 0.1 acres
- NC-2 0.1 acres
- NC-3 0.3 acres
- NC-4 0.14 acres
- NC-6 1.6 acres
- NC-11 3.75 acres

Work as part of BMP NC-11 will expand the stock of forested wetlands by 0.53 acres. Overall, the net change in this wetland type will be a loss of 5.46 acres. Based on discussions with USACE and USEPA, the proposed mitigation can be located anywhere on Staten Island, does not need to be on DEP property, and can be provided at the ratio of one acre of new wetland to one acre of lost wetland.

In conjunction with USACE and the USEPA, DEP is developing a forested wetland mitigation plan. A number of sites have been identified in the Mid-Island Bluebelt where this mitigation could be provided. In the New Creek drainage area, one potential location is between BMPs NC-15 and NC-16. In the South Beach BMP, proposed islands in the wetland complex could be graded and planted to be forested wetlands. However, both of these sites are currently dominated by common reed (p*hragmites*), meaning extra time, investment, and resources would be required to suppress re-invasion by that exotic invasive plant.

Some Bluebelt properties on the southern end of Staten Island would not have that problem of *phragmites* eradication and suppression. Therefore, the process of forested wetland creation in this area would be less expensive and easier, involving fill removal next to a water body and planting of trees at an elevation that would allow for proper soil saturation. One such site is in the Mill Creek Watershed near BMP MC-1 where DEP has already done some forested wetland creation as mitigation for project impacts.

Another possible mitigation site could be Long Pond Park in South Richmond where City streets were graded, but never paved, in what was once a large, continuous forested wetland. A mitigation project here could remove some of the filling and reconnect the wetland fragments.

DEP will continue to work with USACE and USEPA on this forested wetland mitigation plan. DEP will also coordinate with other government agencies such as DPR, NYSDEC, and the New York State Office of Parks, Recreation and Historic Preservation in identifying natural areas where this mitigation would provide the greatest benefit.

Table 8.1-2
Pre-Design Protocol for Mitigation Implementation

Technical Area	BMPs	Mitigating Protocol
Groundwater	All lower watershed BMPs	Perform additional groundwater monitoring and submit results to NYSDEC as seasonal averages for spring (March 1 to June 1), summer (June 1 to August 31) and fall (September 1 to November 30) periods. Verify water levels prior to construction. Utilize data in refining BMP designs.
Trees	All BMPs	Develop site-specific tree and topographic survey maps as the first step in the final design process for the purposes of further minimizing potential clearing impacts, protecting large trees, and determining the minimum necessary tree clearing. Develop a tree replacement plan for trees that could not be avoided and would need to be cleared. Coordinate final designs with DPR and NYSDEC for BMPs sited on City or State parklands. Coordinate with NYSDEC on tree clearing as part of the freshwater wetland permit process.
Key Habitats	NC-6: Boundary Avenue and NC-11: Last Chance Pond and	Gather additional natural resources data (e.g., fish or avian habitat, reptile and amphibians, macroinvertebrate surveys) that would inform the final design. Using these data and site-specific survey maps with tree, water line, and topographic information, delineate habitats and refine BMP designs to further minimize impacts and to identify areas for habitat enhancement at Last Chance Pond and Boundary Avenue. Coordinate with DPR and NYSDEC in developing the final design.
Fisheries	Lower Watershed BMPs	Perform supplemental fisheries surveys as part of the final design process to determine if fish may be present at BMP sites. Determine any needs for fish passage along the channel. Create BMP design details for in-stream structures that would be necessary to allow continued fish movement along the channel and between the BMPs. Identify construction period protection measures and include them in project design specifications with respect to fish rescue or seasonal restrictions on construction.
Rare, Threatened, and Endangered Wildlife	See Table 8.1-1 for species potentially at BMP sites	Perform site investigations in the appropriate season to determine nesting or foraging at BMP sites as the initial step in the final design process. Perform the work within 1-3 years in advance of finalizing the capital project design in order to make a final determination about the potential use of a BMP site by protected species. Provide inventory data to DPR and NYSDEC as appropriate. If species protected under Environmental Conservation Law 11-0535, Part 182 are identified, apply to NYSDEC for incidental takings permit. Implementation of mitigation measures could involve modifications to BMP design or seasonal restrictions on construction.
Rare, Threatened, Endangered, and Exploitably Vulnerable Plants	See Table 8.1-1 for species potentially at BMP sites	Perform a site investigation in sensitive areas (e.g., wooded hummocks) in the appropriate season for confirming the presence or absence of plants as the initial step in final design. Perform the work within 1-3 years in advance of finalizing the capital project design in order to make a final determination about the potential use of a BMP site by protected species.. Provide inventory data to NYSDEC and DPR as appropriate. Incorporate information into the final BMP design to avoid sensitive areas and plant locations, and/or incorporate additional impact avoidance measures into the proposed capital project, including plant salvage, in order to mitigate impacts.

✶