Chapter 1.1: Project Description of the Overall Program

A. INTRODUCTION

PROJECT OVERVIEW

The New York City Department of Environmental Protection (DEP), on behalf of the City of New York, is proposing three amended drainage plans on the East Shore of Staten Island (the "proposed project"). These three amended drainage plans are for the Oakwood Beach, New Creek and South Beach watersheds, which cover a total area of about 5,000 acres. The proposed project area, referred to as Mid-Island, is generally bounded on the west by Great Kills Park (within the Gateway National Recreation Area [GNRA]) and the mapped but unbuilt Willowbrook Parkway right-of-way, and by the Staten Island Expressway to the east. The northern boundary extends along a number of Staten Island Greenbelt parks including LaTourette Park, Richmond County Country Club and Reeds Basket Willow Swamp Park. The southern boundary is Lower Bay (**see Figure 1.1-1**).

The three proposed amended drainage plans would address the chronic flooding of streets and properties in Mid-Island while preserving and enhancing existing wetlands under DEP's Bluebelt Program and using these properties for stormwater management. The proposed project would involve multi-phase capital projects with construction expected to begin in fiscal year 2014 and continue through 2043.

DEP designs its drainage plans based on established criteria for the collection, conveyance, and management of stormwater and sanitary wastewater. The current drainage plans for these three watersheds (which date from the 1960s) call for a full network of storm and sanitary sewers in all mapped streets. The proposed project involves amending these drainage plans to manage stormwater through a combination of collection sewers with Best Management Practices (BMPs) that would restore wetlands while integrating them into the drainage plan design. Under the three proposed amended drainage plans, existing protected wetlands comprised of surface water features such as streams, ponds and other wetlands, would be preserved and enhanced to provide natural hydrologic functions along with the filtering of pollutants, groundwater recharge and flood control within the Bluebelt properties. Proposed BMPs, such as extended detention basins and outlet stilling basins, would be installed at each storm sewer outlet (grey infrastructure) into the Bluebelt wetlands (green infrastructure). These proposed BMPs would alleviate the impacts of urban stormwater discharges into receiving wetlands by reducing erosive runoff velocities, intercepting contaminants and providing runoff storage in extended detention wetlands, thereby reducing downstream flooding and erosion. Moreover, the proposed BMP designs incorporate natural features restoration that enhances wetland habitats and benefits wildlife. The three proposed amended drainage plans also call for completing and upgrading the sanitary sewer system where needed. All sewer construction would involve street reconstruction once the sewers are installed.

DEP has acquired numerous properties in these three watersheds as part of the Mid-Island Bluebelt Program, and would complete the full acquisition through the City's Uniform Land Use Review Procedure (ULURP) process. The City Planning Commission (CPC) approved the New Creek land acquisitions between July 2003 and January 2005. The South Beach properties were approved for acquisition between October 2005 and March 2007. Finally, approval for Oakwood Beach acquisitions was obtained in March 2007. A final ULURP application will be submitted by DEP to complete the acquisition in the New Creek watershed. The acquisition properties are largely within Federal Emergency Management Agency (FEMA) mapped 100-year floodplains and also contain freshwater wetlands as mapped by the New York State Department of Environmental Conservation (NYSDEC) and the National Wetland Inventory (NWI). The appropriate permits to develop the proposed BMPs would be obtained prior to implementation of the proposed project.

ENVIRONMENTAL REVIEW

Adoption and implementation of the proposed amended drainage plans requires a number of City, State, and Federal discretionary approvals for which environmental review is necessary. DEP, as Lead Agency in this environmental review, examined the activities necessary to construct and manage the proposed project and determined that the proposal may result in significant adverse impacts on the environment. As required under City Environmental Quality Review (CEQR) and the State Environmental Quality Review Act (SEQRA), DEP issued a Positive Declaration on April 12, 2010 and initiated a public process to disclose those potential environmental impacts and allow for public review of the proposed project, its impacts, mitigation of significant impacts, and the alternatives that were considered. This Final Generic Environmental Impact Statement (FGEIS) has, therefore, been prepared in accordance with the environmental review laws of the City and State of New York (Executive Order 91, CEQR and SEQRA 6 New York Codified Rules and Regulations Part 617, respectively), and also meets the requirements of the State Revolving Fund Program (SRF), which may be used to fund this project.

With the Positive Declaration, a Draft Scope of Work was distributed to the general public and involved and interested agencies for public review and comment. The scoping document provided a project overview and described the methodologies used for the preparation of this DGEIS. A public scoping meeting was held on May 12, 2010 at the offices of Staten Island Community Board 2 to receive public comments on the Draft Scope of Work. The period for submitting written comments on the draft scope remained open until May 31, 2010. Subsequently, a Final Scope of Work addressing public comments was issued on September 30, 2010.

DEP determined that a GEIS is the appropriate approach to the environmental review of the three watershed amended drainage plans. The *CEQR Technical Manual* states that a programmatic environmental review, or GEIS, is appropriate for proposed programs and plans that have wide application. This type of review allows the lead agency to identify the range of impacts that may occur under the proposed program or plan and to build the appropriate mitigation into the program or plan, thereby ensuring that future actions arising from the plan or program do not have the potential for significant impact, whether or not they are subject to further *CEQR* review. As lead agency, DEP has determined that the appropriate approach is to prepare a GEIS because the proposed project is in the planning phase and proposed BMP designs are conceptual, anticipated project build-out is 2043 and numerous capital projects would be implemented over several decades to allow for the development of detailed designs

prior to construction. This FGEIS presents the Reasonable Worst Case Scenario (RWCS) of amending the existing drainage plans for the Oakwood Beach, New Creek and South Beach watersheds and was prepared well in advance of project build-out because it is needed to inform the amended drainage plan approval process and to obtain the necessary permits from other agencies.

This FGEIS assesses the potential for environmental impacts and related mitigation to occur under the proposed project. In accordance with *CEQR* guidelines, potential impacts were examined comprehensively and the technical analyses are based on proposed drainage plan amendments and RWCS conceptual proposed BMP designs, as described in the Project Descriptions for each watershed (Chapters 1.1, 3.1. 4.1 and 5.1). As lead agency, DEP will ensure that a full project analysis and site-specific analyses for individual capital projects are conducted and documented, prior to construction. For example, DEP will undertake a set of such site-specific analyses called the pre-design protocol for impacts concerning such issues as tree removal, endangered species, fisheries, and groundwater levels. As capital projects to implement the amended drainage plans are initiated, additional information and studies would be completed to develop final designs and assess potential significant adverse environmental impacts. Minor modifications will be used to document potential significant adverse impacts identified during design phases that differ from the initial findings or are not assessed as part of this FGEIS.

REQUIRED PERMITS AND APPROVALS

Implementation of the proposed amended drainage plans requires discretionary actions, including approvals and agreements from the following Federal, State, and City agencies:

- United States Army Corps of Engineers (USACE) for actions within navigable waters (e.g., construction of structures or activities within freshwater or tidal wetlands) as per Title 33 Code of the Federal Register, Parts 320-330[1]. This approval will be in the form of a Regional General Permit (RGP) for regulated activities in the wetlands of the three watersheds.[2]
- NYSDEC permits for activities in tidal and freshwater wetlands and adjacent areas as per Article 24 6NYCRR Part 663 Freshwater Wetlands Permits and Article 25 6NYCRR Part 661 Tidal Wetlands;
- NYSDEC permits for activities within coastal erosion hazard area that is designated along the Lower Bay shoreline as per Article 34 6NYCRR Part 505 (variance under subsection 505.13);
- NYSDEC State Pollution Discharge Elimination System (SPDES) permits for surface water outlets and discharges in accordance with Article 17 6NYCRR Part 750-757;

[1] Pursuant to 33 CFR Section 320.3(e), coordination will be required with the U.S. Coast Guard for the proposed outfalls in tidal waters and National Oceanic and Atmospheric Administration-Fisheries Service (NOAA-FS) and National Marine Fisheries Service-Protected Resources Division (NMFS-PRD) may also require notification if the USACE determines that the proposed project may affect species or habitat under their purview.

[2] DEP is actively coordinating with the USACE and United States Environmental Protection Agency (USEPA) on the RGP. On March 15, 2013 USACE issued a public notice announcing their intention to authorize Bluebelt construction in regulated wetlands with a Regional General Permit.

- NYSDEC approval under the SPDES General Permit for Stormwater Discharges from Construction Activity;
- NYSDEC permits for use of herbicides in and around wetlands (to control invasive plant species, such as Japanese knotweed);
- NYSDEC 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 where impacts have been identified with respect to rare, threatened, or endangered wildlife that is protected under this law;
- Construction of any BMPs proposed on NYSDEC property (e.g., Richmond County Country Club) requires NYSDEC approval in accordance with all applicable regulations, including the granting of an easement by the State to the City for the use of State property for drainage purposes;
- Licenses and agreements between DEP and the New York State Department of Transportation (NYSDOT) for activities within the Willowbrook Parkway right-of-way;
- New York State Department of State (NYSDOS) coastal zone consistency review under the permit review process (all of the watersheds in their entirety are in the coastal zone).
- Licenses and agreements between DEP and the Metropolitan Transportation Authority (MTA) for activities under the Staten Island Rapid Transit (SIRT) tracks;
- Permits, licenses and agreements between DEP and the New York City Department of Parks and Recreation (DPR) for activities in City parkland including tree clearing (e.g., Reeds Basket Willow Swamp Park, Last Chance Pond Park, and Willowbrook Parkway right-of-way, since it is managed by DPR), the need for any controls relative to Asian Longhorned Beetles (although not currently in the City's quarantine zone this area may be added at a future date), and the identification of trees to be cleared and a tree replacement plan consistent with the requirement of Local Law 3 of 2010;
- City Planning Commission (CPC) authorizations for work in the Special South Richmond Development District (SSRDD) and the Staten Island Special Natural Area District (NA-1) as well as coastal zone consistency review (all watersheds are in the coastal zone);
- CPC and New York City Department of Health and Mental Hygiene approval of the proposed amended drainage plans;
- Review by Staten Island Community Boards 2 and 3, the Staten Island Borough President, CPC, and the City Council for future street de-mappings related to siting of BMPS proposed in street beds and acquisition of sewer easements as per the requirements of ULURP;
- New York City Department of Transportation approval for any in-street work; and
- License agreements or other forms of approvals with private landowners for any temporary work on private lands and sewer easements for any permanent infrastructure that would be on private lands and also require maintenance access.

B. WATERSHED DESCRIPTIONS

A brief description of each of the watersheds is provided below. Expanded details for each watershed and the proposed amended drainage plans are provided in the individual "Project Descriptions" (Chapters 3.1, 4.1, and 5.1).

Oakwood Beach Watershed. This watershed is approximately 1,329 acres in size with about 61 acres of Bluebelt property including land acquired or to be acquired (see **Figure 1.1-1**). General boundaries of the watershed are Great Kills Park in the GNRA and Tanglewood Drive to the west, Oceanview Cemetery to the north, Peter Avenue to the east, and the Lower Bay to the south. Most of this watershed is occupied by low-density residential uses, commercial uses along Hylan Boulevard, or DPR parkland including Great Kills Park (separate from the GNRA) and portions of the mapped, but unbuilt, Willowbrook Parkway. These lands are managed as open space by DPR, but are under the jurisdiction of NYSDOT. Drainage channels in the watershed include: the West Branch, which begins as an intermittent stream channel in the Willowbrook Parkway right-of-way; the Middle Branch, which originates at Hylan Boulevard and Adelaide Avenue; and the East Branch, which originates in DPR's Great Kills Park. All three branches flow towards and outlet to the Lower Bay.

New Creek Watershed. This watershed, northeast of Oakwood Beach, covers approximately 2,249 acres with about 94 acres of Bluebelt property including land acquired or to be acquired (**see Figure 1.1-1**). It is generally bounded by Miller Field and New Dorp Lane to the west; the northern boundary extends through and includes portions of the Richmond County Country Club and the Reeds Basket Willow Swamp Park; Seaview Avenue, the Staten Island University Hospital and Burgher Avenue form the eastern boundary; and the Lower Bay is the southern boundary. Land use in the watershed is low-density residential uses, commercial uses along Hylan Boulevard and Richmond Avenue, or State- and City-owned open spaces that are part of the Staten Island Greenbelt (e.g., Reeds Basket Willow Swamp Park). Last Chance Pond and Boundary Avenue Parks are also in the central portion of the watershed and DPR's Franklin Delano Roosevelt (FDR) Boardwalk and Beach Park fronts the Lower Bay shoreline. The New Creek watershed has three principal stream channels: the Main Channel, which originates in Last Chance Pond Park; the West Branch which originates in Boundary Avenue Park; and the East Branch, which originates at Dongon Hills Avenue. Watercourses in the upper watershed flow across Richmond County Country Club and Reeds Basket Willow Swamp Park. These streams, however, become piped as they flow south and enter the more developed part of the watershed.

South Beach Watershed. The easternmost of the three watersheds is the South Beach Watershed (**see Figure 1.1-1**). This watershed is adjacent to and northeast of the New Creek Watershed and covers approximately 1,267 acres of which about 40 acres are Bluebelt property acquired or to be acquired. The watershed boundaries are generally Hillcrest Avenue and Narrows Road/Staten Island Expressway to the north, Seaview Avenue and Burgher Avenue to the west, Lily Pond Avenue to the east and the Lower Bay to the south. Most of this watershed is developed with low-density residential uses and commercial uses along Hylan Boulevard. Most of the Bluebelt properties are located in the lower watershed. There are no remaining open stream channels in the watershed, though remnants exist in several locations. Surface water features include Brady's Pond and Cameron's Lake, both in the upper watershed. Brady's Pond is privately owned except for the north and northeastern portions, which are City parkland, and Cameron's Lake is DEP Bluebelt property.

C. PURPOSE AND NEED

Much of Staten Island, including Mid-Island, remained undeveloped until the intensive wave of suburban expansion that followed World War II. This growth surged with the November 1964 opening of the Verrazano Narrows Bridge, and the subsequent rapid development of the borough outpaced the City's ability to install the necessary infrastructure. In many areas, no formal

stormwater management system was in-place or the installed system became inadequate. In the absence of stormwater management infrastructure, runoff during rain events flows across roads and into currently undersized culverts that cannot properly convey runoff. This results in the flooding of local streets and properties along with the erosion and sedimentation of natural surface water features (see **Figures 1.1-2a and 1.1-2b)**.

The Oakwood Beach, New Creek and South Beach watersheds are largely developed with the exception of parklands and Bluebelt properties. To address flooding during storm events and high tides, DEP is proposing amended drainage plans comprised of a network of storm sewers, BMPs, and Bluebelt wetlands. The primary drainage plan objective is to provide City streets with storm sewers that flow via gravity to proposed BMPs and outfalls to the Lower Bay for discharge. Each of the Mid-Island watersheds is challenging for drainage planning because of extreme topographic conditions. For example, the lower watersheds are extremely flat with large wetlands dominated by common reed grasses. In contrast, the upper watersheds, particularly within the New Creek watershed, have hilly terrain and steep slopes that result in high stream velocities and difficult conditions for stormwater conveyance and treatment.

The proposed amended drainage plans use gravity-flow sewers, to the greatest extent feasible, in accordance with DEP requirements. BMPs are proposed to supplement the storm sewer network in areas where storm sewers cannot be practically constructed, and are proposed in locations where storm sewers end and Bluebelt wetlands begin. BMPs typically utilize existing surface water features such as streams, ponds and wetlands to convey and attenuate stormwater discharges that can otherwise cause unstable stream channels and elevated pollutant loadings. Grading and ecological landscaping at each proposed BMP location are also significant components of the proposed project. An important objective of the Bluebelt planting program is to reinvigorate wetland functions at previously disturbed wetlands, thereby restoring native vegetation and creating a natural, integrated ecological system that is self-sustaining. In particular, the proposed project would remove vegetative non-native monocultures such as common reed that are prone to brushfires.

Thus, the proposed amended drainage plans would reduce flooding and preserve and enhance remaining open spaces and surface water features, while creating comparatively more diverse habitats. In addition, the proposed amended drainage plans are expected to be more cost-effective than the current drainage plan, which requires an extensive hard infrastructure sewer network and a larger capital investment to construct.

D. PROJECT BACKGROUND

CURRENT DRAINAGE PLAN

The current drainage plan for these three watersheds, referred to as the "Potter Plan," dates from approximately 1961. Drafted by the engineering firm of Alexander Potter, that plan called for a fully developed network of sewers within mapped streets and other conventional drainage structures. Under the Potter Plan, the majority of streams in the Mid-Island watersheds would be replaced by large storm sewers laid out as a grid over the landscape without regard for natural features. The Potter Plan would require the draining and filling of natural watercourses, ponds, and other wetlands throughout the Mid-Island watersheds.

The Potter Plan also assumes that many streets in low-lying areas are raised six to eight feet above existing grade. Such changes in grade between raised streets and adjacent properties

would be significant and could potentially affect existing drainage patterns on adjoining private properties in addition to the potential urban design impacts.

Since the Potter Plan was never fully implemented, increased runoff from the continued development of streets and private property throughout the watersheds has resulted in significant local street flooding, particularly in the lower watersheds. This flooding is often due to the absence of sewers and the need for a comprehensive drainage plan that effectively conveys runoff from developed areas, while respecting the existing topography. Thus, the Potter Plan would be difficult to construct and is inconsistent with sustainable environmental design practices, and therefore was never fully implemented.

BLUEBELT PROGRAM

The concept of using freshwater Staten Island wetlands for stormwater management purposes has been in the making for many decades. In the mid-1970s, the City first acted to preserve remaining wetlands and natural areas on Staten Island, as it began to realize that rapid development was not being sufficiently served by infrastructure and was adversely impacting remaining ecological resources. Using zoning, the City sought to better manage land development and protect natural resources through the establishment of the Special South Richmond Development District and the Staten Island Special Natural Area District. In addition, in the 1980s, NYSDEC mapped extensive freshwater wetlands across Staten Island to establish a permitting program that would regulate the development of protected wetlands and adjacent areas.

DEP's Staten Island Bluebelt Program was initiated in the late 1980s as a multi-purpose program to protect and restore natural resources while providing appropriate stormwater management. The Bluebelt Program was launched by initiating property acquisition for permanent protection of the land ensuring its use for stormwater management. Bluebelt wetlands are then integrated into the stormwater management system. Thus, drainage is controlled without constructing extensive sewers that would otherwise fill in and eliminate wetlands. Moreover, under this program, wetlands are restored and enhanced.

Since 1995, DEP has been updating drainage plans in the South Richmond area of Staten Island to incorporate Bluebelt design features. The first approved modified drainage plan was for the Richmond Creek watershed. This was followed by drainage plan amendments for the Arbutus Creek, Blue Heron, Lemon Creek, Wolfe's Pond, Sweet Brook, and ten other watersheds covering southwest Staten Island. Planning is complete for those watersheds and construction is ongoing. With the success of the Bluebelt Program in those watersheds, the concept of utilizing existing wetlands for stormwater management is now proposed in Mid-Island where a large wetland complex still exists and upgraded sewer infrastructure is needed.

ECOLOGICAL ENHANCEMENTS

As is the case throughout the region, Staten Island has lost much of its historic freshwater and tidal wetlands, and the Mid-Island watersheds are no exception. Therefore, the preservation of remaining wetlands under the Bluebelt Program, coupled with the creation of stormwater wetlands, provides an opportunity to protect and restore important habitat. To this end, natural design elements have been added into the proposed BMPs for the purposes of providing ecological diversity in addition to (and in support of) the essential BMP proposed functions of stormwater management. The objective of these design elements is to enhance overall habitat

complexity and ecological values at each of the proposed BMP sites and cumulatively within the watershed.

Proposed BMP designs for the Mid-Island Bluebelt can capitalize on the successful projects and "lessons learned" from the South Richmond Bluebelt experience where over 50 BMPs have been constructed and maintained by the DEP's Bluebelt Unit since 1998. These BMPs have successfully reduced flooding and improved water quality while improving the local ecology and wildlife habitats with diverse plant communities. DEP will bring these "lessons learned" to the Mid-Island Bluebelt.

As stated above, the lower Mid-Island watersheds are currently characterized by vast monotypic stands of the invasive plant common reed (*Phragmites australis*). These monotypic communities do not support diverse or intensive wildlife populations. Faunal diversity depends on a variety of plant communities and habitat types ("niches"). The removal of the common reed through the proposed BMPs would provide a range of habitats from open water to upland forested habitat. This would increase habitat types and vegetative communities that can support greater and more diverse populations of birds, fish, amphibians, and mammals. For example, in the South Richmond Bluebelt, where common reed was removed and replaced with native vegetation, wood ducks quickly moved into the proposed BMP and red winged blackbirds nested in the new vegetation.

The proposed project would build upon existing ecological opportunities by expanding and diversifying habitat attributes and wildlife attractors particularly for coastal nesting and feeding birds. Within the proposed BMPs, irregularly shaped wetland edges with coves and peninsulas are included in the design to create a more complex shoreline edge. Irregular shorelines increase the edge of linear footage available for feeding and provide smaller secluded areas preferred by more reclusive species. Small islands are also included in the proposed BMP designs as individual ecological features aimed at diversifying the otherwise permanent pool habitat.

Several of the critical stormwater wetland design elements currently employed by the Bluebelt Program for flood control and stormwater treatment are similar to the restoration criteria used in waterfowl habitat creation projects around the region. These include shallow water zones with a diverse, native wetland plant community which are preferred feeding zones for dabbling ducks, herons, and egrets. Other species such as wood ducks prefer to forage along the edge of the deep and shallow water areas. "Nesting islands" are also proposed to provide predator-free nesting, resting, and feeding sites for mallard ducks and other waterfowl.

E. PROPOSED AMENDED DRAINAGE PLANS

STORMWATER MANAGEMENT

STORMWATER DRAINAGE PLAN OBJECTIVES

Designing the current Mid-Island drainage plans presents a number of particular challenges. The New Creek watershed, for example, has extreme variations in topography with very steep slopes in the upper watershed that create high velocity streams. The flatness of the lower watershed is conversely problematic for designing a properly functioning gravity flow drainage system. The Oakwood Beach and South Beach watersheds do not present as challenging areas for drainage planning in the upper watersheds since the topography is less dramatic and the hills are not as

steep. Nonetheless, the flatness of the lower watershed landscape makes providing effective drainage a difficult task.

About 80 percent of Mid-Island streets do not have storm sewers. Therefore, the primary drainage pattern under existing conditions is unmanaged runoff from streets and developed properties running directly into streams and other wetlands. Therefore, an objective of the proposed amended drainage plans is to provide comprehensive stormwater management through stormwater collection sewers and proposed BMPs.

The lower watersheds are especially subject to street and property flooding during combined rainfall and high-tide events. This occurs when the tide gates in the existing short sections of outfalls close shut and preclude tidal water from flowing back into the system, but, at the same time, impede the outflow of stormwater from the trunk sewers. This backup of flow causes the storm system to surcharge which results in local property and street flooding. Consequently another objective of the proposed project is to reduce this flooding in the lower watershed through the proposed BMPs, which would store flows from trunk sewers until the tide recedes and the outfalls can drain to the Lower Bay.

In the New Creek lower watershed, there are streams in close proximity to residential communities. Several miles of these streams are filled with sediment that constricts flows and reduces conveyance capacity. Therefore, another objective of the proposed project is to reduce street and property flooding by relocating these streams to Bluebelt properties and realigning the streams to improve their hydrologic functions. In the New Creek upper watershed, another objective is to provide managed runoff that reduces intensive stream velocities that are causing streambank destabilization, erosion, and downstream sedimentation. Reduced street flooding would also diminish storm-event infiltration into sanitary sewers, which results in backups of flow to the Oakwood Beach WWTP.

Completing the remaining unbuilt storm sewer segments under the current drainage plan is not feasible due to the extensive potential impacts on regulated wetlands and the mitigation that would be required. As stated above, the Potter Plan was predicated on the idea of elevating many streets so the sewers in the street beds could be pitched to provide positive drainage. However, private development proceeded along many streets in the watershed without a storm sewer system in place and implementation of the Potter Plan would leave much of this development below the street grade. Accordingly, an objective of the proposed amended drainage plans is to have street elevations remain as close to the existing street grade as possible. In order to ensure gravity flow under the proposed amended drainage plans, some limited increases in street grades are necessary. However, in those cases, all efforts would be made to ensure that properties are protected from street runoff and flooding.

DEP has been acquiring Mid-Island wetlands for the purpose of developing Bluebelt drainage plans where wetlands detain stormwater and play an important role in resolving the problems of unmanaged runoff and chronic flooding. DEP is now in the process of completing its acquisition of the remaining Mid-Island freshwater wetlands necessary for these purposes, including vast marshes dominated by giant common reed grass. Using the past 15 years of the South Richmond Bluebelt drainage planning as a guide, the proposed amended drainage plans include storm sewers that discharge into wetlands. Impacts of urban stormwater discharges into wetlands are avoided by proposing BMPs at each storm sewer outlet to a Bluebelt wetland. In addition to being more environmentally sustainable, this approach is cost effective since it reduces the use of hard infrastructure in favor of Bluebelt wetlands for stormwater conveyance and storage.

STORM SEWER DESIGN CRITERIA

Size and Capacity Analysis

The proposed amended drainage plans call for conventional storm sewers in City streets that then drain to the Bluebelt wetlands or to the existing trunk sewers. Typically, conveyance capacity for sewers in a drainage plan is designed for the 5-year storm (4.5 inches of rain over 24 hours), which is the City's design storm. Based on historical rainfall data, a sewer system designed to convey a 5-year storm effectively manages 95 percent of the City's storms. In the case of the proposed amended drainage plans, this standard is used in calculating sizes for all storm sewers draining into existing trunk sewers. However, for storm sewers where the hydraulic grade line was modeled to be above the top of the pipe during the 5-year storm event (i.e., the pipe would be at capacity), the 10-year design storm (about 5 inches of rain over the same 24-hour period) was used in developing the drainage plan design. This also provides a greater margin of safety necessary given the tidal influence on the Mid-Island drainage system.

Due to the larger pipe sizes necessary to convey greater intensity storms, the margin of safety used in the design of the proposed BMPs increases accordingly. Amended drainage plans also assume full build-out of all lots in the watersheds as per the current zoning with the associated increases in impervious surfaces (e.g., rooftops, driveways, and parking lots) and the resulting runoff. Hydrologic mathematical modeling was used to predict peak flows and water surface elevations throughout the three watersheds both with and without the proposed amended drainage plans. (See Chapter 2.1, "Methodology," for more information on the model with results presented in Chapters 3.9, 4.9, and 5.9, "Natural Resources," for each watershed.)

Amended Street Grades

The grades of certain streets in the watersheds need to be elevated to ensure positive drainage toward the proposed BMPs and to provide adequate cover (i.e., two feet or less of cover) over storm sewers in accordance with City street design standards. This increase in elevations is expected to range from 6 to 24 inches. In order to determine the actual increase, detailed street surveys would be completed as part of final design and, at that time, the final extent of necessary street raisings would be identified. The potential streets, affected by the proposed amended street grades, are described in the project descriptions for each watershed (Chapters 3.1, 4.1, and 5.1).

BMP DESIGN CRITERIA

Site Location and Sizing

The proposed BMPs are sited to provide conveyance for stormwater discharged from storm sewers and in some cases floodwater storage. Proposed BMP sites are selected with the goal of minimizing impacts on natural resources to the greatest extent possible; in fact, previously disturbed sites are especially attractive since proposed BMP development can be combined with natural area restoration. To this end, the proposed BMPs provide a number of social and environmental benefits including: reduced local flooding for neighborhood streets and properties; lower capital costs associated with increased stormwater storage during high tide events that reduces surcharging of storm sewers in the streets; increased green infrastructure and reduced hard infrastructure; improved water quality in the Mid-Island streams; restoration of the most degraded and fragmented sites in heavily urbanized watersheds for stormwater storage and treatment; and enhancement of habitats and natural ecosystems.

A major focus of the proposed BMP siting and design analyses is to determine the storage volumes necessary to protect against flooding. Proposed BMPs provide the hydraulic and hydrologic capacity to handle the volumes of stormwater directed to them by the proposed storm sewers. The proposed extended detention BMPs were generally sized to detain the 2-year storm (3.5 inches of rain over 24 hours) which is considered the downstream channel forming storm. All proposed BMPs are sized to convey the full design storm discharging from the storm sewer system.

In total, 31 BMPs are proposed under the three proposed amended drainage plans. (Design details for each proposed BMP are provided in each of the watershed project descriptions.) The proposed BMPs would be sited on public property that, in most cases, is City-owned lands (or lands to be acquired by the City). City lands include Bluebelt properties and City parkland as well as lands within mapped, but unbuilt, City right-of-ways. For some proposed BMPs, the use of state lands is also proposed including lands within the Richmond County Country Club under the jurisdiction of NYSDEC. One proposed BMP, OB-5, is also sited within an unbuilt section of the Willowbrook Parkway right-of-way, which is managed as open space by DPR, but is under the jurisdiction of NYSDOT.

Velocity Attenuation and Pollutant Removal

Velocity attenuators and other BMP features are proposed to decrease storm flow velocities and surges, as well as capture and retain sediments that contain nutrients and organics. Settling is facilitated by non-turbulent flow and is enhanced by the quiescence provided within a proposed BMP. In the steeply sloped upper watersheds, faster-flowing runoff would be slowed, where possible, before discharging to streams to minimize bank erosion and enhance channel stability. Forebays, outlet stilling basins, and extended detention wetlands encourage settling of pollutants with reduced flow velocities. In addition, wetland plants have root systems supportive of aerobic and anaerobic bacterial colonies that decompose nutrients. Sediment is the pollutant most readily removed from stormwater by the proposed BMPs because it can be physically separated through settling. Removal of phosphorous, nitrogen, and other soluble pollutants is more challenging; however, phosphorous can be reduced when attached to settling solids and by vegetative uptake. Coliform can also be reduced through natural die-off when stormwater is detained.

Peak Flow Management and Flood Reduction

The proposed extended detention BMPs would reduce peak discharges by detaining stormwater runoff until released gradually over a longer period of time after the peak storm, such that the runoff volumes in the system do not cause downstream flooding. During storm events, runoff flows quickly from impervious surfaces and steeply sloped terrain. The proposed BMPs in the upper and lower watersheds would attenuate these runoff rates. The proposed extended detention wetlands in the lower watersheds would also provide peak flow management and flood reduction by detaining stormwater during high tides when the outfall tide gates are closed. Once the tide recedes and the gates open, the detained water in the proposed BMPs can then drain to the Lower Bay. In contrast, the capacity of a fully piped storm system with no proposed BMPs would likely be exceeded during high tide, and floodwaters would collect in the streets or basements of adjacent property owners.

The proposed amended drainage plans are designed to reduce downstream flooding in the FEMA-mapped floodplains and would not expand the size of the floodplains. A detailed assessment of the hydrologic conditions in each watershed with the proposed drainage plans is presented in the natural resources chapter for each watershed (see Chapters 3.9, 4.9, and 5.9).

Typical BMP Design Elements

BMPs proposed for the Mid-Island Bluebelt typically include the following design features:

- Forebays are located at storm sewer discharge points and are intended to attenuate velocity and allow sediment to drop out prior to entering the main part of the BMP. Micropools are located just upstream of BMP outlets and provide a second area for sediment accumulation. Both forebays and micropools are lined with concrete-embedded rip rap to allow for sediment removal by DEP maintenance crews and vactor trucks via dedicated maintenance accessways.
- Permanent pools are always inundated/underwater, whereas extended detention zones are inundated during storms and drain down over a maximum period of 24 hours. The permanent pool elevation is controlled by the invert elevation of the low-flow orifice in the BMP outlet structure. Where applicable, the conceptual design figures for the BMPs indicate permanent pool and extended detention elevations. Extended detention zones are shallow areas of diverse emergent wetland vegetation, which would provide habitat for a variety of bird species and act as important feeding areas.
- Perched pools and ephemeral pools are habitat enhancement features intended to diversify the flora and fauna species found within the proposed BMPs by providing additional and unique habitat. Ephemeral pools would be located in the extended detention zones and would temporarily fill with water during storm events and would drain down over time. Perched pools are permanent installations comprised of clay subsoil, which would allow for standing water to collect. Perched pools have been very successful at a previously constructed site, BMP Richmond Creek 8 (RC-8), near Meisner and Lighthouse Avenues in the Staten Island Greenbelt. At BMP RC-8, green frogs have been observed breeding and painted turtle hatchlings have been found taking refuge in the thick vegetation.

Berms

Several proposed BMP designs call for low, landscaped berms around the proposed BMP footprints (**see Figure 1.1-3**). These proposed berms would be constructed on Bluebelt property adjacent to private properties and streets to provide additional flood protection during storm events. Based on current topographic information, berms are proposed for those proposed BMPs where the adjoining property elevations are lower than the peak water surface elevations of the proposed BMPs during the design storm. In cases where the elevations of the adjoining properties and streets are similar to the proposed BMP elevations, there is less necessity for berms.

The need for these berms would be determined based on site-specific topography during final design for the propose BMPs. Berms would be constructed around the perimeter of the proposed BMP at heights ranging between 6 and 36 inches. The width of the berm would also vary based on final design (see **Figure 1.1-3**). Three types of berms designs would be considered: berms that may be used by DEP for maintenance access vehicles would be 10 to 12 feet wide with an all weather surface; berms to be used only for walking access would be four to five feet wide and feature either a gravel or woodchip surface; and if access is not needed, berms would be narrow grading features landscaped with grasses and small shrubs. Slope stabilization matting or other stabilization techniques would be integrated into the design so that the berms can withstand large rainfall and tidal storm surge events without eroding. The proposed berms, however, are not designed to be a mitigation strategy against local flooding impacts during a tidal storm surge, such as occurred during Hurricane Sandy.

The proposed berms would be designed with careful attention to avoid affecting existing drainage patterns on adjacent properties and wetlands. In some cases this yard drainage, especially in rear yards, currently flows into Bluebelt properties and proposed BMP sites unimpeded. If the proposed berms could potentially alter the drainage of neighboring properties and cause water to pond, a variety of techniques such as drain tiles, French drains (perforated pipes), swales and yard inlets would be considered during final design to avoid impacts. These drainage techniques would either be piped through the berm or to the nearest storm sewer inlet. A backflow prevention device would also preclude reverse flow from a proposed BMP or storm sewer onto adjacent properties.

In addition to maintaining the existing flow patterns on neighboring private properties, another objective of the final design of the proposed berms would be to eliminate or minimize impacts on existing wetlands outside of the proposed BMP sites. To that end, the berms would be sited within the limits of Bluebelt property or DPR parkland and would not adversely impact adjacent private properties. The range of berm heights and lengths as presented in this FGEIS are a conservative estimate based on current information and conceptual designs developed during the EIS process. To eliminate or minimize indirect impacts on wetlands, the final berm design details would also take into consideration details such as current topography and slopes, wetland hydrology and inputs, wetland functions and boundaries, the presence of any limiting structures such as roadways and buildings, and berm design alternatives (described above) that would minimize wetland impacts while meeting the project objectives.

Proposed BMP Planting Programs

The proposed BMP planting program is critical to the effectiveness of the proposed project as it supports the creation, restoration and enhancement of wetland functions. The overall objectives of the Bluebelt planting program are to support a broader restoration effort within the watersheds while creating a natural, integrated ecological system that would be self-sustaining. Proposed BMP plantings are tailored for the existing native vegetative community at each site, and native species are always proposed. Opportunities to increase species diversity, within the context of the native community, are also utilized wherever feasible. Many of the Mid-Island proposed BMP sites are currently vegetative monocultures of common reed. As a result, the proposed project would create comparatively more diverse wetland habitats and enhanced ecological values while preserving open space, visual, and water quality benefits.

In addition to the advantages of large and more complex wetland features, proposed Mid-Island BMPs can also incorporate additional “lessons learned” from the South Richmond Bluebelt. Proposed Mid-Island BMP designs would strive to include the use of smaller trees in the planting plan as they have a better survival rate than larger tree plantings. If larger caliper trees are necessary for a particular BMP proposed design, then native ash and maple trees which have a better survival rates among larger trees. Shrub plantings may also be selected from a list of volunteers identified during pre-construction inventories. Another “lesson learned” from the South Richmond Bluebelt relates to the design of small pocket wetlands. In these cases, it has been observed that setting back tree plantings from the water’s edge is necessary so as to not shade out new wetland plantings in the understory. Muskrats and Canada geese are also known to be responsible for the loss of many emergent wetland plants in the proposed BMPs. Therefore, BMP proposed designs now include species that are not favored by these species along with temporary wildlife exclusion fences and irritants.

A typical proposed BMP extended detention wetland has four zones: low-flow channel, permanent pool, extended detention, and upland buffer. The low-flow channel is open water

with no vegetation. The permanent pool is continually submerged with an area of emergent wetland vegetation including plants that are rooted under water and whose stalks and leaves emerge above the water surface. The extended detention zone supports plants that can tolerate periodic flooding, while the upland buffer zone is basically non-wetland vegetation although occasionally may be flooded. Plant species that are expected to be used for the proposed BMP zones are listed below in **Table 1.1.-1**.

Monitoring and Maintenance

DEP's Bluebelt Program has an established monitoring program to identify the success rates of the various planting regimes and habitats. Based on monitoring information collected in the South Richmond Bluebelt, many previously disturbed lands have been restored back to contributing natural and diverse landscapes. In addition to the landscaping, native plant species have colonized many restoration sites, the majority of them desirable from a natural resources perspective. Nonetheless, invasive exotic plants, such as Japanese knotweed and common reed, always pose a threat to the proposed BMP landscaping and can cause brush fires. DEP, therefore, has a NYSDEC wetlands permit to apply herbicides and to control invasive species to support its monitoring and maintenance program. Modifications to plant selections or sizes, slope length, water depths, and wildlife controls that may be necessary would be based on the monitoring information.

SANITARY SEWER NETWORK

While sanitary sewers are largely installed in the three watersheds, the proposed amended drainage plans include the completion of the sanitary sewer system, where necessary. In some cases, the proposed amended drainage plans call for increasing the size of some existing sanitary sewers that were installed when the standard for minimum pipe sizes was smaller (i.e., an increase in size from an 8-inch to a 10-inch sewer with the proposed amended drainage plans). Within the South Beach watershed, in order to allow for development of proposed BMP SBE-1, relocation of existing sanitary sewers is necessary. All sanitary wastewater collected in the three watersheds would then be subject to secondary treatment at the Oakwood Beach WWTP prior to discharge to the Lower Bay.

Table 1.1-1
Representative Proposed BMP Planting Plan by Zone

Zone	Botanical Name	Common Name	Spacing
Wet/Permanent Pool (Planting shelves)	*Hibiscus moscheutos*	swamp rose mallow	Groups
	Pontederia cordata	pickerel weed	3 feet on center
	Peltandra virginica	green arrow arum	3 feet on center
	Sauruus cernuus	lizard's tail	3 feet on center
	Scirpus validus	softstem bulrush	3 feet on center
	Cephelanthus occidentalis	buttonbush	Groups
	Typha angustifolia	narrowleaf cattail	3 feet on center
	Sagitaria latifolia	broadleaf arrowhead	3 feet on center
	Hibiscus moscheutos	crimson-eyed rosemallow	3 feet on center
	Eleocharis obtusa	blunt's spikerush	3 feet on center

Table 1.1-1 (cont'd)
Representative Proposed BMP Planting Plan by Zone

Zone	Botanical Name	Common Name	Spacing
Moderately Wet -Extended Detention (Wetland edge and along streambanks)	*Juncus effuses*	soft rush	2 feet on center
	Scirpus cyperinus	woolgrass	2 feet on center
	Leersia oryzoides	rice cutgrass	2 feet on center
	Aster novae-angliae	New England aster	2 feet on center
	Cornus amomum	silky dogwood	groups
	Acer saccharinum	Silver Maple	12 feet on center
	Carex hystricina	bottlebrush sedge	2 feet on center
	Carex vulpinodea	fox sedge	2 feet on center
	Iris versicolor	blueflag iris	2 feet on center
	Aslcepius incarnata	swamp milkweeds	2 feet on center
	Verbana hastata	swamp verbena	2 feet on center
	Andropogen virginicus	broom sedge	2 feet on center
	Baccharis halmifolia	eastern baccharis	groups
	Sambucus nigra	American black elderberry	groups
	Rosa palustris	swamp rose	groups
	Salix discolor	pussy willow	Groups
Upland Buffer (Adjacent areas)	*Elymus virginicus*	Virginia wild rye	18" on center
	Solidago canadensis	Canada goldenrod	2 feet on center
	Aronia melanocarpa	black chokeberry	groups
	Viburnum nudum	withe-rod	groups
	Panicum virgatum	Switchgrass	2 feet on center
	Eupatorium rugosum	white snakeroot	2 feet on center
	Veronica noveboracensis	New York ironweed	2 feet on center
	Parthenocissus quinquefolia	Virginia creeper	2 feet on center
	Aster novae-angliae	New England Aster	2 feet on center
	Euthamia graminifolia	lance leaved goldenrod	2 feet on center
	Ascelepias syricia	common milkweed	2 feet on center
	Elymus virgincus	Virginia wild rye	2 feet on center
	Vuburnum dentatum	southern arrowwood	groups
	Rubus allegheniensis	Allegheny blackberry	groups
	Photina pyrifolia	red chokeberry	groups
	Lindera benzoin	spicebush	groups
	Quercus bicolor	swamp white oak	12 feet on center
	Quercus alba	white oak	12 feet on center
	Acer rubrum	red maple	12 feet on center
	Nyssa sylvatica	black gum	12 feet on center
	Populus deltoides	eastern cottonwood	12 feet on center
	Betula populifolia	gray birch	12 feet on center
	Rhus copallinum	winged sumac	12 feet on center
	Salix nigra	black willow	12 feet on center
	Chamaecyparis thyoides	Atlantic white cedar	12 feet on center
	Quercus palustris	pin oak	12' on center

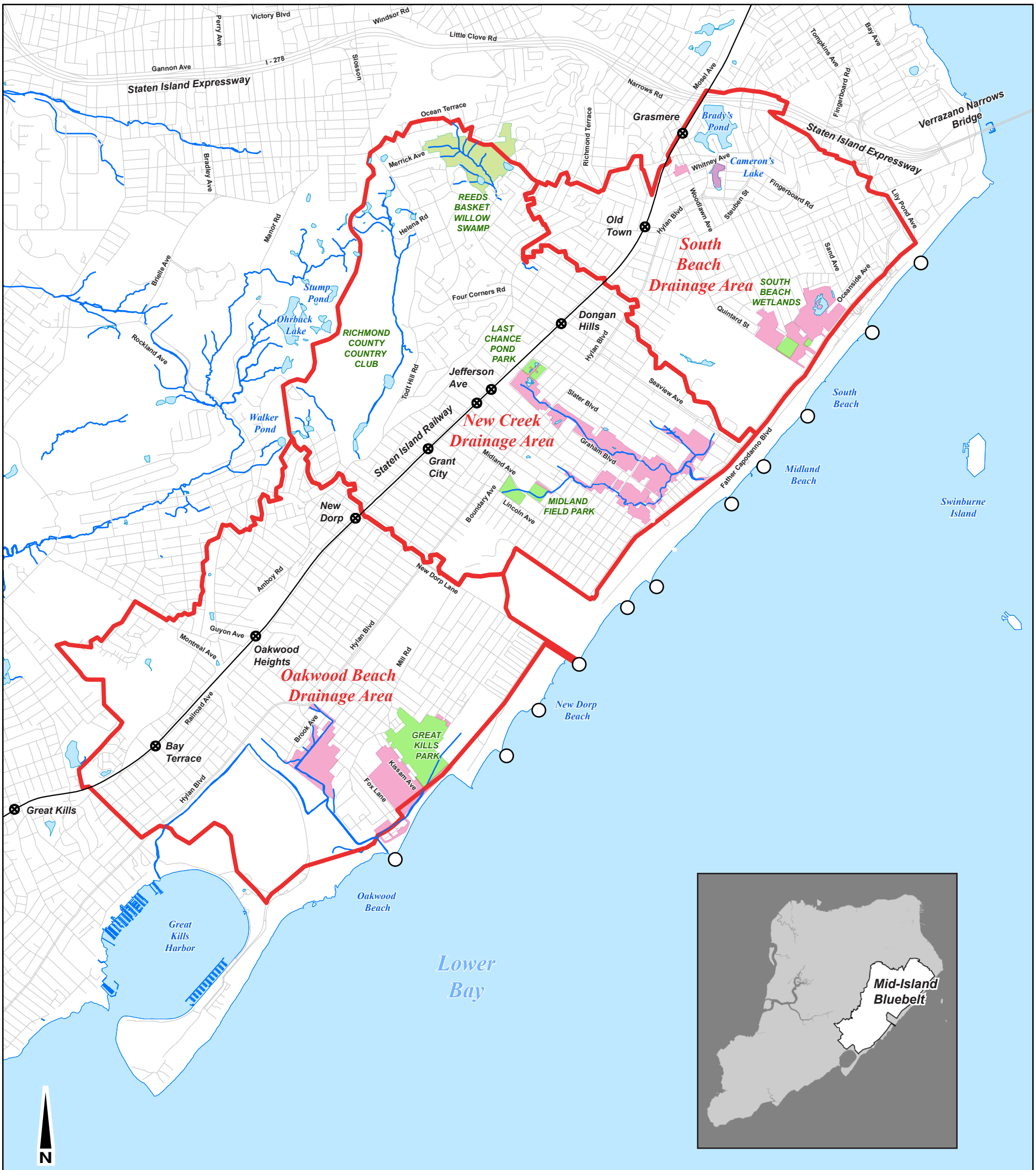
Table 1.1-1 (cont'd)
Representative Proposed BMP Planting Plan by Zone

Zone	Botanical Name	Common Name	Spacing
Forested Wetlands	*Carex stricta*	tussock sedge	2 feet on center
	Carex crinita	fringed sedge	2 feet on center
	Leersia oryzoides	rice cutgrass	2 feet on center
	Peltandra virginica	arrow arum	2 feet on center
	Sagitaria latifolia	arrowhead	2 feet on center
	Symplocarpus foetidus	skunk cabbage	2 feet on center
	Parthenocissus quinquefolia	Virginia creeper	2 feet on center
	Osmunda cinnamomea	cinnamon fern	2 feet on center
	Cephelanthus occidentalis	buttonbush	groups
	Viburnum dentatum	southern arrowwood	groups
	Ilex vertillata	winterbery	groups
	Sambucus canadensis	elderberry	groups
	Vaccinium corymbosum	highbush blueberry	groups
	Lindera benzoin	spicebush	groups
	Cornus amomum	silky dogwood	groups
	Acer rubrum	red maple	12 feet on center
	Acer saccharinum	silver maple	12 feet on center
	Quercus bicolor	swamp white oak	12 feet on center
	Quercus palustris	pin oak	12 feet on center
	Nyssa sylvatica	black gum	12 feet on center
	Chamaecyparis thyoides	Atlantic white cedar	12 feet on center
	Carpinus caroliniana	ironwood	12 feet on center

Source: DEP, October 2013

F. DRAINAGE PLAN CONSTRUCTION PHASING

The phasing and progression of construction would begin at lower elevations before moving upland since the upper watershed of gravity-fed systems cannot be built without a functioning outlet at the system's low point. A phased construction program also allows the City to monitor construction activities and minimize adverse erosion and sedimentation impacts, road closures, and access restrictions. Implementation of the proposed amended drainage plans would, therefore, occur in multiple capital projects expected to continue through 2043. Construction of the first proposed capital project is anticipated to begin in fiscal year 2014 and would involve the construction of proposed BMPs NC-7 and NC-8 and the low flow channel of NC-9 and NC-17 along the West Branch of New Creek (see also **Figure 4.1-9** and **Figure 4.1-9a** in Chapter 4.1 "Project Description for the New Creek Drainage Plan". This proposed capital project would relieve extreme flooding currently experienced during storm events. Each of the project descriptions in the individual watershed chapters provides a detailed description of proposed construction sequencing for that watershed. ✷



Drainage Areas and Watershed Location Map

Figure 1.1-1

1

2

Photographs of Flooding
in the New Creek Watershed

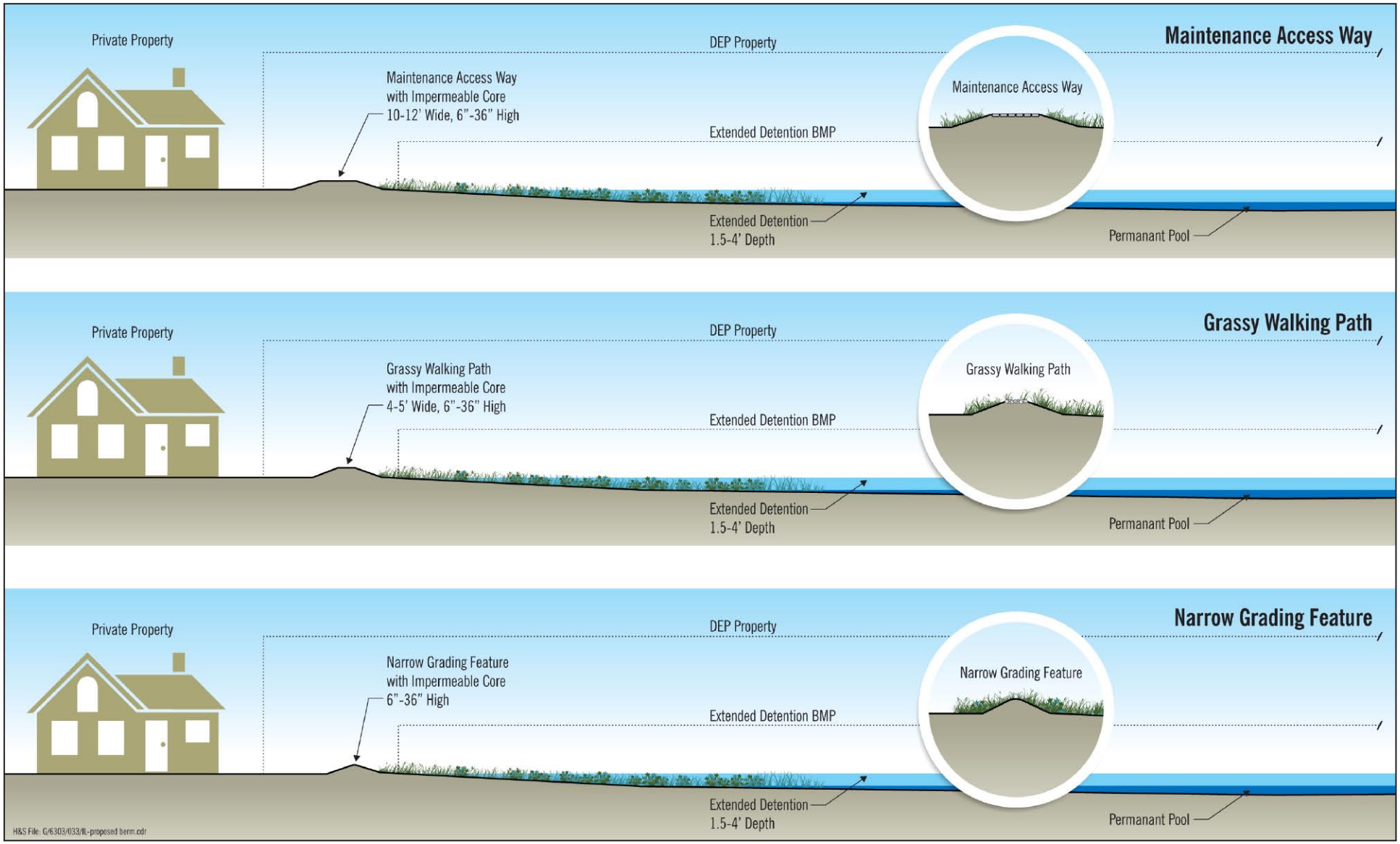
Figure 1.1-2a

3

4

Flooding at the Intersection of
Baden Place and Mapleton Avenue

Figure 1.1-2b



Examples of Berms
Figure 1.1-3