City-Wide Long Term CSO
Control Planning Project

Coney Island Creek Waterbody/Watershed Facility Plan Report

The City of New York
Department of Environmental Protection
Bureau of Engineering Design & Construction

June 2009

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Prepared by

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EXECUTIVE SUMMARY

The New York City Department of Environmental Protection (NYCDEP) has prepared this watershed-specific Waterbody/Watershed Facility Plan Report for controlling combined sewer overflows (CSO) to Coney Island Creek, as required by the Administrative Consent Order between NYCDEP and the New York State Department of Environmental Conservation (NYSDEC) known as DEC Case #CO2-20000107-8 (January 14, 2005) or “the CSO Consent Order.” This Waterbody/Watershed (WB/WS) Facility Plan Report builds on the previous Coney Island Creek CSO Facility Planning Project, Modified CSO Facility Planning Report dated April 2003 and many other water quality planning studies conducted over the past 20 years. Coney Island Creek is one of 18 drainage areas defined by the 2005 CSO Consent Order that encompass the entirety of the waters of the City of New York. A final City-wide LTCP incorporating the plans for all watersheds within the City of New York is scheduled for completion by 2017.

Purpose

The purpose of this WB/WS Plan is to take the first step toward development of a Long-Term Control Plan for this waterbody. This Plan assesses the ability of the existing NYC CSO Facility Plan for Coney Island Creek to provide compliance with the existing water quality standards. Where these facilities will not result in full attainment of the existing standards additional alternatives are evaluated.

Context

This report represents the WB/WS Plan for Coney Island Creek. This is one element of the City’s extensive multiphase approach to CSO control that was started in the early 1970s. As described in more detail in Section 5, New York City has been investing in CSO control for decades. Elements already part of the City’s CSO program and listed in the 2005 CSO Consent Order amount to over $2.1 billion of infrastructure investment. This does not include millions spent annually on control of CSOs through the Nine Minimum Controls that have been in place since 1994.

Regulatory Setting

This WB/WS Plan has been developed in fulfillment of the 2005 CSO Consent Order requirements. This Plan represents one in a series of WB/WS plans covering 18 waterbodies that will be developed prior to development of a final Long Term CSO Control Plan for the City. This WB/WS plan, as do the other plans, contains all the elements required by the USEPA of a Long Term CSO Control Plan.

Goal of Plan

The goal of this plan is to reduce CSO discharges to Coney Island Creek so that they do not contribute to excursions from the current water quality standards. This plan assesses the effectiveness of CSO controls, now in place within New York City or required by the Consent Order to be put in place, to attain water quality that complies with the NYSDEC water quality standards. This WB/WS plan also assesses additional cost-effective CSO control alternatives or strategies (e.g. water quality standards revisions) that can be employed to provide attainment with the water quality standards as the analyses indicate that existing or proposed controls are expected to fall short of attaining water quality standards.

Adaptive Management Approach

As noted in Section 8, additional controls are being proposed to attain water quality standards. Section 8, however, also notes that additional assessments are recommended (i.e.; post construction monitoring, sewer and/or water quality monitoring, pilot testing, detailed facility planning, preliminary design, etc.) prior to construction of any additional CSO controls and that any proposed controls could potentially be modified as a result of these additional analyses.

These additional controls or actions can be thought of as gaps that need to be filled prior to establishment of a final LTCP for Coney Island Creek. After a thorough assessment of these gaps, the City will prepare a final Long Term CSO Control Plan for Coney Island Creek. The goal of the LTCP will be to achieve fishable/swimmable water quality as stipulated in the Clean Water Act.

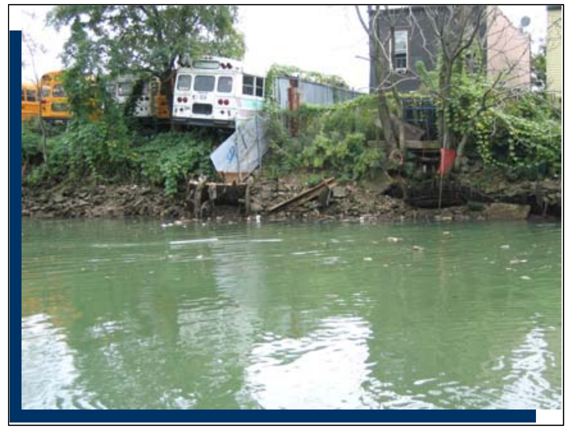
Project Description

Coney Island Creek, located in southwest Brooklyn, is tributary to Gravesend Bay and flows in a southwesterly direction. The first inhabitants of the study area were the Algonquin Indians. Shellfish and finfish were abundant in the waters of the region and were an important part of the Algonquin diet. The region was covered with broad-leaf hardwood forests, salt marshes, and freshwater streams. In the colonial era, Coney Island was part of the township of Gravesend, the only English town along with five Dutch settlements that would later become Brooklyn. Coney Island was predominantly farmland during the late seventeenth and eighteenth centuries. During the nineteenth century, the railroad reached the public beaches at Coney Island and it became a fashionable resort community with horse racing as the main attraction. Ornate wood-frame hotels were built to accommodate visitors from Manhattan and downtown Brooklyn. When amusement rides and spectacles were introduced in the 1890s, Coney Island began to assume the character for which it would become famous. The extension of the subway to Coney Island in the 1920s made the area accessible to all New Yorkers.

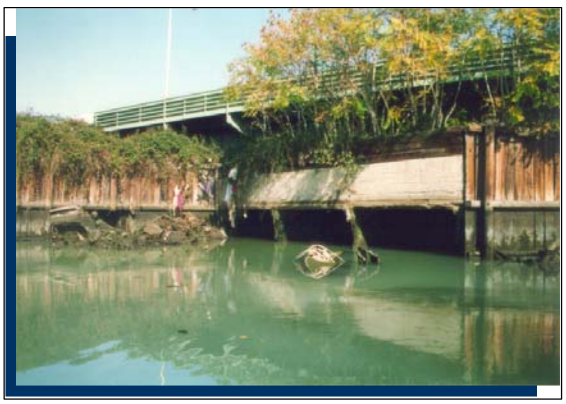
Table 1. Runoff Volumes Pre-urbanized vs. Urbanized Conditions

Watershed Characteristics	Pre-Urbanized (1900)[2]	Urbanized (2000)[3]
Population[1]	75,000	164,222
Imperviousness	30%	57%
Average Annual Storm Runoff Yield (MG) [2]	1,030	1,960
Peak Storm Runoff Yield (MG)[2]	61	120

1. Pre-urbanized population estimate based on estimated urbanized areas within Coney Island Creek drainage area on USC&GD 1890 map. Urbanized population based on census data.
2. Pre-Urbanized flows calculated using the average rainfall year JFK 1988 and based on the rationale approach of Q = C*I*A
3. Urbanized flows determined using InfoWorks model.



Once a bountiful source of fish and oysters, Coney Island Creek is no longer a natural feature. The Coney Island Creek watershed drainage area is now highly urbanized. The majority of Coney Island Creek has been channelized with bulkheading and rip rap. The lower portion of Coney Island Creek is lined with numerous obstructions including wrecks, old barges, pilings, and construction debris. The upper portion of the Creek becomes choked with abandoned cars and boats, pilings, and other urban refuse. As noted in the table above, increases in population and urbanization over the last century has resulted in an increase in annual runoff to the waterbody and has all but eliminated any natural response mechanisms (tidal marshes and buffer zones) that might have helped absorb this hydraulic load. Combined and separated sewers have replaced natural freshwater streams such that the only source of freshwater to Coney Island Creek is CSO and stormwater discharges. As a result, Coney Island Creek receives approximately 290 million gallons a year of combined sewage through the permitted CSO outfall to the Creek. In addition, the Creek receives another 1,487 million gallons per year of urban stormwater. As a consequence of these discharges, nuisance conditions resulting from solids and floatables have impaired its recreational use while depressed dissolved oxygen levels have impacted aquatic health. Elevated bacteria concentrations are common. Restoring Coney Island Creek to its pristine condition is no longer possible due to hydraulic modifications that removed the natural wetlands habitat and man-made conditions that simply cannot be reversed.



Coney Island Creek is classified by the State of New York as a Class I waterbody, with designated best usages of secondary contact recreation and fishing. To support these uses, numerical criteria for dissolved oxygen and bacteria concentrations have been established. Historical dissolved oxygen concentrations are frequently found to show impairments and excursions below the allowable levels. Excursions below 4.0 mg/L are generally confined to the upper and middle portions of the Creek.

Total and fecal coliform bacteria data indicate that recreational uses of the Creek are also impaired. As with dissolved oxygen, excursions above bacterial water quality standards are generally confined to the upper and middle portions of the Creek.

NYSDEC has listed Coney Island Creek as a high priority waterbody for TMDL development with its inclusion on the Section 303(d) List. The cause of the listing was pathogens and oxygen demand due to CSO discharges, failing on-site systems (illegal sanitary connections), storm sewers, and urban runoff. The analyses discussed in Section 4 confirm these findings. Based on this NYSDEC 303(d) List and the analyses conducted herein, no additional pollutants beyond those previously identified are pollutants of concern with respect to CSO discharges to the Creek.

Table 2. Outfalls and Discharge Volumes* to Coney Island Creek

Outfall Number	Type	Total Annual Volume (MG)
OH-021	Combined	292
OH-021	Storm	910
CI-601	Storm	21
CI-602	Storm	69
CI-639	Storm	59
CI-640	Storm	7.2
CI-641	Storm	110
CI-653	Storm	49
CI-664	Storm	50
CI-665	Storm	30
OH-606	Storm	42
n/a	Direct Runoff	138
Totals	**CSO**	**292**
	Stormwater	**1,487**
	Total	**1,779**

* Based on rainfall year 1988 at JFK Airport and 2045 population projections for sanitary flow.

Coney Island Creek has a history of CSO Facility Plan development, as discussed in Section 5.0. Coney Island Creek CSO Facility Planning efforts were initiated in the early 1990s prior to issuance of the 1994 USEPA CSO Control Policy. The approach to improving Coney Island Creek water quality during the early 1990s CSO Facility Planning effort followed many of the CSO Policy requirements including a rigorous evaluation of alternatives that considered "a reasonable range of alternatives…sufficient to make a reasonable assessment of cost and performance" (59 FR 18692).

The 1998 Coney Island Creek CSO Facilities Planning Report (Hazen and Sawyer, 1998), which was subsequently modified in 2003 (Hazen and Sawyer, 2003), described in detail the process used to screen and select CSO control alternatives. The approach first considered all reasonable measures for reducing CSO discharges to Coney Island Creek, then reduced the comprehensive list of alternatives to those that had potential application in Coney Island Creek given the nature of the waterbody, its tributary area, and its sewerage and collection facilities. The options with the highest potential were fully developed and analyzed based on the following criteria:

- Attaining water quality goals;
- Public acceptance;
- Effective cost expenditures;
- Reliable operation;
- Regulatory concurrence; and

- Compatibility with Owls Head and other WPCPs under NYCDEP operation.

Alternatives retained from the preliminary screening process were considered further under a secondary screening process. However, with the existing water quality data and modeling framework it was not possible to confidently project what future conditions would be. Therefore, the 1998 Coney Island Creek CSO Facility Plan recommended removing all illegal sanitary connections and reducing CSOs to the Creek by expanding the Avenue V Pumping Station flow conveyance capacity to 80 MGD. This was expected to achieve an 85 to 90 percent CSO volume reduction to the Creek.

The 1998 CSO Facility Plan that recommended the expansion of the Avenue V Pumping Station, as noted above, was largely developed prior to the USEPA adoption of the CSO Policy in 1994. The Facility Plan preceded the requirement to develop an LTCP as per the SPDES Permit modifications. This recommendation became a requirement of the 2005 CSO Consent Order with NYSDEC. Since NYCDEP is required by the Order to implement the recommendations of the 1998 Coney Island Creek CSO Facility Plan, this Waterbody/Watershed Facility Plan, consistent with USEPA CSO Policy, examines additional CSO controls above and beyond those specified in the original CSO Facility Plan.

After complete examination of the costs and benefits of a wide variety of CSO control alternatives a Waterbody/Watershed Facility Plan was selected that aims at greatly reducing the CSO volume entering Coney Island Creek through a number of infrastructure improvements. The Coney Island Creek Waterbody/Watershed Facility Plan aims to abate the CSO associated aesthetic impairments found in the Creek and reduce CSO related pollutant loads to the Creek in a cost-effective manner. Some of the Facility Plan components have already been initiated through NYCDEP's ongoing CSO planning activities while others will need to be initiated in the future through the LTCP planning process. The Coney Island Creek Waterbody/Watershed Facility Plan consists of the following components:

1. Rehabilitation and upgrade of Avenue V Pumping Station capacity from 30 MGD to 80 MGD to reduce CSOs to Coney Island Creek;

2. Construction of two new force mains, one for dry weather flow and the second for wet weather flow; and

3. Implementation of post-construction water quality monitoring after the Avenue V Pumping Station upgrade.

The Table below presents water quality benefits, in terms of dissolved oxygen, total coliform and fecal coliform for Baseline and Waterbody/Watershed Facility Plan conditions. The Table depicts projected attainment of numerical criteria for each evaluated scenario. Attainment of numeric criteria for dissolved oxygen is determined as a percentage of hours during the year that comply with the applicable existing Class I criteria, while total and fecal coliform is based upon meeting the geometric mean numerical criteria for a given month. As shown, the Waterbody/Watershed Facility Plan represents an improvement from Baseline conditions. Class I (never less than 4.0 mg/L) dissolved oxygen criteria are projected to be met 85 percent of the time (or more, depending on the location within the creek) for the Waterbody/Watershed Facility

Plan. For pathogens, the Waterbody/Watershed Facility Plan provides attainment of total coliform criteria 92% of the time and 67% of the time for fecal coliform. The Table below also provides a summary of water quality associated with 100% CSO removal from Coney Island Creek. It is important to note that no alternative — not even 100 percent CSO retention — improves attainment of numerical criteria for total coliform or fecal coliform beyond the CSO Facility Plan. However, the 100 percent CSO retention alternative does provide a minor incremental increase in the attainment of dissolved oxygen numeric criteria over the Waterbody/Watershed Facility Plan. The Coney Island Creek Watershed/Waterbody Facility Plan is estimated to cost approximately $177 million. For Coney Island Creek, 100% CSO removal would require an additional investment of nearly $1 billion.

Table 3. Projected Water Quality Improvements of Selected Alternatives

Water Quality Parameter	Baseline(3)	WB/WS Facility Plan(3)	100% CSO Retention(3)
Dissolved Oxygen(1)	80	85	87
Total Coliform(2)	67	92	92
Fecal Coliform(2)	58	67	67
Notes: (1) Percentage of typical year DO > 4.0 mg/L, the Class I WQS. (2) Percentage of months in typical year that secondary contact criteria are met. (3) Minimum percentage attainment (i.e., worst-case location) based on water quality modeling.			

The Coney Island Creek CSO Facility Plan was selected based upon the USEPA CSO Control Policy's demonstration approach for a long-term control plan. Federal CSO Policy allows a permittee to demonstrate that the selected control program is adequate to meet the water quality-based requirements of the CWA. To be a successful demonstration, the permittee should demonstrate each of the following:

i. The planned control program is adequate to meet water quality standards (WQS) and protect designated uses, unless WQS or uses cannot be met as a result of natural background conditions or pollution sources other than CSOs. The selected Waterbody/Watershed Facility Plan demonstrates that even 100 percent CSO control will not improve upon water quality benefits derived from the implementation of the Coney Island Creek CSO Facility Plan as stormwater is the major source of pollutants after removal of 87 percent of the CSO as per the selected alternative.

ii. Where WQS and designated uses are not met in part because of natural background conditions or pollution sources other than CSOs, a total maximum daily load, including a wasteload allocation and a load allocation, or other means should be used to apportion pollutant loads. The CSO discharges remaining after implementation of the Waterbody/Watershed Facility Plan will not preclude the attainment of WQS or the receiving waters' designated uses or contribute to their impairment.

iii. The planned control program will provide the maximum pollution reduction benefits reasonably attainable. The Waterbody/Watershed Facility Plan represents the point of diminishing return for CSO load reduction and water quality improvement and hence the most cost-effective scenario.

iv. The planned control program is designed to allow cost effective expansion or cost effective retrofitting if additional controls are subsequently determined to be necessary to meet WQS or designated uses. This criterion does not apply since this report demonstrates that additional CSO control beyond the selected alternative will not improve water quality.

Post-construction monitoring will be integral to the assessment of the Coney Island Creek Waterbody/Watershed Facility Plan achieving the desired results in the waterbody. Compliance monitoring consists primarily of collecting relevant sampling data from the waterbody, but also collecting relevant precipitation data and data characterizing the operation of the sewer system and related control facilities. The data set from each year of sampling will be compiled and evaluated to refine the understanding of the impacts of the Waterbody/Watershed Facility Plan on water quality in Coney Island Creek.

The operation of the Coney Island Creek Waterbody/Watershed Facility Plan will be carried out in conjunction with the existing Owls Head WPCP Wet Weather Operating Plan (WWOP). NYCDEP intends to operate these facilities in accordance with their WWOP. The annual analysis of monitoring data will trigger a sequence of detailed investigations if needed. The WWOP for the Owls Head WPCP is presented in Appendix A of this report.

The receiving water modeling calculations summarized in this report show that the WB/WS Facility Plan improves dissolved oxygen resources in the upper reaches from Baseline conditions. The result is a reasonably high level of compliance on an annual cycle, but complete compliance with the Class I numerical criterion is not attained. The modeling results also show that none of the measures evaluated to improve dissolved oxygen compliance (up to and including 100% CSO capture) is projected to achieve full compliance with the Class I dissolved oxygen standard. It is apparent that the development of the watershed and the resulting imperviousness and attendant large stormwater runoff are human-caused conditions which can not be practicably remedied which is a factor that can be considered for a UAA under Federal and State regulation.

For recreational activity, the currently designated use of secondary contact recreation is not expected to be attained by the WB/WS Facility Plan on an annual basis. However, as shown from the modeling results, the WB/WS Facility Plan is expected to produce a significant improvement in compliance compared with existing conditions once the illegal sanitary connections to storm sewers are rectified. Water quality modeling calculation results also show that additional measures which could be considered to improve Class I secondary contact compliance (100% CSO capture, CSO disinfection, stormwater BMPs with 25% pollutant load reduction) also would not achieve full compliance annually. It is expected that numerical water quality conditions suitable to support Class I secondary contact would be attained during the summer recreation season and would be achieved for both relevant bacteriological indicators, total and fecal coliform. This is a very significant improvement from existing conditions.

From a water quality regulations standpoint, Coney Island Creek could be considered to attain the current Class I secondary contact use on a seasonal basis once the WB/WS Facility plan is implemented. This warrants refinement of the current NYSDEC Water Quality Regulations to allow for seasonal use designations. If seasonal compliance with this use goal is not to be considered and annual compliance is required, then a UAA may also be necessary for the bacteriological indicators. The regulatory basis for the UAA would be the same as that for dissolved oxygen.

The post-construction monitoring program may indicate that Coney Island Creek and other confined waterbodies throughout the City may warrant consideration of the development of a new waterbody classification in NYSDEC Water Quality Regulations, that being “Urban Tributary.” The Urban Tributary classification would have the following attributes:

- Recognition of wet weather conditions in the designation of uses and water quality criteria.
- Application to urban confined waterbodies which satisfy any of the UAA criteria enumerated in 40 CFR 131.10(g).
- Definition of required baseline water uses
- Fish and aquatic life survival (where attainable)
- Secondary contact recreation (where attainable)

Other attainable higher uses would be waterbody specific and dependent upon the effectiveness of the site-specific CSO LTCP based upon knee-of-the-curve considerations and technical feasibility and implementability.

The Urban Tributary classification could be implemented through the application of a generic UAA procedure for confined urban waterbodies based on the criteria of 40 CFR 131.10(g). This procedure could avoid the necessity for repeated UAAs on different waterbodies with similar characteristics. Those waterbodies which comply with the designation criteria can be identified at one time, and the reclassification completed in one rulemaking. If either of the designated baseline uses of fish and aquatic life survival and secondary contact recreation did not appear to be attainable in a particular setting, then a site-specific UAA would be required.

1.0 Introduction

The City of New York owns and operates 14 water pollution control plants (WPCPs) and their associated collection systems through the New York City Department of Environmental Protection (NYCDEP). The system contains approximately 450 combined sewer overflows (CSOs) located throughout the New York Harbor complex. NYCDEP is executing a comprehensive watershed-based approach to long-term CSO control planning to address the impacts of these CSOs on the water quality and use of the waters of New York Harbor. As illustrated in Figure 1-1, multiple waterbody assessments are being conducted that consider causes of non-attainment of water quality standards and identify opportunities and requirements for maximizing beneficial uses. This Waterbody/Watershed (WB/WS) Facility Plan Report provides the details of the assessment and the actions that will be taken to improve water quality in one of these waterbodies.

New York City's environmental stewardship of the New York Harbor began in 1909 with water quality monitoring "to assess the effectiveness of New York City's various water pollution control programs and their combined impact on water quality" that continues today (annual NYCDEP NY Harbor Water Quality Survey Reports, 2000-2007). CSO abatement has been ongoing since at least the 1950s, when conceptual plans were first developed for the reduction of CSO discharges into Spring Creek and other confined tributaries in Jamaica Bay and reduction of CSO discharges to confined tributaries in the East River. From 1975 through 1977, the City conducted a Harbor-wide water quality study funded by a Federal Grant under Section 208 of the Water Pollution Control Act Amendments of 1972. This study confirmed tributary waters in the New York Harbor were negatively affected by CSOs. In addition, dry weather discharges – which NYCDEP has since eliminated – were also occurring. In 1984 a City-wide CSO abatement program was developed that initially focused on establishing planning areas and defining how facility planning should be accomplished. The City was divided into eight individual project areas that together encompass the entire Harbor area. Four open water project areas were developed (East River, Jamaica Bay, Inner Harbor and Outer Harbor), and four tributary project areas were defined (Flushing Bay, Paerdegat Basin, Newtown Creek, and Jamaica Tributaries). The State Pollutant Discharge Elimination System (SPDES) permits for each WPCP required development of CSO Facility Plans for each project area. The permits for each WPCP, administered by the New York State Department of Environmental Conservation (NYSDEC), apply to CSO outfalls as well as WPCP discharges and stormwater outfalls. Therefore, the SPDES permits contain conditions for compliance with applicable federal and New York State requirements for CSOs. The current permits that were issued by the New York State Department of Environmental Conservation (NYSDEC) contain requirements for development of the WB/WS plans and the Long Term Control Plans (LTCP).

In 1992, NYCDEP entered into an Administrative Consent Order with NYSDEC that was incorporated into the SPDES permits with a provision stating that the consent order governs NYCDEP's obligations for its CSO program. The 1992 Order was modified in 1996 to add a catch basin cleaning, construction, and repair program. A new Consent Order became effective in 2005 that supersedes the 1992 Consent Order and its 1996 modifications with the intent to bring all CSO-related matters into compliance with the provisions of the federal Clean Water Act and New York State Environmental Conservation Law. The new Order contains requirements to evaluate and implement CSO abatement strategies on an enforceable timetable for eighteen (18)

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New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

City-Wide Assessment Areas

FIGURE 1-1

waterbodies and, ultimately, for City-wide long-term CSO control. NYCDEP and NYSDEC also entered into a separate Memorandum of Understanding (MOU) to facilitate water quality standards (WQS) reviews in accordance with the federal CSO control policy. The 2005 Order was modified in 2008.

This Waterbody/Watershed (WB/WS) Facility Plan is required by the 2005 Consent Order in accordance with the schedule presented in Appendix A of the 2005 Consent Order, and is intended to support the long term control planning process as outlined in the United States Environmental Protection Agency's (USEPA) CSO Control Policy. In 1994 the USEPA issued a national CSO Policy, which requires municipalities to develop a long term plan for controlling CSOs (i.e. a Long Term Control Plan or LTCP). The CSO policy became law with the passage of the Wet Weather Water Quality Act of 2000 in December 2000. The approach to developing an LTCP is specified in USEPA's CSO Control Policy and Guidance Documents, and involves the following nine minimum elements:

1. System Characterization, Monitoring and Modeling
2. Public Participation
3. Consideration of Sensitive Areas
4. Evaluation of Alternatives
5. Cost/Performance Consideration
6. Operational Plan
7. Maximizing Treatment at the Treatment Plant
8. Implementation Schedule
9. Post-Construction Compliance Monitoring Program

As dictated by the Consent Order, a Waterbody/Watershed Facility Plan is required for each drainage area cited in Appendix A of the Order and each will briefly describe the status with the nine USEPA recommended elements of an LTCP. Subsequent sections of this Waterbody/Watershed Facility Plan report will discuss each of these elements in more depth, along with the simultaneous coordination with State Water Quality standards review and revision as appropriate.

1.1. ASSESSMENT AREA

Located in southwestern Brooklyn, Coney Island Creek originates at the intersection of Shell Road and the Shore Parkway and proceeds in a roughly west to east direction parallel to Neptune Avenue and outlets to Gravesend Bay in Lower New York Harbor. Figure 1-2 illustrates the Coney Island Creek assessment area. The waterbody portion of the Coney Island Creek assessment area follows the NYSDEC designation of Coney Island Creek in its Codes, Rules and Regulations. Coney Island Creek is designated as the 253rd stream encountered on Long Island proceeding in a clockwise direction around the island from Fort Hamilton and as a tributary of Gravesend Bay.

The watershed portion of the Coney Island Creek assessment area is approximately 3,120 acres which consists of the drainage areas of the Avenue V and Avenue U Pump Stations associated with the Owls Head WPCP, a portion of the separate sewer system associated with the Coney Island WPCP which extends from Ocean Parkway to Gravesend Bay, and a small area

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New York City
Department of Environmental Protection

Coney Island Creek Drainage Area

FIGURE 1-2

which drains directly to the Creek. The drainage areas for these two pump stations contain six sub-areas which are served by separate sewer systems and one sub-area served by a combined sewer system. The study area contains all of Community Board District 13 and a portion of Districts 11 and 15. The neighborhoods in the study area include Gravesend, Homecrest, Sea Gate, Coney Island, and West Brighton. The waterbody is classified by New York State as Class I saline surface waters with best uses designated for secondary contact recreation and fishing. These waters are best suited for fish propagation and survival. Coney Island Creek was classified as impaired for oxygen demand and for pathogens on the New York State 303(d) list.

1.2. REGULATORY CONSIDERATIONS

The waters of the City of New York are primarily subject to New York State regulation, but must also comply with the policies of the USEPA, as well as water quality standards established by the Interstate Environmental Commission (IEC). The following sections detail the regulatory issues relevant to long-term CSO planning.

1.2.1. Clean Water Act

Although federal laws protecting water quality were passed as early as 1948, the most comprehensive approach to clean water protection was enacted in 1972. With the adoption of the Federal Water Pollution Control Act Amendments, commonly known as the Clean Water Act (CWA), including amendments adopted in 1977. The CWA established the regulatory framework to control surface water pollution, and gave USEPA the authority to implement pollution control programs. Among the key elements of the CWA was the establishment of the National Pollution Discharge Elimination System (NPDES) permit program, which regulates point sources that discharge pollutants into waters of the United States. CSOs and municipal separate storm sewer systems (MS4) are also subject to regulatory control under the NPDES program. In New York State, the NPDES permit program is administered by the State through the NYSDEC, and is thus a SPDES program. New York has had an approved SPDES program since 1975.

The CWA requires that discharge permit limits be based on receiving water quality standards (WQS), established in the project area by the State of New York. These standards should "wherever attainable, provide water quality for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water and take into consideration their use and value of public water supplies, propagation of fish, shellfish, and wildlife, recreation in and on the water, and agricultural, industrial, and other purposes including navigation" (40 CFR 131.2). The standards must also have an anti-degradation policy for maintaining water quality at acceptable levels, and a strategy for meeting these standards must be developed for those waters not meeting WQS. The most common type of strategy is the development of a Total Maximum Daily Load (TMDL). TMDLs determine what level of pollutant load would be consistent with meeting WQS. TMDLs also allocate acceptable loads among sources of the relevant pollutants.

Section 305(b) of the CWA requires states to periodically report the water quality of waterbodies under their respective jurisdictions, and Section 303(d) requires states to identify impaired waters where specific designated uses are not fully supported. The NYSDEC Division of Water addresses these requirements by following its Consolidated Assessment and Listing

Methodology (CALM). The CALM includes monitoring and assessment components that determine water quality standards attainment and designated use support for all waters of New York State. Waterbodies are monitored and evaluated on a five-year cycle. Information developed during monitoring and assessment is inventoried in the Waterbody Inventory/Priority Waterbody List (WI/PWL). The WI/PWL incorporates monitoring data, information from state and other agencies, and public participation. The Waterbody Inventory refers to the listing of all waters, identified as specific individual waterbodies, within the state that is being assessed. The Priority Waterbodies List is the subset of waters in the Waterbody Inventory that have documented water quality impacts, impairments or threats. The Priority Waterbodies List provides the candidate list of waters to be considered for inclusion on the Section 303(d) List.

Coney Island Creek is included on the Section 303(d) List under Part 3c - Waterbodies for which TMDL Development May be Deferred (Pending Implementation/Evaluation of Other Restoration Measures). The deferral is due to impairments being addressed by the CSO Consent Order, but it is noted that NYSDEC "remains committed to the development of harbor-wide TMDLs for nutrients, pathogens and toxics." Urban runoff, CSO, and OWTS are listed as the sources deemed responsible for depressed dissolved oxygen and elevated pathogen concentrations in Coney Island Creek. As it will address the sources of the impairment, the Coney Island Creek LTCP will serve as the TMDL when approved by NYSDEC.

Another important component of the CWA is the protection of uses. USEPA regulations state that a designated use for a water body may be refined under limited circumstances through a Use Attainability Analysis (UAA). In the UAA, the state would demonstrate that one or more of a limited set of circumstances exists to make such a modification. First, it could be shown that the current designated use cannot be achieved through implementation of applicable technology-based limits on point sources or cost-effective and reasonable best management practices (BMPs) for non-point sources. Or a determination could be made that the cause of non-attainment is due to natural background conditions or irreversible human-caused conditions. Another alternative would be to establish that attaining the designated use would cause substantial environmental damage or substantial and widespread social and economic costs. If the findings of a UAA suggest authorizing a revision to a use or modification of a water quality standard, the analysis and the accompanying proposal for such a modification must go through the public review, participation, and the USEPA approval process.

1.2.2. Federal CSO Policy

The first national CSO Control Strategy was published by USEPA in the Federal Register on September 8, 1989 (54 FR 37370). The goals of that strategy was to minimize water quality, aquatic biota, and human health impacts from CSOs by ensuring that CSO discharges comply with the technology and water quality based requirements of the Clean Water Act. On April 19, 1994, USEPA officially noticed the CSO Control Policy (59 FR 18688), which established a consistent national approach for controlling discharges from all CSOs to the waters of the United States. The CSO Control Policy provides guidance to permittees and NPDES permitting authorities such as NYSDEC on the development and implementation of a Long-Term CSO Control Plan in accordance with the provisions of the CWA to attain water quality standards. On December 15, 2000, amendments to Section 402 of the CWA (known as the Wet Weather Water Quality Act of 2000) were enacted incorporating CSO Control Policy by reference.

USEPA has stated that its CSO Control Policy represents a comprehensive national strategy to ensure that municipalities, permitting authorities, water quality standards authorities and the public engage in a comprehensive and coordinated planning effort to achieve cost effective CSO controls that ultimately meet appropriate health and environmental objectives and requirements (USEPA, 1995a). Four key principles of the CSO Control Policy ensure that CSO controls are cost effective and meet the objectives of the CWA:

1. Clear levels of control are provided that would be presumed to meet appropriate health and environmental objectives;

2. Sufficient flexibility is allowed to municipalities to consider the site-specific nature of CSOs and to determine the most cost effective means of reducing pollutants and meeting CWA objectives and requirements;

3. A phased approach to implementation of CSO controls is acceptable; and

4. Water quality standards and their implementation procedures may be reviewed and revised, as appropriate, when developing CSO control plans to reflect the site-specific wet weather impacts of CSOs.

In addition, the CSO Control Policy clearly defines expectations for permittees, state WQS authorities, and NPDES permitting and enforcement authorities. Permittees were expected to have implemented USEPA's nine minimum controls by 1997, after which long-term control plans were to be developed. The NMCs are embodied in the 14 Best Management Practices (BMPs) required by NYSDEC as discussed in Section 5.3 and include:

1. Proper operations and maintenance of combined sewer systems and combined sewer overflows;
2. Maximum use of the collection system for storage;
3. Review and modification of pretreatment requirements to determine whether non-domestic sources are contributing to CSO impacts;
4. Maximizing flow to the Publicly Owned Treatment Works (POTWs);
5. Elimination of CSOs during dry weather;
6. Control of solid and floatable material in CSOs;
7. Pollution prevention programs to reduce contaminants in CSOs;
8. Public notification; and
9. Monitoring to characterize CSO impacts and the efficacy of CSO controls.

WQS authorities should review and revise, as appropriate, State WQS during the CSO long term planning process. NPDES permitting authorities should consider the financial capability of permittees when reviewing CSO control plans.

In July 2001, USEPA published *Coordinating CSO Long Term Planning with Water Quality Standards Reviews*, additional guidance to address questions and describe the process of integrating development of CSO long-term control plans with water quality standards reviews (USEPA, 2001a). The guidance acknowledges that the successful implementation of an LTCP requires coordination and cooperation among CSO communities, constituency groups, states and

USEPA using a watershed approach. As part of the development of an LTCP, USEPA recommends that WQS authorities need to review the potential LTCP to evaluate the attainability of applicable water quality standards. The data collected, analyses and planning performed by all parties may be sufficient to justify a water quality standards revision if higher level designated uses are attainable or if existing designated uses are not reasonably attainable. If the latter is true USEPA allows the State WQS authorities to consider several options:

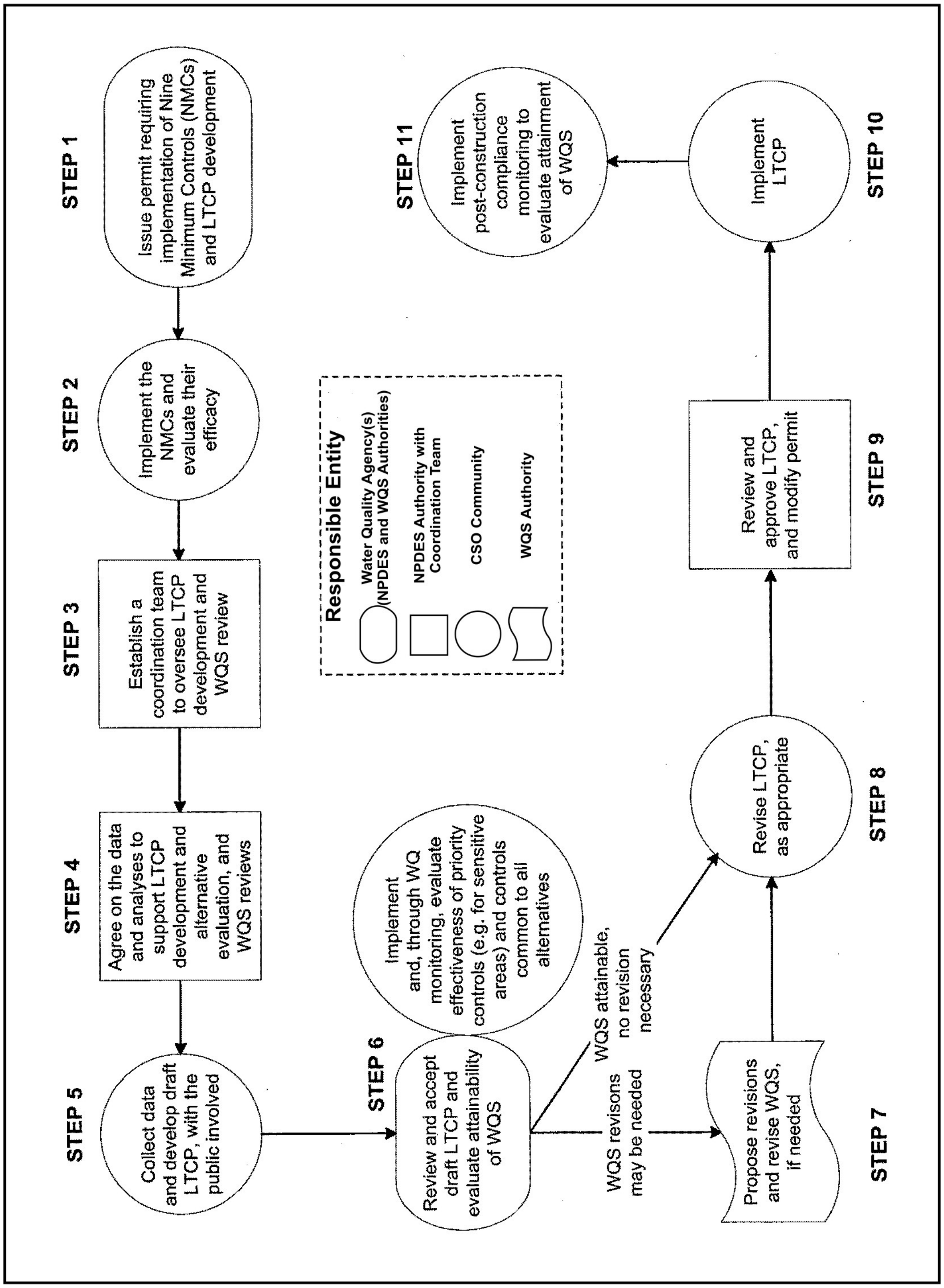
- Apply site-specific criteria;
- Apply criteria at the point of contact rather than at the end-of-pipe through the establishment of a mixing zone, waterbody segmentation, or similar;
- Apply less stringent criteria when it is unlikely that recreational uses will occur or when water is unlikely to be ingested;
- Consider subcategories of uses, such as precluding swimming during or immediately following a CSO event or developing a CSO subcategory of recreational uses; and
- Consider a tiered aquatic life system with subcategories for urban systems.

If the waterbody supports a use with more stringent water quality requirements than the designated use, USEPA requires the State to revise the designated use to reflect the higher use being supported. Conversely, USEPA requires that a Use Attainability Analysis (UAA) be performed whenever the state proposes to reduce the level of protection for the waterbody. States are not required to conduct UAAs when adopting more stringent criteria for a waterbody. Once water quality standards are revised, the CSO Control Policy requires post-implementation compliance monitoring to evaluate the attainment of designated uses and water quality standards and to determine if further water quality revisions and/or additional long-term control planning is necessary. USEPA provides a schematic chart (Figure 1-3) in its guidance for describing the coordination of LTCP development and water quality standards review and revision.

It is important to note that New York City's CSO abatement efforts were prominently displayed as model case studies by USEPA during a series of seminars held across the United States in 1994 to discuss the CSO Control Policy with permittees, WQS authorities, and NPDES permitting authorities (USEPA, 1994a). New York City's field investigations, watershed and receiving water modeling, and facility planning conducted during the Paerdegat Basin Water Quality Facility Planning Project were specifically described as a case study during the seminars. Additional City efforts in combined sewer system characterization, mathematical modeling, water quality monitoring, floatables source and impact assessments, and use attainment were also displayed as model approaches to these elements of long-term CSO planning.

1.2.3. New York State Policies and Regulations

In accordance with the provisions of the Clean Water Act, the State of New York has promulgated water quality standards for all navigable waters within its jurisdiction. The State has developed a system of waterbody classifications based on designated uses that includes five marine classifications, as shown in Table 1-1.



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New York City
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Coney Island Creek Waterbody/Watershed Facility Plan

Long-Term CSO Control Planning Procedures

FIGURE 1-3

Table 1-1. New York State Numeric Surface Water Quality Standards (Saline)

Classes	Usage	Dissolved Oxygen (mg/L)	Total Coliform (number/100mL)	Fecal Coliform (number/100mL)
SA	Shellfishing for market purposes, primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	≥ 4.8 (1) ≥ 3.0 (2)	≤70 (3)	N/A
SB	Primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	≥ 4.8 (1) ≥ 3.0 (2)	≤2,400 (4) ≤5,000 (5)	≤ 200 (6)
SC	Limited primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	≥ 4.8 (1) ≥ 3.0 (2)	≤2,400 (4) ≤5,000 (5)	≤ 200 (6)
I	Secondary contact recreation, fishing. Suitable for fish propagation and survival.	≥ 4.0	≤10,000 (6)	≤ 2,000 (6)
SD	Fishing. Suitable for fish survival. Waters with natural or man-made conditions limiting attainment of higher standards.	≥ 3.0	N/A	N/A

Notes: (1) Chronic standard based on daily average. The DO concentration may fall below 4.8 mg/L for a limited number of days, as defined by $DO_i = \frac{13.0}{2.80 + 1.84e^{-0.1t_i}}$

Where DOi = DO concentration in mg/L between 3.0 – 4.8 mg/L and ti – time in days. This equation is applied by dividing the DO range of 3.0 – 4.8 mg/L into a number of equal intervals. DOi is the lower bound of each interval (i) and ti is the allowable number of days that the DO concentration can be within that interval. The actual number of days that the measured DO concentration falls within each interval (i) is divided by the allowable number of days that the DO can fall within interval (ti). The sum of the quotients of all intervals (i…n) cannot exceed 1.0: i.e.,

$$\sum_{i=1}^{n} \frac{t_i\ (actual)}{t_i\ (allowed)} < 1.0$$

(2) Acute standard (never less than 3.0 mg/L). (3) Median most probable number (MPN) value in any series of representative samples. (4) Monthly median value of five or more samples. (5) Monthly 80th percentile of five or more samples. (6) Monthly geometric mean of five or more samples.

NYSDEC considers the SA and SB classifications to fulfill the Clean Water Act goals of fully supporting aquatic life and recreation. Class SC supports aquatic life and recreation but the recreational use of the waterbody is limited due to other factors. Class I supports the Clean Water Act goal of aquatic life protection and supports secondary contact recreation. SD waters shall be suitable for fish survival only because natural or manmade conditions limit the attainment of higher standards. The NYSDEC regulations state that the total and fecal coliform standards for Class SA, SB, SC, and I "shall be met during all periods when disinfection is practiced". As disinfection is practiced at New York City WPCPs year-round, these standards are applicable to all Class SA, SB, SC, and I waters in New York Harbor.

Dissolved Oxygen

Dissolved oxygen is the numerical standard that NYSDEC uses to establish whether a waterbody supports aquatic life uses. The numerical dissolved oxygen standards for Coney Island Creek (Class I) require that dissolved oxygen concentrations shall not be less than 4.0 mg/L at any time at any location within the waterbody.

Bacteria

Total and fecal coliform bacteria concentrations are the numerical standards that NYSDEC uses to establish whether a waterbody supports recreational uses. The numerical bacteria standards for Coney Island Creek (Class I) require that total coliform bacteria must have a monthly geometric mean of less than 10,000 per 100 mL from a minimum of five examinations. Fecal coliform (Class I) must have a monthly geometric mean of less than 2,000 per 100 mL from a minimum of five examinations.

An additional NYSDEC standard for primary contact recreational waters (not applicable to Coney Island Creek or any other Class I waters) is a maximum allowable enterococci concentration of a geometric mean of 35 per 100 mL for a representative number of samples. This standard, although not promulgated by New York State, is now an enforceable standard in New York State since USEPA established January 1, 2005 as the date upon which the criteria must be adopted for all coastal recreational waters.

NYSDEC considers the SA and SB classifications to fulfill the Clean Water Act goals of fully supporting aquatic life and recreation. Class SC supports aquatic life and recreation but the recreational use of the waterbody is limited due to other factors. Class I supports the Clean Water Act goal of aquatic life protection and supports secondary contact recreation. SD waters shall be suitable for fish survival only because natural or manmade conditions limit the attainment of higher standards.

For non-designated beach areas of primary contact recreation, which are used infrequently, the USEPA criteria suggest that a reference level indicative of pollution events be considered to be 501 per 100 mL. These reference levels according to the USEPA documents are not standards but are to be used as determined by the state agencies in making decisions related to recreational uses and pollution control needs. For bathing beaches, these reference levels (104 per 100 mL) are to be used for announcing bathing advisories or beach closings in response to pollution events.

Narrative Standards

In addition to numerical standards, New York State also has narrative criteria to protect aesthetics in all waters within its jurisdiction, regardless of classification. These standards also serve as limits on discharges to receiving waters within the State. Unlike the numeric standards, which provide an acceptable concentration, narrative criteria generally prohibit quantities that would impair the designated use or have a substantial deleterious effect on aesthetics. Important exceptions include garbage, cinders, ashes, oils, sludge and other refuse, which are prohibited in any amounts. The term "other refuse" has been interpreted to include floatable materials such as street litter that finds its way into receiving waters via uncontrolled CSO discharges. It should be noted that, in August 2004, USEPA Region II recommended NYSDEC "Revise the narrative criteria for aesthetics to clarify that these criteria are meant to protect the best use(s) of the water, and not literally require "none" in any amount, or provide a written clarification to this end." Table 1-2 summarizes the narrative water quality standards.

Table 1-2. New York State Narrative Water Quality Standards

Parameters	Classes	Standard
Taste-, color-, and odor producing toxic and other deleterious substances	SA, SB, SC, I, SD A, B, C, D	None in amounts that will adversely affect the taste, color or odor thereof, or impair the waters for their best usages.
Turbidity	SA, SB, SC, I, SD A, B, C, D	No increase that will cause a substantial visible contrast to natural conditions.
Suspended, colloidal and settleable solids	SA, SB, SC, I, SD A, B, C, D	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.
Oil and floating substances	SA, SB, SC, I, SD A, B, C, D	No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease.
Garbage, cinders, ashes, oils, sludge and other refuse	SA, SB, SC, I, SD A, B, C, D	None in any amounts.
Phosphorus and nitrogen	SA, SB, SC, I, SD A, B, C, D	None in any amounts that will result in growth of algae, weeds and slimes that will impair the waters for their best usages.

1.2.4. Interstate Environmental Commission (IEC)

The States of New York, New Jersey, and Connecticut are signatory to the Tri-State Compact that designated the Interstate Environmental District and created the IEC. The Interstate Environmental District includes all tidal waters of greater New York City. Originally established as the Interstate Sanitation Commission, the IEC may develop and enforce waterbody classifications and effluent standards to protect waterbody uses within the Interstate Environmental District. The applied classifications and effluent standards are intended to be consistent with those applied by the signatory states. There are three waterbody classifications defined by the IEC, as shown in Table 1-3.

Table 1-3. Interstate Environmental Commission Numeric Water Quality Standards

Class	Usage	DO (mg/L)	Waterbodies
A	All forms of primary and secondary contact recreation, fish propagation, and shellfish harvesting in designated areas	≥ 5.0	East R. east of the Whitestone Br.; Hudson R. north of confluence with the Harlem R; Raritan R. east of the Victory Br. into Raritan Bay; Sandy Hook Bay; lower New York Bay; Atlantic Ocean
B-1	Fishing and secondary contact recreation, growth and maintenance of fish and other forms of marine life naturally occurring therein, but may not be suitable for fish propagation.	≥ 4.0	Hudson R. south of confluence with Harlem R.; upper New York Harbor; East R. from the Battery to the Whitestone Bridge; Harlem R.; Arthur Kill between Raritan Bay and Outerbridge Crossing.
B-2	Passage of anadromous fish, maintenance of fish life	≥ 3.0	Arthur Kill north of Outerbridge Crossing; Newark Bay; Kill Van Kull

In general, IEC water quality regulations require that all waters of the Interstate Environmental District are free from floating and settleable solids, oil, grease, sludge deposits, and unnatural color or turbidity to the extent necessary to avoid unpleasant aesthetics, detrimental impacts to the natural biota, or use impacts. The regulations also prohibit the presence of toxic or deleterious substances that would be detrimental to fish, offensive to humans, or unhealthful in biota used for human consumption. The IEC also restricts CSO discharges to within 24 hours of a precipitation event, consistent with NYSDEC's definition of prohibited dry weather overflows. Beyond that restriction, however, IEC effluent quality regulations do not apply to CSOs if the combined sewer system is being operated with reasonable care, maintenance, and efficiency.

Although IEC regulations are intended to be consistent with state water quality standards, the three-tiered IEC system and the five New York State marine classifications in New York Harbor do not correspond exactly in terms of spatial boundaries, numerical limits, or narrative requirements. Primary contact recreation is defined in the IEC regulations as recreational activity that involves significant ingestion risk, including but not limited to wading, swimming, diving, surfing, and waterskiing. It defines secondary contact recreation as activities in which the probability of significant contact with the water or water ingestion is minimal including but not limited to boating, fishing, and shoreline recreational activities involving limited contact with surface waters.

The IEC classifies Coney Island Creek as a B-1 waterbody. Uses for this classification include fishing and secondary contact recreation with a minimum dissolved oxygen concentration of 4.0 mg/l to protect the growth and maintenance – though not necessarily the propagation – of fish and other marine life.

1.2.5. Administrative Consent Order

New York City's 14 SPDES permits contain conditions designed to comply with federal and state CSO requirements. NYCDEP was unable to comply with deadlines imposed in their 1988 permits for completion of four CSO abatement projects initiated in the early 1980s. As a result, NYCDEP entered into an Administrative Consent Order with NYSDEC on June 26, 1992 which was incorporated into the SPDES permits with a provision stating that the Consent Order governs NYCDEP's obligations for its CSO program. It also required NYCDEP to implement CSO abatement projects in nine facility planning areas divided into two tracks: those areas where dissolved oxygen and coliform standards were being contravened (Track One), and those areas for which floatables control was necessary (Track Two). The 1992 Order was modified on September 19, 1996 to add a catch basin cleaning, construction, and repair program.

NYCDEP and NYSDEC negotiated a new Consent Order that was signed January 14, 2008 that supersedes the 1992 Order and its 1996 Modifications with the intent to bring all NYCDEP CSO-related matters into compliance with the provisions of the federal Clean Water Act and state Environmental Conservation Law. The new Order contains requirements to evaluate and implement CSO abatement strategies on an enforceable timetable for 18 waterbodies and, ultimately, for City-wide long-term CSO control in accordance with USEPA CSO control policy. This Order was recently modified and executed on April 14, 2008. NYCDEP and NYSDEC also entered into a separate MOU to facilitate water quality standards reviews in accordance with the CSO control policy.

1.3. CITY POLICIES AND OTHER LOCAL CONSIDERATIONS

New York City's waterfront is approximately 578 miles long, encompassing 17 percent of the total shoreline of the State. This resource is managed through multiple tiers of zoning, regulation, public policy, and investment incentives to accommodate the diverse interests of the waterfront communities and encourage environmental stewardship. The local regulatory considerations are primarily applicable to proposed projects and, as such, do not preclude the existence of non-conforming waterfront uses. However, evaluation of existing conditions within the context of these land use controls and public policy can anticipate the nature of long-term growth in the watershed.

1.3.1. New York City Waterfront Revitalization Program

The New York City Waterfront Revitalization Program (WRP) is the City's principal coastal zone management tool and is implemented by the New York City Department of City Planning (NYCDCP). The WRP establishes the City's policies for development and use of the waterfront and provides a framework for evaluating the consistency of all discretionary actions in the coastal zone with City coastal management policies. Projects subject to consistency review include any project located within the coastal zone requiring a local, state, or federal discretionary action, such as the Uniform Land Use Review Procedure (ULURP) or a City Environmental Quality Review (CEQR). An action is determined to be consistent with the WRP if it would not substantially hinder and, where practicable, would advance one or more of the 10 WRP policies. The New York City WRP is authorized under the New York State Waterfront Revitalization and Coastal Resource Act of 1981 that in turn stems from the Federal Coastal Zone Management Act of 1972. The original WRP was adopted in 1982 as a local plan in accordance with Section 197-a of the City Charter, and incorporated the 44 state policies, added 12 local policies, and delineated a coastal zone to which the policies would apply. The program was revised in 1999 and the new WRP policies were issued in September 2002. The revised WRP condensed the 12 original policies into 10: (1) residential and commercial redevelopment; (2) water-dependent and industrial uses; (3) commercial and recreational boating; (4) coastal ecological systems; (5) water quality; (6) flooding and erosion; (7) solid waste and hazardous substances; (8) public access; (9) scenic resources; and (10) historical and cultural resources.

1.3.2. New York City Comprehensive Waterfront Plan

The City's long-range goals are contained in the Comprehensive Waterfront Plan (CWP). The CWP identifies four principal waterfront functional areas (natural, public, working, and redeveloping) and promotes use, protection, and redevelopment in appropriate waterfront areas. The companion Borough Waterfront Plans (1993-1994) assess local conditions and propose strategies to guide land use change, planning and coordination, and public investment for each of the waterfront functional areas. The CWP has been incorporated into local law through land use changes, zoning text amendments, public investment strategies, and regulatory revisions, providing geographic specificity to the WRP and acknowledging that certain policies are more relevant than others on particular portions of the waterfront.

1.3.3. Department of City Planning Actions

The NYCDCP was contacted to identify any projects either under consideration or in the planning stages that could substantially alter the land use in the vicinity of the waterbody. NYCDCP reviews any proposal that would result in a fundamental alteration in land use, such as zoning map and text amendments, special permits under the Zoning Resolution, changes in the City Map, the disposition of city-owned property, and the siting of public facilities. In addition, NYCDCP maintains a library of City-wide plans, assessments of infrastructure, community needs evaluations, and land use impact studies. These records were reviewed and evaluated for their potential impacts to waterbody use and runoff characteristics, and the NYCDCP community district liaison for the Community District was contacted to determine whether any proposals in process that required NYCDCP review might impact the WB/WS Facility Plan.

1.3.4. New York City Economic Development Corporation

The New York City Economic Development Corporation (NYCEDC) was contacted to identify and projects either under consideration or in the planning stages that could substantially alter the land use in the vicinity of the Coney Island Creek. The NYCEDC is charged with dispensing City-owned property to businesses as a means of stimulating economic growth, employment, and tax revenue in the City of New York while simultaneously encouraging specific types of land use in targeted neighborhoods. As such, NYCEDC has the potential to alter land use on a large scale. In addition, NYCEDC serves as a policy instrument for the Mayor's Office. Policy can have implications on future uses of a waterbody as well as impacts to collection systems, so a thorough review of NYCEDC policy and future projects was performed to determine the extent to which they may impact the WB/WS Facility Plan.

1.3.5. Local Laws

Local law is a form of municipal legislation that has the same status as an act of the State Legislature. The power to enact local laws is granted by the New York State Constitution with the scope and procedures for implementation established in the Municipal Home Rule Law. In New York City, local laws pertaining to the use of City waterways and initiatives associated with aquatic health have been adopted beyond the requirements of New York State. Recent adoptions include Local Law 71 of 2005 which required the development of the Jamaica Bay Watershed Protection Plan (JBWPP) and Local Law 5 of 2008 which requires City-owned buildings or City-funded reconstruction to include certain sustainable practices as well as requiring the City to draft a sustainable stormwater management plan by October 1, 2008. These initiatives are discussed in detail in Section 5.

1.3.6 Bathing Beaches

Bathing beaches in New York City are regulated, monitored and permitted by the City and State under Article 167 of the New York City Health Code and Section 6-2.19 of the New York City Sanitary Code. Siting requirements imposed by State and City codes must be considered to evaluate the potential use of a waterbody for primary contact recreation. These requirements include minimum distances from certain types of regulated discharges (such as

CSO outfalls), maximum bottom slopes, acceptable bottom materials, minimum water quality levels, and physical conditions that insure the highest level of safety for bathers.

1.4. REPORT DESCRIPTION

This report has been organized to clearly describe the proposed WB/WS Facility Plan that supports a Long-Term CSO Control Planning process and the environmental factors and engineering considerations that were evaluated in its development. The nine elements of long-term CSO control planning are listed in Table 1-4 along with relevant sections within this document for cross-referencing.

Section 1 describes general planning information and the regulatory considerations in order to describe the setting and genesis of the LTCP program and the CSO Control Policy. Sections 2, 3, and 4 describe the existing waterbody, watershed, and collection system characteristics, respectively. Section 5 describes waterbody improvement projects within the waterbody and the greater New York Harbor. Section 6 describes the public participation and agency interaction that went into the development of this WB/WS Plan, as well as an overview of NYCDEP's public outreach program. Sections 7 and 8 describe the development of the plan for the waterbody. Section 9 discusses the review and revision of water quality standards. The report concludes with references in Section 10 and a glossary of terms and abbreviations is included in Section 11.

Table 1-4. Locations of the Nine Elements of Long-Term Control Planning

No.	Element	Location(s) Within the Report
1	Characterization of the Combined Sewer System	3.0
2	Public Participation	6.0
3	Consideration of Sensitive Areas	4.7
4	Evaluation of Alternatives	7.0
5	Cost/Performance Considerations	7.0
6	Operational Plan	8.0
7	Maximizing Treatment at the Existing WPCP	7.0 & 8.0
8	Implementation Schedule	8.0
9	Post-Construction Compliance Monitoring	8.0

2.0 Watershed Characteristics

2.1 HISTORICAL CONTEXT OF WATERSHED URBANIZATION

New York City has been physically altered throughout the years to adapt to the demands of a rapidly growing population. Since its settlement in the mid-17th century, physical alterations to the region's topography and natural environment have included land filling, bulkheading, channelization, and other shoreline changes.

The first inhabitants of the study area were the Algonquin Indians. Shellfish and finfish were abundant in the waters of the region and were an important part of the Algonquin diet. The region was covered with broad-leaf hardwood forests, salt marshes, and freshwater streams. Many species of wildlife were present including deer, bear, wolves, game birds, reptiles and amphibians (Kieran, 1982).

Native Americans occupied western Long Island during various cultural periods prior to European colonization. There are archaeological records that place Native American camps, villages, and processing sites in both Brooklyn and Queens. European settlers first claimed lands in Brooklyn in the 1630s. Much of southwest Brooklyn was purchased from the Nyack Indians by the Dutch West India Company in 1652.

In the colonial era, Coney Island was part of the township of Gravesend, the only English town along with five Dutch settlements that would later become Brooklyn. Gravesend was founded in 1643 by Lady Deborah Moody who settled there to escape the Puritan intolerance of New England. Moody and her followers became the first settlers to obtain a written guarantee of religious freedom from the Dutch Director General as well as a town charter which permitted a town meeting form of self-government (Rainone, 1985).

Coney Island was predominantly farmland during the late seventeenth and eighteenth centuries. During the nineteenth century, the railroad reached the public beaches at Coney Island and it became a fashionable resort community with horse racing as the main attraction. Ornate wood-frame hotels were built to accommodate visitors from Manhattan and downtown Brooklyn. When amusement rides and spectacles were introduced in the 1890s, Coney Island began to assume the character for which it would become famous. The extension of the subway to Coney Island in the 1920s made the area accessible to all New Yorkers. Over one million people would make the trip to Coney Island on a typical Sunday to take advantage of the rides and the waves (Willensky, 1986).

Prior to World War II, Coney Island was predominantly a working class community with two and three family attached row houses and summer bungalows. During the 1960s massive urban renewal resulted in condemnation of many of these small homes and the construction of large public high-rise projects on the western end of Coney Island which severely strained community support services. Recently, the development of low-rise single family homes on City-owned land and the formation of block associations have spawned a revitalization of the Coney Island community.

2.2 LAND USE CHARACTERIZATION

2.2.1 Existing Land Use

The Coney Island Creek study area consists of the drainage areas of the Avenue V and Avenue U pump stations and a portion of the separate sewer system associated with the Coney Island WPCP which extends from Ocean Parkway to Gravesend Bay. The drainage areas for these two pump stations contain six subareas which are served by a separate sewer system and one subarea served by a combined sewer system. The study area contains all of Community Planning District 13 and a portion of Districts 11 and 15. The neighborhoods in the study area include Gravesend, Homecrest, Sea Gate, Coney Island and West Brighton.

The study area is composed primarily of residential land uses (Table 2-1 and Figure 2-1). Approximately 60 percent of the land is devoted to residential uses consisting primarily of low density, 1-2 family houses. Approximately 20 percent of the drainage area is developed as high density housing with most of the lots being walkup apartment buildings. Only a small fraction of the housing in the drainage area are condominiums or elevator apartments. No old-law tenements (housing constructed between 1879 and 1901) exist within the study area.

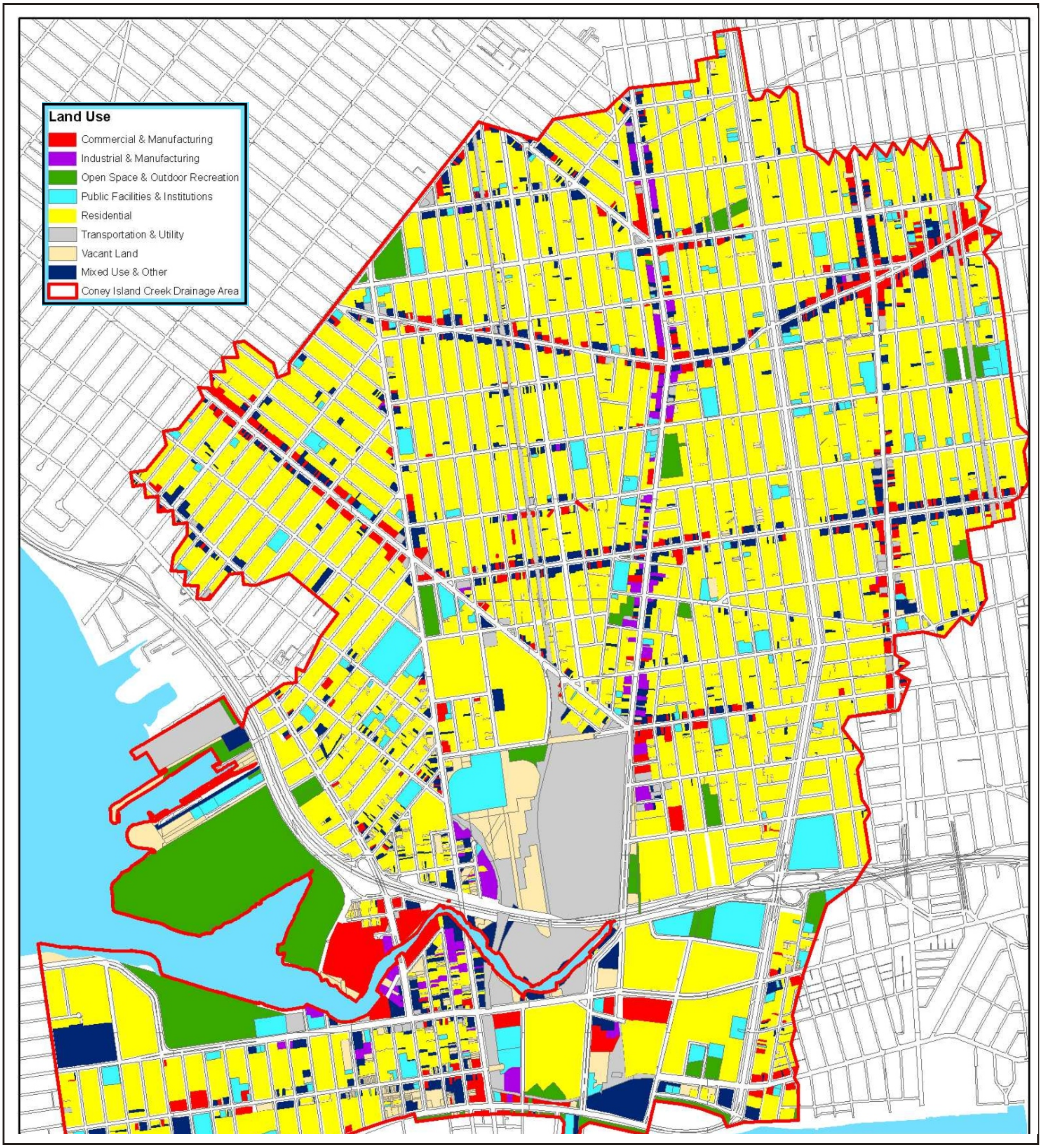
Table 2-1. Land Use Within Coney Island Creek Drainage Area

Land Use Category	Percent of Land Use in Drainage area
Commercial	4.9
Industrial	1.3
Open Space	9.3
Public	6.1
Residential	59.6
Transportation	7.4
Vacant	4.5
Mixed Use	6.9

Commercial land use is predominantly oriented towards serving the daily needs of the resident population. Commercial uses comprise 4.9 percent of the total land area. Only 1.3 percent of the drainage area is industrialized.

Approximately 9 percent of the drainage area is occupied by open spaces such as parks and recreational facilities. Coney Island Beach and Boardwalk, Dreier-Offerman Park, Coney Island Boat Basin, Kaiser playground, and Asser Levy Park and the New York aquarium are among the largest open spaces in the drainage area.

Several public institutions are spread throughout the study area. These include private and public schools, Brooklyn public libraries, senior citizen and day care centers, and Coney Island Hospital.



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Coney Island Creek Waterbody/Watershed Facility Plan

Land Use

FIGURE 2-1

2.2.2 Existing Zoning

The Zoning Resolution of the City of New York regulates the size of buildings and properties, the density of populations, and the locations that trades, industries, and other activities are allowed within the City limits. The Resolution divides the City into residential, commercial, and manufacturing districts with alphanumeric designations indicating use, bulk, and other controls. Residential districts are defined by the allowable density of housing, lot widths, and setbacks with higher number designations indicating a higher allowable density (e.g. single family detached residential units occur in R1 and R2 districts while R8 and R10 districts allow apartment buildings). Commercial districts are divided primarily by usage type so that local retail districts (C1) are distinguished from more regional commerce (C8). Manufacturing districts are distinguished based on the impact of uses on sensitive neighboring districts to ensure that heavy manufacturing (M3) is buffered from residential areas by lighter manufacturing districts (M1 and M2) that have higher performance levels and fewer objectionable influences.

Figure 2-2 presents the zoning within a ¼-mile radius of Coney Island Creek. The majority of the Coney Island Creek watershed is composed of Residential zoning districts (R4, R5, and R6). The "Ocean Parkway Special Use District" occurs along either side of Ocean Parkway and extends northward from Brighton Beach Avenue. The goals of this special use district are to:

- Promote and strengthen the scenic landmark designation of Ocean Parkway by requiring landscaping along Ocean Parkway;
- Maintain the existing scale and character of the community by limiting the bulk of permitted community facilities;
- Protect the environmental quality of and improve circulation within the District by requiring enclosed parking for all uses along Ocean Parkway and by requiring off-street loading for certain community facilities throughout the District; and
- Promote the most desirable use of land in this area and thus to conserve the value of land and thereby protect the City's tax revenue.

The area immediately surrounding Coney Island Creek from the head end westward to West 23rd Street is predominantly manufacturing zones (M3-1, M2-1, and M1-2) mixed with some smaller commercial zones (C8-1 and C3). A "Special Coney Island Mixed Use District" has been established in the area south of the Creek between Stillwell, Cropsey and Neptune Avenues. The goals of this special use district are to:

- Stabilize the residential future of this mixed residential and industrial area by permitting expansion and new development of residential and light manufacturing uses where adequate environmental standards are assured;
- Promote the opportunity for people to work in the vicinity of their residences;

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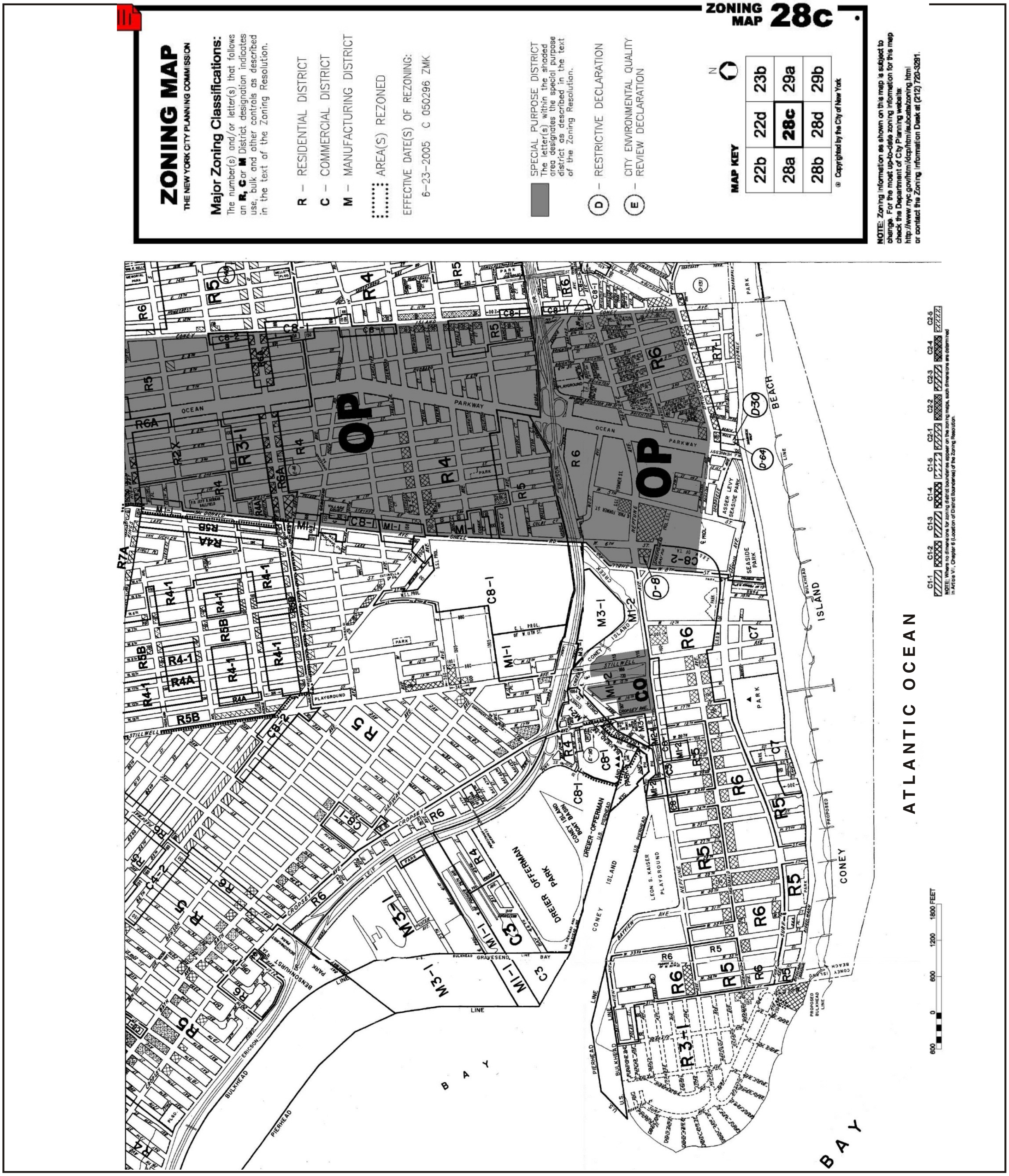

New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

Zoning Map

FIGURE 2-2

- Provide a safe circulation system in this area of mixed residential and manufacturing use;
- Retain adequate wage, job-intensive, seasonally stable industries within New York City;
- Provide an opportunity for the improvement of Coney Island in a manner consistent with the objectives of the Comprehensive Plan for New York City; and
- Promote the most desirable use of land and thus to conserve the value of land and buildings and thereby protect the City tax revenues.

Additional Manufacturing and Commercial Districts in the Coney Island Creek watershed occur to the west of the Belt Parkway between the Creek and Bay Parkway. This area contains a commercial marina, an amusement park, and a Department of Sanitation transfer station.

2.2.3 Neighborhood and Community Character

Settled primarily during the 1920s after the Brooklyn-Manhattan Transit (BMT) subway company acquired the former Sea Beach and West End Railway, the area is characterized by two- and three-story residences, mostly one- and two-family homes, with corridors of six-story and taller apartment houses on Quentin Road, Avenue P, and parts of Kings Highway and 65th Street. Commercial activity is concentrated on Bay Parkway, 65th Street, Kings Highway and Avenue U, and parts of Highlawn Avenue and Avenues O, S and T.

Although the area was mainly built up prior to World War II, small-scale construction continued into the 1980s – mostly groups of three- or four- story row houses with ground floor garages. Recently, however, some taller apartment buildings have been constructed on neighborhood midblocks and on some predominantly low-rise wide streets such as 65th Street.

The study area is composed primarily of residential land uses consisting of low density 1-2 family houses. Some of the drainage area is developed as high density housing with most of the lots being walkup apartment buildings. Only a small fraction of the housing in the drainage area is condominiums or elevator apartments. No old-law tenements exist within the study area. Commercial land use is predominantly oriented towards serving the daily needs of the resident population. Very little of the total land area is industrialized. Coney Island Beach and Boardwalk, Dreier-Offerman Park, Coney Island Boat Basin, Kaiser Playground, and Asser Levy Park and the New York aquarium are among the largest open spaces in the drainage area. Several public institutions are spread throughout the study area including private and public schools, Brooklyn public libraries, senior citizen and day care centers, and Coney Island Hospital.

2.2.4 Proposed Land Uses

Both NYCDCP and the Coney Island Development Corporation (CIDC) were contacted to identify any projects either under consideration or in the planning stages that could substantially alter the land use in the vicinity of Coney Island Creek. The NYCDCP reviews any proposals that result in a fundamental alteration in land use, such as zoning map and text amendments, special permits under the Zoning Resolution, changes in the City Map, the disposition of City-owned property, and the citing of public facilities. The NYCDCP has a community district liaison for each community district in the City of New York who is responsible for processing all proposals requiring NYCDCP review. The CIDC is charged with spearheading and implementing a comprehensive planning process for Coney Island and creating a coordinated economic development strategy for the area to promote a more diversified business community and better employment opportunities. The CIDC is composed of the Mayor, City Council and the Borough President.

The NYCDCP recently proposed zoning map changes for approximately 120 blocks in the Bensonhurst neighborhood of Brooklyn's Community Board 11 (Figure 2-3). The area proposed for rezoning was a predominantly low-rise residential community bounded by Bay Parkway and 61st Street on the north, McDonald Avenue on the east, Avenue U on the south and Stillwell Avenue on the west.

The proposed rezoning would preserve the existing neighborhood scale and character with lower density and contextual zoning districts, preventing new development inconsistent with that low-rise character. The proposal encourages residential development on selected wide streets with good access to mass transit and a character already defined by large apartment buildings – Avenue P, Quentin Road and Kings Highway and, to a lesser extent, along Bay Parkway and 65th Street. Along these corridors, the mid-density contextual zoning districts proposed would establish height limits consistent with neighboring apartment houses and would prevent development of overly large community facility and mixed residential/community facility buildings. The NYCDCP is also planning on instituting this type of rezoning with Community Districts 13 and 15 as well in the near future.

On February 14th, 2005, the NYCDCP certified the Uniform Land Use Review Procedure application for the Bensonhurst rezoning thus beginning the formal public review process. Community Board 11 held a public hearing on the proposal on March 9th and unanimously voted to recommend approval on March 10th. The Brooklyn Borough President recommended approval of the proposal on April 11th. The NYCDCP held a public hearing on the application on April 27, 2005 and on May 25, 2005 adopted the proposed zoning changes. Because the adopted rezoning preserves the existing neighborhood character, no changes in watershed runoff characteristics are anticipated.

The CIDC published a Strategic Development Plan for the Coney Island Creek area in September 2005. Key elements to this plan include (1) create greater connectivity by enhancing east-west and north-south movement, and enhance transit within the area; (2) provide transitions between neighborhoods and destinations; (3) utilize key assets (boardwalk, parachute jump, Shore Theater, Keyspan Park) as focal points; (4) transform Surf Avenue into Coney Island's "front door"; and (5) establish "gateways" at Stillwell Avenue-Stillwell Station, West 17th Street, and West 5th Street. The CIDC has selected a design team to enhance a significant site in Coney Island's amusement district, the famed Parachute Jump – an iconic reminder of Coney Island history that is now a designated landmark. They have designed a pavilion with a matrix of light bulbs rising 30 feet from the ground, relating directly to the towering Parachute Jump

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Rezoning Area

FIGURE 2-3

without competing with its scale or Coney Island's skyline. A souvenir shop will open to a two-story exhibition space and an overhanging section of the pavilion will provide shade in summer and protection in the winter. This plan encompasses the stormwater service area along the southern shoreline of Coney Island Creek, but because the plan for this area is to preserve its residential community character, no changes in watershed runoff characteristics are anticipated.

2.2.5 Consistency with the Waterfront Revitalization Program

The New York City Waterfront Revitalization Program (WRP) policies are used to evaluate proposed actions to promote activities appropriate to various waterfront locations by determining the proposed actions consistency with the WRP's following 10 policy objectives: (1) residential and commercial development, (2) water-dependent and industrial users, (3) commercial and recreational boating, (4) coastal ecological systems, (5) water quality, (6) flooding and erosion, (7) solid waste and hazardous substances, (9) scenic resources, and (10) historic and cultural resources.

The New York City Department of City Planning WRF has designated the majority of the Coney Island Creek watershed as part of the Coastal Zone (Figure 2-4). However, there are no designated Significant Maritime and Industrial Areas or Special Natural Waterfront Areas within the Coney Island Creek Coastal Zone. Any proposed land uses for the Coney Island Creek project area, including those associated with the Long-Term Control Plan, would need to demonstrate consistency with the WRP.

2.3 REGULATED SHORELINE ACTIVITIES

An investigation of selected existing federal and state databases was performed in an effort to gather information on potential land-side sites and/or activities that may have the potential to affect water quality in Coney Island Creek. The extent of the study area was generally limited to the areas immediately adjacent to and up to the nearest adjacent mapped street to Coney Island Creek. For the purposes of this assessment, potential sources included the existence of underground storage tanks (UST), major oil storage facilities (MOSF), known contaminant spills, the existence of state or federal superfund sites, the presence of SPDES permitted discharges to the waterbody and other sources that may have the potential to affect surface water quality.

The USEPA Superfund Information System, which contains several databases with information on existing superfund sites, was accessed. These databases included: the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS), Resource Conservation and Recovery Act Information (RCRAinfo), Brownfields Management System, and the National Priorities List (NPL). In addition to these federal databases, several databases managed by NYSDEC were also reviewed. The NYSDEC Spill Incident Database and the Environmental Site Remediation Database, which allows searches of the NYSDEC Brownfield cleanup, state superfund (inactive hazardous waste disposal sites), environmental restoration and voluntary cleanup programs were reviewed. In addition, an Environmental Data Records (EDR) DataMap Area Study report was performed for areas immediately adjacent to Coney Island Creek and up to the nearest adjacent mapped street. This EDR report was primarily reviewed to provide additional information with regard to UST,

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Coastal Zoning Map

FIGURE 2-4

leaking storage tanks (LTANKS) and MOSFs, which were not readily accessible within the aforementioned databases. A review of the USEPA Superfund Information System indicated that there are no federally listed sites located in proximity to Coney Island Creek. A review of the NYSDEC State Superfund Program however, indicated that there is an inactive hazardous waste disposal site located immediately adjacent to the creek. The site is a former manufactured gas plant (MGP), owned and operated by Brooklyn Borough Gas Works Company/KeySpan. The former MGP site is physically located north of Coney Island Creek, south of the Belt Parkway and west of McDonald Avenue. The NYSDEC previously determined that this site posed a significant threat based upon groundwater concentrations and visible sheen emanating from the site into Coney Island Creek. A Record of Decision (ROD) was issued for this site subsequent to the database query. NYSDEC was contacted to determine the status of the cleanup. As of this report, the dredging of Creek sediment and the capping with three feet of clean material has been completed and the upland remedial actions are ongoing. As per the NYSDEC ROD, a long-term monitoring plan will be implemented upon completion of the project. (NYSDEC, 2008).

A review of RCRA databases indicated that there are five large quantity generators and eleven small quantity generators located in proximity to Coney Island Creek. Under RCRA, a large quantity generator produces over 1,000 kilograms of hazardous waste or greater than one (1) kilogram of acutely hazardous waste per month, while small quantity generators produce between 100 and 1,000 kilograms of waste per month. RCRA sites in proximity to Coney Island Creek are listed in Table 2-2.

The NYSDEC Petroleum Bulk Storage database identified several USTs in the immediate vicinity of Coney Island Creek. According to the database, there are a total of four (4) UST sites in proximity to the Creek. These sites contain USTs that are either in-service or closed. The storage capacities of these USTs range between 550 and 6,600 gallons and they store unleaded gasoline and No. 5 or 6 fuel oil. The UST sites and additional information are identified in Table 2-3.

In addition, the LTANKS database which identifies leaking underground storage tanks (LUST) or leaking above ground storage tanks was reviewed and eight leaking tank sites in proximity to Coney Island Creek were identified. These tanks were identified on Bay 54th Street, Shell Road, Neptune Avenue and West 23rd Street. The eight tanks were reported to leak a variety of different petroleum products including No. 2 or No. 4 fuel oil, diesel, gasoline or unknown petroleum. These leaks were caused by tank overfills, tank test failures or tank failures. Of the eight reported leaks, only two leak files remain open by NYSDEC. One open leak is located at Sam's Shell Service on Shell Road, less than a one-quarter mile from the Creek and involved the leakage of an unidentified amount of gasoline to soils due to tank failure. The second open leak occurred at a park on Neptune Avenue, less than a one-quarter mile from Coney Island Creek, and resulted in the leakage of an unidentified amount of No. 2 fuel oil.

Review of the NYSDEC SPILL databases indicated that there were 43 spills that have occurred within close proximity to Coney Island Creek over the past 10 years. The majority of these spills affected soil; however, contamination to other medium were also noted. Only five of these 43 spills remained open as of December 2005. These are listed in Table 2-4. The remaining open spills resulted in the release of No. 2 fuel oil, auto waste fluids and/or gasoline into soils.

Table 2-2. RCRA Sites Located in the Vicinity of Coney Island Creek in 2005

Site Name	Address
RCRA Large Quantity Generators	
Brooklyn Union Gas Company	873 Neptune Avenue
Cropsey Avenue and Hart Place	Cropsey Avenue and Hart Place
NYCDDC BED 763	Cropsey Avenue and W 17th Street
NYCT Avenue X Storage	Avenue X and Stillwell Avenue
NYCDOT Stillwell Avenue Brg #2240540	Stillwell Avenue Bridge
RCRA Small Quantity Generators	
NYSDOT	Shore Parkway and Stillwell Avenue
NYSDOT – Belt Parkway over Ocean Parkway	2860 Shell Road
Citation Collision Corp.	2695 Stillwell Avenue
Magnum Collision and Repair	2757 Stillwell Avenue
American Health TEC Systems	2730 Stillwell Avenue
Coney Island Electro Plating Works, Inc.	2702 Stillwell Avenue
All City Auto Works LTD	3115 Cropsey Avenue
Cropsey Coney Island Corp.	3072 Cropsey Avenue
Bell Atlantic – NY	West 8th Street/Neptune Avenue
New York Telephone	West 33rd and Neptune Avenue
Bell Atlantic – NY	Stillwell Avenue/Shore Parkway

Searches of additional available environmental records indicated that there were no brownfield sites, MOSFs or New York State SPDES sites identified within approximately one-block of Coney Island Creek.

Table 2-3. Underground Storage Tanks (UST) in Proximity to Coney Island Creek in 2005

Site	Address	Tank Capacity	Product Stored	Number of Tanks	Status
Sam's Neptune Service Station	289 Shell Road Brooklyn, NY	550 Gallons	Unleaded Gasoline	4	Closed - Removed
Alert Ambulette Service Corp.	2702 Stillwell Avenue Brooklyn, NY	6,600 Gallons	No. 5 or 6 Fuel Oil	1	Closed - Removed
Cropsey Auto Center	3118 Cropsey Avenue Brooklyn, NY	550 Gallons	Empty	1	Closed - In Place
Amoco Service Station	3072 Cropsey Avenue Brooklyn, NY	4,000 Gallons 550 Gallons	Unleaded Gasoline Unleaded Gasoline	3 2	In-Service Closed - Removed

A review of the available databases and other information discussed above indicates that none of these potential sources of contamination are associated with existing or previous combined sewer overflows. Several of these sources, however, have the potential to affect surface water quality in Coney Island Creek.

Table 2-4. NYSDEC Open Spills in the Vicinity of Coney Island Creek as of 2005

Location	Date	Spill Number	Quantity	Material	Resource Affected	Spill Cause
Tomwin Realty 27-81 Shell Road	11/13/98	9810231	<1 Gallon	No. 2 Fuel Oil	Soil	Tank Test Failure
Waraco Gas Station 2001 Neptune Avenue	9/03/99	9906623	<1 Gallon	Gasoline	Soil	Unknown
NYC Parks West 23rd Street and Neptune Avenue	4/23/01	0100863	<1 Gallon	No. 2 Fuel Oil	Soil	Tank Test Failure
T&J Salvage Corp. 2647 Stillwell Avenue	6/18/03	0330015	<1 Gallon	Auto Waste Fluids	Soil	Deliberate
Private Residence 2165 West 7th Street	10/15/05	0509114	< 1 Gallon	No. 2 Fuel Oil	Soil	Equipment Failure

3.0 Existing Sewer System Facilities

The Coney Island Creek drainage area lies between the drainage areas of two WPCPs, the Owls Head WPCP and the Coney Island WPCP (Figure 3-1). Coney Island Creek receives both combined sewer overflow and stormwater drainage from the Owls Head WPCP drainage area. The Creek receives only stormwater flow from the Coney Island WPCP drainage area.

3.1 OWLS HEAD WPCP

The Owls Head WPCP is permitted by the NYSDEC under State Pollutant Discharge Elimination System (SPDES) permit number NY-0026166. The facility is located at 6700 Shore Road, Brooklyn, NY, 11220 in the Bay Ridge section of Brooklyn, on a 15 acre site adjacent to the Upper New York Bay next to Owls Head Park. The Owls Head WPCP serves an area of approximately 12,638 acres in Western Brooklyn, including the communities of Bath Beach, Bensonhurst, Bay Ridge, Dyker Heights, Fort Hamilton, Borough Park, Ocean Parkways, Flatbush, Sunset Park, Windsor Terrace, Kensington, Prospect Park South, Gravesend, Prospect Lefferts Gardens, and Park Slope. The total sewer length, including sanitary, combined, and interceptor sewers, that feeds into the Owls Head WPCP is 471 miles. Figure 3-2 is an aerial photograph of the Owls Head WPCP.

The Owls Head plant began operation in 1952. Originally, the plant was designed to remove 80 percent suspended solids (SS) and 75 percent of the biochemical oxygen demand (BOD) from an average wastewater flow of 160 MGD. In 1979, new facilities were designed to treat an average flow of 120 MGD and to provide 90 percent removal of BOD and SS. The Owls Head plant began secondary treatment in 1995. Processes include primary screening, raw sewage pumping, grit removal and primary settling, air activated sludge capable of operating in the step aeration mode, final settling, and chlorine disinfection (see Figure 3-3). The Owls Head WPCP has a design dry weather flow (DDWF) capacity of 120 million gallons per day (MGD), and is designed to receive a maximum flow of 240 MGD (2 times DDWF) with 180 MGD (1.5 times DDWF) receiving secondary treatment. Flows over 180 MGD receive primary treatment and disinfection. The daily average flow during 2005 was 102 MGD, with a dry weather flow average of 94 MGD. During severe wet weather events in 2005, the plant treated from 210 to 246 MGD. Table 3-1 summarizes the Owls Head WPCP permit limits.

3.1.1 Process Information

Figure 3-3 shows the current process treatment for the Owls Head WPCP. 80 percent of the Owls Head treatment plant drainage area is served by combined sewers and 20 percent is served by sanitary sewers. Sewage from the Owls Head drainage area is transported through the north interceptor sewer (12.5-foot by 8-foot) and the south interceptor sewer (9-foot by 9-foot) which join together at a junction chamber. The plant has a functional supervisory control and data acquisition (SCADA) system that monitors and/or controls most major processes includingthrottling gates, main sewage pumps (speed control only) and the secondary bypass gates. The junction chamber divides the flow from the influent sewer into two forebay branches, each of which contains a forebay sluice gate and a stop plank assembly at the lowest ends. The

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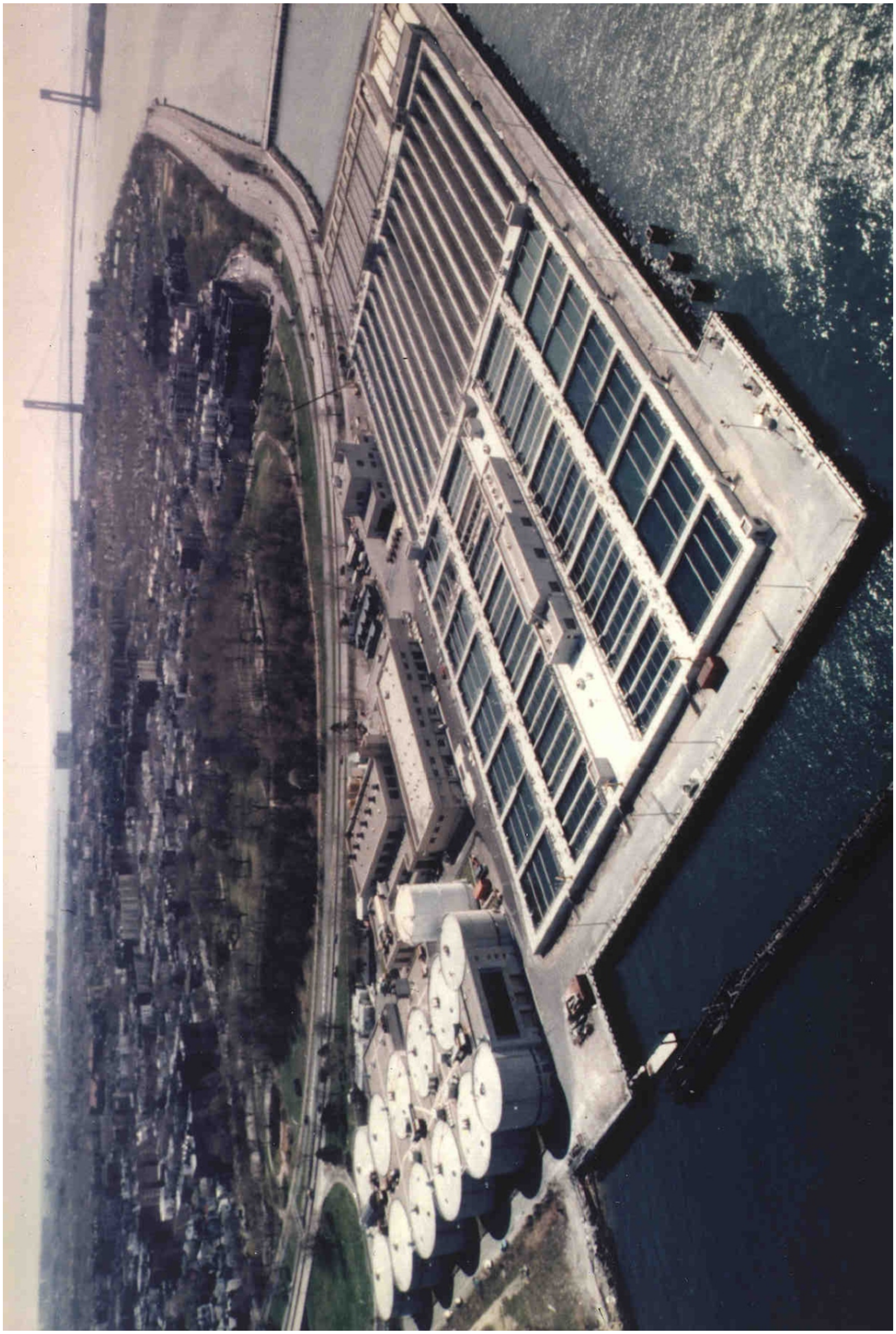
New York City's WPCP's

FIGURE 3-1



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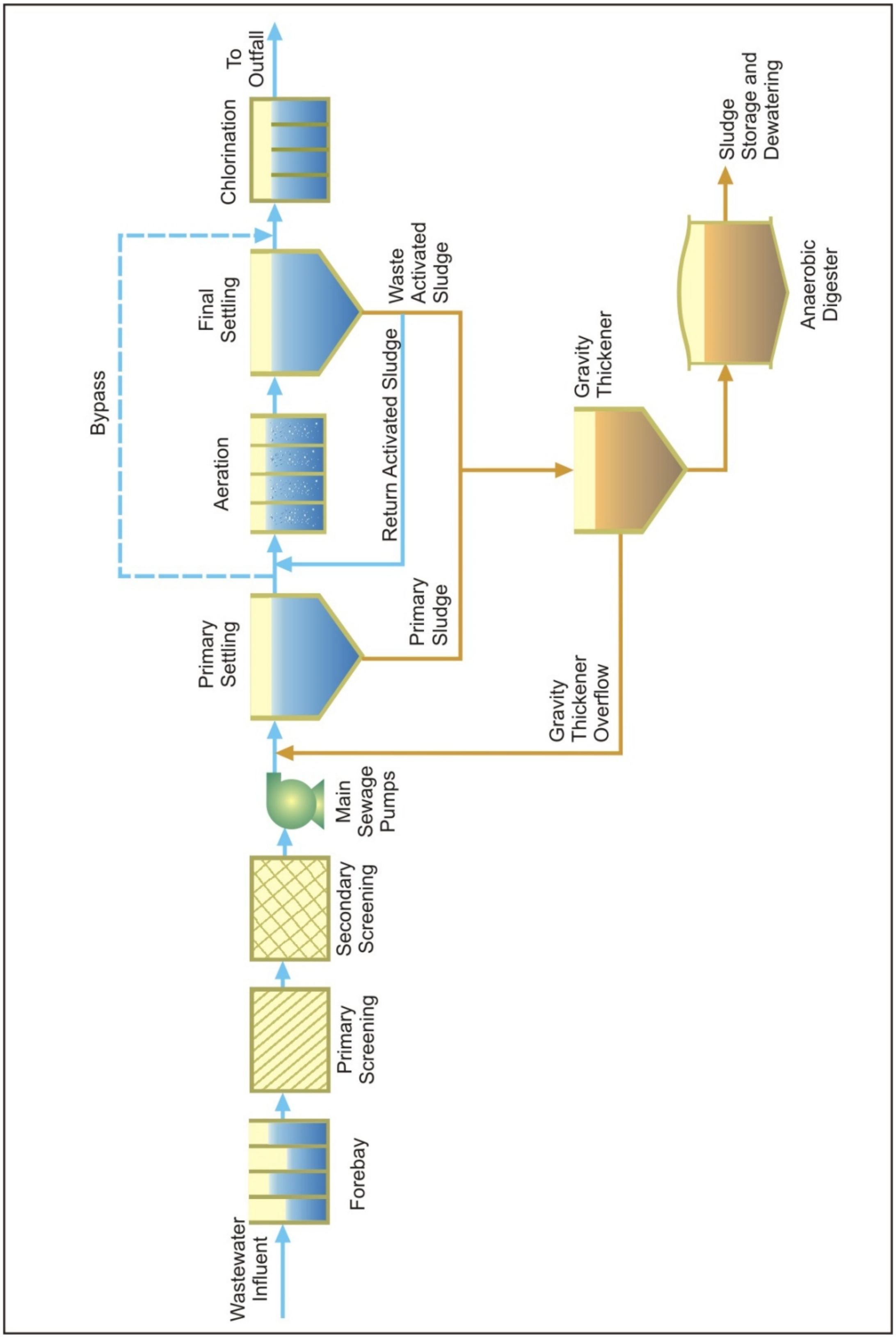
Aerial View of the Owls Head WPCP

FIGURE 3-2



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Process Diagram for the Owls head WPCP

FIGURE 3-3

Table 3-1. Select Owls Head WPCP Permit Limits

Parameter	Basis	Value	Units
Flow	DDWF Maximum secondary treatment Maximum primary treatment	120 180* 240	MGD
$CBOD_5$	Monthly average 7-day average	25 40	mg/L
TSS	Monthly average 7-day average	30 45	mg/L
Total Nitrogen	12-month rolling average	n/a **	1b/day
*1.5 DDWF **Nitrogen limits not applicable to Owls Head WPCP			

forebay sluice gates are used to throttle the flow in the forebay branches. The gates close automatically in the event of a power failure. Downstream of the forebay sluice gates, each of the two forebay piping branches connects to a junction chamber, each of which contains a stop plank assembly which is utilized for isolation purposes. Four pipe branches connect to four 6.7-foot by 15-foot screening channels, each equipped with one hydraulically-operated influent sluice gate, a coarse and fine screen set up in series, and a hydraulically-operated effluent sluice gate. The flow of sewage, after passing through the screening channels and the effluent sluice gates, enters the wetwell, the lowest point in the collection system.

The screens are reciprocating-rake type, front cleaned, front return, mechanically cleaned bar (climber) screens which were designed for continuous operation. Primary and Secondary Screens are provided. The primary (coarse) screens have a 1-1/4 inch clear opening and the secondary (fine) screens have a 3/4-inch clear opening. The bar screen rakes elevate the captured screenings to a discharge chute approximately four feet above the opening floor. There the screenings are dislodged by a screen wiper and dropped into a one cubic yard container. The screenings are later transferred to a six-cubic-yard container and eventually picked up and transported to a designated New York City landfill according to a predetermined schedule.

Five 60 MGD vertical centrifugal or mixed flow-type pumps, driven directly by electric motors, are provided to pump the maximum design flow of 240 MGD with one pump held as a reserve. There are five electric motors, rated at 700 HP, one for each of the five main sewage pumps. The motors are of the wound-rotor induction type and are suitable for speed control by varying rotor resistance. The synchronous speed of the motors is 390 rpm at 50 Hz. New main sewage pumps are currently being designed. The new pumps will be 85 MGD, 800 HP with variable frequency drives. Replacement of the pumps is anticipated to start in 2006. The sewage is discharged from the five main sewage pumps through their respective 42-inch diameter discharge lines to a 90-inch diameter force main which transports the sewage to the four primary settling tanks. The primary settling tanks are equipped with steel chain and redwood flight sludge-collector mechanisms. Primary tank effluent flows to the aeration tanks through a channel equipped with wet-weather-overflow-bypass-weirs.

The plant has a secondary bypass channel which conveys primary effluent to the chlorine contact tanks when the flow into the secondary treatment process exceeds 180 MGD. The bypass channel capacity is believed to be around 60 MGD.

Four 4-pass step-feed aeration tanks are provided for step aeration with activated sludge. The total aeration tank volume is 18.7 MG and four 20,000 standard cubic feet per minute (scfm) blowers provide air through ceramic disc, full-floor coverage, fine-bubble diffusers.

Aeration tank effluent flows by gravity to 16 final settling tanks where solids are settled. The collected solids are either wasted to the gravity thickeners or returned to the aeration tanks. The total volume of the final settling tanks is 13.5 million gallons (MG) with a surface overflow rate of 800 gallons per day per square foot (gpd/sf) average design flow.

The plant effluent is disinfected with sodium hypochlorite solution. Sodium hypochlorite is fed with a rotary-feeder/eductor system, with metering pumps provided for prechlorination and backup. Two plug-flow contact tanks with a total volume of 2.5 MG are provided to detain the effluent for 15 minutes of disinfection contact time at peak flow prior to discharge to the Upper New York Bay. An outfall sewer, with two branches and 64 diffusers, disperses the effluent approximately 220 feet into the Bay.

The primary solids are pumped to cyclone degritters which separate the grit from the primary sludge. Scum from the primary tanks is pumped to a scum concentration tank. Grit and concentrated scum are trucked to a sanitary landfill. Degritted primary sludge is pumped to the sludge processing complex where it is mixed with the waste-activated sludge. Combined sludge is screened with mechanically-cleaned bar screens prior to gravity thickening in four 80-foot diameter thickeners. Thickened sludge is pumped to four 80-foot diameter high rate anaerobic digesters. The digesters are mixed with a pumped liquid mixing system and are heated with external heat exchangers. The digesters are designed to operate in either the mesophilic or thermophilic modes. Digested sludge then flows to two 80-foot diameter gas extractors and eventually is pumped to two 60-foot diameter sludge storage tanks. Digested sludge is transported by sludge vessel to the 26th Ward WPCP for dewatering and beneficial reuse. Exhaust air from the thickener gallery, screening chamber, sludge storage tanks and grit and scum buildings is treated with nine 12-foot diameter dual bed activated carbon adsorption units to remove odors.

3.1.2 Wet Weather Operating Plan

NYCDEP is required by its SPDES permit to maximize the treatment of combined sewage at the Owls Head WPCP. The permit requires treatment of flows up to 180 MGD through complete secondary treatment. Further, to maximize combined sewage treatment the SPDES permit requires flows of up to 240 MGD to be processed through all elements of the WPCP except the aeration basins and the final settling clarifiers.

New York State requires the development of a Wet Weather Operating Plan (WWOP) as one of the 14 BMPs for collection systems that include combined sewers. The goal of the WWOP is to maximize flow to the WPCP, one of the nine minimum elements of long-term CSO control planning. NYCDEP has developed a WWOP for each of its 14 WPCPs, and Table 3-2 summarizes the requirements for the Owls Head WPCP. The WWOP for Owls Head was submitted to NYSDEC in December 2007 as required by the SPDES permit, and was updated in September 2008. The most recent is attached as Apendix A.

Table 3-2. Wet Weather Operating Plan for Owls Head WPCP

Unit Operation	General Protocols	Rationale
Influent Gates and Screens	Leave gate in full open position until pump capacity is hit, screen channel level exceeds acceptable level with maximum pumping, bar screens become overloaded, or grit removal exceeds capacity. Set a third primary screen into operation and set screen rakes to continuous operation in order to accommodate increased flow.	To regulate flow to the plant and prevent excessive flows from destabilizing plant performance.
Main Sewage Pumps	As wetwell level rises put off-line pumps in service and increase speed of variable speed pumps up to maximum capacity always leaving one pump out of service as standby.	Maximize flow to treatment plant and minimize need for flow storage in collection system and associated overflow from collection system into receiving water body.
Primary Settling Tanks	Make sure four primary sludge pumps are on-line and watch water surface elevations at the weirs for flooding and flow imbalances. Reduce flow if sludge cannot be withdrawn quick enough from the primaries, grit accumulation exceeds the plants ability to handle it, or a primary tank must be taken out of service.	Provide settling for the increased flows.
Bypass Channel	The bypass gate automatically opens or closes to maintain secondary flow at 180 MGD or less.	To relieve flow to the aeration system and avoid excessive loss of biological solids and to relieve primary clarifier flooding.
Aeration Tanks	Keep at least four aeration tanks in operation and adjust the airflow to maintain proper dissolved oxygen levels.	To provide effective secondary treatment to storm flows up to 180 MGD.
Final Settling Tanks	Balance flows to the tanks and observe the clarity of the effluent to watch for solids loss.	High flows will substantially increase solids loadings to the clarifiers, which may result in high clarifier sludge blankets or high effluent TSS. This can lead to loss of biological solids that may destabilize treatment efficiency in dry weather conditions.
Chlorination	Check, adjust (increase), and maintain the hypochlorite feed rates to provide proper chlorine residual for adequate fecal kill.	Hypochlorite demand will increase as flow rises and secondary bypasses occur.
Sludge Handling	Proceed as normal.	Uninfluenced by wet weather.

3.1.3 Other Operational Constraints

NYSDEC and NYCDEP entered into a Nitrogen Control Consent Order that updated the New York City SPDES permits to reduce nitrogen discharges to the Long Island Sound and Jamaica Bay to reduce the occurrence of eutrophic conditions and improve attainment of dissolved oxygen numerical criteria. There are no effluent nitrogen limitations at this WPCP associated with the Nitrogen Control Consent Order. Therefore, there are no plans to implement Biological Nitrogen Removal (BNR) at this facility. However, because of ongoing efforts by the Harbor Estuary Program (HEP) for water quality improvements, it is possible that BNR may be required at some point in the future.

3.2 COLLECTION SYSTEM

The drainage system of the Coney Island Creek watershed is divided into four sub-areas: the combined sewer area (regulator AV1 at the Avenue V Pump Station), separate sewer area tributary to the Owls Head WPCP, the separate sewer area tributary to the Coney Island WPCP, and an area that drains directly to the Creek (Figure 3-4). The total drainage area tributary to Coney Island Creek is 3,120 acres of which 808 acres are served by separate sewers tributary to the Coney Island WPCP and the remaining 2,133 acres are tributary to the Owls Head WPCP (Avenue V Pump Station). Of the 2,133 acres tributary to Owls Head WPCP, 763 acres are served by combined sewers and 1,370 acres are served by separate sewers. There are 179 acres that drain directly to the creek.

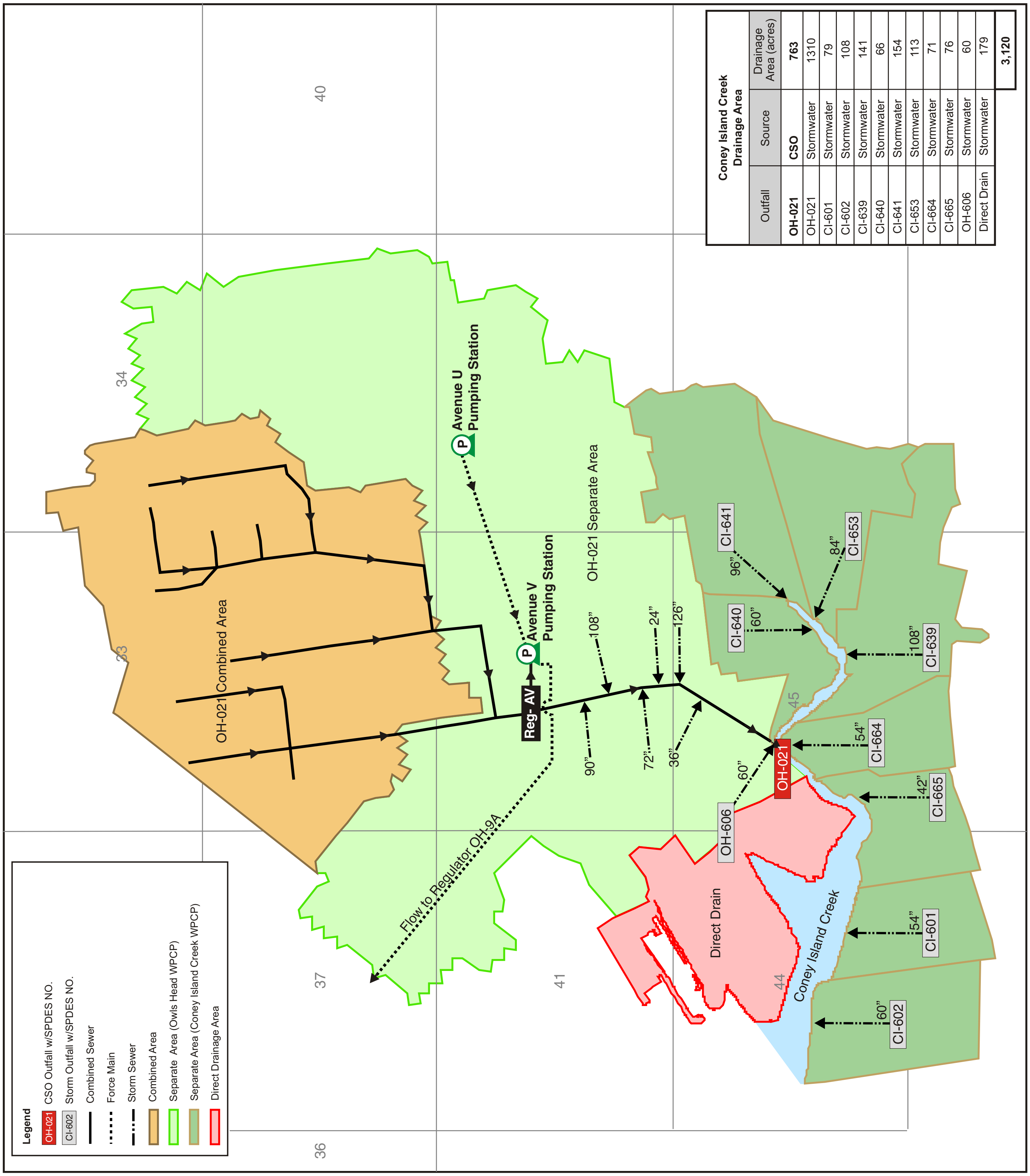
3.2.1 Combined Sewer System

The combined sewer network serving the Coney Island Creek Study area is oriented around the 120-inch trunk sewer running along West 11th Street to the Avenue V pump station. As originally designed and constructed, the 120-inch sewer was a storm sewer serving the central and northern portions of the tributary area. The wet weather flow from this system was conveyed to the 120-inch sewer via numerous separate overflows and separation chambers. In the early 1960's, this system was modified by bulkheading the connections from the combined sewers to the sanitary sewers. The combined flow was then redirected to the storm sewers discharging to the 120-inch line. At the same time, a regulator and tide gate chamber were constructed on the 120-inch sewer adjacent to the Avenue V pump station. This converted the 120-inch and its upstream storm sewers to combined sewers and directed the dry weather flow in them to the pump station.

In the Coney Island Creek drainage area there is only one regulator (AV-1) which is located on the south side of the Avenue V Pump Station. This regulator regulates the flow from the 120-inch combined sewer. The dry weather flow is diverted to the pump station via a 5 ft. x 3 ft. intercepting sewer. The wet weather flow is discharged into Coney Island Creek via a 240-inch diameter outfall located downstream of the tidegates. This outfall sewer also drains six storm sewers (ranging in size from 24 to 108-inches) that serve the separate sewer area. The regulator contains a sluice gate that can be throttled or closed during rain events to limit the flow to the pump station. If the excess flow in the combined sewer backs up and exceeds the tidal level, the tide gates open and allow the CSO to be discharged to Coney Island Creek via the 240-inch diameter outfall sewer.

Avenue V Pumping Station

The Avenue V Pumping Station is located on the corner of Avenue V and West 11th Street in the Bensonhurst section of the borough of Brooklyn. It was built between 1911 and 1916. The pumping station serves the southeastern portion of the Owls Head drainage area. This area is approximately 2,900 acres of primarily residential land use with some small commercial establishments along the major roadways. Sewage and combined flow is collected and pumped to a 78-inch intercepting sewer via two force mains (24-inch and 30-inch) and then conveyed through regulators 9A and 1 to the Owls Head WPCP.



Coney Island Creek Drainage Area

Outfall	Source	Drainage Area (acres)
OH-021	**CSO**	**763**
OH-021	Stormwater	1310
CI-601	Stormwater	79
CI-602	Stormwater	108
CI-639	Stormwater	141
CI-640	Stormwater	66
CI-641	Stormwater	154
CI-653	Stormwater	113
CI-664	Stormwater	71
CI-665	Stormwater	76
OH-606	Stormwater	60
Direct Drain	Stormwater	179
		3,120

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Coney Island Creek Waterbody/Watershed Facility Plan

Coney Island Creek Collection System

FIGURE 3-4

A large 120-inch combined sewer and five sanitary sewers, ranging in size from 24 inches to 48 inches, flow to the pumping station (Figure 3-5). The sewers in the eastern quarter of the area drain to the Avenue U pumping station from where the sewage is pumped to a 42-inch sewer which flows to the Avenue V Pumping Station. Two storm sewers, 90-inch and 108-inch, flow through the pumping station site and combine behind the station in a 228-inch outfall which turns into a 240-inch outfall that flows to Coney Island Creek.

Four sanitary sewers and one combined line enter the site and drain to the wetwell through one of three influent pipes. The regulator is designed to limit flow into the pumping station during rain events. The operation of the regulator chamber is manual and is equipped with a sluice gate. The tide gate chamber is downstream of the regulator and is designed to allow combined sewage overflow to pass through the tide gates to Coney Island Creek. When the sluice gate is throttled or closed, the combined flow backs up in the 120-inch combined sewer, and ultimately flows into Coney Island Creek as the tide gates open.

Two storm sewers pass through the pumping station site and drain the northeastern and northwestern sections of the tributary area. Sanitary sewage was discovered in both of these sewers during field investigation activities conducted in association with the Coney Island Creek CSO Facility Plan. The NYCDEP aggressively abated the illegal sanitary connections that were found as part of the 1998 CSO Facility Planning work. The storm water from these two sewers and whatever CSO flow comes from the tide gates merge in a large outfall structure that drains to Coney Island Creek.

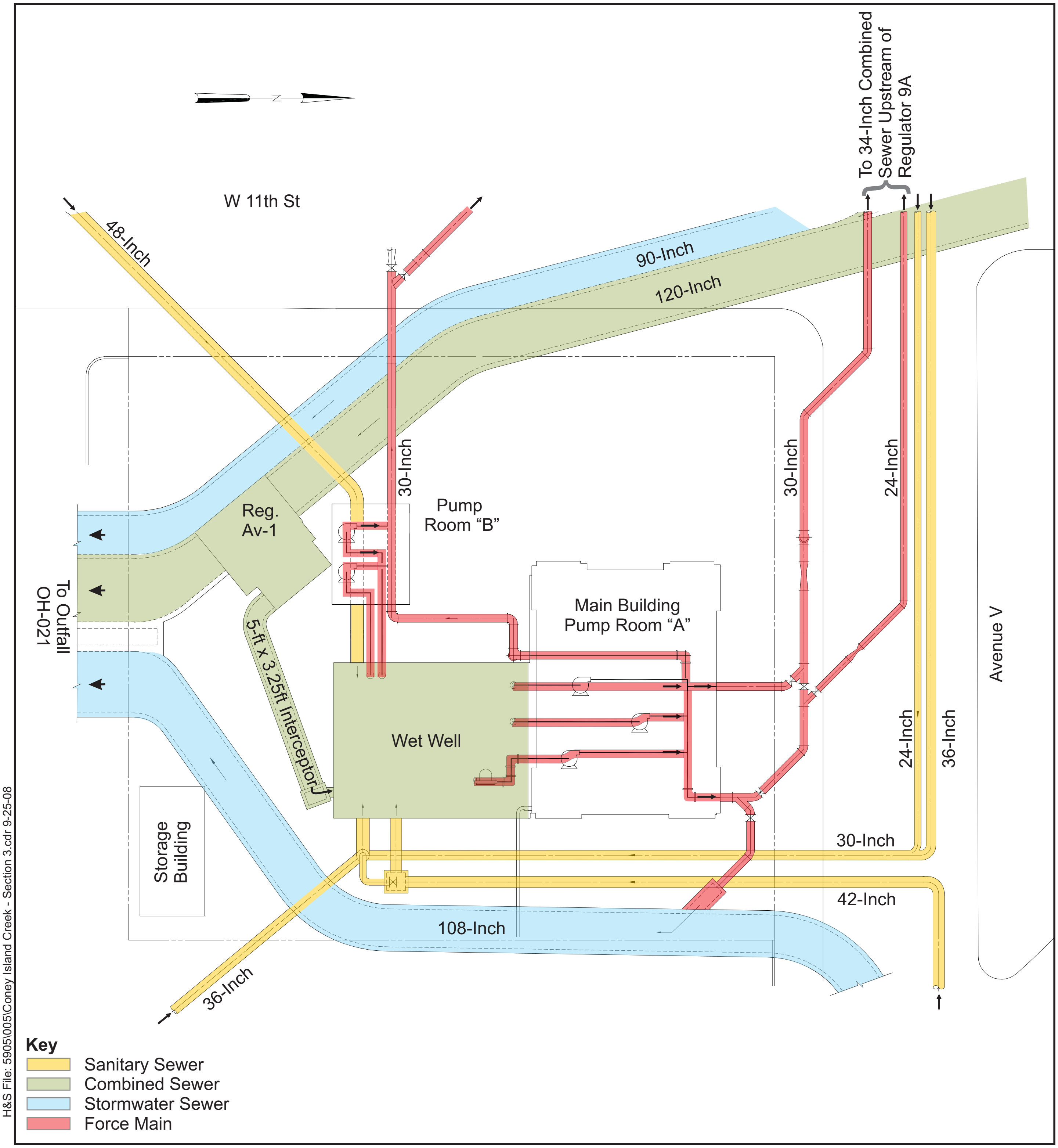
The outfall structure that drains to Coney Island Creek is a three barrel, cast in place structure. Each barrel is 15-feet wide and 8.5-feet high. This outfall is tidally effected and drains south to Coney Island Creek.

Two force mains convey the pumped sewage from the Avenue V Pumping Station approximately 5700-feet to a 78-inch gravity sewer interceptor at Benson Avenue and 21st Avenue. Both the force mains have been sliplined with polyethylene to improve their hydraulic capacity. The 30-inch force main now has an inside diameter of 25.7-inch and the 24-inch force main has an inside diameter of 20.3-inch.

The wet well structure at the Avenue V Pumping Station actually consists of two separate wet wells. A small high level wet well originally received the flow from the 42-inch sewer entering the station from the east and was drained by two pumps. Many years ago, the 42-inch sewer was diverted to the lower wet well and the high wet well was abandoned. The low wet well is divided into three sections. All influent lines enter the south section.

Hydraulic Analysis and Interim Improvements

An analysis of the existing system was done under various modes of operation. This analysis was not done under the CSO study but under the Avenue V Pumping Station Facility Report performed by Velzy Associates (1993). In this study, operation with different combinations of pumps was simulated using a typical daytime wet well elevation of 14 feet



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Avenue V Pumping Station Existing Configuration

Coney Island Creek Waterbody/Watershed Facility Plan

FIGURE 3-5

(invert -5.0 feet). Typical night time operation was simulated using a wet well elevation of 8 feet (invert -11.0 feet). The results of the hydraulic analysis were as follows:

- Under present conditions, the maximum flow through the station, at wet well elevation of 14-feet, with all pumps in operation, is just over 21,000 gpm (30.2 MGD).
- Normal daytime operation with two or three pumps operating results in the station pumping a flow of 18,000 gpm to 20,000 gpm (25.9 to 28.8 MGD).
- The flow through the station under typical night time conditions with one or two pumps ranges from 10,000 gpm (14.4 MGD) to 12,800 gpm (18.4 MGD).

The analysis showed that the force mains are the major limitations in any significant increase in capacity of the pumping station. At pumping station total flow of 20,000 gpm, velocities in the existing force mains are 7 to 8 feet per second and the head loss in the force main exceeds 40 feet. The analyses performed showed that in order to substantially increase the capacity of the pumping station, even with new pumps, a new force main must be constructed. The analysis also showed that a moderate increase in flow could be obtained by replacing one of the existing pumps with a new higher head pump. It was found this new pump along with piping modifications would increase station capacity by 10 percent, permit operation at lower wetwell levels and assist in maintenance of flow during the ultimate station upgrading.

In the study, a pump suited for high flow, high head application with a 20-foot suction lift capability was not found. It was decided to install two submersible pumps rated at 10,000 gpm (nos. 9A and 9B) in series. Besides achieving the goal of increased pumpage, this permits the individual pumps to be rated at a lower head which will make them suitable for use in the ultimate upgrading. The suction head problem is eliminated by installing one interim pump in the wet well for the implementation of the interim improvements pump nos. 1, 2, 3 and 4 were removed and the series configuration of pump nos. 9A and 9B were installed on the main pump building.

From the hydraulic analyses performed in this study it was determined that continual operation at high wet well levels is necessary for the pumps to handle the station flow. This in turn results in continual surcharged conditions in the influent sewers.

3.2.2 Sanitary Sewer System

Avenue V Pumping Station

The existing storm and sanitary sewer network within the Avenue V pump station tributary area was constructed in the early 1900s. There are five major sanitary sewers ranging in size from 24 inches to 48 inches and a 120-inch combined sewer that convey sewage to the Avenue V pump station. The sanitary and dry weather flow from the Avenue V pump station is pumped via 24 inch and 30 inch diameter force mains to a 78-inch diameter intercepting sewer at the intersection of Benson and 21st Avenue. From there the flow is conveyed through regulators 9A and 1 to the Owls Head WPCP for treatment.

Avenue U Pumping Station

The Avenue U Pumping Station was built in 1916 and serves a tributary area of approximately 600 acres. It has three pumps each within the rated capacity of 4100 gpm (17.7 MGD) and a rated head of 30-feet. Sewage is pumped into a 42-inch diameter sanitary sewer which flows into the Avenue V Pumping Station.

Coney Island WPCP

The sanitary and storm sewers serving this area consist of approximately 100 miles of sewers. The material and shape of the sewers vary considerably with size. The flow from the separately sewered section drains by gravity through the Coney Island Interceptor to the treatment plant.

The Coney Island Interceptor serves the 3,300 acres located in the southern section of the drainage basin including the areas of Coney Island Beach, Brighton Beach, Manhattan Beach and Sheepshead Bay. The 84-inch interceptor follows a west to east route from Coney Island Beach and enters the treatment plant at Avenue Z and Brigham Street. It has a capacity of approximately 100 MGD.

3.2.3 Stormwater Sewer System

Owls Head WPCP (Avenue V Pumping Station)

The storm drainage in this area is handled by two major storm sewers. A 108-inch diameter storm sewer serves the area to the east of the pump station and runs along Avenue U to VanSicklen Street and crosses over to Avenue V towards the pump station. A 90-inch storm sewer running along Benson Avenue serves the western portion of the tributary area. The two storm sewers, along with the overflow from the 120-inch diameter combined sewer, combine in an outlet structure at the south side of the pumping station. From there the storm drainage is conveyed through a triple barrel outfall sewer discharging to Coney Island Creek. The outfall sewer is approximately 4,000 ft. long and each barrel is about 8.5 feet high and 15 feet wide. Four additional storms sewers, ranging in size from 24- to 126-inches in diameter, tie in to the outfall sewer approximately 1400 ft downstream of the pump station. These storm sewers drain the areas south of the pump station (Figure 3-4). Additionally a 60-inch storm sewer discharges directly to the Creek at the combined sewer outfall (Table 3-3). The entire storm system serving this area including the outfall sewer is tidally influenced due to the close proximity of the Creek.

Coney Island WPCP

During wet weather, stormwater from this area is discharged into Coney Island Creek. There are eight (8) major stormwater outfalls discharging into Coney Island Creek from this area. These outfalls are presented in Figure 3-4 and Table 3-3.

Table 3-3. Outfall Locations in Coney Island Creek

Outfall	Type	Size (in)	Drainage Area (ac)	Location
CI-601	Storm	60	79	W. 33rd St. & Bayview Avenue
CI-602	Storm	54	108	W. 28th St. & Pierhead Line
CI-639	Storm	108	141	W. 12th St. & Neptune Ave.
CI-640	Storm	60	66	Head of Creek at Belt Parkway
CI-641	Storm	96	154	Belt Parkway. and Shell Road
CI-653	Storm	84	113	N. of Neptune Ave. on sewer easement between W. 6th and W 5th St.
CI-664	Storm	54	71	W. 15th St. bet. Hart Pl. and Neptune Ave.
CI-665	Storm	42	76	Neptune Dr. and W. 21st St.
OH-606	Storm	60	60	Ave. Z and W. 16th Street
OH-021	Combined	240	763	Ave. Z and W. 16th Street
OH-021	Storm	240	1310	Ave. Z and W. 16th Street

3.3. SEWER SYSTEM MODELING

3.3.1. InfoWorks CS

Numerical simulations of the Owls Head WPCP service area response to varying rainfall conditions were performed using the InfoWorks CS modeling program from Wallingford Software. InfoWorks CS combines a relational database with geographical analysis to provide a single environment to integrate asset planning with detailed and accurate modeling. The system provides fast, accurate, and stable modeling of key elements of stormwater sewer systems. The software incorporates full solution modeling of backwater effects and reverse flow, open channels, sewers, detention ponds, complex pipe connections and complex ancillary structures such as culverts, orifices and weirs.

InfoWorks CS incorporates the Storm Water Management Model (SWMM) to route overland runoff, a non-linear reservoir routing model developed for the USEPA. Idealized sub-basins are analyzed as spatially lumped non-linear reservoirs, and hydraulic routing obeys the Saint-Venant equations of conservation of mass and momentum. As in any hydrologic-hydraulic model, InfoWorks CS calculates runoff volumes first and routes the runoff over sub-areas (sub-basins) to generate runoff hydrographs. It then applies the hydrographs to the channel-sewer system for hydraulic routing. Runoff from pervious areas is generated by the model if the rainfall intensity is greater than the soil infiltration rate.

The first step in constructing the runoff volume model is to divide each sub-basin into impervious and pervious areas. The fixed runoff coefficient method was used to calculate runoff volume in impervious areas. It is assumed that there is no rainfall infiltration in impervious areas and there is an initial loss of 0.01 inches due to initial interception which was derived empirically. The rest of the rainfall in the impervious area becomes runoff. In the pervious areas, the initial rainfall loss is assumed to be 0.1 inches after which the rainfall begins to infiltrate the soil, a process modeled using Horton's equation for cumulative rainfall infiltration, which can be expressed as a function of time

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3.3.2. Application of Model to Owls Head Collection System

The collection system model for the Owls Head service area was constructed using information and data compiled from the NYCDEP's as-built drawings, WPCP data, previous and ongoing planning projects, regulator improvement programs, and inflow/infiltration analyses. This information includes invert and ground elevations for manholes, pipe dimensions, pump station characteristics, and regulator configurations and dimensions.

Model simulations include WPCP headworks, interceptors, branch interceptors, major trunk sewers, all sewers greater than 30 inches in diameter plus other smaller, significant sewers, and control structures such as pump stations, diversion chambers, tipping locations, reliefs, regulators and tide gates. The model was calibrated and validated using flow and hydraulic-elevation data collected for this purpose. All CSO and stormwater outfalls permitted by the State of New York are represented in the models, with stormwater discharges from separately sewered areas simulated using separate models as necessary. Conceptual alternative scenarios representing no-action and other alternatives were simulated for the average year (1988 JFK rainfall). Tidally influenced discharges were calculated on a time-variable basis. Pollutant concentrations selected from field data and best professional judgment were assigned to the sanitary and stormwater components of the combined sewer discharges to calculate variable pollutant discharges. Similar assignments were made for stormwater discharges. Discharges and pollutant loadings were then post-processed and used as inputs to the receiving water model, described in Section 4.0.

3.3.3. Baseline Design Condition

Watershed modeling can be an important tool in evaluating the impact of proposed physical changes to the sewer system and/or of proposed changes to the operation of the system. In order to provide a basis for these comparisons, a "Baseline condition" was developed. For the Owls Head Model, the Baseline conditions parameters were as follows:

- Dry-weather flow rates based on 2045 population projections;
- Wet-weather capacity at the Owls Head WPCP of 240 MGD; and
- No sedimentation in the sewers.

The WPCP capacity for baseline conditions was set at the "average sustained flow" observed during the top ten storms of 2003 as tabulated in the BMP Report for 2003 to represent facility performance prior to both the 2005 CSO Consent Order and the full implementation of the wet-weather operating plan (WWOP). The alternatives evaluated in Section 7 were modeled with the WPCP capacity at full 2DDWF to incorporate the improvements to WPCP capacity expected to result from the capital and operational upgrades.

Establishing the future Owls Head WPCP dry weather sewage flow is a critical step in the WB/WS Planning analysis because the City's CSO control program relies on its WPCP treatment capacity to reduce CSO overflows. Increases in sanitary sewage flows associated with increased populations would use part of the WPCP wet weather capacity, thus reducing the amount of CSO flow that can be treated at the existing WPCP. Dry weather sanitary sewage flows used in the Baseline modeling were escalated to reflect anticipated growth within the City. At the direction of the Mayor's Office, NYCDCP made assessments of the growth and movement of the City's population between the year 2000 census and 2010 and 2030 (NYCDCP, 2006). This information is contained in a set of projections made for 188 neighborhoods within the City. NYCDEP has escalated these populations forward to 2045 by assuming the rate of growth between 2045 and 2030 would be 50 percent of the rate of growth between 2000 and 2030. These populations were associated with each of the landside modeling sub-catchment areas tributary to each CSO regulator using geographical information system (GIS) calculations. Dry sanitary sewage flows were then calculated for each of these sub-catchment areas by associating a conservatively high per capita sanitary sewage flow with the population estimate. The per capita sewage flow was established as the ratio of the year 2000 dry weather sanitary sewage flow and the year 2000 population of the Owls Head WPCP area. Increasing the sewage flows for the Owls Head WPCP from the current 2007 flow of 87.2 MGD to an estimated 114.8 MGD in 2045 will properly account for the potential reduction in wet weather treatment capacity associated with projections of a larger population.

In addition to the above watershed/sewer-system conditions, a comparison between model calculations also dictates that the same meteorological (rainfall) conditions are used in each case. In accordance with the Federal CSO Control Policy average rainfall year was used. Long-term rainfall records measured in the New York City metropolitan area were analyzed to identify potential rainfall design years to represent long-term, annual average conditions. Annual statistics compiled included:

- Total rainfall depth and number of storms;
- Average storm volume and intensity;
- Total and average storm duration; and
- Average interevent time.

A more detailed description of these analyses is provided under separate cover (HydroQual, 2004). Although no year was found having the long-term average statistics for all of these parameters, the rainfall record measured at the National Weather Service gage at John F. Kennedy (JFK) International Airport during calendar year 1988 is representative of overall, long-term average conditions in terms of annual total rainfall and storm duration. In addition, the JFK 1988 rainfall record includes high-rainfall conditions during July (recreational) and November (shellfish) periods, which are useful for evaluating potential CSO impacts on water quality during those particular periods. As a result, the JFK 1988 rainfall record was selected as an appropriate design condition for which to evaluate sewer system response to rainfall. The JFK 1988 record has also been adopted by the New York Harbor Estuary Program and the New Jersey Department of Environmental Protection for water quality and CSO performance evaluations. Table 3-4 summarizes the precipitation data used.

Table 3-4. Comparison of Annual 1988 and Long-Term Statistics

Statistic	1970-2002 Median	1988	
		Value	Return Period (years)
Total Volume (inches)	39.4	40.7	2.6
Intensity (inches./hour)	0.057	0.068	11.3
Number of Storms	112	100	1.1
Storm duration (hours)	6.08	6.12	2.1

An important distinction must be made between Baseline and other representative conditions as discussed throughout this document. Because dry weather flow is based on a 2045 population projection, and wet weather flow is based on 1988 precipitation, the Baseline condition should not be construed as analogous to any actual conditions that might have been observable. The Baseline condition was developed to provide a basis for comparison of CSO abatement alternatives, thus representing a "no-build" alternative, i.e., the expected future CSO under typical rainfall conditions if no additional abatement efforts were implemented beyond the current SPDES permit requirements. However, satisfaction of those SPDES requirements that are operational (as opposed to performance) in nature may not result in an explicitly defined outcome. For example, having an approved sewer cleaning and maintenance program does not guarantee that the sewers will be free of debris, or satisfying the 2DDWF treatment target does not necessarily mean it is possible to do so during all wet weather hours when less intense storms do not convey adequate flow.

3.4 DISCHARGE CHARACTERISTICS

3.4.1 Discharges from Combined Sewer Overflows

The drainage area serviced by the Avenue V Pumping Station consists of 763 acres of combined sewer area and 1,370 acres of separately sewered area tributary to the Owls Head WPCP. Detailed information on the Owls Head WPCP landside model can be found in the Owls Head Watershed Modeling Report (NYCDEP, 2007) which is a separate, supporting volume of the Coney Island Creek WB/WS Facility Plan Report. As the calibration results were satisfactory for both dry and wet weather conditions the model was considered a viable tool for calculating CSO and stormwater discharges to Coney Island Creek.

The 240-inch outfall sewer carries CSO from the Regulator AV-1 just upstream of the Avenue V Pumping Station and stormwater flows from the separately sewered area to Coney Island Creek (Figure 3-4). The associated combined sewer discharge average annual flow volume, frequency, and peak volume event were determined for two calibration scenarios using the 1988 JFK average design rainfall year that formed the basis for the development of the Coney Island Creek watershed/ waterbody plan. The first scenario assesses the existing system performance with its current pump station capacity of 30 MGD. The second scenario assesses the system under baseline conditions of 2045 population levels. Details on the selection of 1988 as the average design rainfall year can be found in the Landside Modeling Methodology Report (NYCDEP, 2007) which is a separate, supporting volume of the Coney Island Creek WB/WS Facility Plan Report.

The discharge flows and frequencies under the two scenarios described above are summarized in the Table 3-5.

Table 3-5. CSO Discharge Flows and Frequencies from Outfall OH-021 under Existing and Baseline (2045) Conditions

Parameter	Existing Sewer Conditions	Baseline Conditions
DWF (MGD)	22.9	24.8
Number of Overflows	53	54
Total Annual CSO Volume (MG)	261.3	292.4
Largest Event Volume (MG)	23.5	24.9
All Scenarios based on 1988 JFK Rainfall year		

3.4.2 Discharges from Stormwater Outfalls

Two separate drainage areas contribute stormwater discharges into Coney Island Creek: two outfalls from the Owls Head WPCP drainage area and eight outfalls from the Coney Island WPCP drainage area. The development and calibration of the Owls Head WPCP landside drainage area model is described in the Owls Head Watershed Modeling Report (NYCDEP, 2007) which is a separate, supporting volume of the Coney Island Creek WS/WB Report. Similar modeling efforts were undertaken for the Coney Island WPCP drainage area. Flow was monitored at four locations during the period of June 15, 1993 to December 12, 1993. Three flow meters were in the storm sewer monitoring locations while the other one monitored combined sewer flows. The model parameters were reviewed and adjusted based on accuracy in flow and total volume calculations and therefore is considered a viable tool for the watershed/ waterbody plan development in this report. The development and calibration of the Coney Island WPCP landside drainage area model is described in the Coney Island Watershed Modeling Report (NYCDEP, 2007) which is a separate, supporting volume of the Coney Island Creek WS/WB Report. Stormwater discharge volumes and frequencies were determined as mentioned in the previous section, and the results are summarized in the Table 3-6 below.

Table 3-6. Stormwater Discharge (Based on 1988 JFK Rainfall year)

Outfall Number	Total Annual Volume (MG)	Largest Event Volume (MG)
OH-021*	910.1	150.0
CI-601	21.4	1.3
CI-602	69.0	5.1
CI-639	58.5	4.5
CI-640	7.2	0.5
CI-641	110.3	8.5
CI-653	49.2	3.7
CI-664	50.0	3.1
CI-665	30.4	1.9
OH-606	42.3	2.6
Direct Drain	138.1	10.8
* Stormwater outfall contribution; does not include overflow from Regulator AV-1.		

3.4.3 Effect of Urbanization on Discharge

Once a bountiful source of fish and oysters, Coney Island Creek is no longer a natural feature (Figure 3-6). The Coney Island Creek watershed drainage area is now highly urbanized. Amusement parks, boardwalk development, hotels, and other high-rise buildings have contributed to the increased percentage of imperviousness in the drainage area of this creek. This increased impermeability leads to a greater volume of runoff and faster runoff flow rates. Of all the runoff that enters this area, 94.3 percent reaches the creek through sewer connections (Table 3-7). With more runoff getting into the piping system and to the treatment plant at faster rates, the likelihood of a combined sewer overflow is increased. Increased runoff volumes and flow rates are critical to the transport of pathogens, sediments, and other pollutants to the Coney Island Creek waterbody.

Table 3-7. Coney Island Creek Watershed Summary

Source Category	Drainage Area (acres)	Percent of Watershed
Combined	763	24.5%
Separate	2,178	69.8%
Direct Drainage	179	5.7%

Population and land use changes have altered the runoff volumes significantly in the Coney Island Creek watershed. The population in the watershed has increased from approximately 75,000 people in 1900 to more than 164,000 in 2000 according to the US census. The imperviousness of such a watershed typically would have been around 30 percent in 1900 in comparison to the 57 percent used in the current model. Associated runoff volumes for these pre-urbanized and urbanized conditions were calculated and are summarized in Table 3-8.

Table 3-8. Runoff Volumes Pre-Urbanized vs. Urbanized Conditions

Watershed Characteristics	Pre-Urbanized (1900)[2]	Urbanized (2000)[3]
Population[1]	75,000	164,222
Imperviousness	30%	57%
Average Annual Storm Runoff Yield (MG) [2]	1,030	1960
Peak Storm Runoff Yield (MG)[2]	61	120

1. Pre-urbanized population estimate based on estimated urbanized areas within Coney Island Creek drainage area on USC&GD 1890 map. Urbanized population based on census data.
2. Pre-Urbanized flows calculated using the average rainfall year JFK 1988 and based on the rationale approach of Q = C*I*A
3. Urbanized flows determined using InfoWorks model.

3.4.4 Pollutant Concentrations

In order to calculate the pollutant loadings to Coney Island Creek from the combined and storm sewer outfalls, average concentrations of various pollutants were assigned to both sanitary and storm water flows. Sanitary pathogen concentrations were estimated based on samples taken from the influent of the Owls Head WPCP. Stormwater pathogen concentrations were based on the results of the 2004 stormwater sampling program conducted by the NYCDEP through

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Coney Island Creek Existing Conditions

FIGURE 3-6

CDM/URS. This program collected enterococci data as well as total/fecal coliform concentrations. Samples were taken on three separate days at seven different locations in the city where discharges flow to the NY Harbor. A summary of the pollutant concentrations used in the loading characterization for the Coney Island Creek drainage area is given in Table 3-9.

Table 3-9. Storm and Sanitary Pollutant Concentrations

Parameter	Stormwater	Sanitary
Total Coliform (MPN/100mL)	300,000	25,000,000
Fecal Coliform (MPN/100mL)	120,000	4,000,000
Enterococci (MPN/100mL)	50,000	1,000,000
BOD (mg/L)	9	168
TSS (mg/l)	15	180

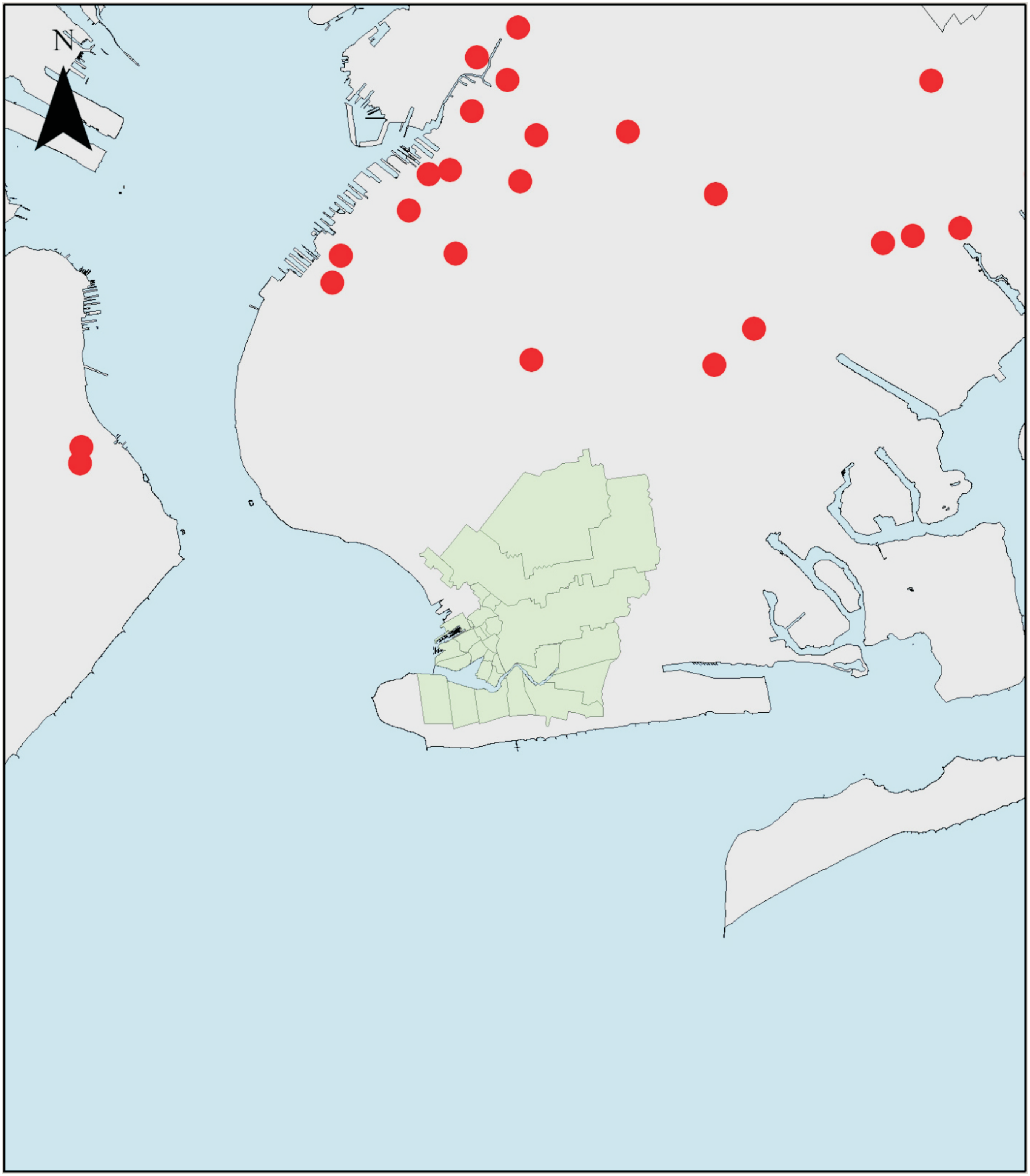
3.4.5 Pollutant Loadings

Using the previously determined flow data (Tables 3-5 and 3-6) and estimated pollutant concentrations (Table 3-9), the annual pollutant loadings were determined for both CSO and stormwater discharges for various water quality parameters in the existing conditions and baseline scenarios. These loadings are summarized in Table 3-10 below.

3.4.6 Toxics Discharge Potential

For industrial source control in separate and combined sewer systems, the USEPA requires approximately 1,500 municipalities nationwide to implement Industrial Pretreatment Programs (IPPs). The intent of the IPP is to control toxic discharges to public sewers that are tributary to sewage treatment plants by regulating Significant Industrial Users (SIU). If a proposed Industrial Pretreatment Program is deemed acceptable, the USEPA will decree the local municipality a Control Authority. NYCDEP has been a Control Authority since January 1987, and enforces the IPP through Chapter 19 of Title 15 of the Rules of the City of New York (Use of the Public Sewers), which specifies excluded and conditionally accepted toxic substances along with required management practices for several common discharges such as photographic processing waste, grease from restaurants and other businesses, and perchloroethylene from dry cleaning. NYCDEP has been submitting annual reports on its activities since 1996. The 310 SIUs that were active at the end of 2004 discharged an estimated average total mass of 38.2 lbs/day of the following metals of concern: arsenic, cadmium, copper, chromium, lead, mercury, nickel, silver and zinc. There are no SIUs located within the watershed drainage area of Coney Island Creek (Figure 3-7).

Early efforts to reduce the amount of toxic contaminants being discharged to the New York City open and tributary waters focused on industrial sources and metals. As part of the IPP, NYCDEP analyzed the toxic metals contribution of sanitary flow to CSOs by measuring toxic metals concentrations in WPCP influent during dry weather in 1993. This program determined that only 2.6 lbs/day (1.5 percent) of the 177 lbs/day of regulated metals being discharged by regulated industrial users were bypassed to CSOs. Of the remaining 174.4 lbs, approximately 100 lbs ended up in biosolids, and the remainder was discharged through the main WPCP outfalls. Recent data suggest even lower discharges. In 2004, the average mass of total



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Significant Industrial Users (SIUs) in the Coney Island Creek Drainage Area

FIGURE 3-7

metals discharged by all regulated industries to the New York City WPCPs would translate into less than 1 lb/day bypassed to CSOs from regulated industries if the mass balance calculated in 1993 is assumed to be maintained. A similarly developed projection was cited by the 1997 NYCDEP report on meeting the nine minimum CSO control standards required by federal CSO policy, in which NYCDEP considered the impacts of discharges of toxic pollutants from SIUs tributary to CSOs (NYCDEP, 1997). The report, audited and accepted by USEPA, includes evaluations of sewer system requirements and industrial user practices to minimize toxic discharges through CSOs. It was determined that most regulated industrial users (of which SIUs are a subset) were discharging relatively small quantities of toxic metals to the NYC sewer system.

Table 3-10. Summary of Annual Pollutant Loadings to Coney Island Creek

Pollutant Loadings under Existing Conditions

	CSO	Stormwater	Total
Total Coliform (counts)	5.73E+16	1.69E+16	7.42E+16
Fecal Coliform (counts)	9.82E+15	6.75E+15	1.66E+16
Enterococci (counts)	2.64E+15	2.81E+15	5.45E+15
BOD (lbs)	98,611	110,595	209,205
TSS (lbs)	116,772	186,396	303,168

Pollutant Loadings under Baseline Conditions

	CSO	Stormwater	Total
Total Coliform (counts)	7.59E+16	1.69E+16	9.28E+16
Fecal Coliform (counts)	1.29E+16	6.75E+15	1.97E+16
Enterococci (counts)	3.41E+15	2.81E+15	6.22E+15
BOD (lbs)	127,325	110,595	237,920
TSS (lbs)	148,436	186,396	334,832

4.0 Waterbody Characteristics

Coney Island Creek, located in southwest Brooklyn, is approximately 1.6 miles long. At its head end, Coney Island Creek is a narrow, shallow body of water approximately 50 yards wide and flows in a southwesterly direction. During periods of low tide, the head of the creek becomes an exposed mudflat. The creek begins to widen past Cropsey Avenue and the depth increases to approximately 7 - 8 feet mean low water. At West 19th Street the width and depth of the creek increases to 500 yards wide and 13 - 14 feet deep at MLW, respectively. The widest portion of Coney Island Creek occurs off the cement fishing pier in Kaiser Park where it is 1,100 yards wide. A large tidal mudflat lies on the north shore of the Creek in Drier-Offerman Park. The mouth of the creek narrows beyond the fishing pier as a considerable amount of beach sand has accumulated along the south shore. The width of the creek here is 700 yards. Coney Island Creek empties into Gravesend Bay and depths here range from 14 to 26 feet at MLW.

4.1 CHARACTERIZATION METHODOLOGY

The USEPA guidance for monitoring and modeling notes that the watershed-based methodology "represents a holistic approach to understanding and addressing all surface water, ground water, and habitat stressors within a geographically defined area, instead of addressing individual pollutant sources in isolation." (USEPA, 1999a) The guidance recommends identifying appropriate quantitative measures of both water quality conditions and the success of long-term control plans based on site-specific conditions, and in a manner that illustrates trends and results over time. Measures may be based on administrative (programmatic), end-of-pipe, ecological, or human health and use. Collecting data and background information to establish a solid understanding of "baseline" conditions is critical to analyzing CSO impacts and evaluating the results of CSO control. Although essential elements of many of the CSO facility planning projects undertaken by NYCDEP were initiated prior to the establishment of long-term CSO control policy, these elements were consistent with this guidance in most cases. Nonetheless, the waterbody assessment began with the compilation and analysis of existing data from investigations conducted by NYCDEP and other agencies spanning several decades. Deficiencies in these existing data sets were identified and sampling programs were developed to address those data gaps. Characterization activities followed the Work Plans developed under the USA Project, the progenitor of the current Long-Term CSO Control Planning (LTCP) Project. These efforts yielded valuable information in support of characterization, mathematical modeling, and engineering efforts. The following describes these activities.

4.1.1 Compilation of Existing Data

A comprehensive review of past and ongoing data collection efforts was conducted to identify programs focused on or including Coney Island Creek and nearby waterbodies. The NYCDEP has conducted facility planning projects related to CSO abatement since at least the 1950's, when conceptual plans were first developed for the reduction of CSO discharges into certain receiving waters. Facility planning efforts resulting in data pertinent to the present WB/WS Facility Plan include the Outer Harbor CSO Facility Planning Project and the Coney Island Creek Facility Planning Project. Several other parallel projects by NYCDEP and others have also been conducted that further contribute to the abundance of data available. In addition, the NYCDEP continues to conduct investigative programs yielding useful watershed and waterbody data, including those specifically targeting gaps in data in the New York Harbor in support of the long-term control plan. These programs are discussed in Section 4.1.2.

From 1975 through 1979, the City conducted a harbor-wide water quality study funded by a Federal Grant under Section 208 of the Water Pollution Control Act Amendments of 1972. This study confirmed tributary waters in the New York Harbor were negatively affected by CSOs. In 1984 a City-wide CSO abatement program was developed that initially focused on establishing planning areas and defining how facility planning should be accomplished. The City was divided into eight individual project areas that together encompass the entire harbor area. Four open water project areas were developed (East River, Jamaica Bay, Inner Harbor and Outer Harbor), and four tributary project areas were defined (Flushing Bay, Paerdegat Basin, Newtown Creek, and Jamaica Tributaries).

In 1993, the City initiated the Coney Island Creek CSO Facility Planning Project to determine the best alternative solutions for controlling CSO discharges to Coney Island Creek, one of the tributary areas of the citywide CSO Abatement Program (NYCDEP, 1997). A comprehensive water quality monitoring program was developed which include samples collected from sewers discharging to Coney Island Creek characteristic of dry and wet weather discharges. The receiving waters of Coney Island Creek were sampled during wet weather and dry weather to provide information on existing water quality conditions and data for the development of a mathematical water quality model. Samples were collected from eight stations along the length of Coney Island Creek (Figure 4-1). Field investigations included the following studies:

- Two (2) dry weather water quality surveys;
- Three (3) wet weather water quality surveys;
- Current velocity monitoring;
- Tidal stage monitoring;
- Sediment oxygen demand analysis;
- Sediment priority pollutant measurements;
- Nitrifier enumerations;
- Odor study;
- Biological surveys; and
- Non-point source runoff analysis.

Three wet weather surveys were conducted. The first wet weather survey was initiated on June 21, the second on July 20, and the third on October 13, 1993. During each wet weather survey, water samples were collected prior to the rainfall to monitor dry weather, or baseline, water quality conditions. Water samples were then collected on four consecutive days following a rainfall in order to track the response and recovery of the receiving waters to CSO and stormwater discharges. In addition, one-day dry weather surveys were conducted on August 5 and September 30, 1993. All dry weather sampling was conducted after a minimum of three antecedent days without rain.

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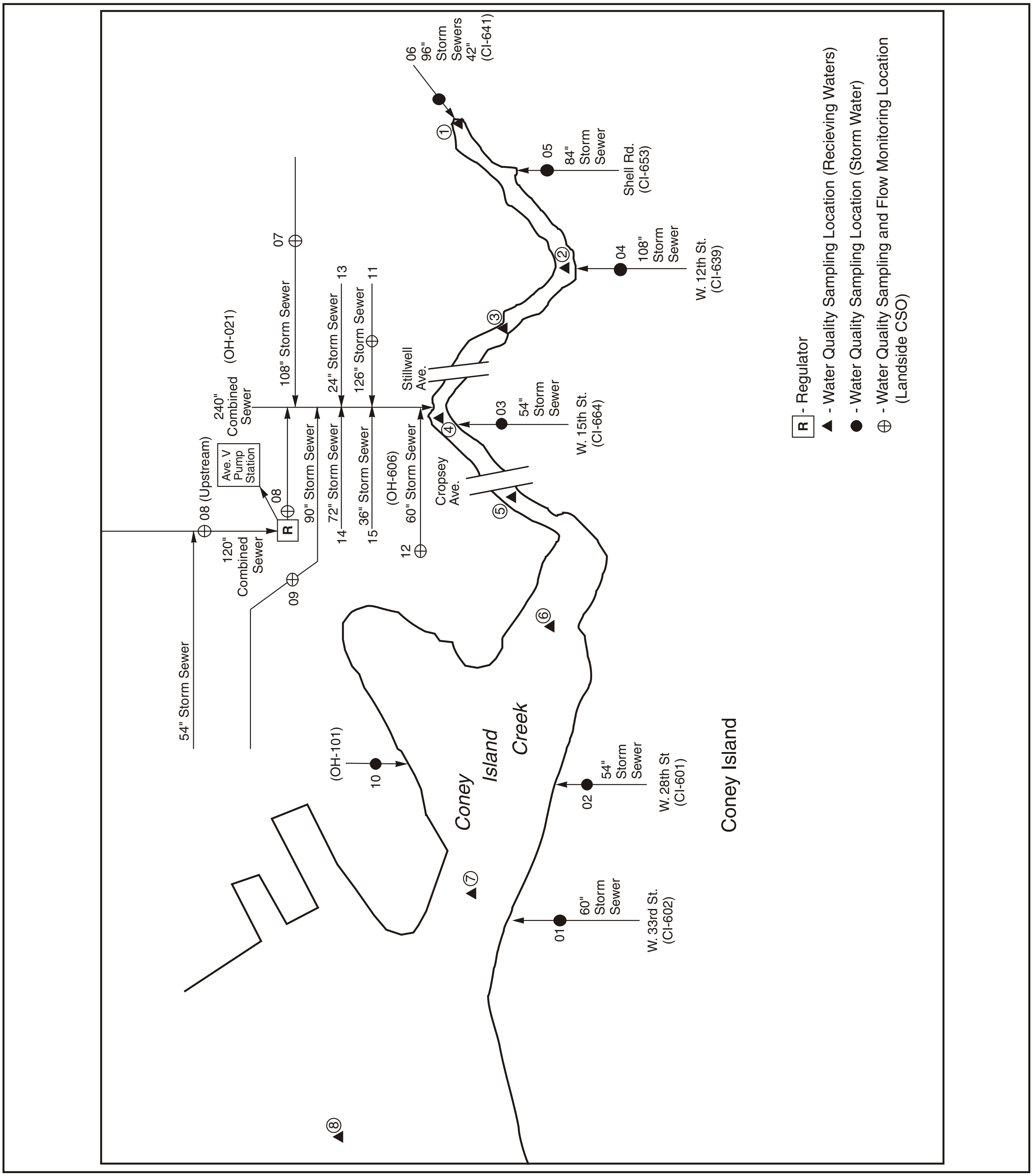


New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

Coney Island Creek
CSO Sampling Sites

FIGURE 4-1

On all sampling days, each station was sampled three times at approximately 0800, 1200 and 1600 hours. Water samples were collected from two feet below the surface and two feet above the bottom except at Stations 1 through 3 where only surface samples were collected due to shallow water conditions.

The number and type of samples collected during the receiving water quality monitoring program are given in Table 4-1. Water samples were collected with a 2.2 liter Van Dorn Bottle. Conductivity, salinity, and temperature were measured with a Hydrolab 4000 and a YSI Model 33 S-C-T meter. pH was measured using an Omega PHH 45 portable pH meter. Dissolved oxygen (DO) samples were analyzed using the Modified Winkler Method (Standard Methods, 1992).

Watershed investigations included sewer system inspections and videotaping, local rainfall recording, and CSO system monitoring. Inspections were made of several regulators, trunk sewers, and pumping stations in the Owls Head WPCP drainage area. Rainfall data was collected throughout the metropolitan region, including from a continuously recording precipitation gauge at the Avenue V Pumping Station. Sewer system monitoring was conducted at several locations in the watershed to characterize sewer system flow and CSO. Landside CSO and stormwater quality sampling surveys were performed at 12 locations. The locations of these monitoring sites are shown on Figure 4-1.

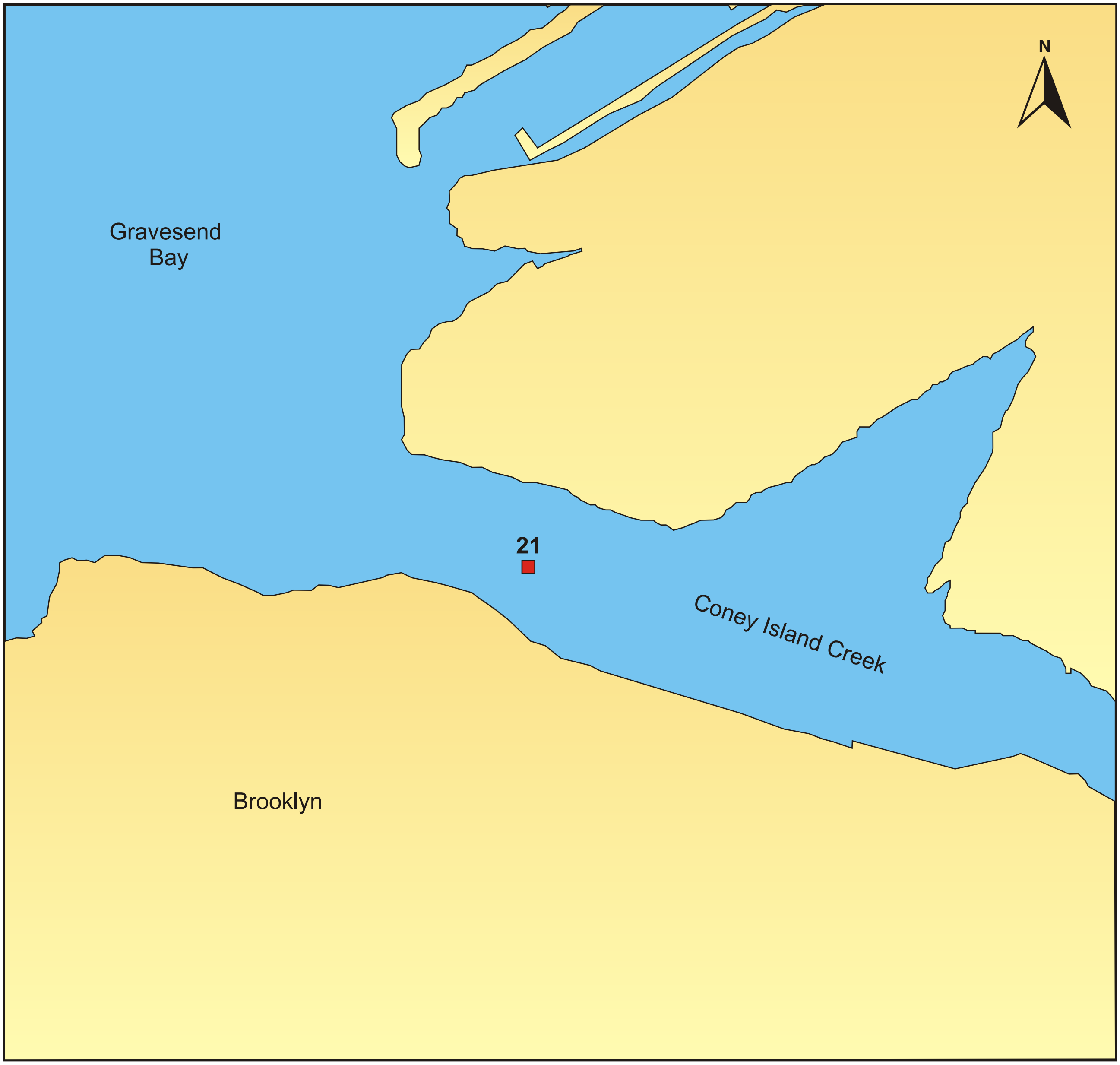
NYCDEP and its predecessor city agencies have been monitoring water quality in New York Harbor waters since 1909, reporting annually in the New York City Regional Harbor Survey. The stated purpose of the program is "to assess the effectiveness of New York City's various water pollution control programs and their combined impact on water quality" (NYCDEP, 2001). There are no current or historical Harbor Survey sampling locations in Coney Island Creek or Gravesend Bay. In 1998, the DEP began supplementing this data with the Sentinel Monitoring Program, in which stations are sampled quarterly for fecal coliform bacteria, and the results are compared with baseline conditions to trigger intensive surveillance of the adjacent shoreline. The Sentinel Monitoring Program includes one station in Coney Island Creek near the mouth. The Sentinel Monitoring Program station is shown on Figure 4-2. The Sentinel Monitoring data for Coney Island Creek for the period 2003-2007 can be found in Appendix E.

Data has been collected by agencies and organizations throughout New York Harbor in addition to the NYCDEP's harbor monitoring and project-specific sampling programs. The USEPA Regional Environmental Monitoring and Assessment Program (REMAP) has evaluated sediment quality of the benthic community throughout New York Harbor, as has the agency's more recent five-year National Coastal Assessment (a.k.a. "Coastal 2000") program (Figure 4-3). The New York State Department of Transportation (TAMS, 1999) conducted studies of the biota of the East River at the Queensboro Bridge, while the New York City Public Development Corporation (EEA, 1991) studied the ecology of Wallabout Bay in the East River. The USACE performed sediment profile imagery and benthic sampling in Jamaica, Upper New York, Newark, Bowery, and Flushing Bays during June and October, 1995. The data from these programs are useful for comparing Coney Island Creek to similar waterbodies in New York Harbor in order to ascertain its relative aquatic and ecological health.

Table 4-1. Coney Island Creek CSO Facility Planning Project Number and Type of Water Quality Parameters Collected During 1993 Sampling Program

Parameter	Dry Weather	Wet Weather	Total Receiving Waters
PRIMARY			
Total Coliform	169	455	624
Dissolved Oxygen	169	455	624
SECONDARY			
Fecal Coliform	91	273	364
BOD (5 day)	91	273	364
Total Suspended Solids	91	273	364
Oil/Grease (1)	46	137	183
TERITIARY			
TKN	39	78	117
Ammonia	39	78	117
Nitrate/Nitrite	39	78	117
Total phosphorus	39	78	117
Chlorophyl a (1)	20	39	59
BOD (30 day)	39	78	117
BOD (filtered)	39	78	117
VSS	39	78	117
Enterococci	39	78	117
Sulfide	12	54	66

NOTE:
(1) samples collected from surface waters only.
BOD = Biochemical Oxygen Demand, TRN = Total Kjeldahl Nitrogen, VSS = Volatile Suspended Solids.



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New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

Harbor Sentinel Monitoring Location in Coney Island Creek

FIGURE 4-2

New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

National Coastal Assessment Sampling Locations

FIGURE 4-3

A significant source of data on fish populations in the New York Harbor comes from the numerous studies associated with electric power generating station cooling water system. Along with cooling water, intakes inadvertently withdraw planktonic biota and smaller fish incapable of escaping the pressure gradients generated by pumping. These organisms either pass through the cooling system (entrainment), or are trapped against the screens and other protective barriers (impingement). Permit conditions at these facilities require entrainment and impingement sampling, providing an abundance of data on fish populations and other aquatic organisms. These data are biased towards younger life-stages (fish eggs and larvae) and smaller fish species, but can provide evidence of the viability of fish species in the waterbody. Local power plants include the East River plant in lower Manhattan; the Arthur Kill plant on Staten Island; and the Ravenswood, Astoria and Poletti plants on the Queens side of the East River. ENSR (1999) reported on the East River generating station, but the most recent summary of these [power plant] data was produced by Sunset Energy Fleet LLC, in its Article X application to the New York State Public Service Commission, to build and operate a power plant in Gowanus Bay (Sunset Energy Fleet, 2002). Sunset Energy also collected and analyzed numerous samples of benthic infauna, and ichthyoplankton, in Gowanus Bay in 1999 and 2000. Again, these data are useful for comparative and baseline evaluations, but do not generally provide meaningful information on NYCDEP's water pollution control efforts.

4.1.2 The NYC Biological and Habitat Assessment

The USEPA has indicated for a long time that water quality based planning should follow a watershed based approach. Such an approach considers all factors impacting water quality including both point and non-point (watershed) impacts on the waterbody. A key component of such watershed-based planning is an assessment of the biological quality on the waterbody. Fish and aquatic life use evaluations require identifying regulatory issues (aquatic life protection and fish survival), selecting and applying the appropriate criteria, and determining the attainability of criteria and uses. According to guidance published by the Water Environment Research Foundation (Michael & Moore, 1997; Novotny et. al., 1997), biological assessments of use attainability should include contemporaneous and comprehensive field sampling and analysis of all ecosystem components. These components include phytoplankton, macrophytes, zooplankton, benthic invertebrates, fish and wildlife. The relevant factors are dissolved oxygen, habitat (substrate composition, organic carbon deposition, sediment pore water chemistry), and toxicity. Biological components and factors were prioritized to determine the greatest need of contemporary information relative to existing data or information expected to be generated by other ongoing studies, and/or which biotic communities would provide the most information relative to the definition of use classifications and the applicability of particular water quality criteria and standards. The biotic communities selected for sampling included subtidal benthic invertebrates (which, being largely sessile, have historically been used as indicators of environmental quality); epibenthic organisms colonizing standardized substrate arrays suspended in the water column (thus eliminating substrate type as a variable in assessing water quality); fish eggs and larvae (their presence being related to fish procreation); and juvenile and adult fish (their presence being a function of habitat preferences and/or dissolved oxygen tolerances).

These field investigations were executed under a harbor-wide biological Field Sampling and Analysis Program (FSAP) designed to fill ecosystem data gaps in New York Harbor. Field and laboratory standard operating procedures (SOP) were developed and implemented for each element of the FSAP in conformance with USEPA's Quality Assurance Project Plan guidance (USEPA, 1998, 2001a, 2001b), its standard operation and procedure guidance (USEPA, 2001c), and in consultation with USEPA's Division of Environmental Science and Assessment in Edison, NJ. The FSAPs collected information to identify uses and use limitations within waterbodies assessing aquatic organisms and factors that contribute to use limitations (dissolved oxygen, substrate, habitat and toxicity). Some of these FSAPs were related to specific waterbodies; others to specific ecological communities or habitat variables throughout the harbor; and still others to trying to answer specific questions about habitat and/or water quality effects on aquatic life. Several FSAPs were conducted by the NYCDEP during the USA Project that included investigations of Coney Island Creek. Figure 4-4 provides a composite map of the biological FSAP sampling station locations in the Coney Island Creek waterbody.

The NYCDEP conducted its Harbor-Wide Ichthyoplankton FSAP in 2001 to identify and characterize ichthyoplankton communities in the open waters and tributaries of New York Harbor (HydroQual, 2001a). Information developed by this FSAP identified what species are spawning, as well as where and when spawning may be occurring in New York City's waterbodies. The Ichthyoplankton FSAP was executed on a harbor-wide basis to assure that evaluations would be performed at the same time and general water quality conditions for all waterbodies. Sampling was performed at 50 stations throughout New York Harbor, its tributaries, and at reference stations outside the harbor complex. The locations of sampling stations are shown on Figure 4-5. One station was located in Coney Island Creek. Samples were collected using a fine mesh plankton net with two replicate tows taken at each sampling event[?] in February, March, May, July and August 2001.

The NYCDEP conducted a Harbor Wide Epibenthic Recruitment and Survival FSAP in 2001 to characterize the abundance and community structure of epibenthic organisms in the open waters and tributaries of New York Harbor (HydroQual, 2001b). The recruitment and survival of epibenthic communities on hard substrates was evaluated because these sessile organisms are good indicators of long-term water quality. This FSAP provided a good indication of both intra- and inter-waterbody variation in organism recruitment and community composition. Artificial substrate arrays were deployed at 37 stations throughout New York Harbor, its tributaries, and at reference stations outside the harbor complex. The locations of sampling stations are shown on Figure 4-6. One station was located in Coney Island Creek. The findings of previous waterbody-specific FSAPs indicated that six months was sufficient time to characterize the peak times of recruitment, which are the spring and summer seasons. Therefore arrays were deployed in April 2001 at two depths (where depth permitted) and retrieved in September 2001.

A special field investigation was conducted during the summer of 2002 to evaluate benthic substrate characteristics in New York Harbor tributaries (HydroQual, 2002a). The goals of this FSAP were to assist in the assessment of physical habitat components on overall habitat suitability and water quality and to assist in the calibration of the water quality models as they compute bottom sediment concentrations of total organic carbon (TOC). Physical characteristics of benthic habitat directly and critically relate to the variety and abundance of the organisms living on the waterbody bottom.

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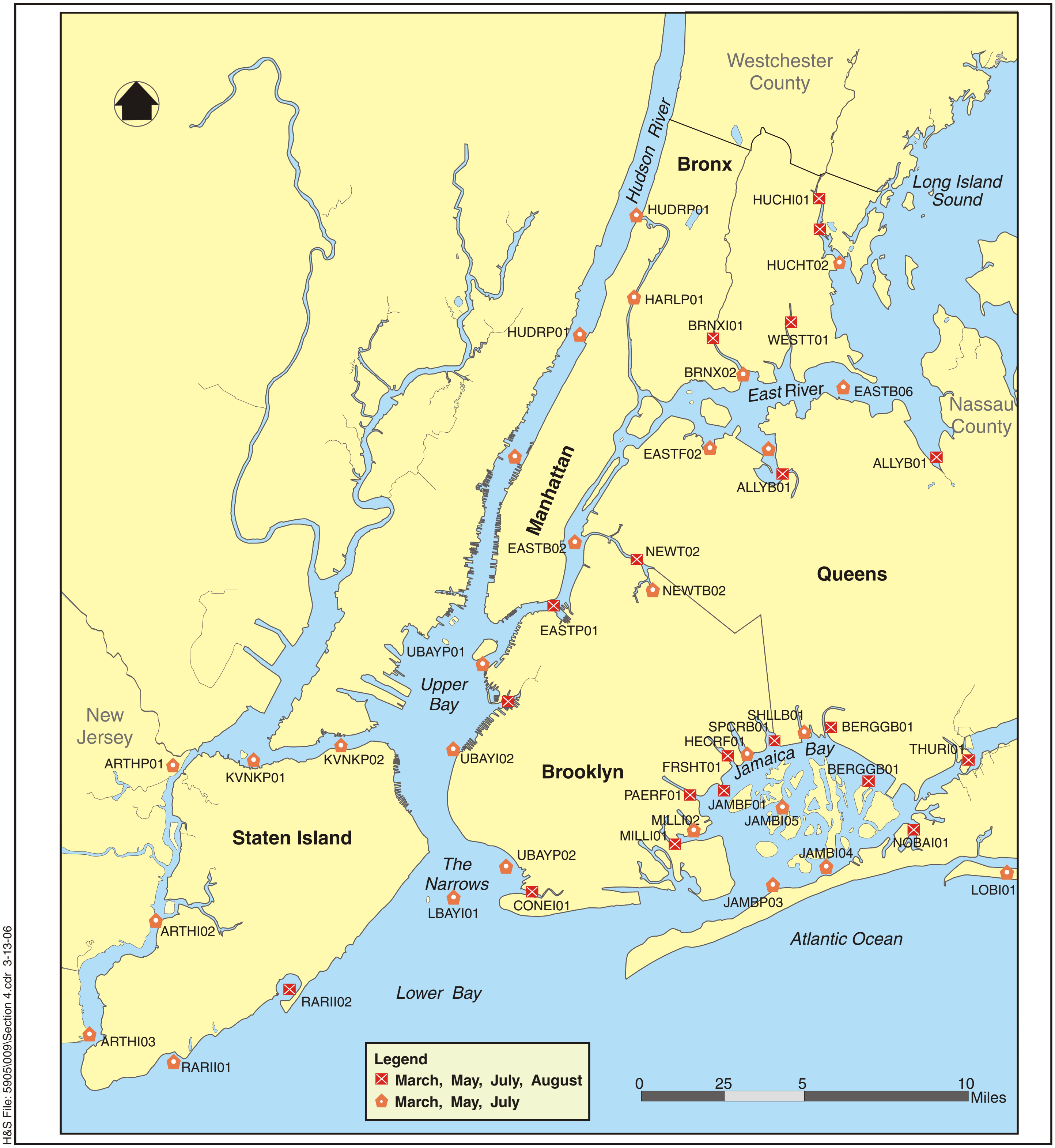
Coney Island Creek Waterbody/Watershed Facility Plan

Biological Sampling Stations in Coney Island Creek and Sheepshead Bay

FIGURE 4-4



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Coney Island Creek Waterbody/Watershed Facility Plan

Ichthyoplankton FSAP Sampling Stations

FIGURE 4-5

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Harbor-Wide Epibenthic Recruitment and Survival FSAP Sampling Locations

Coney Island Creek Waterbody/Watershed Facility Plan

FIGURE 4-6

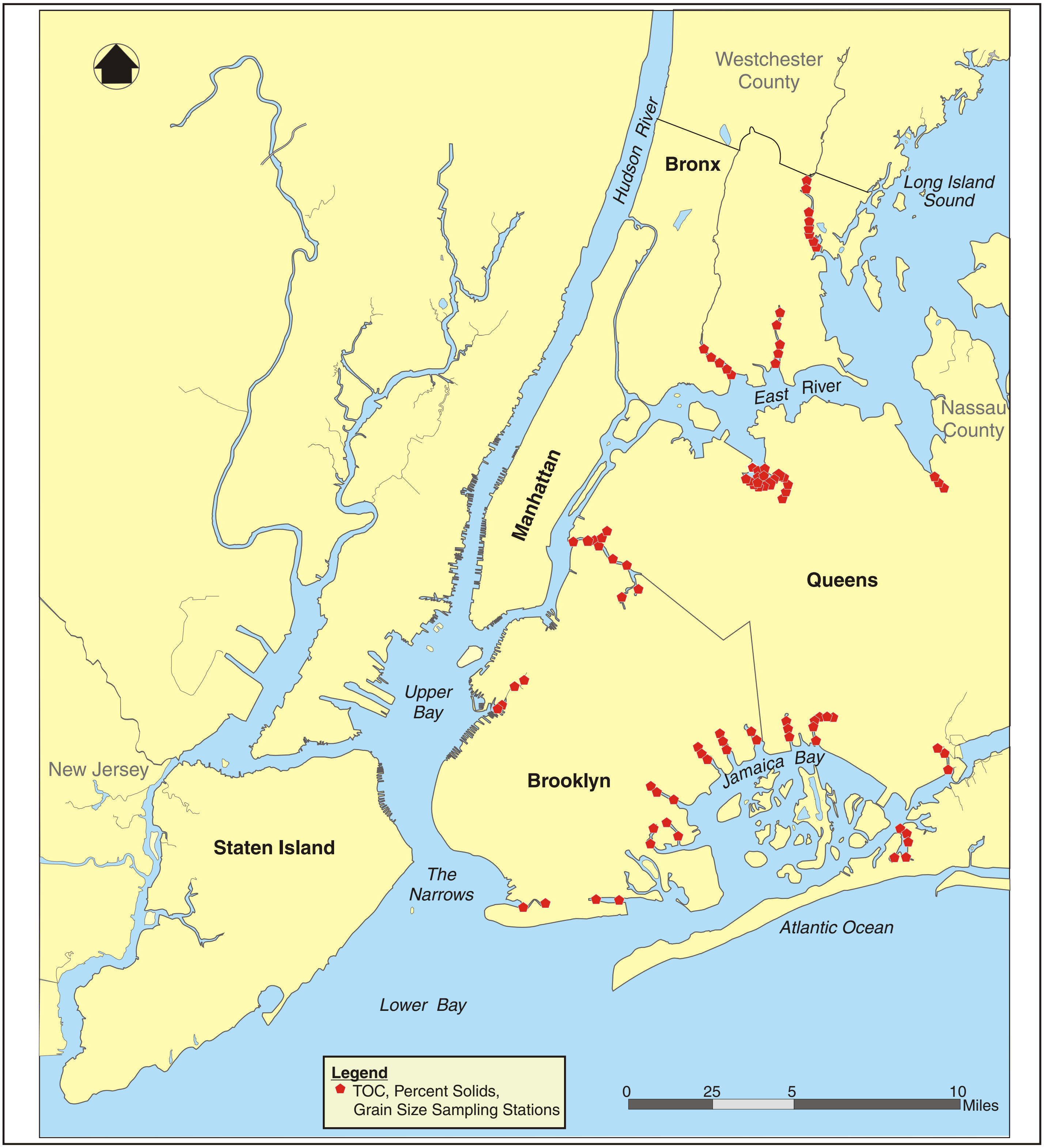
Combined sewer overflows are a primary source of TOC in New York Harbor tributaries. Abating CSO will reduce TOC sources and have a beneficial impact on tributaries. Therefore, a key component in determining the reliability of benefit projections is to have well-calibrated model computations of sediment TOC. Samples were collected from 103 stations in New York Harbor tributaries using a petit ponar grab sampler in July 2002. The locations of sampling stations are shown on Figure 4-7. Four of the stations were located in Coney Island Creek. Samples from each station were analyzed for benthic invertebrates and tested for TOC, grain size, and percent solids.

The DEP conducted a tributary toxicity characterization FSAP in 2003 to determine whether toxicity is a significant issue of concern for NYCDEP's waterbody evaluations (HydroQual, 2003a). Water column and sediment samples were collected from a total of 20 locations in Gowanus Canal, Newtown Creek, Flushing Bay and Creek, the Bronx River, and Westchester Creek. Water column toxicity was tested using 7-day survival and growth toxicity tests with Sheepshead minnow and 7-day survival, growth and consistency toxicity tests with mysid shrimp. Sediment chronic toxicity was evaluated using 28-day whole sediment chronic toxicity tests with Leptocheirus plumulosus. Survival, growth and fecundity of the species were evaluated. In addition to the toxicity tests, sediment samples were collected using an Ekomar dredge sampler and tested for TOC, percent solids, and grain size to help determine the benthic substrate characteristics of the subtidal sediments related to sediment toxicity (if any). Sampling was conducted in August 2003.

4.1.3 Other Data Gathering Programs

As part of the WB/WS Facility Plan for Coney Island Creek, a supplemental receiving water quality monitoring program was initiated in Coney Island Creek in 2004 to determine the extent of dry weather overflow abatement to the Creek subsequent to the Coney Island Creek Facility Planning Project. Two dry and two wet weather surveys were conducted. Receiving water samples were collected at the same eight stations sampled during the Coney Island Creek Facility Plan monitoring effort (Figure 4-1). The water quality parameters sampled replicated those collected during the original facility plan monitoring effort and included dissolved oxygen, total and fecal coliform, chlorophyll a, biochemical oxygen demand, total suspended solids, salinity, temperature, and conductivity. In addition, enterococci data was collected during the 2004 water quality monitoring surveys.

Following the long-term plan guidance, the NYCDEP's waterbody/watershed assessments required characterizations of combined sewer and stormwater discharges to calculate pollution loads and assess impacts on receiving waters during wet weather events. Sanitary sewage is a component of combined sewage but very little recent coliform bacteria data was available characterizing New York City's sanitary sewage. Additionally, the federal Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000 requires adoption of state water quality standards of enterococci for coastal recreational waters but very little local data is available for enterococci. Therefore a sampling program was conducted during the summer of 2002 to collect total and fecal coliform bacteria and enterococci data that would be reasonably representative of sanitary sewage in New York City's combined-sewer system. Each WPCP was sampled on at least five distinct days, with



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New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

July 2002 Sampling Stations for the TOC, Percent Solids and Grain Size FSAP

FIGURE 4-7

samples being collected several times during the day, on a random basis such that no WPCP was sampled on two successive days or on the same day of the week. At least one day of dry weather (preferably two or more) was required prior to the sampling event to assure that sample collection represented sanitary sewage only.

4.1.4 Receiving Water Modeling

The water quality data available for Coney Island Creek are derived from two primary sources. The first source is the sampling program conducted for the Coney Island Creek CSO Facility Planning Project conducted during June through December 1993. The second source is the field sampling conducted during August and September 2004 as part of this WB/WS Facility Plan. One further source of data was the New York City Department of Environmental Protection (NYCDEP) Sentinel Monitoring Program that measured fecal coliform, on a quarterly basis, near the mouth of the creek.

The Coney Island Creek CSO Facility Planning Project data set is the most extensive data set collected in the creek. The data are fully described in HydroQual (1998), but a brief description is provided here. Flow was monitored in seven locations within the sewer system during June 15 to December 12, 1993 to provide information with which to calibrate a landside runoff model. Sewer system overflow water quality sampling was conducted at twelve locations. Grab samples of total and fecal coliform bacteria, five-day biological oxygen demand (BOD_5), total suspended solids (TSS) and chloride every 15 to 30 minutes during wet weather surveys. DO and nutrient samples were taken less frequently. Data collected for the hydrodynamic modeling included bathymetry, tide stage, and vertical current profiles. Eight water quality sampling studies were conducted at eight stations between June and October 1993. These surveys included three wet-weather, three dry-weather and two additional surveys that were stopped due to precipitation or lack thereof.

Model Domain

The model bathymetry was based on the previous Coney Island Creek model with some modifications based on a NOAA navigation chart. The segmentation for the model was also based on the previous modeling effort (HydroQual, 1998) with some refinements to the boundary and spatial coverage.

Hydrodynamic Model

The Estuarine Coastal and Ocean Model (ECOM) was used for the hydrodynamic modeling effort. The hydrodynamic model is a three-dimensional, time-dependent, estuarine and coastal circulation model developed by Blumberg and Mellor (1987). The model incorporates the Mellor and Yamada (1982) turbulent closure scheme to provide a realistic parameterization of vertical mixing. A system of curvilinear coordinates is used in the horizontal direction, which allows for a smooth and accurate representation of variable shoreline geometry. In the vertical scale, the model uses a transformed coordinate system known as the σ-coordinate transformation to allow for a better representation of bottom topography. Water surface elevation, water velocity in three dimensions, temperature and salinity, and water turbulence are predicted in response to weather conditions (winds and incident solar radiation), tributary inflows, tides, temperature and salinity at open boundaries connected to the coastal waters.

The model has gained wide acceptance within the modeling community and regulatory agencies as indicated by the number of applications to important water bodies around the world. A complete description of the hydrodynamic modeling effort conducted for the Coney Island Creek Waterbody/Watershed Facility Plan is given in HydroQual (2005a).

Water Quality Model

The Coney Island Creek Model was developed using Row Column Advanced Ecosystem Modeling Program. The modeling framework is based upon the principle of conservation of mass. The conservation of mass accounts for all of a material entering or leaving a body of water, transport of the material within the waterbody, and physical, chemical and biological transformations of the material.

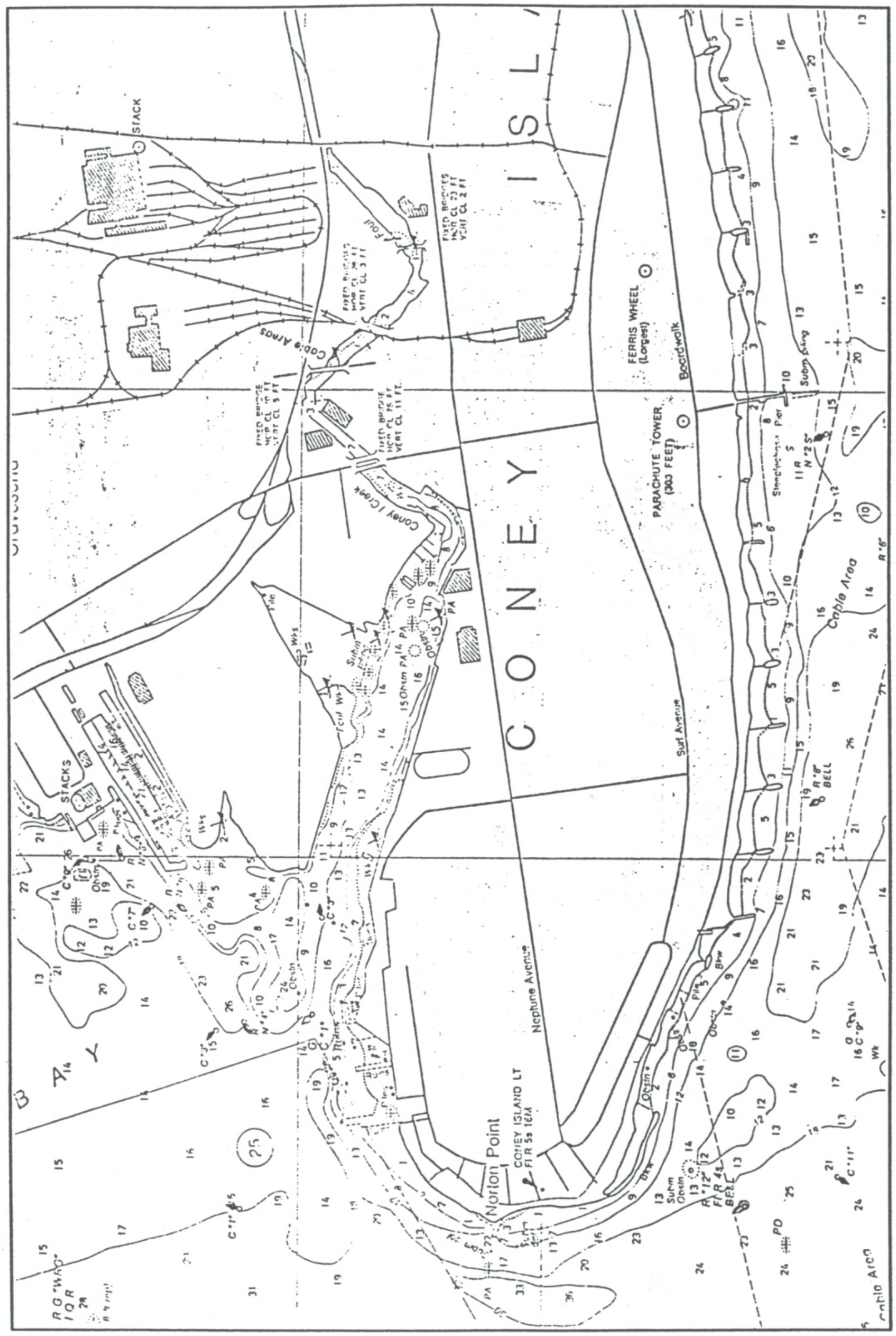
The modeling framework is comprised of two components: (1) the transport due to freshwater flow, tidal, meteorological and density driven currents; and (2) the kinetic interactions between variables and external inputs. Freshwater flow and/or density-driven currents and tidally and wind induced mixing are responsible for the movement of the water quality constituents within the waterbody.

External inputs of nutrients and oxygen-demanding material are derived from numerous sources, including municipal and industrial discharges, combined sewer overflows, storm sewer overflows, natural surface runoff, and atmospheric deposition to the surface of the waterbody. The kinetics control the rates of interactions among the water quality constituents. Ideally, in a modeling effort, they should be independent of location per se, although they may be functions of exogenous variables, such as temperature and light, which may vary with location.

An important criterion for the inclusion of variables in a modeling framework is the existence of adequate field data for calibration/verification of the variable, as well as the importance of the variable in the processes being considered. The kinetic framework employed for the integrated eutrophication model utilized 26 state variables. A complete description of the water quality modeling effort conducted for the Coney Island Creek Waterbody/Watershed Facility Plan is given in HydroQual (2005a).

4.2 PHYSICAL WATERBODY CHARACTERISTICS

Defining Coney Island Creek in terms of its physical characteristics and properties is critical to the development of an accurate and predictive water quality model. Baseline information on bottom topography and contours in the study area was obtained from the NOAA navigational chart 12402 (1988) of Lower New York Harbor (Figure 4-8). Temperature and salinity data collected in conjunction with the receiving water sampling program provided useful information about water column stratification. The tidal and current data collected was used to define the circulation pattern of Coney Island Creek. Field observations of potential nuisance conditions such as odors, sediment mounds, and floating debris were made in order to qualitatively assess the aesthetic impacts CSOs may have on the study area.



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New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

Coney Island Creek NOAA Nautical Chart

FIGURE 4-8

4.2.1 Physical Shoreline Characterization

Coney Island Creek, located in southwest Brooklyn, is approximately 1.6 miles long and flows in a southwesterly direction. At its head end, Coney Island Creek is a narrow, shallow body of water approximately 50 yards wide and during periods of low tide, the head of the creek becomes an exposed mudflat. Beyond Station 2 the creek turns and flows in a northwest direction. Its width remains quite narrow while its depth increases slightly to 2 to 4 feet Mean Low Water (MLW). There is another bend in the creek beyond Stillwell Avenue and the creek flows in a southwest direction again. The creek begins to widen past Cropsey Avenue and the depth increases to approximately 7 to 8 feet MLW. At West 19th Street the creek takes a final turn and flows west-northwest. Here, the width and depth of the creek increases to 500 yards wide and 13 to 14 feet MLW, respectively. The widest portion of Coney Island Creek occurs off the cement fishing pier in Kaiser Park where it is 1,100 yards wide. A large tidal mudflat lies on the north shore of the creek in Drier-Offerman Park. The mouth of the creek narrows beyond the fishing pier as a considerable amount of beach sand has accumulated along the south shore. The width of the creek here is 700 yards. Coney Island Creek empties into Gravesend Bay and depths here range from 14 to 26 feet MLW.

The lower portion of Coney Island Creek from the mouth to Cropsey Avenue is lined with numerous obstructions including wrecks, old barges, pilings, and construction debris. Upstream of the Cropsey Avenue bridge the Creek becomes choked with abandoned cars and boats, pilings, and other urban refuse. Boat passage beyond Station 2 is not possible except during periods of high tide.

Tributary to Gravesend Bay in Lower New York Harbor, the estuarine Coney Island Creek system experiences a semi-diurnal tidal cycle with a mean tide range of 4.8 feet at the mouth of the Creek and 4.9 feet at the head end of the Creek. Tidal currents within the Creek are generally weak and shore-parallel. The strongest currents occur at mid-water and near bottom depths. Current velocities during spring tide were generally 20 percent stronger than under neap tide. The average neap velocity within the Creek is 0.06 knots verses an average spring velocity of 0.08 knots. There was no significant velocity disparity observed between the ebb and flood tidal stage during each survey. There is no freshwater inflow other than CSO and stormwater discharges during wet weather events. The lack of freshwater inflow created a stilling effect on pollutant discharges that allows heavy organic material and grit to settle to the bottom of the waterbody. The lack of freshwater flow and its narrow configuration makes Coney Island Creek water quality dependant on tidal flushing with Lower New York Harbor waters.

4.2.2 Waterbody Access

Public waterbody access to Coney Island Creek from the head end to Cropsey Avenue is mostly precluded by the commercial and industrial development along the waterbody and its riparian zones in this reach of the Creek. There is a small private marina on the south shore of Coney Island Creek located on Neptune Avenue at 20th Street. There are three parks located at the mouth of Coney Island Creek. Drier-Offerman Park located on the north shore of the Creek contains ball fields and undeveloped land with access to the Creek and an adjoining mud flat area. Leon S. Kaiser Park is located on the south shore of the Creek on Neptune Avenue between West 27th and West 31st Streets. Kaiser Park contains ball fields, playgrounds, and a cement fishing pier. While there are no designated beaches in Coney Island Creek, Coney Island Creek Park is a sand spit adjacent to Bay View Avenue on the south shore of the Creek which provides direct access to the waterbody

4.3 CURRENT WATERBODY USES

Coney Island Creek from the head end to Cropsey Avenue is lined with mostly non-water dependent industrial/commercial users (auto repair, gas stations, a bus depot, and retail stores). There are only two water dependent industrial/commercial users in Coney Island Creek: Quaddrozi Cement located at Cropsey Avenue and an adjacent small private marina. The geometry, depth, and aesthetics of the waterbody are not conducive to recreational boating, however, jet skiing is fairly common in nearby Gravesend Bay. There are no designated swimming beaches in Coney Island Creek but Coney Island Creek Park and Drier-Offerman Park at the mouth of the Creek are amenable to sunbathing, wading and fishing (Figure 4-9). Kaiser Park has a cement fishing pier which local residents take advantage of. Religious ceremonies such as baptisms have been observed at Coney Island Creek Park as well.

4.4 CURRENT WATER QUALITY CONDITIONS

The receiving waters of Coney Island Creek were sampled during wet weather and dry weather in 1993 for the Coney Island Creek CSO Facility Planning Project to provide information on existing water quality conditions and data for the development of a mathematical water quality model. Samples were collected from eight stations along the length of Coney Island Creek (Figure 4-1).

As part of the WB/WS Facility Plan for Coney Island Creek, a supplemental receiving water quality monitoring program was initiated in Coney Island Creek in 2004 to determine the extent of dry weather overflow abatement to the Creek subsequent to the Coney Island Creek Facility Planning Project. Two dry and two wet weather surveys were conducted. Receiving water samples were collected at the same eight stations sampled during the Coney Island Creek Facility Plan monitoring effort. The water quality parameters sampled replicated those collected during the original facility plan monitoring effort.

The following sections describe the results of these studies. Data from the water quality surveys were used in developing and calibrating the hydrodynamic and water quality model of the Creek.

New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

Parks Adjacent to Coney Island Creek

FIGURE 4-9

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4.4.1 Dissolved Oxygen

The quantity of dissolved oxygen (DO) in the water column is one of the most universal indicators of overall water quality in aquatic systems. Sufficient levels of oxygen are needed for the survival of marine life and for preventing nuisance conditions such as hydrogen sulfide odors produced from the anaerobic decay of organic material in sediments. The NYSDEC water quality standards for DO in Coney Island Creek are never less than 4.0 mg/L (Table 1-1). Oxygen concentrations in coastal waters depend on a variety of interrelated chemical, physical, and biological factors such as salinity, temperature, photosynthesis, and respiration.

Photosynthesis can play a major role in the dissolved oxygen content of a waterbody. Photosynthesis is the production of organic material with nutrients and light energy by either rooted aquatic plants or free floating, unicellular plants called phytoplankton. Oxygen is a byproduct of the photosynthetic process and when excessive amounts of phytoplankton are present in the water column (e.g. bloom conditions), DO levels may become supersaturated (>8.0 mg/L). The respiration of phytoplankton during dark periods consumes oxygen for the oxidation of organic compounds to provide energy for metabolic needs. Under bloom conditions, phytoplankton respiration can produce hypoxic conditions (DO < 3.0 mg/l) which can severely stress or kill aquatic organisms. Thus when phytoplankton blooms exist, large diurnal fluctuations in DO concentrations can occur.

The oxidation of organic material by bacteria can also result in the depletion of DO. This biological process is the primary cause of low oxygen concentrations in polluted waters. Worst case conditions for the depletion of DO usually occur during the summer months when water temperatures rise. As water temperatures rise oxygen solubilities decrease and the metabolic rates of bacteria increase requiring more oxygen for respiratory purposes. Consequently, bacteria may utilize existing oxygen faster than it can be replenished by either photosynthesis or diffusion from the atmosphere.

Results of the 1993 and 2004 water quality surveys showed that average DO concentrations are lowest at the head end of Coney Island Creek (Station 1) due to accumulated organic matter from stormwater and CSO discharges as well as the confined nature of the creek in this area (Tables 4-2 and 4-3). Average DO levels progressively increased at Stations 2 and 3 under dry and wet weather conditions but then decline at Station 4 in the vicinity of the CSO outfall. In 1993, illegal sanitary connections to storm sewers contributed additional organic loads to the head end of the Creek. Average DO concentrations increase as the width and depth of the creek increase. Average DO levels in the surface waters of Stations 5 through 7 progressively increase and remain high due to photosynthetic activity. DO concentrations at Station 8 are representative of oxygen levels found in Gravesend and Lower New York Bays.

In the 1993 data set, there is no significant difference between average dry and wet weather DO concentrations at Stations 1 through 4 due in part to the limited flushing action caused by the confined nature of the Creek at these locations (Table 4-2). Differences between dry and wet weather DO concentrations become more discernible as tidal exchange with the waters of Gravesend Bay improves water quality after wet weather discharges. Also, there is virtually no difference in average DO concentrations between dry and wet weather or between surface and bottom waters at Station 8. Differences between average dry and wet weather

Table 4-2. Coney Island Creek CSO Facility Planning Project 1993 Average D.O. Concentrations Wet vs. Dry Weather

		Number of	Average D.O.		% – Less than 4.0 mg/l	
STATION	Condition	Observations	Surface	Bottom	Surface	Bottom
1	Dry	12	2.0	--	92	--
	Wet	34	2.3	--	85	--
2	Dry	13	4.8	--	54	--
	Wet	33	4.4	--	58	--
3	Dry	13	5.6	--	31	--
	Wet	34	5.4	--	29	--
4	Dry	13	3.7	4.4	54	46
	Wet	35	4.5	3.8	45	43
5	Dry	13	6.3	5.5	15	17
	Wet	35	5.3	4.7	29	41
6	Dry	13	8.4	5.9	0	15
	Wet	35	7.0	6.6	9	3
7	Dry	13	8.9	6.2	0	0
	Wet	35	7.7	6.7	0	0
8	Dry	13	7.2	7.1	0	0
	Wet	34	6.9	6.9	0	0

NOTE: NYSDEC Standard – Shall not be <4.0 mg/L at any time.

Table 4-3. Coney Island Creek LTCP CSO Facility Planning Project 2004 Average D.O. Concentrations Wet vs. Dry Weather

		Number of	Average D.O.		% –Less than 4.0 mg/l	
STATION	Condition	Observations	Surface	Bottom	Surface	Bottom
1	Dry	4	6.9	--	75	--
	Wet	15	1.7	--	100	--
2	Dry	4	8.2	--	0	--
	Wet	15	2.4	--	93	--
3	Dry	4	7.3	--	0	--
	Wet	15	2.3	--	80	--
4	Dry	4	9.2	4.6	0	75
	Wet	15	2.4	2.2	93	93
5	Dry	4	8.0	5.4	0	33
	Wet	15	3.0	2.5	67	73
6	Dry	4	9.2	3.9	0	25
	Wet	15	5.1	2.8	27	60
7	Dry	4	9.1	5.0	0	0
	Wet	15	5.8	3.2	13	47
8	Dry	4	8.7	7.3	0	0
	Wet	15	6.2	5.3	0	7

NOTE: NYSDEC Standard – Shall not be <4.0 mg/L at any time.

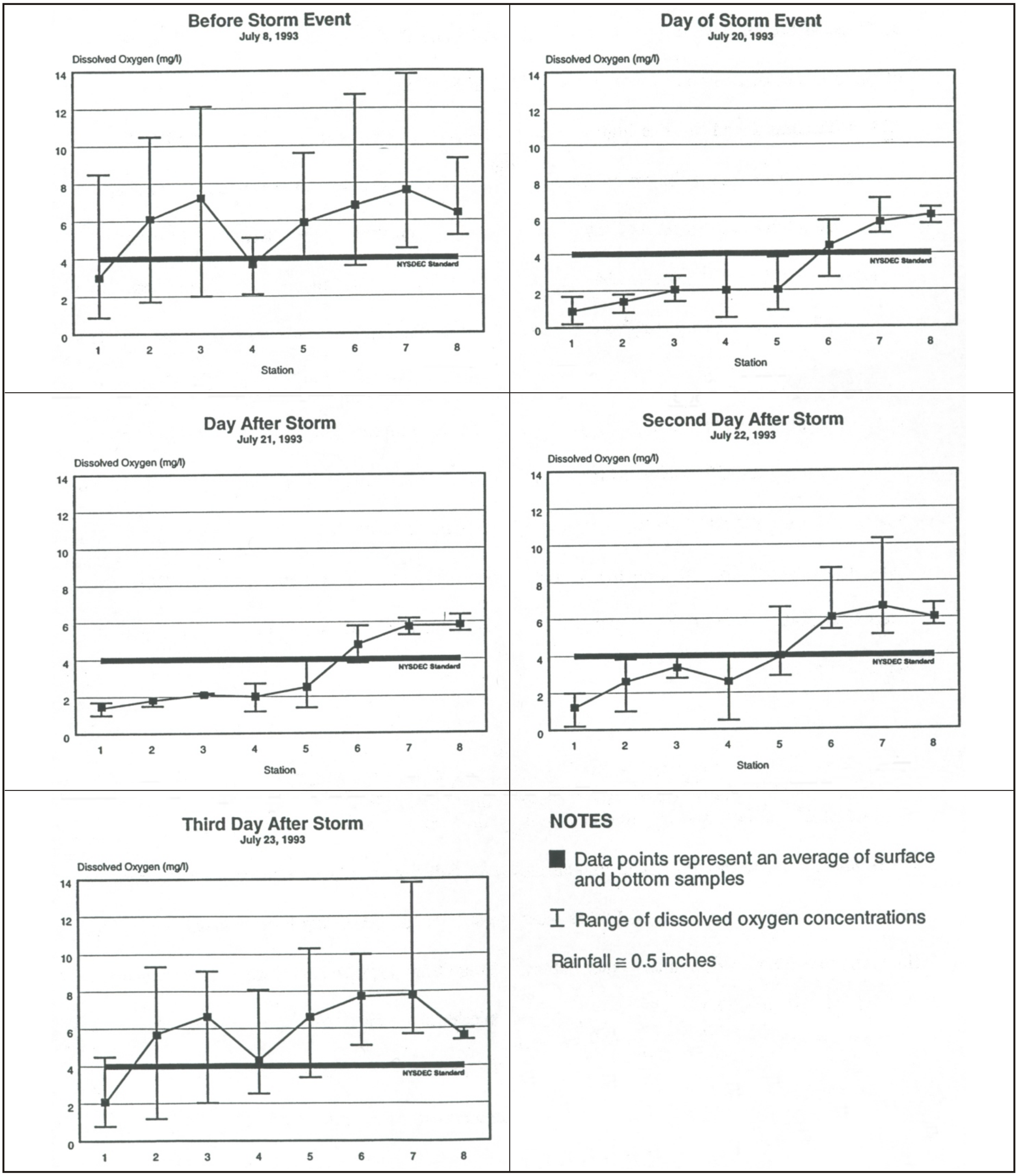
measured values are never less than 4.0 mg/L. In the 1993 data set, approximately 90 percent of all DO samples collected at Station 1 were less than the state standards (Table 4-2). The number of samples below the standard decreases to 50 percent at Stations 2 and 4 and to approximately 25 percent at Stations 3 and 5. The higher number of samples greater then NYSDEC standards at these stations is primarily a result of widespread photosynthetic activity in this region of the Creek. Figure 4-10 indicates that DO concentrations here often reach levels of supersaturation (9 to 14 mg/L) under dry weather conditions. During the July 1993 rain event, however, 100 percent of all DO samples collected from Stations 1 through 4 fell below state standards for three days following the wet weather overflow (Figure 4-10). This was due in part to reduced photosynthetic activity resulting from increased cloud cover and the input of organic matter from CSOs and storm sewer discharges. Without the photosynthetic activity generated by the plankton blooms in the upper portions of Coney Island Creek, DO concentrations there would most likely be substantially lower. Less then 15 percent of all DO samples at Station 6 fell below 4.0 mg/L and no measurements below the state standards were observed at Stations 7 and 8. In the 2004 data set, a greater percentage of DO samples were lower than NYSDEC standards at Stations 1 through 6 (Table 4-3). This may be due, in part, to the reduced sampling effort that was weighted towards wet weather sampling. Percent compliance for DO improve considerably at Stations 7 and 8, however, DO concentrations of less than 4.0 mg/l still occur occasionally.

The results of the 1993 and 2004 water quality monitoring programs indicate that the impact of CSOs, stormwater discharges, and dry weather sanitary flow on DO concentrations in Coney Island Creek are limited primarily to the upper and middle portions of the Creek. Also, the large diurnal fluctuations in DO levels found in the Creek resulting from widespread photosynthetic activity mask the impact of organic loadings on DO concentrations under both dry and wet weather conditions.

4.4.2 Bacteria

Coliform bacteria inhabit the intestines of humans as well as other warm blooded animals and are thus commonly used as indicators of unsanitary water conditions. Waters contaminated with fecal material will have high numbers of coliform bacteria which also indicates the presence of disease causing organisms. Coliform bacteria are measured as total and fecal organisms. The NYSDEC standards for total and fecal coliform levels in Coney Island Creek are summarized in Table 1-1. These standards are based on the collection of a minimum of five samples per month and are to be met in waters where disinfection is practiced. When assessing water quality conditions, coliform concentrations which exceed state standards reflect degraded water conditions.

Coliform bacteria concentrations by month and sampling location for the 1993 and 2004 water quality data sets are given in Table 4-4 and 4-5, respectively. In 1993, total coliform concentrations consistently exceed state standards by one to two orders of magnitude at Stations 1 through 5. Total coliform concentrations ranging from 600,000 to 1,000,000 cells/100mL occurred at Stations 1 and 4. Wet weather discharges from storm sewers and the CSO outfall and dry weather flow from storm sewers with improper sanitary connections cause the very high coliform concentrations found in this area of the creek. The confined nature of the Creek at the head end also contributes to the degraded water quality by restricting the exchange of cleaner waters found further down the Creek and in Gravesend Bay. For example, at Station 6, where



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Dissolved Oxygen Concentrations Wet Weather Survey No. 2

FIGURE 4-10

Table 4-4. Coney Island Creek CSO Facility Planning Project 1993 Coliform Bacteria Concentrations

		TOTAL COLIFORM		FECAL COLIFORM	
STATION	**MONTH**	**Surface**	**Bottom**	**Surface**	**Bottom**
1	June	752,628	--	10,533	--
	July	1,141,262	--	54,357	--
	October	826,901	--	9,418	--
2	June	480,077	--	2,024	--
	July	562,550	--	15,820	--
	October	450,056	--	2,198	--
3	June	347,506	--	1,359	--
	July	292,467	--	8,317	--
	October	399,015	--	1,555	--
4	June	1,024,932	298,030	8,507	3,579
	July	803,145	332,389	27,814	8,697
	October	621,450	303,727	2,285	1,288
5	June	659,542	120,711	1,716	435
	July	572,311	123,982	8,258	1,301
	October	545,781	148,035	918	632
6	June	113,392	13,775	281	130
	July	64,797	7,678	1,819	159
	October	98,345	20,458	340	112
7	June	21,545	3,588	220	64
	July	5,291	2,061	122	48
	October	39,867	14,812	147	65
8	June	747	757	25	19
	July	221	225	11	13
	October	985	390	23	12

NOTE: All values are geometric means.
NYSDEC Standards – Total Coliform: monthly geometric mean of 10,000 cells/100ml
Fecal Coliform: monthly geometric mean of 2,000 cells/100ml

Table 4-5. Coney Island Creek LTCP CSO Facility Planning Project 2004 Bacterial Concentrations

		TOTAL COLIFORM		FECAL COLIFORM		ENTEROCOCCI	
STATION	**MONTH**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**
1	August	73,032	--	9,930	--	1,083	--
	September	197,460	--	32,313	--	2,980	--
2	August	72,194	--	8,856	--	423	--
	September	316,441	--	20,471	--	534	--
3	August	100,774	--	11,203	--	373	--
	September	238,567	--	26,049	--	594	--
4	August	121,704	33,516	13,244	5,520	756	222
	September	358,107	171,619	34,011	20,230	872	569
5	August	99,316	42,276	21,136	5,601	464	175
	September	176,434	77,150	26,234	13,497	377	377
6	August	59,091	12,343	5,395	706	83	20
	September	77,399	18,712	7,624	3,260	131	40
7	August	12,351	4,195	2,250	337	41	9
	September	60,105	21,091	5,901	2,517	60	20
8	August	2,766	665	221	56	6	7
	September	14,201	7,129	1,106	452	27	24

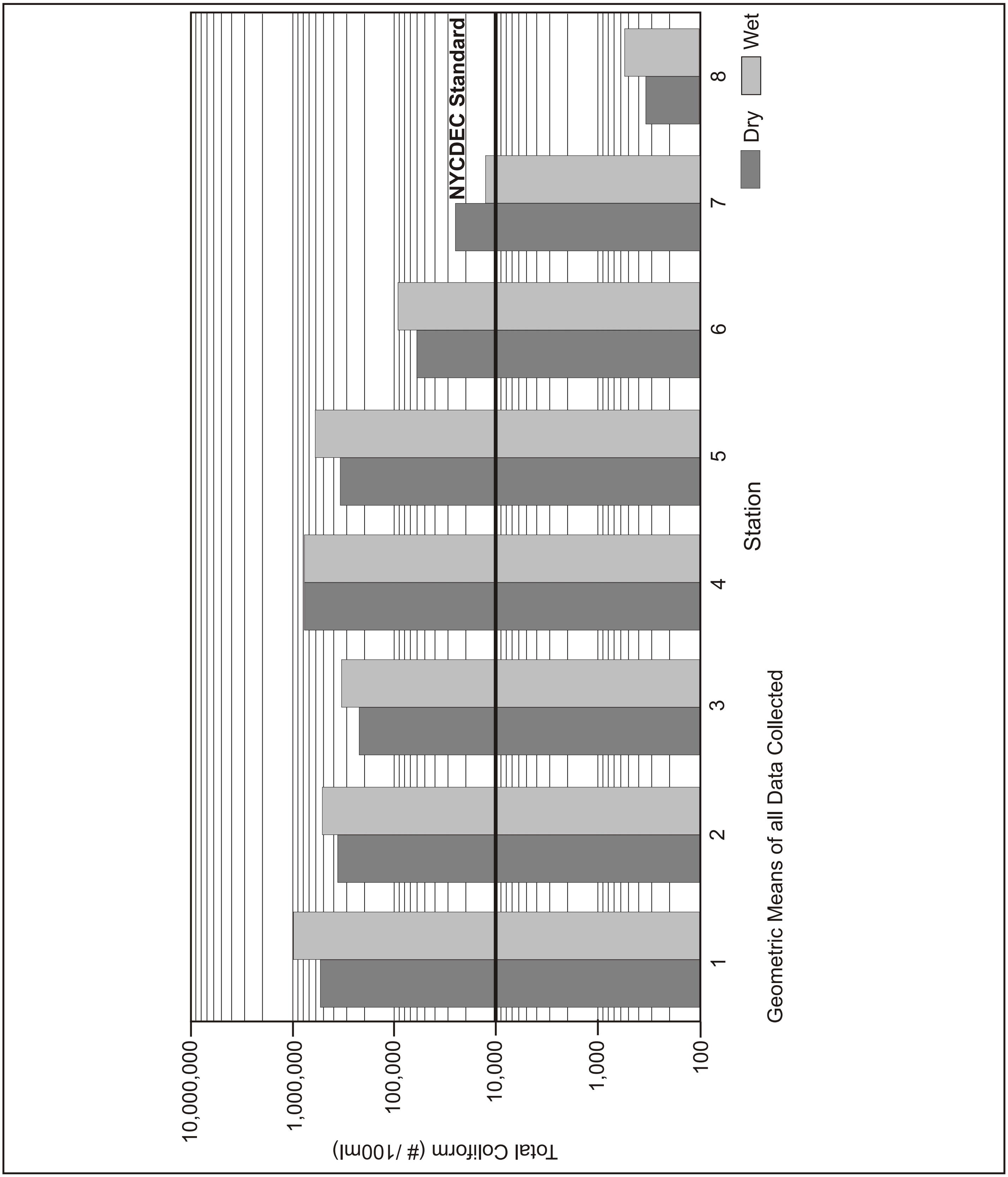
NOTE: All values are geometric means of dry and wet observations.
NYSDEC Standards – Total Coliform: monthly geometric mean of 10,000 cells/100ml
Fecal Coliform: monthly geometric mean of 2,000 cells/100ml
Enterococci: monthly geometric mean of 35 cells/100ml

the Creek becomes wider and deeper, the monthly geometric mean total coliform concentrations are considerably lower than at the upstream stations, however they are still greater than 10,000/100ml. Total coliform concentrations are further reduced at Station 7 and are well below 10,000/100ml at Station 8 reflecting the greater tidal exchange of cleaner waters from Gravesend Bay. A comparison of total coliform concentrations under dry and wet weather conditions reveals little precipitation related difference in total coliform concentrations (Figure 4-11). This indicated that dry weather overflows (improper sanitary connections to storm sewers) were contributing a significant amount of coliform bacteria to the Creek.

The 2004 data set shows total coliform concentrations are approximately an order of magnitude lower than in 1993 (Table 4-5) and coliform concentrations under wet weather conditions are clearly higher than under dry weather conditions (Figure 4-12). This reflects improvement in water quality resulting from dry weather overflow abatement activities carried out as part of the Coney Island Creek CSO Facility Plan. However, observed concentrations still exceed NYSDEC numeric criteria at Stations 1 through 7. This indicates that, in addition to the CSO loadings, dry weather overflows to the Creek may still be occurring and causing elevated coliform concentrations.

In 1993, monthly fecal coliform concentrations generally follow the same pattern as monthly total coliform concentrations (Table 4-4). Fecal coliform concentrations consistently exceed 2,000/100ml at Stations 1, 3, and 4. At Station 5 only one measurement exceeded 2,000/100ml while fecal coliform concentrations at Stations 6, 7, and 8 were consistently below 2,000/100ml. Fecal coliform concentrations in the 2004 data set are comparable to those in 1993. This may be due in part to the reduced sampling effort that was weighted towards wet weather sampling. However, fecal coliform concentrations during wet weather in 2004 are higher than during dry weather indicating an improvement in Creek water quality resulting from dry weather overflow abatement activities carried out as part of the Coney Island Creek CSO Facility Plan (Figure 4-13). Like the total coliform data the fecal coliform data from 2004 provides further indication that, in addition to the CSO loadings, illegal sanitary connections to storm sewers are still occurring and causing contravention of the state standards in the Creek.

As with dissolved oxygen, the impact of CSOs, stormwater discharges, and dry weather sanitary flow on coliform and enterococci bacteria concentrations in Coney Island Creek are limited to the Creek itself and do not appear to impact the waters of Gravesend Bay or Lower New York Bay.



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1993 Coney Island Creek CSO Total Coliform (Surface) Dry vs. Wet

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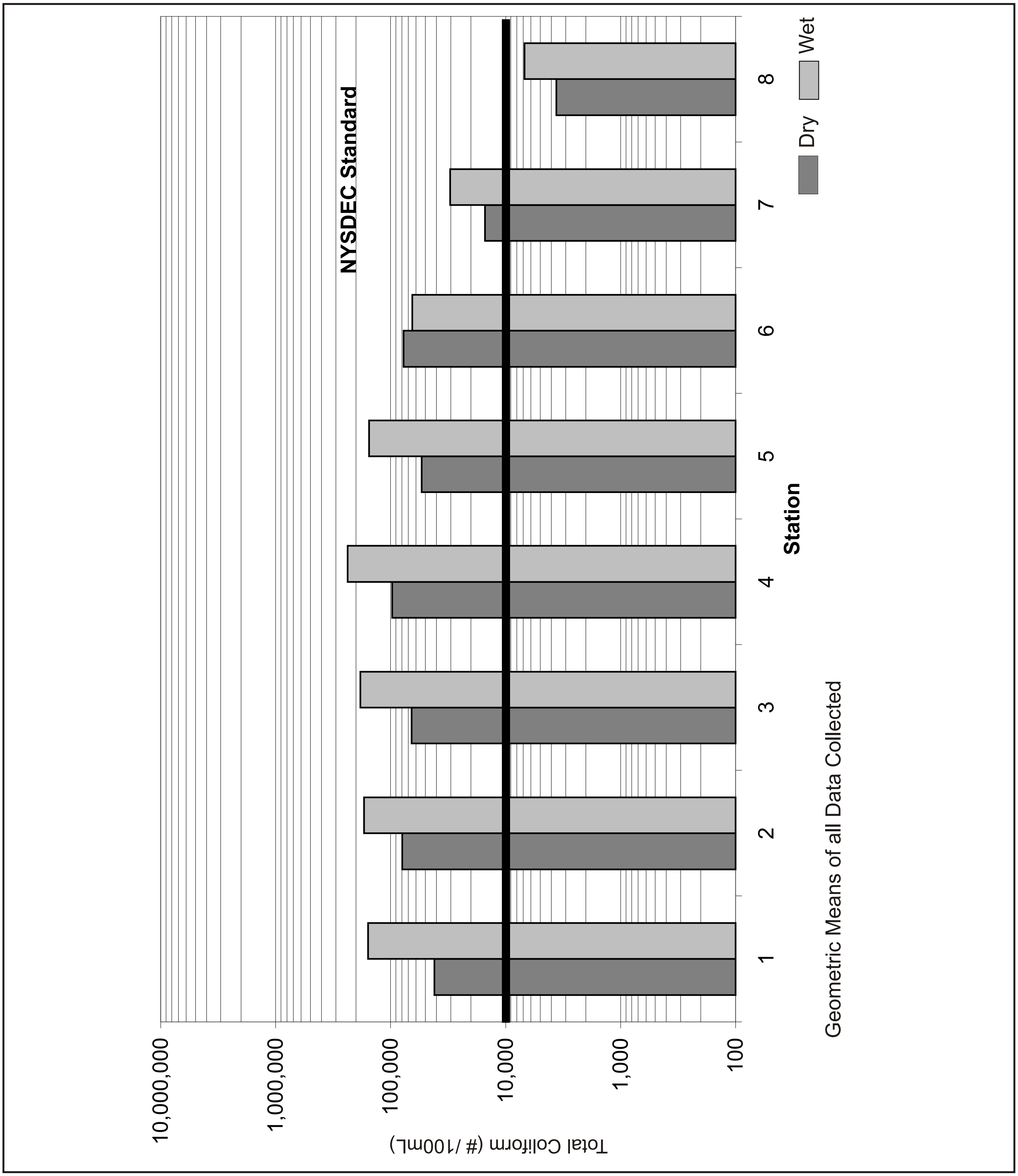

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2004 Coney Island Creek CSO Total Coliform Concentrations Dry vs. Wet (Surface)

FIGURE 4-12

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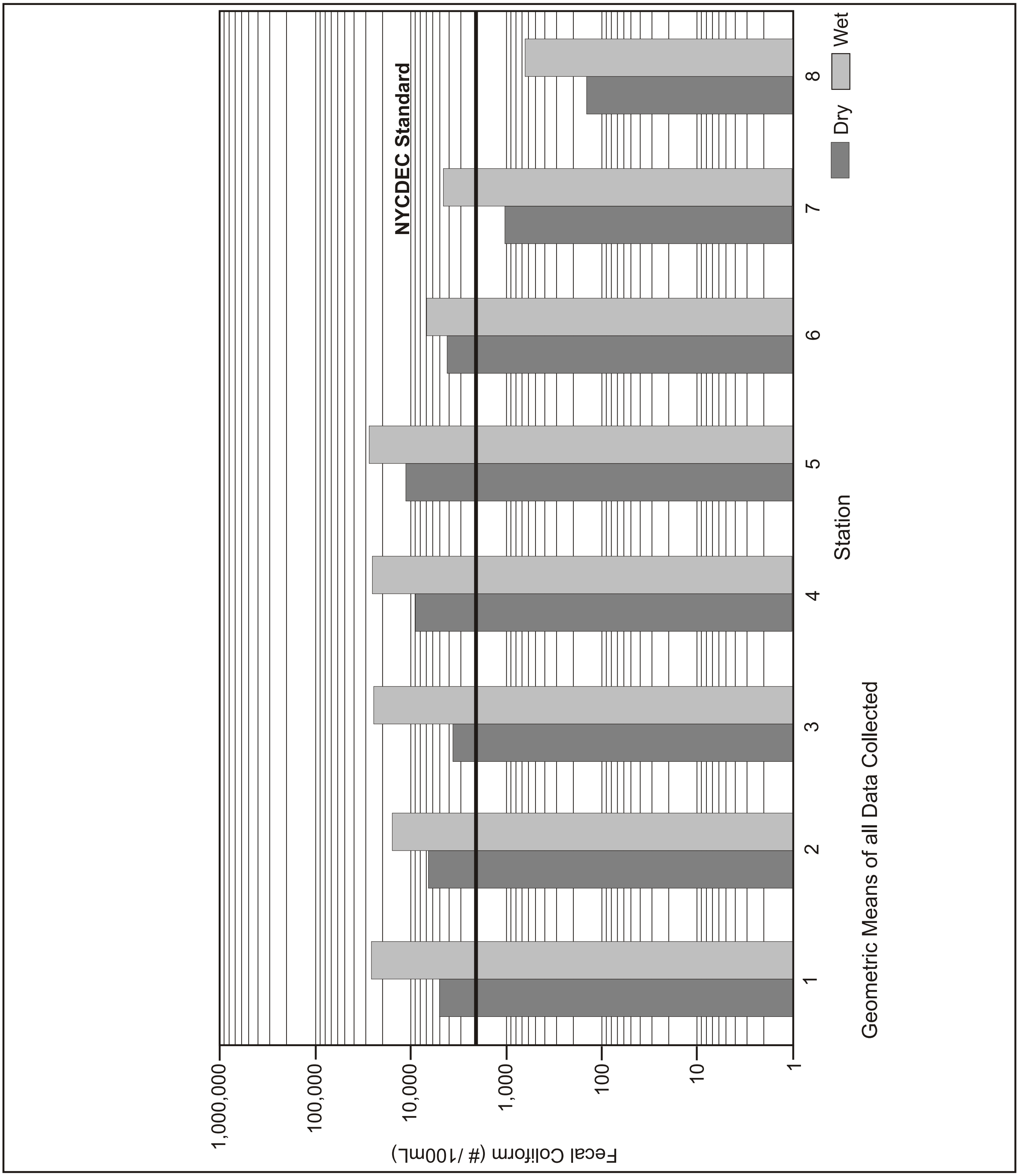

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Coney Island Creek Waterbody/Watershed Facility Plan

2004 Coney Island Creek CSO Fecal Coliform Concentrations Dry vs. Wet (Surface)

FIGURE 4-13

4.4.3 Water Column and Sediment Toxicity

The contamination of estuarine and coastal marine systems with heavy metals is directly attributable to the industrialization and urbanization of the coastal zone. Heavy metal contamination in coastal environments reflects localized impacts from municipal and industrial point source discharges (Kennish, 1992). Domestic effluents probably constitute the largest single source of elevated metals in aquatic sediments (Forstner and Wittmann, 1979). Elevated levels of copper, lead, and zinc result from corrosion within the urban water supply network. Also, household detergents have been shown to contain trace amounts of iron, chromium, zinc, molybdenum, cobalt, and arsenic. Industrial sources such as metal plating and the manufacture of dyes, paints, and textiles add large amounts of heavy metals to coastal ecosystems. Another source of heavy metal contamination results from urban stormwater runoff whereby metals accumulated from atmospheric deposition are washed into coastal systems during periods of storm runoff.

The 1993 Coney Island Creek CSO Facility Planning Project also included collection of sediment samples for analysis of USEPA designated priority pollutants. Sediment samples were collected at the eight water quality monitoring locations. 11 of the 13 priority pollutant metals were detected at one or more of the sampling locations. 11 priority pollutant organic compounds and two pesticides were also detected in the sediments of Coney Island Creek. No polychlorinated biphenyls (PCBs) were detected at quantifiable concentrations in the sediments of Coney Island Creek.

Of the eleven organic priority pollutants found at quantifiable concentrations, ten were semi-volatile compounds consisting of polynuclear aromatic hydrocarbons (PAHs). Unlike heavy metal contamination in Coney Island Creek, the distribution of organic pollutants was limited to Stations 1 through 6 with the highest concentrations occurring at Stations 1 through 3.

PAHs are ubiquitous compounds which are formed during any hydrocarbon combustion process. Sources of PAHs in estuaries include sewage and industrial effluents, petroleum spills, combustion of fossil fuels, and brush fires (Kennish, 1992). Urban runoff, atmospheric deposition, and groundwater flow can deliver substantial quantities of PAHs to aquatic environments as well. PAHs tend to concentrate in sediments due to their relative insolubility in water and strong adsorption to particulate matter.

Brooklyn Borough Gas Works operated a manufactured gas plant (MGP) at the head end of Coney Island Creek beginning in 1908. MGPs produced a gas used for heating and lighting from the heating of coal (coal gas) and/or from a combination of coal gas, oil, and water called the "carbureted water-gas" process. Release of by-products, such as coal tar, generated from MGP operations, has resulted in the contamination of soil, groundwater, and surface water through a combination of leaks from storage facilities and from direct discharge into Coney Island Creek (NYSDEC, 2001 and 2002a).

The nature and extent of contamination to Coney Island Creek's surface water and sediments from the Brooklyn Borough Gas Works site include volatile organic compounds (benzene, toluene, ethylbenziene, and xylene ranging), carcinogenic polycyclic aromatic hydrocarbons (chrysene, benzo(a)anthracene, and benzo(k)fluoranthene), and inorganic compounds (arsenic, nickel, lead, and zinc) in excess of applicable standards, criteria, and guidance values.

The NYSDEC has formulated a Record of Decision (ROD) for the cleanup of both landside and creek contamination (NYSDEC, 2001 and 2002a). The components of the NYSDEC recommended cleanup include:

- Excavate/cap landside contaminated areas;
- Install subsurface barrier walls to prevent continuing discharges to the creek;
- Remove top 3 feet of contaminated sediment from the head end of the creek to the MTA railroad bridge and cap with clean material;
- Restore 50 feet of Creek bank along the area to be dredged; and
- Institute a long-term monitoring plan.

4.4.4 Other Pollutants of Concern

In 2002 NYSDEC listed Coney Island Creek as a high priority waterbody for TMDL development with its inclusion on the Section 303(d) List. The cause of the listing was pathogens and oxygen demand due to CSO discharges, failing on-site systems (illegal sanitary connections), storm sewers, and urban runoff. The analyses discussed in Section 4 confirm these findings. Based on this NYSDEC 303(d) List and the analyses conducted herein, no additional pollutants beyond those previously identified are pollutants of concern with respect to CSO discharges to the Creek

4.5 BIOLOGY

Coney Island Creek supports aquatic communities which are similar to those found throughout the New York/New Jersey Harbor in areas of comparable water quality and sediment type. These aquatic communities contain typical estuarine species but they have been highly modified by physical changes to the original watershed, shoreline, and to water and sediment quality. These changes represent constraints to Coney Island Creek in reaching its full potential to support a diverse aquatic life community and to provide a fishery resource for anglers.

Adverse physical effects on aquatic habitats interact with water and sediment quality to limit the diversity and productivity of aquatic systems. Water and sediment quality can be limiting to aquatic life when they are below thresholds for survival, growth, and reproduction. However, when these thresholds are reached or exceeded, physical habitat factors may continue to limit diversity and productivity. Improvements to water and sediment quality can enhance aquatic life use in degraded areas such as Coney Island Creek, but major irreversible changes to the watershed and the waterbody place limits on the extent of these enhancements. In addition, because Coney Island Creek is part of a much larger modified estuarine/marine system, which is a major source of recruitment of aquatic life to the Creek, its ability to attain use standards is closely tied to overall ecological conditions in the NY/NJ Harbor.

This section describes existing aquatic communities in Coney Island Creek and provides comparison to aquatic communities found in the nearby Sheepshead Bay, Gravesend Bay and Lower Bay. This baseline information, in conjunction with projections of water and sediment quality from modeling, technical literature on the water quality and habitat tolerances of aquatic life, long term baseline aquatic life sampling data from the NY/NJ Harbor, and experience with the response of aquatic life to water quality and habitat restoration in the NY/NJ Harbor, provides the foundation for assessing the response of aquatic life to CSO treatment alternatives for Coney Island Creek.

4.5.1 Wetlands

Coney Island Creek originally consisted of both subtidal areas and tidal flats. The Creek separated Coney Island from the rest of Brooklyn until the center portion was filled for construction of the Belt Parkway before World War II. Current information on wetlands along Coney Island Creek is based on a review of United States Fish and Wildlife Service National Wetland Inventory (NWI) wetland maps (Figure 4-14). Cowardin (1979) developed the classification scheme used for these wetlands. Tidal wetlands along Coney Island Creek are classified as estuarine, intertidal, flat, and regularly flooded (E2FLN). A small E2FLN wetland (4.7 acres) is located at the head of Coney Island Creek, where the Creek dead-ends at Shore Parkway and Shell Road. This is the only wetland in Coney Island Creek proper. Two E2FLN wetlands are located on the north (16.4 acres) and south (2.4 acres) shores of Gravesend Bay near the mouth of Coney Island Creek. There are no freshwater wetlands in the vicinity of Coney Island Creek.

4.5.2 Benthic Invertebrates

The benthic community consists of a wide variety of small aquatic invertebrates, such as worms, mollusks and crustaceans, which live burrowed into or in contact with bottom sediments. Benthic organisms cycle nutrients from the sediment and water column to higher trophic levels through feeding activities. Suspension feeders filter particles out of the water column and deposit feeders consume particles on or in the sediment. The sediment is modified by the benthos through bioturbation and formation of fecal pellets (Wildish and Kristmanson, 1997). Grain size, chemistry, and physical properties of the sediment are the primary factors determining which organisms inhabit a given area of the substrate. Because benthic organisms are closely associated with the sediment and have limited mobility, the benthic community structure reflects local water and sediment quality.

Benthic inventories were conducted in Coney Island Creek as part of the Subtidal Benthos and Icthyoplankton Characterization Field Sampling and Analysis Plan (FSAP) (HydroQual, 2003b). In June 2003, benthic sampling was conducted at two locations in Coney Island Creek, near the mouth of the Creek and near the middle of the Creek. Subtidal benthic samples were collected using a Ponar® Grab. One sediment sample per station was taken for analysis of sediment grain size and TOC content.

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NWI Wetlands in the Vicinity of Coney Island Creek

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Coney Island Creek Waterbody/Watershed Facility Plan

FIGURE 4-14

The sampling site near the middle of the Creek was located near West 15th Street. Fifteen taxa were collected at this location. Annelid worms dominated the benthic community and were present in relatively high numbers (9,384/m^2) (Table 4-6). Oligochaetes and Capitellid polychaetes were the most abundant annelids. Polychaetes of the genus *Polydora* and annelid trochophore larvae were also present in relatively high numbers. Other polychaete species, amphipods, isopods, and copepods were also present, but in relatively low numbers.

The sampling site near the mouth of the Creek was located at West 20th Street. The benthic community near the mouth of Coney Island Creek was lower in diversity (6 taxa) and abundance than the benthic community living in the middle portion of the Creek (Table 4-6). Copepods were the dominant organisms at this location. The polychaete *Neanthes succinea,* Capitellid polychaetes, and oligochaetes were present in numbers that were roughly half of the number of copepods. Mysid shrimp were also present, but in very low numbers.

Benthic inventories were also conducted in Coney Island Creek as part of the CSO Facility Planning Project (Hazen and Sawyer, 1998a). Samples were collected from six stations in Coney Island Creek in May 1993. Two stations were sampled within each segment of Coney Island Creek: head, middle and mouth. A total of 13 species were collected in Coney Island Creek during this survey (Table 4-6). Nematodes and annelid worms were the numerically dominant groups near the head and middle of the Creek, comprising 100 percent and 90 percent of the community at each location, respectively. Small numbers of amphipods and copepods were also colleted from stations near the middle of the Creek. At stations near the mouth of the creek, nematodes and annelid worms comprised 80 percent of the individuals. Four species of mollusks were collected at this location. *Nucula proxima* was the dominant mollusk species, followed by *Crepidula plana*. The greatest number of taxa was collected at the station near the mouth of the Creek.

Although the sampling locations are described as “middle” and “mouth” in the analysis of data collected in both the FSAP and CSO Facility Planning Project, sampling was not conducted at exactly the same locations. Differences in species composition between the two studies may be due to localized differences in deposition of organic material. Percent TOC was measured in Coney Island Creek sediments as part of the FSAP. The sediments in the middle reach of Coney Island Creek had a percent TOC of 1.66 percent and the sediments near the mouth of the Creek had a percent TOC of 5.3 percent. Two additional locations were sampled for TOC content in Coney Island Creek, sediment at the head of the Creek had percent TOC of 5.8 percent and sediment at the mouth of the Creek had percent TOC of 4.8 percent. Thus, the sediment in the middle of the Creek had the lowest TOC content of all locations sampled. In the FSAP survey, the greatest number of taxa was collected near the middle of the Creek, which reflects the relationship between benthic community diversity and percent TOC presented in the Bronx River Waterbody/Watershed Facility Plan (NYCDEP, 2004). In general, as the percent TOC increases, the number of taxa decreases. The Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational Scientific and Cultural Organization (UNESCO) suggested that stress to the benthic community will be greatest in sediment with TOC greater than 3 percent (Hyland et al 2000). Three sampling locations in Coney Island Creek had sediment TOC greater than 3 percent. Near the mouth of the Creek, where TOC

Table 4-6. Abundance (#/m²) of benthic invertebrates collected from different reaches of Coney Island Creek (head, middle, mouth) as part of the Field Sampling and Analysis Program (2003) and CSO Facility Plan study (1993)

Phylum	Lowest Taxonomic Level	Coney Island Creek FSAP [1]		Coney Island Creek CSO Study [2]		
		Middle	Mouth	Head	Middle	Mouth
Nematoda	Nematoda			2405	22.5	444.5
Annelida	Annelida	1276	119			
	Oligochaeta	4428	106			
	Nais variabilis			447.5		
	Peloscolex benedeni			1165		
	Peloscolex gabriellae			292.5		
	Capitellidae	1768	133			
	Eteone sp.	146				
	Neanthes succinea	93	146			
	Neries succinea				4.5	70.5
	Ophelia sp.	79				
	Pectinaria gouldi					9.5
	Polydora sp.	638				
	Polydora ligni				77.5	
	Scoloplos sp.	13				
	Streblospio benedicti	26				
	Trochophore (larvae)	917				
Mollusca	*Acmaea testudinalis*					2
	Crepidula plana					35
	Mercenaria mercenaria					5.5
	Nucula proxima					81.5
Arthropoda	Copepoda	93	292			
	Alteutha depressa				9.5	
	Mysidacea		26			
	Aoridae sp.	106				
	Corophium insidiosum				2.5	
	Gammaridae	79				
	Unciola sp.	186				
	Isopoda	13				
Number of taxa		**15**	**6**	**4**	**5**	**7**
Number of individuals/m²		**9861**	**822**	**4310**	**116.5**	**648.5**

[1] Number of individuals collected at one sampling station. Data compiled from the Hydroqual database.

[2] Average number of individuals collected from each sampling station within the reach.

content was greater than 5 percent, the degree of impairment of the benthic community was greater than near the middle of the Creek, where TOC content was less than 3 percent.

Overall, the benthic community in Coney Island Creek was low in abundance and diversity. For both studies, all locations were dominated by either annelid worms or a combination of annelid worms and nematodes. The greatest number of taxa was collected during the 2003 FSAP sampling at the station near the middle of the Creek, but annelid worms dominated the community, comprising 10 of the 15 taxa and 95 percent of the individuals. Mollusks were only collected near the mouth of the Creek during the 1993 CSO Facility Planning Project study.

The benthic community structure in Coney Island Creek is similar to that described in studies of the effects of organic pollution on the benthos. In areas of high levels of organic enrichment benthic communities are composed of a few small, rapidly breeding, short-lived species with high genetic variability (Pearson and Rosenberg 1978). The abundance, diversity and composition of benthic species, in combination with their relative pollution tolerance, are indicators of habitat quality. Both studies show that the benthic community in Coney Island Creek has low species diversity and high proportion of pollution tolerant organisms. This indicates degraded benthic habitat quality in Coney Island Creek.

4.5.3 Epibenthic Communities

Epibenthos live on or move over the substrate surface. Epibenthic organisms include sessile suspension feeders (mussels and barnacles), free swimming crustaceans (amphipods, shrimp, and blue crabs) and tube-dwelling polychaete worms found around the base of attached organisms. Epibenthic organisms require hard substrate, they cannot attach to substrates composed of soft mud and fine sands (Dean and Bellis 1975). In general, the main factors that limit the distribution of epibenthic communities are: the amount of available hard substrate for settlement, species interactions, and water exchange rates. In Coney Island Creek, the shoreline consists of fill materials, riprap and wooden or concrete bulkheads (NYSDEC, 2002b). These structures provide the majority of underwater substrates that can support epibenthic communities. The epibenthic communities living on underwater structures impact the ecology of the nearshore zone. Suspension feeding organisms continuously filter large volumes of water, removing seston (particulate matter which is in suspension in the water) and releasing organic particles to the sediment. This flux of organic particles (from feeding and feces) enriches the benthic community living in the sediment below piers and bulkheads (Zappala, 2001).

The epibenthic community was studied in Coney Island Creek as Part of the Harbor-wide Epibenthic Recruitment and Survival FSAP (HydroQual, 2001b). Multi-plate arrays of 8-inch x8-inch synthetic plates were suspended in the water column from June 2001 to September 2001. Upon retrieval, the arrays were inspected and weighed and both sessile organisms and motile organisms clinging to or stuck in the arrays (*i.e.*, crabs and fish) were counted and identified.

In Coney Island Creek nine taxa were identified on the epibenthic arrays (Table 4-7). Tunicates (*Molgula manhattensis*) were the dominant organisms on the arrays. Mussels, barnacles, crabs, polychaetes, bryozoans and cnidarians were also present. The number of species and weights of individual species were greater on the top array than on the bottom array (Table 4-7).

Table 4-7. Weight (g) of epibenthic organisms collected from suspended multi- plate arrays (top and bottom) placed in Coney Island Creek from June – September 2001

Phylum	Lowest taxonomic level	Mid-Creek Top	Mid-Creek Bottom
Cnidaria	*Diadumene lineata*		0.1
	Campanularia	0.3	
Bryozoa	Bugula	3.4	0.9
Annelida	*Sabella microphthalma*	0.2	0.1
	Nereis succinea	0.1	
Mollusca	*Mytilus edulis*	6.5	
Arthropoda	*Balanus eburneus*	5.4	0.1
	Panopeus herbstii	4.9	
Chordata	*Molgula manhattensis*	88.9	0.9
	Number of taxa	**8**	**5**
	Total weight (g)	**109.7**	**2.1**

Data were compiled from the FSAP database

Typically, epibenthic communities in the NY/NJ Harbor exhibit a vertical distribution on pier piles and bulkheads (Zappala, 2001). This vertical distribution coincides with changes in water level, salinity and dissolved oxygen (DO) associated with the tides and water stratification. The epibenthic community in Coney Island Creek that developed on test plates did exhibit vertical distribution. Greater use of the upper water column relative to the lower water column may be related to unfavorable conditions in the bottom water of Coney Island Creek. The plates were deployed during the summer, which is the period when DO concentrations in the Creek are expected to be lowest. Low DO concentrations may limit epibenthic organism growth in the lower water column in the middle of Coney Island Creek. However, the development of epibenthic communities in the Creek may also be limited by the amount of available hard substrate for settlement, recruitment and species interactions (predation and competition).

4.5.4 Phytoplankton and Zooplankton

Phytoplankton and zooplankton were sampled in Coney Island Creek as part of the CSO facility planning project (Hazen and Sawyer, 1998b). Sampling was conducted in May 1993. Sampling for phytoplankton and zooplankton was not conducted as part of the use and standards attainment program FSAPs.

Phytoplankton

Phytoplankton are the dominant primary producers in Coney Island Creek (Hazen and Sawyer, 1998b). Factors that affect phytoplankton community structure include: temperature, light, nutrients, and grazing by other organisms. Phytoplankton are affected by all hydrodynamic forces in a waterbody. Resident times of phytoplankton species within the NY/NJ harbor are short and these organisms move quickly through the system, limiting the time they are available to grazers (NYSDOT and MTA 2004).

Six stations were sampled for phytoplankton in Coney Island Creek. Two stations were sampled within each reach of Coney Island Creek: head, middle and mouth. A total of 40 phytoplankton taxa were identified (Table 4-8). Diatoms were the dominant class of phytoplankton, followed by dinoflagellates and chryptophytes. The species collected in the greatest concentrations (cells/l) were skeletonema costatum (diatom), asterionella japonica (diatom), chroomonas sp. (cryptophte), cryptomonas sp. (cryptophyte), amphidinium sp. (dinoflagellate), and rhizosolenia fragilissima (diatom).

Average phytoplankton concentrations were similar for stations near the head and middle of the creek (approximately 26,000 x 103 cells/l), but concentrations were much lower near the mouth of the creek (approximately 6,000 x 103 cells/l). In addition, greater numbers of phytoplankton taxa were collected at the stations near the head and middle of the creek compared to stations near the mouth of the creek. Oscilliatoria sp., a pollution indicator species of cyanobacteria, was collected in all three reaches of the creek, but concentrations were greatest near the head of the creek.

Three toxic species of dinoflagellates were collected in Coney Island Creek. Prorocentrum micans and dinophysis norvegica are associated with diarrhetic shellfish poisoning. These two species were collected in relatively low concentrations (0.1 to 1.1 x 103 cells/l), near the head, middle and mouth of the creek. Prorocentrum minimum is associated with toxic shellfish poisoning and shellfish kills. This species was collected in greater concentrations (5.9 x 103 cells/l) but only at the stations near the middle of the creek.

Zooplankton

Zooplankton are one of the primary herbivores in estuaries. Like phytoplankton, they are affected by all hydrodynamic forces in a waterbody. The typical zooplankton community of lower New York harbor is composed of a mixture of estuarine and coastal species, dominated by copepods (Hazen and Sawyer, 1998b). Four stations were sampled in Coney Island Creek: one near the head of the creek, one near the middle of the creek, and two near the mouth of the creek.

A total of 20 zooplankton taxa were collected in Coney Island Creek (Table 4-9). Polychaete larvae, barnacle nauplii, cladocerans and the copepod tortanus discaudatus were collected in the greatest numbers in the creek. Greater numbers of taxa were collected at stations near the middle and mouth of the creek (17 taxa) compared to the station near the head of the creek (14 taxa). Polychaete larvae were the numerically dominant zooplankton near the head of the creek and barnacle nauplii were numerically dominant near the middle and mouth of the creek. In addition, greater numbers of copepod species and numbers of individuals were collected at stations near the middle and mouth of the creek compared to the station near the head of the creek.

Table 4-8. Average concentration of phytoplankton (cells/L x 10^3) collected from stations within three reaches (head, middle, mouth) of Coney Island Creek in May 1993

Phylum	Species	Head	Middle	Mouth
Bacillariophyta (Diatoms)	*Skeletonema costatum*	16781.5	19866.5	5319
	Asterionella japonica	2149.9	4505.9	44.65
	Rhizosolenia fragilissima	106.0	247.4	
	Chaetoceros sp	153.2	70.7	100.1
	Thalassiosira rotula	23.6	94.3	23.6
	Melosira sp	82.5	0.6	
	Ceratulina pelagica	23.6	53.0	0.6
	Cyclotella sp	35.4		
	Chaetoceros curvestus			23.55
	Thalassionema nitzchoides	11.8		
	Leptocylindrus minimus	11.8		
	Pleorosigma angulatum	2.7	0.2	0.1
	Melosra sp	1.6		0.6
	Gyrosigma sp	0.3		0.1
	Guinardia flaccida	0.1		
	Nitzschia seriata	0.2		
	Rhizosolenia alata	0.1		
	Eucampia zoodiacus	0.3		
	Ditylum brightsellii		0.4	0.2
	Stephanopyxis turris	0.2	0.6	
	Paralia sulcata		0.5	
	Melosira islandica	0.5		
Cyanobacteria (Blue-green Algae)	*Oscillatoria sp*	64.7	6.2	7.5
Dinoflagellata (Dinoflagellates)	*Amphidinium sp*	341.6	82.45	
	Gymnodinium sp	105.9	29.45	41.2
	Amphidinium sphenoides	58.9		
	Katodinium rotundatum	5.9	47.1	
	Heterocapsa triquetra		17.85	8.7
	Protoperidinium sp	1.8	23.55	
	Prorocentrum minimum		5.9	
	Dinophysis norvegica		0.7	1.1
	Ceratium lineatum	0.2	0.6	
	Prorocentrum micans	0.2		0.1
	Prorocentrum compressum			0.2
	Scripsiella trochoidea		0.2	
	Gyrodinium sp		0.1	0.3
Cryptophyceae (Cryptophytes)	*Chroomonas sp*	4688.5	1507.5	382.85
	Cryptomonas sp	906.9	282.7	182.6
	Calycomonas ovalis	30.5	45.75	90.1
	Calycomonas wulffii		15.25	13.85
Number of species		30	26	21
Total number of Cells/ml x 10^3 (average of two stations)		25590.2	26905.3	6241.0

Table 4-9. Average abundance of zooplankton (#/m^3) collected from stations within three reaches of Coney Island Creek (head, middle, mouth) in May 1993

Phylum	Lowest Taxonomic Level	Head	Middle	Mouth
Annelida	Polychaete larvae	941.5	11.3	9.75
Mollusca	Bivalve veliger	0.9	27.4	11.6
Arthropoda	*Acartia hudsonica*		6.4	1.2
	Acartia sp	26.1	43.5	28
	Acartia tonsa	10.1	9.7	9.9
	Centrapages sp		0.9	0.6
	Copepod nauplii	1.4	19.3	10.35
	Eucyclops sp		1.6	
	Eurytemora hirundoides			0.6
	Eurytemora sp	4.3		
	Harpaticoid sp	7.2	22.5	17.65
	Oithona colcarva			0.6
	Oithona similis		4.8	6.85
	Temora sp	1.4	3.2	16.45
	Tortanus discaudatus	21.7	48.3	31.85
	Barnacle nauplii	197	483.1	912.5
	Evadne sp	139	62.8	113.15
	Podon polyphemoides	211.5	8	4.25
	Ostracod	2.9	3.2	1.85
	Mite larvae	2.9	1.6	
Total number of taxa		14	17	17
Total number of individuals/m^3 (average per station)		1567.9	757.6	1177.15

4.5.5 Ichthyoplankton

Because the issue of fish propagation is integral to defining use classifications and attainment of associated water quality standards and criteria, ichthyoplankton sampling was conducted to identify any fish species spawning in Coney Island Creek or using its waters during the planktonic larval stage. Ichthyoplankton sampling was conducted in Coney Island Creek in March, May, July, and August 2001 as part of the Harbor-wide Icthyoplankton FSAP (HydroQual, 2001a). March and May were chosen based on spawning of a variety of important species, and July and August were chosen to observe activity during anticipated worst case DO conditions.

A total of 14 taxa were collected in Coney Island Creek (Table 4-10). Eggs were the dominant life stage collected, and cunner, bay anchovy and wrasse dominated the community. Although lower in abundance, the diversity of larvae collected in Coney Island Creek was greater than the diversity of eggs. Winter flounder dominated the larval community.

The ichthyoplankton community found in Coney Island Creek varied seasonally. Winter flounder and sculpin larvae were the only species present in March and the greatest number of species of eggs and larvae (8) were present in May (Table 4-11). Six species comprised the icthyoplankton community in both July and August. Winter flounder, windowpane, sculpin, herring and Atlantic menhaden were only present in the spring and pipefish, searobin, gobies and the Northern puffer were only present in the summer months. The eggs of bay anchovy, wrasse, cunner and tautog were present in both the spring and summer.

Ichthyoplankton are planktonic (organisms drift in the water column) and some questions remain as to whether fish are spawning in Coney Island Creek or if fish are spawning in Lower Bay with their eggs and larvae transported into the Creek by the tides. Because the duration of the egg stage is short (about two days after fertilization) compared to the larval stage (2-3 months depending on species) there is a higher degree of confidence that an egg found in the upper Coney Island Creek may have been spawned there.

4.5.6 Adult and Juvenile Finfish

Lower New York Bay supports a wide variety of fish species with seasonal occurrence and distribution governed by their life history patterns. These species face diverse conditions such as wide fluctuations in salinity, dissolved oxygen, and temperature. Year round residents (i.e. fish that spawn and remain within the harbor for their entire life cycle) include silversides, killifish, white perch, and bay anchovies (Studholme, 1987). Many of these species are important prey items for seasonally abundant carnivores and serve as an attraction for coastal species looking for food.

Table 4-10. Number of fish eggs and larvae collected in Coney Island Creek in March, May, July and August 2001

Species	Common name	Eggs	Larvae
Anchoa mitchelli	Bay anchovy	1180	2
Brevoortia tyrannus	Atlantic menhaden		10
Clupeidae	Herrings	324	14
Gobiidae	True goby		2
Gobiosoma bosc	Naked goby		16
Labridae	Wrasse	606	
Myoxocephalus	Sculpin		14
Prionotus	Searobin	8	
Pseudopleuronectes americanus	Winter flounder		130
Scophthalmus aquosus	Windowpane	376	18
Syngnathus fuscus	Northern pipefish		2
Sphoeroides maculates	Northern puffer		3
Tautoga onitis	Tautog	230	
Tautogolabrus adspersus	Cunner	2324	
	Total number of taxa	**7**	**10**
	Total number of individuals	**5,048**	**211**

*Data compiled from the FSAP database

Table 4-11. Seasonal distribution of fish eggs (E) and larvae (L) collected in Coney Island Creek in 2001

Lowest taxonomic level	Common name	March	May	July	August
Tautogolabrus adspersus	Cunner		E	E	E
Tautoga onitis	Tautog		E	E	E
Syngnathus fuscus	Northern pipefish				L
Scophthalmus aquosus	Windowpane		E, L		
Pseudopluronectes americanus	Winter flounder	L	L		
Prionotus	Searobin			E	
Myoxocephalus	Sculpin	L			
Labridae	Wrasse		E		E
Gobiidae	True goby				L
Gobiosoma bosc	Naked goby			L	
Sphoeroides maculatus	Northern puffer			L	
Clupeidae	Herring		E, L		
Brevoortia tyrannus	Atlantic menhaden		L		
Anchoa mitchelli	Bay anchovy		E	E, L	E

*Compiled from the FSAP database

Other species such as bluefish, scup, weakfish, summer and winter flounder, depend on both estuarine and marine habitats during different portions of their life histories. Adults utilize the Lower Bay as spawning grounds while juveniles feed on the abundant prey available before moving offshore to take up adult residency. Several species such as the red and silver hake, tautog, and adult bluefish move in and out of the Lower Bay opportunistically in search of food or more optimal habitat.

The fish community of Coney Island Creek was not sampled as part of the FSAPs. The fish community of Coney Island Creek was sampled as part of the CSO Facility Planning Project study. Sampling was conducted in May 1994. A baited trap net was used to sample one station near the head of the Creek. Trawls were conducted at one station near the middle of the Creek and at two stations near the mouth of the Creek. A total of 11 fish (three species) were collected in Coney Island Creek (Table 4-12). No fish were collected near the head of the Creek and only one Atlantic silverside was collected in the middle of the Creek. Eight northern kingfish and one striped bass were collected near the mouth of the Creek. Overall, the fish community in Coney Island Creek is extremely low in both species diversity and abundance.

4.5.7 Inter-Waterbody Comparisons

The aquatic communities of Coney Island Creek were compared with those found in Sheepshead Bay, Gravesend Bay and the near-shore area of Lower Bay in order to further evaluate the potential of Coney Island Creek to support fish propagation and survival.

The aquatic communities found in Coney Island Creek are similar to those in Sheepshead Bay and Gravesend Bay in terms of the species composition of the invertebrate and fish communities. Prior to infilling, Coney Island Creek connected Gravesend Bay and Sheepshead Bay. Both Coney Island Creek and Sheepshead Bay are dead-end water bodies with very limited freshwater inflow. Gravesend Bay is an open water area, part of the larger Lower Bay system, and the dominant source of water to Coney Island Creek. All of these water bodies have heavily urbanized shorelines. Differences in the relative abundance and diversity of aquatic communities between the three water bodies are most likely due to differences in water quality, available substrate, and food resources.

Table 4-12. Number of fish collected from the three reaches of Coney Island Creek in May 1994

Species	Common name	Head [1]	Middle [2]	Mouth [3]
Menidia menidia	Atlantic silverside		1	
Menticirrhus saxatilis	Northern kingfish			8
Morone saxatilis	Striped bass			2
	Total number of taxa	**0**	**1**	**2**
	Total number of individuals	**0**	**1**	**10**

[1]Number of fish collected from on station using a baited trap net
[2]Number of fish collected from one station using a trawl (two 3-minute trawls).
[3]Number of fish collected from two stations using a trawl (two 3-minute trawls per station).

As part of the FSAP and CSO Facility Plan studies, the benthic community was sampled in Coney Island Creek, Sheepshead Bay and Gravesend Bay to determine the community composition, number of species (richness), and the relationship between the number of species and their relative abundance (diversity). Like the stations sampled in Coney Island Creek, the benthic communities at the sampling stations in Sheepshead Bay and Gravesend Bay were numerically dominated (80-90 percent) by nematodes and annelids (Table 4-13). However, both Gravesend Bay and Sheepshead Bay had greater numbers of mollusk and arthropod taxa than Coney Island Creek. Of all of the stations sampled, the greatest numbers of taxa were collected in Gravesend Bay (23 taxa), followed by Sheepshead Bay (17 taxa). Greater species diversity suggests that the conditions in Sheepshead Bay and Gravesend Bay may be more favorable to benthic organisms than conditions in Coney Island Creek. This is likely due to greater water exchange in the Bays relative to the Creek.

The recruitment and survival of epibenthic communities on hard substrates was evaluated because these assemblages reflect the average water quality conditions of an area over an extended period of time (Day et al 1989). The epibenthic communities were compared among multi-plate arrays placed near the mouth of Coney Island Creek and in the near-shore area of Gravesend Bay. The epibenthic community in Gravesend Bay was more diverse than the epibenthic community in Coney Island Creek, but greater weights of individual species were collected in Coney Island Creek (Table 4-14). In Gravesend Bay, the epibenthic community was dominated by barnacles on the top plates and slipper limpets on the bottom plates, but all species that settled on the plates had low weights. In Coney Island Creek, the epibenthic community was dominated by tunicates on the top plates, but they did not exclude crabs, barnacles, mussels and bryozoans from settling. In both Gravesend Bay and Coney Island Creek, the species diversity and weights of individual organisms were greater on the top plates relative to the bottom plates, which may be due to more favorable conditions in the upper water column relative to the lower water column. The differences in the epibenthic community structure between the two areas may be due to differences in recruitment. Recruitment is affected by the presence of a spawning population, which is determined by availability of substrates, DO concentrations, temperature, and salinity (Dean and Bellis 1975). As Gravesend Bay is the main source of water in Coney Island Creek, differences in recruitment between the two areas due to transport of planktonic life stages from other areas is not likely.

Table 4-13. Abundance (#/m^2) of benthic invertebrates collected form different reaches of Coney Island Creek (head, middle, mouth) compared to those collected in Sheepshead Bay and Gravesend Bay.

Phylum	Lowest Taxonomic Level	Coney Island Creek FSAP [1]		Coney Island Creek CSO Study [2]			Sheeps-head Bay [1]	Graves-end Bay [2]
		Middle	Mouth	Head	Middle	Mouth		
Nematoda	Nematoda			2405	22.5	444.5		487
Annelida	Annelida	1276	119				512	
	Oligochaeta	4428	106				960	
	Nais variabilis			447.5				
	Peloscolex benedeni			1165				
	Peloscolex gabriellae			292.5				117
	Capitellidae	1748	133					
	Eteone sp.	146					8	9.5
	Glycera sp.						16	2
	Harmothoe imbricata							2
	Heteromastus filiformis							598
	Neanthes succinea	93	146				40	
	Nephtys incisa							81.5
	Neries succinea				4.5	70.5		
	Ophelia sp.	79					64	
	Pectinaria gouldi					9.5		17
	Polydora sp.	638						
	Polydora ligni				77.5			
	Scololepides viridis							46.5
	Scoloplos sp.	13					240	
	Syllis sp.							46.5
	Streblospio benedicti	26					952	231.5
	Tharyx acutus							5.5
	Trochophore (larvae)	917						
Mollusca	*Acmaea testudinalis*					2		2
	Acteocina canaliculata						8	
	Crepidula plana					35		102
	Nassarius obsoletus							2
	Mercenaria mercenaria					5.5	8	15
	Mya arenaria							2
	Mytilus edulis						8	
	Mulinia lateralis						48	
	Nucula proxima					81.5		242.5
	Tellina sp.						8	
Arthropoda	Copepoda	93	292					
	Alteutha depressa				9.5			18.5
	Cumacea						8	
	Balanus improvisus							2
	Mysidacea		26				32	
	Amphipoda						24	
	Ampeliscidae						112	
	Ampelisca verrilli							5.5
	Aoridae sp.	106						
	Corophium insidiosum				2.5			
	Gammaridae	79						3.5
	Unciola sp.	186						
	Isopoda	13						3.5
Number of taxa		**15**	**6**	**4**	**5**	**7**	**17**	**23**
Number of individuals/m^2		**9841**	**822**	**4310**	**116.5**	**648.5**	**3048**	**2042.5**

[1] Abundance of benthic invertebrates collected at one sampling station within the reach. Data compiled from the Hydroqual database.

[2] Average abundance of benthic invertebrates collected from two sampling stations within the reach.

Table 4-14. Weight (g) of epibenthic organisms collected from suspended multi- plate arrays (top and bottom) placed in Coney Island Creek and Gravesend Bay from June – September 2001

Phylum	Lowest taxonomic level	Coney Is. Creek (middle)		Gravesend Bay (near-shore)	
		Top	Bottom	Top	Bottom
Cnidaria	*Diadumene lineata*		0.1		
	Campanularia sp.	0.3			
Bryozoa	*Bugula* sp.	3.4	0.9	0.1	0.2
	Membranipora tenuis			0.1	0.4
Annelida	*Sabella microphthalma*	0.2	0.1		
	Nereis succinea	0.1		0.1	
	Eumida sanguinea			0.1	
Mollusca	*Mytilus edulis*	6.5			
	Crepidula fornicata				2.5
	Crepidula plana			0.1	0.4
	Onchidorididae			0.1	
Arthropoda	*Balanus eburneus*	5.4	0.1	5.1	2.0
	Panopeus herbstii	4.9		0.1	
	Xanthidae				
Chordata	*Molgula manhattensis*	88.9	0.9	0.2	
	Botryllus schlosseri			1.0	0.9
Total number of taxa		**8**	**5**	**10**	**6**
Total weight (g)		**109.7**	**2.1**	**7.0**	**6.4**

* Data were compiled from the FSAP database

The ichthyoplankton community in the middle of Coney Island Creek was similar in diversity and abundance relative to the ichthyoplankton community in the nearshore area of Lower Bay. Both areas had greater icthyoplankton diversity and abundance than Sheepshead Bay (Table 4-15). Greater numbers of cunner, wrasse, herrings and bay anchovy icthyoplankton were found in Coney Island Creek relative to Lower Bay and greater numbers of winter flounder, windowpane, tautog and true goby icthyoplankton were found in Lower Bay relative to Coney Island Creek. Only icthyoplankton in the family Sciaenidae were found in greater numbers in Sheepshead Bay relative the other two waterbodies. The abundance and diversity of an ichthyoplankton community is dependent on several factors (NYCDEP, 2004):

- spawning season;
- proximity to spawning areas;
- type of eggs and larvae (demersal or pelagic); and
- adult life stage habitat requirements.

Table 4-15. Number of fish eggs and larvae collected from Coney Island Creek, Sheepshead Bay and Lower Bay

Species	Common name	Coney Is. Creek (middle)	Sheepshead Bay (mouth)	Lower Bay (near-shore)
Ammodytes americanus	American sand lance			2
Anchoa sp.	Anchovies		67	2
Anchoa mitchelli	Bay anchovy	1182	325	150
Brevoortia tyrannus	Atlantic menhaden	10	2	16
Clupeidae	Herrings	338		254
Enchelyopus cimbrius	Fourbeard rockling			6
Gobiidae	True goby	2		122
Gobiosoma bosc	Naked goby	16		
Hypsoblennius hentzi	Feather blenny			4
Labridae	Wrasse	606	69	
Myoxocephalus	Sculpin	14		6
Prionotus	Searobin	8	3	13
Pseudopleuronectes americanus	Winter flounder	130		452
Sciaenidae	Roncadores		51	
Scophthalmus aquosus	Window-pane	394		614
Sphoeroides maculates	Northern puffer	3		
Syngnathus fuscus	Northern pipefish	2	1	2
Tautoga onitis	Tautog	230		386
Tautogolabrus adspersus	Cunner	2324		1536
	Total number of taxa	**14**	**7**	**15**
	Total number of individuals	**5,259**	**518**	**3,565**

*Data compiled from the FSAP database.

The spawning season of a fish species will determine if water quality is a limiting factor in the potential survivability of the eggs and larvae. For example, winter flounder spawn in the winter and larvae are present in the spring, when hypoxia is infrequent. Winter flounder larvae were found in Coney Island Creek in both March and May. However, greater numbers were found in Lower Bay. This may be related to substrate preference, as winter flounder prefer sandy substrates and most of Coney Island Creek is dominated by fine-grained substrates.

Bay anchovy spawn in the summer, when DO levels are at their lowest, but their eggs and larvae are found in surface waters, where DO levels are generally higher than in the bottom water. Bay anchovy eggs and larvae were present in the summer months in all three water bodies. The greatest numbers were found in Coney Island Creek. Bay anchovy eggs and larvae could be exposed to low DO conditions in the Creek, but the duration of exposure depends upon the location of adult spawning and larval dispersal by tidal currents.

The development of the ichthyoplankton community is affected by the type of habitat present for juvenile and adult fish, the differences in habitat diversity, relative habitat quality and the type of bottom substrate. Based on the results of the FSAP, the eggs and larvae of cunner, a structure oriented species, dominated the ichthyoplankton community of both Coney Island Creek and Lower Bay. The majority of structure in both water bodies is probably provided by pilings, riprap and bulkheads, rather than natural structure such as rock piles and complex shorelines.

Fish are motile organisms that can choose which habitats they enter and utilize. As such, their presence or absence can be used to evaluate water quality. As part of the CSO Facility Plan study, the fish community of Gravesend Bay was sampled in addition to Coney Island Creek. Nine species of fish (85 individuals) were collected in Gravesend Bay, compared to collection of three species (11 individuals) in Coney Island Creek (Table 4-16). Thus, it appears as if the habitat quality for fish is much lower in Coney Island Creek than in adjacent Gravesend Bay.

4.6 SENSITIVE AREAS

4.6.1 CSO Policy Requirements

Federal CSO Policy requires that the long-term CSO control plan give the highest priority to controlling overflows to sensitive areas. For such areas, the CSO Policy indicates the LTCP should: (a) prohibit new or significantly increased overflows; (b) eliminate or relocate overflows that discharge to sensitive areas if physically possible, economically achievable, and as protective as additional treatment or provide a level of treatment for remaining overflows adequate to meet standards; and (c) provide reassessments in each permit term based on changes in technology, economics, or other circumstances for those locations not eliminated or relocated (USEPA, 1994a). The policy defines sensitive areas as:

- Waters designated as Outstanding National Resource Waters (ONRW);
- National Marine Sanctuaries;
- Public drinking water intakes;
- Waters designated as protected areas for public water supply intakes;
- Shellfish beds;
- Waters with threatened or endangered species and their habitat;
- Water with primary contact recreation; and
- Additional areas determined by the Permitting Authority (i.e., NYSDEC).

4.6.2 Assessment Summary

Table 4-17 summarizes the sensitive areas assessment in Coney Island Creek. Note that there are no ONRW waters, National Marine Sanctuaries, or public water supplies in or near the waters of New York Harbor. Based on the responses to Freedom of Information Act (FOIA) letter requests sent to the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), and the New York Natural Heritage Program under NYSDEC, there are no

Table 4-16. Number of fish collected from the three reaches of Coney Island Creek and Gravesend Bay in May 1994

Species	Common name	Head [1]	Middle [2]	Mouth [3]	Graves-end Bay [3]
Etropus microstomus	Smallmouth flounder				1
Menidia menidia	Atlantic silverside		1		19
Menticirrhus saxatilis	Northern kingfish			8	44
Morone saxatilis	Striped bass			2	
Paralichthys dentatus	Summer flounder				11
Pseudopleuronectes americanus	Winter flounder				1
Stenotomus chrysops	Scup				3
Syngnathus fuscus	Northern pipefish				1
Tautoga onitis	Tautog				1
Urophycis regia	Spotted hake				4
	Total number of taxa	**0**	**1**	**2**	**9**
	Total number of individuals	**0**	**1**	**10**	**85**

[1]Number of fish collected from on station using baited trap nets
[2]Number of fish collected from one station using a trawl (two 3-minute trawls).
[3]Number of fish collected from two stations using a trawl (two 3-minute trawls per station).

Table 4-17. Sensitive Areas in Coney Island Creek

Designation	Present
Outstanding National Resource Waters	No
National Marine Sanctuaries	No
Public Water Supply Intake and Protected Areas	No
Shellfish Bed	No
Threatened or Endangered Species	No
Primary Contact Recreation	No
Areas determined by NYSDEC	No

sensitive areas within this waterbody resulting from the presence of threatened or endangered species or their habitat. There are no primary contact recreation waters such as bathing beaches within the waterbody study area. There are no designated shellfish harvest areas or other waters designated Class SA within the waterbody study area. No additional sensitive areas were idenitified by the Natural Resources Division of NYSDEC. There are no sensitive areas in Coney Island Creek.

5.0 Waterbody Improvement Projects

Although the primary sources of pollution that NYCDEP facility plans have addressed are CSOs and 14 WPCP point sources, a watershed approach necessitates identifying all pollutant sources influencing water quality. The City of New York has over 450 CSO discharges and operates fourteen WPCPs discharging to various waterbodies in the New York Harbor. Several New Jersey municipalities also have combined sewer systems with discharges to the harbor and its tributaries, and twenty other wastewater treatment plants and 250 additional CSOs discharge to waters within or immediately adjacent to the harbor from other New York and New Jersey systems. In addition to these municipal sewer systems, other point sources such as stormwater, commercial, and industrial discharges contribute to water quality, and non-point pollutant sources such as urban and rural runoff, atmospheric deposition, and others can play a significant role. Finally, consideration must be given to water quality of influent tributaries to the New York Harbor complex, such as the Hudson and Bronx Rivers.

NYCDEP is conducting many water quality improvement projects that will benefit New York Harbor. In the early 1980s NYCDEP initiated planning projects for CSO abatement, incorporating specific assessments of CSO-impacted waterbodies, including the City-wide CSO study beginning in 1985. Additional investigations focusing on collection system improvement and optimization were undertaken through the City-wide Regulator Improvement Program (1985) and numerous Infiltration/Inflow Analyses, and numerous WPCP expansions and improvements. NYCDEP continues to address CSO-related water quality issues through its City-Wide CSO Floatables program, pump station improvements, and the ongoing analysis of CSO abatement alternatives. The following sections describe these programs in detail.

5.1 CSO PROGRAMS 1950 TO 1992

Early CSO assessment programs began in the 1950s and culminated with the Spring Creek Auxiliary WPCP, a 12 MG CSO retention tank constructed on a tributary to Jamaica Bay. Completed in 1972, this project was one of the first such facilities constructed in the United States. Shortly thereafter, New York City was designated by the USEPA to conduct an Area-Wide Wastewater Management Plan authorized by Section 208 of the then recently enacted CWA. This plan, completed in 1979, identified a number of urban tributary waterways throughout the city in need of CSO abatement throughout the City. During the period from the mid-1970s through the mid-1980s New York City's resources were devoted to the construction of wastewater treatment plant upgrades.

In 1983, NYCDEP re-invigorated its CSO facility-planning program in accordance with NYSDEC-issued SPDES permits for its wastewater treatment plants with a project in Flushing Bay and Creek. In 1985, a City-wide CSO Assessment was undertaken which assessed the existing CSO problem and established the framework for additional facility planning. From this program, the City was divided into eight areas, which together cover the entire Harbor. Four area-wide projects were developed (East River, Jamaica Bay, Inner Harbor and Outer Harbor) and four tributary project areas were defined (Flushing Bay, Paerdegat Basin, Newtown Creek, and the Jamaica Tributaries). Detailed CSO facility planning projects were conducted in each of these areas in the 1980s and early 1990s and resulted in a series of detailed plans.

In 1989, NYCDEP initiated the City-Wide Floatables Study in response to a series of medical waste and floating material wash-ups and resulting bathing beach closures in New York and New Jersey in the late 1980s. This comprehensive investigation identified the primary sources of floatable materials in metropolitan urban area waters, aside from illegal dumping of medical wastes, as CSO and stormwater discharges. The study also concluded that street litter in surface runoff is the origin of floatable materials in these sources. The Floatables Control Program is discussed in Section 5.5.

5.2 1992 CONSENT ORDER

In 1992, the NYSDEC and NYCDEP entered into the original CSO Administrative Consent Order (1992 ACO). As a goal, the 1992 ACO required NYCDEP to develop and implement a CSO abatement program to effectively address the contravention of water quality standards for coliforms, dissolved oxygen, and floatables attributable to CSOs. The 1992 ACO contained compliance schedules for the planning, design and construction of the numerous CSO projects in the eight CSO planning areas.

The Flushing Bay and Paerdegat Basin CSO retention tanks now under construction were included in the 1992 ACO. In addition, two parallel tracks were identified for CSO planning purposes. Track 1 addressed dissolved oxygen (aquatic life protection) and coliform bacteria (recreation) issues. Track 2 addressed floatables, settleable solids and other water use impairment issues. The 1992 ACO also provided for an Interim Floatables Containment Program to be implemented consisting of a booming and skimming program in confined tributaries, skimming in the open waters of the Harbor, and an inventory of street catch basins where floatable materials enter the sewer systems.

In accordance with the 1992 ACO, the NYCDEP continued to implement its work for CSO abatement through the facility-planning phase into the preliminary engineering phase. Work proceeded on the planning and design of eight CSO retention tanks located on confined and highly urbanized tributaries throughout the City. The CSO retention tanks at Flushing Bay and Paerdegat Basin proceeded to final design. The Interim Floatables Containment Program was fully developed and implemented. The Corona Avenue Vortex Facility pilot project for floatables and settleable solids control was designed and implemented. The City’s 130,000 catch basins were inventoried and a re-hooding program for floatables containment was implemented and substantially completed. Reconstruction and re-hooding of the remaining basins (less than 4 percent) will be completed by 2010.

For CSOs discharging to the open waters of the Inner and Outer Harbor areas, efforts were directed to the design of sewer system improvements and wastewater treatment plant modifications to increase the capture of combined sewage for processing at the plants. For the Jamaica Tributaries, efforts focused on correction of illegal connections to the sewer system and evaluation of sewer separation as a control alternative. For Coney Island Creek, attention was directed to corrections of illegal connections and other sewer system/pumping station improvements. These efforts and the combination of the preliminary engineering design phase work at six retention tank sites resulted in changes to some of the original CSO Facility Plans included in the 1992 ACO and the development of additional CSO Facility Plans in 1999. CSO projects currently under design or construction are presented in Table 5-1.

5.3 BEST MANAGEMENT PRACTICES (BMPS)

The SPDES permits for all 14 WPCP in New York City require NYCDEP to report annually on the progress of fourteen BMPs related to CSOs. The BMPs are equivalent to the Nine Minimum Controls (NMCs) required under the USEPA National Combined Sewer Overflow policy, which were developed by USEPA to represent best management practices that would serve as technology based CSO controls. They were intended to be the best available technology based controls that could be implemented within 2 years by permittees. USEPA developed two guidance manuals that embodied the underlying intent of the NMCs (USEPA 1995a, 1995b) for permit writers and municipalities, offering suggested language for SPDES permits and programmatic controls that may accomplish the goals of the NMCs.

A list of BMPs follows, along with brief summaries of each BMP and their respective relationships to the federal NMCs. In general, the BMPs address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO and reduce contaminants in the combined sewer system, thereby reducing water quality impacts. Through the annual reports, which were initiated in 2004 for the reporting year 2003, NYCDEP provides brief descriptions of the City-wide programs and any notable WPCP drainage area specific projects that address each BMP. The sixth annual report documents calendar year 2008 and is the most recent available as of June 2009.

5.3.1 CSO Maintenance and Inspection Program

This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and NMC 9 (Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls). Through regularly scheduled inspection of the CSOs and the performance of required repair, cleaning, and maintenance, dry weather overflows and leakage can be prevented and maximization of flow to the WPCP can be ensured. Specific components of this BMP include:

- Inspection and maintenance of CSO tide gates;
- Telemetering of regulators;
- Reporting of regulator telemetry results;
- Recording and reporting of rain events that cause dry weather overflows; and
- NYSDEC review of inspection program reports.

Table 5-1. CSO Projects under Design or Construction

Planning Area	Project	Design Completion	Construction Completion
Alley Creek	Outfall & Sewer System Improvements	Mar 2002	Dec 2006
	CSO Retention Facility	Dec 2005	Dec 2009
Outer Harbor	Regulator Improvements – Fixed Orifices	Apr 2005	Jul 2008
	Regulator Improvements – Automation	Nov 2006	Jun 2010
	Port Richmond Throttling Facility	Aug 2005	Dec 2008
	In-Line Storage	DELETED	DELETED
Inner Harbor	Regulator Improvements – Fixed Orifices	Sep 2002	Apr 2006
	Regulator Improvements – Automation	Nov 2006	Jun 2010
	In-Line Storage	Nov 2006	Aug 2010
Paerdegat Basin	Influent Channel	Mar 1997	Feb 2002
	Foundations and Substructures	Aug 2001	Feb 2009
	Structures and Equipment	Nov 2004	May 2011
Flushing Bay	CS4-1 Reroute & Construct Effluent Channel	Sep 1994	Jun 1996
	CS4-2 Relocate Ball fields	Sep 1994	Aug 1995
	CS4-3 Storage Tank	Sep 1996	Aug 2001
	CS4-4 Mechanical Structures	Feb 2000	May 2007
	CS4-5 Tide Gates	Nov 1999	Apr 2002
	CD-8 Manual Sluice Gates	May 2003	Jun 2005
Jamaica Tributaries	Meadowmere & Warnerville DWO Abatement	May 2005	Jul 2009
	Expansion of Jamaica WPCP Wet Weather Capacity	Jun 2011	Jun 2015
	Destratification Facility	Dec 2007	Nov 2010
	Laurelton & Springfield Stormwater Buildout Drainage Plan	Jan 2008	-
	Regulator Automation	Nov 2006	Jun 2010
Coney Island Creek	Avenue V Pumping Station Upgrade	Jan 2005	Apr 2011
	Avenue V Force Main	Sep 2006	Jun 2012
Newtown Creek	Aeration Zone I	Dec 2004	Dec 2008
	Aeration Zone II	Jun 2010	Jun 2014
	Relief Sewer/Regulator Modification	Jun 2009	Jun 2014
	Throttling Facility	Jun 2008	Dec 2012
	CSO Storage Facility	Nov 2014	Dec 2022
Westchester Creek	Phase 1 (Influent Sewers)	Jun 2010	Jun 2015
	CSO Storage Facility	-	Dec 2022
Bronx River	Floatables Control	Jul 2008	Jun 2012
Hutchinson River	Phase I of Storage Facility	Jun 2010	Jun 2015
	Future Phases	-	Dec 2023
Jamaica Bay	Spring Creek AWPCP Upgrade	Feb 2002	Apr 2007
	26th Ward Drainage Area Sewer Cleaning & Evaluation	Jun 2007	Jun 2010
	Hendrix Creek Dredging	Jun 2008	Dec 2011
	26th Ward Wet Weather Expansion	Jun 2010	Dec 2015

General maintenance was documented for OH-2, OH-6C, and OH-10 during CY 2008, and corrective maintenance was performed at OH CSO-2 and OH-11 to control tidal inflow in the Owls Head service area. Although 12-month rolling average influent chloride concentrations suggest an increase in tidal inflow of 10.27 percent from CY 2007 to CY 2008, calculated inflow remained approximately 1 percent of the dry weather flow. No CSO alarms were triggered in the Owls Head WPCP service area during CY 2008.

5.3.2 Maximum Use of Collection System for Storage

This BMP addresses NMC 2 (Maximum Use of the Collection System for Storage) and requires the performance of cleaning and flushing to remove and prevent solids deposition within the collection system as well as an evaluation of hydraulic capacity so that regulators and weirs can be adjusted to maximize the use of system capacity for CSO storage and thereby reduce the amount of overflow. NYCDEP reported on five drainage area specific efforts in 2004 and provided general information describing the status of City-wide SCADA, regulators, tide gates, interceptors, and collection system cleaning.

Fixed orifice regulator improvements at OH-2, OH-3, OH-4, and OH-5 were listed as "Complete" in the CY 2008 Annual Report. In CY 2008, 40 cubic yards of debris was removed and 195 linear feet of sewers were inspected using CCTV in the Owls Head North Branch Interceptor service area. In addition, Contract PS-266 was put out to bid and included CCTV inspection of 13,700 linear feet of sewers in the Owls Head WPCP service area that commenced in February 2009.

5.3.3 Maximize Flow to WPCP

This BMP addresses NMC 4 (Maximizing Flow to the Publicly Owned Treatment Works) and reiterates the WPCP operating targets established by the SPDES permits with regard to the ability of the WPCP to receive and treat minimum flows during wet weather. The collection systems are required to deliver and the WPCPs are required to accept the following flows for the associated levels of treatment:

- Receipt of flow through the headworks of the WPCP: 2xDDWF;
- Primary treatment capacity: 2xDDWF; and
- Secondary treatment capacity: 1.5xDDWF.

The BMP also refers to the establishment of collection system control points in the system's Wet Weather Operating Plan as required in BMP #4, and requires the creation of a capital compliance schedule within six months of the NYSDEC approval of the Wet Weather Operating Plan should any physical limitations in flow delivery be detected.

For 2008 all New York City WPCPs were physically capable of reaching the peak design hydraulic loading rates for all process units. At times, construction activities impacted the actual ability to handle the peak flows. The sustained average wet weather capacity at the Owls Head WPCP was in excess of 240 MGD for the ten largest storms in CY 2008.

5.3.4 Wet Weather Operating Plan

In order to maximize treatment during wet weather events, WWOPs are required for each WPCP drainage area. Each WWOP should be written in accordance with the NYSDEC publication Wet Weather Operations and Wet Weather Operating Plan Development for Wastewater Treatment Plants, and should contain the following components:

- Unit process operating procedures;
- CSO retention/treatment facility operating procedures, if relevant for that drainage area; and
- Process control procedures and set points to maintain the stability and efficiency of BNR processes, if required.

This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and NMC 4 (Maximizing Flow to the Publicly Owned Treatment Works). NYCDEP provides a schedule of plan submittal dates as part of the Best Management Practices Annual Report. The Owls Head WWOP was originally submitted to NYSDEC April 2005 with subsequent revisions in December 2007, September 2008, and December 2008. The last of these was approved in January 2008 and is provided in Appendix A.

5.3.5 Prohibition of Dry Weather Overflow

This BMP addresses NMC 5 (Elimination of CSOs during Dry Weather) and NMC 9 (Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls) and requires that any dry weather flow event be promptly abated and reported to NYSDEC within 24 hours. A written report must follow within 14 days and contain information per SPDES permit requirements. The status of the shoreline survey, the Dry Weather Discharge Investigation report, and a summary of the total bypasses from the treatment and collection system are provided in each Best Management Practices Annual Report. For CY 2008, there was one pump station bypassing event documented, which occurred at the 2nd Avenue Pumping Station when pump blockage led to approximately 0.3 MG being discharged over a 12.45-hour period.

5.3.6 Industrial Pretreatment

This BMP addresses three NMCs: NMC 3 (Review and Modification of Pretreatment Requirements to Determine Whether Non-domestic Sources are Contributing to CSO Impacts); NMC 7 (Pollution Prevention Programs to Reduce Contaminants in CSOs); and NMC 9 (Monitoring to characterize CSO Impacts and the Efficacy of CSO Controls). By regulating the discharges of toxic pollutants from unregulated, relocated, or new SIUs tributary to CSOs, this BMP addresses the maximization of persistent toxics treatment from industrial sources upstream of CSOs. Specific components of this BMP include:

- Consideration of CSOs in the calculation of local limits for indirect discharges of toxic pollutants;

- Scheduled discharge during conditions of non-CSO, if appropriate for batch discharges of industrial wastewater;
- Analysis of system capacity to maximize delivery of industrial wastewater to the WPCP, especially for continuous discharges;
- Exclusion of non-contact cooling water from the combined sewer system and permitting of direct discharges of cooling water;
- Prioritization of industrial waste containing toxic pollutants for capture and treatment by the POTW over residential/commercial service areas; and

The 2008 Best Management Practices Annual Report addresses the components of the industrial pretreatment BMP through a description of the City-wide program. It is noted that, for all WPCP service areas in New York City, the industrial flow contributions to the plant flows are less than one percent.

5.3.7 Control of Floatable and Settleable Solids

This BMP addresses NMC 6 (Control of Solid and Floatable Material in CSOs), NMC 7 (Pollution Prevention Programs to Reduce Contaminants in CSOs), and NMC 9 (Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls) by requiring the implementation of four practices to eliminate or minimize the discharge of floating solids, oil and grease, or solids of sewage origin which cause deposition in receiving waters, i.e.:

- Catch Basin Repair and Maintenance: This practice includes inspection and maintenance schedules to ensure proper operation of basins;
- Catch Basin Retrofitting: By upgrading basins with obsolete designs to contemporary designs with appropriate street litter capture capability, this program is intended to increase the control of floatable and settleable solids City-wide;
- Booming, Skimming and Netting: This practice establishes the implementation of floatables containment systems within the receiving waterbody associated with applicable CSO outfalls. Requirements for system inspection, service, and maintenance are established as well; and
- Institutional, Regulatory, and Public Education - A one-time report must be submitted examining the institutional, regulatory, and public education programs in place City-wide to reduce the generation of floatable litter. The report must also include recommendations for alternative City programs and an implementation schedule that will reduce the water quality impacts of street and toilet litter.

NYCDEP hooded 3,582 catch basins in CY 2008, including 168 in the Owls Head WPCP service area. Of the nearly 9,000 catch basins in the Owls Head service area, only 49 remain in need of reconstruction as of the end of 2008. NYCDEP collected 2,036.5 cubic yards of floatable material from the 25 containment facilities it operated during CY 2008 (20 booms and 5 net sites) and two open water sites. Among these is the boom on Coney Island Creek, which yielded 51.5 cubic yards of floatable material in CY 2008. City-wide street cleanliness continued an ongoing trend of improvements: over 95% of all tested blockfaces were rated acceptable or better, and only 0.14% were rated as "filthy." NYCDEP also has a substantial public outreach component for its floatables control program that is discussed in detail in the Best Management Practices Annual Report.

5.3.8 Combined Sewer System Replacement

This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls), requiring all combined sewer replacements to be approved by New York State Department of Health (NYSDOH) and to be specified within the NYCDEP Master Plan for Sewage and Drainage. Whenever possible, separate sanitary and storm sewers should be used to replace combined sewers. No projects are reported for the Owls Head WPCP service area in the Best Management Practices 2008 Annual Report.

5.3.9 Combined Sewer Extension

In order to minimize storm water entering the combined sewer system, this BMP requires combined sewer extensions to be accomplished using separate sewers whenever possible. If separate sewers must be extended from combined sewers, analysis must occur to ensure that the sewage system and treatment plant are able to convey and treat the increased dry weather flows with minimal impact on receiving water quality. This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and a brief status report was included in the Best Management Practices 2008 Annual Report, although no combined sewer extension projects were completed during that year.

5.3.10 Sewer Connection and Extension Prohibitions

This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and prohibits sewer connections and extensions that would exacerbate recurrent instances of either sewer back-up or manhole overflows. Wastewater connections to the combined sewer system downstream of the last regulator or diversion chamber are also prohibited. The 2008 BMP Annual Report contains a brief status report for this BMP as no chronic sewer back-up or manhole overflow notifications were received from the NYSDEC during the reporting period.

5.3.11 Septage and Hauled Waste

The discharge or release of septage or hauled waste upstream of a CSO (i.e., scavenger waste) is prohibited under this BMP. Scavenger wastes may only be discharged at designated manholes that never drain into a CSO, and only with a valid permit. This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer

Overflow Outfalls). The 2008 BMP Annual Report summarizes the three scavenger waste acceptance facilities controlled by NYCDEP and the regulations governing discharge of such material at the facilities. The facilities are in the Hunts Point, Oakwood Beach, and 26th Ward WPCP service areas, and all of the designated manholes for receiving scavenger waste are downstream of CSO regulators.

5.3.12 Control of Run-off

This BMP addresses NMC 7 (Pollution Prevention Programs to Reduce Contaminants in CSOs) by requiring all sewer certifications for new development to follow NYCDEP rules and regulations, to be consistent with the NYCDEP Master Plan for Sewers and Drainage, and to be permitted by NYCDEP. This BMP ensures that only allowable flow is discharged into the combined or storm sewer system. The 2008 BMP Annual Report refers to the NYCDEP permit regulations required of new development and sewer connections.

5.3.13 Public Notification

This BMP requires easy-to-read identification signage to be placed at or near CSO outfalls with contact information for NYCDEP to allow the public to report observed dry weather overflows. All signage information and appearance must comply with the Discharge Notification Requirements listed in the SPDES permit. This BMP also requires that a system be in place to determine the nature and duration of an overflow event, and that potential users of the receiving waters are notified of any resulting, potentially harmful conditions. The BMP does allow NYCDHMH to implement and manage the notification program. BMP # 13 addresses NMC 8 (Public Notification) as well as NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and NMC 9 (Monitoring to characterize CSO Impacts and the Efficacy of CSO Controls).

NYCDEP provided the status of the CSO signage program as of March 2009, listing 15 signed CSO outfalls associated with the Owls Head WPCP, only one of which discharges to Coney Island Creek (OH-021). Beach closure information provided by NYCDHMH lists no closures of public beaches in 2008. Of the seven advisories issued for public beaches, only one was attributable to a suspected pathogen exceedance; the other six were presumptive wet weather advisories triggered by a certain precipitation event. Private beaches nearest to Coney Island Creek include Seagate on Coney Island and South Beach and Midland Beach on Staten Island. None of these three beaches have had closures back through the bathing season of 2005, with a maximum of four advisories occurring at South Beach (two each for wet weather and for pollution).

5.3.14 Annual Report

This BMP requires an annual report summarizing implementation of the BMPs, including lists of all existing documentation of implementation of the BMPs, be submitted by April 1st of each year. This BMP addresses all nine minimum controls. As of June 2009, the most recent BMP Annual Report submitted was for calendar year 2008.

5.4 NEW YORK CITY'S CSO ABATEMENT PROGRAM

The sewer system drains some 200,000 acres and serves a population of about 7 million. Approximately 60 percent of the sewered areas of the City of New York are served by 4,800 miles of combined sewers within its five boroughs. Over 450 outfalls are permitted by the State of New York to discharge during wet weather to the receiving waters of New York Harbor, to the detriment of aesthetic and water quality conditions. The City is committed to improving water quality in the New York Harbor to achieve the maximum potential uses of the region's waters and to attain compliance with applicable state and federal regulations.

This commitment is demonstrated by NYCDEP's $2.1 billion city-wide CSO program. This major initiative is addressing dissolved oxygen, coliform bacteria, floatables and settleable solids issues throughout the Harbor. The waters of the City of New York have been divided into eight CSO facility planning areas: the East River, Jamaica Bay, Inner Harbor, Outer Harbor, Flushing Bay, Gowanus Canal, Newtown Creek, and the tributaries of Jamaica Bay. Abatement actions recommended by the facility planning projects include providing combined sewage retention facilities, inducing inline storage, or artificially promoting circulation. The facility plans also recommend system adjustments both within the sewer systems and at the WPCPs to maximize flow to the WPCPs by making regulator adjustments, expanding capacity, or constructing WPCP throttling facilities. As a result of this ongoing program, water quality has improved dramatically over the past 30 years, and the implementation of many of these solutions within NYCDEP's current 10-year capital plan will continue that trend.

NYCDEP also has a demonstrated commitment to evaluating state-of-the-art alternatives that have the potential to provide cost-effective solutions with the maximum water quality benefit possible. It has constructed and tested its Corona Avenue Vortex Facility in the Corona section of Queens for evaluating the effectiveness of three different vortex technologies. The NYCDEP investigated inline storage using inflatable devices in the Soundview section of the Bronx. It has and continues to evaluate high-rate physical/chemical treatment of CSO discharges. The NYCDEP has also investigated instream supplemental aeration as a method of improving dissolved oxygen conditions. At the time of the writing of this report, instream aeration systems were being designed for construction in Shellbank Basin (for inducing destratification) and in Newtown Creek (for dissolved oxygen enhancement). The NYCDEP has been in the forefront of abating floatables discharges by conducting several floatables investigations, pilot testing floatables controls, and implementing control programs in catch basins, sewer systems, at the ends of pipes, and in receiving waters. Lastly, where appropriate, the NYCDEP is also implementing Green Projects to achieve water quality standards and meeting beneficial uses.

5.5 CITY-WIDE CSO FLOATABLES PLAN

NYCDEP developed a floatables plan for the CSO areas of New York City in June 1997 that was subsequently modified in 2004, reflecting the completion of some proposed action elements, as well as changes appurtenant to SPDES permits and modifications of regional

Waterbody / Watershed Facility Plans and CSO Facility Plans. The objectives of this plan are to provide substantial reductions in floatables discharges from CSOs throughout the City and to provide for compliance with appropriate NYSDEC and IEC requirements pertaining to floatables. The City-Wide CSO Floatables Plan consists of the following action elements:

- Monitor city-wide street litter levels and coordinate with the New York City Department of Sanitation (DSNY) to maintain litter levels at or below 1993-1994 levels;
- Hood catch basins and reconstruct unhoodable basins; Capture floatables at wet-weather CSO storage/treatment facilities;
- Capture floatables at end-of-pipe floatables control facilities, including the Interim Floatables Containment Program (IFCP);
- Continue Illegal Dumping Notification Program (IDNP);
- Engage in public outreach programs; Evaluate emerging floatables-control technologies through pilot testing and demonstration projects;
- Conduct a floatables-monitoring program to track floatables levels in the Harbor and inform decisions to address both short- and long-term floatables-control requirements.

The Floatables Plan is a living program that will undergo various changes over time in response to ongoing assessment of the program itself as well as changing facility plans associated with other ongoing programs. A key part of the Floatables Plan is a self-assessment component including a new floatables-monitoring program to evaluate the effectiveness of Plan elements and to provide for actions to address both short- and long-term floatables-control requirements (see Section 8.5.3). Evidence of increasing floatables levels that impede uses could require the addition of new floatables controls, expansion of BMPs, and modifications of Waterbody/Watershed Facility Plans and/or drainage-basin specific LTCPs, as appropriate.

The full scale Floatables Monitoring Program will be implemented in Coney Island Creek in conjunction with the Post-Construction Compliance Monitoring Program (PCM). The floatables ratings will be conducted during the PCM water quality sampling activities that will be initiated upon the completion of Avenue V Pumping Station Upgrade and Avenue V Force Main expected in 2011-2012. In addition, floatables monitoring activities have been conducted during the summers of 2007 and 2008 and will be done again in the summers of 2009 and 2010 as part of the Environmental Benefit Project shoreline cleanups that will be performed by NYCDEP. One of the cleanup sites is located along the Coney Island Creek shoreline at Kaiser Park in the vicinity of Bayview Avenue. This project was undertaken in connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State law and DEC regulations.

In addition to the Floatables Monitoring Program, the Department mitigates the impacts of floatables through the maintenance and servicing of a floatables containment boom on Coney Island Creek near Cropsey Avenue. In the past five years, over 150 cubic yards of floatables have been retrieved from the boom, precluding their dispersal throughout the creek.

The City of New York also engages in several best management practices that reduce the amount of floatables discharged to Coney Island Creek, many of which are described in the City-Wide Comprehensive CSO Floatables Plan, Modified Facility Planning Report, July 2005. Such activities include catch basin hooding, reconstruction, and maintenance; maximization of combined sewage flow to the WPCP; illegal dumping notification programs; and street litter control. Street litter control practices carried out in the Coney Island Creek drainage area include street sweeping, enforcement of New York City Department of Sanitation trash and recycling set out and sidewalk sweeping regulations, public litter basket service, New York City Department of Parks and Recreation cleanup days, and public outreach programs. These programs are tracked, in part, through the Scorecard Litter Rating street cleanliness rating system. And, in addition to the aforementioned Environmental Benefit Project shoreline cleanup, Coney Island Creek Park has been cleaned by volunteers as part of the Annual New York State Beach Cleanup organized by the American Littoral Society and supported by the Department.

5.6 SHORELINE CLEANUP PILOT PROGRAM

The NYCDEP will be conducting a pilot program using Environmental Benefit Program funds to cleanup shorelines at locations known to be chronic areas where floatables are known to accumulate due to CSO overflows as well as careless behaviors and illegal dumping. These pilot programs are being initiated as a result of enforcement actions pursuant to violations of the Long Island Sound Consent Judgment. NYCDEP's existing floatables collection program only addresses CSO and storm outfalls, which have boom and netting containment facilities. This project will address CSO and storm outfall locations, which do not have containment facilities and based on inspection warrant a manual clean up effort to remove near-shore floatables and trash on an as needed basis throughout the year. NYCDEP has identified several specific sites as examples of areas that may benefit from these efforts including;

- Coney Island Creek, Brooklyn
- Kaiser Park, Brooklyn
- Sheepshead Bay, Brooklyn
- Cryders Land, Queens
- Flushing Bay, Queens
- Owls Head, Brooklyn

These cleanup efforts will be consist of two primary methods of cleanup.

- Mechanical cleanup -Where debris is caught up in riprap on the shoreline, use of high-pressure pumps to spray water onto the shoreline to dislodge the debris and floatables and flush them out of the rip-rap back into the water where a skimmer vessel can gather the debris. There will be a containment boom placed in the water surrounding the skimmer vessel and the riprap area being cleaned to hold the debris so that the skimmer vessel can remove it.

- Workboat assisted cleanup – At a few locations where the shoreline is not readily accessible from the landside a small workboat will an operator and two crewmembers will collect debris by hand or with nets and other tools. The debris will be placed onto the workboat for transport to a skimmer boat for ultimate disposal.
- Manual cleanup- At some locations simply raking and hand cleaning will be the cleanup method of choice. Debris will be removed and placed into plastic garbage bags or containers and transported away with a pickup truck for disposal.

DEP is currently planning on performing these cleanups each year for a four-year period at each of the above locations. Pending the outcome of this program as well as the findings of the floatables monitoring program an evaluation will be made of how NYDEP will proceed in the future.

Components of the Shoreline Cleanup Pilot Program relevant to Coney Island Creek are described below:

5.6.1 Coney Island Creek, Brooklyn – Cropsey Avenue Bridge

A field inspection conducted on 7/26/2006 revealed that there is debris at the shoreline adjacent to either side of the Cropsey Avenue Bridge. The field inspection also determined that this site would have to be cleaned from the water during low tide, since the area adjacent to a shoreline is fenced off. The main reason there is a fence is to eliminate any access to the water since walking on the rocks is dangerous. The shoreline consists of rocks and rip rap.

The Shoreline adjacent to either side of the Cropsey Ave. Bridge contained large debris in the form of wood and cardboard, old tires, plastic bottles and paper debris. There were several shopping carts located in the water and along the shore line on either side of the bridge. At low water cleanup operations would require two (2) personnel on the shore line to handle the larger debris and a Jon boat with an operator and one (1) crew to receive the larger debris for transport to the skimmer vessel. The skimmer vessel crew would consist of an operator and two (2) crew to handle the larger debris, the tow boat with operator would standby to assist the skimmer and the Jon boat should either get entangled in the debris and to tow the skimmer vessel to the offload site at the Ward - 26 Sewage Treatment Plant. This site including both shore lines on either side of the bridge could be cleaned up with the above indicated crew in two (2) ten (10) hour days of onsite work.

5.6.2 Kaiser Park, Brooklyn

A small portion of the shoreline in Kaiser Park consists of rip rap and the rest of it is a flat sandy beach. The Kaiser Park shoreline contains wood, plastic, cloths and paper debris in various sizes and amounts. Cleanup operations along the park's shoreline will consist of a shore team equipped with rakes, pitch forks, heavy ply garbage bags, and large plastic containers used for recycling. After debris is collected it will be carried to a pick up truck, which can be parked at various locations convenient for the crew to dispose what has been collected.

On September 26, 2006 a Kaiser Park Beach Cleanup Program was conducted. The cleanup effort was coordinated with a local junior high school. One hundred students and seven teachers participated in this volunteer program. The cleanup was coordinated by Erick Delva from NYCDEP. The students were provided with gloves and garbage bags. The students collected the debris into the garbage bags and dropped it off by the "weighing station". The Items collected were categorized and documented. More than 150 pounds of garbage were removed by the students and teachers. Debris collected ranged from plastic bags, plastic bottles, cups, food wrappers, beverage cans, clothing, shoes, straws, fishing line, tobacco packaging, tires, and wood. The students who participated were given certificates and small prizes to encourage future involvement.

5.7 REGIONAL WATER QUALITY FACILITY PLAN

In response to the NYSDEC SPDES discharge permits, the NYCDEP has initiated a CSO facility planning project to determine the best alternatives for controlling CSO discharges to New York City's Outer Harbor receiving waters (Hazen and Sawyer, 1998c). This was the last of the four study areas of the citywide Combined Sewer Overflow Abatement Program which included the East River, Jamaica Bay and Inner Harbor projects.

The goal of the project was to develop a cost effective and environmentally sound plan to improve the water quality of the Outer Harbor. Specifically, the plan focused on current water quality in comparison to State water quality standards; control of CSOs into the Harbor which degrade the water and cause odors; and identification of required CSO control systems, preliminary designs, and recommendations for implementation to meet State water quality standards.

The Outer Harbor study area consisted of: (1) all land areas in the Borough of Staten Island and the southwestern half of Brooklyn; (2) receiving waters encompassing the New York limits of the Kill Van Kull, Arthur Kill, Raritan Bay, the Narrows, Gravesend Bay and Lower New York Bay to the Rockaway - Sandy Hook transect; (3) the drainage areas to the Port Richmond, Oakwood Beach, Owls Head and Coney Island (separate sewer area) WPCPs and their associated sewers and pumping stations; and (4) the bathing beaches and designated shell fishing areas of Staten Island, Coney Island and the Rockaways.

The Project Tasks included: (1) compilation of existing information; (2) investigation of the local combined sewers and overflows; (3) study of receiving water quality in the Outer Harbor waters;(4) mathematical modeling of CSO receiving water quality; (5) evaluation and selection of alternatives; (6) public participation program; (7) preliminary design of the recommended CSO abatement facilities; (8) citywide coordination of the other CSO projects; (9) facility planning reports; and (10) monthly progress meetings.

Field investigations and a review of existing information were conducted to assess current conditions in the sewer system and receiving waters of the study area. Inspections and surveys were conducted to confirm the physical configuration and operating characteristics of the combined sewer system, establish baseline water quality data, and determine the system response to storm events. This information provided the basis for evaluating various CSO abatement alternatives through computer modeling. In addition, the effect of pollutant wasteloads from adjacent areas such as New Jersey have been characterized to assure that the selected plan accounts for current and future external impacts on the receiving waters. Land use constraints including proposed water quality and waterfront projects were reviewed and incorporated into the final Facility Plan.

Following the assessment of current conditions, water quality objectives were defined in terms of existing water uses and compliance with appropriate State standards. Other relevant information used to develop the water quality objectives included projected population and resulting wasteload growth through the year 2020, existing and proposed water quality management programs and the effect of neighboring sewer systems on the study area. The ability to achieve these objectives was then assessed using various computer models to estimate CSO quantity and quality and the impacts on water quality. The models were calibrated using field data to ensure the accuracy of modeling results and were used to evaluate the effectiveness of various alternatives to control CSO discharges.

CSO reduction alternatives were evaluated to determine the best practical solution to the water quality problems in the Outer Harbor. Evaluations were based on the results of system runoff and water quality modeling to determine the overall environmental benefit of each alternative under consideration. Cost benefit analysis was performed, and construction feasibility was assessed in terms of engineering feasibility, reliability, compatibility with existing conditions, and community concerns. This process proceeded sequentially through screening and evaluation stages of alternatives and resulted in a recommended plan for the Outer Harbor study area.

The Recommended CSO Control Plan for the Outer Harbor area is as follows:

1. Maximize use of existing treatment plant flow capacity during wet weather;

2. Improve and optimize regulators to maximize transmission of wet weather flows to the Water Pollution Control Plants; and

3. Use in-line sewer storage (e.g., sewers and interceptors) to retain a portion of the wet weather combined sewer flows for subsequent release to WPCPs for treatment and discharge.

In addition, BMPs designed to reduce the frequency, duration and intensity of CSOs were also pursued. Various ongoing City programs like water conservation efforts, pollution prevention efforts (recycling program), and public education and participation will be working in parallel with the recommended plan for the Outer Harbor CSO Facility Planning Project. These programs also address the USEPA's "Nine Minimum Controls".

5.8 WATERBODY-SPECIFIC WATER QUALITY FACILITY PLAN

NYCDEP also initiated CSO facility planning for Coney Island Creek, one of the tributary areas of the citywide Combined Sewer Overflow Abatement Program (Hazen and Sawyer, 1998b). The study area encompassed the southwestern portion of Brooklyn, which includes Coney Island, Seagate, Gravesend and a portion of Bensonhurst. The receiving waters encompass Coney Island Creek.

The goal of this project was to develop a cost-effective and environmentally sound plan to improve the water quality of Coney Island Creek. Specifically, the plan focused on (1) evaluation of water quality in comparison to State water quality standards (WQS); (2) implementation of the nine minimum controls as per the USEPA's CSO Control Policy; and (3) identification of required CSO control systems, and recommendations for implementation to meet State water quality standards and address the USEPA's CSO Control Policy.

The Project Tasks of the Facility Plan included: 1) compilation of Existing Information; 2) investigation of the Local Combined Sewers and Overflows; 3) study of Receiving Water Quality in Coney Island Creek; 4) mathematical modeling of CSO Receiving Water Quality; 5) Evaluation and selection of alternatives; 6) preliminary design of the recommended CSO abatement facilities; 7) facility planning reports; and 8) monthly progress meetings.

Field investigations and a review of existing information were conducted to assess existing conditions in the sewer system and receiving waters of the study area. Inspections and surveys were conducted to confirm the physical configuration and operating characteristics of the combined sewer system, to establish baseline water quality data, and to determine the system response to storm events.

Results of the field investigation program and the water quality model developed in conjunction with this project indicated that the occurrence of illegal sanitary connections to storm sewers within the Coney Island Creek drainage area negatively impact the waters of Coney Island Creek. Elevated levels of coliform bacteria were found in the storm sewer discharges in the study area, indicating the presence of improper sanitary connections to the storm sewers. Elevated levels of coliform bacteria observed in Coney Island Creek during both dry and wet weather conditions were attributed to illegal sanitary connections to storm sewers and CSOs from Avenue V Pumping Station. The illegal sanitary connections also significantly contributed to phytoplankton blooms in Coney Island Creek through the addition of excessive amounts of nutrients to the receiving waters. The phytoplankton blooms cause large diurnal fluctuations in DO levels in the Creek. The dominant influence on DO levels in Coney Island Creek, under existing conditions, appears to be algal activity induced by the occurrence of illegal sanitary connections. Due to the Creek's limited flushing characteristics and the presence of illegal sanitary connections, the impact of CSOs in Coney Island Creek were not well-defined.

As a result, the CSO abatement plan for Coney Island Creek described in the 1998 Coney Island Creek CSO Facilities Planning Report (Hazen and Sawyer, 1998b) was based on the presumptive approach as per the USEPA National CSO Policy. The CSO Control Policy identifies two general approaches for attainment of WQS: the demonstration approach and the presumptive approach. Generally, if sufficient data are available to demonstrate that the proposed plan would result in meeting appropriate water quality standards, then the demonstration approach can be applied. Alternatively, the USEPA policy allows for the presumptive approach which presumes "that water quality standards will be met if certain minimum levels of CSO controls are achieved, e.g. the elimination or capture for treatment of 85 percent of CSO volume. In Coney Island Creek, the presumption approach was recommended for establishing the level of CSO controls (Hazen and Sawyer, 1998b). The primary reason for selecting this approach was the lack of conclusive water quality data due to the presence of illegal sanitary connections.

The recommended plan for the Coney Island Creek CSO Program contained the following elements:

- Develop and execute a study to identify and quantify the sources of illegal sanitary connections and make recommendations for their removal;
- Eliminate all illegal sanitary connections to storm sewers;
- Apply the presumptive approach to achieve 85 percent CSO volume reduction by increasing the wet weather flow conveyance capacity of the Avenue V Pumping Station and the associated force mains. (Approximately 18,300 linear feet of force main will be installed in two stages to convey sanitary and combined sewage to the existing SE-133 Owls Head Interceptor. The capacity of the pumping station will be increased from approximately 30 mgd to 80 mgd. New pumps, motors, variable frequency drives and controls will be installed.);

- Implementation of a post construction ambient water quality monitoring plan after the Avenue V Pumping Station upgrade.

5.9 LONG-TERM CSO CONTROL PLANNING

In June 2004, the NYCDEP authorized the LTCP Project. This work integrates all Track I and Track II CSO Facility Planning Projects and the Comprehensive City-wide Floatables Abatement Plan, incorporates on-going USA Project work in the remaining waterbodies, and develops Watershed/Waterbody Facility Plan reports and ultimately the LTCP for each waterbody area. The LTCP Project monitors and assures compliance with applicable Administrative Consent Orders. This document is a work product of the LTCP Project.

5.10 NEW YORK CITY SUSTAINABILITY INITIATIVES

Sustainable stormwater management usually involves replicating the natural water balance and stormwater dynamics through the design of natural ecological processes and functions, and controlling stormwater at the source. The technologies that serve this goal are referred to as stormwater best management practices (BMPs), and include a wide range of techniques that can capture stormwater, remove urban pollutants, reduce runoff volumes and peak flows, and return stormwater to the landscape and subsurface in a manner beneficial to the environment (see Section 7.3.2). Low-impact development (LID) refers to the land use approach that integrates various stormwater management practices in an attempt to minimize the changes to the natural environment that the built environment has, and has alternately been referred to as Green Site Design (GSD) or more generically as simply “green solutions.” Distributive by design, stormwater BMPs must be applied over a large area in order to achieve significant runoff attenuation. In densely developed, ultra-urban cities such as New York City, it is easiest to incorporate green solutions into new construction.

Green solutions, including various BMPs and feasible implementation strategies, are currently being evaluated through the NYCDEP Bureau of Environmental Planning and Assessment and the Mayor's Office of Long-Term Planning and Sustainability. The Mayor’s Office established the BMP Interagency Task Force to incorporate BMPs into the design and construction of projects as part of PlaNYC 2030. The Interagency Task Force assisted the development of the Sustainable Stormwater Management Plan, a comprehensive analysis of the costs and benefits of source controls, which was submitted to City Council in December 2008 per Local Law 5. NYCDEP participated in the Interagency Task Force and substantially supported the development of the Stormwater Management Plan. NYCDEP is also evaluating regulatory changes that could require BMPs for new development, and will have a contractor on board in 2009 to design and construct BMP pilot projects, evaluate watershed specific BMP effects, and develop a New York City specific urban BMP design manual (see Section 5.10.1). The following subsections detail these and other stormwater management initiatives the City has recently undertaken. Many initiatives are City-wide in nature and have broad implications within the Coney Island Creek watershed as the City continues to refine its policies and practices pertaining to stormwater management.

5.10.1 Jamaica Bay Watershed Protection Plan

On June 30, 2005, the New York City Council passed Local Law 71 (LL 71) of 2005 to require the development of a watershed protection plan for Jamaica Bay. The legislation required NYCDEP to "assess the technical, legal, environmental and economical feasibility" of a variety of protection measures as part of the Jamaica Bay Watershed Protection Plan (JBWPP) development process, the objective of which is to restore and maintain the water quality and ecological integrity of the Bay though a comprehensive watershed approach. The Final JBWPP was submitted to the City Council on October 1, 2007, and annual JBWPP updates are expected in October of 2008 and 2010.

The JBWPP included a myriad of ecological restoration and water quality improvement strategies, and new and emerging techniques previously unaddressed, such as stream bank protection, stream buffers, other BMPs, enforcement, access and use restrictions, freshwater ponds, urban runoff management, and expansion of community use and participation. A set of recommendations for restoring and protecting desired uses of Jamaica Bay and its watershed were generated. Collectively, these pilot studies, regulatory initiatives, public outreach efforts, and technical innovations will begin to address water quality and ecological issues facing Jamaica Bay, promoting sustainability in New York City based on sound development and infrastructure practices at multiple levels. Many of the recommendations in the JBWPP are outside NYCDEP's authority or mission, and NYCDEP's support for these projects must be considered in the context of other agency mandates. The financial plan for the Bay has not been fully developed.

The first JBWPP update was submitted to City Council in October 2008, and included status reports on the implementation of many strategies identified in the JBWPP and the status information presented below for stormwater BMPs.

5.10.2 BMP Pilots, Design Manual and Watershed Planning

Following the development of the JBWPP, NYCDEP developed a contract to implement BMP strategies throughout the City. A significant portion of the contract, which commenced in April 2009, includes multiple stormwater BMP pilot projects that will be used to evaluate the efficacy of each BMP, maintenance needs, schedules, and uncertainties associated New York City-specific climate and site conditions (local geology, cold weather limitations, construction costs, maintenance requirements, etc.). The results of these pilots will be used to guide future development practices, and the development of a BMP design manual and watershed planning analyses. The specific pilots in the contract included:

- Three locations in the Bronx at which stormwater BMP retrofits for open space and other land uses will be evaluated;
- New York City Housing Authority (NYCHA) complex will test the ability to redirect runoff to existing pervious surfaces and encourage on-site stormwater infiltration;

- A porous pavement pilot to investigate different types of porous pavement and potential maintenance issues associated with the use of porous pavement;

- Two locations in southeast Queens along North and South Conduit Avenues that will be used to quantify the benefits of tree plantings and other BMPs for stormwater management;

- Two 10,000 square-foot, publicly owned rooftops will be retrofitted with blue roofs to evaluate retrofitting existing structures;

- The distribution of 1,000 55-gallon capacity rain barrels to gauge public acceptance of and interest in this technology, with focused distribution in the Jamaica Bay watershed (250 of which were distributed during the spring and summer of 2007).

The BMP Design Manual, to be developed under the same contract, will provide specific guidance for designing and constructing BMPs based on New York City conditions and the regulatory environment. The BMP Design Manual will identify specifically how to design and install effective BMPs in New York City, addressing different land use and building classifications, local climate conditions, and the regulatory environment. The manual will include the pilot and demonstration projects as examples and is anticipated to have an online, interactive access portal that can be used to tailor a stormwater control to specific site conditions.

Another noteworthy component of the contract is the development of watershed plans for up to four watersheds that will be based on a comprehensive water quality and ecological approach. These watershed plans will identify BMP, restoration, and other low-impact/decentralized strategies for addressing multiple water quality and ecosystem goals. As of the date of this report, the four watersheds are the Bronx River, Flushing Bay and Creek, Gowanus Canal, and Newtown Creek; however, this list is subject to modification as new information arises and priorities evolve.

5.10.3 PlaNYC 2030

On Earth Day in 2007, Mayor Bloomberg announced a comprehensive City-wide set of initiatives focused on environmental stewardship called PlaNYC 2030. By dividing the urban environment into its fundamental components (land, water, transportation, energy, and air), PlaNYC enabled New York City to identify and execute actions that would lead to a more sustainable city. PlaNYC identified specific initiatives to promote BMP implementation, including the formation of an interagency BMP Task Force, development of pilot projects for promising BMPs, and providing incentives for green roofs. The BMP Interagency Task Force met regularly during 2007 and 2008 to discuss feasible mechanisms for distributed stormwater control through the design and construction of different agency projects within the City's right-of-way, open space, and public and private developments. The Task Force held several public meetings to receive the input of diverse stakeholders citywide. The pilot projects identified in PlaNYC (e.g., improved tree pit design and roadway vegetated swales) will be implemented by NYCDEP along with other stormwater BMP pilot projects as part of several contracts described below. Finally, the State Legislature recently approved a green roof tax abatement program (Bill Number A11226) to encourage construction and maintenance of green roofs in the City. The amount of the abatement would be $4.50 per square foot of green roof, limited to the lesser of $100,000 or the building's tax liability for the year in which the abatement is taken. The bill was officially written as law in fall 2008 with a sunset date of March 15, 2013.

5.10.4 Sustainable Stormwater Management Plan

The City Council passed Local Law 5 in 2008 requiring the Mayor's Office of Long-Term Planning and Sustainability to develop a City-wide Sustainable Stormwater Management Plan, the goals of which are to reduce stormwater volume, improve water quality, and enhance the use and enjoyment of the city's waterbodies for recreational activities. The specific requirements of the plan focus on defining cost-effective stormwater management measures for different types of properties or areas in the city, along with a prioritization of measures and timeline for implementation. A substantial public participation and public education program obtained public input during the development of the plan. Specific requirements for signage, public notification for location and occurrence of CSOs, and other education activities were also included. The draft plan was issued as required on October 1, 2008 to the mayor, speaker of the council, and the public; the final was issued December 1, 2008. The Plan provides a framework for testing, assessing, and implementing pilot installations to control stormwater at its source, as well as strategies to supplement existing stormwater control efforts, develop innovative and cost-effective source controls, and secure funding for future implementation. NYCDEP lent substantial support to the development of the Plan. The law expects a four-year review cycle, with reports every other October beginning in 2010.

5.10.5 Environmental Benefit Projects

In connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State law and DEC regulations, NYCDEP submitted a Nitrogen Consent Judgment Environmental Benefit Project (EBP) Plan to NYSDEC in January 2007 that proposed a stormwater pilot study in the Jamaica Bay drainage area. This project will use Nitrogen Consent Judgment EBP funds to conduct a three year pilot study program to implement and monitor several stormwater treatment technologies and volume reduction stormwater BMPs for potential application within the Jamaica Bay watershed. The goals of Jamaica Bay Watershed Stormwater Pilot Project include documenting the quality of New York City stormwater and refining the specific capture rates and treatment efficiencies that may be expected locally. Once this information has been gathered, effective Green Site Design stormwater strategies would be developed for potential future applications.

The project is expected to cost approximately $1.75 million and will include infiltration swales for street-side and parking lot applications, parking lot curb water capture systems, enhanced tree pits, and a commercial green roof / blue roof comparison installation. The EBP is being conducted through an innovative collaborative effort between NYCDEP and the Gaia Institute. NYCDEP entered into a contract with the Gaia Institute to complete the pilot study. The Gaia Institute is a 501(c)3 not-for-profit corporation located on City Island in the Bronx that explores how human activities can be attenuated to increase ecological productivity, biodiversity, environmental quality, and economic well being.

In connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State law and DEC regulations, NYCDEP also submitted an approvable CSO EBP Plan for NYSDEC approval in March 2008 that is expected to partially mitigate the impacts of stormwater and CSO discharges in the New York Harbor Estuary through stormwater BMP implementation. Practices such as bioinfiltration swales, enlarged street tree pits with underground water storage, constructed wetlands, and others will be evaluated. The CSO EBP Plan proposed pilots in the Bronx, Flushing, and Gowanus watersheds, which were selected in part to be representative of the range of watersheds encountered in New York City so that pilot results may be applied City-wide. NYSDEC approved the EBP Plan in April 2008.

5.10.6 Other NYC Initiatives

NYCDEP has also worked closely with the City Planning Commission (CPC), Department of City Planning (DCP) and Economic Development Corporation (EDC) to review the proposed Coney Island Rezoning which encompasses approximately 47 acres of developable land on the Coney Island peninsula in southern Brooklyn and within Community District 13. The rezoning is anticipated to result in an increase in development of amusement and eating and drinking establishments, hotel rooms, residential units, general retail, and parking spaces. EDC will be developing an amended drainage plan that will require separate sewers, with storm sewers discharging to Coney Island Creek. All new storm sewer outfalls will be subject to NYSDEC standards, including the SPDES General Permit and related requirements. Prior to full sewer buildout, development in the rezoning area will be phased and interim measures including BMPs will be undertaken based on the capacity of the sewer system. A public hearing was held by the CPC on May 6, 2009 and it is anticipated that the CPC will vote on the Uniform Land Use Review Procedure (ULURP) application for the rezoning on June 17, 2009.

5.10.7 BMP Code Review Task Force

A detailed review of New York City's existing codes and regulations is being performed in an attempt to identify potential code revisions that could be recommended to promote BMP implementation. NYCDEP convened various staff from different bureaus and offices within the agency—Bureau of Environmental Planning and Analysis, Bureau of Water and Sewer Operations, Legal Office and Office of Strategic Projects—and other City agencies—Department of Buildings, Law Department and Mayor's Office of Long-Term Planning and Sustainability—to conduct the review. The Task Force identified opportunities for revisions that would encourage BMP installation based on a review of BMP regulations and practices in other urban municipalities such as Portland, Philadelphia, Chicago, and Seattle. As described in the Mayor's Sustainable Stormwater Management Plan, new stormwater requirements are anticipated by the end of 2009.

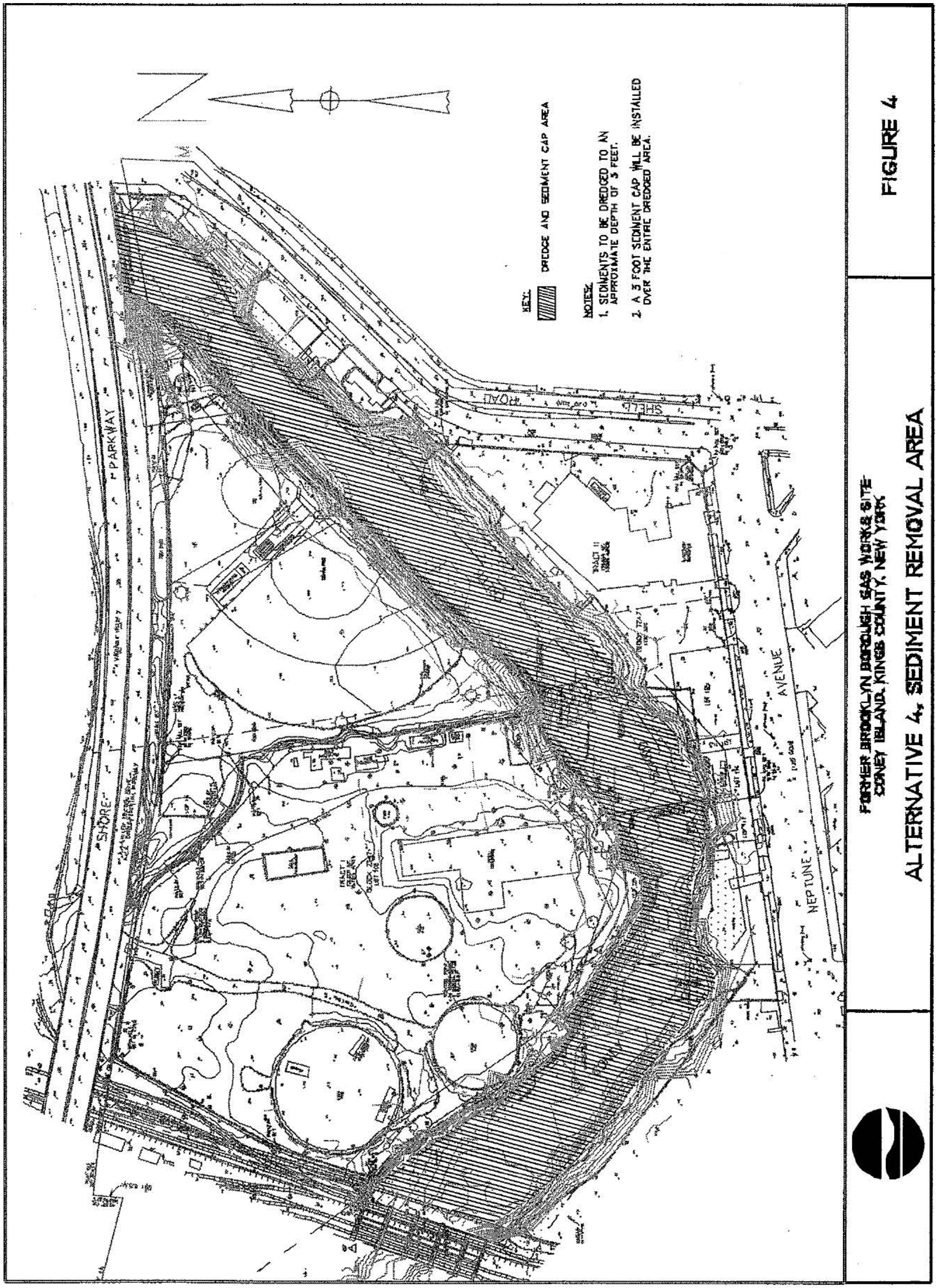
5.11 NYSDEC ROD FOR CLEANUP OF CONEY ISLAND CREEK

As discussed previously, Brooklyn Borough Gas Works operated an MGP at the head end of Coney Island Creek beginning in 1908. Release of by-products, such as coal tar, generated from MGP operations, has resulted in the contamination of soil, groundwater, and surface water with volatile organic compounds (benzene, toluene, ethylbenzene, and xylene), carcinogenic polycyclic aromatic hydrocarbons (chrysene, benzo(a)anthracene, and benzo(k)fluoranthene), and inorganic compounds (arsenic, nickel, lead, and zinc) through leaks from storage facilities and from direct discharge into Coney Island Creek (NYSDEC, 2001 and 2002a).

The NYSDEC has formulated a Record of Decision (ROD) for the cleanup of both landside and creek contamination (NYSDEC, 2001 and 2002a). The components of the NYSDEC recommended cleanup include:

- Excavate/cap landside contaminated areas;
- Install subsurface barrier walls to prevent continuing discharges to the creek;
- Remove top 3 feet of contaminated sediment from the head end of the creek to the MTA railroad bridge and cap with clean material (Figure 5-1);
- Restore 50 feet of Creek bank along the area to be dredged; and
- Institute a long-term monitoring plan.

As of September 2008, the dredging of Creek sediment and the capping with three feet of clean material has been completed (NYSDEC, 2008). The upland remedial actions are ongoing. According to NYSDEC’s website, the Remedial Action was 90% complete as of October 2008 (NYSDEC, 2009). As per the NYSDEC ROD, a long-term monitoring plan will be implemented upon completion of the project.



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New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

Sediment Removal Area for NYSDEC ROD

FIGURE 5-1

6.0 Public Participation and Agency Interaction

Establishing communication with both the general public, regulatory agencies, and other stakeholders is important to the successful development of the long term CSO control planning approach (USEPA, 1995a), and is one of the nine elements of a long-term control plan enumerated in federal CSO policy. Permittees are expected to meet early and frequently with water quality standards authorities, permitting authorities, and USEPA regional offices throughout the process to facilitate such coordinated efforts as water quality standards review and scoping data, modeling, and monitoring requirements to support the long-term control plan. NYCDEP has a well-established commitment to stakeholder involvement in the planning and development of capital projects though the formation and support of advisory committees, information sharing at public meetings, and providing opportunity for comment regarding any capital improvement. The following sections describe the public participation and agency interaction programs utilized in the development of the Coney Island Creek WWFP.

6.1 Harbor-Wide Steering Committee

NYCDEP convened a Harbor-Wide Government Steering Committee to ensure overall program coordination and integration of management planning and implementation activities by holding quarterly meetings, exploring regulatory issues, prioritizing planning and goals, developing strategies, reviewing and approving assessment-related work plans and coordinating actions. The Steering Committee is comprised of city, state, interstate, and federal stakeholders representing regulatory, planning, and public concerns in the New York Harbor watershed. The Citizens Advisory Committee on Water Quality (CAC), which reviews and comments on NYCDEP water quality improvement programs, is represented on the Steering Committee and separately monitors and comments on the progress of CSO projects, among other NYCDEP activities.

Federal government members of the Harbor-Wide Government Steering Committee included representatives of the USEPA, USACE and the National Park Service. USEPA Region 2 was represented by its Deputy Director and its Water Quality Standards Coordinator. The USACE was represented by its Chief of the Technical Support Section, Planning Division, New York District. The National Park Service member was a representative of its Division of Natural Resources at the Gateway National Recreational Area.

The State of New York is represented by the central and regional offices of the NYSDEC. The Central Office of NYSDEC in Albany was represented by its Associate Director of the Division of Water, the Director of the Bureau of Water Permits in the Division of Water, the Director of the Bureau of Water Assessment and Management Branch of the Division of Water, and the Director of the Bureau of Water Compliance in the Division of Water. The Region II office of the NYSDEC is represented by the Regional Engineer for the Region II Water Division.

Several departments of the City of New York are represented on the Harbor-Wide Government Steering Committee. The Deputy Director of the Bureau of Engineering Design and Construction represent the NYCDEP. The Department of City Planning was represented by its Director of Waterfront/Open Space. The New York City Department of Parks and Recreation was represented by the Chief of its Natural Resources Group.

Public interests were represented on the Steering Committee by the General Counsel of Environmental Defense at the New York Headquarters and the Real Estate Board of New York. These two members also co-chaired the Citizens Advisory Committee on Water Quality. In 2006 these positions have been changed after a few years' hiatus of the CAC.

Interstate interests are represented by the Executive Director and Chief Engineer of IEC. The IEC is a joint agency of the States of New York, New Jersey, and Connecticut. The IEC was established in 1936 under a Compact between New York and New Jersey and approved by Congress. The State of Connecticut joined the IEC in 1941. The mandates of the IEC are governed by the Tri State Compact, Statutes, and the IEC's Water Quality Regulations. Its responsibilities and programs include activities in areas such as air pollution, resource recovery facilities and toxics; however, the IEC's continuing emphasis is on water quality, an area in which the IEC is a regulatory and enforcement agency. The IEC's area of jurisdiction runs west from Port Jefferson and New Haven on Long Island Sound, from Bear Mountain on the Hudson River down to Sandy Hook, New Jersey (including Upper and Lower New York Bays, Newark Bay, Arthur Kill and Kill Van Kull), the Atlantic Ocean out to Fire Island Inlet on the southern shore of Long Island, and the waters abutting all five boroughs of New York City.

The Steering Committee is responsible for reviewing the methodology and findings of NYCDEP water quality-related projects, and to offer recommendations for improvement. The Steering Committee will review and approve the Coney Island Creek watershed/waterbody work plan. Recommendations provided by the Steering Committee have included the investigation of cost-effective engineering alternatives that improve water quality conditions to remove harbor waters from the State of New York 303(d) list, pursuance of ecosystem restoration projects with USACE, and coordination of use attainment evaluations with the NYSDEC.

6.2 CONEY ISLAND CREEK FACILITY PLANNING PROJECT

6.2.1 Public Participation Background

A public participation program for the Coney Island Creek CSO Facilities Planning Project was conducted in conjunction with the Outer Harbor CSO Facilities Planning Project. The public participation program was developed to involve the public in the decision making process toward the selection of a recommended CSO facility plan for both the Outer Harbor and Coney Island Creek which is a tributary to the Outer Harbor. The public participation program followed the minimum requirements and suggested program elements as set forth by the USEPA in the Code of Federal Regulations (40 CFR 25).

The public was invited and encouraged to participate from the initial stages of the facilities planning process. A public participation program is desirable for a number of reasons including:

- Local residents often have an intimate understanding of their community and its problems and can provide information that may be more pertinent to the project and more up-to-date than that obtained from existing reports and studies.

- Local residents reflect community values, concerns, and goals which can contribute to the facility planning process. Open discussion and suggestions can help to shape a plan to better fit the area's particular needs and circumstances.

- Alternatives can be discussed and their potential impacts better understood.

- Controversial issues can be identified early so that reasonable compromises and resolutions can be achieved.

- Public involvement gives community participants a stake in the long-term benefits of the project. The result for the community, its residents, and the City will be a Facility Plan that offers the best engineering solution, has the least environmental impacts, and is the most cost-effective solution.

6.2.2 Public Participation Program

The Public Participation Program for the Outer Harbor and Coney Island Creek CSO Facilities Planning Projects included the following work items:

Work Plan: The Work Plan included a description of the proposed projects, establishing and recruiting a CAC, a comprehensive mailing list of groups and persons affected by the proposed projects, and a schedule of public participation activities.

Public Meetings and Hearings: Two public meetings and one public hearing were held to discuss the technical aspects of the two projects. The first public meeting was held on December 10, 1990 when the Outer Harbor Project was initiated to inform the public of the scope, schedule, and the goals of the project. A second public meeting was held on May 17, 1993 to present the findings of the water quality monitoring and modeling and to discuss potential CSO alternatives for the Outer Harbor and Coney Island Creek study areas. A public hearing was held on June 29, 1993 to inform and invite response to the recommended facility plan for the Outer Harbor.

Public Information: Preparation and dissemination of project fact sheets, press releases, direct mailings, and public notices to keep the public apprised of the two projects. Additionally, project data was assembled and made available at various repositories for review.

Citizens Advisory Committee: A CAC was established and received regularly scheduled project updates. Questions and concerns by the CAC were addressed either at the meetings or by follow-up materials. A total of 10 CAC meetings were held from October 23, 1990 through April 1, 1993 to discuss specific project related topics.

6.3 PUBLIC OPINION SURVEY

The NYCDEP conducted a telephone survey in order to assess and measure the use of waterbodies in New York City, and obtain feedback from New York City residents about their attitudes towards the water resources in their community and elsewhere. Surveys addressed city-wide issues as well as those for local waterbodies. Primary and secondary waterbody survey results (dependent on residential location within watersheds) were analyzed discreetly and summarized to provide additional insight public into waterbody uses and goals in addition to those identified via other public participation programs run by NYCDEP.

Survey interviews were conducted using Computer Assisted Telephone Interviews (CATI) among residents of the five New York City boroughs that were 18 years of age or older. Residents were asked about specific waterways depending on their zip code. A total of 7,424 interviews with New York City residents were conducted during these telephone surveys and a total of 8,031 primary waterway responses were recorded. Questionnaire development involved a pre-test prior to the full field application of the survey to ensure that the survey covered all relevant issues and it was presented in a way that would be clear to respondents. The pre-test was conducted via a series of five focus groups representing residents of each of the five New York City boroughs. Final presentation of results involved editing, cleaning, and weighting collected data. The weights were applied to the data to correct for unequal probability of household selection due to households with more than one telephone number, and different numbers of individuals available to be interviewed in different households. Post-stratification weighting was also applied for each waterbody to balance the sample data to 2000 U.S. Census population data that takes into account household composition, age, gender, and race/ethnicity. The survey data then was projected to actual population counts from the 2000 U.S. Census so that areas could easily be combined to yield an appropriate weighted sample for all five boroughs of New York City.

The telephone survey included 7,424 interviews of New York City residents and a minimum of 300 interviews for each of 26 watersheds within the scope of the USA Project. The survey was analyzed to quantify the extent of existing uses of the waterbody and riparian areas, and to record interest in future uses. Elements of the survey focused on awareness of the waterbody, uses of the waterbody and riparian areas, recreational activities involving these areas and how enjoyable these activities were, reasons why residents do not partake in recreational activities in or around the waterbody, overall perceptions of New York City waterbodies; and what improvements have been recognized or are desired.

6.3.1 Waterbody Awareness

Approximately 58 percent of Coney Island Creek area residents that participated in the survey were aware of the basin but only one percent could identify Coney Island Creek as their primary waterbody without any prompting or aid in their response. Less than 0.5 percent of all New York City residents who participated in the survey had unprompted awareness of Coney Island Creek. Most of the City residents identified the East River or the Hudson River as the waterway closest to their home.

6.3.2 Water and Riparian Uses

Approximately 32 percent of Coney Island Creek area residents that participated in the survey visit waterbodies in their community or elsewhere in New York City on a regular basis and 38 percent occasionally visit waterbodies. The remaining percentage visit waterbodies rarely or never. This is less frequent than New York City residents in general, 60 percent of whom visit city waterbodies either regularly or occasionally. Only 24 percent of area residents have visited Coney Island Creek at some point, and 6 percent have done so in the prior twelve months. Those who have visited the Creek within the prior 12 months responded that they visit the Creek an average of six times per year, higher than the city-wide median of four visits per year. Among those area residents who are aware of Coney Island Creek but have never visited the canal, the majority (35 percent) responded that there was no particular reason, 30 percent cited waterbody conditions, and 27 percent cited riparian conditions.

The number of are residents that have participated in waterbody-related activities at Coney Island Creek represents 14 percent of those who have ever visited the basin and only three percent of the total area residents surveyed. The most frequent water activities participated in for those who have ever visited the Creek include in-water activities (5%), fishing (3%), and on-water activities (2%). Among the respondents who have never participated in water activities while visiting the Creek, 17 percent responded that pollution was the reason for not participating in water activities and 14 percent responded that garbage in/on the water or the water being dirty was their main reason for not participating.

Riparian-based activities appear to be more popular in general than in-water activities. Forty-five percent of area residents who have visited Coney Island Creek responded that they had participated in activities in riparian areas of the Creek. The compilation of Coney Island Creek area responses suggest that strolling is the most-favored land-based activity followed by eating or strolling along riparian areas.

6.3.3 Improvements Noted

The city-wide respondents to the telephone survey mentioned negative perceptions more than positive perceptions by 44 percent to 35 percent, and only two percent of Coney Island Creek area residents responded that they have noticed improvements in the Basin. Forty percent of Coney Island Creek residents want the water of the Creek improved. Another 15 percent cited improvements to cleanliness, sanitation, or maintenance as desirable, compared to a city-wide median of 12 percent. Five percent cited improvements to security and safety measures as desirable.

When asked how much they would be willing to pay, 37 percent of residents that felt primary waterbody improvements were extremely important responded that they would be willing to pay a range of $10 to $25 a year for that improvement, but 28 percent responded that they would not be willing to pay for the desired improvement at all. In general, 39 percent of the New York City residents with similar attitudes towards improvements to their primary waterbody responded that they would be willing to pay for those improvements, and 22 percent responded that they would not be willing to pay for anything. Of area residents that felt water quality improvements in specific were extremely important, 37 percent responded that they would be willing to pay a range of $10 to $25 a year for that improvement, but 31 percent responded that they would not be willing to pay for the this improvement. For New York City residents desiring water quality improvements in their primary waterway, 41 percent responded that they would be willing to pay for those improvements, and 22 percent responded that they would not be willing to pay for anything.

6.4 ADMINISTRATIVE CONSENT ORDER

The Administrative Consent Order was published for public comments on September 8, 2004, as part of the overall responsiveness effort on behalf of NYSDEC. The public comment period, originally limited to 30 days, was extended twice to November 15, 2004, to allow for additional commentary. Comments were received from public agencies, elected officials, private and non-profit organizations, and private individuals. In total, NYSDEC received in excess of 600 official comments via letter, facsimile, or email during the comment period. All comments received were carefully reviewed and evaluated, then categorized by thematic elements deemed similar in nature by NYSDEC. Each set of similar comments received a specific, focused response. Many of the comments received, although differing in detail, contained thematic elements similar in nature regarding NYSDEC and NYCDEP efforts toward CSO abatement, water quality issues, standards, and regulatory requirements.

None of the comments received changed the terms of the Order, but the volume of commentary was interpreted by NYSDEC to indicate that "NYC citizenry places CSO abatement as a high ongoing priority" (NYSDEC, 2005a). The terms of the Order offer numerous opportunities for public participation and input for future CSO abatement measures and regulatory decisions, such as the requirement to comply with federal CSO policy with regard to public participation during LTCP development. The Order (DEC Case # C02-20000/07-8) was executed on January 14, 2005.

6.5 SPDES PERMITTING AUTHORITY

Any facilities built as a part of this Waterbody/Watershed Facility Plan or water quality standards revision would be subject to the modifications of the Owls Head WPCP SPDES permits and as such would be subject to a formal public review process.

Following NYSDEC review of the Coney Island Creek Waterbody/Watershed Facility Plan and/or the subsequent Coney Island Creek Long Term Control Plan, the NYCDEP or the NYSDEC may choose to solicit additional public comment through public notice and/or public hearing processes.

6.6 PUBLIC PARTICIPATION FOR THE CONEY ISLAND CREEK WATERBODY/WATERSHED FACILITY PLAN

As part of the Coney Island Creek WB/WS Facility Plan, a stakeholder group was reconvened. Formation of this stakeholder group utilized stakeholders assembled under the Outer Harbor CSO Facility Planning Project and was augmented with representatives from Community Boards located within the Coney Island Creek drainage area and local grass roots organizations. In addition, City Council members were contacted informing them of the waterbody projects in their district and inviting them to send one representative to stake holder meetings. There were a total of two stakeholder team meetings throughout the course of the Coney Island Creek WB/WS Facility Plan public participation program.

On June 29, 2006, NYCDEP participated in a community meeting that offered a public forum on the issue of CSO in Coney Island Creek. This meeting, organized by the NYCDEP, was attended by private citizens and stakeholder groups. The NYCDEP provided a presentation on the current water quality and existing conditions within Coney Island Creek as well as the City's latest plans to address the CSO Consent Order in Coney Island Creek and fielded questions posed at the forum. Minutes from this meeting are presented in Appendix B.

On August 2, 2006, the NYCDEP conducted an additional meeting with the public. This meeting represented the second time that NYCDEP met specifically with Coney Island Creek stakeholder groups. NYCDEP representatives reviewed the status of the long-term control planning process in the context of the requirements of the federal CSO Control Policy and the CSO Consent Order, and informed the group that NYCDEP planned to submit to NYSDEC for approval a Waterbody/Watershed Facility Plan for Coney Island Creek by June 2007 and a Long-Term Control Plan by September 2007, and that NYCDEP sought public questions and comments on the Waterbody/Watershed Facility Plan that was being presented. [Note that the Consent Order Modification of 2008 has changed the LTCP Milestone from September 2007 to 6 months after approval of the WB/WS Facility Plan.] The NYCDEP also presented a detailed description of the development of the proposed Coney Island Creek Waterbody/Watershed Facility, including other evaluated alternatives as well as the implementation schedule associated with the selected alternatives. Approximately 12 members of the public, including representatives of several stakeholder groups and private citizens, attended the meeting, provided comments, and asked a variety of questions pertaining to the development of the Waterbody/Watershed Facility Plan. The NYCDEP responded to each of the questions and requested that the group provide any additional comments on the Waterbody/Watershed Facility Plan. The NYCDEP provided hard copies of the presentation to all attendees and posted an electronic copy on a special website available to the stakeholders. Minutes from this meeting are presented in Appendix B.

6.7 NYSDEC PUBLIC NOTIFICATION FOR THE CONEY ISLAND CREEK WATERBODY/WATERSHED FACILITY PLAN

In accordance with the NYSDEC public notification requirements, NYCDEP posted in the Environmental News Bulletin (ENB) a notice of a meeting held jointly between NYCDEP and NYSDEC to provide the public with updates on the Coney Island Creek Waterbody/Watershed Facility Plan process and a forum in which to ask questions and provide feedback. This meeting was held on Wednesday, November 12, 2008 at 6:30 p.m. at the Offices of Community Board #13, 1201 Surf Avenue, Brooklyn, New York. Appendix B includes the presentations shown at the public meeting, a summary of questions and comments received at the meeting and during the 60-day public comment period, and the responsiveness summary prepared jointly by NYSDEC and NYCDEP.

7.0 Evaluation of Alternatives

CSO pollution control alternatives are developed and analyzed in this section with the goals of improving water quality within Coney Island Creek and providing compliance with existing water quality standards. Each alternative is evaluated with regards to several parameters, including: feasibility of construction and implementation; improvements to the waterbody in terms of water quality parameters (dissolved oxygen, total coliform and fecal coliform) and aesthetics (floatables); significant reductions in the number of CSO events and annual CSO volume; and construction costs. At the conclusion of this section, a Waterbody/Watershed (WB/WS) Facility Plan is selected that optimizes the above parameters cost-effectively, thus providing a higher quality water than is currently present in Coney Island Creek.

Coney Island Creek has a history of CSO Facility Plan development, as discussed in Section 5.0 and detailed in Section 7.1 and 7.2. Although these efforts were initiated in the early 1990s prior to issuance of the 1994 USEPA CSO Control Policy CSO facility planning followed many of the CSO Policy requirements, including a rigorous evaluation of alternatives that considered "a reasonable range of alternatives…sufficient to make a reasonable assessment of cost and performance" (59 FR 18692). The 1998 Coney Island Creek CSO Facilities Planning Report (Hazen and Sawyer, 1998), later modified in 2003 (Hazen and Sawyer, 2003) provides such a rigorous evaluation of CSO control alternatives.

At the time there was no requirement for the City to develop a Long Term CSO Control Plan (LTCP) for Coney Island Creek. This requirement was introduced into the Owls Head WPCP SPDES permit when the permit was modified in 2003. At that time, NYCDEP was well along in the planning and design of the recommendations of the 1998 Coney Island Creek CSO Facility Plan. Further, in January 2005, the CSO Consent Order required that the City submit a Modified CSO Facility Plan Report (Hazen and Sawyer, 2003) and complete the construction of certain aspects of the 1998 Coney Island Creek CSO Facility Plan recommendations.

Because of this long history of facility planning and the degree to which the plan has been implemented, this WB/WS Facility Plan is based on the 2003 Coney Island Creek Modified CSO Facility Plan recommendations as the starting point for assessing water quality and the evaluation of CSO control alternatives in Coney Island Creek. This WB/WS Facility Plan examines controls beyond those provided in this CSO Facility Plan to determine if additional controls are required to comply with water quality standards within the Creek, and whether these additional controls can be implemented cost-effectively. A WB/WS Facility Plan is recommended, herein, in accordance with the USEPA CSO Policy requirements for Long Term Control Plans.

7.1 EVALUATION OF CSO CONTROL ALTERNATIVES IN PREVIOUS CONEY ISLAND CREEK CSO FACILITY PLANNING

The Coney Island Creek CSO Facilities Planning Report (Hazen and Sawyer, 1998a) described in detail the process used to screen and select CSO control alternatives. The approach first considered all reasonable measures for reducing CSO discharges to Coney Island Creek, then reduced the comprehensive list of alternatives to those that had potential application in Coney Island Creek given the nature of the waterbody, its tributary area, and its sewerage and collection facilities. The options with the highest potential were fully developed and analyzed based on the following criteria:

- Attaining water quality goals;
- Public acceptance;
- Effective cost expenditures;
- Reliable operation;
- Regulatory concurrence; and
- Compatibility with Owls Head and other WPCPs under NYCDEP operation.

Numerous CSO control alternatives were considered during development of the 1998 Coney Island Creek CSO Facility Plan, many that were capable of being implemented in combination. As summarized in Table 7-1, the alternatives were grouped into five general categories: improvement of the existing collection system; CSO storage; waterbody modifications; programmatic controls; and end-of-pipe treatment. Issues of scaling (i.e., optimizing the utility of a particular alternative) were addressed only for those alternatives determined to have high potential for applicability during the preliminary screening.

Table 7-1. 1998 Coney Island Creek CSO Facility Plan Preliminary Alternatives Screening

Category	Alternative	Retained for Consideration
Improvements to Existing Facilities	I/I Reduction	Yes
	Low Tech Modifications	Yes
	Regulator/Tidegate improvements	Yes
	Sewer separation	Yes
	Chemical Additions	No
	Additional Interceptor Capacity	Yes
	Discharge relocation	Yes
CSO Storage	In-line storage	Yes
	Off-line storage	Yes
Water Body Modifications	Dredging	Yes
	Basin aeration	No
	Relocation of CSOs	Yes
	Floatables Boom	Yes
	Forced flushing	No
Programmatic Controls	Zoning and land use	No
	Street sweeping	No
	Sewer flushing for ‘first flush’	No
	Catch Basin Cleaning	No
	Porous Pavement	No
	Construction Site Runoff	No
	Water Conservation	No
End-of-Pipe Treatment	Maximize Treatment Plant Capacity	Yes
	Disinfection only	Yes
	Physical Treatment	Yes
	Biological Treatment	No

This preliminary screening analysis focused on necessary system improvements. In addition, the preliminary screening reduced the number of viable alternatives considerably.

Those alternatives that were not addressed in detail were generally dismissed based on a combination of cost and control limitations. In general, reasonable changes to land use, land use restrictions, and watershed best management practices (BMPs) were not expected to result in substantial pollutant discharge reduction within a timeframe suitable for facility planning. The results of the water quality monitoring program showed elevated coliform levels in Coney Island Creek during both dry and wet weather conditions. Elevated coliform levels were also found in the storm sewer discharges, indicating illegal sanitary connections to the storm sewers.

Large diurnal variations in dissolved oxygen within the Creek were also observed. These diurnal variations were noted to occur in response to phytoplankton blooms and their associated photosynthetic processes. The dominant influence on the dissolved oxygen balance in the Creek, under previous conditions, appeared to be phytoplankton activity, making it difficult to discern the direct impact of storm-and CSO related discharges. Since the impacts of the CSO discharges on dissolved oxygen levels in Coney Island Creek were masked by this phytoplankton activity as well as the illegal sanitary connections, it was not possible at that time to reliably project water quality benefits associated with CSO control. If phytoplankton growth continued after the illegal sanitary connections were eliminated, insignificant benefits of CSO control were anticipated and the photosynthesis and respiration of phytoplankton would still dominate the oxygen balance. If the phytoplankton influence were reduced completely, some benefits of CSO control may have been recognized.

These complications made the assessment of a CSO control plan difficult since water quality benefits could not be forecast with a high degree of certainty. As an alternative, CSO controls were screened with respect to their ability to reduce the volume and frequency of CSO overflow to the Creek. CSO control alternatives retained from the preliminary screening process were considered further under a secondary screening process. The one CSO control alternative that appeared to be the most favorable was the removal of CSO from the Creek in association with some existing infrastructure improvements. During CSO facility planning, it was recognized that the Avenue V Pumping Station, a 30 MGD pump station, needed rehabilitation. The most cost effective way to reduce CSOs to the Creek was found to be to fold in the CSO reduction plan into the Pumping Station rehabilitation plan. As such, it was decided that the Pumping Station capacity would be increased from 30 MGD to 80 MGD and additional force main conveyance would be provided to remove the additional wet weather flow from the creek watershed.

Thus, the 1998 Coney Island Creek Facility Plan first recommended removing all illegal sanitary connections and removing between 85 and 90 percent of the CSO by volume of the CSO from the Creek. To do this, the design basis for expanding the Avenue V Pumping Station flow conveyance capacity was increased to 80 MGD. The 1998 Coney Island Creek CSO Facility Plan was modified in 2003 (Hazen and Sawyer, 2003) to include a post-construction water quality monitoring program that would be conducted upon completion of the Avenue V Pumping Station upgrade. The new water quality data would be analyzed with the water quality model of Coney Island Creek to determine if other CSO control measures were necessary.

7.2 HISTORICAL DEVELOPMENT OF THE CONEY ISLAND CREEK CSO FACILITY PLAN

Section 5.7 described the 1998 CSO Facility Planning Project initiated by NYCDEP to determine the best alternative solutions for controlling CSO discharges to Coney Island Creek, which targeted sewer system components within the associated watershed and water quality improvement measures for the waterbody. As summarized above in Section 7.1, the goal of the 1998 Coney Island Creek CSO Facility Plan was to develop a cost-effective and environmentally sound plan to improve the water quality of Coney Island Creek. Specifically, the plan focused on (1) evaluation of water quality in comparison to State water quality standards; (2) implementation of the nine minimum controls as per USEPA's CSO Control Policy; and (3) identification of required CSO control systems, and recommendations for implementation to meet State water quality standards and address the USEPA's CSO Control Policy.

Field investigations and a review of existing information were conducted to assess existing conditions in the sewer system and receiving waters of the study area. Inspections and surveys were conducted to confirm the physical configuration and operating characteristics of the combined sewer system, to establish baseline water quality data and to determine the system response to storm events.

Results of the field investigation program and the water quality model developed in conjunction with this project indicated that the occurrence of illegal sanitary connections to storm sewers that negatively impact the waters of Coney Island Creek (Hazen and Sawyer, 1998b). Elevated levels of coliform bacteria were found in the storm sewer discharges in the study area, indicating the presence of illegal sanitary connections to the storm sewers. These illegal sanitary connections to storm sewers and combined sewers from the Avenue V Pumping Station caused the elevated levels of coliform bacteria observed in Coney Island Creek during both dry and wet weather conditions.

The illegal sanitary connections were suspected of also significantly contributing to phytoplankton blooms which occurred in Coney Island Creek through the addition of nutrients to the Creek waters. The phytoplankton blooms caused large diurnal fluctuations in dissolved oxygen (DO) levels in the Creek. The dominant influence on DO levels in Coney Island Creek appeared to be algal activity induced by the nutrient load associated with the illegal sanitary connections. Due to the Creek's limited flushing characteristics and pollutant loads from illegal sanitary connections, the impact of CSO’s in Coney Island Creek were not well-defined.

The 1998 Coney Island Creek CSO Facilities Planning Report (Hazen and Sawyer, 1998a) and later modified in 2003 (Hazen and Sawyer, 2003) contained the following elements:

- Develop and execute a study to identify and quantify the sources of illegal sanitary connections and make recommendations for their removal.
- Eliminate all illegal sanitary connections identified.

- Maximize the existing system by increasing the wet weather flow conveyance capacity of the Avenue V Pumping Station and the associated force mains from 30 MGD to 80 MGD.

- Implementation of a post-construction ambient water quality monitoring plan after the Avenue V Pumping Station upgrade.

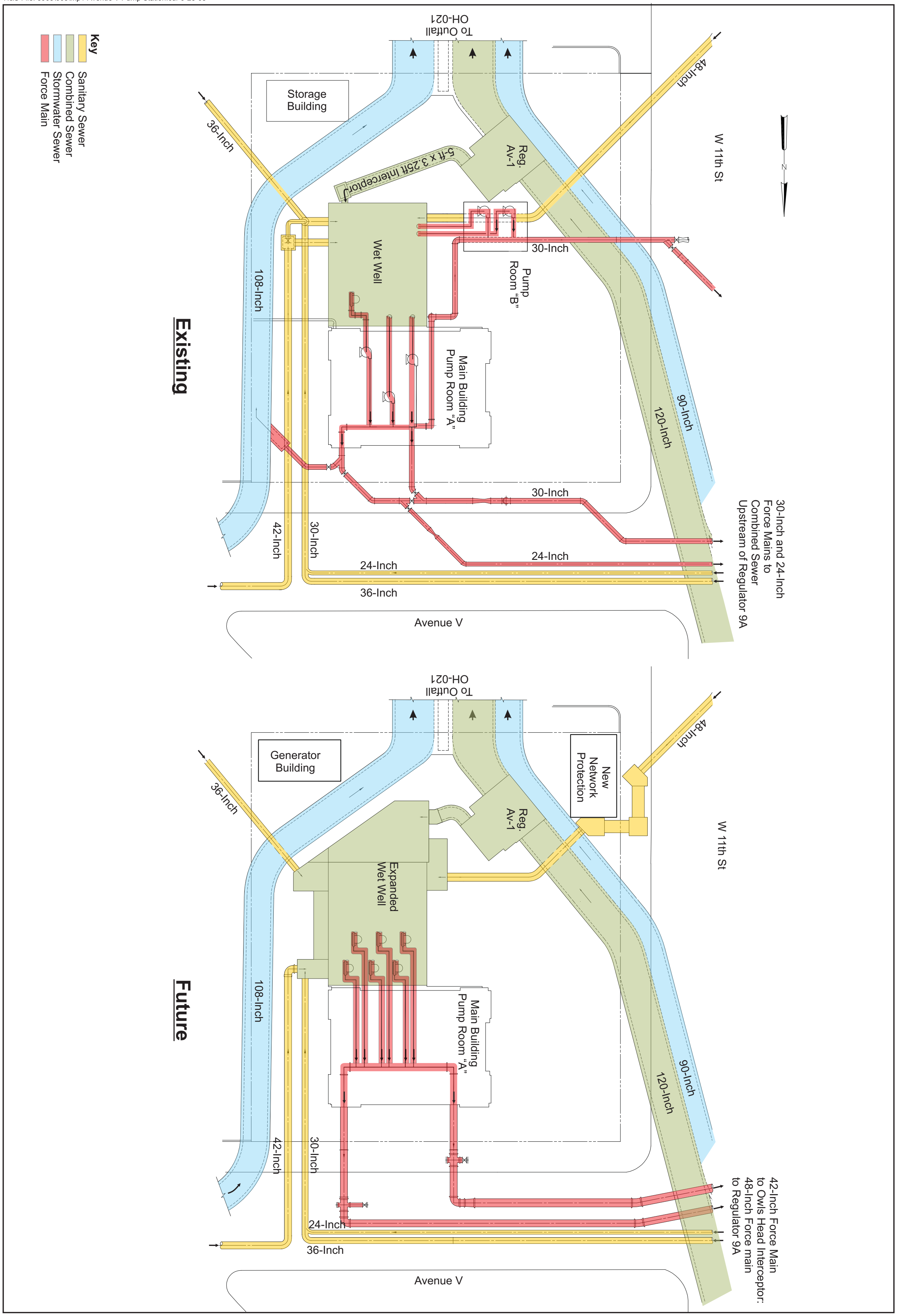
Table 7-2 summarizes the design flow basis for the upgrade of the Avenue V Pumping Station. The combined sewer flow component to the upgraded pumping station was estimated to be 42.0 MGD. This was determined based on a long-term rainfall capture simulation (20 years, 1964-1984) using a computer model developed under the Coney Island Creek CSO study. This peak CSO pumping rate was determined with the goal of reducing CSOs to the Creek by 85 to 90 percent. The design peak sanitary flow from the separately sewered portion of the pumping station was 34.6 MGD. Accordingly, the minimum required pumping station capacity was 76.6 MGD, and an 80 MGD station capacity was used for design purposes.

Various flow routing schemes to convey the flow from the Avenue V Pumping Station to the Owls Head WPCP were investigated. The conveyance capacity of the existing force mains was found to be limited. As part of the Avenue V Pumping Station rehabilitation and upgrade, the installation of new force mains is required to provide additional conveyance capacity. The Avenue V Pumping Station currently has the capacity to pump approximately 30 MGD of dry or wet weather flow, and the minimum flow rate is approximately 8 MGD. Two force mains, a 24-inch and a 30-inch, convey the pumped flow from the Avenue V Pumping Station to a 78-inch gravity sewer. Additional conveyance capacity was required to handle both dry and wet weather flow from the expanded Avenue V Pumping Station. Multiple force mains were planned to be provided to provide operationally flexibility and redundancy as part of the Pumping Station upgrade work. Approximately 18,300 linear feet of force main will be constructed to convey dry weather flow to the SE-133 Owls Head Interceptor and 13,100 linear feet of force main will be constructed to convey wet weather flow to Regulator 9A. Figures 7-1 and 7-2 show the Avenue V Pumping Station upgrade and new force mains.

Table 7-2. Design Flow Basis for the Upgrade of the Avenue V Pumping Station

Source	Dry Weather (MGD)		Wet Weather (MGD)
	Average	Peak	
Sanitary Sewers	19.2	34.6	34.6
Combined Sewers	7.6	13.7	42.0
Total	26.8	48.3	76.6*
***Use 80 MGD for design purposes**			

Following implementation of the plan, which included the elimination of illegal sanitary connections and the Pumping Station upgrade, additional water quality monitoring was planned. The modeling framework and the results of the additional water quality monitoring would be used to revise the water quality modeling projections to determine whether the implemented CSO abatement plan meets the designated water quality standards. Based on these revised water quality projections, additional CSO controls, if required, were planned to be implemented to provide the best practical solution to the water quality problems in Coney Island Creek.

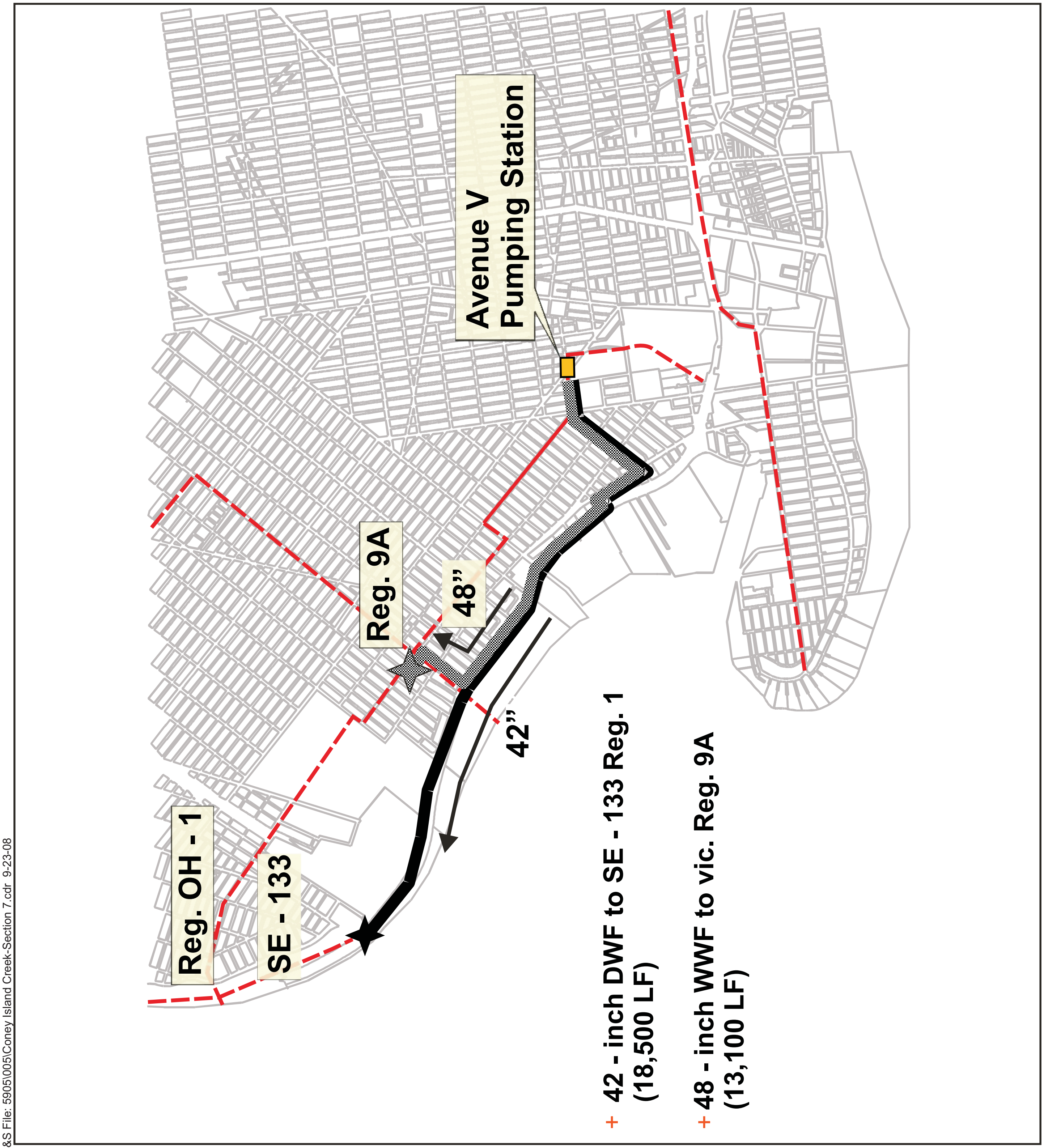


New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

Avenue V Pumping Station
Existing and Future Configurations

FIGURE 7-1



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New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

Avenue V Pumping Station Future Force Mains

FIGURE 7-2

Several elements of the 2003 Coney Island Creek CSO Facility Plan are currently active. The upgrade and rehabilitation of the Avenue V Pumping Station has begun and is anticipated to be completed in 2011. To date, the extension of the wet well in the Pumping Station has been completed and the temporary pumping system was successfully tested and is expected to be operational within 6 weeks. The architectural restoration of the main building is ongoing as well. Construction of the 48-inch and 42-inch force mains began in July 2007 and a completion date of 2012 is expected. To date, a combined 10,000 linear feet of the 48-inch and 42-inch force mains have been installed. The remaining force mains are staged for installation. Subsequent to the 1998 CSO Facility Planning efforts, NYCDEP removed numerous household connections from storm sewers that discharged to Coney Island Creek. Elimination of newly found illegal sanitary connections is being undertaken by NYCDEP's Compliance Monitoring Section based on field observations made in preparation of the Waterbody/Watershed Facility Plan. During 2005 and early 2006, they have identified households with improper sanitary connections to the storm sewer system on storm sewer lines CI-601, CI-664, and CI-665 (south side of Coney Island Creek between W. 28th and W. 15th Streets). The improper sanitary connections to these storm sewer lines have been abated. A list of the specific households identified with illegal sanitary connections to these storm sewers and their abatement status is provided in Appendix C.

7.3 ANALYSIS OF ADDITIONAL CSO CONTROL TECHNOLOGIES

A wide range of CSO control technologies was considered for application in Coney Island Creek. The technologies are grouped into the following general categories:

- Source Control;
- Inflow Control;
- Sewer System Optimization;
- Sewer Separation;
- Storage;
- Treatment; and
- Receiving Water Improvement.

Each technology is described below along with a discussion of the suitability of implementing it as a control technology for Coney Island Creek. Table 7-3 lists the various CSO control technologies typically included within each of the general categories. Information is provided regarding implementation and operational factors that should be considered when evaluating the control technologies for a given locale. The table also indicates the general effectiveness of each control technology for four performance criteria: CSO volume reduction, bacteria reduction, floatables capture, and suspended solids reduction. It should be noted that a technology receiving "low" or "none" for some performance parameters does not preclude that technology from being considered for Coney Island Creek. There are other areas where the control technology could be effective, such as improving dissolved oxygen in the waterbody or in conjunction with another control technology.

Table 7-3. Assessment of CSO Control Technologies

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume	Bacteria	Floatables	Suspended Solids	
Source Control (Section 7.3.1)					
Public Education	None	Low	Medium	Low	Cannot reduce the volume, frequency or duration of CSO overflows.
Street Sweeping	None	Low	Medium	Medium	Effective at floatables removal, cost-intensive O&M. Ineffective at reducing CSO volume, bacteria and very fine particulate pollution.
Construction Site Erosion Control	None	Low	Low	Medium	Reduces sewer sediment loading, enforcement required. Contractor pays for controls.
Catch Basin Cleaning	None	Low	Medium	Low	Labor intensive, requires specialized equipment.
Industrial Pretreatment	Low	Low	Low	Low	There is limited industrial activity in this sewer area.
Inflow Control (Section 7.3.2)					
Storm Water Detention	Medium	Medium	Medium	Medium	Requires large area in congested urban environment, potential siting difficulties and public opposition, construction would be disruptive to affected areas, increased O&M.
Street Storage of Storm Water	Medium	Medium	Medium	Medium	Potential flooding and freezing problems, public opposition, low operational cost.
Water Conservation	Low	Low	Low	Low	Potentially reduces dry weather flow making room for CSO, ancillary benefit is reduced water consumption
Inflow/Infiltration Control	Low	Low	Low	Low	Infiltration usually lower volume than inflow, infiltration can be difficult to control
Green Solutions	Low	Medium	Low	Medium	Site specific, requires widespread application across city to be effective, potential to be cost intensive in some areas.
Sewer System Optimization (Section 7.3.3)					
Optimize Existing System	Medium	Medium	Medium	Medium	Low cost relative to large scale structural BMPs, limited by existing system volume and dry weather flow dam elevations.
Real Time Control	Medium	Medium	Medium	Medium	Highly automated system, increased O&M, increased potential for sewer backups.
Sewer Separation (Section 7.3.4)					
Complete Separation	High	Medium	Low	Low	Disruptive to affected areas, cost intensive, potential for increased stormwater pollutant loads, requires homeowner participation.
Partial Separation	High	Medium	Low	Low	Disruptive to affected areas, cost intensive, potential for increased stormwater pollutant loads.
Rain Leader Disconnection	Medium	Medium	Low	Low	Low cost, requires home and business owner participation, potential for increased storm water pollutant loads.
Storage (Section 7.3.5)					
Closed Concrete Tanks	High	High	High	High	Requires large space, disruptive to affected area, cost intensive, aesthetically acceptable.

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume	Bacteria	Floatables	Suspended Solids	
Storage Pipelines/Conduits	High	High	High	High	Disruptive to affected areas, potentially expensive in congested urban areas, aesthetically acceptable, provides storage and conveyance.
Tunnels	High	High	High	High	Non-disruptive, requires little area at ground level, capital intensive, provides storage and conveyance, pump station required to lift stored flow out of tunnel.
Treatment (Section 7.3.6)					
Screening/Netting Systems	None	None	High	None	Controls only floatables.
Primary Sedimentation[1]	Low	Medium	High	Medium	Limited space at WPCP, difficult to site in urban areas.
Vortex Separator (includes Swirl Concentrators)	None	Low	High	Low	Variable pollutant removal performance. Depending on available head, may require foul sewer flows to be pumped to the WPCP and other flow controls, increased O&M costs.
High-Rate Physical-Chemical Treatment[1]	None	Medium	High	High	Limited space at WPCP, requires construction of extensive new conveyance conduits, high O&M costs.
Disinfection	None	High	None	None	Cost Intensive/Increased O&M.
Expansion of WPCP	High	High	High	High	Limited by space at WPCP, increased O&M.
Receiving Water Improvement (Section 7.3.7)					
Outfall Relocation	High	High	High	High	Relocates discharge to different area, requires the construction of extensive new conveyance conduits.
In-stream Aeration	None	None	None	None	High O&M, only effective for increasing DO, limited effective area, may require dredging.
Maintenance Dredging	None	None	None	None	Removes deposited solids after build-up occurs.
Solids and Floatables Controls (Section 7.3.8)					
Netting Systems	None	None	High	None	Easy to implement, potential negative aesthetic impact.
Containment Booms	None	None	High	None	Simple to install, difficult to clean, negative aesthetic impact.
Skimming Vessels	None	None	High	None	Easy to implement but limited to navigable waters.
Manual Bar Screens	None	None	High	None	Prone to clogging, requires manual maintenance.
Weir Mounted Screens	None	None	High	None	Relatively low maintenance, requires suitable physical configuration, must bring power to site.
Fixed baffles	None	None	High	None	Low maintenance, easy to install, requires proper hydraulic configuration.
Floating Baffles	None	None	High	None	Moving parts make them susceptible to failure.
Catch Basin Modifications/Hooding	None	None	High	None	Requires suitable catch basin configuration and increases maintenance efforts.

7.3.1 Source Control

To control pollutants at their source, management practices can be applied where pollutants accumulate. Source management practices are described below:

Public Education

Public education programs can be aimed at reducing (1) littering by the public and the potential for litter to be discharged to receiving waters during CSO events and (2) illegal dumping of contaminants in the sewer system that could be discharged to receiving waters during rain events. Public education programs cannot reduce the volume, frequency or duration of CSO overflows, but can help improve CSO quality by reducing floatable debris in particular. Public education and information is an integral part of any LTCP. Public Education is also an ongoing activity within NYCDEP as described in its April 2005 report *New York City Floatable Litter Reduction: Institutional, Regulatory and Public Education Programs*.

Street Sweeping

The major objectives of municipal street cleaning are to enhance the aesthetic appearance of streets and to prevent pollutants such as litter, debris, dust and dirt, from entering storm or combined sewers. Common methods of street cleaning are manual, mechanical and vacuum sweepers, and street flushing. Studies on the effect of street sweeping on the reduction of floatables and pollutants in runoff have been conducted. New York City found that street cleaning can be effective in removing floatables (HydroQual, 1995). The Department of Sanitation of New York City employs a regular street sweeping program and an aggressive enforcement program targeting property owners to minimize the amount of litter on their sidewalks. These programs are described in New York City's City-Wide Comprehensive CSO Floatables Plan (HydroQual, 2005b).

Studies, funded by the National Urban Renewal Program (NURP) during the late 1970s to the early 1980s, reported that street sweeping was generally ineffective at removing pollutants and improving the quality of urban runoff (MWCOG, 1983 and USEPA, 1983). The principal reason cited was that mechanical sweepers employed at the time could not capture the finer particles (diameter < 60 microns), which studies have shown contain a majority of the target pollutants on city streets that are washed into sewer systems. In the early 1990s vacuum-assisted sweeper technology was introduced that can pick up particles less than 60 microns with a 70 percent efficiency (Sutherland, 1995).

Street sweeping only affects the pollutant concentration in the runoff component of combined sewer flows. Thus, a street sweeping program is ineffective at reducing the volume and frequency of CSO events. Furthermore, the total area accessible to sweepers is limited. Areas such as sidewalks, traffic islands, and congested street parking areas cannot be cleaned using this method. Although a street sweeping program employing high efficiency sweepers could reduce the concentrations of some pollutants in CSOs, bacteriological pollution originates primarily from the sanitary component of sewer flows. Thus, minimal reductions in pathogen concentrations in CSO would be expected.

Construction Site Erosion Control

Construction site erosion control involves management practices aimed at controlling the washing of sediment and silt from disturbed land associated with construction activity. Erosion control has the potential to reduce solids concentrations in CSOs and reduce sewer cleanout operation and maintenance costs.

Catch Basin Cleaning

The major objective of catch basin cleaning is to reduce conveyance of solids and floatables to the combined sewer system by regularly removing accumulated catch basin deposits. Methods to clean catch basins include manual, bucket, and vacuum removal. Cleaning catch basins can only remove an average of 1-2 percent of the BOD5 produced by a combined sewer watershed (USEPA, 1977). As a result catch basins cannot be considered an effective pollution control alternative for BOD removal.

New York City has an aggressive catch basin hooding program to contain floatables within catch basins and remove the material through catch basin cleaning (City-Wide Comprehensive CSO Floatables Plan, Modified Facility Planning Report, City of New York, Department of Environmental Protection, July 2005). While catch basins can be effective in reducing floatables in combined sewers, catch basin cleaning does not necessarily increase floatables retention in the catch basin. Results of a pilot scale study showed that floatables capture improves as material accumulates in the catch basin (HydroQual, 2001f). During a rain event, the accumulated floatables can dissipate the hydraulic load entering a catch basin, thereby reducing turbulence in the standing water and reducing the escape of floatables. Thus, while hooding of catch basins will improve floatables capture, the hooding program is not expected to results in a major increase in catch basin cleaning.

Industrial Pretreatment

Industrial pretreatment programs are geared toward reducing potential contaminants in CSO by controlling industrial discharges to the sewer system. NYCDEP has an industrial pretreatment program as described in Section 3.3.6.

Summary of Source Control Technologies

The City already has myriad source-control programs in place. Public education and dissemination of information are ongoing NYCDEP activities. The City's CEQR program addresses construction site erosion control. The City's City-Wide Comprehensive CSO Floatables Plan features both street sweeping and catch basin cleaning as source-control elements. Finally, the City's successful industrial pretreatment program has been in place since January 1987. Therefore, source controls are already being effectively implemented to a satisfactory level.

7.3.2 Inflow Control

Inflow control involves eliminating or retarding storm water inflow to the combined sewer system, lowering the magnitude of the peak flow through the system, and thereby reducing overflows. Methods for inflow control are described below:

Stormwater Detention

Stormwater detention utilizes a surface storage basin or facility to capture stormwater before it enters the combined sewer system. Typically, a flow restriction device is added to the catch basin to effectively block stormwater from entering the basin. The stormwater is then diverted along natural or man-made drainage routes to a surface storage basin or "pond-like" facility where evaporation and/or natural soil percolation eventually empties the basin. Such systems are applicable for smaller land areas, typically up to 75 acres, and are more suitable for non-urban areas. Such a system is not considered viable for a highly congested urban area such as New York City. Stormwater blocked from entering catch basins would be routed along streets to the detention pond which would be built in the urban environment. Extensive public education and testing is required to build support for this control and to address public concerns such as potential unsafe travel conditions, flood damage, damage to roadways.

Street Storage of Stormwater

Street storage of stormwater utilizes the City's streets to temporarily store stormwater on the road surface. Typically, the catch basin is modified to include a flow restriction device that limits the rate at which surface runoff enters the combined sewer system. The excess stormwater is retained on the roadway, entering the catch basin at a controlled rate. Street storage can effectively reduce inflow during peak periods and can decrease CSO volume. It also can promote street flooding and must be carefully evaluated and planned to ensure that unsafe travel conditions and damage to roadways do not occur. Such a system is not considered viable for a highly congested urban area such as New York City. Stormwater blocked from entering catch basins would be routed along streets to the detention pond which would be built in the urban environment. Extensive public education and testing is required to build support for this control and to address public concerns such as potential unsafe travel conditions, flood damage, damage to roadways.

Water Conservation, Infiltration/Inflow (I/I) Reduction

Water conservation and infiltration control are both geared toward reducing the dry weather flow in the system, thereby allowing the system to accommodate more CSO. Water conservation includes measures such as installing low flow fixtures, public education to reduce wasted water, leak detection and correction, and other programs. The City of New York has an on-going water conservation and public education program. The NYCDEP's ongoing efforts to save water include: installing home meters to encourage conservation; use of sonar equipment to survey all water piping for leaks; replacement of approximately 70 miles of old water supply pipe a year; and equipping fire hydrants with special locking devices. These programs in conjunction with other on-going water conservation programs have resulted in the reduction of city-wide water consumption by approximately 230 million gallons per day over a 10 year period or a reduction of 43 gallons per person per day from 1996 to 2006 (NYCDEP, 2007). This change equates to a 17.5 percent decrease in overall daily water consumption, even as the population increased by roughly 9 percent. The water consumption on a daily per capita basis decreased by 24.5 percent. Water conservation, as a CSO control technology, is effectively implemented to a satisfactory level.

Infiltration is ground water that enters the collection system through leaking pipe joints, cracked pipes, manholes, and other similar sources. Excessive amounts of infiltration can take up hydraulic capacity in the collection system. In contrast, inflow in the form of surface drainage is intended to enter the CSS. For combined sewer communities, sources of inflow that might be controlled include leaking or missing tide gates and inflow in the separate sanitary system located upstream of the CSS. New York City has achieved significant reductions in wastewater flow through its existing water conservation program. This control technology, then, is eliminated from further consideration for actions to be taken within this WB/WS Plan, however, DEP will through other in-house programs continue to evaluate opportunities to reduce sanitary flows from domestic sewage.

Green Solutions/Low Impact Development

For the purposes of this WB/WSFP, "green solutions" encompasses a range of techniques that includes stormwater best management practices (BMPs) and low impact development (LID). The goal of green solutions is to mimic predevelopment site hydrology to capture, infiltrate, evaporate, and detain runoff to reduce both the volume of stormwater generated by a site and its peak overflow rate, thereby improving the quality of the stormwater. Green solutions are promising, and their potential benefits extend beyond stormwater management to include habitat restoration, heat island mitigation, and urban aesthetics.

Data are available to assess the cost and benefits of green solutions to undeveloped sites. However, few studies have been conducted for applying green solutions to urban areas such as New York City, where high-density development, existing infrastructure, and land acquisition issues tend to counterbalance the environmental benefits of implementation. In addition, input and acceptance by numerous City agencies will be necessary, including the Department of Parks and Recreation, the Department of Transportation, and the Department of Buildings.

Common green solutions are described below:

- Bioretention (rain garden) – a planting bed or landscaped area used to hold runoff and to allow it to infiltrate.
- Filter Strips – a band of vegetation located between the runoff location and the receiving channel or waterbody. Overland flow over the filter strip allows infiltration and filtering of storm water.
- Vegetated Buffers – a strip of vegetation around such areas as water bodies to provide a means to rain to infiltrate into the soil. This slows and disperses storm water and allows some trapping of sediment.
- Grassed Swales – depressions designed to collect, treat, and retain runoff from a storm event. Swales can be designed to be dry or wet (with standing water) between rain events. Wet swales typically contain water tolerant vegetation and use natural processes to remove pollutants.

- Rain Barrels – a barrel placed at the end of a roof downspout to capture and hold runoff from roofs. The water in the barrel must be manually emptied onto the ground, or it can be put to beneficial use to water vegetation. The barrel top typically has a completely sealed lid and a downspout diverter to direct overflow back to the roof leader.

- Cisterns – an oversized or underground tank that stores rain water from roofs for non-potable reuse.

- Subsurface Open Bottom Detention Systems – an excavated trench backfilled with stone, perforated pipes or manufactured storm chambers to create a subsurface basin or trench that provides storage for water, allows stormwater to infiltrate, and releases water to the sewer system at a controlled rate.

- Blue Roofs – the practice of constructing rooftop detention to temporarily store and gradually drain rainwater off a building's rooftop via a controlled flow roof drain.

- Rooftop Green Roofs – the practice of constructing pre-cultivated vegetation mats on rooftops to capture rainfall, thereby reducing runoff and CSO.

- Increased Tree Cover – planting trees in the City to capture a portion of rainfall.

- Permeable Pavements – a type of surface material that reduces runoff by allowing precipitation to infiltrate through the paving material and into the earth.

Green solutions are distributive in nature (i.e., constructed within individual properties or in right-of-ways). The time necessary for enough of these source control measures to be in place and to have a substantial impact on stormwater inflows to the combined sewers is significantly longer than implementing more traditional CSO abatement approaches. In urban areas, it is not reasonable to demolish existing development or infrastructure just for the purpose of green solutions alone. It is generally accepted that green solutions are reasonable to apply with new development or construction within an urban area. Trenches excavated for street and sidewalk construction allow substantial BMP construction cost savings and municipal codes or rules for new development allow green solutions to be incorporated as part of site plans and building design and minimize potential economic hardship for property owners. In the case of existing development, significant participation and cooperation of business and private property owners as well as additional evaluations are necessary.

NYCDEP and other agencies, as described in the Mayor's Sustainable Stormwater Management Plan, will be conducting a number of pilot studies to assess the effectiveness of BMPs in New York City's urban environment. While there are numerous published studies about stormwater BMPs from other municipalities, various public agencies, and environmental organizations, there is a critical data gap of specific information related to the effectiveness and appropriateness of the use of these technologies within New York City.

The pilot projects will start to fill that data gap by conducting multi-year studies to implement and monitor innovative stormwater treatment and volume reduction BMP technologies. The pilot projects will include the design, construction and monitoring of various BMPs to reduce runoff and associated stormwater pollutant loadings into the City's combined and storm sewers. Runoff will be directed into swales, wetlands, and BMPs rather than to combined and storm sewers discharging to waterbodies. As part of the pilot studies, stormwater capture volume and pollutant removal rates of each of the technologies will be documented. Once these technologies are proven to be effective, a wider citywide application of these technologies would be evaluated. See Section 5.10 for more detailed information about current NYCDEP pilot projects and evaluations of green solutions.

The anticipated environmental benefits of identifying Green Site Design (GSD) or BMPs for use in New York City can be grouped into three categories. The first category relates to the capture of the "first flush" of stormwater that contains the highest concentration of nitrogen, other nutrients and urban pollutants and reduce these discharges to the City's sewer system and surrounding waterbodies. The second category relates to reducing the volume of stormwater entering the combined sewer system. A reduction in the volume of stormwater entering the combined sewer system will also increase the ability of the City's WPCPs to properly treat a greater volume of sanitary wastewater and reduce the volume of sanitary wastewater discharged in CSOs. The third category relates to returning stormwater to the landscape and subsurface environments in order to benefit ecological communities and provide opportunities for open space.

The timeline for the study and evaluation of the green solutions further described in Section 5.10 will extend beyond the Consent Order milestones for delivery of approvable Waterbody/Watershed Facility Plans to NYSDEC; as a result, further evaluation of Source or Inflow Controls in the Coney Island Creek Waterbody/Watershed Facility Plan is not possible. However, green solutions will continue to undergo the rigorous level of evaluation necessary for programmatic implementation by the City of New York through parallel planning efforts as described in detail in Section 5. NYCDEP will provide updates on these evaluations and will incorporate the most promising technologies into the CSO program where possible, cost-effective, and environmentally beneficial. Any solution satisfying these criteria would be included through a future modification when the WB/WS Plan is converted to a Drainage Basin Specific Long Term Control Plan, a 5-year update of a Drainage Basin Specific Long Term Control Plan or in the subsequent City-Wide Long Term Control Plan.

Summary of Inflow Control Technologies

Stormwater storage and detention are not viable options for the City of New York because of its highly urbanized character and the need for conveyance infrastructure for diverting stormwater from the combined sewers to the detention site. Further, any aboveground infrastructure would introduce public safety concerns associated with flooding, traffic, and standing water health issues. In contrast, the remaining inflow control technologies have been successfully implemented by the City of New York. As noted above, green solutions will continue to undergo the rigorous level of evaluation necessary for programmatic implementation by the City of New York through parallel planning efforts. The NYCDEP's ongoing efforts in water conservation include home metering, sonar leak detection surveys, annual replacement of approximately 70 miles of old water supply piping, locking fire hydrants, and an ongoing public education program that have collectively resulted in the reduction of water consumption by approximately 200 MGD over a 12-year period. Based on the fact that these technologies are either infeasible or have been implemented to a satisfactory degree, inflow control is not retained for further consideration in Coney Island Creek.

7.3.3 Sewer System Optimization

This CSO control technology involves making the best use of existing facilities to limit overflows. The techniques are described below:

Optimize Existing System

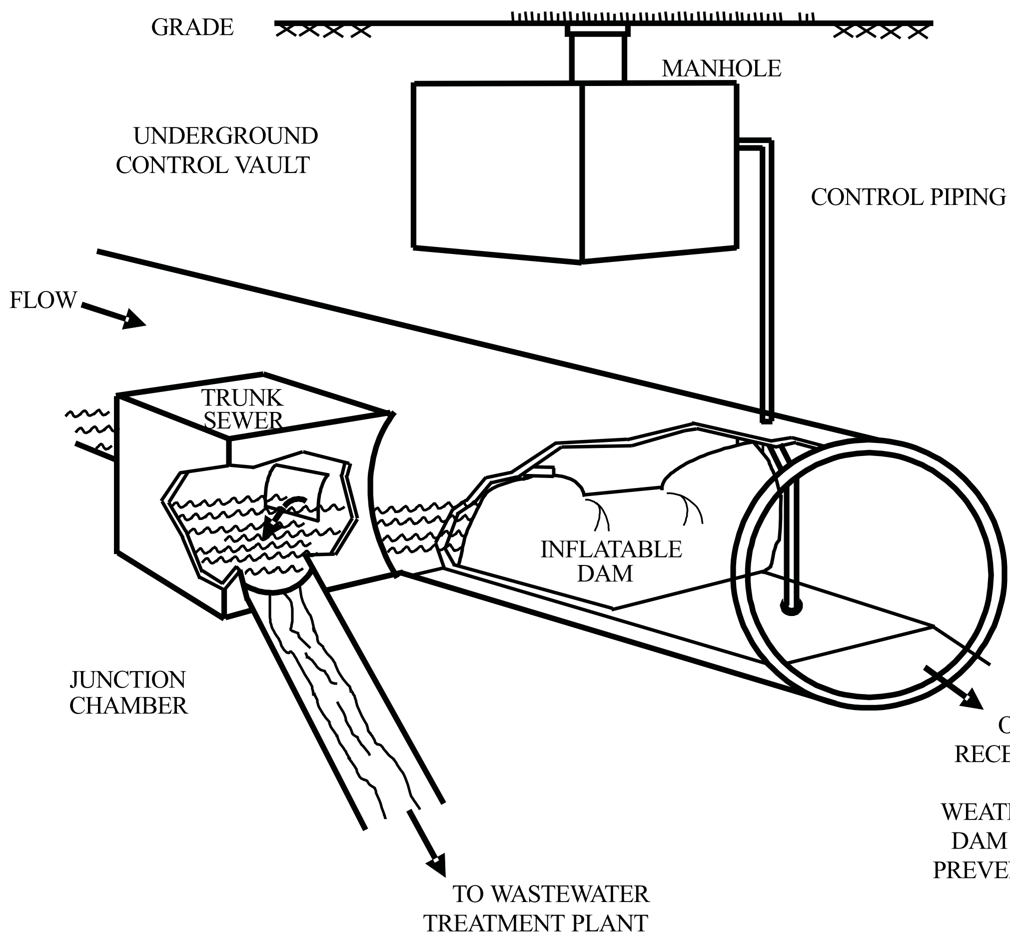
This approach involves evaluating the current standard operating procedures for facilities such as pump stations, control gates, inflatable dams, and treatment facilities to determine if improved operating procedures can be developed to provide benefit in terms of CSO control. As described in Section 5, previous and ongoing NYCDEP projects routinely consider alternatives to operating procedures to optimize the existing system. The operating procedures are satisfactorily implemented under the existing system. Elevated static weir heights, opportunities for inflatable dams and/or control gates, and similar alternatives have been eliminated from further consideration in light of the unacceptably high risk that these alternatives would pose to flooding in the community. However, as the Avenue V Pumping Station upgrades are implemented and the existing system changes, NYCDEP will continue to look for new opportunities to optimize the system.

Real Time Control (RTC)

RTC is any control response (manual or automatic) to changing sewer system conditions as they are occurring. For example, sewer level and flow data can be measured in real-time at key points in the sewer system and transferred to a control device such as a central computer where decisions are made to operate control components (such as gates, pump stations or inflatable dams) to maximize use of the existing sewer system and to limit overflows. Data monitoring need not be centralized: local dynamic controls can be used to control regulators to prevent localized flooding. However, system-wide dynamic controls are typically used to implement control objectives such as maximizing flow to the WPCP or transferring flows from one portion of the CSS to another to fully utilize the system. Predictive control, which incorporates weather forecasting, is also possible, but is complex and requires sophisticated operational capabilities.

RTC can reduce CSO volumes where in-system storage capacity is available. In-system storage is a method of using excess sewer capacity by containing combined sewage within a sewer and releasing it to the WPCP after a storm event when capacity for treatment becomes available. Methods of equipping sewers for in-system storage include inflatable dams, mechanical gates and increased overflow weir elevations.

RTC is being developed in other cities such as Louisville, Kentucky; Cleveland, Ohio; and Quebec, Canada. Refer to Figure 7-3 for a diagram of an example inflatable dam system. New York City has conducted an extensive pilot study of the use of inflatable dams (O'Brien & Gere, 2004) within the City's combined sewers. This study included full-scale demonstration of



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Coney Island Creek Waterbody/Watershed Facility Plan

Inflatable Dam System

FIGURE 7-3

inflatable dams and RTC to control them at two locations (Metcalf Avenue and Lafayette Avenue) in the Bronx. The performance of these facilities demonstrated minimal effectiveness, and they are scheduled for removal. Widespread application of inflatable dams and RTC is limited in the New York City collection system because it does not provide for storage of large enough volumes of combined sewage in areas where it may be used to improve degraded water quality. In the case of the Coney Island Creek sewershed the only combined sewer tributary to the waterbody is already controlled by the operation of the Avenue V Pumping Station.

Summary of Sewer System Optimization Technologies

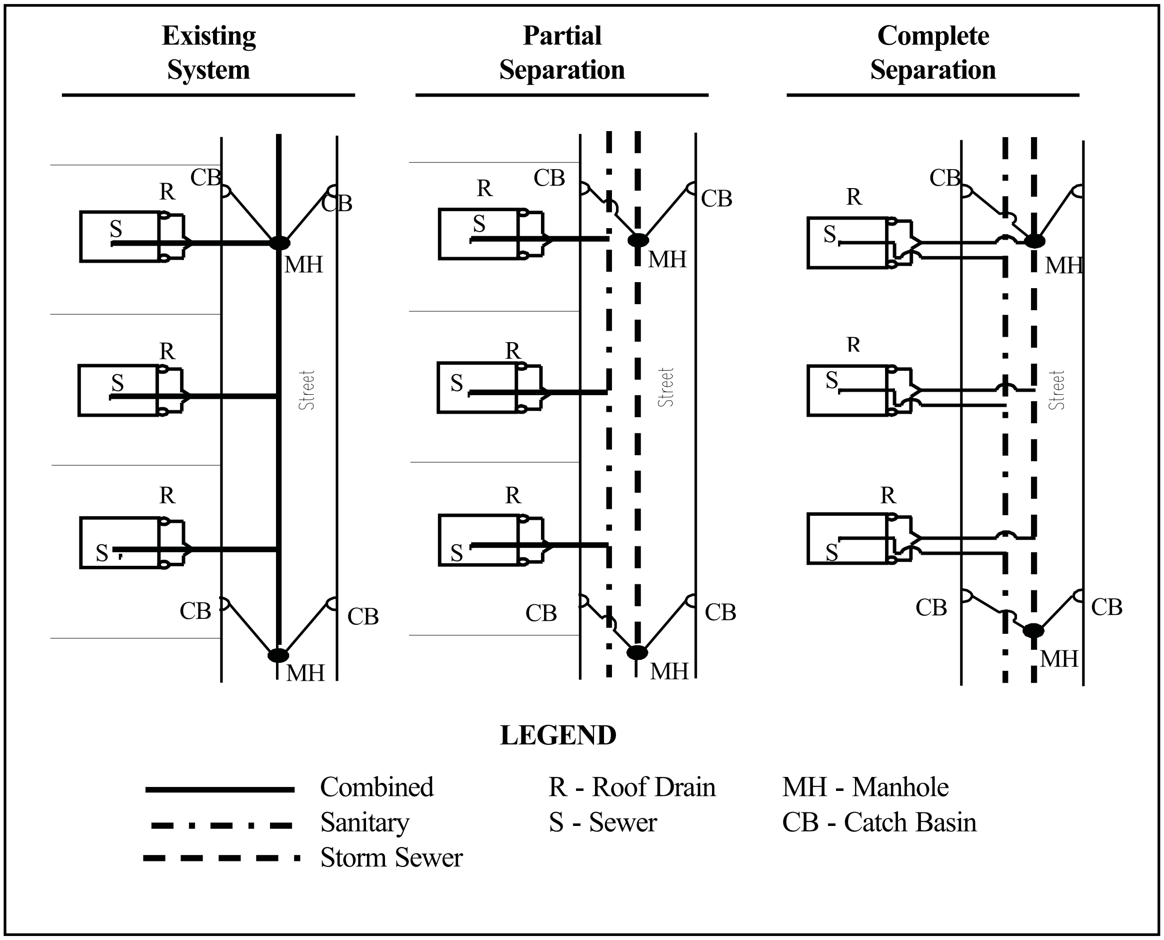
The only CSO outfall on Coney Island Creek (OH-021) is associated with the Avenue V Pumping Station, the operation of which will be real-time control of Regulator AV-1. During development of the Avenue V Pumping Station expansion, the size of the facility was optimized, i.e., capacity was expanded to the maximum extent possible given the space constraints and hydraulic limitations of the system. Thus, sewer system optimization is implemented to a satisfactory degree and is eliminated from further consideration.

7.3.4 Sewer Separation

Sewer separation is the conversion of a combined sewer system into a system of separate sanitary sewers and storm sewers. This alternative prevents sanitary wastewater from being discharged to receiving waters. However, when combined sewers are separated, storm sewer discharges to the receiving waters will increase since storm water will no longer be captured and treated in the combined sewer system. Loading of some pollutants, such as floatables, would increase with sewer separation because concentrations of these pollutants are higher in storm water than in sanitary sewage. In addition, this alternative involves substantial excavation that would exacerbate street disruption problems within the City.

Varying degrees of sewer separation could be achieved as illustrated in Figure 7-4. The simplest is to disconnect rain leaders from the combined sewer system and divert stormwater elsewhere, such as a dry well, vegetation bed, a lawn, a storm sewer or the street, depending on the locale. Partial separation can be accomplished by separating combined in the streets or other public rights-of-way only by constructing either a new sanitary wastewater system or a new stormwater system. Complete separation would require separation of sewers in the streets as well as stormwater runoff collection systems from private residences and other buildings.

Complete separation is almost impossible to attain in New York City since it requires re-plumbing of individual buildings where roof drains are interconnected to the sanitary plumbing inside the building, and requires the construction of a new conduit to convey stormwater to an appropriate end-use or destination. In urban areas, there is a substantial lack of pervious areas (lawns, rain gardens, etc.) to disperse the storm runoff into the ground, leading to nuisance flooding and wet foundations and basements. These risks have led to the City building code to prohibit stormwater disconnections from the combined sewer. In addition, the widespread excavation and lengthy timeframes to implement broadly across an urban area would lead unacceptable street disruptions, and may be infeasible in areas with dense buried infrastructure.



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Coney Island Creek Waterbody/Watershed Facility Plan

Sewer Separation Alternatives

FIGURE 7-4

In areas that are adjacent to a waterbody, many of the challenges can be accommodated through construction of high level storm sewers (HLSS), an approach that is featured in the New York City Mayor's PlaNYC 2030 initiative, and is being implemented by NYCDEP at select locations throughout the City, particularly those undergoing new development projects. NYCDEP will continue to promote and support opportunities for local partial separation through the construction of HLSS as new development continues into the future, but partial separation will not be retained as an alternative for the Coney Island Creek Waterbody/Watershed Facility Plan.

7.3.5 Storage

The objective of retention facilities (also referred to as off-line storage) is to reduce overflows by capturing combined sewage in excess of WPCP capacity during wet weather for controlled release into wastewater treatment facilities after the storm. Retention facilities can provide a relatively constant flow into the treatment plant and thus reduce the size of treatment facilities required.

Retention facilities have had considerable use, are well-documented, and may be located at overflow points or near dry weather or wet weather treatment facilities. A major factor determining the feasibility of using retention facilities is land availability. Operation and maintenance costs are generally small, typically requiring only collection and disposal cost for residual sludge solids, unless inlet or outlet pumping is required. Many demonstration projects have included storage of peak storm water flows, including those in Richmond (VA), Chippewa Falls (WI), Boston (MA), Milwaukee (WI), and Columbus (OH). The following subsections discuss the most common types of CSO retention facilities.

Closed Concrete Tanks

Closed concrete tanks are similar to open tanks except that the tanks are covered and include many mechanical facilities to minimize their aesthetic and environmental impact. Closed concrete tanks typically include odor control systems, washdown/solids removal systems, and access for cleaning and maintenance. Closed concrete tanks have been constructed below grade such that the overlying surface can be used for parks, playgrounds, parking or other light public uses.

Storage Pipelines/Conduits

Large diameter pipelines or conduits can provide significant storage in addition to the ability to convey flow. A pipeline is fitted with discharge control to allow flow to be stored within the pipeline during wet weather. After the rain event, the contents of the pipeline are allowed to flow by gravity along its length. A pipeline has the advantage of requiring a relatively small right-of-way for construction. The primary disadvantage is that the large diameter pipeline required to provide a volume adequate to accommodate large periodic CSO flows has a greater construction cost than a pipeline used only for conveyance. For large drainage areas, the pipeline size required may be so large that construction of a tunnel is more feasible.

Tunnels

Tunnels are similar to storage pipelines in that they can provide both significant storage volume and conveyance capacity. Tunnels have the advantage of causing minimal surface disruption and of requiring little right-of-way for construction. Excavation to construct the tunnel is carried out deep underground to minimize impacts to traffic and other surface activities. The ability to construct tunnels at a reasonable cost depends on local geology, but tunnels have been used in CSO control plans throughout the United States, including Chicago (IL), Rochester (NY), Cleveland (OH), and Richmond (VA), among others. A schematic diagram of a typical storage tunnel system is shown in Figure 7-5. Because storage tunnels are generally very deep, dewatering is almost always accomplished by a pump station that lifts flows for conveyance to the WPCP.

Summary of Storage Technologies

CSO retention facilities have been successfully utilized in various locations, including New York City. In light of their operational history, each of the three retention facility types listed above will be retained for further consideration.

7.3.6 Treatment

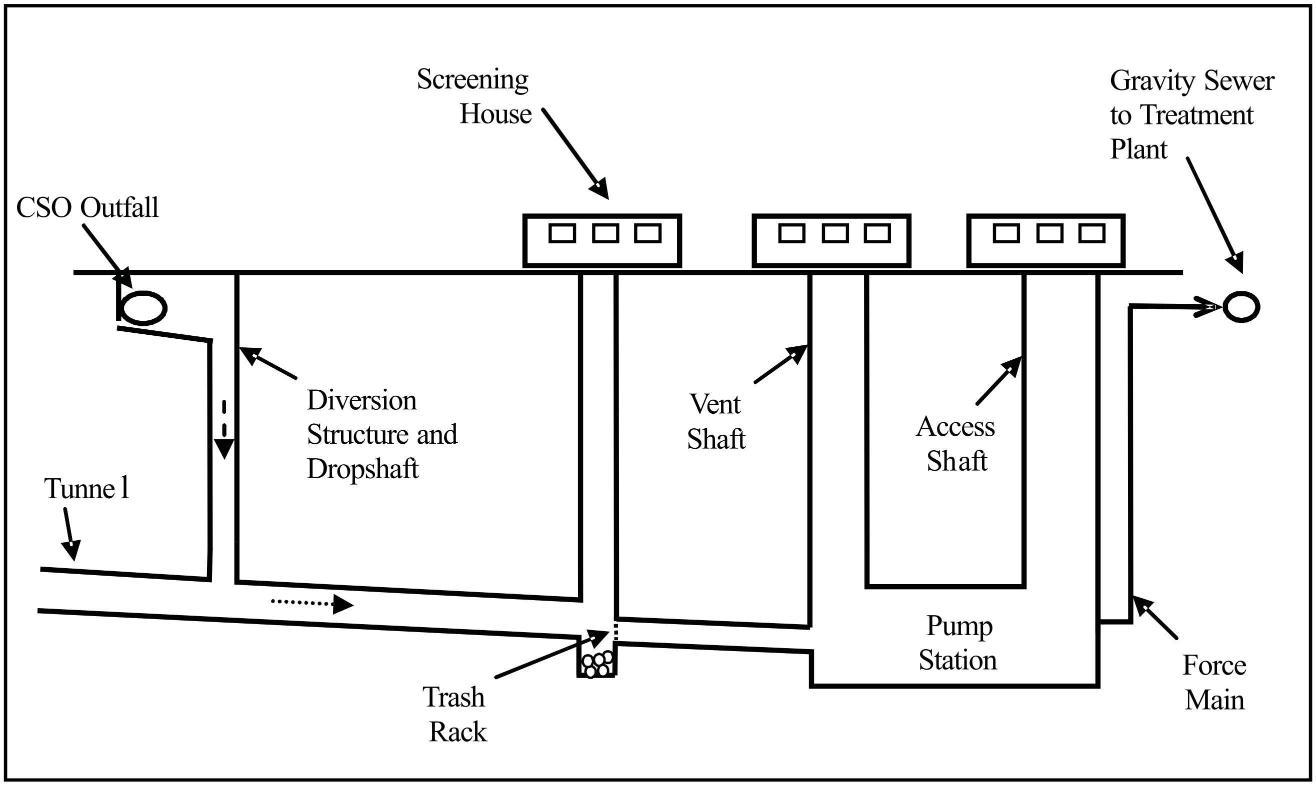
Treatment alternatives include technologies intended to separate solids and/or floatables from the combined sewage flow, disinfect for pathogens treatment, or provide secondary treatment for some portion of the combined flow. The types of treatment technologies available are too numerous to detail, but include the following general types:

- Screening;
- Primary sedimentation;
- Vortex separation;
- High-rate physical-chemical treatment;
- Disinfection; and
- Expansion of WPCP treatment.

The City of New York has experience with each of these to varying degrees. Screening – The major objective of screening is to provide high rate solids/liquid separation for combined sewer floatables and debris thereby preventing floatables from entering receiving waters. The following categories of screens are applicable to CSO outfall applications.

Screening

Removal of solid material from a waste stream depends on the spacing or opening size of the screening barrier. Flow is passed through the openings and solids are retained on the surface. Screens can be in the shape of a rotary drum or linear horizontal or vertical screens. Trash racks generally capture larger particles, from 1.5 to 3.0 inches, while bar racks capture smaller objects (1.0 to 2.0 inches). Smaller particles (0.25 to 1.0 inches) require mechanically-cleaned bar screens with raking mechanisms mounted at an angle, or fine screens, which typically follow bar screens and have openings between 0.010 and 0.5 inches. Proprietary screens such as ROMAG



Storage Tunnel Schematic

FIGURE 7-5

have been specifically designed for wet weather applications, and can retain solids within the collection system for conveyance to the wastewater treatment plant with the sanitary wastewater, thereby minimizing manual operations. Floatable material can be effectively captured using end-of-pipe or in-line netting systems. Depending on the type of technology used, facilities may require a building to house the screens and store the retained screenings that must then be collected after each CSO event and transported to a landfill.

Manually cleaned screens for CSO control at remote locations have not been widely applied due to the need to clean screens, and the potential to cause flooding if screens blind. Mechanically cleaned screens have had much greater application at CSO facilities. Due to the widely varying nature of CSO flow rates, even mechanically cleaned screens are subject to blinding under certain conditions. In addition, the screening must be housed in a building to address aesthetic concerns and may require odor facilities as well. Fine screens have had more limited application for CSOs in the United States. ROMAG reports that over 250 fine screens have been installed in Europe and several screens have been installed in the United States (USEPA, 1999a).

Primary Sedimentation

The objective of sedimentation is to produce a clarified effluent by gravitational settling of the suspended particles that are heavier than water. It is one of the most common and well-established unit operations for wastewater treatment. Sedimentation tanks also provide storage capacity, and disinfection can occur concurrently in the same tank. It is also very adaptable to chemical additives, such as lime, alum, ferric chloride, and polymers, which provide higher suspended solids and BOD removal. Many CSO control demonstration projects have included sedimentation, including Dallas (TX), Saginaw (MI), and Mount Clements (MI) (USEPA, 1978). Studies on existing stormwater basins indicate suspended solids removals of 15 to 89 percent; BOD5 removals of 10 to 52 percent (USEPA, 1978; Fair and Geyer, 1965; Ferrara and Witkowski, 1983; Oliver and Gigoropolulos, 1981). The NYCDEP's WPCPs are designed to accept their respective 2xDDWF for primary treatment during wet weather events. As such, NYC already controls a significant portion of combined sewage through the use of this technology.

Vortex Separation

Vortex separation technologies operate of each unit and the mechanisms for solids separation are similar. Flow enters the unit tangentially and is directed around the perimeter of a cylinder, creating a swirling, vortex pattern. The swirling action causes solids to move to the outside wall and fall toward the bottom, where the solids concentrated flow is conveyed through a sewer line to the WPCP. The overflow is discharged over a weir at the top of the unit. Various baffle arrangements capture floatables that are subsequently carried out in the underflow. Principal attributes of the vortex separator are the ability to treat high flows in a very small footprint, and a lack of mechanical components and moving parts, thereby reducing operation and maintenance.

Vortex separators have been operated in a number of cities, including Decatur, Illinois; Columbus, Georgia; Syracuse, New York; West Roxbury, Massachusetts; Rochester, New York;

Lancaster, Pennsylvania; Indianapolis, Indiana; and Toronto, Ontario, Canada. Vortex separator prototypes have achieved suspended solids removals of 12 to 86 percent in Lancaster, Pennsylvania; 18 to 55 percent in Syracuse, New York; and 6 to 36 percent in West Roxbury, Massachusetts. BOD5 removals from 29 to 79 percent have been achieved with the swirl concentrator prototype in Syracuse New York (Alquier, 1982).

New York City evaluated the performance of three swirl/vortex technologies at a full scale test facility (133 MGD each) at the Corona Avenue Vortex Facility (Figure 7-6). The purpose of the test was to demonstrate the effectiveness of the vortex technology for control of CSO pollutants, primarily floatables, oil and grease, settleable solids and total suspended solids. The two-year testing program, initiated in late 1999, evaluated the floatables-removal performance of the facility for a total of 22 wet weather events. Overall, the results indicated that the vortex units provided an average floatables removal of approximately 60 percent during the tested events. Based on the results of the testing, NYCDEP concluded that widespread application of the vortex technology is not effective for control of settleable solids and was not a cost effective way to control floatables. As such, the application of this technology will be limited and other methods to control floatable discharges into receiving waters will need to be assessed. Also, the performance of vortex separators has been found to be inconsistent in other demonstrations. A pilot study in Richmond, Virginia showed that the performance of two vortex separators was irregular and ranged from <0 percent to 26 percent with an average removal efficiency of about 6 percent (Greeley and Hansen, 1995). The performance of vortex separators is also a strong function of influent TSS concentrations. A high average influent TSS concentration will yield a higher percent removal. As a result, if influent CSO is very dilute with stormwater, the overall TSS removal will be low. Suspended solids removal in the beginning of a storm may be better if there is a pronounced first flush period with high solids concentrations (City of Indianapolis, 1996). Removal effectiveness is also a function of the hydraulic loading rate with better performance observed at lower loading rates. Furthermore, one of the advantages of vortex separation - the lack of required moving parts - requires sufficient driving head.

Based on the poor results of the testing at the Corona Vortex Facility (NYCDEP, 2003a; HydroQual, 2005b), and the general lack of available head, vortex separators have been removed from further consideration in New York City.

High-Rate Physical-Chemical Treatment (HRPCT)

HRPCT is a traditional gravity settling process enhanced with flocculation and settling aids to increase loading rates and improve performance. In general, removal rates of 80 to 95 percent for TSS and 30 to 60 percent for BOD can be expected. The pretreatment requirements for high rate treatment are screening and degritting, identical to that required prior to primary sedimentation. The first stage of HRPCT is coagulant addition, where ferric chloride, alum or a similar coagulant is added and rapidly mixed into solution. Degritting may be incorporated into the coagulation stage with a larger tank designed for gravity settling of grit material. The coagulation stage is followed by a flocculation stage where polymer is added and mixed to form floc particles that will settle in the following stage. Also in this stage recycled sludge or micro sand from the settling stage is added back in to improve the flocculation process. Finally, the wastewater enters the gravity settling stage that is enhanced by lamella tubes or plates. Disinfection, which is not part of the HRPCT process, typically is completed after treatment to

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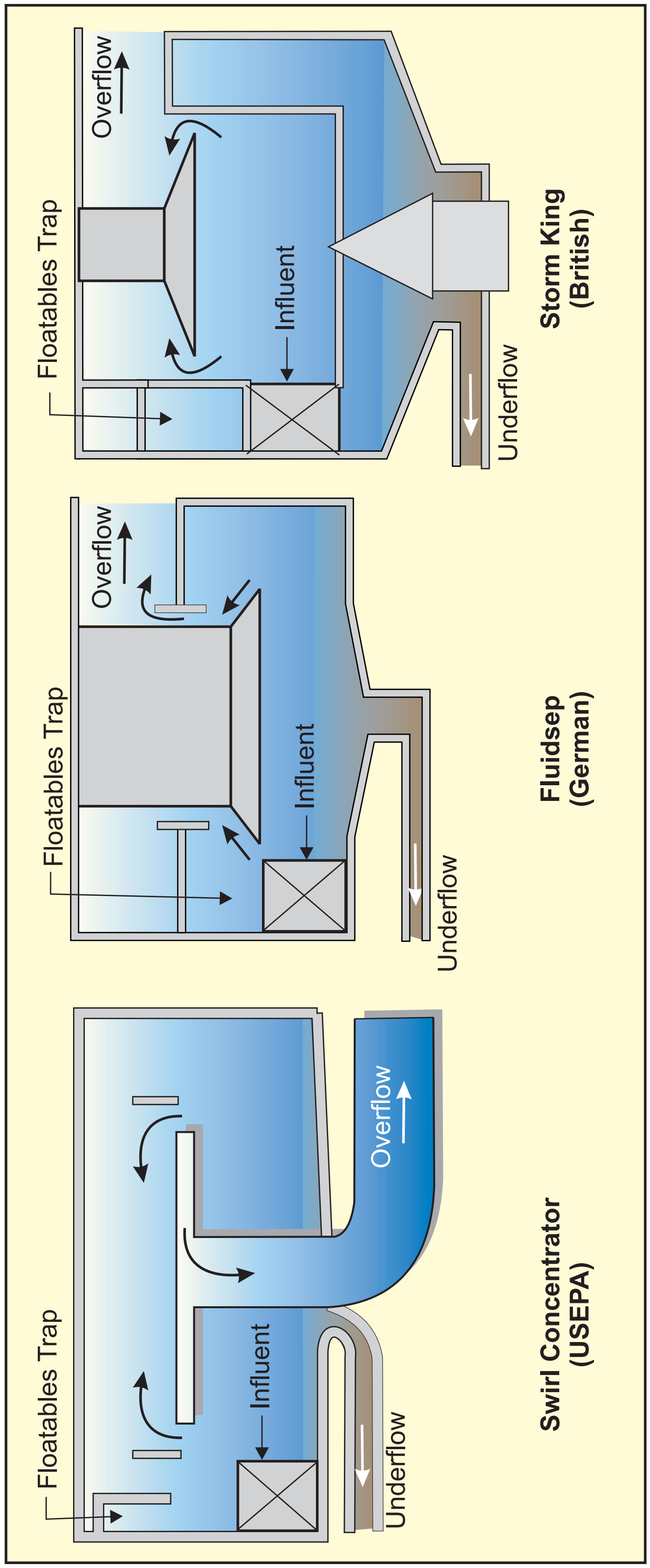

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Schematic Diagrams of the Three Vortex Technologies Tested at CAVF

FIGURE 7-6

the HRPCT effluent. Sludge is collected at the bottom of the clarifier and either pumped back to the flocculation stage or wasted periodically when sludge blanket depths become too high.

Pilot testing of HRPCT was performed by NYCDEP at the 26th Ward WPCP in Brooklyn from May through August 1999, and consisted of evaluating equipment from three leading manufacturers: the Ballasted Floc Reactor from Microsep/US Filter, the Actiflo from Kruger, and the Densadeg 4D from Infilco Degremont. Pilot testing suggested good to excellent performance on all units, often in excess of 80 percent for TSS and 50 percent for BOD5. However, operational challenges suggested the need for further testing, which was to be performed in a demonstration-scale facility to be located at the Port Richmond WPCP on Staten Island. Subsequent facility planning did not reveal any opportunities to apply this technology for CSO abatement in New York City, so the demonstration project was indefinitely postponed.

Disinfection

The major objective of disinfection is to control the discharge of pathogenic microorganisms in receiving waters. Disinfection of combined sewer overflow is included as part of many CSO treatment facilities, including those in Washington (DC), Boston, (MA), Rochester (NY), and Syracuse (NY). The disinfection methods considered for use in combined sewer overflow treatment are chlorine gas, calcium or sodium hypochlorite, chloride dioxide, peracetic acid, ozone, ultraviolet radiation, and electron beam irradiation (USEPA, 1999b and 1999c).

Three disinfection technologies (chlorine, ozone, and ultraviolet radiation) were preliminarily evaluated by NYCDEP for the Paerdegat Basin LTCP based upon technical feasibility, effectiveness, adverse side effects (e.g., residuals), and comparative cost (NYCDEP, 2005b). Chlorination was determined to be by far the least expensive of the three technologies, and to have the advantages of NYCDEP experience and greater application to CSO than the others on the scale necessary, and chlorine disinfection using sodium hypochlorite was considered the preferred option as a consequence. However, results of receiving water modeling indicated that chlorine residual concentrations in the head-end of Paerdegat Basin would exceed the acute standard routinely, and the spatial extent of the contravention would encompass a substantial portion of the entire waterbody, leading to a substantial impairment to the aquatic ecosystem for the marginal improvement in bacteria, sacrificing attainment of an existing use (fishing) for a non-existent one (swimming). Because of this risk and the operational challenges associated with the highly variable nature of CSO flows and water quality (i.e., chlorine demand), disinfection was precluded from further analysis for the Paerdegat Basin LTCP.

These findings were presumed to be applicable to Coney Island Creek as well because of the waterbodies' similar qualities (highly urbanized tributary, poor mixing dynamics). Further, where Paerdegat Basin disinfection could use existing facilities for contact basins, additional facilities would have to be constructed in Coney Island Creek for chlorine contact, and the cost-benefit analysis weighs against disinfection more than in the case of Paerdegat Basin as a consequence.

Expansion of WPCP Treatment

The NYCDEP developed a WWOP for the Owls Head WPCP (see Appendix A) per NYSDEC requirements, which provided recommendations for maximizing treatment of flow during wet weather events. The most recent version of the WWOP was submitted in December 2008, and was approved by NYSDEC in January 2009. The report outlined three primary objectives in maximizing treatment for wet-weather flows: (1) maximize plant wet-weather inflows to prevent overflows from the collection system regulators and provide primary treatment and disinfection to up to 2xDDWF; (2) provide secondary treatment for wet-weather flows up to 1.5xDDWF to maximize pollutant removal during wet-weather events; and (3) maintain reasonably high effluent quality during wet weather while allowing for a subsequent, stable recovery to dry-weather operations. With this WWOP implemented, NYCDEP is implementing this alternative to a satisfactory level. However, it may be possible to create additional wet weather capacity, or utilize existing WPCP tankage to reduce CSO discharges to Coney Island Creek.

Summary of Treatment Technologies

Primary sedimentation has been implemented by NYCDEP to a large degree at its WPCPs, which are designed to accept their respective 2xDDWF for primary treatment during wet weather events. Vortex separation was not successful based on the poor results of the testing at the Corona Vortex Facility. HRPCT was also pilot tested and, although promising, operational challenges and the indefinite postponement of the demonstration project render the technology untested to a satisfactory degree for New York City CSO applications. Disinfection was thoroughly evaluated for Paerdegat Basin facility planning and was eliminated form consideration there as well. The remaining technologies of this type are screening and WPCP expansion, which are retained for further consideration.

7.3.7 Receiving Water Improvement

Outfall Relocation

Outfall relocation involves moving the combined sewer outfall to another location or diverting flow from the outfall in question to another existing outfall. For example, an outfall may be relocated away from a sensitive area to prevent negative impacts to that area. In the case of Coney Island Creek, there is only one CSO outfall (OH-021) which serves as a relief for the Avenue V Pumping Station and the associated combined sewer service area.

Aeration

Aeration improves the dissolved oxygen content of the river by adding air directly to the waterbody ("in-stream aeration"). Air could possibly be added in large enough volumes to increase dissolved oxygen in the waterbody to meet the ambient water quality standards. However, shallow water-column depths and soft substrates can limit the effectiveness and applicability of in-stream aeration. Furthermore, depending on the amount of air that would be required to be transferred into the water column, the facilities necessary and the delivery systems could be extensive and impractical. An alternative would be to deliver a lower volume of air and control short term anoxic conditions that may result from intermittent wet weather overflows. NYCDEP has investigated in-stream aeration as a method of meeting dissolved oxygen standards and will be conducting pilot tested this technology within Newtown Creek over the next few years.

Flushing Tunnel

The addition of flushing water at the head end of dead end waterbodies improves circulation, purging pollutant-laden water from the waterbody while bringing in cleaner water with higher dissolved oxygen. The Gowanus Canal Flushing Tunnel, which was initially completed in 1911, is an existing example of this technology.

Dredging

Maintenance dredging technology is essentially the dredging of settled CSO solids from the bottom of waterbodies on an interim basis. The settled solids would be dredged from the receiving waterbody as needed to prevent use impairments such as access limitations for boats and kayaks and nuisance conditions such as odors. If dredging were to be conducted as an alternative to structural CSO controls such as storage, bottom water conditions between dredging operations would likely not comply with dissolved oxygen standards and bottom habitat would degrade following each dredging.

Summary of Receiving Water Improvement Technologies

All in-stream improvements are retained for further consideration, but because they do not directly address the pollutant loadings of CSO discharges, receiving water improvement technologies will be considered for supplemental improvements along with the selected plan.

7.3.8 Solids and Floatables Control

Technologies that provide solids and floatables control do not reduce the frequency or magnitude of CSO overflows, but can reduce the presence of aesthetically objectionable items such as plastic, paper, polystyrene, and sanitary matter, etc. These technologies include both end-of-pipe technologies such as netting and screens, as well as BMPs such as catch basin modifications and street cleaning which could be implemented upstream of outfalls in the drainage area. Each of these technologies is summarized below.

Netting Devices

Netting devices can be used to separate floatables from CSOs by passing the flow through a set of netted bags. Floatables are retained in the bags, and the bags are periodically removed for disposal. Netting systems can be located in-water at the end of the pipe, or can be placed in-line to remove the floatables before discharge to the receiving waters.

Containment Booms

Containment booms are specially fabricated flotation structures with suspended curtains designed to capture buoyant materials. They are typically anchored to a shoreline structure and to the bottom of the receiving water. After a rain event, collected materials can be removed using either a skimmer vessel or a land-based vacuum truck. A 2-year pilot study of containment booms was conducted by New York City in Jamaica Bay. An assessment of the effectiveness indicated that the containment booms provided a retention efficiency of approximately 75 percent. In addition, NYCDEP currently operates floatables booms at various locations city-wide as part of its Interim Floatables Containment Program (IFCP), including one in Coney Island Creek that retains CSO floatables discharged from OH-021. Figure 7-7 presents a photograph of the floatables boom in Coney Island Creek.

Skimmer Vessels

Skimmer vessels remove materials floating within a few inches of the water surface and are being used in various cities, including New York. The vessels range in size from less than 30 feet to more than 100 feet long. They can be equipped with moving screens on a conveyor belt system to separate floatables from the water or with nets that can be lowered into the water to collect the materials. Skimmer vessels are typically effective in areas where currents are relatively slow-moving and can also be employed in open-water areas where slicks from floatables form due to tidal and meteorological conditions. New York City currently operates skimmer vessels to service containment boom sites and to conduct open-water operations.

Screens

As discussed previously, several types of screens have utility in CSO abatement, although some are more effective at floatables capture. Manually cleaned bar screens can be located within inline CSO chambers or at the point of outfall in a configuration similar to that found in the influent channels of small wastewater pumping stations or treatment facilities to capture floatables. In CSO applications, very high maintenance requirements and a propensity for clogging may limit their application. Horizontal, weir-mounted, mechanically-cleaned screens use electric motors or hydraulic power packs to power a rake mechanism triggered by a float switch in the influent channel, returning the screened materials to the interceptor sewer. Various screen configurations and bar openings are available depending on the manufacturer. Horizontal screens can be installed in new overflow weir chambers or retrofitted into existing structures if adequate space is available. Electric power service must be brought to each site.

Baffles

A transverse baffle typically mounted perpendicular to the direction of flow can be used to prevent the discharge of floatables by blocking their path to the overflow pipe and conveying the retained floatables to the WPCP in the dry weather flow conveyance. The applicability and effectiveness of the baffle depends on the configuration and hydraulic conditions at the regulator structure. Fixed underflow baffles are the simplest type, and are basically rigid walls that cross the water surface. A variation on this is the floating underflow baffle, which intercepts floatables at a greater range of hydraulic conditions by floating with the varying water level. This

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Coney Island Creek Floatables Boom

FIGURE 7-7

technology has not yet been demonstrated in the United States, but has been successfully operated in Germany (marketed under HydroSwitch by GrandeGabriel, or Novac & Associates, Inc.). A hinged baffle with bending weir offers an additional level of safety through a built-in mechanical emergency release mechanism that eliminates emergency bypass and power requirement and results in low operation and maintenance costs.

Baffles are being used in CSO applications in several locations including Boston (MA) and Louisville (KY). However, the typical regular structures in New York City are not amenable to fixed baffle retrofits.

Catch Basin Modifications

Catch basin modifications consist of various devices to prevent floatables from entering the collection system. Inlet grates and closed curb pieces reduce the amount of street litter and debris that enters the catch basin. Catch basin modifications such as hoods, submerged outlets, and vortex valves, alter the outlet pipe conditions and keep floatables from entering the collection system. Catch basin hoods are similar to the underflow baffle concept described previously for installation in regulator chambers. These devices also provide a water seal for containing sewer gas. The success of a catch basin modification program is dependent on having catch basins with sumps deep enough to accommodate hood-type devices. A potential disadvantage of catch basin outlet modifications and other insert-type devices is the fact that retained materials could clog the outlet if cleaning is not performed frequently enough. This could result in backup of storm flows and increased street flooding. New York City has moved forward with a program to hood all of its catch basins and reports annually on the progress of this program in its CSO Best Management Practices Annual Report.

Summary of Solids and Floatables Control Technologies

Netting Systems, screens, and baffles can be retrofit to existing regulator structures, or may be built as new construction if space is available. Containment booms, catch basin modifications, and periodic skimming are already being implemented by NYCDEP in Coney Island Creek. Table 7-4 provides a comparison of the floatables control technologies discussed above in terms of implementation effort, required maintenance, effectiveness and relative cost. For implementation effort and required maintenance, technologies that require little to low effort are preferable to those requiring moderate or high effort. When considering effectiveness, a technology is preferable if the rating is high.

7.3.9 Initial Screening of CSO Control Technologies

Table 7-5 presents a tabular summary of the results of the initial technology screening discussed in the previous sections. Technologies that will advance to the alternatives development screening are noted under the column entitled "Retain for Consideration." These technologies have proven experience and have the potential for producing some level of CSO control. Other technologies were considered as having a positive effect on CSOs but either could only be implemented to a certain degree or could only provide a specific benefit level and would therefore have a variable effect on CSO overflow. For instance, NYCDEP has implemented a water conservation program which, to date, has been largely effective. This program, which will be maintained in the future, directly affects dry weather flow since it pertains to water usage patterns. As such, technologies included in this category provide some level of CSO control but in-of-themselves do not provide the level of control sought by this program. Technologies included under the heading "Consider Combining with Other Control Technologies" are those that would be more effective if combined with another control or would provide an added benefit if coupled with another control technology. The last classification is for those technologies that did not advance through the initial screening process. In the case of technologies such as infiltration/inflow control, the NYCDEP has implemented a program in accordance with federal and state laws that has effectively reduced I/I, and inclusion of this control technology in the CSO control program would not provide further tangible benefits. Other technologies like complete sewer separation are simply not feasible in an urban area as extensively built-out as New York City.

Table 7-4. Comparison of Solids and Floatables Control Technologies

Technology	Implementation Effort	Required Maintenance	Effectiveness	Relative Capital Cost
Public Education	Moderate	High	Variable	Moderate
Street Cleaning	Low	High	Moderate	Moderate
Catch Basin Modifications	Low	Moderate	Moderate	Low
Weir-Mounted Screens	Low	Moderate	High	Moderate
Screen with Backwash	High	Low	High	High
Fixed Baffles	Low	Low	Moderate	Low
Floating Baffles	High	Low	Moderate	Moderate
Bar Screens – Manual	Low	High	Moderate	Low
In-Line Netting	High	Moderate	High	High
End-of-Pipe Netting	Moderate	Moderate	High	Moderate
Containment Booms	Moderate	Moderate	Moderate	Moderate

7.4 CSO CONTROL TECHNOLOGIES RETAINED FOR CONEY ISLAND CREEK

This list of feasible alternatives retained from the preliminary screening as shown in Table 7-5 represents a toolbox from which a suitable technology may be applied to a particular level of CSO abatement. As suggested in USEPA guidance for long-term CSO control plans, water quality modeling was performed for a "reasonable range" of CSO volume reductions, from no reduction up to 100 percent CSO abatement. The technology employed at each level of this range was selected based on engineering judgment and established principles. For example, any of the storage technologies may be employed to achieve a certain reduction, but the water quality response would be the same, so the manner of achieving that level of control is a matter of balancing cost-effectiveness and feasibility. In that sense the alternatives discussed below each represents an estimate of the optimal manner of achieving that particular level of control. All costs presented in this section are in September 2008 dollars.

The retained technologies, summarized below, are considered to be feasible insofar as there is no fatal flaw or obvious cost-benefit limitation, and implementation is expected to result in improvements to water quality.

Table 7-5. Initial Screening of CSO Control Technologies

CSO Control Technology	Retain for Consideration	Being Implemented	Consider Combining with Other Control Technologies	Eliminate from Further Consideration
Source Control				
Public Education		X		X
Street Sweeping		X		X
Construction Site Erosion Control		X		X
Catch Basin Cleaning		X		X
Industrial Pretreatment		X		X
Inflow Control				
Storm Water Detention				X
Street Storage of Storm Water				X
Water Conservation I/I Reduction		X		X
Green Solutions – See Section 5	X	X	X	
Sewer System Optimization				
Optimize Existing System		X		X
Real Time Control		X		X
Sewer Separation				
Complete Separation				X
Partial Separation				X
Rain Leader Disconnection				X
Storage				
Closed Concrete Tanks	X		X	
Storage Pipelines/Conduits	X		X	
Tunnels	X		X	
Treatment				
Screening	X		X	
Primary Sedimentation		X		X
Vortex Separator				X
High Rate Physical Chemical Treatment				X
Disinfection				X
Expansion of WPCP	X	X	X	
Receiving Water Improvement				
Outfall Relocation	X			
In-stream Aeration	X		X	
Flushing Tunnel	X			
Maintenance Dredging	X		X	
Solids and Floatable Controls				
Netting Systems	X		X	
Containment Booms		X		X
Skimming		X		X
Screens	X			
Baffles				X
Catch Basin Modifications		X		X

- The Avenue V Pumping Station Upgrade (Section 7.4.2)

- Supplemental Storage (Sections 7.4.3). All three technologies considered under this category remain feasible alternatives based on cost-effectiveness and NYCDEP experience, and all three can be combined with other technologies. Closed concrete tanks, such as the storage facilities at Spring Creek, Paerdegat Basin, and Flushing Creek, tend to be more cost-effective for smaller volumes. In-line storage has potential based on review of the sewer system layout, as-builts, contract drawings, other documents, and drainage calculations. Deep storage tunnels are not usually as cost-effective as tanks, but have an advantage where siting issues present a major challenge, such as in an urban environment. For very large volumes, they are often the only feasible approach, and were therefore envisioned for alternatives to provide 90 to 100 percent CSO reduction in Coney Island Creek.

- Treatment (Section 7.4.4). The proximity of the regulator that overflows to OH-21 to the Avenue V Pumping Station presents an opportunity to retrofit screening facilities, weir screens, or different netting technologies at a low cost. These technologies were evaluated for application at OH-021 in particular. In addition, expanding the WPCP wet weather capacity was also evaluated for the Owls Head WPCP.

- Receiving Water Improvement (Section 7.4.5). Owing to its low-cost and flexibility, adding in-stream aeration to Coney Island Creek will be discussed as a possible supplemental alternative. Dredging will be handled similarly. A flushing tunnel is viable based on the Creek's proximity to a source of high-quality water for circulation.

- Green Solutions / Low Impact Development (Section 7.3.2) are fully retained as viable technologies expected to result in improvements to water quality. Because of this promise, these technologies will continue to undergo the rigorous level of evaluation necessary for programmatic implementation by the City of New York through parallel planning efforts as described in detail in Section 5.10. NYCDEP will provide updates on these evaluations and will incorporate the most promising technologies into the CSO program where possible, cost-effective, and environmentally beneficial.

Mathematical sewer system modeling was conducted as part of this WB/WS Facility Planning Project using the InfoWorks CS model for Owls Head and Coney Island Creek WPCP service areas and is documented in Sewer System Modeling Reports (NYCDEP, 2007). Full-year model simulations were performed for the set of Coney Island Creek CSO control alternatives, and the model results were then evaluated in terms of compliance with applicable water quality criteria, designated uses, and overall improvement from the established Baseline condition. Compliance with fish and aquatic-life uses was evaluated by comparing projected dissolved oxygen conditions to the applicable New York State numerical criterion. Compliance with recreational uses was evaluated by comparing projected indicator bacteria levels to New York State numerical criteria for secondary recreation. Aesthetics and riparian uses were evaluated by comparing projected levels of floatables, odors and other aesthetic conditions (based on CSO volume reduction) to narrative water quality standards.

7.4.1 Baseline Condition

As indicated above, all model simulations were conducted using a common set of conditions appropriate for long-term planning. The Baseline condition represents the state and operation of the sewer system and other facilities in a manner that predates implementation of any long-term CSO abatement plans, but does include implementation of the CSO Policy nine minimum controls and existing permit requirements regarding system wet-weather capacity, and a projected future condition with regard to population and water use. Briefly, the Baseline condition represents the following:

- Typical annual precipitation data (1988 JFK Airport) having long-term average total rainfall volume and storm duration;
- Dry-weather flow rates at year 2045 projections for the Owls Head WPCP (114.8 MGD) as discussed in Section 3.3.3;
- Wet-weather capacity of twice the design dry-weather flow at the Owls Head WPCP (240 MGD);
- Avenue V Pumping Station with 30 MGD capacity that discharges through one 24-inch and one 30-inch force main to a gravity interceptor that conveys flow to the Owls Head WPCP;
- All illegal sanitary connections have been abated;
- A floatables containment boom at Cropsey Avenue Bridge;
- Other environmental conditions (meteorology, tidal conditions, water temperature, salinity, winds, etc.) corresponding to the 1988 calendar year.

The sewer system modeling conducted as part of this WB/WS Facility Planning Project calculated that the Baseline condition would result in 54 events totaling 292 million gallons (MG). The annual CSO discharge characteristics (volume and number of events) are provided below, along with the resulting water quality attainment predicted at the head end of Coney Island Creek, expected to be the worst-case location for all scenarios.

Baseline Conditions Summary
Dissolved Oxygen Criteria Attainment………………80%
Total Coliform Criteria Attainment..…………………67%
Fecal Coliform Criteria Attainment..…………………58%
Annual CSO Volume (MG)..…………………………292
Number of Projected Overflow Events per Year*……54
* - Based on number of CSO events >0.01 MG

7.4.2 2003 Coney Island Creek CSO Facility Plan

The 1998 Coney Island Creek CSO Facilities Planning Report (Hazen and Sawyer, 1998a) and later modified in 2003 (Hazen and Sawyer, 2003) outlined a cost-effective and environmentally sound plan to improve water quality in the creek. By focusing on the evaluation of existing water quality conditions in comparison to NYSDEC numeric water quality standards and identified CSO controls, the 2003 Coney Island Creek CSO Facility Plan consisted of:

- Upgrade the Avenue V Pumping Station from 30 MGD to 80 MGD to reduce CSOs to Coney Island Creek and constructing two new discharge force mains: a 42-inch dry weather discharge capable of conveying 35 MGD to a 4-ft x 8-ft sewer near the Verrazano Bridge; and a 48-inch wet weather force main capable of conveying 45 MGD to the combined sewer main upstream of Regulator 9A;
- Eliminate illicit sanitary connections; and
- Implementation of post construction ambient water quality monitoring plan after the Avenue V Pumping Station upgrade.

The existing and future configurations of the Avenue V Pumping Station are shown in Figure 7-1 at the beginning of this section. The upgrade and rehabilitation of the Avenue V Pumping Station has begun and is anticipated to be completed in 2011. To date, the extension of the wet well in the Pumping Station has been completed and the temporary pumping system was successfully tested and is now in operation. The architectural restoration of the main building is ongoing as well. Construction of the 48-inch and 42-inch force mains began in July 2007 and a completion date of 2012 is expected. To date, a combined 10,000 linear feet of the 48-inch and 42-inch force mains have been installed. The remaining force mains are staged for installation. As noted, the 2003 CSO Facility Plan is assumed to be a basic component of any water quality improvement plan for the Creek.

The sewer system modeling calculated that the 2003 Coney Island Creek CSO Facility Plan would significantly reduce CSO events in Coney Island Creek from 54 events under the Baseline condition to 15 events. The 2003 CSO Facility Plan would reduce annual CSO overflow volume by 87 percent (255 MG), the BOD load by 95 percent, the TSS load by 94 percent and the total coliform load by 96 percent.

<u>2003 Coney Island Creek CSO Facility Plan - Cost/Benefit Summary</u>
Probable Total Project Cost (Millions)..………………$177.12
Dissolved Oxygen Criteria Attainment..………………85%
Total Coliform Criteria Attainment……………………92%
Fecal Coliform Criteria Attainment……………………67%
Annual CSO Volume (MG) ..…………………………37
Reduction in Annual CSO Volume……………………87%
Number of Projected Overflow Events per Year*……15
*Based on number of CSO events >0.01 MG

7.4.3 Supplemental Storage

Four different sizes of storage facilities (closed tanks and tunnels) were evaluated, ranging from a 10 MG facility that would reduce CSO volume by 75 percent to a 25 MG facility that would provide 100 percent CSO volume reduction. Table 7-6 summarizes the different storage facilities that were evaluated, the percentage of CSO volume reduction that each facility would provide, the number of CSO events that would occur after the storage facility was brought on-line and the costs associated with constructing a storage tank or a storage tunnel.

Table 7-6. Evaluation of Storage Facility Sizes

Size of Facility	10 MG	15 MG	20 MG	25 MG
CSO Volume Reduction %	75%	90%	95%	100%
CSO Events per Year	10	5	2	0
Storage Tank Cost (Millions)	$746	$874	$960	$1,045
Storage Tunnel Cost (Millions)	$951	$1,013	$1,059	$1,097

Due to the lack of available land and the significant costs associated with the construction of a storage facility, a larger capacity (>10 MG) storage facility is generally not considered a feasible alternative in the Coney Island area. However, a more moderately sized storage facility (<10 MG) may prove to be more economically feasible and will be further evaluated in consideration with other alternatives, so as to achieve varying levels of CSO reduction. The following alternatives examine higher levels of CSO control with the 2003 Coney Island Creek CSO Facility Plan as its starting point. Additional CSO controls are added to the 2003 CSO Facility Plan to provide for higher levels of CSO control all the way up to 100 percent CSO reduction from the Baseline Condition. It should be noted that construction cost estimates for the CSO storage tanks are conceptual at this point and could vary significantly based on site conditions, land acquisition, and installation of conveyance conduits to and from the Avenue V Pumping Station. Since there is inadequate space to construct the storage tank at the Avenue V Pumping Station, the storage tank would have to be located off-site at a location on the north shore of Coney Island Creek. This would require the construction of gravity sewers and force mains to convey the stored CSO to and from the Avenue V Pumping Station. These additional appurtenances are included in the construction cost estimates.

Supplemental Storage Plan #1
2003 Coney Island Creek CSO Facility Plan + 2.5 MG Storage Tank

This alternative involves the construction of the 2003 Coney Island Creek CSO Facility Plan (described in Section 7.4.2) and a 2.5 MG storage tank, thus attaining 94 percent system-wide CSO volume reduction. With the construction of a 2.5 MG tank in addition to the 2003 CSO Facility Plan, this proposed alternative reduces overflow events from 15 events (for the Facility Plan) down to 6 events. However, the 2003 CSO Facility Plan + 2.5 MG Storage scenario provides similar dissolved oxygen attainment levels as is achieved by the 2003 CSO Facility Plan alone. In addition, attainment of numeric criteria for total coliform and fecal coliform are no better than provided by the 2003 CSO Facility Plan alone. In summary, the 2.5 MG storage facility provides almost no tangible water quality benefits above those provided by the 2003 CSO Facility Plan, although it does reduce the volume of and number of CSO events.

Supplemental Storage Plan #1 - Cost/Benefit Summary
Probable Total Project Cost (Millions)……………...…$804.5
Dissolved Oxygen Criteria Attainment………………86%
Total Coliform Criteria Attainment..…………………92%
Fecal Coliform Criteria Attainment..…………………67%
Annual CSO Volume (MG)…………..………………17
Reduction in Annual CSO Volume..………………….94%
Number of Projected Overflow Events per Year*……6
*Based on number of CSO events >0.01 MG

Supplemental Storage Plan #2
2003 Coney Island Creek CSO Facility Plan + 4.5 MG Storage Tank

Similar to Supplemental Storage Plan #1, this alternative involves the construction of the 2003 Coney Island Creek CSO Facility Plan and a 4.5 MG storage tank, thus attaining 97.5 percent system-wide CSO volume reduction. With the construction of a 4.5 MG tank in addition to the 2003 CSO Facility Plan, this proposed alternative reduces overflow events from 15 events (for the Facility Plan) down to 3 events. However, the CSO Facility Plan + 4.5 MG Storage Tank scenario provides similar dissolved oxygen attainment as well as total coliform and fecal coliform concentrations that would be similar to those provided by the 2003 CSO Facility Plan alone. As discussed in Sections 7.5 and 7.6, the 4.5 MG storage facility provides almost no tangible water quality benefits above those provided by the 2003 CSO Facility Plan.

Supplemental Storage Plan #2 - Cost/Benefit Summary
Probable Total Project Cost (Millions)…………...……$855.7
Dissolved Oxygen Criteria Attainment..………………86%
Total Coliform Criteria Attainment……………………92%
Fecal Coliform Criteria Attainment……………………67%
Annual CSO Volume (MG)..…………..………………7
Reduction in Annual CSO Volume…………………….97.5%
Number of Projected Overflow Events per Year**……3
*Based on number of CSO events >0.01 MG

Supplemental Storage Plan #3
2003 Coney Island Creek CSO Facility Plan + 8.5 MG Storage Tank

The last of three supplemental storage plans, this alternative involves the construction of the 2003 Coney Island Creek CSO Facility Plan and an 8.5 MG storage tank that would achieve 100 percent CSO volume reduction in Coney Island Creek. With the construction of an 8.5 MG tank in addition to the 2003 CSO Facility Plan, this proposed alternative reduces overflow events from 15 events (for the Facility Plan) down to 0 events. However, the 2003 CSO Facility Plan provides similar dissolved oxygen criteria attainment and similar concentrations of total and fecal coliform as provided by the 100 percent removal scenario shown here, so the supplemental 8.5 MG storage facility provides almost no tangible water quality benefits above those provided by the 2003 CSO Facility Plan.

Supplemental Storage Plan #3 - Cost/Benefit Summary
Probable Total Project Cost (Millions)…………...……$975.3
Dissolved Oxygen Criteria Attainment..………………87%
Total Coliform Criteria Attainment……………………92%
Fecal Coliform Criteria Attainment……………………67%
Annual CSO Volume (MG)..…………..………………0
Reduction in Annual CSO Volume…………………….100%
Number of Projected Overflow Events per Year**……0
*Based on number of CSO events >0.01 MG

7.4.4 Treatment

Floatables Control

The proximity of the regulator that overflows to OH-21 to the Avenue V Pumping Station presents an opportunity to retrofit screening facilities. Screening at the Regulator AV-1 would be required to handle 145 MGD peak flow for an 80 MGD pump station capacity. The size of the weir opening is 10 ft by 5 ft. A horizontal screen system that would satisfy these constraints at Regulator AV-1 has a PTPC of $30.3 million (2008).

Installation of floatables control for the CSO discharge would not be possible. Construction at the regulator location would encounter extremely dense existing infrastructure, and the regulator is bound by two large stormwater conduits and the expanded Avenue V Pumping Station wet well, rendering expansion or bypassing impossible. Further, the water quality benefit would be marginal given that only 25% of the total volume discharged from OH-021 is CSO and the large volume of untreated stormwater that also discharges from outfall OH-021 would continue to convey floatables, thus offsetting any mitigation of the aesthetic consequences of floatables discharges. Because of this large stormwater discharge, siting at the outfall would require a facility at least four times the size of one required at the regulator, and space constraints at that location would make it impossible to build.

Expansion of WPCP Treatment

The NYCDEP developed a wet weather operating plan (WWOP) for the Owls Head WPCP per NYSDEC requirements. NYSDEC approved this WWOP, which provided recommendations for maximizing treatment of flow during wet weather events. The reports outlined three primary objectives in maximizing treatment for wet-weather flows: (1) consistently achieve primary treatment and disinfection for wet-weather flows up to 2xDDWF; (2) consistently provide secondary treatment for wet weather flows up to 1.5xDDWF before bypassing the secondary treatment system; and (3) do not appreciably diminish the effluent quality or destabilize treatment upon return to dry-weather operations.

The existing Owls Head plant site occupies 15 acres adjacent to Upper New York Bay and the Belt Parkway. The plant site is fully developed with wastewater treatment facilities (Figure 7-8). Expansion of secondary treatment to twice DDWF would require a 15 percent expansion of the existing aeration tanks, clarifiers and other associated facilities. However, any expansion should be done with tanks of similar size to the existing tanks to avoid the problems inherent with dissimilar facilities, such as flow and loading balances. Also, any consideration of secondary treatment expansion should try to site the new tanks adjacent to the existing tanks to minimize additional infrastructure expansion such as air distribution, primary effluent channels, return activated sludge piping and pumping and secondary clarifier effluent conveyance. The Owls Head WPCP has four aeration tanks and 16 secondary clarifiers. An expansion of two additional aeration tanks and six additional clarifiers would be required to provide 2xDDWF capacity in secondary treatment. This would require an area of approximately 2.3 acres which is not available at the existing site (Figure 7-8).

The construction of new facilities would be required to handle this additional flow through secondary treatment and/or to increase plant capacity, but space constraints are limiting. Owls Head WPCP is bound on three sides by Upper New York Bay and the fourth side bounded by the Belt Parkway, Owls Head Park, and Brooklyn Army Terminal rail yard. Expansion into Owls Head Park would require approval of the New York State Legislature. The Brooklyn Army Terminal rail yard is currently in use and therefore unavailable for development. Further, the Owls Head WPCP is completely enclosed to reduce odor impacts to nearby neighborhoods, so expansion would require a similar level of odor control. Finally, the conveyance capacity would become limiting, so expansion of the collection system would be necessary. Therefore, expanding the Owls Head WPCP is not a feasible alternative for reducing CSO discharges to Coney Island Creek.

7.4.5 Receiving Water Improvement

Low-cost and flexibility are the two main benefits of receiving water improvements, but they do not directly address the ongoing pollutant loading that a CSO outfall would discharge, and so are considered as possible supplemental alternatives.

In-Stream Aeration

In-stream aeration in Coney Island Creek could be accomplished by providing coarse air diffusers along to lengths of the Creek as shown on Figure 7-9. The first area is 1,400 feet long by 115 feet wide, and has an average depth of 3.5 feet. The second area is 1,550 feet long by 165 feet wide and has an average depth of 9 feet. For the analysis, it was assumed that the diffusers would be in the bottom 20% of the water column, airflow rate of 2,000 scfm for each area, and the diffusers would operate from approximately April through September depending on when the DO drops below 5-6 mg/L (Figure 7-9). The PTPC is $6.7 million (2008).

The initial projection of water quality benefit predicts attainment of the dissolved oxygen numeric criterion 91 percent of the time. Because the Avenue V Pumping Station upgrades reduce the combined sewer overflows significantly, the remaining dissolved oxygen depression is dominated by non-CSO sources. Nonetheless, in-stream aeration can increase dissolved oxygen cost-effectively and is therefore retained for further consideration as a response to post-construction monitoring results indicating unacceptably low dissolved oxygen. Note however that the developed PTPC for the coarse bubbler aeration system does not include land acquisition for the aeration building, site specific conditions, or dredging costs, all of which could significantly increase the cost. An aeration building would have to be constructed, the size and

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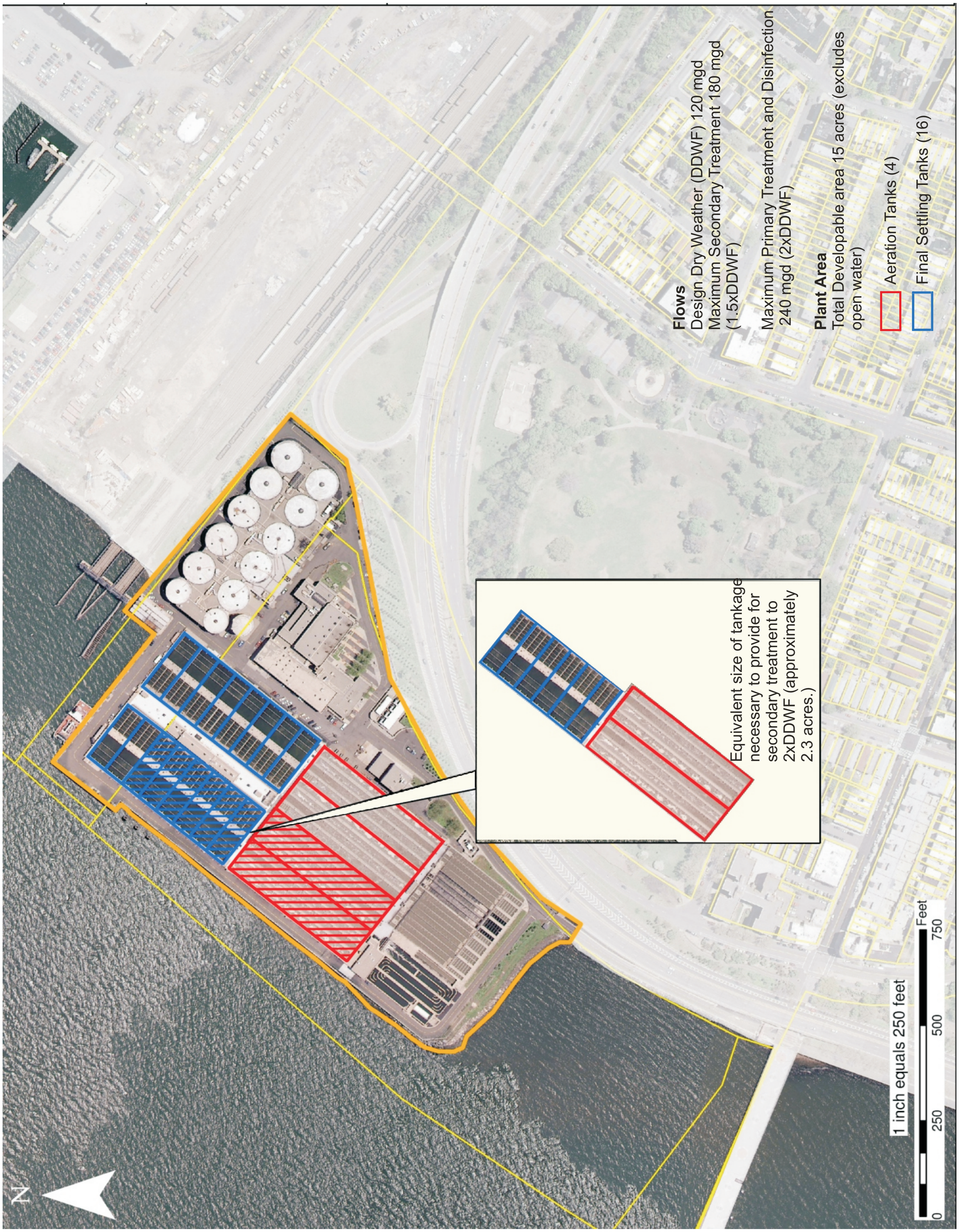

Additional Tankage Needed for Secondary Treatment of 2xDDWF at Owls Head WPCP

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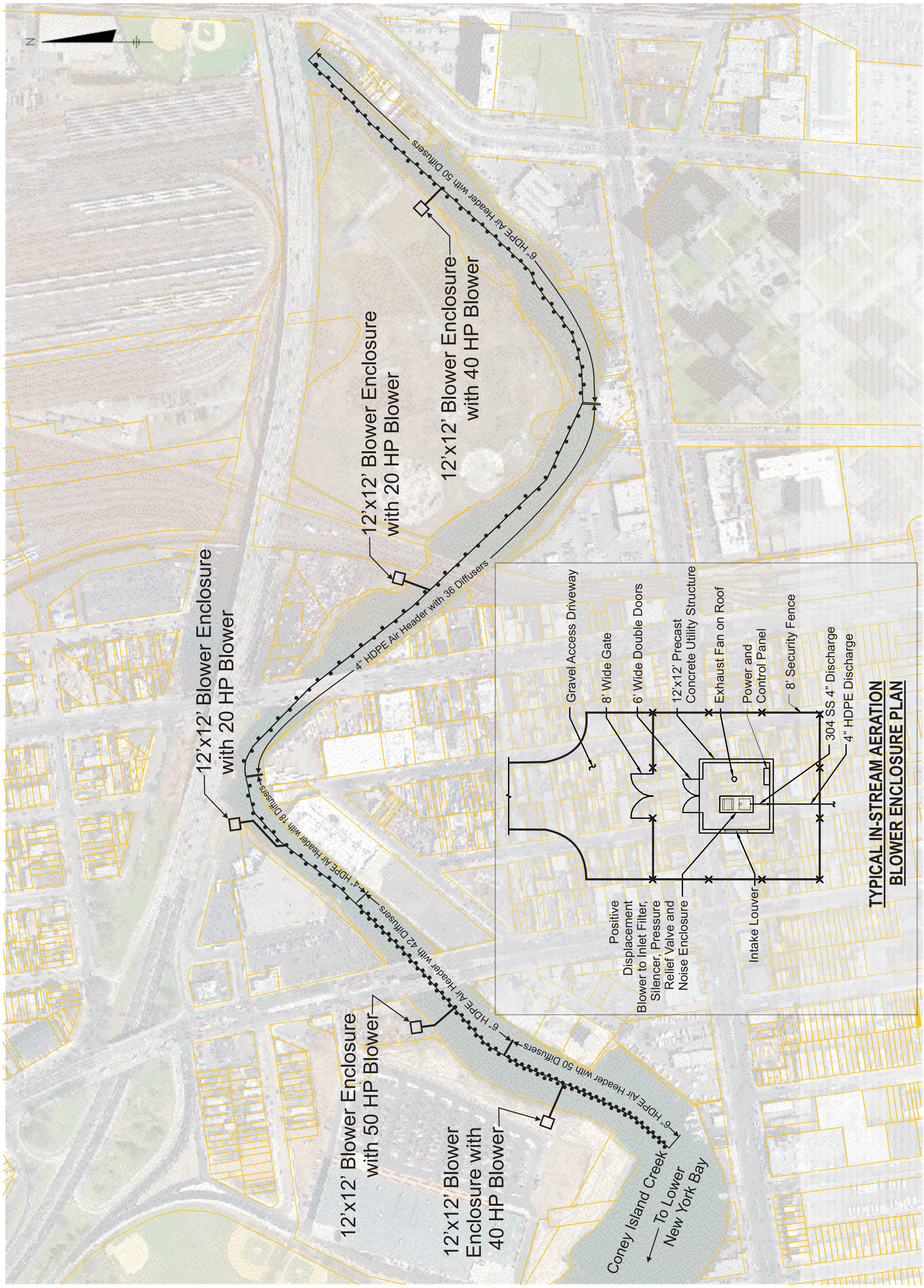
FIGURE 7-8



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Coney Island Creek Waterbody/Watershed Facility Plan

Conceptual Layout of In-Stream Aeration

FIGURE 7-9

layout of which would be dependent on the capacity of the aeration system ultimately implemented. Scaling and other design attributes are contingent upon the success of the Newtown Creek pilot aeration project that is scheduled to begin operation in the spring of 2009.

Dredging

The dredging of the upper portion of Coney Island Creek was performed by KeySpan Corporation as part of the remediation of the former Brooklyn Borough Gas Works Site, located near the head of the Creek. The NYSDEC Record of Decision (ROD) for the site, issued in March 2002, required the top 3 feet of sediment in the Creek be removed (approximately 34,000 cubic yards) from the head end down to the MTA railroad bridge located east of Stillwell Avenue (see Figure 5-1). The ROD has indicated that 3 feet of new sediment quality material will be put back into the Creek as a cap to contain any remaining contaminants. However, it left open the possibility that less sediment could be put back to allow the Creek to sufficiently drain. The proposed dredging would also lead to improved benthic habitat in the Creek by removing accumulated organic matter and improving water circulation. As of September 2008, the dredging associated with this ROD has been completed, but upland remedial actions are ongoing, and long-term monitoring plan will not be implemented until completion of all phases of the remedial action (NYSDEC, 2008).

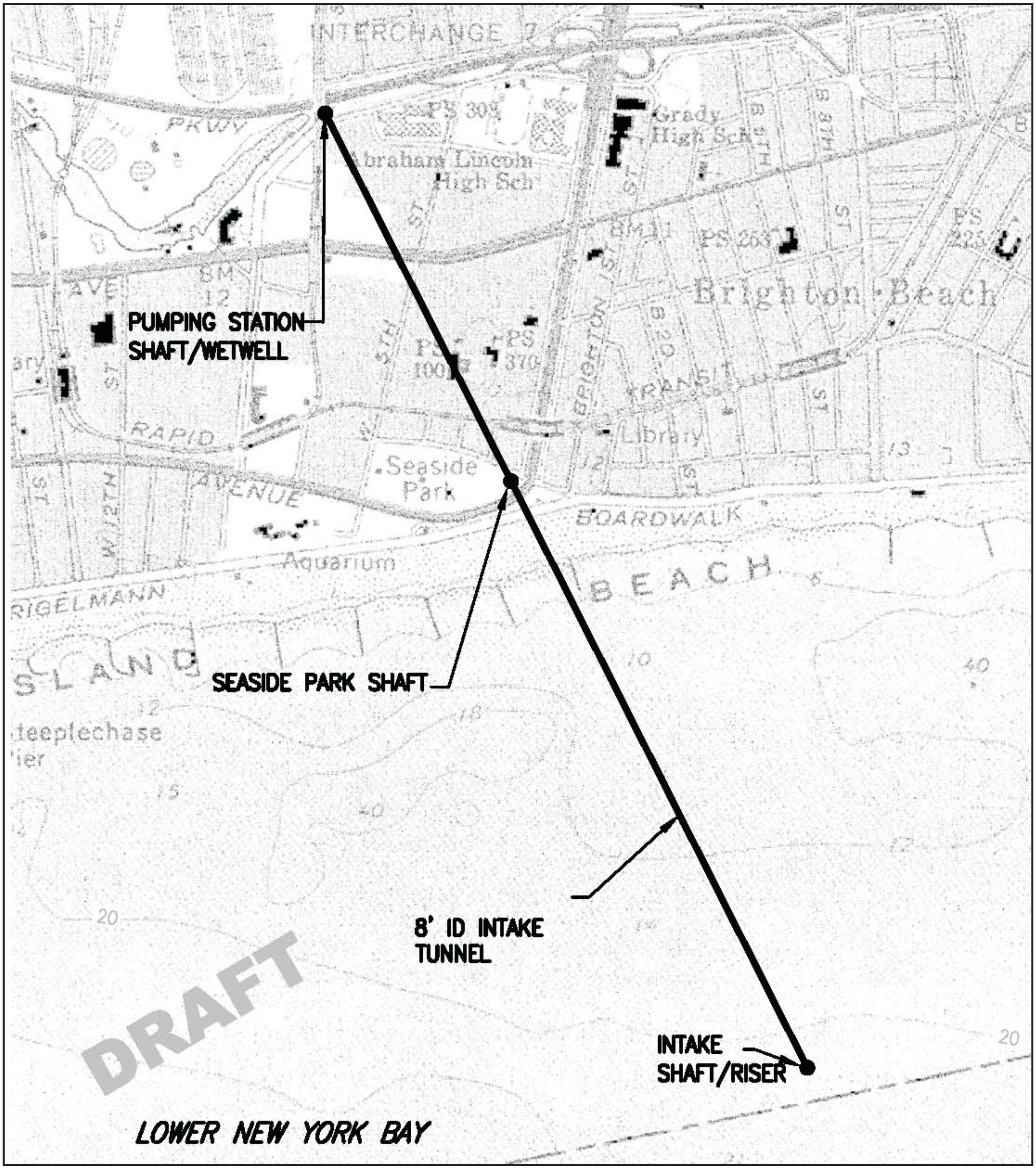
Outfall OH-021 is located along the middle reach of Coney Island Creek, downstream from where the Brooklyn Borough Gas Works Site had its greatest impact. The area in the immediate vicinity of OH-021 remains at an adequate depth for water circulation, and no CSO sediment mound occurs in the area that might contribute to visual and olfactory aesthetic impairments. Thus, no immediate benefit would be expected to result, and dredging is eliminated from further consideration for Coney Island Creek.

Flushing Tunnel

Coney Island Creek is separated from the Atlantic Ocean by Coney Island, a narrow strip of land that includes bathing beaches on its ocean-side. The Creek's proximity to a source of high-quality water suggests that circulation in Coney Island Creek could be enhanced using a flushing tunnel. Three capacities of flushing tunnel were evaluated as shown in Table 7-7. The alignment was the same for all three, as shown on Figure 7-10.

Table 7-7. Evaluation of Flushing Tunnel Facilities

Size of Facility	50 MGD	100 MGD	150 MGD
Cost (Millions)	$514.2	$565.1	$616.0
Dissolved Oxygen Criteria Attainment	88%	93%	95%
Total Coliform Criteria Attainment	92%	100%	100%
Fecal Coliform Criteria Attainment	92%	100%	100%
Note: Assumes CSO reduction, water quality attainment, and facility costs associated with Avenue V Pumping Station upgrade and construction of new force mains.			



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Conceptual Layout of Flushing Tunnel

FIGURE 7-10

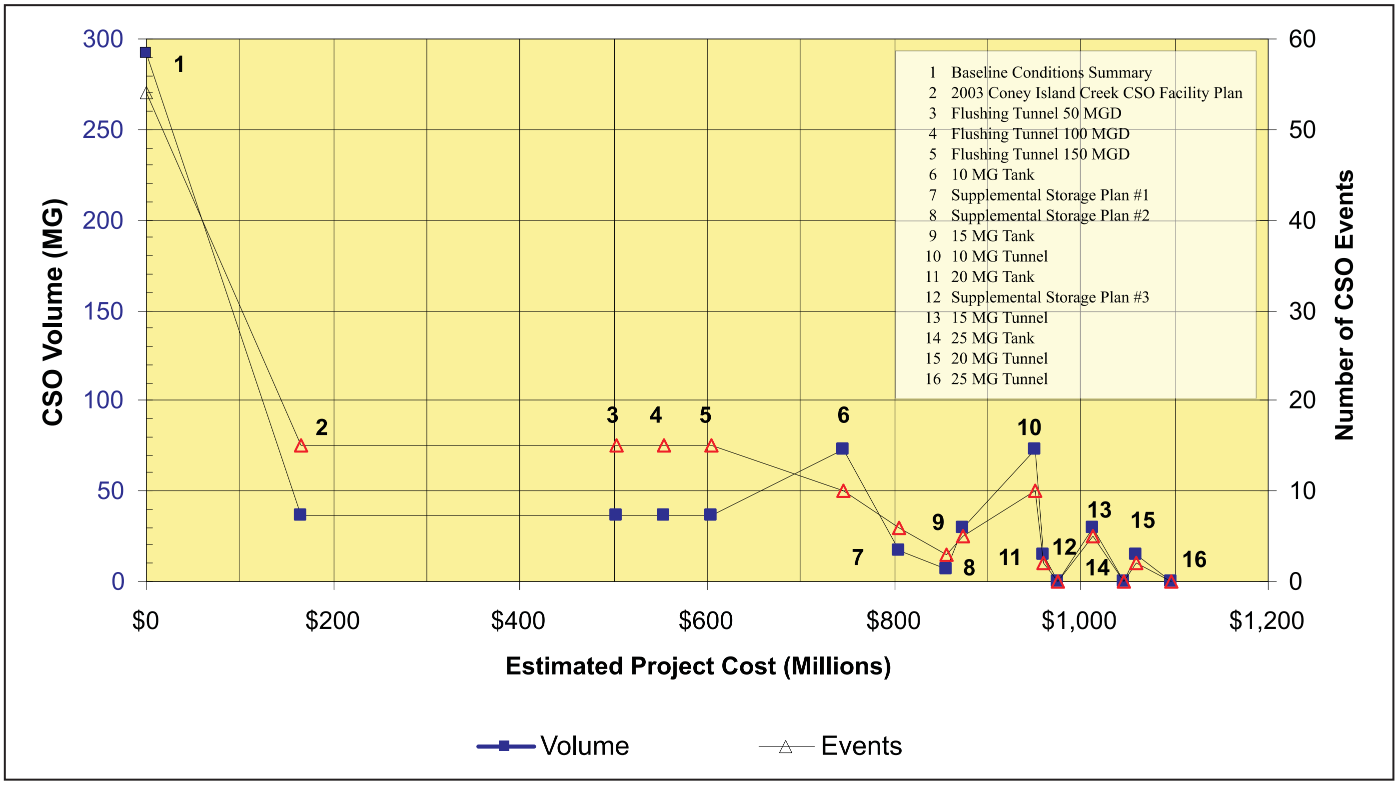
7.5 PERFORMANCE-COST ANALYSIS OF ALTERNATIVES

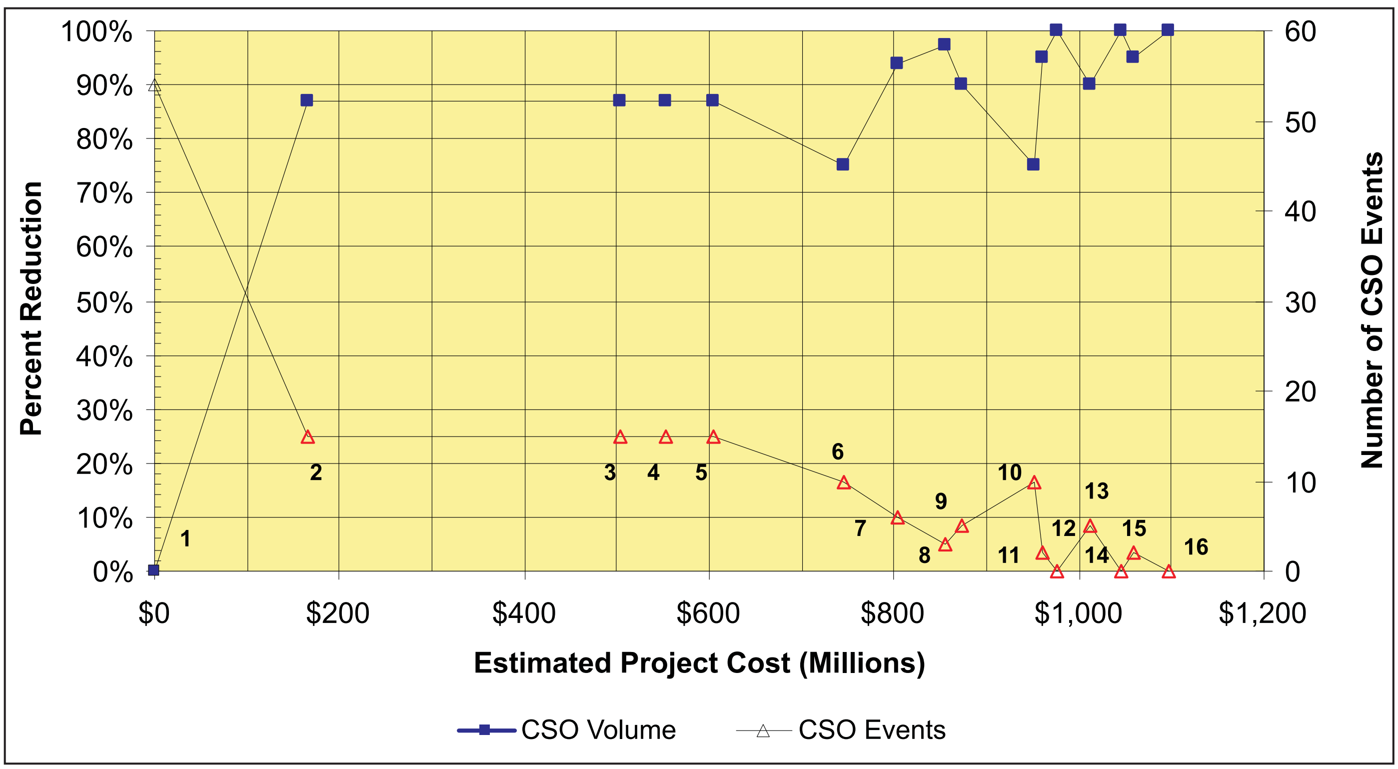
The CSO Policy (USEPA, 1994a) expects that long-term CSO control planning will "consider a reasonable range of alternatives" that would achieve a range of CSO control levels, up to 100 percent capture. The Policy further states that the "analysis of alternatives should be sufficient to make a reasonable assessment of cost and performance" and that the selected alternative must provide "the maximum pollution reduction benefits reasonably attainable." For those alternatives presented in Section 7.4 that were not eliminated from further consideration, an evaluation of cost and performance was conducted to assist in the final alternative selection.

Figure 7-11 presents a graphic representation of the performance and cost of the evaluated alternatives. The upper panel shows the performance, in terms of CSO volume and number of events, versus cost, where each alternative is represented as a point along a curve connecting all of the alternatives from the least costly/effective to the most costly/effective. The blue line/closed squares represent calculated CSO volume and the red line/open triangles represent the number of CSO events (scale on right hand side). As shown, successive scenarios represent higher levels of CSO control and higher costs. The scenarios reduce the annual CSO volume from 292 MG to 0 MG and the number of CSO events from 54 to 0, for costs ranging from $177 million to over $1 billion. The lower panel is similar, except that percentage reduction from Baseline CSO volume and number of CSO events is shown. The percentage reductions range from zero to 100 percent. As shown in Figure 7-11, the 2003 Coney Island Creek CSO Facility Plan represents a point of diminishing return in terms of CSO reduction attained for the costs incurred.

7.6 WATER QUALITY AND USE BENEFITS OF ALTERNATIVES

To complete the assessment of alternatives, an evaluation was made of whether and how cost-effectively each alternative achieves water quality and water use objectives. According to the CSO Policy, a selected alternative must be adequate to meet water quality standards and designated uses unless those standards and uses are unattainable through CSO control. This is expressed graphically on Figure 7-12 which presents water quality benefits in terms of dissolved oxygen, total coliform and fecal coliform, versus CSO control cost analysis that depicts projected attainment of numerical criteria versus costs for each evaluated scenario. Dissolved oxygen criteria attainment is determined as a percentage of hours during the year that comply with the applicable existing Class I criteria, while total and fecal coliform comparisons are based upon attaining in stream concentrations that are equal to or less than the geometric mean numerical criteria for a given month. As shown, the 2003 CSO Facility Plan represents a point at which significant improvement from controls beyond those proposed are minimal. Class I (never less than 4.0 mg/L) dissolved oxygen criteria are projected to be met 85 percent of the time (or more, depending on the location within the creek) for the 2003 CSO Facility Plan. It is important to note that only the flushing tunnel alternatives improve attainment of numerical criteria for total or fecal coliform beyond the 2003 CSO Facility Plan, but at a probable total project cost of at least $550 million and no additional reduction in CSO. Note also that none of the CSO reduction alternatives (i.e., alternatives other than the flushing tunnels) substantially increase attainment of dissolved oxygen criteria over the 2003 CSO Facility Plan: even 100 percent removal, at a cost of $975 million, increases attainment only 5 percentage points over the 2003 CSO Facility Plan.





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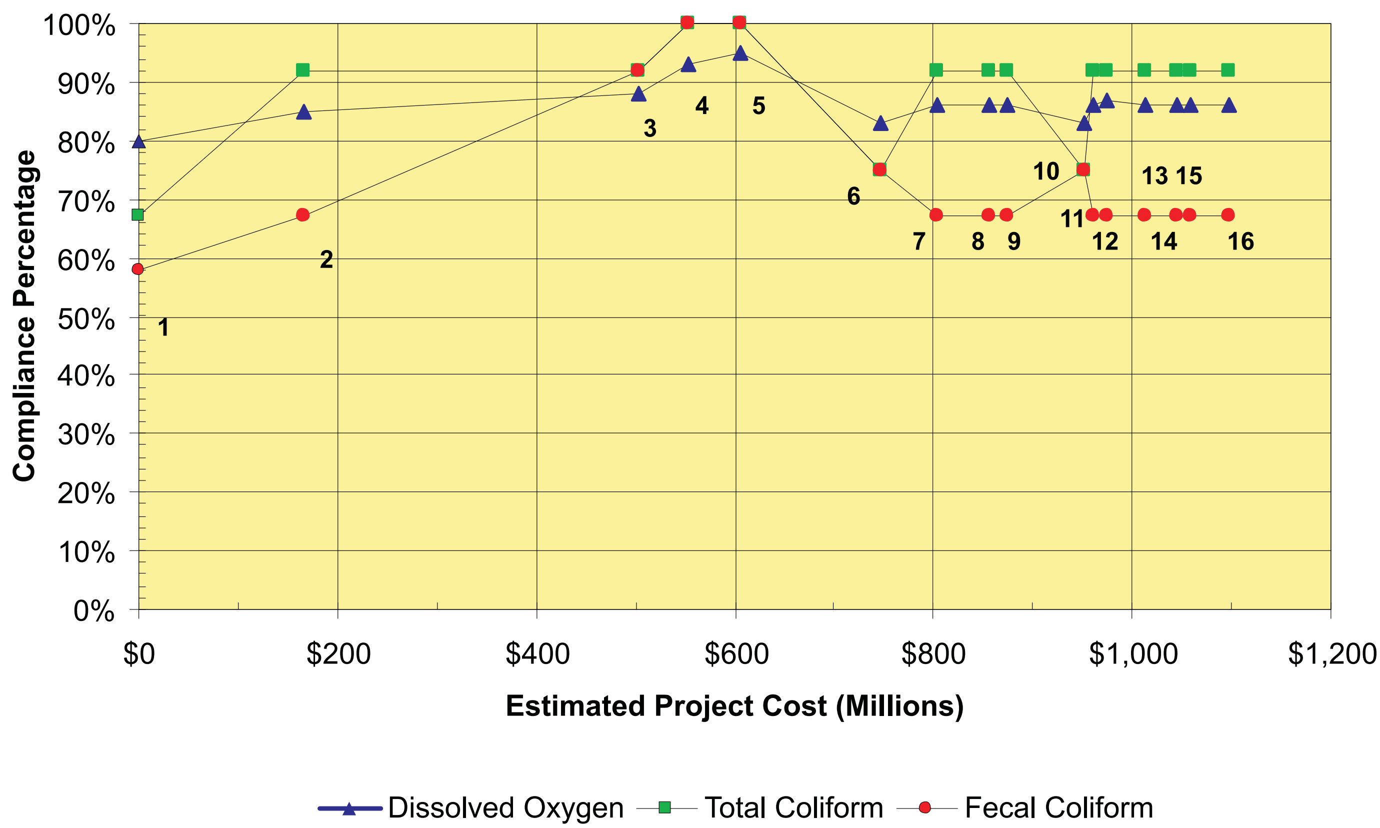
CSO Discharges vs. Cost of Evaluated Alternative

FIGURE 7-11



1	Baseline Conditions Summary
2	2003 Coney Island Creek CSO Facility Plan
3	Flushing Tunnel 50 MGD
4	Flushing Tunnel 100 MGD
5	Flushing Tunnel 150 MGD
6	10 MG Tank
7	Supplemental Storage Plan #1
8	Supplemental Storage Plan #2
9	15 MG Tank
10	10 MG Tunnel
11	20 MG Tank
12	Supplemental Storage Plan #3
13	15 MG Tunnel
14	25 MG Tank
15	20 MG Tunnel
16	25 MG Tunnel

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Percent Attainment of Numeric Criteria vs. Cost of Evaluated Alternatives

FIGURE 7-12

In summary, Figure 7-12 demonstrate that the 2003 CSO Facility Plan represents the most cost-effective scenario to attain existing water quality standards and designated uses. However, modeling projections indicate that higher aquatic uses (fish propagation, never less than 4.0 mg/L) will not be met 100 percent of the time at all locations within the Coney Island Creek. Due to the inherent uncertainties and conservative assumptions associated with the receiving water modeling analyses, it is possible that the higher aquatic use could be supported throughout the Creek. Also, it should be noted that all modeled scenarios, including the existing and Baseline conditions, provide 100 percent attainment for higher aquatic use (fishing) at the mouth of Coney Island Creek and extending approximately ½ mile into the Creek, the area along the creek banks where fishing traditionally occurs.

7.7 NUMERIC WATER QUALITY CRITERIA ATTAINABILITY ANALYSIS

To further clarify how the 2003 Coney Island Creek CSO Facility Plan compares to the maximum levels of CSO control, a comparison of water quality improvements for all applicable criteria is presented for the Baseline condition, the 2003 CSO Facility Plan and the 100 percent CSO Retention scenarios. As summarized in Table 7-8, the projected attainment of dissolved oxygen (for aquatic life criteria) and indicator bacteria numerical standards (for recreational uses) for the Baseline condition, the 2003 CSO Facility Plan, and 100 percent CSO Retention scenarios. Each of these criteria and numeric standards are evaluated in the ensuing subsections.

Table 7-8. Projected Water Quality Improvements of Selected Alternatives

		Baseline	2003 CSO Facility Plan	100% CSO Retention
Dissolved Oxygen	Head	82	86	87
	Mid-Creek	80	85	89
	Mouth	100	100	100
Total Coliform	Head	75	92	92
	Mid-Creek	67	92	92
	Mouth	100	100	100
Fecal Coliform	Head	58	75	75
	Mid-Creek	58	67	67
	Mouth	100	100	100

Notes: Dissolved oxygen is percentages of time > 4.0 mg/L annually; pathogens are percentages of months in the year the monthly geometric mean is below the numeric criteria; "Mid-Creek" is the location within Coney Island Creek with the minimum attainment.

7.7.1 Dissolved Oxygen

With respect to the Class I standard of not less than 4.0 mg/L, the two evaluated scenarios provide improvement over the 80 percent attainment of the Baseline condition, but neither of the scenarios attains the criteria 100 percent of the time. The 100 percent CSO Retention scenario provides a margin of 1 percent over the CSO Facility Plan.

7.7.2 Total Coliform

With respect to the total coliform secondary contact numerical criteria of a monthly geometric mean not greater than 10,000 per 100 mL, the two evaluated scenarios provide significant improvement over the Baseline condition, but neither of the scenarios reaches 100 percent attainment of the numerical criteria. Both the 2003 CSO Facility Plan and 100 percent CSO Retention scenarios attain the numerical criteria 92 percent of the time - November is the only month with a geometric mean total coliform concentration greater than 10,000 per 100 mL.

7.7.3 Fecal Coliform

With respect to the fecal coliform secondary contact numerical criteria of a geometric mean not greater than 2,000 per 100 mL, the two evaluated scenarios provide improvement over the 58 percent attainment of the numerical criteria of the Baseline condition, but neither of the scenarios attains 100 percent attainment of the numerical criteria. Both the 2003 CSO Facility Plan and 100 percent CSO Retention scenarios attain the numerical criteria 67 percent of the time - January, February, May and November are the four months with a geometric mean fecal coliform concentration greater than 2,000 per 100 mL.

7.8 SELECTED ALTERNATIVE

7.8.1 Basis of Selection

After a complete examination of the costs and benefits of a wide variety of CSO control alternatives, the 2003 Coney Island Creek CSO Facility Plan was selected to abate the CSO associated aesthetic impairments found in the Creek and to reduce pollutant loads to the Creek in a cost-effective manner. Further, none of the other control plans assessed provided significant improvements in water quality, including complete removal of CSO. The components of the 2003 Coney Island Creek CSO Facility Plan are listed in Section 7.4.2.

The Waterbody/Watershed Facility Plan for Coney Island Creek was selected based on the demonstration approach as defined by federal CSO policy, which allows a permittee to demonstrate that the selected control program is adequate to meet the water quality-based requirements of the CWA. To be a successful demonstration, the permittee should demonstrate each of the following:

(i) The planned control program is adequate to meet WQS and protect designated uses, unless WQS or uses cannot be met as a result of natural background conditions or pollution sources other than CSOs.

As indicated in Section 7.7, even 100 percent CSO control will not improve upon water quality benefits derived from the implementation of the 2003 Coney Island Creek CSO Facility Plan because stormwater (Section 3.3.5) is the major source of pollutants after removal of 87 percent of the CSO per the selected alternative. Figure 7-13 shows the fractions of pollutant loadings to Coney Island Creek, and the resulting water quality components are shown on Figures 7-14 and 7-15. Compliance with numeric WQS cannot be met as a result of pollution sources other than CSOs, i.e., stormwater.

(ii) Where water quality standards and designated uses are not met in part because of natural background conditions or pollution sources other than CSOs, a total maximum

daily load, including a wasteload allocation and a load allocation, or other means should be used to apportion pollutant loads.

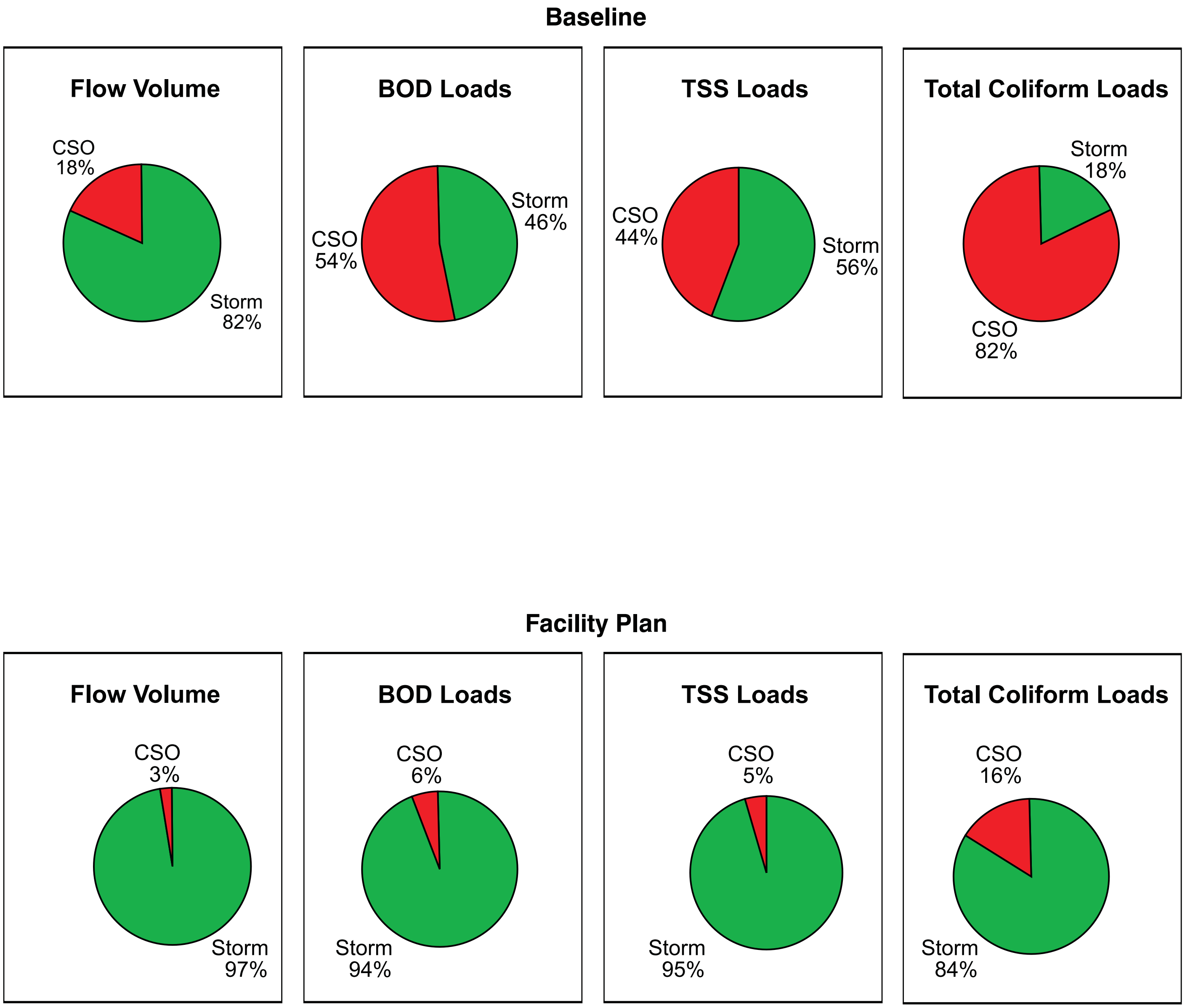
The CSO discharges remaining after implementation of the planned control program will not preclude the attainment of WQS or designated uses, and it will not contribute to their impairment.

(iii) The planned control program will provide the maximum pollution reduction benefits reasonably attainable.

As indicated in Figures 7-11 and 7-12 the selected plan represents the point of diminishing return for CSO load reduction and water quality improvement and hence the most cost-effective scenario.

(iv) The planned control program is designed to allow cost effective expansion or cost effective retrofitting if additional controls are subsequently determined to be necessary to meet WQS or designated uses.

This criterion does not apply since it has been demonstrated that additional CSO control beyond the selected alternative will not improve water quality.



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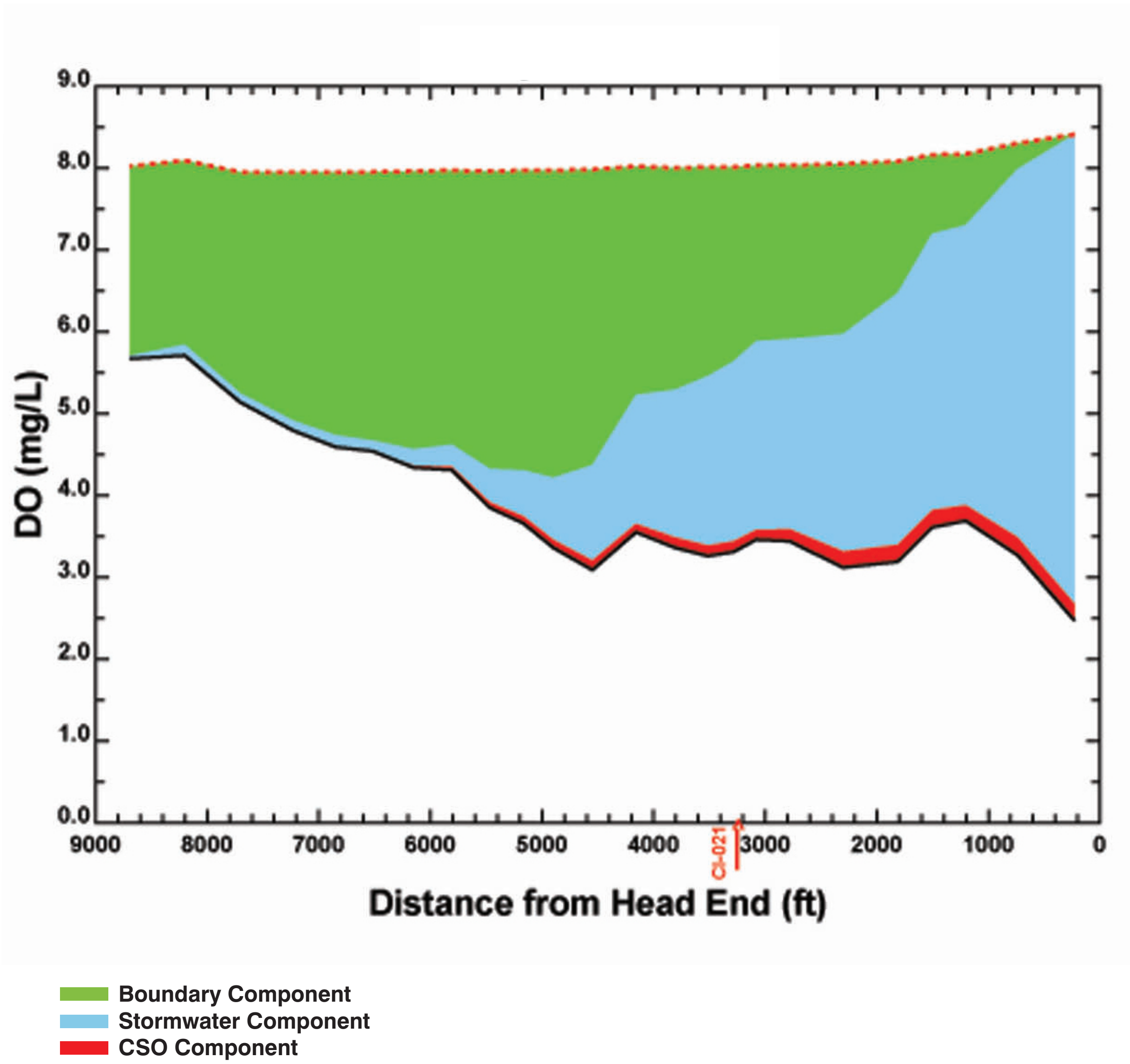
Pollutant Loading Summary Baseline vs. WB/WS Facility Plan



2-Week Average, July 1988

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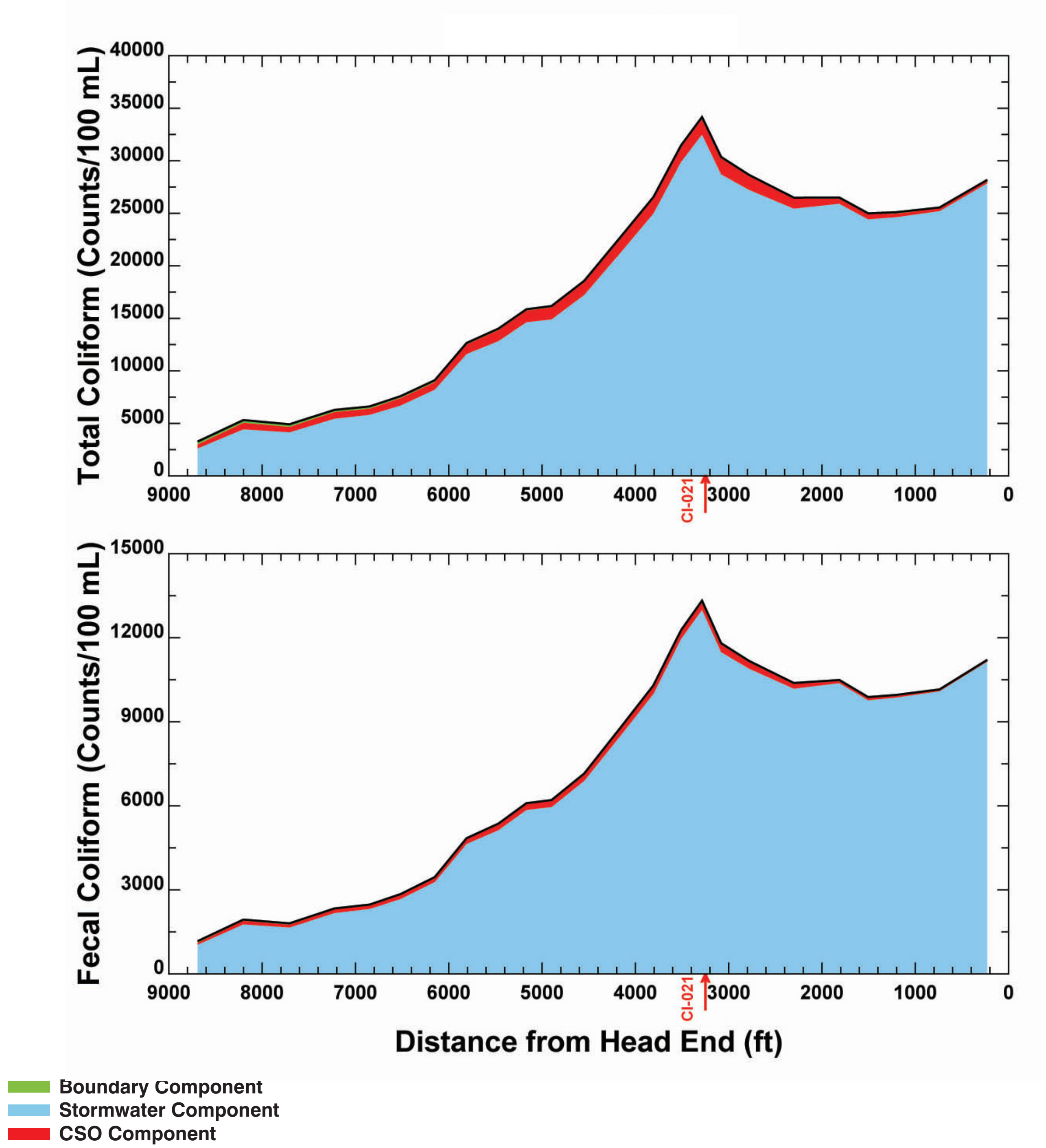
Coney Island Creek Waterbody/Watershed Facility Plan

Dissolved Oxygen Components under Waterbody/Watershed Facility Plan Scenario

FIGURE 7-14



1988 Annual Average Contributions of Stormwater, CSO and Boundary Conditions

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Pathogen Components under Waterbody/Watershed Facility Plan Scenario

FIGURE 7-15

8.0 Waterbody/Watershed Facility Plan

The efforts of the NYCDEP to develop an approach to achieve the current water quality standards in Coney Island Creek have culminated herein with the development of a Waterbody/Watershed (WB/WS) Facility Plan that recognizes achieving water quality objectives will require more than a reduction in CSO discharges. The approach incorporates cost-effective engineering with demonstrable positive impacts on water quality, including increased dissolved oxygen concentrations, decreased coliform concentrations, as well as expected reductions in the deleterious aesthetic consequences of CSO discharges such as sediment mounds, nuisance odors, and floatables. The recommended approach also maximizes utilization of the existing collection system infrastructure and treatment of combined sewage at the Owls Head WPCP.

The subsections that follow present the CSO controls recommended to attain current water quality criteria and achieve the use goals for the waterbody. Post-construction compliance monitoring (including modeling), discussed in detail in Section 8.5, is an integral part of the WB/WS Facility Plan, and provides the basis for adaptive management for Coney Island Creek.

8.1 PLAN COMPONENTS

Because of its substantial consistency with federal CSO policy, the 2003 Coney Island Creek CSO Facility Plan (Hazen and Sawyer, 2003) is the central element of the proposed WB/WS Facility Plan for Coney Island Creek. It is currently being implemented and it is a requirement of the 2005 CSO Consent Order. The components of the Waterbody/Watershed Facility Plan for Coney Island Creek are summarized as follows:

- Continued implementation of programmatic controls;
- Upgrade and rehabilitation of the Avenue V Pumping Station;
- Construct dry and wet weather force mains; and
- Periodic waterbody floatables skimming.

The total cost of the Waterbody/Watershed Facility Plan is approximately $166 million. This cost represents the actual contractor bid prices for the upgrade of the Avenue V Pumping Station and installation of the force mains received in 2005 and 2007, respectively. The difference between the cost estimate for the 2003 Coney Island Creek CSO Facility Plan ($139 million) and the construction bid price for the Waterbody/Watershed Facility Plan ($166 million) is due to increases in commodity prices and the escalation of construction costs from 2003 to 2005/2007. The construction bid price was further escalated to September 2008 ($177 million) for comparison purposes in Section 7.

8.1.1 Continued Implementation of Programmatic Controls

As discussed in detail in Section 5.0, NYCDEP currently operates several programs designed to reduce CSO to a minimum and provide treatment levels appropriate to protect waterbody uses. As the effects of the WB/WS Facility Plan become understood through long-term monitoring, ongoing programs will be routinely evaluated based on receiving water quality considerations. Floatables reduction plans, targeted sewer cleaning, real-time level monitoring, and other operations and maintenance controls and evaluations will continue, in addition to the following:

- The 14 BMPs for CSO control required under the City's 14 SPDES permits. In general, the BMPs address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO and reduce contaminants in the combined sewer system, thereby reducing water quality impacts.

- Sustainable Stormwater Management – The NYCDEP will continue to develop green solutions for stormwater management and the programmatic implementation of sustainable stormwater practices in cooperation with other City agencies and the Mayor's Office of Long-Term Planning and Sustainability. Once New York City has developed a City-Wide program that includes sustainable practices, then the NYCDEP will incorporate those practices in a future modification to the current Waterbody/Watershed Facility Plan, either when the Plan is converted to a drainage-basin specific LTCP, or when the subsequent City-Wide LTCP is developed.

- The City-Wide Comprehensive CSO Floatable Plan (HydroQual, 2005a) provides substantial control of floatables discharges from CSOs throughout the City and provides for compliance with appropriate NYSDEC and IEC requirements. Like the Waterbody/Watershed Facility Plan, the Floatables Plan is a living program that is expected to change over time based on continual assessment and changes in related programs.

- The ongoing illegal sanitary connections abatement program similar to the one conducted during the Coney Island CSO facility Planning Project in 1995. NYCDEP's Compliance Monitoring Section will continue to monitor and abate illegal sanitary connections to storm sewer lines tributary to Coney Island Creek that were indicated by the elevated bacteria levels encountered in the 2004 supplemental receiving water quality monitoring program initiated during the development of the Waterbody/Watershed Facility Plan for Coney Island Creek. Illegal sanitary connections have been confirmed at several locations by NYCDEP, including households with improper sanitary connections to the storm sewer system on storm sewer lines CI-601, CI-664, and CI-665 (south side of Coney Island Creek between W. 28th and W. 15th Streets). The improper sanitary connections to storm sewer lines CI-664 and CI-665 have been abated while the improper connections to storm sewer line CI-601 are in the process of being remediated. A list of the specific households identified with illegal sanitary connections to these storm sewers and their abatement status is provided in Appendix C.

8.1.2 Upgrade and Rehabilitation of the Avenue V Pumping Station

The upgrade and rehabilitation of the Avenue V Pumping Station will be implemented at a capital cost of approximately $68.2 million. The Avenue V Pumping Station capacity will be increased to 80 MGD to capture 87 percent, by volume, of the CSO discharges. The major pumping station rehabilitative work includes the following: (1) contractor interim pumping; (2)

removal of all existing mechanical, HVAC and electrical equipment and gutting the entire building; (3) lowering the operating level of the wet well to alleviate surcharge conditions in the upstream sewers; (4) installation of new, mechanical HVAC and electrical equipment; and (5) architectural and structural rehabilitation of the building interior and exterior. The resulting pumping station configuration is shown in Figure 8-1. A detailed description of the Avenue V Pumping Station upgrade can be found in Appendix D.

8.1.3 Construct Dry and Wet Weather Force Mains

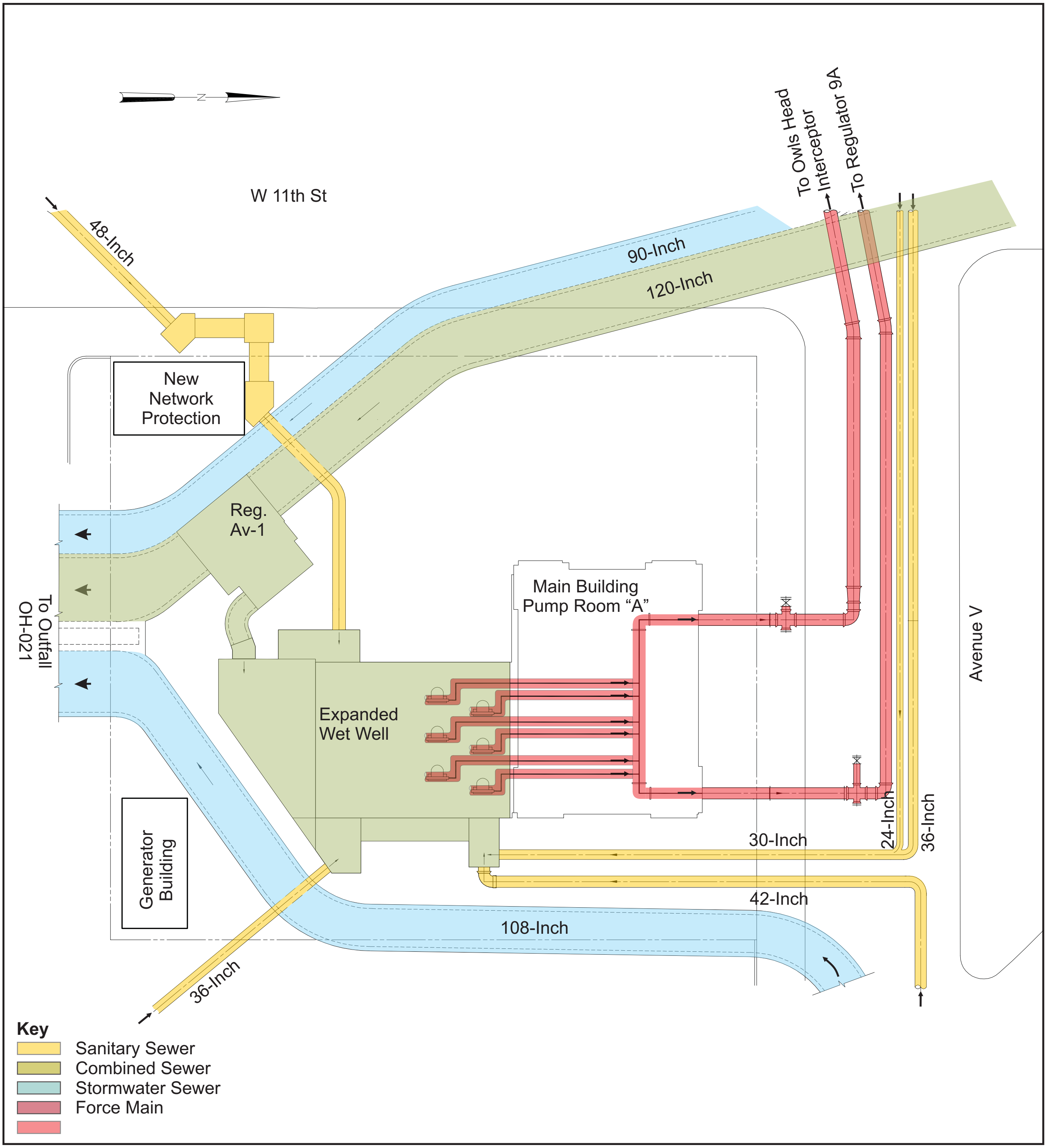
As part of the Avenue V Pumping Station rehabilitation and upgrade, the installation of two new force mains are required to provide additional conveyance capacity at a capital cost of approximately $97.8 million. The conveyance capacity of the existing force mains is limited. Additional conveyance capacity is required to handle the additional dry and wet weather flow from the Avenue V Pumping Station once it has been upgraded. Two force mains will be provided to provide operational flexibility and redundancy as part of the pump station upgrade work. An 18,500-foot long 42-inch dry weather flow force main will discharge up to 35 MGD of dry weather flow from Avenue V Pumping Station to a 4-foot x 8-foot sewer near the Verrazano Bridge. In addition, a 13,100-foot long 48-inch wet weather flow force main will be constructed to convey wet weather flow to the combined sewer upstream of Regulator 9A at Bath Avenue and 17th Avenue. The force main alignment is shown in Figure 8-2. A detailed description of the new Avenue V Pumping Station force mains can be found in Appendix D.

8.1.4 Periodic Waterbody Floatables Skimming

Floatables discharges to Coney Island Creek will be substantially reduced with the continued implementation of City-wide programmatic controls and the reduction in CSO discharges to the Creek from the Avenue V Pumping Station upgrades and associated force mains. Once construction of the Pumping Station is completed, the interim floatables containment boom located at the Cropsey Avenue Bridge may be removed depending on the findings of Post-Construction Monitoring (Section 8.5).

8.2 ANTICIPATED WATER QUALITY IMPROVEMENTS

Implementing the Waterbody/Watershed Facility Plan will have both sewer system performance and water quality benefits. The various components of the Plan will reduce CSO discharges, improve aesthetic conditions, and enhance habitat to levels consistent with regulatory use goals. The central component of the Plan, the rehabilitation of the Avenue V Pumping Station and force main upgrades, is expected to reduce CSO discharge volume to Coney Island Creek by 87 percent (to 37 MG from 292 MG) in a typical year. This reduction in CSO discharges will lead to improved water quality and aesthetic conditions in the Creek as shown in Figures 8-3 through 8-5, resulting in the Creek achieving the Class I total and fecal coliform standards 100 percent of the time in the middle and mouth reaches of the Creek where secondary contact recreation activities occur. Further, non-attainment of Class I coliform bacteria standards at the head end of the Creek would only occur during months where water-related recreation typically does not occur (e.g. November for total coliform and January, February, May, and November for fecal coliform).



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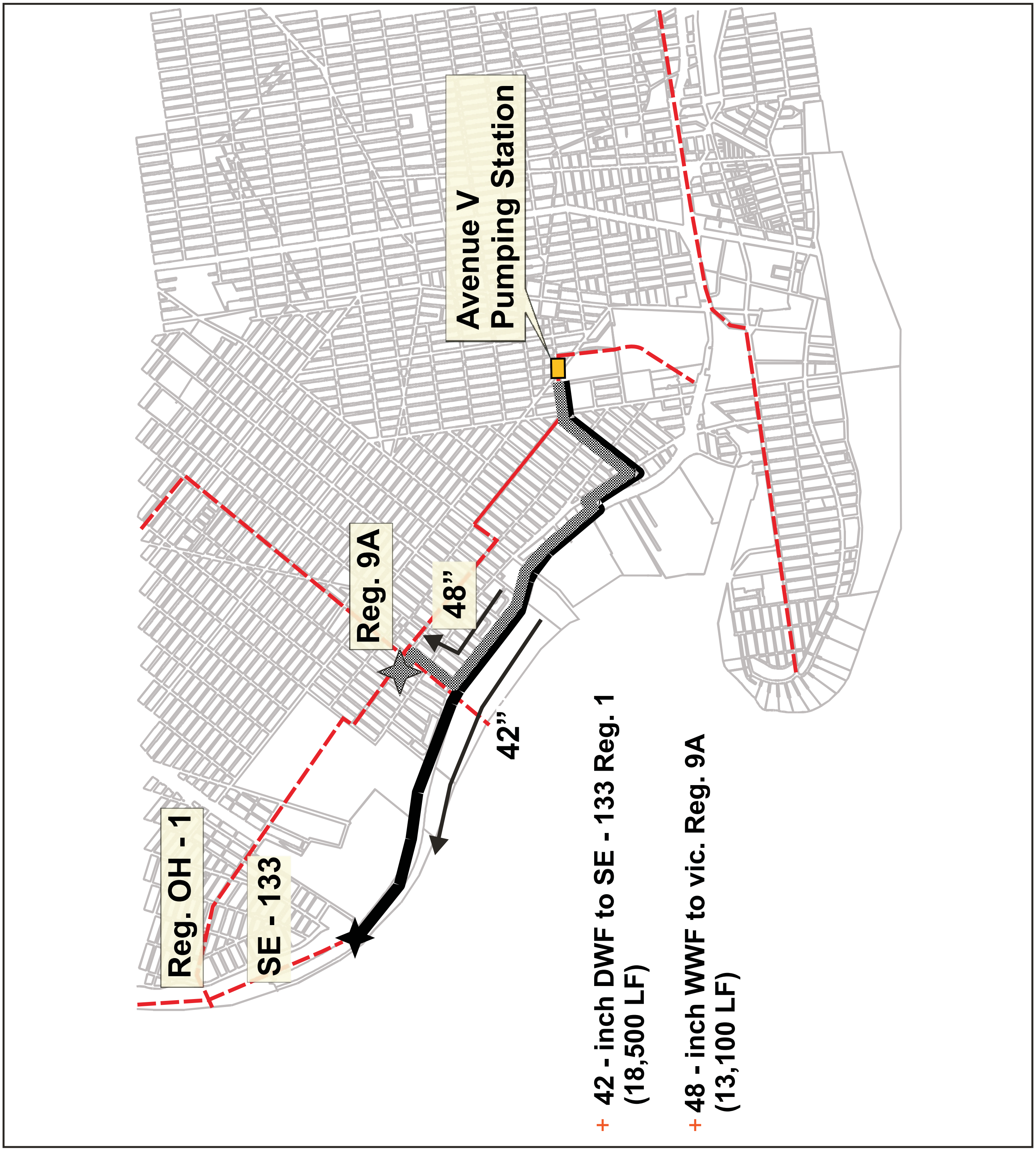
Avenue V Pumping Station Future Configuration

FIGURE 8-1



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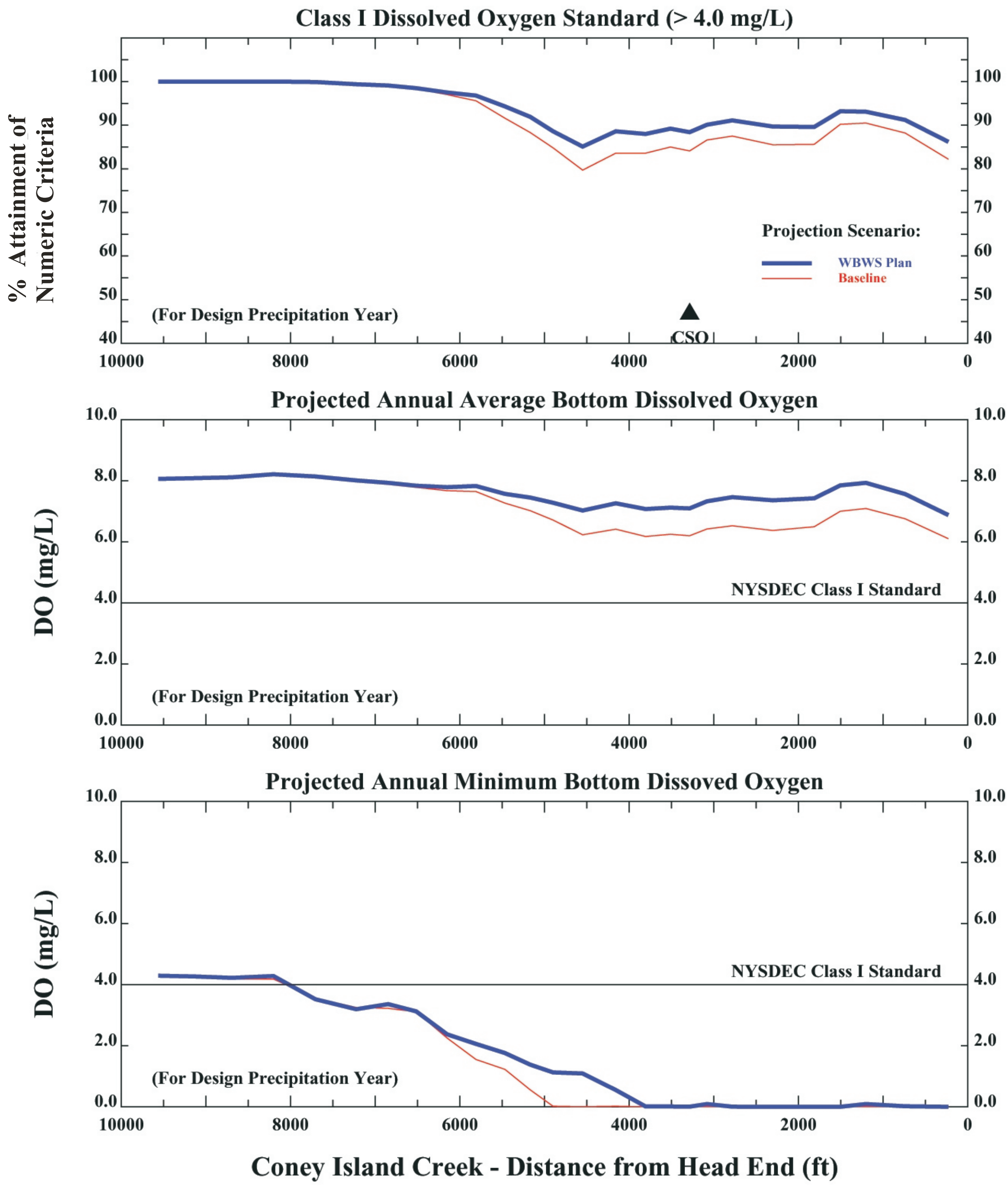
Avenue V Pumping Station Future Force Mains

Coney Island Creek Waterbody/Watershed Facility Plan

FIGURE 8-2



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New York City
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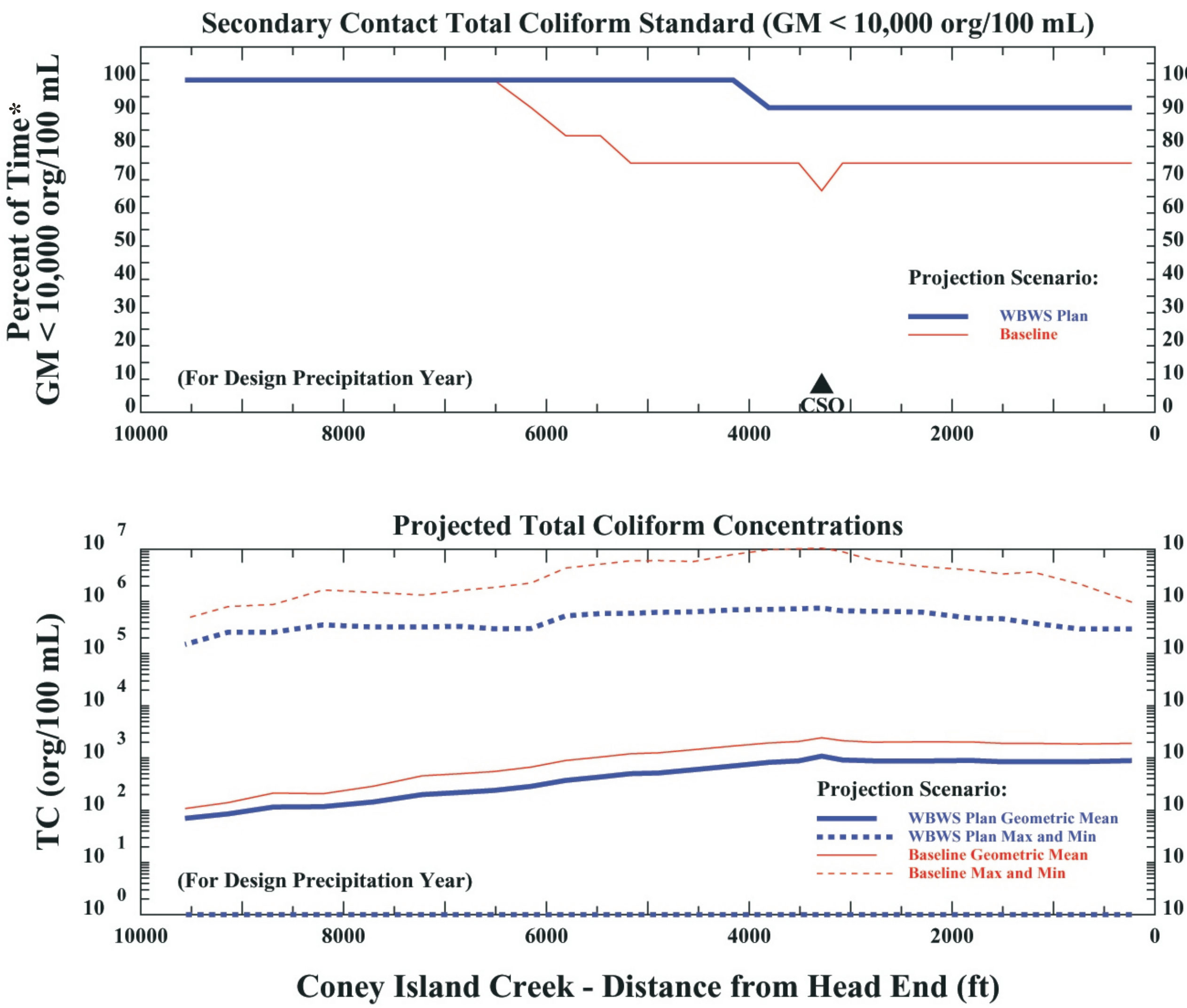
Projected Dissolved Oxygen Concentrations Waterbody/Watershed Facility Plan



Note: Data in graphs represent annual geometric means.

*Percent of time represents the number of months in calendar year.

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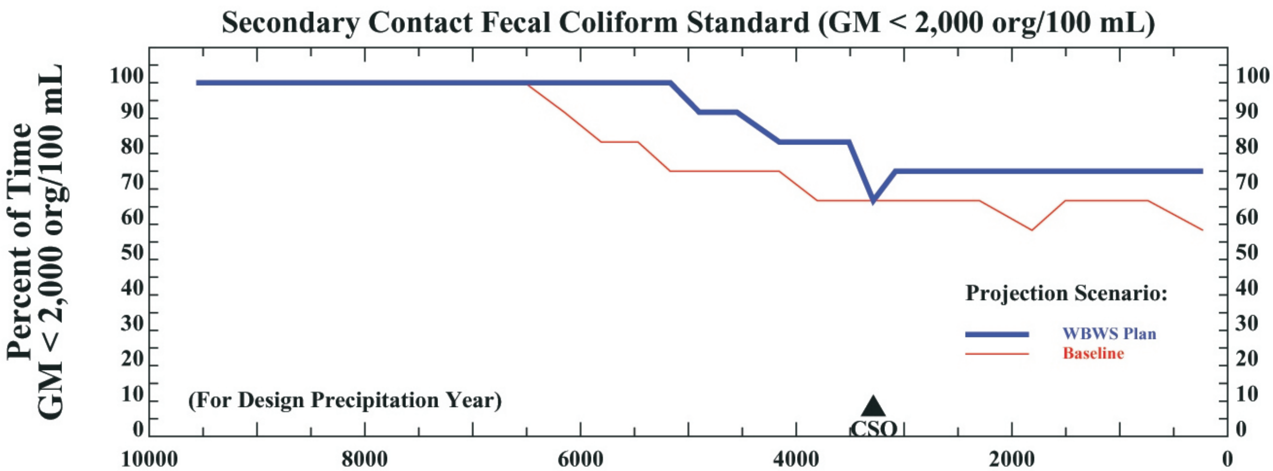
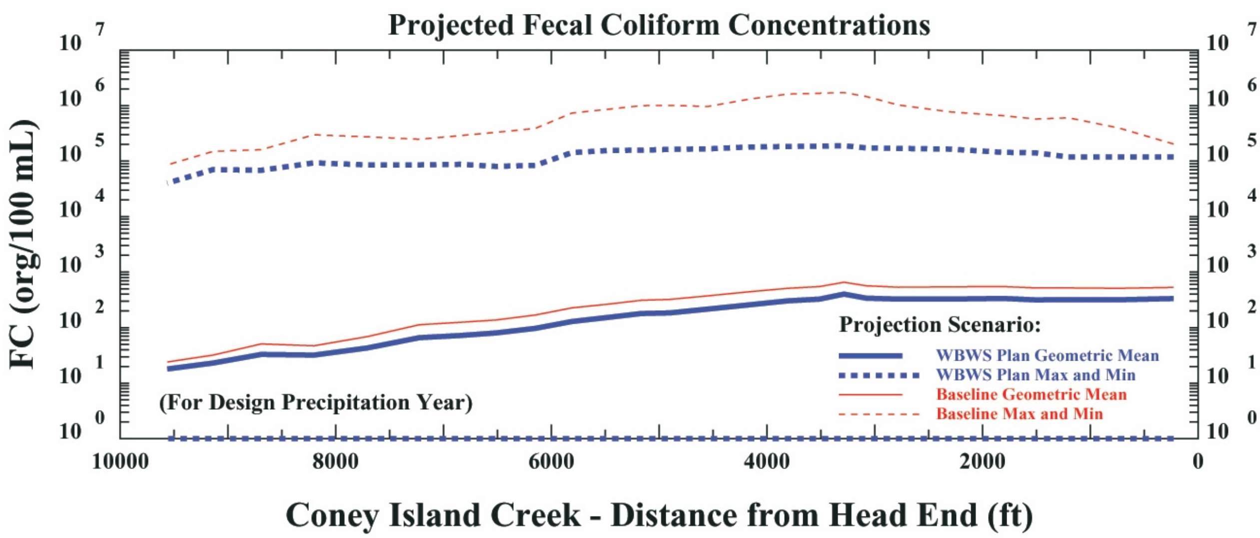
Projected Total Coliform Concentrations
Waterbody/Watershed Facility Plan





Note: Data in graphs represent annual geometric means.

*Percent of time represents the number of months in calendar year.

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New York City
Department of Environmental Protection

Projected Fecal Coliform Concentrations Waterbody/Watershed Facility Plan

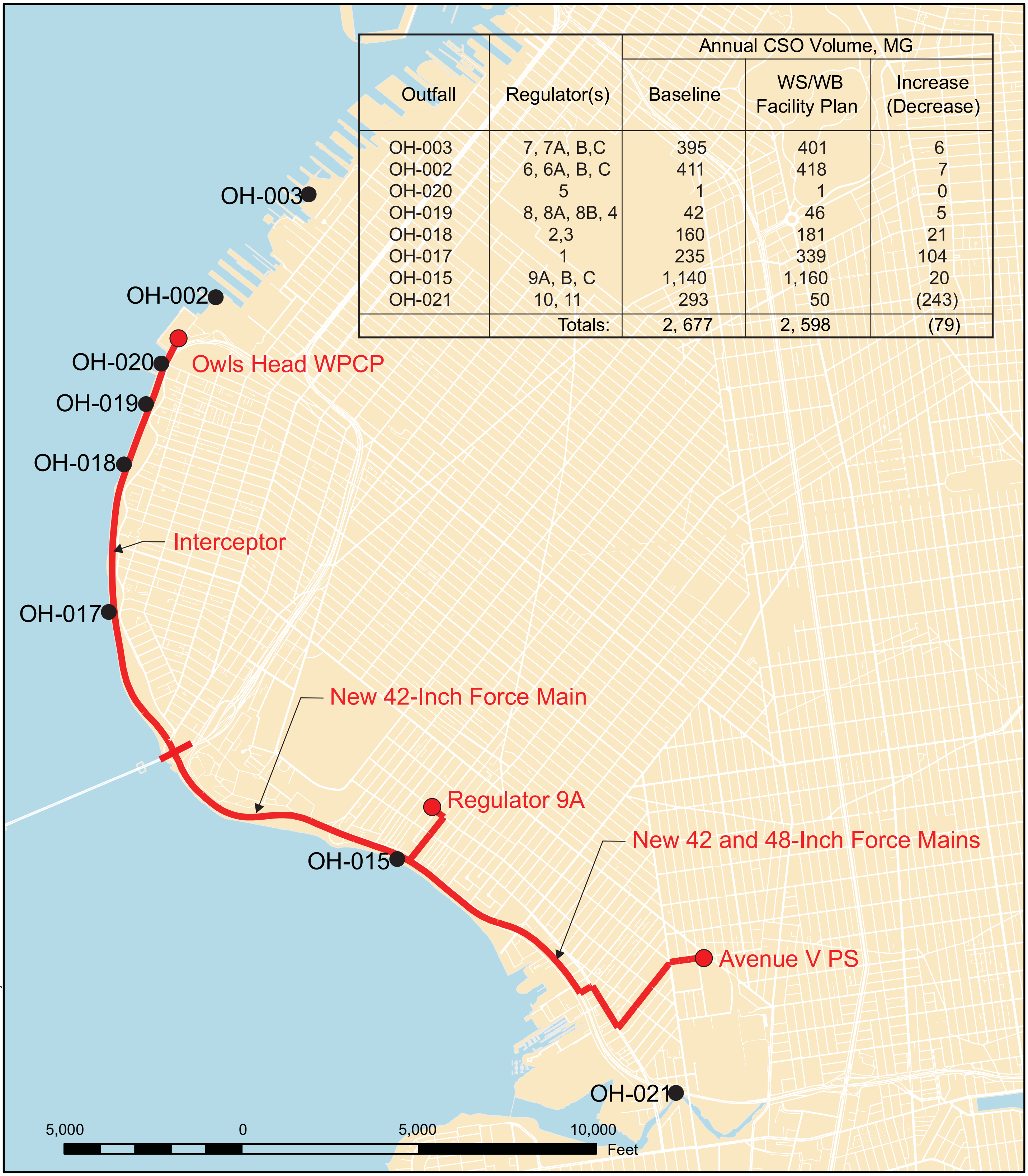
Increases in dissolved oxygen over the Baseline condition will occur as well; however, 100 percent dissolved oxygen compliance with not be achieved at all times throughout Coney Island Creek. As noted in Section 7, remaining excursions below water quality criteria will be the result of stormwater inputs to the Creek. In addition, although not completely eliminating all of the parameters of concern, the WB/WS Facility Plan will improve the aesthetic uses of Coney Island Creek by the reduction of odors, turbidity, deposition of organic solids, and floatable material discharges. The technical evaluations conducted herein indicate that complete attainment of the narrative criteria for aesthetics and to enhance riparian uses can only be attained by completely abating CSOs and relocating or capturing and treating all stormwater discharges as well. The WB/WS Facility Plan represents a cost-effective CSO plan for achieving the highest reasonably attainable levels of aesthetic use.

Although there will be a net increase in flow to the Owls Head WPCP, a portion of the annual CSO flow diverted from Coney Island Creek will be discharged to other waterbodies, specifically Gravesend Bay and Upper New York Bay. Figure 8-6 shows the outfalls and waterbodies impacted, along with the increased volumes of annual CSO that will result from the implementation of the WB/WS Facility Plan (i.e., the 2003 Coney Island Creek CSO Facility Plan). The net increase in flow to the Owls Head WPCP is projected to be 79 MG; the remaining 163 MG of the 242 MG reduction in Coney Island Creek is projected to result in increased CSO discharges from six outfalls along Gravesend Bay and Upper New York Bay. These increased CSO discharge volumes are not anticipated to negatively impact water quality because the larger waterbodies have greater assimilative capacity. The largest increase in CSO is at OH-017 located on the Varrazano Narrows, a tidal strait with particularly strong mixing dynamics. The other increases projected are small in comparison to the calculated Baseline CSO volumes.

A preliminary impact analysis was performed to estimate the impact of these increases on pathogen concentrations at South Beach, Staten Island, which is the most sensitive receiving water receptor in the vicinity. The analysis used the Open Waters Pathogen Model (PATH) which is being used for both the LTCP Project and the EPA Harbor Estuary Program TMDL Development Project. The analysis indicated that enterococcus levels at South Beach would increase by approximately 4 percent over Baseline conditions. The seasonal geometric mean standard for enterococcus bacteria is 35 per 100 mL. Since the calculated seasonal geometric mean at Baseline conditions at South Beach is less than 5 per 100 mL, this increase would not adversely impact compliance with this standard. Additional analysis and details are presented in the East River and Open Waters WB/WS Facility Plan.

8.3 OPERATIONAL PLAN

USEPA guidance specifies that municipalities should be required to develop and document programs for operating and maintaining the components of their combined sewer systems (USEPA, 1995a). Once a long-term control plan has been approved, the municipality's operation and maintenance program should be modified to incorporate the facilities and operating strategies associated with selected controls. The upgrade and rehabilitation of the Avenue V Pumping Station has begun and is anticipated to be completed in 2012. To date, the extension of the wet well in the Pumping Station has been completed and the temporary pumping system was successfully tested and is now in operation. The architectural restoration of the main building is ongoing as well. Construction of the 48-inch and 42-inch force mains began in July



Outfall	Regulator(s)	Annual CSO Volume, MG		
		Baseline	WS/WB Facility Plan	Increase (Decrease)
OH-003	7, 7A, B,C	395	401	6
OH-002	6, 6A, B, C	411	418	7
OH-020	5	1	1	0
OH-019	8, 8A, 8B, 4	42	46	5
OH-018	2,3	160	181	21
OH-017	1	235	339	104
OH-015	9A, B, C	1,140	1,160	20
OH-021	10, 11	293	50	(243)
	Totals:	2, 677	2, 598	(79)

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Flow Transfer from Coney Island Creek to Open Waters Outfalls

FIGURE 8-6

2007 and a completion date of 2012 is expected. To date, a combined 10,000 linear feet of the 48 inch and 42-inch force mains have been installed. The remaining force mains are staged for installation. The operational plan for the facility will be developed in accordance with any permit requirements.

Upon implementation of the Waterbody/Watershed Facility Plan elements, NYCDEP intends to operate the facilities as designed. However, it is both environmentally responsible and fiscally prudent to be responsive to changing and unforeseen limitations and conditions. An adaptive management approach will be employed to provide this flexibility. Post-construction compliance monitoring (described in Section 8.5) may trigger a sequence of more detailed investigations that, depending on the findings, could culminate in corrective actions. During the first ten post-construction years, the analysis will ultimately determine whether the performance of the CSO controls was adequate. If the performance is unacceptable, the finding will be verified, the causes will be identified, and reasonable corrective actions will be taken. Modifications and retrofits that are implemented and demonstrate improvement will be documented through the issuance of an LTCP update, subject to NYSDEC approval.

8.4 IMPLEMENTATION SCHEDULE

Figure 8-7 shows the implementation schedule for the WB/WS Facility Plan, along with relevant aspects of the programmatic controls and post-construction compliance monitoring schedules. It should be noted that elements shown in this schedule address the implementation of the recommended Waterbody/Watershed Facility Plan elements only. As noted in the CSO Consent Order (Section III.C.2) "once the Department approves a Drainage Basin Specific LTCP, the approved Drainage Basin Specific LTCP is hereby incorporated by reference, and made an enforceable part of this Order". As such, a schedule will be incorporated by reference only when this Waterbody/Watershed Facility Plan is further developed and submitted as an LTCP in accordance with dates presented in Appendix A of the CSO Consent Order.

8.5 POST-CONSTRUCTION COMPLIANCE MONITORING

The Post-Construction Compliance Monitoring Program (PCM) will be integral to the optimization of the Coney Island Creek Waterbody/Watershed Facility Plan, providing data for model validation, feedback to facility operations, and an assessment metric for the effectiveness of these facilities. Each year's data set will be compiled and evaluated to refine the understanding of the interaction between the New York City collection system and Coney Island Creek, with the ultimate goal of fully attaining compliance with current water quality standards or for supporting a UAA to revise such standards. The monitoring will contain three basic components:

1. The monitoring and reporting requirements contained in the Owls Head WPCP and Coney Island Creek WPCP SPDES permits;

2. Receiving water data collection in Coney Island Creek and nearby open water areas using existing NYCDEP Harbor Survey locations and adding stations as necessary; and

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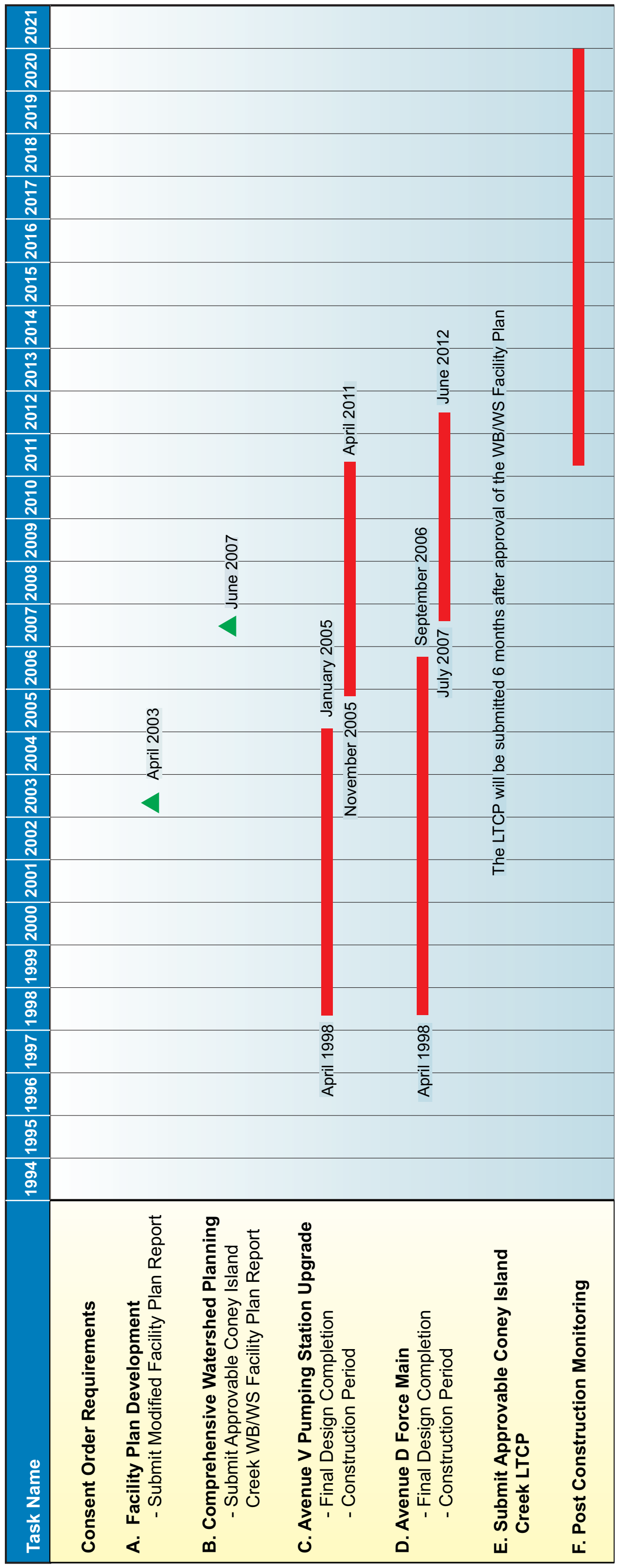

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Implementation Schedule

Coney Island Creek Waterbody/Watershed Facility Plan

FIGURE 8-7

3. Modeling of Coney Island Creek to characterize water quality.

Interim Post-Construction Compliance Monitoring Programs were developed for Flushing Bay, Flushing Creek, and Spring Creek waterbodies in 2008, and monitoring in accordance with those plans preceded those submittals, beginning prior to Summer 2007 when facilities associated with those waterbodies were placed into service. The PCM described herein conforms with the Interim Post-Construction Compliance Monitoring Programs approved by NYSDEC. The full details of the program are being developed under the City-Wide LTCP, including monitoring and laboratory protocols, QA/QC, and other aspects, to ensure adequate spatial coverage, consistency, and a technically sound sampling program for the entire New York Harbor.

The details provided herein are limited to the Coney Island Creek Post-Construction Compliance Monitoring Program and may be modified as the City-Wide program takes form. Any further modifications to the Monitoring Program will be submitted to NYSDEC for review and approval as part of the drainage basin specific LTCPs.

8.5.1 SPDES Facility Monitoring Requirements

It is important that the WPCPs that receive wet weather flow from the Coney Island Creek watershed be monitored to enable performance assessments and provide a basis for operational modifications if necessary. This is an adaptive management approach to optimize the wet-weather performance of these facilities. The Coney Island Creek drainage area lies between the drainage areas of two WPCPs, the Owls Head WPCP and the Coney Island WPCP. Coney Island Creek receives both combined sewer overflow and stormwater drainage from the Owls Head WPCP drainage area. The Creek receives stormwater flow only (i.e. no CSO) from the Coney Island Creek WPCP drainage area. The SPDES permit for the Coney Island WPCP includes a section pertaining to monitoring requirements for the Paerdegat Basin CSO Retention Facility one month following the startup date of the facility. The current SPDES permit for the Owls Head WPCP does not contain any requirements for the Coney Island Creek control facilities, as the facilities consist of pump stations and force mains.

8.5.2 Receiving Water Monitoring

The post-construction compliance monitoring program will continue along the protocols of the New York City Harbor Survey initially, including laboratory protocols listed in Table 8-1. This program primarily measures four parameters related to water quality: dissolved oxygen, fecal coliform, chlorophyll “a”, and secchi depth. These parameters have been used by the City to identify historical and spatial trends in water quality throughout New York Harbor. Secchi depth and chlorophyll “a” have been monitored since 1986; DO and fecal coliform have been monitored since before 1972. Recently, enterococci analysis has been added to the program. Except for secchi depth and vertical profiling of conductivity, temperature, and dissolved oxygen, parameters are analyzed from samples collected at a depth of three feet below the water surface to reduce influences external to the water column chemistry itself, such as wind and precipitation influences near the surface. NYCDEP regularly samples 33 open water stations annually, which is supplemented each year with approximately 20 rotating tributary stations or periodic special stations sampled in coordination with capital projects, planning, changes in facility operation, or in response to regulatory changes.

Table 8-1. Current Harbor Survey Laboratory Protocols

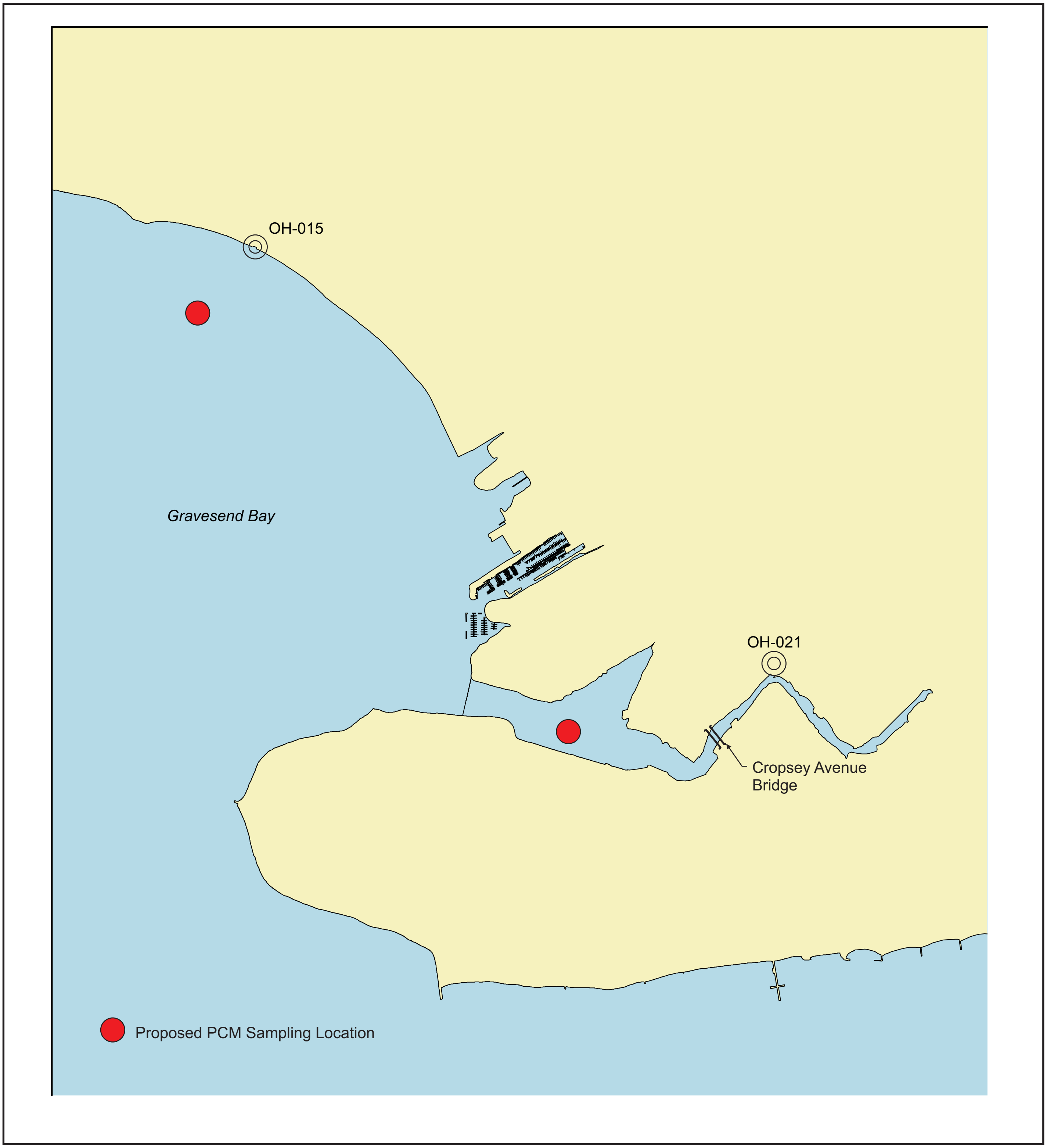
Parameter	Method
Ammonia (as N)	EPA 350.1
Chlorophyll ‘a’	EPA 445.0, modified for the Welschmeyer Method
Dissolved Oxygen	SM 4500-O C, Azide Modification (Winkler Method)
Dissolved Silica	SM 18-19 4500-Si D or USGS I-2700-85
Enterococcus	EPA Method 1600, Membrane Filter
Fecal Coliform	SM 18-20 9222D, Membrane Filter
Nitrate (as N)	EPA 353.2 or SM 18-20 4500-NO3 F
Orthophosphate (as P)	EPA 365.1
pH	SM 4500-H B, Electrometric Method
Total Kjeldahl Nitrogen	EPA 351.2
Total Phosphorus	EPA 365.4
Total Suspended Solids	SM 18-20 2540D

Notes: SM – Standard Methods for the Examination of Water and Wastewater; EPA – EPA’s Sampling and Analysis Methods. Field instrumentation also includes an SBE 911 Sealogger CTD which collects salinity, temperature, and conductivity, among other parameters.

For the purposes of the post-construction monitoring of Coney Island Creek, sampling will be conducted at two locations as shown on Figure 8-8: downstream of the Cropsey Avenue Bridge and at a location in Gravesend Bay that is expected to be remote from influences of Coney Island Creek. Neither of these locations is currently sampled by the Harbor Survey program. All stations related to the Post-Construction Monitoring Program will be sampled a minimum of twice per month from May through September and a minimum of once per month during the remainder of the year. If sampling stations are covered with ice during cold weather, NYCDEP personnel will not be engaging in sampling.

Data collected during this program will be used primarily to verify the receiving-water model that will be used to demonstrate relative compliance levels in the waterbody. Therefore, during each annual cycle of compliance monitoring, the calibrated model will be used to measure compliance, and will be verified annually with the post-construction compliance monitoring data collected.

Because the data will be used in this manner, the data collected will be evaluated for its utility in model verification during each annual cycle of compliance monitoring, and stations may be added, eliminated, or relocated depending on this evaluation. Similarly, the parameters measured will be evaluated for their utility and appropriateness for verifying the receiving water model calibration. At a minimum, the program will collect those parameters with numeric WQS (i.e., DO, fecal coliform, and enterococci). In addition, moored instrumentation may be added or substituted at one or more of these locations if continuous monitoring is determined to be beneficial to model verification, or if logistical considerations preclude the routine operation of the program (navigational limits, laboratory issues, etc.).



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New York City
Department of Environmental Protection

Coney Island Creek Waterbody/Watershed Facility Plan

Post-Construction Compliance Monitoring

FIGURE 8-8

8.5.3. Floatables Monitoring Program

This Waterbody/Watershed Plan incorporates by reference the City-Wide Comprehensive CSO Floatables Plan Modified Facility Planning Report (HydroQual, 2005a) and Addendum 1 – Pilot Floatables Monitoring Program (December 2005) to the Floatables Plan. These documents contain a conceptual framework for the monitoring of floatables conditions in New York Harbor and a workplan for the ongoing program to develop and test the monitoring methodology envisioned in the framework. The objectives set forth in both the Floatables Plan and the program workplan provide a metric for LTCP performance. The program will include the collection of basic floatables presence/absence data from monitoring sites throughout the harbor that will be used to rate and track floatables conditions, correlate rating trends to floatables control programs where applicable, and trigger investigations into the possible causes of consistently poor ratings should they occur. Actions based on the floatables monitoring data and investigations could include short term remediation in areas where monitored floatables conditions create acute human or navigation hazards and, as appropriate, longer term remediation actions and modifications to the Waterbody/Watershed Facility Plan if monitored floatables trends indicate impairment of waters relative to their intended uses.

The full scale Floatables Monitoring Program will be implemented in Coney Island Creek in conjunction with the Post-Construction Compliance Monitoring Program. The floatables ratings will be conducted during the PCM water quality sampling activities that will be initiated upon the completion of Avenue V Pumping Station Upgrade and Avenue V Force Main expected in 2012. In addition, floatables monitoring activities have been conducted during the summers of 2007 and 2008 and will be done again in the summers of 2009 and 2010 as part of the Environmental Benefit Project shoreline cleanups that will be performed by NYCDEP. One of the cleanup sites is located along the Coney Island Creek shoreline at Kaiser Park in the vicinity of Bayview Avenue. This project was undertaken in connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State law and DEC regulations.

In addition to the Floatables Monitoring Program, the Department mitigates the impacts of floatables through the maintenance and servicing of a floatables containment boom on Coney Island Creek near Cropsey Avenue. In the past five years, over 150 cubic yards of floatables have been retrieved from the boom, precluding their dispersal throughout the creek.

The City of New York also engages in several best management practices that reduce the amount of floatables discharged to Coney Island Creek, many of which are described in the City-Wide Comprehensive CSO Floatables Plan, Modified Facility Planning Report, July 2005. Such activities include catch basin hooding, reconstruction, and maintenance; maximization of combined sewage flow to the WPCP; illegal dumping notification programs; and street litter control. Street litter control practices carried out in the Coney Island Creek drainage area include street sweeping, enforcement of New York City Department of Sanitation trash and recycling set out and sidewalk sweeping regulations, public litter basket service, New York City Department of Parks and Recreation cleanup days, and public outreach programs. These programs are tracked, in part, through the Scorecard Litter Rating street cleanliness rating system. And, in addition to the aforementioned Environmental Benefit Project shoreline cleanup, Coney Island

Creek Park has been cleaned by volunteers as part of the Annual New York State Beach Cleanup organized by the American Littoral Society and supported by the Department.

8.5.4 Meteorological Conditions

The performance of any CSO control facility cannot be fully evaluated without a detailed analysis of precipitation, including the intensity, duration, total rainfall volume, and precipitation event distribution that led to an overflow or, conversely, the statistical bounds within which the facility may be expected to control CSO completely. NYCDEP has established 1988 as representative of long-term average conditions and therefore uses it for analyzing facilities where "typical" conditions (rather than extreme conditions) serve as the basis for design. The comparison of rainfall records at JFK airport from 1988 to the long-term rainfall record is shown in Table 8-2, and includes the return period for 1988 conditions.

Table 8-2. Rainfall Statistics, JFK Airport, 1988 and Long-Term Average

Statistic	1970-2002 Median	1988	
		Value	Return Period (years)
Total Volume (inches)	39.4	40.7	2.6
Intensity, (in/hr)	0.057	0.068	11.3
Number of Storms	112	100	1.1
Storm Duration (hours)	6.08	6.12	2.1

In addition to its aggregate statistics indicating that 1988 was representative of overall long-term average conditions, 1988 also includes critical rainfall conditions during both recreational and shellfishing periods. Further, the average storm intensity for 1988 is greater than one standard deviation from the mean so that using 1988 as a design rainfall year would be conservative with regard to water quality impacts since CSOs and stormwater discharges are driven primarily by rainfall intensity. However, considering the complexity and stochastic nature of rainfall, selection of any year as "typical" is ultimately qualitative, and performance is not expected to simply correlate to annual rainfall volume or any other single statistic. The performance of the upgraded Avenue V Pumping Station and the response of Coney Island Creek with respect to widely varying precipitation conditions will be evaluated with respect to observed rainfall, and will be summarized in a manner similar to that shown in Table 8-2.

Multiple sources of rainfall data will be compiled as part of the final City-Wide Post-Construction Monitoring Program. On an interim basis, however, the primary source of rainfall data will be from nearby airports (JFK, LGA, and EWR), the Central Park NOAA gauge, and from any NYCDEP gauges that may be available in the vicinity of the Coney Island Creek watershed. The use of NEXRAD cloud reflectivity data will be limited to testing implementation techniques until its utility is fully understood. Any data sets determined to be of limited value in the analysis of compliance may be discontinued.

8.5.5 Analyses

The performance of the Coney Island Creek WB/WS Facility Plan will be evaluated on an annual basis using InfoWorks, a landside computer model approved by NYSDEC (HydroQual, 2004). Rather than rely on a high spatial sampling program that would be unable to account for temporal variability, performance will be analyzed using a calibrated modeling system verified with data from a more limited field sampling program. The InfoWorks collection system model has historically been used in Coney Island Creek facility planning and will serve as the basis for future model-related activities.

CSO volumes will be quantitatively analyzed on a monthly basis to isolate any periods of non-compliance or performance issues and their impact on water quality. Water quality modeling re-assessments will be conducted every two years, based on the previous two years of collected water quality field data. Water quality modeling conditions will be based on the hydrodynamic and meteorological conditions for the study year, documented operational issues that may have impacted the facility performance, and water quality boundary conditions measured in Upper New York Bay as part of the Harbor Survey. Results will be compared to relevant post-construction monitoring (Harbor Survey) data to validate the modeling system, and the performance will be expressed in a quantitative compliance level for applicable standards. Should this analysis indicate that progress towards the desired results is not being made, the analysis will:

- Re-verify all model inputs, collected data and available QA/QC reports;
- Consult with operations personnel to ensure unusual operational problems (e.g. screening channel overload/shutdown, pump repair, etc.) were adequately documented;
- Evaluate specific periods of non-compliance to identify attributable causes;
- Confirm that operational protocols were implemented and that these protocols are sufficient to avoid operationally-induced underperformance;
- Re-evaluate protocols as higher frequency and routine problems reveal themselves; and, finally,
- Revise protocols as appropriate, and if necessary, conduct a Use Attainability Analysis (UAA) and revise the Waterbody/Watershed Plan.

Because of the dynamic nature of water quality standards and approaches to non-compliance conditions, a period of ten years of operation will be necessary to generate the minimal amount of data necessary to perform meaningful statistical analyses for water quality standards review and for any formal use attainability analysis (UAA) that may be indicated. Following completion of the tenth annual report containing data during facility operation, a more detailed evaluation of the capability of the Coney Island Creek Waterbody/Watershed Facility Plan to achieve the desired water quality goals will take place, with appropriate weight given to the various issues New York City identified during the evaluations documented in the annual reports. If it is determined that the desired results are not achieved, NYCDEP will revisit the feasibility of cost-effective improvements. Alternately, the water quality standards revision process may commence with a UAA that would likely rely in part on the findings of the post-construction compliance monitoring program. The approach to future improvements beyond the 10-year post-construction monitoring program will be dictated by the findings of that program as well as the input from NYSDEC SPDES permit and CSO Consent Order administrators. This schedule is not intended to contradict the 5-year cycle used for updating SPDES permits.

8.5.6 Reporting

Post-construction compliance monitoring will be appended to the annual BMP report submitted by NYCDEP in accordance with their SPDES permits. The monitoring report will provide summary statistics on rainfall, the amount of combined sewage, and the fraction of the generated volume of combined sewage that discharged to Coney Island Creek. Verification and refinement of the landside and water quality models will be documented as necessary, and modeling results will be presented to assess water quality effects, and other conditions affecting water quality impacts will also be included in the BMP report.

In addition to the information to be provided in the Annual BMP Report, NYCDEP will submit a summary of the monitoring and modeling, including the data, once every five years. NYSDEC has acknowledged that the variability in precipitation dynamics may require more than five successive years of data to statistically validate the models used for evaluating compliance, but have nonetheless stated that this information will be used to identify areas of significant water quality non-compliance and gaps in the water quality modeling, and measure progress with the LTCP goals.

8.6 CONSISTENCY WITH FEDERAL CSO POLICY

The Coney Island Creek Waterbody/Watershed Facility Plan was developed so that it satisfies the requirements of the federal CSO Control Policy. Through extensive water quality and sewer system modeling, data collection, community involvement, and engineering analysis, the NYCDEP has adopted a plan that incorporates the findings of over a decade of inquiry to achieve the highest reasonably attainable use of Coney Island Creek. This Watershed/Waterbody Facility Plan addresses each of the nine elements of long-term CSO control as defined by federal policy and shown in Table 8-3. The CSO Consent Order requires submission of a Coney Island Creek Long Term Control Plan six months after the approval of the Waterbody/Watershed Facility Plan. As this report addresses all the elements required in an LTCP it will become the foundation for the LTCP submittal.

Table 8-3. Nine Elements of Long-Term CSO Control

Element	Section(s)	Summary
1. Characterization, Monitoring, and Modeling of the Combined Sewer System	3.0	Addressed during Outer Harbor Facility planning (1994), Coney Island Creek Facilities Upgrade (1998), and Waterbody/Watershed Plan development (2005-2009).
2. Public Participation	6.0	The Waterbody/Watershed Plan was developed with active involvement from the affected public and other stakeholders during its development.
3. Consideration of Sensitive Areas	4.6	There are no sensitive areas identified within Coney Island Creek.
4. Evaluation of Alternatives	7.0	Detailed evaluations conducted during facility planning projects and herein clearly establish the combination of alternatives that comprise the Waterbody/Watershed Facility Plan.
5. Cost/Performance Considerations	7.0	Both facility planning and Waterbody/Watershed Plan development evaluations of cost suggest that the highest-level controls (100% CSO capture, sewer separation) provide insignificant additional water quality benefits despite inordinate costs. The Waterbody/Watershed Plan was developed according to a "knee-of-the-curve" type cost-benefit analysis.
6. Operational Plan	8.0	NYCDEP will continue to satisfy the operational requirements of the 14 BMPs for CSO control, including the Owls Head WPCP Wet Weather Operating Plans, as required under the City SPDES permits. The BMPs satisfy the nine minimum control requirement of federal CSO policy. NYCDEP will also continue implementation of other programmatic controls.
7. Maximizing Treatment at the Existing WPCP	7.0	Maximization of treatment at the Owls Head and Coney Island WPCP's is included in the Waterbody/Watershed Plan through satisfaction of the operational requirements of the WPCP WWOPs. However, both WPCP's are remote from Coney Island Creek and their operation does not significantly affect CSO discharges to the Creek.
8. Implementation Schedule	8.0	The Coney Island Creek Facility Upgrade was underway at the time of the writing of this report. Construction activity is anticipated to conclude in 2012.
9. Post-Construction Compliance Monitoring	8.0	Post-construction monitoring will be performed per CSO Control Policy requirements: receiving water will be monitored per Harbor Survey protocols at three stations within Coney Island Creek. Monitoring data will be used to assess compliance, to optimize facility performance, and to trigger adaptive management alternatives.

9.0 Water Quality Standards Review

The Coney Island Creek Waterbody/Watershed (WB/WS) Facility Plan follows the requirements of the USEPA CSO policy. In September 2007, the WB/WS Facility Plan will serve as the basis for the CIC LTCP and will be a component of the New York City Department of Environmental Protection's Combined Sewer Overflow City-Wide Long-Term Control Plan. As such, this Plan is being prepared in a manner fully consistent with USEPA's CSO Control Policy, the Wet Weather Water Quality Act of 2000 and applicable USEPA guidance.

As noted in Section 1.2 and as stated in the Clean Water Act (CWA), it is a national goal to achieve "fishable/swimmable" water quality in the nation's waters wherever attainable. The CSO Policy also reflects the CWA's objectives to achieve high water quality standards (WQS) by controlling CSO impacts, but the Policy recognizes the site-specific nature of CSOs and their impacts and provides the necessary flexibility to tailor controls to local situations. The key principles of the CSO Policy were developed to ensure that CSO controls are cost-effective and meet the objectives of the CWA. In doing so, the Policy provides flexibility to municipalities to consider the site-specific nature of CSOs and to determine the most cost-effective means of reducing pollutants and meeting CWA objectives and requirements. The Policy also provides for the review and revision, as appropriate, of water quality standards when developing CSO control plans to reflect the site-specific wet weather impacts of CSOs.

In 2001, USEPA published guidance for coordinating CSO long-term planning with water quality standards reviews. This guidance re-affirmed that USEPA regulations and guidance provide States with the opportunity to adapt their WQS to reflect site-specific conditions related to CSOs. The guidance encouraged the States to define more explicitly their recreational and aquatic life uses and then, if appropriate, modify the criteria accordingly to protect the designated uses.

The Coney Island Creek WB/WS Facility Plan was developed in a manner consistent with the CSO Policy and applicable guidance. Specifically, cost-effectiveness and knee-of-the-curve evaluations were performed for CSO load reduction evaluations using 1988 precipitation data (JFK Airport). Baseline and WB/WS Facility Plan receiving water impact evaluations were performed for average annual rainfall conditions consistent with CSO Policy guidance. The plan resulting from following EPA regulation and guidance results in substantial benefits. However, it does not fully attain the "fishable/swimmable" goal. When the planning process has this result the national policy calls for a review and where appropriate, a revision to water quality standards. The purpose of this section therefore is to address the water quality standards review and revision guidance applicable to the CSO Policy.

9.1 WATER QUALITY STANDARDS REVIEW

9.1.1 Numeric Water Quality Standards

New York State waterbody classifications and numerical criteria which are or could become applicable to Coney Island Creek are shown in Table 9-1. Coney Island Creek is classified as Class I at present with best usages as secondary contact recreation and fishing. This classification is suitable for fish propagation and survival.

Table 9-1. New York State Numeric Surface Water Quality Standards (Saline)

Class	Dissolved Oxygen	Coliform Bacteria (Pathogens)		Enterococci
		Total	Fecal	
I	>4.0 mg/L	Monthly geometric mean <10,000/100 mL	Monthly geometric mean <2,000/100 mL	NA
SB, SC	≥ 4.8 mg/L ≥ 3.0 mg/L	Monthly median <2,400/100 mL 80% <5,000/100 mL	Monthly geometric mean <200/100 mL	Geometric Mean <35/100 mL

Notes: The dissolved oxygen standard for SB/SC includes a chronic standard based on daily average; the concentration may fall below 4.8 mg/L for a limited number of days, but must never fall below the acute standard of 3.0 mg/L. The enterococci coastal recreation water infrequent use reference level (upper 95% confidence limit) = 501/100 mL based on the EPA Bacteria Rule; the geometric mean applies to the bathing season.
NA: Not Applicable.

It is understood at present that the Class I dissolved oxygen criterion of never-less-than 4.0 mg/L is considered satisfactory for fish propagation and survival and therefore consistent with the fishable goal of the CWA.

The Interstate Environmental Commission (IEC) waterbody classifications applicable to waters within the Interstate Environmental District are shown in Table 9-2. Coney Island Creek is classified as Class B-1 with best intended uses of fishing and secondary contact recreation.

Table 9-2. Interstate Environmental Commission Numeric Water Quality Standards

Class	Usage	DO (mg/L)	Waterbodies
A	All forms of primary and secondary contact recreation, fish propagation, and shellfish harvesting in designated areas	≥ 5.0	East R. east of the Whitestone Br.; Hudson R. north of confluence with the Harlem R; Raritan R. east of the Victory Br. into Raritan Bay; Sandy Hook Bay; lower New York Bay; Atlantic Ocean
B-1	Fishing and secondary contact recreation, growth and maintenance of fish and other forms of marine life naturally occurring therein, but may not be suitable for fish propagation.	≥ 4.0	Hudson R. south of confluence with Harlem R.; upper New York Harbor; East R. from the Battery to the Whitestone Bridge; Harlem R.; Arthur Kill between Raritan Bay and Outerbridge Crossing.
B-2	Passage of anadromous fish, maintenance of fish life	≥ 3.0	Arthur Kill north of Outerbridge Crossing; Newark Bay; Kill Van Kull

9.1.2 Narrative Water Quality Standards

The New York State narrative water quality standards which are applicable to Coney Island Creek and all waterbody classifications are shown in Table 9-3. The IEC narrative water quality regulations which are applicable to Paerdegat Basin and all waters of the Interstate Environmental District are shown in Table 9-4.

Table 9-3. New York State Narrative Water Quality Standards

Parameters	Classes	Standard
Taste-, color-, and odor producing toxic and other deleterious substances	SA, SB, SC, I, SD A, B, C, D	None in amounts that will adversely affect the taste, color or odor thereof, or impair the waters for their best usages.
Turbidity	SA, SB, SC, I, SD A, B, C, D	No increase that will cause a substantial visible contrast to natural conditions.
Suspended, colloidal and settleable solids	SA, SB, SC, I, SD A, B, C, D	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.
Oil and floating substances	SA, SB, SC, I, SD A, B, C, D	No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease.
Garbage, cinders, ashes, oils, sludge and other refuse	SA, SB, SC, I, SD A, B, C, D	None in any amounts.
Phosphorus and nitrogen	SA, SB, SC, I, SD A, B, C, D	None in any amounts that will result in growth of algae, weeds and slimes that will impair the waters for their best usages.

Table 9-4. Interstate Environmental Commission Narrative Regulations

Classes	Regulation
A, B-1, B-2	All waters of the Interstate Environmental District (whether of Class A, Class B, or any subclass thereof) shall be of such quality and condition that they will be free from floating solids, settleable solids, oil, grease, sludge deposits, color or turbidity to the extent that none of the foregoing shall be noticeable in the water or deposited along the shore or on aquatic substrata in quantities detrimental to the natural biota; nor shall any of the foregoing be present in quantities that would render the waters in question unsuitable for use in accordance with their respective classifications.
A, B-1, B-2	No toxic or deleterious substances shall be present, either alone or in combination with other substances, in such concentrations as to be detrimental to fish or inhibit their natural migration or that will be offensive to humans or which would produce offensive tastes or odors or be unhealthful in biota used for human consumption.
A, B-1, B-2	No sewage or other polluting matters shall be discharged or permitted to flow into, or be placed in, or permitted to fall or move into the waters of the District, except in conformity with these regulations.

9.1.3 Attainability of Water Quality Standards

Sections 7.6 and 8.2 describe the results of water quality modeling analyses which were performed to evaluate attainability of water quality standards under Baseline and WB/WS Facility Plan conditions. The complete results of these analyses are summarized graphically in the Coney Island Creek Water Quality Modeling Report (NYCDEP, 2007) and in tabular form in Tables 9-5 through 9-14 for the various numerical criteria for dissolved oxygen and bacteria for current and fishable/swimmable classifications.

Attainment of Currently Applicable Standards

Table 9-5 summarizes projected percentage annual attainability for dissolved oxygen for current NYSDEC Class I and IEC CLASS B-1 criterion for Baseline and WB/WS Facility plan conditions at the head-end, mid-creek (approximately adjacent to W. 21st St.) and mouth of

Coney Island Creek. The WB/WS Facility Plan improves compliance at the head-end to 86% from 82% under Baseline conditions, achieves 85% mid-creek and 100% compliance at the mouth.

Table 9-5. Annual Attainment of Dissolved Oxygen Criteria for Design Year

Location	NYSDEC Class I (>4.0 mg/L) Percent Attainment		IEC Class B-1 (>4.0 mg/l) Percent Attainment	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	82%	86%	82%	86%
Mid-Creek*	80%	85%	80%	85%
Mouth	100%	100%	100%	100%
*Reach with lowest attainment in Coney Island Creek				

Table 9-6 summarizes projected percentage annual compliance for total coliform for the current Class I secondary contact criterion on a monthly basis. The table indicates that the WB/WS Facility Plan achieves almost total compliance along the length of Coney Island Creek under Baseline conditions, the only exception being one month (November) when the upper portion of the creek below the head end would not attain the criterion.

Table 9-6. Annual Attainment of Total Coliform Criteria for Design Year

Location	Class I GM < 10,000 Percent Attainment	
	Baseline	WB/WS FP
Head End	75%	92%
Mid-Creek*	67%	92%
Mouth	100%	100%
*Reach with lowest attainment in Coney Island Creek		

Table 9-7 presents projected percentage compliance for total coliform for the recreation season for current Class I secondary contact criterion. The recreation season is defined as the four month period from May 15 through September 15 which encompasses the official public bathing season at New York City's seven public bathing beaches. The table indicates complete compliance for the secondary contact criterion on a seasonal basis along the length of Coney Island Creek under both Baseline and WB/WS Facility Plan conditions.

Table 9-7. Recreation Season Attainment of Total Coliform Criteria Design Year

Location	Class I GM < 10,000 Percent Attainment	
	Baseline	WB/WS FP
Head End	100%	100%
Mid-Creek*	100%	100%
Mouth	100%	100%
*Reach with lowest attainment in Coney Island Creek		

Table 9-8 shows similar conditions for fecal coliform. For current Class I secondary contact, the WB/WS Facility Plan improves the level of compliance throughout Coney Island

Creek from Baseline conditions. However, more than the upper one-half of the waterway is projected to be in non-compliance for one to three months of the year.

Table 9-8. Annual Attainment of Fecal Coliform Criteria for Design Year

Location	Class I GM < 2,000 Percent Attainment	
	Baseline	**WB/WS FP**
Head End	58%	75%
Mid-Creek*	58%	67%
Mouth	100%	100%
*Reach with lowest attainment in Coney Island Creek		

Table 9-9 presents compliance for fecal coliform for the recreation season for the current Class I secondary contact criterion. As for total coliform, the secondary contact criterion is attained throughout Coney Island Creek under both Baseline and WB/Ws Facility Plan conditions.

Table 9-9. Recreation Season Attainment of Fecal Coliform Criteria for Design Year

Location	Class I GM < 2,000 Percent Attainment	
	Baseline	**WB/WS FP**
Head End	100%	100%
Mid-Creek*	100%	100%
Mouth	100%	100%
*Reach with lowest attainment in Coney Island Creek		

It is to be noted that under existing conditions, no compliance is attained in Coney Island Creek with the secondary contact criteria, annually or seasonally. The WB/WS Facility Plan represents a significant improvement from existing conditions.

Attainment of Potential Future Standards

NYSDEC considers Class I dissolved oxygen standards supportive of aquatic life uses and consistent with the "fishable" goal of the CWA. Therefore, a standards revision would not be necessary for full use attainment in Coney Island Creek. For Coney Island Creek to be fully supportive of primary contact uses, it would be necessary to comply with Class SB/SC standards for total and fecal coliform, and to the enterococci standard and reference level established by USEPA with the Bacteria Rule. Tables 9-10 through 9-14 summarize projected percentage annual and recreation season compliance with these potential criteria. The WB/WS Facility Plan improves compliance with the primary contact criteria for total and fecal coliform on an annual basis from the Baseline condition (Tables 9-10 and 9-12) but does not achieve total compliance throughout Coney Island Creek. For the recreation season, the median for total coliform and the geometric mean for fecal coliform are achieved under WB/WS Facility Plan and Baseline conditions on a seasonally averaged basis (Tables 9-11 and 9-13), but the upper limit for total coliform is not achieved for either condition except near the mouth.

Table 9-10. Annual Attainment of SB/SC Total Coliform Criteria

Location	Class SB/SC Percent Attainment			
	Median < 2,400		80% < 5,000	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	33%	50%	8%	17%
Mid-Creek*	33%	67%	8%	25%
Mouth	100%	100%	58%	92%
*Reach with lowest attainment in Coney Island Creek				

Table 9-11. Recreation Season Attainment of SB/SC Total Coliform Criteria

Location	Class SB/SC Percent Attainment			
	Median < 2,400		80% < 5,000	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	100%	100%	33%	67%
Mid-Creek*	100%	100%	33%	67%
Mouth	100%	100%	100%	100%
*Reach with lowest attainment in Coney Island Creek				

Table 9-12. Annual Attainment of SB/SC Fecal Coliform Criteria

Location	Class SB/SC GM < 200 Percent Attainment	
	Baseline	WB/WS FP
Head End	33%	42%
Mid-Creek*	42%	50%
Mouth	83%	92%
*Reach with lowest attainment in Coney Island Creek		

Table 9-13. Recreation Season Attainment of SB/SC Fecal Coliform Criteria

Location	Class SB/SC GM < 200 Percent Attainment	
	Baseline	WB/WS FP
Head End	100%	100%
Mid-Creek*	100%	100%
Mouth	100%	100%
*Reach with lowest attainment in Coney Island Creek		

Table 9-14 summarizes projected compliance for potential enterococci criteria which could be applied to Coney Island Creek for primary contact water use. It is noted that the compliance values shown on Table 9-14 are for the four month period May 15 through September 15 only, as the enterococci criteria were developed for the bathing season. The table shows expected compliance with the seasonal geometric mean enterococci criterion throughout most of Coney Island Creek under both Baseline and WB/WS Facility Plan conditions although modeling calculations show a zone of non-compliance in the vicinity of CSO Outfall OH-021. The WB/WS Facility Plan improves the level of compliance with the infrequent use coastal recreation water reference level (upper 95% confidence limit) somewhat, but complete compliance is not attained.

Table 9-14. Recreation Season Attainment of Enterococci Bacteria Criteria for Design Year

Location	Water Quality Standard Geometric Mean < 35		Infrequent Use Reference Level <501	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	100%	100%	64%	68%
Mid-Creek	100%	100%	67%	70%
Mouth	100%	100%	85%	87%
*Reach with lowest attainment in Coney Island Creek				

It should be noted that NYSDEC considers Class I dissolved oxygen standards supportive of aquatic life uses. Therefore, a standards upgrade is not necessary for full use attainment.

9.1.4 Attainment of Narrative Water Quality Standards

Table 9-3 summarizes NYSDEC narrative water quality standards which are applicable to Coney Island Creek and all waters of the state. The existing CSO discharge to the creek and the stormwater from the separately sewered areas discharge some amounts of materials which affect most or all of the listed parameters to some degree. Periodic odors at the head end of Coney Island Creek are the result of deposition of organic solids; turbidity may be evident after significant rainfall events; oil, floating substances and floatable materials are discharged in some amounts, and phosphorus and nitrogen are present in CSO and stormwater discharges.

The WB/WS Facility Plan will not completely eliminate, but will reduce, the discharge of these materials to Coney Island Creek, especially those materials contributed by the CSO discharge. For the CSO discharge, the upgrade and rehabilitation of the Avenue V Pumping Station, and the construction of new dry and wet weather force mains will reduce the discharge of the CSO-based parameters of concern by at least 87 percent based on volumetric capture, heavy solids that would settle near the outfall will be virtually eliminated and floatable materials originating from the combined sewer area will be significantly abated beyond levels required by the CSO Policy. Additional safeguards for floatable materials are effective implementation of the City-Wide CSO Floatables Plan and the retention of the floatables boom and continuation of skimmer vessel operations. Consequently, the adverse impacts of the current CSO discharges will be greatly diminished and, for floatable materials, virtually eliminated.

The full scale Floatables Monitoring Program will be implemented in Coney Island Creek in conjunction with the Post-Construction Compliance Monitoring Program (PCM). The floatables ratings will be conducted during the PCM water quality sampling activities that will be initiated upon the completion of Avenue V Pumping Station Upgrade and Avenue V Force Main expected in 2012. In addition, floatables monitoring activities have been conducted during the summers of 2007 and 2008 and will be done again in the summers of 2009 and 2010 as part of the Environmental Benefit Project shoreline cleanups that will be performed by NYCDEP. One of the cleanup sites is located along the Coney Island Creek shoreline at Kaiser Park in the vicinity of Bayview Avenue. This project was undertaken in connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State law and DEC regulations.

In addition to the Floatables Monitoring Program, the Department mitigates the impacts of floatables through the maintenance and servicing of a floatables containment boom on Coney

Island Creek near Cropsey Avenue. In the past five years, over 150 cubic yards of floatables have been retrieved from the boom, precluding their dispersal throughout the creek.

The City of New York also engages in several best management practices that reduce the amount of floatables discharged to Coney Island Creek, many of which are described in the City-Wide Comprehensive CSO Floatables Plan, Modified Facility Planning Report, July 2005. Such activities include catch basin hooding, reconstruction, and maintenance; maximization of combined sewage flow to the WPCP; illegal dumping notification programs; and street litter control. Street litter control practices carried out in the Coney Island Creek drainage area include street sweeping, enforcement of New York City Department of Sanitation trash and recycling set out and sidewalk sweeping regulations, public litter basket service, New York City Department of Parks and Recreation cleanup days, and public outreach programs. These programs are tracked, in part, through the Scorecard Litter Rating street cleanliness rating system. And, in addition to the aforementioned Environmental Benefit Project shoreline cleanup, Coney Island Creek Park has been cleaned by volunteers as part of the Annual New York State Beach Cleanup organized by the American Littoral Society and supported by the Department.

With regard to the impacts of stormwater on the narrative criteria, the City-Wide programs for street cleaning, catch-basin repair and hood replacement, and catch-basin maintenance serve as effective best management practices to reduce impacts. In the case of floatable materials, these controls are considered to reduce impacts to the maximum extent practicable.

The WB/WS Facility plan, although not completely eliminating all of the parameters of concern, will eliminate odors, reduce turbidity, the deposition of organic solids and floatable materials and improve the aesthetic uses of Coney Island Creek. Phosphorus and nitrogen discharges from the CSOs will be reduced by more than 87 percent and the remaining amounts are not significant in comparison to other sources of these materials to Lower New York Bay.

9.1.5 Water Uses Restored

Fish and Aquatic Life Protection Use

Table 9-5 presents the expected improvements in attainment of dissolved oxygen criteria with the WB/WS Facility Plan as compared to Baseline conditions for current dissolved oxygen standards. The plan is expected to attain the Class I dissolved oxygen standard between 85 to 100 percent of the time along the length of Coney Island Creek on an annual basis. This is considered to be a reasonably high level of attainment on an annual cycle in terms of the protection of fish and aquatic life, various forms of which spawn throughout almost the entire year. In addition, the periodic anoxia which currently exists throughout the upper one-half of Coney Island Creek will be eliminated, thus producing habitat suitable for the restoration of a diversity of benthic organisms. This level of attainment of the Class I dissolved oxygen standard results from complete elimination of the illegal sanitary connections to storm sewers and significant abatement of the CSO as specified in the WB/WS Facility Plan. Dissolved oxygen response diagrams shown in the Coney Island Creek Water Quality Modeling Report (NYCDEP, 2007) indicate that increasing the CSO capture from 87 to 100 percent would result in a negligible improvement in dissolved oxygen. Full attainment of the dissolved oxygen standard would require relocation or capture and treatment of the stormwater discharges. This level of control is beyond engineering feasibility and cost-effectiveness and is not practicable.

Primary and Secondary Contact Recreation Use

Table 9-6 through Table 9-14 present expected attainment of the various bacteriological water quality standards under both annual and recreational season conditions for the Baseline and WB/WS Facility Plan conditions. It is observed from Table 9-6 (total coliform) and Table 9-8 (fecal coliform) that the WB/WS Facility Plan is not expected to achieve the current Class I secondary contact water quality standards along the length of the creek throughout the year. The continuation of the stormwater discharges precludes the attainment of this use year-round. Tables 9-7 and 9-9 indicate that the current secondary contact criteria are attained during the summer recreation season.

Table 9-10 and Table 9-12 indicate that, for a potential Class SB/SC primary contact designation, the WB/WS Facility plan produces some improvement in attainment of the criteria than exists under Baseline conditions, but that these primary contact water quality standards would not be attained for significant period of the year.

For the summer recreation season, Tables 9-11, 9-13, and 9-14 show differing results. Table 9-11 indicates that while the total coliform median is attained under both Baseline and WB/WS Facility plan conditions, the upper limit is not achieved. Tables 9-13 and 9-14 for fecal coliform and enterococci, respectively, indicate that the numerical geometric mean requirements for primary contact are expected to be attained during the summer (note that there is an area near the CSO outfall where the enterococci requirement would be exceeded). It is the continuation of the stormwater discharges into Coney Island Creek which is primarily responsible for the levels of non-attainment shown.

Aesthetic Use

As discussed in Section 9.1.4, the WB/WS Facility Plan will not completely eliminate all regulated parameters in the NYSDEC narrative water quality standards to zero discharge levels, but will greatly reduce the volumetric discharge of such substances from the CSOs. A best management practice level of control is being implemented for floatable materials for current CSO and stormwater discharges and will continue after implementation of the Waterbody/Watershed Facility Plan as well as for some of the other factors addressed by the narrative criteria. Accordingly, with the proposed CSO controls, the aesthetic conditions in Coney Island Creek should improve significantly to a level consistent with the other attained water uses and the nature of the adjacent shoreline uses.

9.1.6 Practical Considerations

The previous section describes the improvement in the level of attainment with Class I dissolved oxygen standards which is expected to result from the WB/WS Facility Plan. As noted, the annual attainment is expected to be reasonably good, but dissolved oxygen is projected to be below the Class I criterion for some confined periods of time over the annual cycle in the upper two-thirds of Coney Island Creek.

For the majority of months, complete attainment throughout the creek is expected. In the other months where some criterion exceedances are expected, it should be noted that the impact on fish larval propagation is likely to be contained. Fish larvae spawning in Coney Island Creek will be exchanged with, and transported to, Gravesend Bay and Lower New York Bay waters where dissolved oxygen will be greater and in compliance with standards. The organisms will therefore not be continuously exposed to Coney Island Creek dissolved oxygen which may be depressed below the criterion. Because of the significant amount of larval transport which occurs between Coney Island Creek and the Lower Bay and the exposure of the organisms to continuously varying, rather than static, dissolved oxygen concentrations, it is considered to be more technically appropriate to view the Coney Island Creek and Lower Bay ecosystem in its entirety rather than by individual tributary or sub-region for purposes of fish and aquatic life protection.

Additionally, impacts to juvenile fish in the upper reach of Coney Island Creek should not occur as there exists no through passage and the fish would avoid any temporarily depressed dissolved oxygen. As noted, minimum dissolved oxygen projected for the upper reach should be sufficient for restoration and protection of benthic organisms.

For these reasons, conditions in Coney Island Creek are supportive of the fishable goal of the CWA. Sections 9.1.4 and 9.1.5 indicate that the WB/WS Facility Plan is not expected to achieve current Class I secondary contact bacteriological criteria on an annual basis because of the continued presence of stormwater discharges from the separately sewered areas. Modeling calculations shown in the Coney Island Creek Water Quality Modeling Report (NYCDEP, 2007) also indicate that implementation of stormwater BMPs to the maximum extent practicable would not result in annual attainment of the secondary contact criteria for fecal coliform. Compliance annually with potential primary contact Class SB/SC bacteriological criteria is even less attainable given current practicable abatement practices for stormwater.

Section 9.1.5 also notes that during the summer recreation season, water quality is expected to be supportive of some of the numerical criteria for the swimmable (primary contact recreation) goal of the CWA. However, swimming should not be considered as a best use due to periodic discharges from the CSOs and continuing stormwater discharges. In addition, the nature of the Creek with its bulkheading, limited access, and degraded conditions along its shorelines precludes swimming as a suitable use for Coney Island Creek

9.2 WATER QUALITY STANDARDS REVISION

9.2.1 Overview of Use Attainability and Recommendations

Section 9.1 summarizes the existing and potential water quality standards for Coney Island Creek and expected levels of attainment based on modeling calculations. As shown from modeling calculations in the Coney Island Creek Water Quality Modeling Report (NYCDEP, 2007), the WB/WS Facility Plan improves dissolved oxygen resources in the upper reaches from existing and the Baseline conditions. The result is a reasonably high level of attainment of Class I numerical criterion on an annual cycle, but complete attainment is not achieved. The modeling results in the Coney Island Creek Water Quality Modeling Report (NYCDEP, 2007) also show that none of the measures evaluated to improve dissolved oxygen (100% CSO capture, stormwater BMPs at 25% reduction) is projected to achieve full attainment of the Class I dissolved oxygen standard.

For aquatic life protection, the attainment of this water use can be expected to be greater than that suggested by compliance with numerical criteria during the summer period due to the limited larval residence time in the creek, organism transport to Lower New York Bay and the technical appropriateness of considering the Coney Island Creek and Lower Bay ecosystem in its entirety rather than as individual components. In addition, the Coney Island Creek habitat has been significantly altered by human activity throughout the last two centuries thus limiting its attractiveness as a fish habitat.

From a water quality regulations standpoint, if attainability of the fish and aquatic life protection use is to be assessed solely by the attainment of the numerical dissolved oxygen criteria for Class I rather than by a larval survivability, then a Use Attainability Analysis (UAA) may be warranted for Coney Island Creek for dissolved oxygen. It is considered that the development of the watershed and the resulting imperviousness and attendant large stormwater runoff are human-caused conditions which can not be practicably remedied which is a factor that can be considered for a UAA under Federal and State regulation.

For recreational activity, the currently designated use of secondary contact recreation is not expected to be attained by the WB/WS Facility Plan on an annual basis. However, as shown from the modeling calculation results presented in the Coney Island Creek Water Quality Modeling Report (NYCDEP, 2007), the WB/WS Facility Plan is expected to produce a significant improvement in attainment compared with existing conditions once the illegal sanitary connections to storm sewers are rectified. Water quality modeling calculation results also show that additional measures which could be considered to improve Class I secondary contact attainment (100% CSO capture, CSO disinfection, stormwater BMPs with 25% load reduction) also would not achieve full attainment annually. It is expected that numerical water quality conditions suitable to support Class I secondary contact would be attained during the summer recreation season and would be achieved for both relevant bacteriological indicators, total and fecal coliform. This is a very significant improvement from existing conditions.

From a water quality regulations standpoint, Coney Island Creek could be considered to attain the current Class I secondary contact use on a seasonal basis once the WB/WS Facility plan is implemented. This warrants refinement of the current NYSDEC Water Quality Regulations to allow for seasonal use designations. If seasonal compliance with this use goal is not to be considered and annual compliance is required, then a UAA may also be necessary for the bacteriological indicators. The regulatory basis for the UAA would be the same as that for dissolved oxygen.

As noted previously, expected levels of water quality standards attainment are based on modeling calculations which are subject to some level of uncertainty. In addition, calculations are based on a typical year with an average amount of annual rainfall. Therefore, it is recommended that the actual improvements in water quality conditions resulting from the WB/WS Facility Plan be assessed from the multi-year long-term monitoring program described elsewhere in the WB/WS Facility Plan report. The monitoring program will document the actual attainment of uses; whether the uses achieve the attainment compliances expected; whether higher levels of usage are actually achieved supporting a higher waterbody classification.

Sections 9.1.4 and 9.1.5 discuss the attainability of the narrative criteria in the State Water Quality Regulations. As noted, the two primary categorical sources of the narrative criteria constituents are the CSO discharge from outfall OH-021 and the nine stormwater outfalls from the separately sewered areas. Section 7.4.1 indicates that, for the CSO discharge, the WB/WS Facility Plan will achieve an 87% reduction in discharge volume and an expected 95% reduction in TSS loads. From the CSO control standpoint, these percentage reductions exceed the requirements of an 85% reduction in volume/mass in the Federal CSO Control Policy incorporated into the CWA. Therefore, on this basis, for the CSO-based impacts on the narrative criteria, it is presumed that WB/WS Facility Plan provides an adequate level of control to comply with the State's narrative criteria.

As described in this report, modeling calculations indicate that complete attainment of the Class I narrative water quality criteria, both numerical and narrative, can not be attained on an annual basis even with 100 percent retention of the CSO discharges to Coney Island Creek. This water quality based effluent limit (WQBEL) of zero annual CSO overflows is neither cost-effective nor consistent with federal CSO policy. Therefore, until the long-term post-construction monitoring program is completed for Coney Island Creek to document conditions actually attained, it is recommended that a variance to the WQBEL be applied for, and approved, for the Coney Island Creek Waterbody/Watershed Facility Plan for appropriate effluent variables.

9.2.2. NYSDEC Requirements for Variances to Effluent Limitations

The requirements for variances to water quality based effluent limitations are described in Section 702.17 of NYSDEC's Water Quality Regulations. The following is an abbreviated summary of the variance requirements which are considered applicable to Coney Island Creek. The lettering and numbering are those used in Section 702.17.

(a) The department may grant, to a SPDES permittee, a variance to a water quality-based effluent limitation included in a SPDES permit.

(1) A variance applies only to the permittee identified in such variance and only to the pollutant specified in the variance. A variance does not affect or require the department to modify a corresponding standard or guidance value.

(5) A variance term shall not exceed the term of the SPDES permit. Where the term of the variance is the same as the permit, the variance shall stay in effect until the permit is reissued, modified or revoked.

(b) A variance may be granted if the requester demonstrates that achieving the effluent limitation is not feasible because:

(1) Naturally occurring pollutant concentrations prevent attainment of the standard or guidance value;

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent attainment, unless these conditions may be compensated for by the

discharge of sufficient volume of effluent to enable the standard or guidance value to be met without violating water conservation requirements.

(3) human-caused conditions or sources of pollution prevent attainment of the standard or guidance value and cannot be remedied or would cause more environmental damage to correct them to leave in place.

(4) Dams, diversions or other types of hydrologic modifications preclude attainment of the standard or guidance value, and it is not feasible to restore the waterbody to its original condition or to operate such modification in a way that would result in such attainment.

(5) Physical conditions related to the natural features of the waterbody, such as the lack of a proper substrate cover, flow, depth, pools, riffles, and the like, unrelated to chemical water quality, preclude attainment of the standard or guidance value; or

(6) Controls more stringent than those required by section 754.1(a)(1) and (2) of this Title would result in substantial and widespread economic and social impact.

(c) In addition to the requirements of subdivision (b) of this section, the requestor shall also characterize, using adequate and sufficient data and principles, any increased risk to human health and the environment associated with granting the variance compared with attainment of the standard or guidance value absent the variance, and demonstrate to the satisfaction of the department that the risk will not adversely affect the public health, safety and welfare.

(d) The requestor shall submit a written application for a variance to the department. The application shall include:

(1) all relevant information demonstrating that achieving the effluent limitation is not feasible based on subdivision (b) of this section; and

(2) All relevant information demonstrating compliance with the conditions is subdivision (c) of this section.

(e) Where a request for a variance satisfies the requirements of this section, the department shall authorize the variance through the SPDES permit. The variance request shall be available to the public for review during the public notice period for the permit. The permit shall contain all conditions needed to implement the variance. Such conditions shall, at minimum, include:

(1) Compliance with an initial effluent limitation that, at the time the variance is granted represents the level currently achievable by the requestor, and that is no less stringent than that achieved under the previous permit where applicable.

(2) that reasonable progress be made toward achieving the effluent limitations based on the standard or guidance value, including, where reasonable, an effluent limitation more stringent than the initial effluent limitations;

(3) Additional monitoring, biological studies and pollutant minimization measures as deemed necessary by the department.

(4) when the duration of a variance is shorter than the duration of a permit, compliance with an effluent limitation sufficient to meet the underlying standard or guidance value, upon the expiration of the variance; and

(5) A provision that allows the department to reopen and modify the permit for revisions to the variance.

(g) A variance may be renewed, subject to the requirements of this section. As part of any renewal application, the permittee shall again demonstrate that achieving the effluent limitation is not feasible based on the requirements of this section.

(i) The department will make available to the public a list of every variance that has been granted and that remains in effect.

9.2.3. Manner of Compliance with the Variance Requirements

Subdivision (a) authorizes NYSDEC to grant a variance to a "water quality based effluent limitation…included in a SPDES permit." It is assumed that the Coney Island Creek Waterbody/Watershed Facility Plan will be referenced in the Owls Head WPCP SPDES permit in order to provide an additional enforceable mechanism beyond the CSO Consent Order requiring implementation and operations of all plan components. This array of facilities necessary to attain Class I water quality standards can be interpreted as the equivalent of an "effluent limitation" in accordance with the "alternative effluent control strategies" provision of Section 302(a) of the CWA.

Subdivision (a)(1) indicates that a variance will apply only to a specific permittee, in this case, NYCDEP, and only to the pollutant specified in the variance. It is understood that "pollutant" can be interpreted in the plural and one application and variance can be used for one or more relevant pollutants. In Coney Island Creek, a variance would be needed for effluent constituents covered by narrative water quality standards (suspended colloidal and settleable solids; oil and floating substances) that are associated with CSOs. A variance would not be requested for other effluent variables as the non-attainment of dissolved oxygen and bacteriological criteria is expected due to continuing stormwater discharges even with 100 percent CSO removal.

Subdivision (b) requires the permittee to demonstrate that achieving the (water quality based) effluent limitation is not feasible due to a number of factors. It is noted that these factors are the same as those in 40CFR131.10(g) which indicate federal requirements for a Use Attainability Analysis. As with the federal regulations, it is assumed that any one of the six factors is justification for the granting of a variance. The Coney Island Creek Use Attainability Evaluation Report documents the applicability of these six factors cited in Subdivision (b): and specifically discusses (3) human caused conditions.

Subdivision (c) requires the applicant to demonstrate to the department any increased risk to human health associated with granting of the variance compared with attainment of the water quality standards absent the granting of the variance. The information documenting this analysis is contained elsewhere in the Waterbody/Watershed Facility Plan report. Tables 9-6 through 9-9 describe bacteriological conditions which are expected under Baseline and Waterbody/Watershed Facility Plan conditions. As noted, the current Class I secondary contact recreation water quality criteria are attained under both Baseline and Waterbody/Watershed Facility Plan conditions during the recreation season. Further, in the interim, and until the Watershed/Waterbody Facility Plan is fully implemented and operational, very little risk to human health is anticipated.

Subdivision (d) of the variance regulations requires that the requestor submit a written application for a variance to NYSDEC which includes all relevant information pertaining to Subdivisions (b) and (c). NYCDEP will submit a variance application for the Coney Island Creek Waterbody/Watershed Facility Plan to NYSDEC six months before the Plan is placed in operation. The application will be accompanied by the Coney Island Creek Waterbody/Watershed Facility Plan report, the Coney Island Creek Use Attainability Evaluation, and all other supporting documentation pertaining to Subdivisions (b) and (c) and as required by any other subdivisions of the variance requirements.

Subdivision (e) stipulates that approved variances be authorized through the appropriate SPDES permit, be available to the public for review and contain a number of conditions:

- It is assumed that the initial effluent limitation achievable by the permittee at the time the variance becomes effective, after the Waterbody/Watershed Facility Plan is fully implemented and operational, will be based upon the performance characteristics of the Waterbody/Watershed Facility Plan as agreed upon between NYSDEC and NYCDEP. These interim operational conditions will be based on the Plan's design specifications. It is expected that a fact sheet outlining the basis for the WQBEL and interim operational conditions will be appended to the SPDES permit.

- It is assumed that the requirement for demonstration of reasonable progress after construction as required in the permit will include NYCDEP activities such as implementation of the long-term monitoring program and additional waterbody improvement projects as delineated in Section 5 of this Waterbody/Watershed Facility Plan report. Such actions and projects include: 14 best management practices, the City-wide CSO plan for floatables abatement, other long term CSO control planning activities which may affect Coney Island Creek, various New York Harbor water quality improvement projects, and various ecosystem restoration activities. These activities are also required under section (3) of the Subdivision

- It is assumed that the SPDES permit authorizing the Coney Island Creek Waterbody/Watershed Facility Plan variance(s) will contain a provision that allows the department to reopen and modify the permit for revisions to the variance(s).

Subdivision (g) indicates that a variance may be renewed. It is anticipated that a variance for the Coney Island Creek Waterbody/Watershed Facility Plan would require renewals to allow for sufficient long term monitoring to assess the degree of water quality standards compliance.

As appropriate, a variance renewal application will be submitted 180 days before SPDES permit expiration.

At the completion of the variance period(s), it is expected that the results of the long term monitoring program will demonstrate each of the following:

- The degree to which the Waterbody/Watershed Facility Plan attains the Class I classification water quality standards and uses;

- The degree to which the Waterbody/Watershed Facility Plan achieves water quality criteria consistent with the fishable/swimmable goals of the CWA, whether any new low-cost technology is available to enhance the Waterbody/Watershed Facility Plan performance, if needed, whether the waterbody classification for Coney Island Creek can be revised, or whether a Use Attainability Analysis should be approved.

- The degree to which any remaining CSOs impact observed water quality in the Creek.

In this manner, the approval of a WQBEL variance for Coney Island Creek together with an appropriate long term monitoring program can be considered as a step toward a determination of the following:

- Can Coney Island Creek be reclassified in a manner which is wholly or partially compatible with the fishable/swimmable goals of the Clean Water Act, or

- Are controls required for other parameters other than CSOs in order to provide the desired levels of protection and can those controls be implemented, or

- Is a Use Attainability Analysis needed for Coney Island Creek and for which water quality criteria?

Although Coney Island Creek's current waterbody classification, Class I, is not compatible with the goals of the Clean Water Act and would normally require reclassification or a UAA in the State's triennial review obligation, it is considered to be more appropriate to proceed with the more deliberative variance approval/monitoring procedure outlined above. The recommended procedure will determine actual improvements resulting from Waterbody/Watershed Facility Plan implementation enable a proper determination for the appropriate waterbody classification for Coney Island Creek and perhaps avoid unnecessary, repetitive and possibly contradictory rulemaking.

9.2.4 Future Considerations

Urban Tributary Classification

The probability is recognized that the long-term monitoring program recommended for Coney Island Creek, and ultimately for other confined waterbodies throughout the City, may warrant consideration be given to the development of a new waterbody classification in NYSDEC Water Quality Regulations, that being "Urban Tributary."

The Urban Tributary classification would have the following attributes:

- Recognition of wet weather conditions in the designation of uses and water quality criteria.
- Application to urban confined waterbodies which satisfy any of the UAA criteria enumerated in 40CFR131.10(g).
- Definition of required baseline water uses
- Fish and aquatic life survival (where attainable)
- Secondary contact recreation (where attainable)

Other attainable higher uses would be waterbody specific and dependent upon the effectiveness of the site-specific CSO LTCP based upon knee-of-the-curve considerations and technical feasibility and implementability.

The Urban Tributary classification could be implemented through the application of a generic UAA procedure for confined urban waterbodies based on the criteria of 40CFR131.10(g). This procedure could avoid the necessity for repeated UAAs on different waterbodies with similar characteristics. Those waterbodies which comply with the designation criteria can be identified at one time, and the reclassification completed in one rulemaking.

If either of the designated baseline uses of fish and aquatic life survival and secondary contact recreation did not appear to be attainable in a particular setting, then a site-specific UAA would be required.

Narrative Criteria

The recommendation for a WQBEL variance for the Coney Island Creek Waterbody/Watershed Facility Plan would apply with regard to the narrative water quality standards previously cited. However, a broad issue remains with the practical ability to attain the requirements of the narrative standards in situations where wet weather discharges are unavoidable and will occasionally occur after controls. Therefore, it is recommended that NYSDEC review the application of the narrative standards, provide for a wet weather exclusion with demonstrated need, or make all narrative standards conditional upon the impairment of waters for their best usage.

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11.0 Glossary

A Posteriori Classification: A classification based on the results of experimentation.

A Priori Classification: A classification made prior to experimentation.

ACO: Administrative Consent Order

Activated Sludge: The product that results when primary effluent is mixed with bacteria-laden sludge and then agitated and aerated to promote biological treatment, speeding the breakdown of organic matter in raw sewage undergoing secondary waste treatment.

Acute Toxicity: The ability of a substance to cause severe biological harm or death soon after a single exposure or dose. Also, any poisonous effect resulting from a single short-term exposure to a toxic substance (see chronic toxicity, toxicity).

Administrative Consent Order (ACO): A legal agreement between a regulatory authority and an individual, business, or other entity through which the violator agrees to pay for correction of violations, take the required corrective or cleanup actions, or refrain from an activity. It describes the actions to be taken, may be subject to a comment period, applies to civil actions, and can be enforced in court.

Administrative Law Judge (ALJ): An officer in a government agency with quasi-judicial functions including conducting hearings, making findings of fact, and making recommendations for resolution of disputes concerning the agency's actions.

Advanced Treatment: A level of wastewater treatment more stringent than secondary treatment; requires an 85-percent reduction in conventional pollutant concentration or a significant reduction in non-conventional pollutants. Sometimes called tertiary treatment.

Advanced Wastewater Treatment: Any treatment of sewage that goes beyond the secondary or biological water treatment stage and includes the removal of nutrients such as phosphorus and nitrogen and a high percentage of suspended solids. (See primary, secondary treatment.)

Advection: Bulk transport of the mass of discrete chemical or biological constituents by fluid flow within receiving water. Advection describes the mass transport due to the velocity, or flow, of the waterbody. Example: The transport of pollution in a river: the motion of the water carries the polluted water downstream.

ADWF: Average Dry Weather Flow

Aeration: A process that promotes biological degradation of organic matter in water. The process may be passive (as when waste is exposed to air), or active (as when a mixing or bubbling device introduces the air). Exposure to additional air may be by means of natural of engineered systems.

Aerobic: Environmental conditions characterized by the presence of dissolved oxygen; used to describe biological or chemical processes that occur in the presence of oxygen.

Algae: Simple rootless plants that live floating or suspended in sunlit water or may be attached to structures, rocks or other submerged surfaces. Algae grow in proportion to the amount of available nutrients. They can affect water quality adversely since their biological activities can appreciably affect pH and low dissolved oxygen of the water. They are food for fish and small aquatic animals.

Algal Bloom: A heavy sudden growth of algae in and on a body of water which can affect water quality adversely and indicate potentially hazardous changes in local water chemistry. The growth results from excessive nutrient levels or other physical and chemical conditions that enable algae to reproduce rapidly.

ALJ: Administrative Law Judge

Allocations: Allocations are that portion of receiving water's loading capacity that is attributed to one of its existing or future sources (non-point or point) of pollution or to natural background sources. (Wasteload allocation (WLA) is that portion of the loading capacity allocated to an existing or future point source and a load allocation (LA) is that portion allocated to an existing or future non-point source or to a natural background source. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading.)

Ambient Water Quality: Concentration of water quality constituent as measured within the waterbody.

Ammonia (NH_3): An inorganic form of nitrogen, is contained in fertilizers, septic system effluent, and animal wastes. It is also a product of bacterial decomposition of organic matter. NH3-N becomes a concern if high levels of the un-ionized form are present. In this form NH3-N can be toxic to aquatic organisms.

Anaerobic: Environmental condition characterized by zero oxygen levels. Describes biological and chemical processes that occur in the absence of oxygen. Anoxia. No dissolved oxygen in water.

Anthropogenic: Pertains to the [environmental] influence of human activities.

Antidegradation: Part of federal water quality requirements. Calls for all existing uses to be protected, for deterioration to be avoided or at least minimized when water quality meets or exceeds standards, and for outstanding waters to be strictly protected.

Aquatic Biota: Collective term describing the organisms living in or depending on the aquatic environment.

Aquatic Community: An association of interacting populations of aquatic organisms in a given waterbody or habitat.

Aquatic Ecosystem: Complex of biotic and abiotic components of natural waters. The aquatic ecosystem is an ecological unit that includes the physical characteristics (such as flow or velocity and depth), the biological community of the water column and benthos, and the chemical characteristics such as dissolved solids, dissolved oxygen, and nutrients. Both living and nonliving components of the aquatic ecosystem interact and influence the properties and status of each component.

Aquatic Life Uses: A beneficial use designation in which the waterbody provides suitable habitat for survival and reproduction of desirable fish, shellfish, and other aquatic organisms.

Assemblage: An association of interacting populations of organisms in a given waterbody (e.g., fish assemblage or benthic macro-invertebrate assemblage).

Assessed Waters: Waters that states, tribes and other jurisdictions have assessed according to physical, chemical and biological parameters to determine whether or not the waters meet water quality standards and support designated beneficial uses.

Assimilation: The ability of a body of water to purify itself of pollutants.

Assimilative Capacity: The capacity of a natural body of water to receive wastewaters or toxic materials without deleterious efforts and without damage to aquatic life or humans who consume the water. Also, the amount of pollutant load that can be discharged to a specific waterbody without exceeding water quality standards. Assimilative capacity is used to define the ability of a waterbody to naturally absorb and use a discharged substance without impairing water quality or harming aquatic life.

Attribute: Physical and biological characteristics of habitats which can be measured or described.

Average Dry Weather Flow (ADWF): The average non-storm flow over 24 hours during the dry months of the year (May through September). It is composed of the average dry weather inflow/infiltration.

Bacteria: (Singular: bacterium) Microscopic living organisms that can aid in pollution control by metabolizing organic matter in sewage, oil spills or other pollutants. However, some types of bacteria in soil, water or air can also cause human, animal and plant health problems. Bacteria of the coliform group are considered the primary indicators of fecal contamination and are often used to assess water quality.

Measured in number of bacteria organisms per 100 milliliters of sample (No./mL or #/100 mL).

BASINS: Better Assessment Science Integrating Point and Non-point Sources

BEACH: Beaches Environmental Assessment and Coastal Health

Beaches Environmental Assessment and Coastal Health (BEACH): The BEACH Act requires coastal and Great Lakes States to adopt the 1986 USEPA Water Quality Criteria for Bacteria and to develop and implement beach monitoring and notification plans for bathing beaches.

Benthic: Refers to material, especially sediment, at the bottom of an aquatic ecosystem. It can be used to describe the organisms that live on, or in, the bottom of a waterbody.

Benthic Macroinvertebrates: See benthos.

Benthos: Animals without backbones, living in or on the sediments, of a size large enough to be seen by the unaided eye, and which can be retained by a U.S. Standard No. 30 sieve (28 openings/in, 0.595-mm openings). Also referred to as benthic macroinvertebrates, infauna, or macrobenthos.

Best Available Technology (BAT): The most stringent technology available for controlling emissions; major sources of emissions are required to use BAT, unless it can be demonstrated that it is unfeasible for energy, environmental, or economic reasons.

Best Management Practice (BMP): Methods, measures or practices that have been determined to be the most effective, practical and cost effective means of preventing or reducing pollution from non-point sources.

Better Assessment Science Integrating Point and Non-point Sources (BASINS): A computer tool that contains an assessment and planning component that allows users to organize and display geographic information for selected watersheds. It also contains a modeling component to examine impacts of pollutant loadings from point and non-point sources and to characterize the overall condition of specific watersheds.

Bioaccumulation: A process by which chemicals are taken up by aquatic organisms and plants directly from water as well as through exposure via other routes, such as consumption of food and sediment containing the chemicals.

Biochemical Oxygen Demand (BOD): A measure of the amount of oxygen per unit volume of water required to bacterially or chemically breakdown (stabilize) the organic matter in water. Biochemical oxygen demand measurements are usually conducted over specific time intervals (5,10,20,30 days). The term BOD generally refers to a standard 5-day BOD test. It is also considered a standard measure of the organic content in water and is expressed as mg/L. The greater the BOD, the greater the degree of pollution.

Bioconcentration: A process by which there is a net accumulation of a chemical directly from water into aquatic organisms resulting from simultaneous uptake (e.g., via gill or epithelial tissue) and elimination. In other words, the accumulation of a chemical in tissues of a fish or other organism to levels greater than the surrounding medium.

Biocriteria: A combination of narrative and numerical measures, such as the number and kinds of benthic, or bottom-dwelling, insects living in a stream, that describe the biological condition (structure and function) of aquatic communities inhabiting waters of a designated aquatic life use. Biocriteria are regulatory-based biological measurements and are part of a state's water quality standards.

Biodegradable: A substance or material that is capable of being decomposed (broken down) by natural biological processes.

Biodiversity: Refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequencies. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the biological structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species and genes.

Biological Assemblage: A group of phylogenetically (e.g., fish) or ecologically (e.g., benthic macroinvertebrates) related organisms that are part of an aquatic community.

Biological Assessment or Bioassessment: An evaluation of the condition of a waterbody using biological surveys and other direct measures of the resident biota of the surface waters, in conjunction with biological criteria.

Biological Criteria or Biocriteria: Guidelines or benchmarks adopted by States to evaluate the relative biological integrity of surface waters. Biocriteria are narrative expressions or numerical values that describe biological integrity of aquatic communities inhabiting waters of a given classification or designated aquatic life use.

Biological Indicators: Plant or animal species or communities with a narrow range of environmental tolerances that may be selected for monitoring because their absence or presence and relative abundances serve as barometers of environmental conditions.

Biological Integrity: The condition of the aquatic community inhabiting unimpaired waterbodies of a specified habitat as measured by community structure and function.

Biological Monitoring or Biomonitoring: Multiple, routine biological surveys over time using consistent sampling and analysis methods for detection of changes in biological condition.

Biological Nutrient Removal (BNR): The removal of nutrients, such as nitrogen and/or phosphorous during wastewater treatment.

Biological Oxygen Demand (BOD): An indirect measure of the concentration of biologically degradable material present in organic wastes. It usually reflects the amount of oxygen consumed in five days by biological processes breaking down organic wastes.

Biological Survey or Biosurvey: Collecting, processing and analyzing representative portions of an estuarine or marine community to determine its structure and function.

Biological Magnification: Refers to the process whereby certain substances such as pesticides or heavy metals move up the food chain, work their way into rivers and lakes, and are eaten by aquatic organisms such as fish, which in turn are eaten by large birds, animals or humans. The substances become concentrated in tissues or internal organs as they move up the food chain. he result of the processes of bioconcentration and bioaccumulation by which tissue concentrations of bioaccumulated chemicals increase as the chemical passes up through two or more trophic levels in the food chain. (See bioaccumulation.)

Biota: Plants, animals and other living resources in a given area.

Biotic Community: A naturally occurring assemblage of plants and animals that live in the same environment and are mutually sustaining and interdependent.

BMP: Best Management Practice

BNR: Biological Nutrient Removal

BOD: Biological Oxygen Demand; Biochemical Demand

Borrow Pit: See Subaqueous Borrow Pit.

Brackish: Water with salt content ranging between that of sea water and fresh water; commonly used to refer to Oligohaline waters.

Brooklyn Sewer Datum (BSD): Coordinate system and origins utilized by surveyors in the Borough of Brooklyn, New York City.

BSD: Brooklyn Sewer Datum

CAC: Citizens Advisory Committee

Calcareous: Pertaining to or containing calcium carbonate; Calibration; The process of adjusting model parameters within physically defensible ranges until the resulting predictions give a best possible fit to observed data.

Calibration: The process of adjusting model parameters within physically defensible ranges until the resulting predictions give a best possible fit to observed data.

CALM: Consolidated Assessment and Listing Methodology

Capital Improvement Program (CIP): A budget and planning tool used to implement non-recurring expenditures or any expenditure for physical improvements, including costs for: acquisition of existing buildings, land, or interests in land; construction of new buildings or other structures, including additions and major alterations; construction of streets and highways or utility lines; acquisition of fixed equipment; landscaping; and similar expenditures.

Capture: The total volume of flow collected in the combined sewer system during precipitation events on a system-wide, annual average basis (not percent of volume being discharged).

Catch Basin: (1) A buried chamber, usually built below curb grates seen at the curbline of a street, to relieve street flooding, which admits surface water for discharge into the sewer system and/or a receiving waterbody. (2) A sedimentation area designed to remove pollutants from runoff before being discharged into a stream or pond.

Carbonaceous Biochemical Oxygen Demand ($CBOD_5$): The amount of oxygen required to oxidize any carbon containing matter present in water in five days.

CATI: Computer Assisted Telephone Interviews

$CBOD_5$: Carbonaceous Biochemical Oxygen Demand

CEA: Critical Environmental Area

CEQR: City Environmental Quality Review

CERCLIS: Comprehensive Environmental Response, Compensation and Liability Information System

CFR: Code of Federal Regulation

Channel: A natural stream that conveys water; a ditch or channel excavated for the flow of water.

Channelization: Straightening and deepening streams so water will move faster or facilitate navigation - a tactic that can interfere with waste assimilation capacity, disturb fish and wildlife habitats, and aggravate flooding.

Chemical Oxygen Demand (COD): A measure of the oxygen required to oxidize all compounds, both organic and inorganic, in water.

Chlorination: The application of chlorine to drinking water, sewage, or industrial waste to disinfect or to oxidize undesirable compounds. Typically employed as a final process in water and wastewater treatment.

Chrome+6 (Cr+6): Chromium is a steel-gray, lustrous, hard metal that takes a high polish, is fusible with difficulty, and is resistant to corrosion and tarnishing. The most common oxidation states of chromium are +2, +3, and +6, with +3 being the most stable. +4 and +5 are relatively rare. Chromium compounds of oxidation state 6 are powerful oxidants.

Chronic Toxicity: The capacity of a substance to cause long-term poisonous health effects in humans, animals, fish and other organisms (see acute toxicity).

CIP: Capital Improvement Program

Citizens Advisory Committee (CAC): Committee comprised of various community stakeholders formed to provide input into a planning process.

City Environmental Quality Review (CEQR): CEQR is a process by which agencies of the City of New York review proposed discretionary actions to identify the effects those actions may have on the environment.

Clean Water Act (CWA): The Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972), Public Law 92-500, as amended by Public Law 96-483 and Public Law 97-117, 33 U.S.C. 1251 et seq. The CWA contains a number of provisions to restore and maintain the quality of the nation's water resources. One of these provisions is section 303(d), which establishes the Total maximum Daily Load (TMDL) program.

Coastal Waters: Marine waters adjacent to and receiving estuarine discharges and extending seaward over the continental shelf and/or the edge of the U.S. territorial sea.

Coastal Zone Boundary (CZB): Generally, the part of the land affected by its proximity to the sea and that part of the sea affected by its proximity to the land as the extent to which man's land-based activities have a measurable influence on water chemistry and marine ecology. Specifically, New York's Coastal zone varies from region to region while incorporating the following conditions: The inland boundary is approximately 1,000 feet from the shoreline of the mainland. In urbanized and developed coastal locations the landward boundary is approximately 500 feet from the mainland's shoreline, or less than 500 feet where a roadway or railroad line runs parallel to the shoreline at a distance of under 500 feet and defines the boundary. In locations where major state-owned lands and facilities or electric power generating facilities abut the shoreline, the boundary extends inland to include them. In some areas, such as Long Island Sound and the Hudson River Valley, the boundary may extend inland up to 10,000 feet to encompass significant coastal resources, such as areas of exceptional scenic value, agricultural ore recreational lands, and major tributaries and headlands.

Coastal Zone: Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its ecology, or whose uses and ecology are affected by the sea.

COD: Chemical Oxygen Demand

Code of Federal Regulations (CFR): Document that codifies all rules of the executive departments and agencies of the federal government. It is divided into fifty volumes, known as titles. Title 40 of the CFR (references as 40 CFR) lists most environmental regulations.

Coliform Bacteria: Common name for Escherichia coli that is used as an indicator of fecal contamination of water, measured in terms of coliform count. (See Total Coliform Bacteria)

Coliforms: Bacteria found in the intestinal tract of warm-blooded animals; used as indicators of fecal contamination in water.

Collection System: Pipes used to collect and carry wastewater from individual sources to an interceptor sewer that will carry it to a treatment facility.

Collector Sewer: The first element of a wastewater collection system used to collect and carry wastewater from one or more building sewers to a main sewer. Also called a lateral sewer.

Combined Sewage: Wastewater and storm drainage carried in the same pipe.

Combined Sewer Overflow (CSO): Discharge of a mixture of storm water and domestic waste when the flow capacity of a sewer system is exceeded during rainstorms. CSOs discharged to receiving water can result in contamination problems that may prevent the attainment of water quality standards.

Combined Sewer Overflow Event: The discharges from any number of points in the combined sewer system resulting from a single wet weather event that do not receive minimum treatment (i.e., primary clarification, solids disposal, and disinfection, where appropriate). For example, if a storm occurs that results in untreated overflows from 50 different CSO outfalls within the combined sewer system (CSS), this is considered one overflow event.

Combined Sewer System (CSS): A sewer system that carries both sewage and storm-water runoff. Normally, its entire flow goes to a waste treatment plant, but during a heavy storm, the volume of water may be so great as to cause overflows of untreated mixtures of storm water and sewage into receiving waters. Storm-water runoff may also carry toxic chemicals from industrial areas or streets into the sewer system.

Comment Period: Time provided for the public to review and comment on a proposed USEPA action or rulemaking after publication in the Federal Register.

Community: In ecology, any group of organisms belonging to a number of different species that co-occur in the same habitat or area; an association of interacting assemblages in a given waterbody. Sometimes, a particular subgrouping may be specified, such as the fish community in a lake.

Compliance Monitoring: Collection and evaluation of data, including self-monitoring reports, and verification to show whether pollutant concentrations and loads contained in permitted discharges are in compliance with the limits and conditions specified in the permit.

Compost: An aerobic mixture of decaying organic matter, such as leaves and manure, used as fertilizer.

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS): Database that contains information on hazardous waste sites, potentially hazardous waste sites and remedial activities across the nation. The database includes sites that are on the National Priorities List or being considered for the List.

Comprehensive Waterfront Plan (CWP): Plan proposed by the Department of City Planning that provides a framework to guide land use along the city's entire 578-mile shoreline in a way that recognizes its value as a natural resource and celebrates its diversity. The plan presents a long-range vision that balances the needs of environmentally sensitive areas and the working port with opportunities for waterside public access, open space, housing and commercial activity.

Computer Assisted Telephone Interviews (CATI): CATI is the use of computers to automate and control the key activities of a telephone interview.

Conc: Abbreviation for “Concentration”.

Concentration: Amount of a substance or material in a given unit volume of solution. Usually measured in milligrams per liter (mg/L) or parts per million (ppm).

Consolidated Assessment and Listing Methodology (CALM): USEPA framework for states and other jurisdictions to document how they collect and use water quality data and information for environmental decision making. The primary purposes of these data analyses are to determine the extent that all waters are attaining water quality standards, to identify waters that are impaired and need to be added to the 303(d) list, and to identify waters that can be removed from the list because they are attaining standards.

Contamination: Introduction into the water, air and soil of microorganisms, chemicals, toxic substances, wastes or wastewater in a concentration that makes the medium unfit for its next intended use.

Conventional Pollutants: Statutorily listed pollutants understood well by scientists. These may be in the form or organic waste, sediment, acid, bacteria, viruses, nutrients, oil and grease, or heat.

Cost-Benefit Analysis: A quantitative evaluation of the costs, which would be incurred by implementing an alternative versus the overall benefits to society of the proposed alternative.

Cost-Share Program: A publicly financed program through which society, as a beneficiary of environmental protection, allocates project funds to pay a percentage of the cost of constructing or implementing a best management practice. The producer pays the remainder of the costs.

Cr+6: Hexavalent chromium

Critical Condition: The combination of environmental factors that results in just meeting water quality criterion and has an acceptably low frequency of occurrence.

Critical Environmental Area (CEA): A CEA is a specific geographic area designated by a state or local agency as having exceptional or unique environmental characteristics. In establishing a CEA, the fragile or threatened environmental conditions in the area are identified so that they will be taken into consideration in the site-specific environmental review under the State Environmental Quality Review Act.

Cross-Sectional Area: Wet area of a waterbody normal to the longitudinal component of the flow.

Cryptosporidium: A protozoan microbe associated with the disease cryptosporidiosis in man. The disease can be transmitted through ingestion of drinking water, person-to-person contact, or other pathways, and can cause acute diarrhea, abdominal pain, vomiting, fever and can be fatal. (See protozoa).

CSO: Combined Sewer Overflow

CSS: Combined Sewer System

Cumulative Exposure: The summation of exposures of an organism to a chemical over a period of time.

Clean Water Act (CWA): Federal law stipulating actions to be carried out to improve water quality in U.S. waters.

CWA: Clean Water Act

CWP: Comprehensive Waterfront Plan

CZB: Coastal Zone Boundary

DDWF: design dry weather flow

Decay: Gradual decrease in the amount of a given substance in a given system due to various sink processes including chemical and biological transformation, dissipation to other environmental media, or deposition into storage areas.

Decomposition: Metabolic breakdown of organic materials; that releases energy and simple organics and inorganic compounds. (See Respiration)

Degradable: A substance or material that is capable of decomposition; chemical or biological.

Delegated State: A state (or other governmental entity such as a tribal government) that has received authority to administer an environmental regulatory program in lieu of a federal counterpart.

Demersal: Living on or near the bottom of a body of water (e.g., mid-water and bottom-dwelling fish and shellfish, as opposed to surface fish).

Department of Sanitation of New York (DSNY): New York City agency responsible for solid waste and refuse disposal in New York City

Design Capacity: The average daily flow that a treatment plant or other facility is designed to accommodate.

Design Dry Weather Flow (DDWF): The flow basis for design of New York City wastewater treatment plants. In general, the plants have been designed to treat 1.5 times this value to full secondary treatment standards and 2.0 times this value, through at least primary settling and disinfection, during stormwater events.

Designated Uses: Those water uses specified in state water quality standards for a waterbody, or segment of a waterbody, that must be achieved and maintained as required under the Clean Water Act. The uses, as defined by states, can include cold-water fisheries, natural fisheries, public water supply, irrigation, recreation, transportation, or mixed uses.

Deoxyribonucleic Acid (DNA): The genetic material of living organisms; the substance of heredity. It is a large, double-stranded, helical molecule that contains genetic instructions for growth, development, and replication.

Destratification: Vertical mixing within a lake or reservoir to totally or partially eliminate separate layers of temperature, plant, or animal life.

Deterministic Model: A model that does not include built-in variability: same input will always equal the same output.

Die-Off Rate: The first-order decay rate for bacteria, pathogens, and viruses. Die-off depends on the particular type of waterbody (i.e., stream, estuary , lake) and associated factors that influence mortality.

Dilution: Addition of less concentrated liquid (water) that results in a decrease in the original concentration.

Direct Runoff: Water that flows over the ground surface or through the ground directly into streams, rivers, and lakes.

Discharge Permits (NPDES): A permit issued by the USEPA or a state regulatory agency that sets specific limits on the type and amount of pollutants that a municipality or industry can discharge to a receiving water; it also includes a compliance schedule for achieving those limits. It is called the NPDES because the permit process was established under the National Pollutant Discharge Elimination System, under provisions of the Federal Clean Water Act.

Discharge: Flow of surface water in a stream or canal or the outflow of ground water from a flowing artesian well, ditch, or spring. It can also apply to discharges of liquid effluent from a facility or to chemical emissions into the air through designated venting mechanisms.

Discriminant Analysis: A type of multivariate analysis used to distinguish between two groups.

Disinfect (Disinfected): A water and wastewater treatment process that kills harmful microorganisms and bacteria by means of physical, chemical and alternative processes such as ultraviolet radiation.

Disinfectant: A chemical or physical process that kills disease-causing organisms in water, air, or on surfaces. Chlorine is often used to disinfect sewage treatment effluent, water supplies, wells, and swimming pools.

Dispersion: The spreading of chemical or biological constituents, including pollutants, in various directions from a point source, at varying velocities depending on the differential instream flow characteristics.

Dissolved Organic Carbon (DOC): All organic carbon (e.g., compounds such as acids and sugars, leached from soils, excreted from roots, etc) dissolved in a given volume of water at a particular temperature and pressure.

Dissolved Oxygen (DO): The dissolved oxygen freely available in water that is vital to fish and other aquatic life and is needed for the prevention of odors. DO levels are considered a most important indicator of a water body's ability to support desirable aquatic life. Secondary and advanced waste treatments are generally designed to ensure adequate DO in waste-receiving waters. It also refers to a measure of the amount of oxygen available for biochemical activity in a waterbody, and as an indicator of the quality of that water.

Dissolved Solids: The organic and inorganic particles that enter a waterbody in a solid phase and then dissolve in water.

DNA: deoxyribonucleic acid

DO: dissolved oxygen

DOC: Dissolved Organic Carbon

Drainage Area or Drainage Basin: An area drained by a main river and its tributaries (see Watershed).

Dredging: Dredging is the removal of mud from the bottom of waterbodies to facilitate navigation or remediate contamination. This can disturb the ecosystem and cause silting that can kill or harm aquatic life. Dredging of contaminated mud can expose biota to heavy metals and other toxics. Dredging activities are subject to regulation under Section 404 of the Clean Water Act.

Dry Weather Flow (DWF): Hydraulic flow conditions within a combined sewer system resulting from one or more of the following: flows of domestic sewage, ground water infiltration, commercial and industrial wastewaters, and any other non-precipitation event related flows (e.g., tidal infiltration under certain circumstances).

Dry Weather Overflow: A combined sewer overflow that occurs during dry weather flow conditions.

DSNY: Department of Sanitation of New York

DWF: Dry weather flow

Dynamic Model: A mathematical formulation describing the physical behavior of a system or a process and its temporal variability. Ecological Integrity. The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes.

E. Coli: Escherichia Coli.

Ecoregion: Geographic regions of ecological similarity defined by similar climate, landform, soil, natural vegetation, hydrology or other ecologically relevant variables.

Ecosystem: An interactive system that includes the organisms of a natural community association together with their abiotic physical, chemical, and geochemical environment.

Effects Range-Low: Concentration of a chemical in sediment below which toxic effects were rarely observed among sensitive species (10th percentile of all toxic effects).

Effects Range-Median: Concentration of a chemical in sediment above which toxic effects are frequently observed among sensitive species (50th percentile of all toxic effects).

Effluent: Wastewater, either municipal sewage or industrial liquid waste that flows out of a treatment plant, sewer or outfall untreated, partially treated, or completely treated.

Effluent Guidelines: Technical USEPA documents which set effluent limitations for given industries and pollutants.

Effluent Limitation: Restrictions established by a state or USEPA on quantities, rates, and concentrations in wastewater discharges.

Effluent Standard: See effluent limitation.

EIS: Environmental Impact Statement

EMAP: Environmental Monitoring and Assessment Program

EMC: Event Mean Concentration

Emergency Planning and Community Right-to-Know Act of 1986, The (SARA Title III): Law requiring federal, state and local governments and industry, which are involved in either emergency planning and/or reporting of hazardous chemicals, to allow public access to information about the presence of hazardous chemicals in the community and releases of such substances into the environment.

Endpoint: An endpoint is a characteristic of an ecosystem that may be affected by exposure to a stressor. Assessment endpoints and measurement endpoints are two distinct types of endpoints that are commonly used by resource managers. An assessment endpoint is the formal expression of a valued environmental characteristic and should have societal relevance. A measurement endpoint is the expression of an observed or measured response to a stress or disturbance. It is a measurable environmental characteristic that is related to the valued environmental characteristic chosen as the assessment endpoint. The numeric criteria that are part of traditional water quality standards are good examples of measurement endpoints.

Enforceable Requirements: Conditions or limitations in permits issued under the Clean Water Act Section 402 or 404 that, if violated, could result in the issuance of a compliance order or initiation of a civil or criminal action under federal or applicable state laws.

Enhancement: In the context of restoration ecology, any improvement of a structural or functional attribute.

Enteric: Of or within the gastrointestinal tract.

Enterococci: A subgroup of the fecal streptococci that includes S. faecalis and S. faecium. The enterococci are differentiated from other streptococci by their ability to grow in 6.5% sodium chloride, at pH 9.6, and at 10°C and 45°C. Enterococci are a valuable bacterial indicator for determining the extent of fecal contamination of recreational surface waters.

Environment: The sum of all external conditions and influences affecting the development and life of organisms.

Environmental Impact Statement (EIS): A document required of federal agencies by the National Environmental Policy Act for major projects or legislative proposals significantly affecting the environment. A tool for decision making, it describes the positive and negative effects of the undertaking and cites alternative actions.

Environmental Monitoring and Assessment Program (EMAP): The Environmental Monitoring and Assessment Program (EMAP) is a research program to develop the tools necessary to monitor and assess the status and trends of national ecological resources. EMAP's goal is to develop the scientific understanding for translating environmental monitoring data from multiple spatial and temporal scales into assessments of current ecological condition and forecasts of future risks to our natural resources.

Epibenthic: Those animals/organisms located at the surface of the sediments on the bay bottom, generally referring to algae.

Epibenthos: Those animals (usually excluding fishes) living on the top of the sediment surface.

Epidemiology: All the elements contributing to the occurrence or non-occurrence of a disease in a population; ecology of a disease.

Epifauna: Benthic animals living on the sediment or on and among rocks and other structures.

EPMC: Engineering Program Management Consultant

Escherichia Coli: A subgroup of the fecal coliform bacteria. E. coli is part of the normal intestinal flora in humans and animals and is, therefore, a direct indicator of fecal contamination in a waterbody. The O157 strain, sometimes transmitted in contaminated waterbodies, can cause serious infection resulting in gastroenteritis. (See Fecal coliform bacteria)

Estuarine Number: Nondimensional parameter accounting for decay, tidal dispersion, and advection velocity. Used for classification of tidal rivers and estuarine systems.

Estuarine or Coastal Marine Classes: Classes that reflect basic biological communities and that are based on physical parameters such as salinity, depth, sediment grain size, dissolved oxygen and basin geomorphology.

Estuarine Waters: Semi-enclosed body of water which has a free connection with the open sea and within which seawater is measurably diluted with fresh water derived from land drainage.

Estuary: Region of interaction between rivers and near-shore ocean waters, where tidal action and river flow mix fresh and salt water. Such areas include bays, mouths of rivers, salt marshes, and lagoons.

These brackish water ecosystems shelter and feed marine life, birds, and wildlife (see wetlands).

Eutrophication: A process in which a waterbody becomes rich in dissolved nutrients, often leading to algal blooms, low dissolved oxygen and changes in the composition of plants and animals in the waterbody. This occurs naturally, but can be exacerbated by human activity which increases nutrient inputs to the waterbody.

Event Mean Concentration (EMC): Input data, typically for urban areas, for a water quality model. EMC represents the concentration of a specific pollutant contained in stormwater runoff coming from a particular land use type within a watershed.

Existing Use: Describes the use actually attained in the waterbody on or after November 28, 1975, whether or not it is included in the water quality standards (40 CFR 131.3).

Facility Plan: A planning project that uses engineering and science to address pollution control issues and will most likely result in the enhancement of existing water pollution control facilities or the construction of new facilities.

Facultative: Capable of adaptive response to varying environments.

Fecal Coliform Bacteria: A subset of total coliform bacteria that are present in the intestines or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of water. They are measured by running the standard total coliform test at an elevated temperature (44.5EC). Fecal coliform is approximately 20 percent of total coliform. (See Total Coliform Bacteria)

Fecal Streptococci: These bacteria include several varieties of streptococci that originate in the gastrointestinal tract of warm-blooded animals such as humans (Streptococcus faecalis) and domesticated animals such as cattle (Streptococcus bovis) and horses (Streptococcus equinus).

Feedlot: A confined area for the controlled feeding of animals. The area tends to concentrate large amounts of animal waste that cannot be absorbed by the soil and, hence, may be carried to nearby streams or lakes by rainfall runoff.

FEIS: Final Environmental Impact Statement

Field Sampling and Analysis Program (FSAP): Biological sampling program undertaken to fill-in ecosystem data gaps in New York Harbor.

Final Environmental Impact Statement (FEIS): A document that responds to comments received on the Draft EIS and provides updated information that has become available after publication of the Draft EIS.

Fish Kill: A natural or artificial condition in which the sudden death of fish occurs due to the introduction of pollutants or the reduction of the dissolved oxygen concentration in a waterbody.

Floatables: Large waterborne materials, including litter and trash, that are buoyant or semi-buoyant and float either on or below the water surface. These materials, which are generally man-made and sometimes characteristic of sanitary wastewater and storm runoff, may be transported to sensitive environmental areas such as bathing beaches where they can become an aesthetic nuisance. Certain types of floatables also cause harm to marine wildlife and can be hazardous to navigation.

Flocculation: The process by which suspended colloidal or very fine particles are assembled into larger masses or floccules that eventually settle out of suspension.

Flux: Movement and transport of mass of any water quality constituent over a given period of time. Units of mass flux are mass per unit time.

FOIA: Freedom of Information Act

Food Chain: A sequence of organisms, each of which uses the next, lower member of the sequence as a food source.

Freedom of Information Act (FOIA): A federal statute which allows any person the right to obtain federal agency records unless the records (or part of the records) are protected from disclosure by any of the nine exemptions in the law.

FSAP: Field Sampling and Analysis Program

gallons per day (gpd): unit of measure of flow

gallons per minute (gpm): unit of measure of flow

Gastroenteritis: An inflammation of the stomach and the intestines.

General Permit: A permit applicable to a class or category of discharges.

Geochemical: Refers to chemical reactions related to earth materials such as soil, rocks, and water.

Geographical Information System (GIS): A computer system that combines database management system functionality with information about location. In this way it is able to capture, manage, integrate, manipulate, analyze and display data that is spatially referenced to the earth's surface.

Giardia lamblia: Protozoan in the feces of humans and animals that can cause severe gastrointestinal Ailments. It is a common contaminant of surface waters. (See protozoa).

GIS: Geographical Information System

Global Positioning System (GPS): A GPS comprises a group of satellites orbiting the earth (24 are now maintained by the U.S. Government) and a receiver, which can be highly portable. The receiver can generate accurate coordinates for a point, including elevation, by calculating its own position relative to three or more satellites that are above the visible horizon at the time of measurement.

gpd: Gallons per Day

gpd/ft: gallons per day per foot

gpd/sq ft: gallons per day per square foot

gpm: Gallons per minute

GPS: Global Positioning System

Gradient: The rate of decrease (or increase) of one quantity with respect to another; for example, the rate of decrease of temperature with depth in a lake.

Groundwater: The supply of fresh water found beneath the earth's surface, usually in aquifers, which supply wells and springs. Because groundwater is a major source of drinking water, there is growing concern over contamination from leaching agricultural or industrial pollutants and leaking underground storage tanks.

H_2S: Hydrogen Sulfide

Habitat Conservation Plans (HCPs): As part of the Endangered Species Act, Habitat Conservation Plans are designed to protect a species while allowing development. HCP's give the U.S. Fish and Wildlife Service the authority to permit "taking" of endangered or threatened species as long as the impact is reduced by conservation measures. They allow a landowner to determine how best to meet the agreed-upon fish and wildlife goals.

Habitat: A place where the physical and biological elements of ecosystems provide an environment and elements of the food, cover and space resources needed for plant and animal survival.

Halocline: A vertical gradient in salinity.

HCP: Habitat Conservation Plan

Heavy Metals: Metallic elements with high atomic weights (e.g., mercury, chromium, cadmium, arsenic, and lead); can damage living things at low concentrations and tend to accumulate in the food chain.

High Rate Treatment (HRT): A traditional gravity settling process enhanced with flocculation and settling aids to increase loading rates and improve performance.

Holding Pond: A pond or reservoir, usually made of earth, built to store polluted runoff.

Holoplankton: An aggregate of passively floating, drifting or somewhat motile organisms throughout their entire life cycle; Hot spot locations in waterbodies or sediments where hazardous substances have accumulated to levels which may pose risks to aquatic life, wildlife, fisheries, or human health.

HRT: High Rate Treatment

Hydrogen Sulfide (H_2S): A flammable, toxic, colorless gas with an offensive odor (similar to rotten eggs) that is a byproduct of degradation in anaerobic conditions.

Hydrology: The study of the distribution, properties, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hypoxia: The condition of low dissolved oxygen in aquatic systems (typically with a dissolved oxygen concentration less than 3.0 mg/L).

Hypoxia/Hypoxic Waters: Waters with dissolved oxygen concentrations of less than 2 ppm, the level generally accepted as the minimum required for most marine life to survive and reproduce.

I/I: Inflow/Infiltration

Index of Biotic Integrity: A fish community assessment approach that incorporates the zoogeographic, ecosystem, community and population aspects of fisheries biology into a single ecologically-based index of the quality of a water resource.

IBI: Indices of Biological Integrity

IDNP: Illegal Dumping Notification Program

IEC: Interstate Environmental Commission

IFCP: Interim Floatables Containment Program

Illegal Dumping Notification Program (IDNP): New York City program wherein the NYCDEP field personnel report any observed evidence of illegal shoreline dumping to the Sanitation Police section of DSNY, who have the authority to arrest dumpers who, if convicted, are responsible for proper disposal of the material.

Impact: A change in the chemical, physical or biological quality or condition of a waterbody caused by external sources.

Impaired Waters: Waterbodies not fully supporting their designated uses.

Impairment: A detrimental effect on the biological integrity of a waterbody caused by an impact.

Impermeable: Impassable; not permitting the passage of a fluid through it.

In situ: Measurements taken in the natural environment.

in.: Abbreviation for "Inches".

Index Period: A sampling period, with selection based on temporal behavior of the indicator(s) and the practical considerations for sampling.

Indicator Organism: Organism used to indicate the potential presence of other (usually pathogenic) organisms. Indicator organisms are usually associated with the other organisms, but are usually more easily sampled and measured.

Indicator Taxa or Indicator Species: Those organisms whose presence (or absence) at a site is indicative of specific environmental conditions.

Indicator: Measurable quantity that can be used to evaluate the relationship between pollutant sources and their impact on water quality. Abiotic and biotic indicators can provide quantitative information on environmental conditions.

Indices of Biological Integrity (IBI): A usually dimensionless numeric combination of scores derived from biological measures called metrics.

Industrial Pretreatment Programs (IPP): Program mandated by USEPA to control toxic discharges to public sewers that are tributary to sewage treatment plants by regulating Significant Industrial Users (SIUs). NYCDEP enforces the IPP through Chapter 19 of Title 15 of the Rules of the City of New York (Use of Public Sewers).

Infauna: Animals living within submerged sediments. (See benthos.)

Infectivity: Ability to infect a host. Infiltration. 1. Water other than wastewater that enters a wastewater system and building sewers from the ground through such means as defective pipes, pipe joints, connections or manholes. (Infiltration does not include inflow.) 2. The gradual downward flow of water from the ground surfaces into the soil.

Infiltration: The penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

Infiltration/Inflow (I/I): The total quantity of water entering a sewer system from both infiltration and inflow.

Inflow: Water other than wastewater that enters a wastewater system and building sewer from sources such as roof leaders, cellar drains, yard drains, foundation drains, drains from springs and swampy areas, manhole covers, cross connections between storm drains and sanitary sewers, catch basins, cooling towers, stormwaters, surface runoff, street wash waters or drainage. (Inflow does not include infiltration.)

Influent: Water, wastewater, or other liquid flowing into a reservoir, basin, or treatment plant.

Initial Mixing Zone: Region immediately downstream of an outfall where effluent dilution processes occur. Because of the combined effects of the effluent buoyancy, ambient stratification, and current, the prediction of initial dilution can be involved.

Insolation: Exposure to the sun's rays.

Instream Flow: The amount of flow required to sustain stream values, including fish, wildlife, and recreation.

Interceptor Sewers: Large sewer lines that, in a combined system, collect and carry sewage flows from main and trunk sewers to the treatment plant for treatment and discharge. The sewer has no building sewer connections. During some storm events, their capacity is exceeded and regulator structures relieve excess flow to receiving waters to prevent flooding basements, businesses and streets.

Interim Floatables Containment Program (IFCP): A New York City Program that includes containment booms at 24 locations, end-of-pipe nets, skimmer vessels that pick up floatables and transports them to loading stations.

Interstate Environmental Commission (IEC): The Interstate Environmental Commission is a joint agency of the States of New York, New Jersey, and Connecticut. The IEC was established in 1936 under a Compact between New York and New Jersey and approved by Congress. The State of Connecticut joined the Commission in 1941. The mission of the IEC is to protect and enhance environmental quality through cooperation, regulation, coordination, and mutual dialogue between government and citizens in the tri-state region.

Intertidal: The area between the high- and low-tide lines.

IPP: Industrial Pretreatment Programs

Irrigation: Applying water or wastewater to land areas to supply the water and nutrient needs of plants.

JABERRT: Jamaica Bay Ecosystem Research and Restoration Team

Jamaica Bay Ecosystem Research and Restoration Team (JABERRT): Team established by the Army Corps of Engineers to conduct a detailed inventory and biogeochemical characterization of Jamaica Bay for the 2000-2001 periods and to compile the most detailed literature search established.

Jamaica Eutrophication Model (JEM): Model developed for Jamaica Bay in 1996 as a result of a cost-sharing agreement between the NYCDEP and US Army Corps of Engineers.

JEM: Jamaica Eutrophication Model

Karst Geology: Solution cavities and closely-spaced sinkholes formed as a result of dissolution of carbonate bedrock.

Knee-of-the-Curve: The point where the incremental change in the cost of the control alternative per change in performance of the control alternative changes most rapidly.

KOTC: Knee-of-the-Curve

Kurtosis: A measure of the departure of a frequency distribution from a normal distribution, in terms of its relative peakedness or flatness.

LA: Load Allocation

Land Application: Discharge of wastewater onto the ground for treatment or reuse. (See irrigation)

Land Use: How a certain area of land is utilized (examples: forestry, agriculture, urban, industry).

Landfill: A large, outdoor area for waste disposal; landfills where waste is exposed to the atmosphere (open dumps) are now illegal; in constructed landfills, waste is layered, covered with soil, and is built upon impermeable materials or barriers to prevent contamination of surroundings.

lb/day/cf: pounds per day per cubic foot

lbs/day: pounds per day

LC: Loading Capacity

Leachate: Water that collects contaminants as it trickles through wastes, pesticides, or fertilizers. Leaching can occur in farming areas, feedlots, and landfills and can result in hazardous substances entering surface water, groundwater, or soil.

Leaking Underground Storage Tank (LUST): An underground container used to store gasoline, diesel fuel, home heating oil, or other chemicals that is damaged in some way and is leaking its contents into the ground; may contaminate groundwater.

LID: Low Impact Development

LID-R: Low Impact Development - Retrofit

Limiting Factor: A factor whose absence exerts influence upon a population or organism and may be responsible for no growth, limited growth (decline) or rapid growth.

Littoral Zone: The intertidal zone of the estuarine or seashore; i.e., the shore zone between the highest and lowest tides.

Load Allocation (LA): The portion of receiving water's loading capacity that is attributed either to one of its existing or future non-point sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and non-point source loads should be distinguished. (40 CFR 130.2(g))

Load, Loading, Loading Rate: The total amount of material (pollutants) entering the system from one or multiple sources; measured as a rate in mass per unit time.

Loading Capacity (LC): The greatest amount of loading that water can receive without violating water quality standards.

Long-Term Control Plan (LTCP): A document developed by CSO communities to describe existing waterway conditions and various CSO abatement technologies that will be used to control overflows.

Low-Flow: Stream flow during time periods where no precipitation is contributing to runoff to the stream and contributions from groundwater recharge are low. Low flow results in less water available for dilution of pollutants in the stream. Due to the limited flow, direct discharges to the stream dominate during low flow periods. Exceedences of water quality standards during low flow conditions are likely to be caused by direct discharges such as point sources, illicit discharges, and livestock or wildlife in the stream.

Low Impact Development (LID): A sustainable storm water management strategy implemented in response to burgeoning infrastructural costs of new development and redevelopment projects, more rigorous environmental regulations, concerns about the urban heat island effect, and the impacts of natural resources due to growth and development. The LID strategy controls water at the source—both rainfall and storm water runoff—which is known as 'source-control' technology. It is a decentralized system that distributes storm water across a project site in order to replenish groundwater supplies rather than sending it into a system of storm drain pipes and channelized networks that control water downstream in a large storm water management facility. The LID approach promotes the use of various devices that filter water and infiltrate water into the ground. It promotes the use of roofs of buildings, parking lots, and other horizontal surfaces to convey water to either distribute it into the ground or collect it for reuse.

Low Impact Development – Retrofit (LID-R): Modification of an existing site to accomplish LID goals.

LTCP: Long-Term CSO Control Plan

LUST: leaking underground storage tank

Macrobenthos: Benthic organisms (animals or plants) whose shortest dimension is greater than or equal to 0.5 mm. (See benthos.)

Macrofauna: Animals of a size large enough to be seen by the unaided eye and which can be retained by a U.S. Standard No. 30 sieve (28 meshes/in, 0.595-mm openings).

Macro-invertebrate: Animals/organism without backbones (Invertebrate) that is too large to pass through a No. 40 Screen (0.417mm) but can be retained by a U.S. Standard No. 30 sieve (28 meshes/in, 0.595-mm openings). The organism size is of sufficient size for it to be seen by the unaided eye and which can be retained

Macrophytes: Large aquatic plants that may be rooted, non-rooted, vascular or algiform (such as kelp); including submerged aquatic vegetation, emergent aquatic vegetation, and floating aquatic vegetation.

Major Oil Storage Facilities (MOSF): Onshore facility with a total combined storage capacity of 400,000 gallons or more of petroleum and/or vessels involved in the transport of petroleum on the waters of New York State.

Margin of Safety (MOS): A required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving waterbody (CWA section 303(d)(1)(C)). The MOS is normally incorporated into the conservative assumptions used to develop TMDLs (generally within the calculations or models) and approved by USEPA either individually or in state/EPA agreements. If the MOS needs to be larger than that which is allowed through the conservative assumptions, additional MOS can be added as a separate component of the TMDL (in this case, quantitatively, a TMDL = LC = WLA + LA + MOS).

Marine Protection, Research and Sanctuaries Act of 1972, The Ocean Dumping Act: Legislation regulating the dumping of any material in the ocean that may adversely affect human health, marine environments or the economic potential of the ocean.

Mass Balance: A mathematical accounting of substances entering and leaving a system, such as a waterbody, from all sources. A mass balance model for a waterbody is useful to help understand the relationship between the loadings of a pollutant and the levels in the water, biota and sediments, as well as the amounts that can be safely assimilated by the waterbody.

Mass Loading: The quantity of a pollutant transported to a waterbody.

Mathematical Model: A system of mathematical expressions that describe the spatial and temporal distribution of water quality constituents resulting from fluid transport and the one, or more, individual processes and interactions within some prototype aquatic ecosystem. A mathematical water quality model is used as the basis for wasteload allocation evaluations.

Mean Low Water (MLW): A tidal level. The average of all low waters observed over a sufficiently long period.

Median Household Income (MHI): The median household income is one measure of average household income. It divides the household income distribution into two equal parts: one-half of the cases fall below the median household income, and one-half above it.

Meiofauna: Small interstitial; i.e., occurring between sediment particles, animals that pass through a 1-mm mesh sieve but are retained by a 0.1-mm mesh.

Memorandum of Understanding (MOU): An agreement between two or more public agencies defining the roles and responsibilities of each agency in relation to the other or others with respect to an issue over which the agencies have concurrent jurisdiction.

Meningitis: Inflammation of the meninges, especially as a result of infection by bacteria or viruses.

Meroplankton: Organisms that are planktonic only during the larval stage of their life history.

Mesohaline: The estuarine salinity zone with a salinity range of 5-18-ppt.

Metric: A calculated term or enumeration which represents some aspect of biological assemblage structure, function, or other measurable characteristic of the biota that changes in some predictable way in response to impacts to the waterbody.

mf/L: Million fibers per liter – A measure of concentration.

MG: Million Gallons – A measure of volume.

mg/L: Milligrams Per Liter – A measure of concentration.

MGD: Million Gallons Per Day – A measure of the rate of water flow.

MHI: Median Household Income

Microgram per liter (ug/L): A measure of concentration

Microorganisms: Organisms too small to be seen with the unaided eye, including bacteria, protozoans, yeasts, viruses and algae.

Milligrams per liter (mg/L): This weight per volume designation is used in water and wastewater analysis. 1 mg/L = 1 ppm.

milliliters (mL): A unit of length equal to one thousandth (10^{-3}) of a meter, or 0.0394 inch.

Million fibers per liter (mf/L): A measure of concentration.

million gallons (MG): A unit of measure used in water and wastewater to express volume. To visualize this volume, if a good-sized bath holds 50 gallons, so a million gallons would be equal to 20,000 baths.

million gallons per day (MGD): Term used to express water-use data. Denotes the volume of water utilized in a single day.

Mitigation: Actions taken to avoid, reduce, or compensate for the effects of environmental damage. Among the broad spectrum of possible actions are those which restore, enhance, create, or replace damaged ecosystems.

Mixing Zone: A portion of a waterbody where water quality criteria or rules are waived in order to allow for dilution of pollution. Mixing zones have been allowed by states in many NPDES permits when discharges were expected to have difficulty providing enough treatment to avoid violating standards for the receiving water at the point of discharge.

mL: milliliters

MLW: mean low water

Modeling: An investigative technique using a mathematical or physical representation of a system or theory, usually on a computer, that accounts for all or some of its known properties. Models are often used to test the effect of changes of system components on the overall performance of the system.

Monitoring: Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.

Monte Carlo Simulation: A stochastic modeling technique that involves the random selection of sets of input data for use in repetitive model runs. Probability distributions of receiving water quality concentrations are generated as the output of a Monte Carlo simulation.

MOS: Margin of Safety

MOSF: major oil storage facilities

MOU: Memorandum of Understanding

MOUSE: Computer model developed by the Danish Hydraulic Institute used to model the combined sewer system.

MS4: municipal separate storm sewer systems

Multimetric Approach: An analysis technique that uses a combination of several measurable characteristics of the biological assemblage to provide an assessment of the status of water resources.

Multivariate Community Analysis: Statistical methods (e.g., ordination or discriminant analysis) for analyzing physical and biological community data using multiple variables.

Municipal Separate Storm Sewer Systems (MS4): A conveyance or system of conveyances (roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, storm drains) that is 1) Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage districts, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges to waters of the United States; 2) Designed or used for collecting or conveying stormwater; 3) Which is not a combined sewer; and 4) Which is not part of a publicly owned treatment works.

Municipal Sewage: Wastes (mostly liquid) originating from a community; may be composed of domestic wastewater and/or industrial discharges.

National Estuary Program: A program established under the Clean Water Act Amendments of 1987 to develop and implement conservation and management plans for protecting estuaries and restoring and maintaining their chemical, physical, and biological integrity, as well as controlling point and non-point pollution sources.

National Marine Fisheries Service (NMFS): A federal agency - with scientists, research vessels, and a data collection system - responsible for managing the nation's saltwater fish. It oversees the actions of the Councils under the Fishery Conservation and Management Act.

National Pollutant Discharge Elimination System (NPDES): The national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318, and 405 of the Clean Water Act. The program imposes discharge limitations on point sources by basing them on the effluent limitation capabilities of a control technology or on local water quality standards. It prohibits discharge of pollutants into water of the United States unless a special permit is issued by USEPA, a state, or, where delegated, a tribal government on an Indian reservation.

National Priorities List (NPL): USEPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund. The list is based primarily on the score a site receives from the Hazard Ranking System. USEPA is required to update the NPL at least once a year. A site must be on the NPL to receive money from the Trust Fund for remedial action.

National Wetland Inventory (NWI): The National Wetlands Inventory (NWI) of the U.S. Fish & Wildlife Service produces information on the characteristics, extent, and status of the Nation's wetlands and deepwater habitats. The National Wetlands Inventory information is used by Federal, State, and local agencies, academic institutions, U.S. Congress, and the private sector. Congressional mandates in the Emergency Wetlands Resources Act requires the Service to map wetlands, and to digitize, archive and distribute the maps.

Natural Background Levels: Natural background levels represent the chemical, physical, and biological conditions that would result from natural geomorphological processes such as weathering or dissolution.

Natural Waters: Flowing water within a physical system that has developed without human intervention, in which natural processes continue to take place.

Navigable Waters: Traditionally, waters sufficiently deep and wide for navigation; such waters in the United States come under federal jurisdiction and are protected by the Clean Water Act.

New York City Department of City Planning (NYCDCP): New York City agency responsible for the city's physical and socioeconomic planning, including land use and environmental review; preparation of plans and policies; and provision of technical assistance and planning information to government agencies, public officials, and community boards.

New York City Department of Environmental Protection (NYCDEP): New York City agency responsible for addressing the environmental needs of the City's residents in areas including water, wastewater, air, noise and hazmat.

New York City Department of Parks and Recreation (NYCDPR): The New York City Department of Parks and Recreation is the branch of government of the City of New York responsible for maintaining the city's parks system, preserving and maintaining the ecological diversity of the city's natural areas, and furnishing recreational opportunities for city's residents.

New York City Department of Transportation (NYCDOT): New York City agency responsible for maintaining and improving New York City's transportation network.

New York City Economic Development Corporation (NYCEDC): City's primary vehicle for promoting economic growth in each of the five boroughs. NYCEDC works to stimulate investment in New York and broaden the City's tax and employment base, while meeting the needs of businesses large and small. To realize these objectives, NYCEDC uses its real estate and financing tools to help companies that are expanding or relocating anywhere within the city.

New York District (NYD): The local division of the United States Army Corps of Engineers,

New York State Code of Rules and Regulations (NYCRR): Official statement of the policy(ies) that implement or apply the Laws of New York.

New York State Department of Environmental Conservation (NYSDEC): New York State agency that *conserves, improves, and protects New York State's natural resources and environment, and controls water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well being.*

New York State Department of State (NYSDOS): Known as the "keeper of records" for the State of New York. Composed of two main divisions including the Office of Business and Licensing Services and the Office of Local Government Services. The latter office includes the Division of Coastal Resources and Waterfront Revitalization.

NH_3: Ammonia

Nine Minimum Controls (NMC): Controls recommended by the USEPA to minimize CSO impacts. The controls include: (1) proper operation and maintenance for sewer systems and CSOs; (2) maximum use of the collection system for storage; (3) review pretreatment requirements to minimize CSO impacts; (4) maximize flow to treatment facility; (5) prohibit combines sewer discharge during dry weather; (6) control solid and floatable materials in CSOs; (7) pollution prevention; (8) public notification of CSO occurrences and impacts; and, (9) monitor CSOs to characterize impacts and efficacy of CSO controls.

NMC: nine minimum controls

NMFS: National Marine Fisheries Service

No./mL (or #/mL): number of bacteria organisms per milliliter – measure of concentration

Non-Compliance: Not obeying all promulgated regulations, policies or standards that apply.

Non-Permeable Surfaces: Surfaces which will not allow water to penetrate, such as sidewalks and parking lots.

Non-Point Source (NPS): Pollution that is not released through pipes but rather originates from multiple sources over a relatively large area (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land by storm water. Non-point sources can be divided into source activities related to either land or water use including failing septic tanks, improper animal-keeping practices, forest practices, and urban and rural runoff. Common non-point sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets.

NPDES: National Pollution Discharge Elimination System

NPL: National Priorities List

NPS: Non-Point Source

Numeric Targets: A measurable value determined for the pollutant of concern which is expected to result in the attainment of water quality standards in the listed waterbody.

Nutrient Pollution: Contamination of water resources by excessive inputs of nutrients. In surface waters, excess algal production as a result of nutrient pollution is a major concern.

Nutrient: Any substance assimilated by living things that promotes growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

NWI: National Wetland Inventory

NYCDCP: New York City Department of City Planning

NYCDEP: New York City Department of Environmental Protection

NYCDOT: New York City Department of Transportation

NYCDPR: New York City Department of Parks and Recreation

NYCEDC: New York City Economic Development Corporation

NYCRR: New York State Code of Rules and Regulations

NYD: New York District

NYSDEC: New York State Department of Environmental Conservation

NYSDOS: New York State Department of State

O&M: Operation and Maintenance

Oligohaline: The estuarine salinity zone with a salinity range of 0.5-5-ppt.

ONRW: Outstanding National Resource Waters

Operation and Maintenance (O&M): Actions taken after construction to ensure that facilities constructed will be properly operated and maintained to achieve normative efficiency levels and prescribed effluent eliminations in an optimum manner.

Optimal: Most favorable point, degree, or amount of something for obtaining a given result; in ecology most natural or minimally disturbed sites.

Organic Chemicals/Compounds: Naturally occurring (animal or plant-produced or synthetic) substances containing mainly carbon, hydrogen, nitrogen, and oxygen.

Organic Material: Material derived from organic, or living, things; also, relating to or containing carbon compounds.

Organic Matter: Carbonaceous waste (organic fraction) that includes plant and animal residue at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population originating from domestic or industrial sources. It is commonly determined as the amount of organic material contained in a soil or water sample.

Organic: (1) Referring to other derived from living organisms. (2) In chemistry, any compound containing carbon.

Ortho P: Ortho Phosphorus

Ortho Phosphorus: Soluble reactive phosphorous readily available for uptake by plants. The amount found in a waterbody is an indicator of how much phosphorous is available for algae and plant growth. Since aquatic plant growth is typically limited by phosphorous, added phosphorous especially in the dissolved, bioavailable form can fuel plant growth and cause algae blooms.

Outfall: Point where water flows from a conduit, stream, or drain into receiving water.

Outstanding National Resource Waters (ONRW): Outstanding national resource waters (ONRW) designations offer special protection (i.e., no degradation) for designated waters, including wetlands. These are areas of exceptional water quality or recreational/ecological significance. State antidegradation policies should provide special protection to wetlands designated as outstanding national resource waters in the same manner as other surface waters; see Section 131.12(a)(3) of the WQS regulation and USEPA guidance (Water Quality Standards Handbook (USEPA 1983b), and Questions and Answers on: Antidegradation (USEPA 1985a)).

Overflow Rate: A measurement used in wastewater treatment calculations for determining solids settling. It is also used for CSO storage facility calculations and is defined as the flow through a storage basin divided by the surface area of the basin. It can be thought of as an average flow rate through the basin. Generally expressed as gallons per day per square foot (gpd/sq.ft.).

Oxidation Pond: A relatively shallow body of wastewater contained in an earthen basin; lagoon; stabilization pond.

Oxidation: The chemical union of oxygen with metals or organic compounds accompanied by a removal of hydrogen or another atom. It is an important factor for soil formation and permits the release of energy from cellular fuels.

Oxygen Demand: Measure of the dissolved oxygen used by a system (microorganisms) in the oxidation of organic matter. (See also biochemical oxygen demand)

Oxygen Depletion: The reduction of dissolved oxygen in a waterbody.

PAH: Polycyclic Aromatic Hydrocarbons

Partition Coefficients: Chemicals in solution are partitioned into dissolved and particulate adsorbed phase based on their corresponding sediment-to-water partitioning coefficient.

Parts per Million (ppm): The number of "parts" by weight of a substance per million parts of water. This unit is commonly used to represent pollutant concentrations. Large concentrations are expressed in percentages.

Pathogen: Disease-causing agent, especially microorganisms such as bacteria, protozoa, and viruses.

PCBs: Polychlorinated biphenyls

PCS: Permit Compliance System

PE: Primary Effluent

Peak Flow: The maximum flow that occurs over a specific length of time (e.g., daily, hourly, instantaneous).

Pelagic Zone: The area of open water beyond the littoral zone.

Pelagic: Pertaining to open waters or the organisms which inhabit those waters.

Percent Fines: In analysis of sediment grain size, the percent of fine (.062-mm) grained fraction of sediment in a sample.

Permit Compliance System (PCS): Computerized management information system which contains data on NPDES permit-holding facilities. PCS keeps extensive records on more than 65,000 active water-discharge permits on sites located throughout the nation. PCS tracks permit, compliance, and enforcement status of NPDES facilities.

Permit: An authorization, license, or equivalent control document issued by USEPA or an approved federal, state, or local agency to implement the requirements of an environmental regulation; e.g., a permit to operate a wastewater treatment plant or to operate a facility that may generate harmful emissions.

Petit Ponar Grab Sampler: Dredge designed to take samples from all types of benthos sediments on all varieties of waterbody bottoms, except those of the hardest clay. When the jaws contact the bottom they obtain a good penetration with very little sample disturbance. Can be used in both fresh and salt water.

pH: An expression of the intensity of the basic or acid condition of a liquid. The pH may range from 0 to 14, where 0 is most acid, 14 most basic and 7 neutral. Natural waters usually have a pH between 6.5 and 8.5.

Phased Approach: Under the phased approach to TMDL development, load allocations (LAs) and wasteload allocations (WLAs) are calculated using the best available data and information recognizing the need for additional monitoring data to accurately characterize sources and loadings. The phased approach is typically employed when non-point sources dominate. It provides for the implementation of load reduction strategies while collecting additional data.

Photic Zone: The region in a waterbody extending from the surface to the depth of light penetration.

Photosynthesis: The process by which chlorophyll-containing plants make carbohydrates from water, and from carbon dioxide in the air, using energy derived from sunlight.

Phytoplankton: Free-floating or drifting microscopic algae with movements determined by the motion of the water.

Point Source: (1) A stationary location or fixed facility from which pollutant loads are discharged. (2) Any single identifiable source of pollutants including pipes, outfalls, and conveyance channels from either municipal wastewater treatment systems or industrial waste treatment facilities. (3) Point sources can also include pollutant loads contributed by tributaries to the main receiving water stream or river.

Pollutant: Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. (CWA Section 502(6)).

Pollution: Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water.

Polychaete: Marine worms of the class Polychaeta of the invertebrate worm order Annelida. Polychaete species dominate the marine benthos, with dozens of species present in natural marine environments. These worms are highly diversified, ranging from detritivores to predators, with some species serving as good indicators of environmental stress.

Polychlorinated Biphenyls (PCBs): A group of synthetic polychlorinated aromatic hydrocarbons formerly used for such purposes as insulation in transformers and capacitors and lubrication in gas pipeline systems. Production, sale and new use was banned by law in 1977 following passage of the Toxic Substances Control Act. PCBs have a strong tendency to bioaccumulate. They are quite stable, and therefore persist in the environment for long periods of time. They are classified by USEPA as probable human carcinogens.

Polycyclic Aromatic Hydrocarbons (PAHs): A group of petroleum-derived hydrocarbon compounds, present in petroleum and related materials, and used in the manufacture of materials such as dyes, insecticides and solvents.

Population: An aggregate of interbreeding individuals of a biological species within a specified location.

POTW: Publicly Owned Treatment Plant

pounds per day per cubic foot: lb/day/cf

pounds per day: lbs/day; unit of measure

ppm: parts per million

Precipitation Event: An occurrence of rain, snow, sleet, hail, or other form of precipitation that is generally characterized by parameters of duration and intensity (inches or millimeters per unit of time).

Pretreatment: The treatment of wastewater from non-domestic sources using processes that reduce, eliminate, or alter contaminants in the wastewater before they are discharged into Publicly Owned Treatment Works (POTWs).

Primary Effluent (PE): Partially treated water (screened and undergoing settling) passing from the primary treatment processes a wastewater treatment plant.

Primary Treatment: A basic wastewater treatment method, typically the first step in treatment, that uses skimming, settling in tanks to remove most materials that float or will settle. Usually chlorination follows to remove pathogens from wastewater. Primary treatment typically removes about 35 percent of biochemical oxygen demand (BOD) and less than half of the metals and toxic organic substances.

Priority Pollutants: A list of 129 toxic pollutants including metals developed by the USEPA as a basis for defining toxics and is commonly referred to as “priority pollutants”.\

Probable Total Project Cost (PTPC): Probable Total Project Cost represents the realistic total of all hard costs, soft costs, and ancillary costs associated with a particular CSO abatement technology per the definitions provided in O'Brien & Gere, April 2006. All PTPCs shown in this report are adjusted to July 2005 dollars (ENR CCI = 11667.99).

Protozoa: Single-celled organisms that reproduce by fission and occur primarily in the aquatic environment. Waterborne pathogenic protozoans of primary concern include Giardia lamblia and Cryptosporidium, both of which affect the gastrointestinal tract.

PS: Pump Station or Pumping Station

PTPC: Probable Total Project Cost

Pseudoreplication: The repeated measurement of a single experimental unit or sampling unit, with the treatment of the measurements as if they were independent replicates of the sampling unit.

Public Comment Period: The time allowed for the public to express its views and concerns regarding action by USEPA or states (e.g., a Federal Register notice of a proposed rule-making, a public notice of a draft permit, or a Notice of Intent to Deny).

Publicly Owned Treatment Works (POTW): Any device or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature that is owned by a state or municipality. This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

Pump Station or Pumping Station: Sewer pipes are generally gravity driven. Wastewater flows slowly downhill until it reaches a certain low point. Then pump, or "lift," stations push the wastewater back uphill to a high point where gravity can once again take over the process.

Pycnocline: A zone of marked density gradient.

Q: Symbol for Flow (designation when used in equations)

R.L: Reporting Limit

Rainfall Duration: The length of time of a rainfall event.

Rainfall Intensity: The amount of rainfall occurring in a unit of time, usually expressed in inches per hour.

Raw Sewage: Untreated municipal sewage (wastewater) and its contents.

RCRAInfo: Resource Conservation and Recovery Act Information

Real-Time Control (RTC): A system of data gathering instrumentation used in conjunction with control components such as dams, gates and pumps to maximize storage in the existing sewer system.

Receiving Waters: Creeks, streams, rivers, lakes, estuaries, groundwater formations, or other bodies of water into which surface water and/or treated or untreated waste are discharged, either naturally or in man-made systems.

Red Tide: A reddish discoloration of coastal surface waters due to concentrations of certain toxin producing algae.

Reference Condition: The chemical, physical or biological quality or condition exhibited at either a single site or an aggregation of sites that represents the least impaired condition of a classification of waters to which the reference condition applies.

Reference Sites: Minimally impaired locations in similar waterbodies and habitat types at which data are collected for comparison with test sites. A separate set of reference sites are defined for each estuarine or coastal marine class.

Regional Environmental Monitoring and Assessment Program (REMAP): The Environmental Monitoring and Assessment Program (EMAP) is a research program to develop the tools necessary to monitor and assess the status and trends of national ecological resources. EMAP's goal is to develop the scientific understanding for translating environmental monitoring data from multiple spatial and temporal scales into assessments of current ecological condition and forecasts of future risks to our natural resources.

Regulator: A device in combined sewer systems for diverting wet weather flows which exceed downstream capacity to an overflow.

REMAP: Regional Environmental Monitoring and Assessment Program

Replicate: Taking more than one sample or performing more than one analysis.

Reporting Limit (RL): The lowest concentration at which a contaminant is reported.

Residence Time: Length of time that a pollutant remains within a section of a waterbody. The residence time is determined by the streamflow and the volume of the river reach or the average stream velocity and the length of the river reach.

Resource Conservation and Recovery Act Information (RCRAinfo): Database with information on existing hazardous materials sites. USEPA was authorized to develop a hazardous waste management system, including plans for the handling and storage of wastes and the licensing of treatment and disposal facilities. The states were required to implement the plans under authorized grants from the USEPA. The act generally encouraged "cradle to grave" management of certain products and emphasized the need for recycling and conservation.

Respiration: Biochemical process by means of which cellular fuels are oxidized with the aid of oxygen to permit the release of the energy required to sustain life; during respiration, oxygen is consumed and carbon dioxide is released.

Restoration: Return of an ecosystem to a close approximation of its condition prior to disturbance. Re-establishing the original character of an area such as a wetland or forest.

Riparian Zone: The border or banks of a stream. Although this term is sometimes used interchangeably with floodplain, the riparian zone is generally regarded as relatively narrow compared to a floodplain. The duration of flooding is generally much shorter, and the timing less predictable, in a riparian zone than in a river floodplain.

Ribonucleic acid (RNA): RNA is the generic term for polynucleotides, similar to DNA but containing ribose in place of deoxyribose and uracil in place of thymine. These molecules are involved in the transfer of information from DNA, programming protein synthesis and maintaining ribosome structure.

Riparian Habitat: Areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands.

Riparian: Relating to or living or located on the bank of a natural watercourse (as a river) or sometimes of a lake or a tidewater.

RNA: ribonucleic acid

RTC: Real-Time Control

Runoff: That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into receiving waters.

Safe Drinking Water Act: The Safe Drinking Water Act authorizes USEPA to set national health-based standards for drinking water to protect against both naturally occurring and man-made contaminants that may be found in drinking water. USEPA, states, and water systems then work together to make sure these standards are met.

Sanitary Sewer Overflow (SSO): When wastewater treatment systems overflow due to unforeseen pipe blockages or breaks, unforeseen structural, mechanical, or electrical failures, unusually wet weather conditions, insufficient system capacity, or a deteriorating system.

Sanitary Sewer: Underground pipes that transport only wastewaters from domestic residences and/or industries to a wastewater treatment plant. No stormwater is carried.

Saprobien System: An ecological classification of a polluted aquatic system that is undergoing self-purification. Classification is based on relative levels of pollution, oxygen concentration and types of indicator microorganisms; i.e., saprophagic microorganisms – feeding on dead or decaying organic matter.

SCADA: Supervisory Control and Data Acquisition

scfm: standard cubic feet per minute

Scoping Modeling: Involves simple, steady-state analytical solutions for a rough analysis of the problem.

Scour: To abrade and wear away. Used to describe the weathering away of a terrace or diversion channel or streambed. The clearing and digging action of flowing water, especially the downward erosion by stream water in sweeping away mud and silt on the outside of a meander or during flood events.

Secchi Disk: Measures the transparency of water. Transparency can be affected by the color of the water, algae and suspended sediments. Transparency decreases as color, suspended sediments or algal abundance increases.

Secondary Treatment: The second step in most publicly owned waste treatment systems in which bacteria consume the organic parts of the waste. It is accomplished by bringing together waste, bacteria, and oxygen in trickling filters or in the activated sludge process. This treatment removes floating and settleable solids and about 90 percent of the oxygen-demanding substances and suspended solids. Disinfection is the final stage of secondary treatment. (See primary, tertiary treatment.)

Sediment Oxygen Demand (SOD): A measure of the amount of oxygen consumed in the biological process that breaks down organic matter in the sediment.

Sediment: Insoluble organic or inorganic material often suspended in liquid that consists mainly of particles derived from rocks, soils, and organic materials that eventually settles to the bottom of a waterbody; a major non-point source pollutant to which other pollutants may attach.

Sedimentation: Deposition or settling of suspended solids settle out of water, wastewater or other liquids by gravity during treatment.

Sediments: Soil, sand, and minerals washed from land into water, usually after rain. They pile up in reservoirs, rivers and harbors, destroying fish and wildlife habitat, and clouding the water so that sunlight cannot reach aquatic plants. Careless farming, mining, and building activities will expose sediment materials, allowing them to wash off the land after rainfall.

Seiche: A wave that oscillates (for a period of a few minutes to hours) in lakes, bays, lagoons or gulfs as a result of seismic or atmospheric disturbances (e.g., "wind tides").

Sensitive Areas: Areas of particular environmental significance or sensitivity that could be adversely affected by discharges, including Outstanding National Resource Waters, National Marine Sanctuaries, waters with threatened or endangered species, waters with primary contact recreation, public drinking water intakes, shellfish beds, and other areas identified by State or Federal agencies.

Separate Sewer System: Sewer systems that receive domestic wastewater, commercial and industrial wastewaters, and other sources but do not have connections to surface runoff and are not directly influenced by rainfall events.

Separate Storm Water System (SSWS): A system of catch basin, pipes, and other components that carry only surface run off to receiving waters.

Septic System: An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a system of tile lines or a pit for disposal of the liquid effluent (sludge) that remains after decomposition of the solids by bacteria in the tank; must be pumped out periodically.

SEQRA: State Environmental Quality Review Act

Settleable Solids: Material heavy enough to sink to the bottom of a wastewater treatment tank.

Settling Tank: A vessel in which solids settle out of water by gravity during drinking and wastewater treatment processes.

Sewage: The waste and wastewater produced by residential and commercial sources and discharged into sewers.

Sewer Sludge: Sludge produced at a Publicly Owned Treatment Works (POTW), the disposal of which is regulated under the Clean Water Act.

Sewer: A channel or conduit that carries wastewater and storm-water runoff from the source to a treatment plant or receiving stream. "Sanitary" sewers carry household, industrial, and commercial waste. "Storm" sewers carry runoff from rain or snow. "Combined" sewers handle both.

Sewerage: The entire system of sewage collection, treatment, and disposal.

Sewershed: A defined area that is tributary to a single point along an interceptor pipe (a community connection to an interceptor) or is tributary to a single lift station. Community boundaries are also used to define sewer-shed boundaries.

SF: Square foot, unit of area

Significant Industrial User (SIU): A Significant Industrial User is defined by the USEPA as an industrial user that discharges process wastewater into a publicly owned treatment works and meets at least one of the following: (1) All industrial users subject to *Categorical Pretreatment Standards* under the Code of Federal Regulations - Title 40 (40 CFR) Part 403.6, and CFR Title 40 Chapter I, Subchapter N- Effluent Guidelines and Standards; and (2) Any other industrial user that discharges an average of 25,000 gallons per day or more of process wastewater to the treatment plant (excluding sanitary, non-contact cooling and boiler blowdown wastewater); or contributes a process waste stream which makes up 5 percent or more of any design capacity of the treatment plant; or is designated as such by the municipal Industrial Waste Section on the basis that the industrial user has a reasonable potential for adversely affecting the treatment plants operation or for violating any pretreatment standard or requirement.

Siltation: The deposition of finely divided soil and rock particles upon the bottom of stream and river beds and reservoirs.

Simulation Models: Mathematical models (logical constructs following from first principles and assumptions), statistical models (built from observed relationships between variables), or a combination of the two.

Simulation: Refers to the use of mathematical models to approximate the observed behavior of a natural water system in response to a specific known set of input and forcing conditions. Models that have been validated, or verified, are then used to predict the response of a natural water system to changes in the input or forcing conditions.

Single Sample Maximum (SSM): A maximum allowable enterococci or E. Coli density for a single sample.

Site Spill Identifier List (SPIL): Federal database with information on existing Superfund Sites.

SIU: Significant Industrial User

Skewness: The degree of statistical asymmetry (or departure from symmetry) of a population. Positive or negative skewness indicates the presence of a long, thin tail on the right or left of a distribution respectively.

Slope: The degree of inclination to the horizontal. Usually expressed as a ratio, such as 1:25 or 1 on 25, indicating one unit vertical rise in 25 units of horizontal distance, or in a decimal fraction (0.04); degrees (2 degrees 18 minutes), or percent (4 percent).

Sludge: Organic and Inorganic solid matter that settles to the bottom of septic or wastewater treatment plant sedimentation tanks, must be disposed of by bacterial digestion or other methods or pumped out for land disposal, incineration or recycled for fertilizer application.

SNWA: Special Natural Waterfront Area

SOD: Sediment Oxygen Demand

SOP: Standard Operating Procedure

Sorption: The adherence of ions or molecules in a gas or liquid to the surface of a solid particle with which they are in contact.

SPDES: State Pollutant Discharge Elimination System

Special Natural Waterfront Area (SNWA): A large area with concentrations of important coastal ecosystem features such as wetlands, habitats and buffer areas, many of which are regulated under other programs.

SPIL: Site Spill Identifier List

SRF: State Revolving Fund

SSM: single sample maximum

SSO: Sanitary Sewer Overflow

SSWS: Separate Storm Water System

Stakeholder: One who is interested in or impacted by a project.

Standard Cubic Feet per Minute (SCFM): A standard measurement of airflow that indicates how many cubic feet of air pass by a stationary point in one minute. The higher the number, the more air is being forced through the system. The volumetric flow rate of a liquid or gas in cubic feet per minute. 1 CFM equals approximately 2 liters per second.

State Environmental Quality Review Act (SEQRA): New York State program requiring all local government agencies to consider environmental impacts equally with social and economic factors during discretionary decision-making. This means these agencies must assess the environmental significance of all actions they have discretion to approve, fund or directly undertake. SEQR requires the agencies to balance the environmental impacts with social and economic factors when deciding to approve or undertake an action.

Standard Operating Procedure (SOP): Document describing a procedure or set of procedures to perform a given operation or evolutions or in reaction to a given event.

State Pollutant Discharge Elimination System (SPDES): New York State has a state program which has been approved by the United States Environmental Protection Agency for the control of wastewater and stormwater discharges in accordance with the Clean Water Act. Under New York State law the program is known as the State Pollutant Discharge Elimination System (SPDES) and is broader in scope than that required by the Clean Water Act in that it controls point source discharges to groundwaters as well as surface waters.

State Revolving Fund (SRF): Revolving funds are financial institutions that make loans for specific water pollution control purposes and use loan repayment, including interest, to make new loans for additional water pollution control activities. The SRF program is based on the 1987 Amendments to the Clean Water Act, which established the SRF program as the CWA's original Construction Grants Program was phased out.

Steady-State Model: Mathematical model of fate and transport that uses constant values of input variables to predict constant values of receiving water quality concentrations.

Storage: Treatment holding of waste pending treatment or disposal, as in containers, tanks, waste piles, and surface impoundments.

STORET: U.S. Environmental Protection Agency (USEPA) national water quality database for STORage and RETrieval (STORET). Mainframe water quality database that includes physical, chemical, and biological data measured in waterbodies throughout the United States.

Storm Runoff: Stormwater runoff, snowmelt runoff, and surface runoff and drainage; rainfall that does not evaporate or infiltrate the ground because of impervious land surfaces or a soil infiltration rate lower than rainfall intensity, but instead flows onto adjacent land or waterbodies or is routed into a drain or sewer system.

Storm Sewer: A system of pipes (separate from sanitary sewers) that carries waste runoff from buildings and land surfaces.

Storm Sewer: Pipes (separate from sanitary sewers) that carry water runoff from buildings and land surfaces.

Stormwater: The portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels or pipes into a defined surface water channel, or a constructed infiltration facility.

Stormwater Management Models (SWMM): USEPA mathematical model that simulates the hydraulic operation of the combined sewer system and storm drainage sewershed.

Stormwater Protection Plan (SWPP): A plan to describe a process whereby a facility thoroughly evaluates potential pollutant sources at a site and selects and implements appropriate measures designed to prevent or control the discharge of pollutants in stormwater runoff.

Stratification (of waterbody): Formation of water layers each with specific physical, chemical, and biological characteristics. As the density of water decreases due to surface heating, a stable situation develops with lighter water overlaying heavier and denser water.

Stressor: Any physical, chemical, or biological entity that can induce an adverse response.

Subaqueous Burrow Pit: An underwater depression left after the mining of large volumes of sand and gravel for projects ranging from landfilling and highway construction to beach nourishment.

Substrate: The substance acted upon by an enzyme or a fermenter, such as yeast, mold or bacteria.

Subtidal: The portion of a tidal-flat environment that lies below the level of mean low water for spring tides. Normally it is covered by water at all stages of the tide.

Supervisory Control and Data Acquisition (SCADA): System for controlling and collecting and recording data on certain elements of WASA combined sewer system.

Surcharge Flow: Flow in which the water level is above the crown of the pipe causing pressurized flow in pipe segments.

Surface Runoff: Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of non-point source pollutants in rivers, streams, and lakes.

Surface Water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other groundwater collectors directly influenced by surface water.

Surficial Geology: Geology relating to surface layers, such as soil, exposed bedrock, or glacial deposits.

Suspended Loads: Specific sediment particles maintained in the water column by turbulence and carried with the flow of water.

Suspended Solids or Load: Organic and inorganic particles (sediment) suspended in and carried by a fluid (water). The suspension is governed by the upward components of turbulence, currents, or colloidal suspension. Suspended sediment usually consists of particles <0.1 mm, although size may vary according to current hydrological conditions. Particles between 0.1 mm and 1 mm may move as suspended or bedload. It is a standard measure of the concentration of particulate matter in wastewater, expressed in mg/L. Technology-Based Standards. Minimum pollutant control standards for numerous categories of industrial discharges, sewage discharges and for a growing number of other types of discharges. In each industrial category, they represent levels of technology and pollution control performance that the USEPA expects all discharges in that category to employ.

SWEM: System-wide Eutrophication Model

SWMM: Stormwater Management Model

SWPP: Stormwater Protection Plan

System-wide Eutrophication Model (SWEM): Comprehensive hydrodynamic model developed for the New York/New Jersey Harbor System.

Taxa: The plural of taxon, a general term for any of the hierarchical classification groups for organisms, such as genus or species.

TC: Total coliform

TDS: Total Dissolved Solids

Technical and Operational Guidance Series (TOGS): Memorandums that provide information on determining compliance with a standard.

Tertiary Treatment: Advanced cleaning of wastewater that goes beyond the secondary or biological stage, removing nutrients such as phosphorus, nitrogen, and most biochemical oxygen demand (BOD) and suspended solids.

Test Sites: Those sites being tested for biological impairment.

Threatened Waters: Water whose quality supports beneficial uses now but may not in the future unless action is taken.

Three-Dimensional Model (3-D): Mathematical model defined along three spatial coordinates where the water quality constituents are considered to vary over all three spatial coordinates of length, width, and depth.

TKN: Total Kjeldahl Nitrogen

TMDL: Total Maximum Daily Loads

TOC: Total Organic Carbon

TOGS: Technical and Operational Guidance Series

Topography: The physical features of a surface area including relative elevations and the position of natural and man-made features.

Total Coliform Bacteria: A particular group of bacteria, found in the feces of warm-blooded animals, that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°. Note that many common soil bacteria are also total coliforms, but do not indicate fecal contamination. (See also fecal coliform bacteria)

Total Coliform (TC): The coliform bacteria group consists of several genera of bacteria belonging to the family *enterobacteriaceae*. These mostly harmless bacteria live in soil, water, and the digestive system of animals. Fecal coliform bacteria, which belong to this group, are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals, and can enter water bodies from human and animal waste. If a large number of fecal coliform bacteria (over 200 colonies/100 milliliters (mL) of water sample) are found in water, it is possible that pathogenic (disease- or illness-causing) organisms are also present in the water. Swimming in waters with high levels of fecal coliform bacteria increases the chance of developing illness (fever, nausea or stomach cramps) from pathogens entering the body through the mouth, nose, ears, or cuts in the skin.

Total Dissolved Solids (TDS): Solids that pass through a filter with a pore size of 2.0 micron or smaller. They are said to be non-filterable. After filtration the filtrate (liquid) is dried and the remaining residue is weighed and calculated as mg/L of Total Dissolved Solids.

Total Kjeldahl Nitrogen (TKN): The sum of organic nitrogen and ammonia nitrogen.

Total Maximum Daily Load (TMDL): The sum of the individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for non-point sources and natural background, and a margin of safety (MOS). TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.

Total Organic Carbon (TOC): A measure of the concentration of organic carbon in water, determined by oxidation of the organic matter into carbon dioxide (CO2). TOC includes all the carbon atoms covalently bonded in organic molecules. Most of the organic carbon in drinking water supplies is dissolved organic carbon, with the remainder referred to as particulate organic carbon. In natural waters, total organic carbon is composed primarily of nonspecific humic materials.

Total P: Total Phosphorus

Total Phosphorus (Total P): A nutrient essential to the growth of organisms, and is commonly the limiting factor in the primary productivity of surface water bodies. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particle form. Agricultural drainage, wastewater, and certain industrial discharges are typical sources of phosphorus, and can contribute to the eutrophication of surface water bodies. Measured in milligrams per liter (mg/L).

Total Suspended Solids (TSS): See Suspended Solids Toxic Substances. Those chemical substances which can potentially cause adverse effects on living organisms. Toxic substances include pesticides, plastics, heavy metals, detergent, solvent, or any other materials that are poisonous, carcinogenic, or otherwise directly harmful to human health and the environment as a result of dose or exposure concentration and exposure time. The toxicity of toxic substances is modified by variables such as temperature, chemical form, and availability.

Total Volatile Suspended Solids (VSS): Volatile solids are those solids lost on ignition (heating to 550 degrees C.) They are useful to the treatment plant operator because they give a rough approximation of the amount of organic matter present in the solid fraction of wastewater, activated sludge and industrial wastes.

Toxic Pollutants: Materials that cause death, disease, or birth defects in organisms that ingests or absorbs them. The quantities and exposures necessary to cause these effects can vary widely.

Toxicity: The degree to which a substance or mixture of substances can harm humans or animals. Acute toxicity involves harmful effects in an organism through a single or short-term exposure. Chronic toxicity is the ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism.

Treated Wastewater: Wastewater that has been subjected to one or more physical, chemical, and biological processes to reduce its potential of being a health hazard.

Treatment Plant: Facility for cleaning and treating freshwater for drinking, or cleaning and treating wastewater before discharging into a water body.

Treatment: (1) Any method, technique, or process designed to remove solids and/or pollutants from solid waste, waste-streams, effluents, and air emissions. (2) Methods used to change the biological character or composition of any regulated medical waste so as to substantially reduce or eliminate its potential for causing disease.

Tributary: A lower order stream compared to a receiving waterbody. "Tributary to" indicates the largest stream into which the reported stream or tributary flows.

Trophic Level: The functional classification of organisms in an ecological community based on feeding relationships. The first trophic level includes green plants; the second trophic level includes herbivores; and so on.

TSS: Total Suspended Solids

Turbidity: The cloudy or muddy appearance of a naturally clear liquid caused by the suspension of particulate matter. It can be measured by the amount of light that is scattered or absorbed by a fluid.

Two-Dimensional Model (2-D): Mathematical model defined along two spatial coordinates where the water quality constituents are considered averaged over the third remaining spatial coordinate. Examples of 2-D models include descriptions of the variability of water quality properties along: (a) the length and width of a river that incorporates vertical averaging or (b) length and depth of a river that incorporates lateral averaging across the width of the waterbody.

U.S. Army Corps of Engineers (USACE): The United States Army Corps of Engineers, or USACE, is made up of some 34,600 civilian and 650 military men and women. The Corps' mission is to provide engineering services to the United States, including: Planning, designing, building and operating dams and other civil engineering projects ; Designing and managing the construction of military facilities for the Army and Air Force; and, Providing design and construction management support for other Defense and federal agencies

United States Environmental Protection Agency (USEPA): The Environmental Protection Agency (EPA or sometimes USEPA) is an agency of the United States federal government charged with protecting human health and with safeguarding the natural environment: air, water, and land. The USEPA began operation on December 2, 1970. It is led by its Administrator, who is appointed by the President of the United States. The USEPA is not a cabinet agency, but the Administrator is normally given cabinet rank.

U.S. Fish and Wildlife Service (USFWS): The United States Fish and Wildlife Service is a unit of the United States Department of the Interior that is dedicated to managing and preserving wildlife. It began as the U.S. Commission on Fish and Fisheries in the United States Department of Commerce and the Division of Economic Ornithology and Mammalogy in the United States Department of Agriculture and took its present form in 1939.

U.S. Geological Survey (USGS): The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

UAA: Use Attainability Analysis

ug/L: Microgram per liter – A measure of concentration

Ultraviolet Light (UV): Similar to light produced by the sun; produced in treatment processes by special lamps. As organisms are exposed to this light, they are damaged or killed.

ULURP: Uniform Land Use Review Procedure

Underground Storage Tanks (UST): Buried storage tank systems that store petroleum or hazardous substances that can harm the environment and human health if the USTs release their stored contents.

Uniform Land Use Review Procedure (ULURP): New York City program wherein a standardized program would be used to publicly review and approve applications affecting the land use of the city would be publicly reviewed. The program also includes mandated time frames within which application review must take place.

Unstratified: Indicates a vertically uniform or well-mixed condition in a waterbody. (See also Stratification)

Urban Runoff: Storm water from city streets and adjacent domestic or commercial properties that carries pollutants of various kinds into the sewer systems and receiving waters.

Urban Runoff: Water containing pollutants like oil and grease from leaking cars and trucks; heavy metals from vehicle exhaust; soaps and grease removers; pesticides from gardens; domestic animal waste; and street debris, which washes into storm drains and enters receiving waters.

USA: Use and Standards Attainability Project

USACE: United States Army Corps of Engineers

Use and Standards Attainability Project (USA): A NYCDEP program that supplements existing Harbor water quality achievements. The program involves the development of a four-year, expanded, comprehensive plan (the Use and Standards Attainment or "USA" Project) that is to be directed towards increasing water quality improvements in 26 specific bodies of water located throughout the entire City. These waterbodies were selected by NYCDEP based on the City's drainage patterns and on New York State Department of Environmental Conservation (NYSDEC) waterbody classification standards.

Use Attainability Analysis (UAA): **A**n evaluation that provides the scientific and economic basis for a determination that the designated use of a water body is not attainable based on one or more factors (physical, chemical, biological, and economic) proscribed in federal regulations.

Use Designations: Predominant uses each State determines appropriate for a particular estuary, region, or area within the class.

USEPA: United States Environmental Protection Agency

USFWS: U.S. Fish and Wildlife Service

USGS: United States Geological Survey

UST: underground storage tanks

UV: ultraviolet light

Validation (of a model): Process of determining how well the mathematical representation of the physical processes of the model code describes the actual system behavior.

Verification (of a model): Testing the accuracy and predictive capabilities of the calibrated model on a data set independent of the data set used for calibration.

Viewsheds: The major segments of the natural terrain which are visible above the natural vegetation from designated scenic viewpoints.

Virus: Submicroscopic pathogen consisting of a nucleic acid core surrounded by a protein coat. Requires a host in which to replicate (reproduce).

VSS: Total Volatile Suspended Solids

Wasteload Allocation (WLA): The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation (40 CFR 130.2(h)).

Wastewater Treatment Plant (WWTP): A facility that receives wastewaters (and sometimes runoff) from domestic and/or industrial sources, and by a combination of physical, chemical, and biological processes reduces (treats) the wastewaters to less harmful byproducts; known by the acronyms, STP (sewage treatment plant), POTW (publicly owned treatment works), WPCP (water pollution control plant) and WWTP.

Wastewater Treatment: Chemical, biological, and mechanical procedures applied to an industrial or municipal discharge or to any other sources of contaminated water in order to remove, reduce, or neutralize contaminants.

Wastewater: The used water and solids from a community (including used water from industrial processes) that flows to a treatment plant. Stormwater, surface water and groundwater infiltration also may be included in the wastewater that enters a wastewater treatment plant. The term sewage usually refers to household wastes, but this word is being replaced by the term wastewater.

Water Pollution Control Plant (WPCP): A facility that receives wastewaters (and sometimes runoff) from domestic and/or industrial sources, and by a combination of physical, chemical, and biological processes reduces (treats) the wastewaters to less harmful byproducts; known by the acronyms, STP (sewage treatment plant), POTW (publicly owned treatment works), WWTP (wastewater treatment) and WPCP.

Water Pollution: The presence in water of enough harmful or objectionable material to damage water quality.

Water Quality Criteria: Levels of water quality expected to render a body of water suitable for its designated use. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

Water Quality Standard (WQS): State or federal law or regulation consisting of a designated use or uses for the waters of the United States, water quality criteria for such waters based upon such uses, and an antidegradation policy and implementation procedures. Water quality standards protect the public health or welfare, enhance the quality of water and serve the purposes of the Clean Water Act. Water Quality Standards may include numerical or narrative criteria.

Water Quality: The biological, chemical, and physical conditions of a waterbody. It is a measure of a waterbody's ability to support beneficial uses.

Water Quality-Based Limitations: Effluent limitations applied to discharges when mere technology-based limitations would cause violations of water quality standards.

Water Quality-Based Permit: A permit with an effluent limit more stringent than technology based standards. Such limits may be necessary to protect the designated uses of receiving waters (e.g., recreation, aquatic life protection).

Waterbody/Watershed (WB/WS) Facility Plan: A predecessor document to the LTCP defined by the Administrative Consent Order. A waterbody/watershed facility plan supports the long-term CSO control planning process by describing the status of implementation of the nine USEPA recommended elements of an LTCP and by providing the technical framework to complete facility planning.

Waterbody Inventory/Priority Waterbody List (WI/PWL): The WI/PWL incorporates monitoring data, information from state and local communities and public participation. The Waterbody Inventory portion refers to the listing of all waters, identified as specific individual waterbodies, within the state that are assessed. The Priority Waterbodies List is the subset of waters in the Waterbody Inventory that have documented water quality impacts, impairments or threats.

Waterbody Segmentation: Implementation of a more systematic approach to defining the bounds of individual waterbodies using waterbody type, stream classification, hydrologic drainage, waterbody length/size and homogeneity of land use and watershed character as criteria.

Waterfront Revitalization Program (WRP): New York City's principal coastal zone management tool. As originally adopted in 1982 and revised in 1999, it establishes the city's policies for development and use of the waterfront and provides the framework for evaluating the consistency of all discretionary actions in the coastal zone with those policies. When a proposed project is located within the coastal zone and it requires a local, state, or federal discretionary action, a determination of the project's consistency with the policies and intent of the WRP must be made before the project can move forward.

Watershed Approach: A coordinated framework for environmental management that focuses public and private efforts on the highest priority problems within hydrologically-defined geographic area taking into consideration both ground and surface water flow.

Watershed: A drainage area or basin that drains or flows toward a central collector such as a stream, river, estuary or bay: the watershed for a major river may encompass a number of smaller watersheds that ultimately combined at a common point.

Weir: (1) A wall or plate placed in an open channel to measure the flow of water. (2) A wall or obstruction used to control flow from settling tanks and clarifiers to ensure a uniform flow rate and avoid short-circuiting.

Wet Weather Flow: Hydraulic flow conditions within a combined sewer system resulting from a precipitation event. Flow within a combined sewer system under these conditions may include street runoff, domestic sewage, ground water infiltration, commercial and industrial wastewaters, and any other non-precipitation event related flows. In a separately sewered system, this type of flow could result from dry weather flow being combined with inflow.

Wet Weather Operating Plan (WWOP): Document required by a permit holder's SPDES permit that optimizes the plant's wet weather performance.

Wetlands: An area that is constantly or seasonally saturated by surface water or groundwater with vegetation adapted for life under those soil conditions, as in swamps, bogs, fens, marshes, and estuaries. Wetlands form an interface between terrestrial (land-based) and aquatic environments; include freshwater marshes around ponds and channels (rivers and streams), brackish and salt marshes.

WI/PWL: Waterbody Inventory/Priority Waterbody List

WLA: Waste Load Allocation

WPCP: Water Pollution Control Plant

WQS: Water Quality Standards

WRP: Waterfront Revitalization Program

WWOP: Wet Weather Operating Plan

WWTP: Wastewater Treatment Plant

Zooplankton: Free-floating or drifting animals with movements determined by the motion of the water.

APPENDIX A

OWLS HEAD WATER POLLUTION CONTROL PLANT

WET WEATHER OPERATING PLAN

City of New York
Department of Environmental Protection
Bureau of Wastewater Treatment

Wet Weather Operating Plan
Owls Head Water Pollution Control Plant

Prepared by:
The New York City Department of Environmental Protection
Bureau of Wastewater Treatment

December 2008

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1. 0 INTRODUCTION

One effective strategy to abate pollution resulting from Combined Sewer Overflows (CSOs) is to maximize the delivery of flows during wet weather to a wastewater treatment plant for processing. Delivering these flows would maximize the use of available wastewater treatment plant capacity for wet weather flows and would ensure that combined sewer overflow would receive at least primary treatment prior to discharge. To implement this goal, New York State Department of Environmental Conservation (NYSDEC) requires the development of a Wet Weather Operating Plan (WWOP) for collection systems that include combined sewers. This requirement is one of 13 Best Management Practices (BMPs) that New York includes in the SPDES permit requirements of plants with Combined Sewer Overflows (CSOs). This particular provision has been included in consideration of the Federal CSO policy that mandates maximization of flow to Publicly Owned Treatment Works (POTWs).

This document provides an evaluation and specific guidance for the Owls Head WPCP. The implementation of these plans will help The City to improve treatment of sewage during wet weather events, and will allow them to demonstrate compliance with the State and Federal BMP requirements.

1.1 BACKGROUND OF EXISTING SYSTEM

The Owls Head Water Pollution Control Plant (WPCP) is located in the Bay Ridge section of the Borough of Brooklyn, City of New York, on the southwestern tip of the Owls Head Park. The Owls Head WPCP treats wastewater from a combined sewage collection system, which serves a population of approximately 780,000 and which drains storm water flow from an area of almost 13,664 acres.

The Owls Head plant began operation in 1952. Originally, the plant was designed to remove 80 percent suspended solids (SS) and 75 percent of the biochemical oxygen demand (BOD) from an average wastewater flow of 160 MGD. In 1979, the engineering firm of Metcalf and Eddy of New York Inc. was engaged to prepare the plans and contract drawings for updating the Owls Head plant to meet more stringent Federal standards requirements. Normal operation of the plant provides treatment for up to 120 MGD. The upgraded plant was designed to provide primary treatment and chlorination to wet weather peak flow of twice design average dry weather flow (240 MGD), and secondary treatment to 1.5 times average dry weather flow.

In 1997, DEP's Office of Environmental Planning and Assessment (OEPA) developed water demand and wastewater flow projections for each of the City WPCPs. The high-end projected flow to the Owls Head WPCP in the year 2020 is estimated to be 134 MGD. Maximum design wet weather flow to the plant is 240 MGD. The design maximum flow to secondary treatment is 1.5 times average flow, or 180 MGD.

1.2 DRAINAGE AREA

The Owls Head regulation system is comprised of ten regulator stations (eight of which incorporate tide gate chambers). Nine of the regulators have outfall sewers discharging into the Bay. A typical regulator consists of one or more float controlled sluice gates, which regulate the flow to the interceptors.

During dry weather the regulators will be in the open position and all flow will be directed to the plant. During times of storms when it is necessary to limit flow to the plant, regulators should always be used in preference to throttling the inlet gates. Throttling at the inlet gates surcharges the interceptor, which in turn may cause deposition behind the gates or produce damaging velocities through the inlet gates and into the screen units located just downstream.

There are four sanitary pumping stations located in the Owls Head drainage area. In addition, the Prospect Expressway "storm water" pumping station is also located in the Owls Head drainage area. The following Table 1-1 lists the regulators and outfalls for the Owls Head WWTP drainage area.

1.3 WASTEWATER TREATMENT PLANT DESCRIPTION

Wastewater treatment at the plant consists of screening, primary settling, step aeration activated sludge, final settling and chlorination with sodium hypochlorite.

1.4 EFFLUENT PERMIT LIMITS

The Owls Head WPCP is currently operating under SPDES Permit No. 0026166. Under this SPDES Permit, the plant is rated at 120 MGD dry weather flow and 240 MGD wet weather flow. The current effluent flow, CBOD, TSS, and fecal coliform limits and monitoring requirements from the permit are summarized in Table 1-2 below.

Table 1-1: Owls Head WPCP
Conventional Effluent Limitations and Monitoring Requirements

Parameter	Limit	**Type**
Plant Flow [6]	120 MGD	12 month rolling average
$CBOD_5$ [1]	25 mg/l [2]	Monthly average
	40 mg/l	7 day arithmetic mean
	50 mg/l [3]	6 consecutive hour avg.
TSS [1]	30 mg/l [2]	Monthly average
	45 mg/l	7 day arithmetic mean
	50 mg/l [5]	Daily Maximum
	50 mg/l [3]	6 consecutive hour avg.
Fecal Coliform	200 No./100 ml	30 day geometric mean
	400 No./100 ml	7 day geometric mean
	800 No./100 ml [3]	6 hour geometric mean
	2400 No./100 ml [3]	Instantaneous Maximum
Chlorine, Total Residual	2.0 mg/l [4]	Daily Maximum
pH	6.0 – 9.0 SU	Range

(1) Sample Frequency: 1/day; Sample Type: 24-hour composite
(2) Effluent values shall not exceed 15% and 15% of influent values for $CBOD_5$ & TSS respectively. During periods of wet weather which causes plant flows over the permitted flow for a calendar day, the $CBOD_5$ and TSS influent and effluent results for that day shall not be used to calculate 30-day arithmetic mean percent removal limitations. However, all concentrations shall be used in the calculations of the arithmetic mean value concentration limitations. All other effluent limitations remain in full effect.
(3) This is an Interstate Environmental Commission (IEC) requirement. The permittee is not required to perform this sampling but shall be required to meet the permit limit at all times. EPA, DEC, or IEC may perform the sampling.
(4) This is an interim limit of 2.0 mg/l, which shall be in effect until completion of construction of facilities necessary to achieve compliance with the final water quality based effluent limit. See the TRC compliance schedule in the SPDES Discharge Permit Number NY- 0026166.
(5) During periods of wet weather, which results in an instantaneous plant influent flow that is equal to or greater than twice the permitted flow, the TSS Daily Maximum limit of 50 mg/L shall not apply for the day of measured flow nor for the succeeding day.
(6) A 12-month rolling average is defined as the average of the current month with the eleven previous months. The 12-month rolling averages shall be calculated using total influent flow.

1.5 Wet Weather Flow Control

Original design of the collection system assumed that when it was necessary to limit flow to the plant, the regulators should be used in preference to throttling the plant inlet gates. Throttling at the inlet gates surcharges the interceptors, which in turn may cause deposition behind the gates or produce damaging velocities through the inlet gates and into the screen units located just downstream.

1.6 PERFORMANCE GOALS FOR WET WEATHER EVENTS

The goal of this Wet Weather Operating Plan is to maximize treatment of wet weather flows at the Owls Head WPCP and, in doing so, reduce the volume of untreated CSO being discharged in the Upper Bay and its tributaries.

There are three primary objectives in maximizing treatment for wet weather flows:

- Consistently achieve primary treatment and disinfection for wet weather flows up to 240 MGD before CSOs occur. In doing so the plant will satisfy the SPDES requirement of providing this level of treatment for 2xDDWF.

- Consistently provide secondary treatment for wet weather flows up to 180 MGD before bypassing the secondary treatment system. In doing so this plant will provide a secondary level of treatment for 1.5xDDWF

- Do not appreciably diminish the effluent quality or destabilize treatment upon return to dry weather operations.

1.7 PURPOSE OF THIS MANUAL

The purpose of this manual is to provide a set of operating guidelines to assist the Owls Head WPCP staff in making operational decisions which will best meet their performance goals and the requirements of the NPDES discharge permit. During a wet weather event, numerous operational decisions must be made to effectively manage and optimize treatment of wet weather flows. Plant flow is normally controlled through influent pump operations and adjustment of influent gates. Flow rates at which the secondary bypass is used are dependant upon a complex set of factors, including conditions within specific treatment processes (such as sludge settling characteristics) and anticipated storm intensity and duration. Each storm event produces a unique combination of flow patterns and plant conditions. No manual can describe the decision making process for every possible wet weather scenario which will be encountered at the Owls Head WPCP. This manual can, however, serve as a useful reference, which both new and experienced operators can utilize during wet weather events. The manual can be useful in preparing for a coming wet weather event, a source of ideas for controlling specific processes during the storm, and a checklist to avoid missing critical steps in monitoring and controlling processes during wet weather.

1.8 USING THE MANUAL

This manual is designed to allow use as a reference during wet weather events. It is broken down into sections that cover major unit processes at the Owls Head WPCP. Each protocol for the unit processes includes the following information:

- List of unit processes and equipment covered in the section.
- Steps to take before a wet weather event and who is responsible for these steps.
- Steps to take during a wet weather event and who is responsible for these steps.
- Steps to take after a wet weather event and who is responsible for these steps
- Discussion of why the recommended control steps are performed.
- Identification of specific circumstances that trigger the recommended changes.
- Identification of things that can go wrong with the process.

This manual is a living document. Users of the manual are encouraged to identify new steps, procedures, and recommendations to further the objectives of the manual. Modifications, which improve upon the manual's procedures to maximize treatment of wet weather, are encouraged. With continued input from the plant's experienced operations staff this manual will become a useful and effective tool.

1.9 REVISIONS TO THIS MANUAL

In addition to revisions based on plant operating experience, this manual will also be revised as modifications and stabilizations are made to the collection system and the Owls Head WPCP that affect the plants ability to receive and treat wet weather flows. Applicable changes are listed as follows:

- **Regulator Automation**- Under DEP's SCADA system project, automatic control of the regulators will be provided to plant operators. Control strategies for these regulators should be incorporated into this manual after automation is complete.
- **Throttling Gate Automation**- The Forebay throttling gate will eventually be actuated by a hydraulic cylinder operator. The objective of the Forebay throttling gate system is to automatically throttle flow into the plant at 240 MGD during wet weather conditions, and to prevent the level in the Afterbay channel from exceeding Elevation **(-)1.00.** The revisions to the operating procedure for the gate should be incorporated into this manual after automation is complete.

- **Future Construction Phases-** Future construction phases may impact the operation of the plant and may require revisions to this manual.

❖❖❖end of section❖❖❖

Owls Head Drainage Area Outfalls			
Outfall No.	**Location**	**Size**	**Receiving Waterbody**
001	Owls Head WPCP		Upper New York Bay
002	64th Street (Reg #6, 6A, B, C)	3BL 15' x 7'6"	Upper New York Bay
003	49th Street (Reg #7, 7A, B, C)	11' x 8'	Upper New York Bay
004	43rd Street (Reg # 7D)	6' x 4'	Upper New York Bay
005	5' s/o Carroll St. Bridge	42" DIA	Gowanus Canal
006	19th Street (North side)	36" DIA	Gowanus Creek (E)
007	e/o 2nd Avenue	78" DIA	Gowanus Canal
008	E. 9th Street	12" DIA	Gowanus Canal
009	5th Street	78" DIA	Gowanus Canal
015	17th Avenue (Reg #9A, B, C)	4 BL 14'6" x 10'	Gravesend Bay
017	92nd Street (Reg #1)	3BL 7'4" x 7'4"	Upper New York Bay
018	79th Street (Reg #2, 3)	90" DIA	Upper New York Bay
019	71st Street (Reg #8, 8A, 8B, 4)	48" DIA	Upper New York Bay
020	Bay Ridge Avenue (Reg #5)	3' x 3'	Upper New York Bay
021	West 15th Street (Reg #10, 11)	3BL 15' x 10'	Coney Island Creek (N)
022	32nd St. (Bush Terminal Complex)	6' x 4'	Gowanus Bay
023	28th St. (N side) (Bush Terminal Complex)	10" DIA	Gowanus Bay

Table 1-2: Owls Head WPCP

2.0 EXISTING FACILITY - WET WEATHER OPERATING PROCEDURES AND GUIDELINES

This section presents equipment summaries and wet weather operating protocols for each major unit operation of the plant. The protocols are divided into steps to be followed before, during and after a wet weather event that address the rational trigger mechanisms and potential problem areas for wet weather operations. Table **2-1** located at the end of this Section outlines a summary of unit operation capacities.

2.1 THROTTLING GATE

2.1.1 Equipment for Influent Gate System

EQUIPMENT	NUMBER
Influent Sluice Gate	4
Effluent Sluice Gate	4
26 Cubic Yard (cy) Container	1
Backup 10 cy Container	3

2.1.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Senior Sewage Treatment Worker (SSTW)	Sewage Treatment Worker (STW)	• Forebay gates should be in full open position during dry weather and prior to wet weather. • Check gate operation.
During Wet Weather Event		
SSTW	STW	• Leave gates in full open position until: 1. Plant flow approaches capacity of pumps in service or 2. Screen channel level exceeds acceptable level with maximum pumping, or 3. Bar screens become overloaded with screenings or 4. Grit removal exceeds the plant's grit handling capacity. • Set the gates to maintain acceptable wet well water level.

<table>
<tr><th colspan="2">WHO DOES IT?</th><th rowspan="2">WHAT DO WE DO?</th></tr>
<tr><th>SUPERVISORY</th><th>IMPLEMENTATION</th></tr>
<tr><td></td><td></td><td>• Record forebay gate adjustments on the Screening Chamber Log. Forebay gate adjustments are also automatically archived on Bailey system.
• As wet weather event subsides open the forebay gates to maintain the wet well water level until the gates are completely open.</td></tr>
<tr><td colspan="3">After Wet Weather Event</td></tr>
<tr><td>SSTW</td><td>STW</td><td>• Make sure the forebay gates are in the full open position.
• Conduct maintenance or repair of the forebay gates as necessary.</td></tr>
<tr><td colspan="3">Why Do We Do This?</td></tr>
<tr><td colspan="3">To regulate flow to the WWTP and prevent excessive flows from destabilizing plant performance.</td></tr>
<tr><td colspan="3">What Triggers The Change?</td></tr>
<tr><td colspan="3">High water levels in the wet well or other unacceptable plant conditions related to high flows.</td></tr>
<tr><td colspan="3">What Can Go Wrong?</td></tr>
<tr><td colspan="3">If the forebay gates are not operated when necessary, or fail to operate, high water levels in the wet well may result. Flooding of the screen chamber may occur. If the forebay gates fail to operate, flow to the plant should be manually throttled with the screen channel influent gates.</td></tr>
</table>

❖❖❖end of section❖❖❖

2.2 WASTEWATER SCREENING

Screenings are accomplished at Owls Head by means of a double row of bar screens consisting of eight climber screens, two per channel, one coarse screen followed by one fine screen, in series with each other.

2.2.1 Equipment

Screens	
Primary Screens	
Number of Units	4 units
Bar Openings	Coarse 11/4" - Fine 3/4"
Screen Channel Width (nominal)	6' - 9"
Screen Channel Invert Elevation @ Screen	-16.0'
Operating Lower Floor Elevation	4-'0"
Operating Higher Floor Elevation	12.5'

2.2.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Stationary Engineer Electrical (SEE)	SSTW/STW	• During normal dry weather operations, operating experience will dictate the number of screens required based on parameters such as grit settling problems, and quantity of screenable material. General guide for number of primary screens in service for various flow ranges: **Up to 150 MGD - 2 Primary Screens** **150 to 240 MGD - 3 Primary Screens** • Rotate screen operation to ensure that all available screens are in working order. Make sure empty screenings containers are available.
During Wet Weather Event		
SEE	SSTW/STW	• Put a third primary screen into operation. • Set all screen rakes to continuous operation.

<table>
<tr><th colspan="2">WHO DOES IT?</th><th rowspan="2">WHAT DO WE DO?</th></tr>
<tr><th>SUPERVISORY</th><th>IMPLEMENTATION</th></tr>
<tr><td></td><td></td><td>• Regulate the plant flow with the forebay gates if the screens become overwhelmed or the water elevation in the screen channel exceeds -1.0 (OH WPCP uses submersible screens).
• Remove and replace screenings containers as necessary.</td></tr>
<tr><td colspan="3">After Wet Weather Event</td></tr>
<tr><td>SEE</td><td>SSTW/STW</td><td>• Take extra screen out of operation. Return to two screens online.
• Remove screenings for disposal.</td></tr>
<tr><td colspan="3">Why Do We Do This?</td></tr>
<tr><td colspan="3">Two primary screens can accommodate flow of 150 MGD. Three primary screens are required to handle flows between 150 MGD and 240 MGD. This leaves the fourth screen on standby in case of a screen failure or excessive loadings.</td></tr>
<tr><td colspan="3">What Triggers The Change?</td></tr>
<tr><td colspan="3">Flows in excess of 150 MGD will require a third primary screen to be put online. Screen rakes will operate on time mode or if the head differential across the screens exceeds 2 to 4 inches.</td></tr>
<tr><td colspan="3">What Can Go Wrong?</td></tr>
<tr><td colspan="3">If an insufficient number of screens are online the screen channel may surcharge above acceptable levels (-1.0).</td></tr>
</table>

❖❖❖end of section❖❖❖

2.3 MAIN SEWAGE PUMPS

2.3.1 Equipment

EQUIPMENT	NUMBER
Influent Wet Wells	Total 1
Main Sewage Pumps (MSPs)	Total 5

2.3.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• Monitor wet well elevation. • Number and speed of pumps in service are selected and automatically adjusted by the sonic control system in the pump control room. The pumps are activated manually. • Adjustments made based on maintaining the level in the screen chamber wet well at a nominally constant level. • Check that wet well level monitor is functional.
During Wet Weather Event		
SEE	SSTW/STW	• Monitor wet well elevation. • As wet well level rises put off-line pumps in service and increase speed of variable speed pumps as necessary. • Pump to maximum capacity during wet weather events always leaving one pump out of service as standby. • Pumps are controlled automatically using the sonic control system, which is based on maintaining wet well levels within a desired operating range. Pumps are activated manually.

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	**IMPLEMENTATION**	
After Wet Weather Event		
SEE	SSTW/STW	• Maintain pumping rate as required to keep wet well level in operating range. • If the forebay gates have been throttled, maintain maximum pumping rate until forebay gates are returned to fully open position. • Reduce pump speeds and number in service to maintain wet well level and return to dry weather operation.
Why Do We Do This?		
Maximize flow to treatment plant, and minimize need for flow storage in collection system and associated overflow from collection system into receiving water body.		
What Triggers The Change?		
High flows, and the subsequent increase in the level of the screen channels and wet well.		
What Can Go Wrong?		
Pump fails to start. Pump fails while running. Screens blind, necessitating pump speed reduction or slowdown. Subsequent flooding of wet well and bar screen equipment.		

❖❖❖end of section❖❖❖

2.4 PRIMARY SETTLING TANKS

The primary settling tanks are designed to treat a minimum flow of approximately 60 MGD for each tank during storm conditions. When primary tanks are taken out of service, the primary settling effluent quality should be checked to avoid overloading and degradation of the secondary treatment process. Below table lists minimum primary tank flow rates.

2.4.1 Equipment

EQUIPMENT		NUMBER	
Primary Settling Tanks (PSTs)		Total 4 4 Passes/PST	
Longitudinal Collectors		4/PST	
Cross Collector		1/PST	
Grease Pit		1	
Skimmings Dipping Weir w/ Trough		16	
6 Cubic Yard (cy) Container		1	
Primary Sludge Pump Stations (PSPS)		1	
Primary Sludge Pumps (PSPs)		6	
Cyclone Degritters		Total 6 4 in service	
Classifiers		Total 3 2 in service	
Number of Primary Settling Tanks in Service	**2 Units East Side**	**2 Units West Side**	**Minimum Flow Rates**
4	2	2	240 MGD
3	2	1	180 MGD
3	1	2	180 MGD
2	1	1	120 MGD
2	2	0	120 MGD
2	0	2	120 MGD
1	1	0	60 MGD
1	0	1	60 MGD

2.4.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• Under normal operations all available primary tanks should be in service.

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
		• Check the flow balance to all tanks in service by looking at the effluent weirs. • Check the sludge collector operation and inspect tanks for broken flights. • Check for floating sludge or bubbles on the tank surface as an indication of sludge collector problems. • Check sludge pump operation. • Repair any malfunctions or equipment out of service.
During Wet Weather Event		
SEE	SSTW/STW	• Make sure four primary sludge pumps are on-line. • Watch water surface elevations at the weirs for flooding and flow imbalances. • Check the collector and drive operation. • Make sure grit flushers are operating. • Assign additional operators to grit handling if necessary. • Repair equipment failures as needed. • Reduce flow (sewage pumps and throttle forebay gates) if: 1. Sludge cannot be withdrawn quick enough from the primaries, 2. Grit accumulation exceeds the plants ability to handle it. 3. A primary tank must be taken out of service.
After Wet Weather Event		

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
SEE	SSTW/STW	• Take tanks out of service for repair or maintenance if necessary. • Remove floating debris and scum on the tanks. • Repair any failures. • Clean the effluent weirs if needed.

❖❖❖end of section❖❖❖

2.5 BYPASS CHANNEL

2.5.1 Equipment

EXISTING	
Bypass Channel	2 Bypass Control Sluice Gates
Location of Sluice Gates	End of bypass channels - East of Primary tanks

That portion of the primary settling tank flow, which is in excess of the secondary treatment process capacity, must be bypassed around secondary treatment. The bypass gates will automatically open to limit flow to secondary treatment to a minimum of 180 MGD (1.5 times DDWF). (Automatic function)

2.5.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• Conduct routine bypass gate preventative maintenance. • Check the secondary flow meter operation.
During Wet Weather Event		
SEE	SSTW/STW	• Bypass gate automatically open or close to maintain secondary flow at 180 MGD or greater. • Repair failures as necessary.
After Wet Weather Event		
SEE	SSTW/STW	• As the secondary flow drops below 180 MGD, bypass gate automatically closes.
Why Do We Do This?		
To relieve flow to the aeration system and avoid excessive loss of biological solids. To relieve primary clarifier flooding.		

What Triggers The Change?
Secondary flow in excess of 185 MGD. Bailey system is programmed to maintain flows between 180 MGD and 190 MGD.
What Can Go Wrong?
If the bypass gate does not open, secondary clarifier washout could occur and discharge large amount of biological solids. Bypass gate can open too much and cause flows less than 180 MGD to be passed through the secondary system.

❖❖❖end of section❖❖❖

2.6 AERATION TANKS

2.6.1 Equipment

Aeration Tanks		
Number of Tanks	2 Units - West Side	2 Units - East Side
Unit Dimensions (Ft)	West Side	East Side
Length	392'-8"	392'-8"
Width	100'	100'
Number of Passes Per Tanks	4	4
Sidewater Depth	17.3"	17.3"
Diffuser System	Ceramic Dome Diffusers	

2.6.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• During normal dry weather operations, at least 4 aeration tanks should be in operation. • The plant operates in a Step feed mode with Inlets at the Head of Passes B, C, and D. • Monitor Filamentous Growth.
During Wet Weather Event		
SEE	SSTW/STW	• Monitor the dissolved oxygen and adjust the airflow to maintain proper dissolved oxygen levels. • During wet weather operations, at least 4 aeration tanks should be in operation.
After Wet Weather Event		
SEE	SSTW/STW	• Monitor the dissolved oxygen and adjust the air flow to maintain proper dissolved oxygen levels. • Monitor Filamentous Growth.
Why Do We Do This?		
Limiting the secondary treatment flow to 1.5 x DDWF with the balance being bypassed.		
What Triggers The Change?		
Secondary flows above 180 MGD.		
What Can Go Wrong?		
Potential impacts of wet weather events on the activated sludge process include: • Loss of biomass from the aeration tanks and secondary clarifiers		

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	

- Overloading of the aeration system resulting from high CBOD loadings caused by solids washout from the sewer system and solids washout from the primary clarifiers.
- Decreased CBOD removal efficiency due to shortened hydraulic retention time in the aeration tanks.
- The operator must maintain proper dissolved oxygen levels in the aerators to avoid filamentous organisms.

❖❖❖end of section❖❖❖

2.7 FINAL SETTLING TANKS

2.7.1 Equipment

EQUIPMENT	NUMBER
Final Settling Tanks (FSTs)	16
Flight & Chain Sludge Collection System	6/FST
Skimmings Concentration Pit	2
Skimmings Trough	4
6 Cubic Yard (cy) Container	1

2.7.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• During normal dry weather operation all available final clarifiers should be in service. • Check the telescoping valves for plugging. Free any plugged valves. • Skim tanks as necessary. • Check the flow balance to all tanks in service by looking at effluent weirs. • Normal operation is to set the RAS rates to maintain a minimal sludge blanket.
During Wet Weather Event		
SEE	SSTW/STW	• Balance flows to the tanks. • Observe the clarity of the effluent and watch for solids loss. • Open the secondary bypass if secondary treatment flow exceeds 180 MGD (automatic function).
After Wet Weather Event		
SEE	SSTW/STW	• Modify the sludge wasting based on MLSS levels. • Close the secondary bypass when secondary flow drops below 180

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
		MGD. • Observe the effluent clarity. • Skim the clarifiers if necessary.

Why Do We Do This?

High flows will substantially increase solids loadings to the clarifiers and result in high effluent TSS. These conditions can lead to loss of biological solids, which can destabilize treatment efficiency when the plant returns to dry weather flow conditions.

What Triggers The Change?

Twice design dry weather flow.

What Can Go Wrong?

Excessive loss of TSS will reduce the biomass inventory of the plant, which will adversely affect secondary treatment efficiency when the plant returns to dry weather flow conditions.

❖❖❖end of section❖❖❖

2.8 CHLORINATION

EQUIPMENT	NUMBER
Chlorine Contact Tanks (CCTs)	2
Sodium Hypochlorite Storage Tanks	3
Sodium Hypochlorite Roto-Dip	3
Dilution Water Pumps - Automatic Strainer - Manual Strainers	3 3 3
Skimmings Trough w/ Weir	1/Tank
Sump Pit	2
Hydraulic Actuated Slide Gate	2

Chlorination System		
Number of Tanks	2	
Number of Bays Per Tank	3	
Hypochlorite Storage Tanks	3	
Total Capacity Hypochlorite Tanks	10000 x 3	(30,000 gallons total)
Detention Time - Minutes	2 Tanks in Service	1 Tank in Service
Design Average Flow, 120mgd	30	15
Peak Weather Maximum, 240mgd	15	7

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	**IMPLEMENTATION**	
Before Wet Weather Event		
SEE	SSTW/STW	• Maintain adequate hypochlorite in storage tanks. • Make sure there are sufficient chlorine residual test kit supplies. • Report problems within a 2-hour window. • Perform preventative maintenance on equipment if necessary. • When the disinfection system is in automatic mode, the hypo feed rate is controlled by flow pacing and is proportional to the plant influent flow. The hypo feed rate is also trimmed or fine tuned by the ORP set point (Oxidation Reduction Potential). • When the system is on manual, the operator determines the hypo feed rate based on titrations for chlorine residual, the change from the last reading, and the change in flow conditions. When the chlorine residual is on target, the operator checks the residual every hour. When the chlorine residual is out of the target range, the operator checks the residual every half hour.

<table>
<tr><th colspan="2">WHO DOES IT?</th><th rowspan="2">WHAT DO WE DO?</th></tr>
<tr><th>SUPERVISORY</th><th>IMPLEMENTATION</th></tr>
<tr><td colspan="3">During Wet Weather Event</td></tr>
<tr><td>SEE</td><td>SSTW/STW</td><td>• Check, adjust and maintain the hypochlorite feed rates to provide proper chlorine residual for adequate fecal kill.
• When the disinfection system is in automatic mode, the hypo feed rate is controlled by flow pacing and is proportional to the plant influent flow. The hypo feed rate is also trimmed or fine tuned by the ORP set point (Oxidation Reduction Potential).
• When the system is on manual, the operator determines the hypo feed rate based on titrations for chlorine residual, the change from the last reading, and the change in flow conditions. When the chlorine residual is on target, the operator checks the residual every hour. When the chlorine residual is out of the target range, the operator checks the residual every half hour.
• Check and maintain the Hypochlorite tank levels.</td></tr>
</table>

<table>
<tr><th colspan="2">WHO DOES IT?</th><th rowspan="2">WHAT DO WE DO?</th></tr>
<tr><th>SUPERVISORY</th><th>IMPLEMENTATION</th></tr>
<tr><td colspan="3">After Wet Weather Event</td></tr>
<tr><td>SEE</td><td>SSTW/STW</td><td>Drop the Hypochlorite feed rates as needed to maintain the chlorine residual.
When the disinfection system is in automatic mode, the hypo feed rate is controlled by flow pacing and is proportional to the plant influent flow. The hypo feed rate is also trimmed or fine tuned by the ORP set point (Oxidation Reduction Potential).
When the system is on manual, the operator determines the hypo feed rate based on titrations for chlorine residual, the change from the last reading, and the change in flow conditions. When the chlorine residual is on target, the operator checks the residual every hour. When the chlorine residual is out of the target range, the operator checks the residual every half hour.
Maintain the Hypochlorite tank levels.
Repair equipment as necessary.</td></tr>
<tr><td colspan="3">Why Do We Do This?</td></tr>
<tr><td colspan="3">Hypochlorite demand will increase as flow rises and secondary bypasses occur. Increase the Hypochlorite feed rates to maintain the target chlorine residual.</td></tr>
<tr><td colspan="3">What Triggers The Change?</td></tr>
<tr><td colspan="3">High flows and secondary bypasses will increase Hypochlorite demand and usage.</td></tr>
<tr><td colspan="3">What Can Go Wrong?</td></tr>
<tr><td colspan="3">Chlorination system is on automatic mode most of the time. However, manual chlorination control with rapid flow changes and effluent quality changes can cause the chlorine residual to increase or decrease dramatically. Effluent chlorine residual must be monitored closely to maintain the target residual.</td></tr>
</table>

❖❖❖end of section❖❖❖

2.9 SLUDGE THICKENING, DIGESTION AND STORAGE

2.9.1 Equipment

EQUIPMENT	NUMBER
Waste Activated Sludge (WAS) Wet Well	1
WAS Pumps	3
Polymer Pumps	1

Sludge Thickening Digestion and Storage	
Design Condition	
Sludge Thickeners	
Installed	4
Operating	4
Anaerobic Sludge Digesters	
No. Of Units	6
No. Of Units Operating	6
Sludge Storage	
No. Of Storage Tanks	2
Storage Capacity (Days)	1

2.9.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	SUPERVISORY	
During Wet Weather Event		
SEE	SSTW/STW	• Sludge handling activities should proceed, as they normally would during dry weather flow.

Table 2-1. Rated Minimum Capacity for Equipment in Service				
Process Equipment	Number of Units Installed	Number of Units in Service	Minimum Plant Influent Flow	Minimum Secondary Treatment Flow
Screens	4	3 2 1	240 150 35	
Main Sewage Pump	5	4 3 2 1	240 180 120 35	
Primary Settling Tanks	4	4 3 2	240 180 120	
Aeration Tanks	4	4 3 2		180 135 90
Final Settling Tanks	16	16 15 14 13		180 170 160 150
Chlorine Contract Tanks	2	2 1	240 120*	

Note: * Plant will not reduce flow with only one chlorine contact tank in service.

❖❖❖end of section❖❖❖

APPENDIX B

PUBLIC PARTICIPATION PROGRAM

MEETING MINUTES

Long Term Control Plan
Coney Island Creek Stakeholder Meeting #1
June 29, 2006

The first Stakeholder Meeting for the Coney Island was held on June 29th at 6:30 in the Auditorium of the Coney Island Hospital. Stephen Whitehouse of Starr Whitehouse, DEP's consultant for public participation, presented background information on the purpose and need for the Long Term Control Plan.

Kevin Ward, project engineer from Hazen and Sawyer, spoke about the effects of CSOs on the Coney Island Creek area. Kevin began by describing the conditions of Coney Island Creek, showing the location of the single CSO outfall and 9 storm sewer outfalls. He described the existing water dependent uses, including fishing, boating, a cement factory, and park-related uses at the parks at the mouth of the creek.

Kevin then described the Coney Island Creek Drainage System, presenting a map of the combined and separate sewer areas and the division of the Creek watershed between the separate collection areas of the Owl's Head and Coney Island Water Pollution Control Plants. He then showed the water quality sampling sites. Kevin shared data on dissolved oxygen and coliform bacteria from a 1993 sampling. Kevin pointed out that in 1993, the dry days had higher coliform counts than the wet days, which suggested the presence of dry weather sanitary flow in the creek. The data from 1993 was compared with counts from 2004, which were considerably lower.

One stakeholder asked if the team looks for benzene in sediment samples. Kevin responded that they look for phosphorus, nitrogen, salinity, fecal coliform, and total coliform.

A stakeholder asked for more information about the weather conditions during sampling Kevin explained that samples were taken in dry and wet weather at the surface and bottom.

Kevin spoke about the site remediation project being conducted by Keyspan at the former Brooklyn Borough Gas Works site; dredging associated with the site remediation should improve overall water quality in the creek. A stakeholder added that the benefit of capping will be limited since the area near to the train tracks, with the highest concentration of contaminates, cannot be capped due to the MTA's continuing use of the tracks.

Kevin then went through the major points of Coney Island Creek CSO Facility Plan.

He started with illegal sanitary connection abatement. After the observation that coliform levels were higher in dry weather, DEP's investigative unit began to look for illegal hookups, which included the use of dye testing. By identifying and rectifying improper sewer hookups, the level of coliform has significantly decreased. The plan calls for ongoing efforts to identify illegal connections.

Kevin described the planned upgrade of the capacity of the Avenue V pumping station to achieve 85% of CSO capture. The Facility Plan includes a new force main to convey higher volumes of wet weather flow to Owl's Head. One stakeholder asked if there was sufficient capacity given area development. Kevin responded that the project was designed to account for population projections to 2045.

The planned improvements from the Coney Island Creek CSO Facility Plan will be augmented by the creek dredging associated with the former Brooklyn Borough Gas Works remediation being conducted separately by Keyspan; the dredging met with enthusiasm from the stakeholder group. There will also be additional water monitoring.

Kevin explained that the next steps are to finish the waterbody/watershed facility plan, submit it to NY State DEC for their review, and continue implementation of the Coney Island Creek CSO facility plan. Stephen Whitehouse explained that the role of the stakeholder group is to represent community interest. He explained that the Coney Island Creek Plan is part of a larger City plan for CSO abatement and that the NY State DEC review will result in the formulation of the Long Term Control Plan, for which DEC will conduct a future public hearing.

The floor was opened to discussion. One stakeholder spoke about the importance of Drier Offerman Park for birding and bird migration. Another resident asked whether DEP was involved in projects to reintroduce marshgrass and oysters to clean the water. The importance of education was discussed and one stakeholder suggested that the plan would be a good opportunity for vocational exploration with high school children.

In general, the stakeholders were excited about the plan, particularly the dredging of the creek and increased pumping capacity to reduce CSO discharges. Several stakeholders offered to help to recruit people for the next meeting. The team and stakeholders set a tentative date for the next meeting of August 2nd.

Long Term Control Plan
Coney Island Creek Stakeholder Meeting #2
August 2nd, 2006

The second meeting for the Long Term Control Plan (LTCP) for Combined Sewer Overflows with the Coney Island Creek Stakeholder Group took place on August 2, 2006 at 7:00 pm in the Coney Island Hospital Auditorium at 2601 Ocean Parkway. Stephen Whitehouse, DEP's consultant for public participation from Starr Whitehouse, opened the meeting. He reviewed the notes of the first meeting; the notes were accepted without revision by the participants. Stephen explained that the purpose of the LTCP project is to improve the quality of the city's open waters and tributaries by developing a plan to invest in infrastructure that will reduce the number and volume of combined sewer overflow (CSO) events. He reviewed the definition and location of CSOs in New York City. Stephen gave an overview of water quality legislation leading to the 2004 Consent Order with NY State Department of Conservation (DEC) that, among other requirements, defined the scope of the LTCP. He explained that, through the LTCP project, alternative plans would be developed and evaluated in terms of costs and performance. Stephen said that all of the waterbody/watershed plans would be submitted to the DEC in June 2007.

Kevin Ward, consultant from Hazen and Sawyer, described existing conditions within Coney Island Creek and its watershed. He stated that there is no natural freshwater flow. He showed a map of the combined and separate sewer area and reviewed a number of existing water-related uses. Showing a map of the collection system, Kevin located the single CSO collection area and associated outfall. Kevin explained that most of the drainage area of the Creek is served by separate sewers.

Kevin described water sampling data from 1993 and 2004. He showed the sampling locations and the water quality results relative to the Creek's Class I standards for dissolved oxygen and total and fecal coliform levels. He noted that in 1993, there was little differentiation between the dry and wet weather levels of total coliform, which indicates dry weather sanitary discharge resulting from improper residential sanitary sewer connections to storm sewers. Based on this observation, DEP deployed its investigative unit to locate and abate illegal sanitary connections to the storm sewers. The sampling data from 2004 shows nearly an order-of-magnitude improvement in pathogen levels in dry weather resulting from this enforcement effort. A stakeholder asked when sampling occurred. Kevin replied that sampling was carried out in all weather and tidal conditions and that water samples were collected from the surface and bottom portions of the water column.

A stakeholder asked whether a flushing tunnel like the one at the Gowanus Canal was considered as an alternative. Kevin confirmed that it was but added that analysis suggested that the alternative would be costly and would serve only to transfer the problem to Gravesend Bay. Another stakeholder asked whether the creek was afflicted with blooming phytoplankton. Kevin responded that phytoplankton blooms do occur in the creek and cause wide fluctuations in dissolved oxygen.

Then Kevin spoke about the remediation work by Keyspan at the former Brooklyn Borough Gas Works Site. A stakeholder confirmed that phase I was in progress but phase II, which includes dredging of the Creek, has not commenced. A stakeholder asked about the hazards of the dredging. Kevin explained that Keystone's work is governed by a regulatory Record of Decision, and that the permits address work conditions and requirements for handling and disposal of dredged materials. Another stakeholder mentioned that Keystone would be having its own public meeting, coordinated with the community boards, where these issues will be dealt with in full. A stakeholder expressed concern about local wildlife. He explained that after dredging removes a layer of contaminated material, the bottom will be capped with 3 feet of clean sand, which will protect marine wildlife that inhabit the creek after the dredging occurs. Kevin indicated that the dredging will remove sediment now exposed at low tide and that the constant cover of water will abate nuisance odors.

Kevin reviewed the components of the Coney Island Creek Waterbody/Watershed (WB/WS) Facility Plan, including upgrades to the Avenue V pumping station from 30 million gallons per day (MGD) to 80 MGD pumping capacity which will direct 87% of the current CSOs that enter Coney Island Creek to the Owl's Head WPCP for treatment. The increased flow from the pumping station will travel through two new force mains west to regulators in the Owl's Head collection system. Kevin said that the full construction, including the work at the Avenue V Pump Station and the force mains, is scheduled to be completed by 2012. He said that there would be ongoing work in the drainage area to eliminate illegal sanitary hookups and a post-construction water monitoring program will verify that the facility plan is delivering the intended benefits to water quality. A stakeholder asked whether the Owl's Head WPCP had enough capacity to hold the flow from the Avenue V Pumping Station and Kevin answered that it did. He noted that, according to the model, the plan would reduce the number of CSO events from 54 to 15 a year and that the annual CSO volume would decrease from 292.4 to 27.2 MG.

Kevin presented alternatives that would eliminate up to 100 percent of the annual CSO volume, a required analysis for a Long Term Control Plan. Kevin stated that the team considered CSO-storage tanks and looked at three sizes of tanks, including 2.5MG, 4.5MG and 8.5 MG. Because there is no available land near the Avenue V Pumping Station to locate storage tanks, the tank alternatives require their own facility site; for alternative analysis, a site near Drier Offerman Park was identified. The tank would require gravity piping from the Avenue V Pump Station and a return force main for emptying the tank after rain events. The piping requirements add significantly to the estimated cost of the tank alternatives.

Kevin showed the cost-benefit analysis of the various control alternatives presented. Based on this analysis, the Coney Island Creek WB/WS Facility Plan was identified as the most cost effective. The analysis demonstrates that little additional benefit would result relative to the additional cost.

Next, Kevin discussed plans to continue the illegal sanitary connection abatement. A stakeholder asked which agency was carrying out tests. Kevin answered that DEP ran the testing program and enforced requirements for abatement, but one area of the abatement work on Coney Island was being performed by the NYC Housing Preservation Department (HPD). Kevin described the project schedule for the Avenue V Pump Station. He spoke about post-construction monitoring as a way to verify that the controls produce the desired improvements. Kevin said that the Coney Island Creek WB/WS Facility Plan would be submitted to the NYSDEC by June 2007.

The floor was opened to questions:

- Several stakeholders asked about backup power at the pump stations in the event of a blackout. DEP answered that the pumping stations would have generators as they were upgrading and that was the case for Avenue V as well. Since the meeting, this has been confirmed.
- There was a discussion about water quality, which most stakeholders agreed is improving. One stakeholder suggested that poor quality was due to a lack of industrial waste abatement program. John Leonforte, of DEP, said an aggressive industrial waste program is in place and that such measures are discussed at the Water Pollution CAC.
- Another stakeholder asked about public education, particularly the stenciling of storm drains. John Leonforte commented that a stenciling program has been discussed. He said that current education programs target children.
- One stakeholder expressed his interest in related education programs. DEP suggested that he get in touch with the agency's public education department and offered to pass on the contact information.
- A stakeholder asked whether the Coney Island Creek area would benefit from a study, such the Jamaica Bay Watershed Protection Plan. The team responded that DEP is hoping to learn more about the quantifiable effects of Best Management Practices (BMPs) in the Jamaica Bay Watershed Protection Plan. The Plan will analyze and assess technologies and evaluate potential sites that may be applicable to other areas of the City.

6/04/09

Responsiveness Summary
To Questions and Comments Presented to the
New York State Department of Environmental Conservation and the
New York City Department of Environmental Protection
On the Coney Island Creek Waterbody/Watershed Facility Plan

A. QUESTIONS BY ATTENDEES AT PUBLIC MEETING HELD NOVEMBER 12, 2008 AT THE OFFICES OF COMMUNITY BOARD #13

(Note: Bob Alpern's comments from the meeting are not included here as they were repeated in his email to the NYSDEC – see Comments B1-B4 below)

A1. Several comments were received regarding illegal dumping in and around Coney Island Creek along Stillwell Avenue, including abandoned bus, shopping carts and other debris.

The proposed plan addresses water quality over the entire length of Coney Island Creek and is expected to attain the applicable (Class I) water quality standards 85% of the time for dissolved oxygen, 92% of the time for total coliform, and 75% of the time for fecal coliform. The dumping cited in the comment is illegal and may be curtailed through legal action. Observed illegal dumping should be reported either by calling 311 or by notifying the NYSDEC.

A2. The operation of the Avenue V Pumping Station causes stormwater to pond in front of stores along Mermaid Avenue.

Mermaid Avenue is not located within the Avenue V Pumping Station combined sewer drainage area. It is located in the separately sewered area that is tributary to the Coney Island Water Pollution Control Plant. Therefore, the ponding referred to in this comment is unrelated to the Avenue V Pumping Station operation. Regardless, flooding should be reported by calling 311 so that the cause can be identified and rectified.

A3. Is the DEC playing a role on decisions about NYC Water Board water and sewer rates?

No, the NYSDEC does not play a role in decisions regarding NYC Water Board water and sewer rates.

A4. Several comments were received regarding public education and the Long Term Control Plans. Can local school children participate in taking and evaluating water quality samples and measurements, perhaps using the activity space at the Coney Island Aquarium?

Requests for education opportunities with the DEP should be addressed to Kim Estes-Fradis of the DEP Education Department (718) 595-3506. The DEP has successfully coordinated water quality education opportunities for local school children in the Gowanus Canal watershed and in many other communities in NYC and in the upstate watershed.

A5. Oysters should be added to and marsh grass should be planted around Coney Island Creek to restore water quality. The Army Corps of Engineers is collaborating with PANYNJ and DEC on marsh restoration in other waterbodies, let's do it here.

The DEP will begin a study of ecological and stormwater best management practices (BMP) to reduce CSOs in 2009. The study will entail the piloting and evaluation of innovative, long-term sustainable measures to address water quality and ecological concerns in the City's waterways, including New York Harbor and its various tributaries. As part of the study, pilot projects involving the establishment of oyster reefs, ribbed mussels and eel grass beds in Jamaica Bay will be undertaken. Once these pilot projects are implemented and performance data are collected, meaningful information related to costs, environmental benefits, and operation and maintenance will be used to update DEP's long term CSO control planning efforts, PlaNYC, and other related plans.

A6. Build partnerships with other non-profits and work with Parks Department to use Drier-Offerman funds for betterment of Coney Island Creek.

Drier-Offerman Park borders Coney Island Creek along its northern shoreline near Gravesend Bay. Funds allocated for the improvement of this park are controlled by the City Department of Parks and Recreation. However, as an active participant in PlaNYC and many other Mayoral planning and development initiatives, DEP is involved with comprehensive NYC sustainability planning. To advance many desirable green initiatives, DEP engages and interacts with other government agencies, not-for-profit and community organizations, and industry to establish and promote a healthier urban environment. The Administration and the DEP understand that improvements to Coney Island Creek and the nearby community, coupled with rezoning initiatives, will add to both residents' and the public's enjoyment of this popular area.

A7. Please confirm that the Avenue V Pumping Station and associated new force mains will be completed in 2011.

Per the 2005 CSO Consent Order between DEP and DEC, construction of the Avenue V Pumping Station is scheduled to be completed by April 2011 and the new force mains are scheduled to be completed by June 2012. The contractors performing the work have schedule-related incentives in their contracts to ensure the timely completion of the work.

A8. Can microbes be put into the retention system to eat the pollution?

The treatment process that occurs at the City's 14 wastewater pollution control plants (WPCPs) utilizes bacteria to breakdown the organic material in the waste stream. The Avenue V Pumping Station is not a wastewater treatment facility but acts as a conveyance mechanism that collects and transfers wastewater to the Owls Head WPCP where bacteria are used to treat the wastewater.

A9. Will wet weather capacity be reduced in the system due to the increasing use of dry weather retainage in the system?

The wet and dry weather capacity in the Avenue V Pumping Station drainage area will be increased due to the increased capacity of the Pumping Station from 30 million gallons per day (mgd) to 80 mgd. All of the dry weather flow and an increased portion of the wet weather flow will be conveyed to the Owls Head WPCP via the new 42 inch force main and the new 48 inch force main.

A10. Several comments regarding the use of the Urban Tributary waterbody classification discussed in Section 9 of the Coney Island Creek WB/WS report were received.

The concept of an Urban Tributary waterbody classification is a proposal common to all of the Waterbody/Watershed Facility Plans. Its implementation is suggested for those confined waterbodies that will not meet currently designated water quality standards after implementation of their respective CSO abatement measures have been completed. It is a means of recognizing that these confined waterbodies are impacted by sources of water quality impairment in addition to CSOs (e.g. urban stormwater runoff) which prevent attainment of current water quality standards.

The Urban Tributary classification could be implemented through the application of a generic Use Attainability Analysis (UAA) procedure for confined urban waterbodies which would avoid the necessity for filing repeated UAA's for different waterbodies with similar characteristics. The Urban Tributary waterbody classification is a suggested means of classifying confined, urban waterbodies with chronic water quality impairment. The NYSDEC will evaluate this recommendation during the development of the City-wide Long Term Control Plan and determine if its implementation is viable.

A11. Several comments were received requesting the DEP to post signs at CSO outfall locations along the Gravesend Bay promenade to notify anglers that fish in the vicinity of the CSO outfalls.

Pursuant to NYCDEP's SPDES permits, NYCDEP provides signs identifying each CSO outfall. The DEP is currently working with the NYSDEC to improve the CSO outfall signage. Additionally, the DEP has specifically initiated the Owls Head Waterwalk Project which posts informational signs related to CSOs along the Gravesend Bay promenade.

A12. A comment was received regarding a brochure created by members of the community about the importance of the Avenue V Pumping Station because Bensonhurst was flooding in the 1980s and there was flooding around PS 128.

In addition to the improved water quality in Coney Island Creek that will result from expanding the capacity of the Avenue V Pumping Station, localized flooding should be reduced as well.

A13. Get DEP to bring back the retention tank idea.

By increasing the capacity of the Avenue V Pumping Station from 30 million gallons per day (mgd) to 80 mgd and constructing new force mains to convey additional dry and wet weather flows to the Owls Head WPCP, the proposed Coney Island Creek Waterbody/Watershed Facility Plan will reduce annual CSO discharges to Coney Island Creek by 87%. The alternatives analysis conducted as part of the WB/WS planning process indicated that construction of a storage tank to collect the remaining CSO discharged to Coney Island Creek would not significantly improve attainment of existing water quality standards within the Creek and would be prohibitively expensive.

A14. Several comments were received regarding the planned construction of a marine transfer station (MTS) within the direct drainage area. The Department of Sanitation (DSNY) transfer station will become a city-wide transfer station, adding additional pollution to the area. DEP and NYSDEC should prevent DSNY either from building or operating the facility if it will pollute waterways.

The Department of Sanitation Transfer Station will need to comply with all applicable New York City and New York State environmental regulations during construction and operation.

B. QUESTIONS RECEIVED DURING THE PUBLIC COMMENT PERIOD

(Comments B1-B4 received from Bob Alpern via email)

B1. Decisions regarding individual Waterbody/Watershed Facility Plans and Long-Term Control Plans are critically affected by City-wide and Regional policies. City-wide policies include: the PlaNYC Water Quality Section and Sustainable Stormwater Management Plan of the Mayor's Office of Long-Term Planning and Sustainability (OLTPS); demographic, economic and climate projections, including the demographic projections of the NYC Department of City Planning (DPC), the economic projections of the NYC Economic Development Corporation (EDC), and climate projections of the Climate Change Assessment and Action Plan of the NYC Department of Environmental Protection (DEP); and decisions on the level and structure of water and sewer rates by the NYC Water Board (WB) and their implications for City funding of water programs and incentives for rate-payer actions. Regional policies include: the Comprehensive Conservation and

Management Plans for the New York/New Jersey Harbor and Long Island Sound. How do the State and city view the relationship of these city-wide policies and policy documents to the CSO Consent Order, the 18 Waterbody/Watershed Facility Plans, and the City-wide Long Term CSO Control Plan?

Developing and improving ways to capture, detain, reuse, and otherwise mitigate stormwater runoff improves stormwater and wastewater conveyance and treatment capacity by reducing the load to the sewer and collection systems at its source. In addition to the previously mentioned BMP study, DEP is evaluating several stormwater BMPs that are being undertaken with Environmental Benefits Program (EBP) funds in connection with the settlement of an enforcement action taken by New York State and DEC against New York City and DEP for violations of New York State Law and DEC regulations. Additionally, DEP participated in the Mayor's Office BMP Interagency Task Force created as part of PlaNYC 2030. Information from the Task Force was used by the Mayor's Office of Long-Term Planning and Sustainability to create the stormwater management plan required by Intro 630 [Local Law 5 of 2008] and DEP assisted with the development of the final Mayor's Sustainable Stormwater Management Plan. Several DEP pilot projects are in the design phase including constructed wetlands, streetside infiltration swales, enhanced tree pits and green and blue roofs. Once these pilot projects are implemented and performance data are collected, meaningful information related to costs, environmental benefits, and operation and maintenance will be used to update PlaNYC, Sustainable Stormwater Management Plan and DEP's long term CSO control planning efforts.

In addition, the DEP Climate Change Program Assessment and Action Plan (May 2008), addressed planning efforts across the Department to integrate potential risks of climate change and greenhouse gas emissions management in the future in DEP operations and mitigation strategies. The Action Plan is complete and is available on DEP's website at:

http://home2.nyc.gov/html/dep/html/news/climate_change_report_05-08.shtml.

As part of DEP's ongoing climate change planning efforts, DEP will begin a study in 2009 to identify the potential impacts of climate change and sea-level rise on predicted rainfall patterns, sewer capacity, and wastewater treatment capacity. Potential drainage modification and other adaptation strategies derived from this study will be included in DEP's BMP planning efforts along with updated rezoning, growth and population projections.

B2. The review and approval procedures under City Charter Sec. 197-a involve review by the community and borough boards, the City Planning Commission and the City Council. These procedures were followed by NYSDEC regarding city approval of the New York City Sec. 208 plan and by NYSDOS for City approval of the Coastal Management program's NYC Waterfront Revitalization Plan. Will the Charter's Section 197-a procedure be followed for Waterbody/Watershed Facility Plans and Long-Term Control Plans?

The DEP will continue to abide by all applicable laws and regulations during the planning, environmental review, and construction phases of its capital projects. The Waterbody/Watershed Facility Plans and the Long Term Control Plans have a public participation element although they are done pursuant to Orders on Consent and are not governed by the Charter sections mentioned. In addition, NYSDEC provides notification in the Environmental Notice Bulletin for public comments. Because the LTCP and each of the WB/WS plans have such an extensive and lengthy development process, and because the Community Boards and elected officials in each LTCP area are an integral part of the development of these plans (as demonstrated by the input and participation of elected officials' representatives and by members of Community Board #13 in this process), it is not necessary to follow the Section 197-a process, which, in many aspects, is duplicative of the process underway to establish the LTCP. The public is invited to comment on the LTCP many times as it unfolds.

B3. Several comments were received regarding the City's Waterbody/Watershed Facility Plan Public Participation Program. Public participation at more than the Waterbody/Watershed level is needed to provide citywide and regional context for the Waterbody/Watershed Facility Plans. At an earlier stage in the planning process, the Stakeholders Group for Open Waters/East River attempted to also serve as a Citywide CAC for the WWFP and LTCP process with the tacit approval of NYCDEP. Will the City establish a City-wide Stakeholders Committee or recognize the City-wide role of the Open Waters/East River Stakeholders Committee in the review of individual Waterbody/Watershed Facility Plans and the development of Long-Term Control Plans?

Each of the Waterbody/Watershed Facility Plans has its own public participation component which included the formation of a Citizens Advisory Committee (CAC) as a mechanism of providing public comment and input in the development of the related Waterbody/Watershed Facility Plan. In addition, the East River and Open Waters CAC was established to function as the city-wide CAC for the Waterbody/Watershed Facility planning process. Representatives of each individual Waterbody/Watershed CAC were invited to participate in the East River and Open Waters CAC along with other non-governmental organizations, business interests, and concerned citizens at large. Meetings of the East River and Open Waters CAC were held every other month from March 2006 through May 2007. A summary of the recommendations from the East River and Open Waters CAC were presented to the Commissioner of the DEP on July 11, 2007. These recommendations will be taken into account under the individual Waterbody/Watershed Facility Plans and the Long-Term Control Plans as well.

B4. The nation is in the midst of an economic crisis and the New York State and New York City budgets are undergoing major cuts. According to the WWFP for Coney Island Creek, $2.1 billion in infrastructure investment, listed in the 2005 Consent Order, is already part of the City's CSO program and millions more is spent annually on control of CSOs through the nine minimum controls. How will City and State budget cuts affect the WB/WS Plans and the Long-Term Control Plan?

Achieving the LTCP goals and implementing the waterbody/watershed plans will continue to be a priority within the overall budget realities of the city and the state government. It is evident that DEP considers its WB/WS Plans and LTCP important because the funding for capital improvements appears in DEP's one year, three year, and 10 year capital programs.

(Comments B5-B11 received from Natural Resources Protective Association. Note: Responses to some of the NRPA comments are addressed elsewhere as they were repeats of other comments)

B5. The upgrade of the Avenue V Pumping Station and construction of two new force mains will surely improve water quality in Coney Island Creek. We are pleased to see that this long overdue project is finally moving forward. Substantial progress has also been made in pursuing illegal sanitary sewer connections to storm drains, although additional work is still needed.

The DEP's investigation and abatement of illegal sanitary connections to storm sewers in the Coney Island Creek drainage area is an ongoing activity conducted by the DEP Bureau of Wastewater Treatment's Compliance Monitoring Section. DEP is pleased with its progress to date to eliminate illegal connections through assiduous track down and follow up.

B6. The Plan incorporates new connections to a box sewer that was constructed in 1970 with the expectation that it would be needed for future expansion. But the current Plan, while acknowledging projected population increases, does not make provisions for future expansion. While describing the impediments to expanding the Owls Head Water Pollution Control Plant (WPCP), the Plan notes that "Increases in sanitary sewage flows associated with increased populations would use part of the WPCP wet weather capacity, thus reducing the amount of CSO flow that can be treated at the existing WPCP." (page 3-15). Since a portion of the drainage area of the Owls Head WPCP consists of combined sewers, the end result will be more sewage released into receiving waterways during wet weather events as population increases. DEP's proposed solution for this problem is diverting overflow from Coney Island Creek to a larger receiving waterway, Gravesend Bay. This is the ancient "dilution is the solution to pollution" trick and it only creates more problems. If there is no additional land available to expand the WPCP, then the only reasonable solution is to limit population growth by downzoning within the drainage area of the Owls Head WPCP. Merely accepting a slowly declining wet weather capacity does not constitute planning for the future.

Only a portion of the wet weather flow diverted from Coney Island Creek will be discharged at outfalls along Gravesend Bay and Upper New York Bay. The proposed improvements to the Avenue V Pumping Station and the associated force mains will convey an additional 79 million gallons of CSO to the Owls Head WPCP for treatment in *a typical year. As shown in Figure 8-6 of the report, the remaining 163 MG of the 242 MG reduction in Coney Island Creek is projected to result in increased CSO discharges from six outfalls along Gravesend Bay and Upper New York Bay.*

B7. At the November 12, 2008 Public Information Meeting on this plan, participants stated that the Gravesend Bay outfall (mentioned in Comment B6, above) is a very popular fishing spot. Many subsistence anglers routinely fish along the shore in close proximity to this outfall. DEP proposes to deal with the anglers' exposure to sewage and street pollutants by simply posting "No Fishing" signs. We can assure DEP and DEC that these signs will soon be removed, defaced or completely ignored. Therefore, the end result is that more people will be exposed to water borne pathogens and toxins. A similar concern is the hazard to marine life. Cormorants and harbor seals are also attracted to the plentiful fish near the outfall, so more combined sewage directed to this outfall ultimately results in biomagnification of toxins in the food chain.

CSO Outfall OH-015 is the only outfall along Gravesend Bay and under this plan, the annual CSO discharges from this outfall is estimated to increase approximately 1.8% (from 1140 million gallons to 1160 million gallons). This would not materially change the local aquatic environment. In addition, the water quality modeling conducted to assess the effects of these redirected flows indicates that no adverse impacts to existing water quality will result from these diverted flows and that the existing SB water quality standards will be maintained in the immediate vicinity of these outfalls. The New York State Department of Health publishes and posts fish consumption advisories for fish caught in this area of the Harbor. It should be noted that the fish consumption advisories are not specifically related to CSO discharges but are for all waters in New York Harbor. Also see response to Comment A11 regarding informational signage along Gravesend Bay.

B8. The document categorizes Asser Levy Park as "among the largest open spaces in the drainage area", (page 2-6). Yet there are plans to cover most of this area with a large amphitheater. This will reduce open space that currently absorbs storm water. There was no calculation of these impacts on the drainage areas.

The Coney Island Creek Waterbody/Watershed Facility Plan addresses impacts associated with combined sewer overflows to Coney Island Creek. While described in the plan, Asser Levy Park is located along the ocean shoreline of Coney Island and is not in the drainage area of Coney Island Creek. Moreover, the plan for an amphitheater in Asser Levy Park will be vetted by planning and environmental agencies as well as by the community before any final decision is made.

B9. The document notes that "Two separate drainage areas contribute stormwater discharges into Coney Island Creek...two outfalls from ...Owl's Head...and eight outfalls from the Coney Island WPCP drainage area." (page 3-18). The Plan is trying to improve conditions in Coney Island Creek, yet it only addresses the portion contributed by the Owl's Head WPCP. The Coney Island WPCP drainage

area and its eight outfalls also contribute to problems in Coney Island Creek. Exponential development has occurred in the Coney Island WPCP area and several large scale projects will commence in the very near future. There will also be a significant reduction in the amount of available open space to absorb storm water. Therefore, more floatable debris and toxins carried by first flush storm water will enter Coney Island Creek. The Plan needs to address this situation.

The Waterbody/Watershed Facility Plans were specifically focused on the impacts of combined sewer overflows, as they are documents that will be modified into Long Term CSO Control Plans. Note, all but one outfall to the Creek are separate stormwater outfalls. Further, as described above, the DEP is piloting, monitoring and evaluating several stormwater BMPs that are being undertaken as a means of developing and improving ways to capture, detain, reuse, and otherwise mitigate stormwater runoff. In addition, the Mayor's Sustainable Stormwater Management Plan describes strategies to supplement existing stormwater control efforts, develop innovative and cost-effective source controls, and secure funding to capture one billion gallons of stormwater—in both the City's combined sewer and separate storm sewer areas—through BMPs .

B10. We are concerned about other impacts within the direct drainage area. There is a culvert—a long, deep, open ditch running parallel to Bay 44th St., adjacent to Dreier Offerman Park (recently renamed Calvert Vaux Park) that was designed to divert storm water from the Belt Parkway into Gravesend Bay. The city and private sanitation trucks that exit from the proposed MTS will travel down Shore Parkway (the Belt Parkway service road) for several blocks within the direct drainage area. Therefore, any leakage from the trucks will ultimately go right into Gravesend Bay. There has been no discussion about the cumulative impact of leakage from large numbers of sanitation trucks carrying fecal contaminants and unknown toxins within the direct drainage area.

Observed illegal dumping should be reported either by calling 311 or by notifying the NYSDEC. Private and city sanitation vehicles are regulated as to their requirements for keeping waste on board during travel along proscribed routes. In addition to enforcement by NYSDEC and DEP, the DSNY has a Police unit that enforces illegal and unlawful waste dumping and spillage DEC.

B11. Various city agencies also need to do their share to improve water quality. For example, local beaches lack trash cans before Memorial Day and after Labor Day, even though many people are on the beach. The end result is more trash on beaches and more floatable debris. But the NYC Parks Department lacks funding to provide adequate staff for trash pick up within this time period. A plan that incorporates the responsibility of various city agencies in litter control is needed.

Budget difficulties affect all agencies. However, this comment should be directed to the Parks and Recreation Department. Further, there are no public bathing beaches along the shoreline of Coney Island Creek or in its drainage area although access to the waterfront is indeed a priority for the city Administration.

(Comments B12-B21 received from NRDC. Note: Responses to some of the NRDC comments are addressed elsewhere as they were repeats of other comments.)

B12. Several comments were received regarding the incorporation of source control measures within the Waterbody/Watershed Facility Plan. NYSDEC must ensure that the alternatives analysis in the Coney Island Creek LTCP (and all other LTCPs) will quantitatively assess the costs and benefits of source controls with the same degree of rigor applied to other alternatives.

The DEP focused its alternative analysis on technologies that showed promise in attaining the goals of the CSO abatement program in cost-effective, timely, and quantifiable ways. Source controls such as stormwater BMPs and green solutions are promising and their potential benefits may extend beyond stormwater management to include habitat restoration, heat island mitigation, and urban aesthetics. All WB/WS Facility Plans retain stormwater BMPs and other green solutions for further consideration to supplement built controls, and DEP is undertaking a number of BMP pilot projects and evaluations to address various uncertainties associated with BMPs including how BMPs function with New York City-specific climate and site conditions. The findings of these pilots and evaluations will be incorporated into the City's CSO long-term control planning program where specific BMPs are deemed feasible, cost-effective, and environmentally beneficial. Any solution satisfying these criteria would be included when the WB/WS plan is converted into a Drainage Basin Specific LTCP or when the LTCP is updated.

B13. In order to analyze the benefits associated with a given CSO control strategy – and to compare the resulting water quality with water quality under baseline conditions – it is essential to consider not only average conditions but also the frequency, duration, and magnitude of episodic "spikes" in pollution levels associated with discrete CSO events.

The NYSDEC surface water quality standards and classifications were used for evaluation of CSO Control Alternatives. For standards compliance purposes, the calculated fecal coliform and total coliform concentrations were analyzed in a manner consistent with the numerical standard's applicable statistic (mean, geometric mean, monthly maximum, etc.). These statistics were established by USEPA based on epidemiological studies that use these statistical measures to account for health impacts of variable pathogen concentrations in natural surface waters. In addition, federal CSO policy expects the evaluation of alternatives to be performed using "average" conditions. Because focusing on the spikes does not indicate compliance with standards it is not appropriate for the planning-level analyses contained in the WB/WS Facility Plan. Though extreme conditions are not explicitly relevant to these standards, frequency, duration and magnitude are accounted for indirectly in the statistical measures. These results are presented graphically in Sections 7 and 8 of the WB/WS Facility Plan.

The NYSDEC dissolved oxygen standard is expressed as a "never-less-than" single value so that any one location not meeting that value during any hour of the year represents a *contravention of the water-quality standard.[In January 2008, NYSDEC adopted acute and chronic dissolved oxygen standards based on a November 2000 USEPA publication in which exposure to low dissolved oxygen over time was used to establish protection limits for different life stages, rather than a single absolute value. For SA, SB, and SC waters, the standard states that "[t]he DO may fall below 4.8 mg/L for a limited number of days" but "shall not fall below the acute standard of 3.0 mg/L at any time." The allowable duration of time between 4.8 and 3.0 mg/L depends on the duration and intensity of the low DO condition. This standard is not applicable in Coney Island Creek which is classified as an "I" waterbody where only the "never-less-than" standard is used].*

B14. The final paragraph of Section 3.3.3 (page 3-17) discusses modeling discrepancies related to potential dry weather overflows in the Hutchinson River or Westchester Creek. A discussion of the relevant issues applicable to Coney Island Creek should be substituted here.

The text in Section 3.3.3 of the Coney Island Creek Waterbody/Watershed Facility Plan will be revised accordingly.

B15. All of the WWFPs should include deadlines for the City to complete modeling, pilot projects, and any other analyses necessary to identify the optimal set of source control measures – and a corresponding implementation plan for those measures – to be included in the LTCPs.

All WB/WS Facility Plans retain stormwater BMPs and other green solutions for further consideration to supplement built controls, and DEP is undertaking a number of BMP pilot projects and evaluations to address various uncertainties associated with BMPs including how BMPs function with New York City-specific climate and site conditions. The contract is anticipated to begin in 2009 and the term of the contract will be three years. The findings of these pilots and evaluations will be incorporated into the City's CSO long-term control planning program where specific BMPs are deemed feasible, cost-effective, and environmentally beneficial. Any solution satisfying these criteria would be included when the WB/WS plan is converted into a Drainage Basin Specific LTCP or when the LTCP is updated

B16. The final WWFP should present a modeled projection of CSO volumes (and frequency) under current baseline conditions, and not only 2045 baseline conditions, so the reader can make a meaningful comparison of net improvements over time between today and 2045, if the proposed plan – or any other alternatives – were implemented.

CSO discharge flows and frequencies from Outfall OH-021 under baseline conditions were determined using the 1988 JFK average design rainfall year and are presented in Table 3-5 (page 3-18). In addition, the description of each modeled alternative in Section 7 of the report provides the reader with the reduction in the number of annual CSO events and percent reduction in annual CSO volume over baseline conditions. The *baseline condition is reflective of a future "no-build" scenario against which each alternative may be compared.*

B17. The WWFP appears to present "CSO volumes" as the total flow discharging through the outfall, without differentiating between the amount coming from the combined sewer system and the amount coming from separate stormwater sewers. Therefore, it is not possible to conduct any meaningful analysis of the benefits (and cost-effectiveness) of the proposed plan (or of other alternatives) in terms of reduced overflow from the combined sewer system.

The CSO volumes presented in the Waterbody/Watershed Facility Plan represent the overflow of sanitary and combined sewage from Regulator AV-1 at the Avenue V Pumping Station which does not include any stormwater flow. Please refer to the description of the combined sewer collection system on page 3-8, Figure 3-5 which illustrates the components of the Avenue V Pumping Station, and Table 3-5 which presents the CSO discharge flows from Regulator AV-1 under existing conditions and baseline conditions. Please also refer to Table 3-6 on page 3-19, which provides a summary of the stormwater flow through outfall OH-021. As noted in this table, the stormwater flow was included in all analyses of Coney Island Creek.

B18. According to Figure 8-6, approximately two-thirds of the reduction in CSO discharge to Coney Island Creek (163 MG of 243 MG) is attributable to redirecting CSO discharges to other waterbodies. There are a number of other public access points in the vicinity of the outfalls where the 163 MG of CSO discharge will be redirected, at least as close or closer to those outfalls than South Beach. Effects on recreational activities at these public access points must be considered as well.

The water quality modeling conducted to assess the effects of these redirected flows indicate that no adverse impacts to existing water quality will result from these diverted flows and that the existing SB water quality standards will be maintained in the immediate vicinity of these outfalls. As previously stated, the New York State Department of Health publishes and posts fish consumption advisories for fish caught in this area of the Harbor. Please see response to Comment A11 regarding informational signage in the location of these outfalls.

B19. The WWFP concludes that water quality standards violations will remain after implementation of the proposed CSO control measures, primarily due to pollutant loadings from discharges via separate storm sewers. NYSDEC should enforce existing provisions in the City's SPDES permits that cover Municipal Separate Storm Sewers ("MS4") discharges, or amend those permit provisions as needed, to ensure compliance with these requirements. Additionally, NYSDEC should reclassify Coney Island Creek on the state's Section 303(d) List of Impaired Waters Requiring a TMDL from Part 3(c) "Waterbody Segments Being Addressed Through Other Restoration Measures" to Part 1 "Individual Waterbody Segments with Impairments Requiring TMDL Development." NYSDEC's rationale for listing Coney Island Creek in Part 3(c) was that water quality impairments "are being

addressed by a 2005 Order on Consent with NYC directing the city to develop and implement watershed and facility plans to address CSO discharges and bring New York City waters into compliance with the Clean Water Act." This rationale no longer appears to be valid.

The NYCDEP is currently in compliance with all MS4 provisions of its SPDES permits. DEP has an ongoing program of tracking down and eliminating illegal connections to the storm sewers, as has been shown in the WWFP. The requirements for the TMDL have been addressed by this WWFP. The Long Term Control Plan, when developed, will address Coney Island Creek's ability to meet the Clean Water Act.

In addition, through use of the Environmental Benefit Project Fund in connection with the settlement of an enforcement action taken by New York State and DEC against New York City and DEP for violations of New York State Law and DEC regulations associated with the Long Island Sound Consent Judgment, the DEP has recently conducted clean-ups of Coney Island Creek.

B20. DEP lacks the authority and budgetary control to fully address the CSO problem alone because it shares jurisdiction over above-ground stormwater management with numerous other agencies. City-wide source control and related land use measures must be a critical feature of the LTCP in addition to measures constructed within the sewer system. Thus the operation plan must include a City-wide operation and maintenance program to be implemented by all affected and responsible City departments. DEC should require the City to amend the WWFP to address this issue.

The City now has a final Stormwater Management Plan that was developed with input from the many City agencies involved in dealing with stormwater. Please refer to the answer to question B1 above. The Long Term Control Plan will include advancements of the City's Stormwater Management Plan, including results of the BMP pilot studies currently being conducted and how those results can be applied to various drainage basins within the City.

B21. The WWFP should provide that the City will implement a policy that City-owned and City-financed construction projects shall be designed and constructed according to standards that minimize the post-construction discharge of stormwater into sewers and waterbodies through the retention, detention, infiltration, reuse, and treatment of stormwater.

Specific to this WWFP, there are no substantive changes being made to the property on which the Avenue V Pump Station resides. The project is neither increasing nor decreasing the amount of stormwater flow leaving that site. Further, the DEP is currently conducting pilot studies to test the feasibility of several stormwater management technologies such as pervious pavements, rain barrels, green roofs, and blue roofs. City owned and financed infrastructure projects are constructed in *accordance with all current and applicable Building Code requirements for stormwater management, including Local Law 86 of the Laws of 2008 which requires capital projects to comply with green building standards. Also see response to Comment B1.*

Comments Received from the Following:

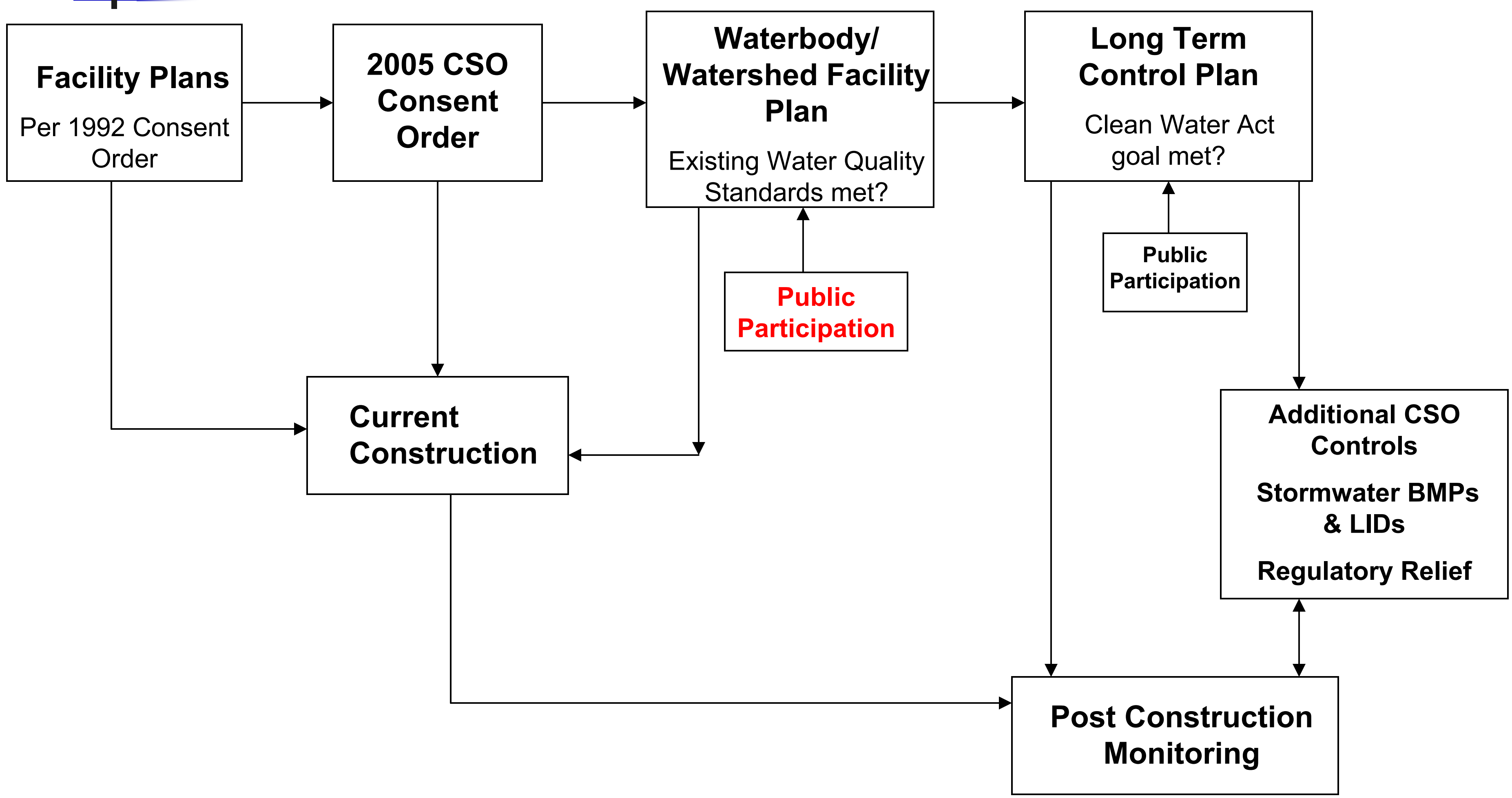
Letter from Lawrence M. Levine, Staff Attorney, Natural Resources Defense Council, dated December 11, 2008

Letter from Ida Sanoff, Chair, Natural Resources Protective Association of Staten Island Inc. dated December 1, 2008

Email from Bob Alpern dated November 18, 2008

Comments during the November 12, 2008 Public Meeting made by Bob Alpern, Eddie Martin, Adeline Michaels, Charles Michaels, Lou Powsner, Gene Ritter, Ida Sanoff.

Combined Sewer Overflow (CSO) Long Term Control Plan Process



Waterbody/Watershed Facility Plan (WWFP) Current Document Review

- Identify and Evaluate
  - Cost effective CSO controls to meet or exceed current Water Quality Standards (WQS)
  - 100% CSO abatement
  - The highest reasonably attainable uses of the water body
  - Acts as a foundation for future long term control planning

- Public Participation
  - Draft Coney Island Creek WWFP provided to the public after DEC's initial review
  - Public information meeting held by DEC/DEP – 11/12/08
  - 30 day public comment period closes 12/11/08 with published responsiveness summary to follow

Long Term Control Plan(LTCP)

- Evaluation of anticipated Water Quality (WQ) post-WWFP implementation vs. Clean Water Act (CWA) Goals = The "Gap"
- Identification of cost-effective alternatives and feasibility analysis of additional CSO abatement to meet CWA Goals
- Inclusion of Stormwater Best Management Practices (BMPs) and Low Impact Developments (LIDs)
- Looking for:
  - Incremental WQ improvements over time (20-30 years)
  - Ways to bridge the "Gap"
    - 9 Minimum Controls
    - Source Control – Stormwater BMPs & LIDs
    - Additional cost-effective CSO reduction
    - Variance – allows operation to verify effectiveness through post construction monitoring
    - Use Attainability Analysis (UAA)

Long Term Control Plan

- Coney Island Creek LTCP due 6 months after DEC approval of WWFP – anticipated Fall 2009

- Public Participation
  - Draft Coney Island Creek LTCP provided to the public after DEC's initial review
  - Public information meeting will be held by DEC/DEP
  - 30 day public comment period with responsiveness summary

- City-Wide LTCP – compilation of all 12 LTCPs – due 12/31/2017

Post Construction Monitoring

- Post Construction Monitoring data to be used in re-evaluation of the LTCP every 5 years upon State Pollution Discharge Elimination System (SPDES) permit renewal
  - May identify additional CSO controls
  - Evaluation and implementation of BMPs & LIDs as appropriate
  - LTCPs are "living documents"

Coney Island Creek WWFP

- DEC and EPA support core components
- Implementation will be a major step in incremental WQ improvement:
  - Coney Island Creek = Class I Standards
    - Improved Dissolved Oxygen attainment from 82 to 86%; Fecal Coliform from 58 to 75%; and Total Coliform from 75 to 92% at Head of Creek
    - Remaining non-compliance mainly due to stormwater
- DEC expects additional incremental improvements through the LTCP process

Contact Information

- Please send questions and comments by December 11, 2008 to:

Sue McCormick, P.E.
New York State Dept. of Environmental Conservation
625 Broadway
Albany, NY 12233-3506
sdmccorm@gw.dec.state.ny.us
Fax: 518-402-9029
Phone: 518-402-8199

Long-Term CSO Control Planning

Coney Island Creek

Waterbody/Watershed Facility Plan

November 12, 2008

Waterbody Introduction

- Urban Tributary to Gravesend Bay
  - Bulkheaded, Channelized
  - 1 CSO Outfall
  - 9 Storm Sewer Outfalls
  - No Natural Freshwater Flow
- Owls Head WPCP Collection System
- 303(d) List Pollutants of Concern:
  - DO/Pathogens

- Class I Waterbody
  - Total Coliform: <10,000/100ml
  - Fecal Coliform: <2,000/100ml
  - Dissolved O_2: Never <4.0

Waterbody Uses

- 2 Water Dependent Users
  - Quaddrozi Cement/Small Marina
- Fishing Observed at Mouth
- No Designated Swimming Areas
- Jet Skiing in Gravesend Bay
- Parks – Drier Offerman Park
  - C. I. Creek Park
  - Kaiser Park

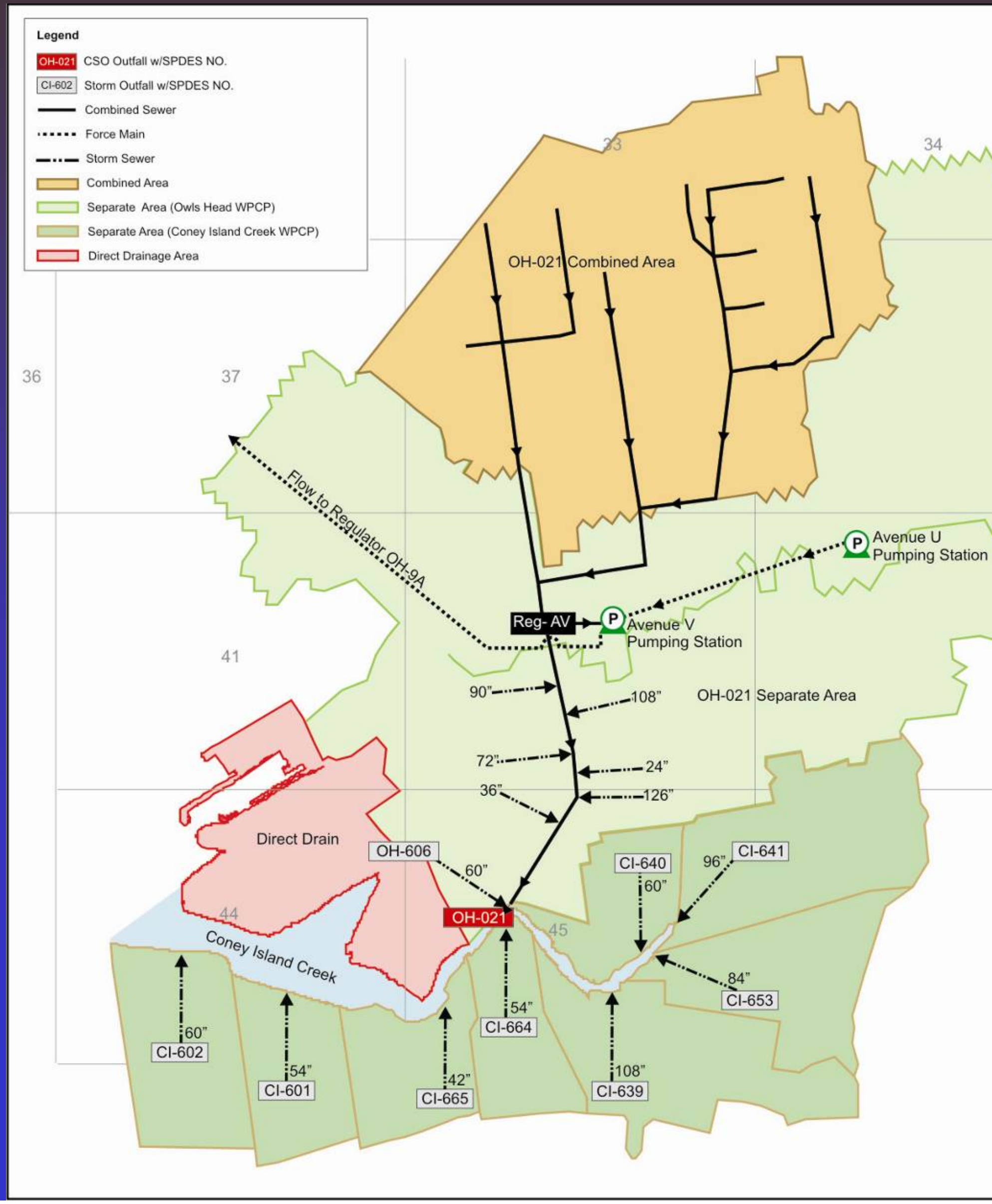
NYSDEC ROD – Former Brooklyn Borough Gas Works Site

- Manufactured Gas Plant at Head of Creek Beginning in 1908
- Release of MGP By-Products (e.g. coal tar) has Contaminated Soil, Groundwater and Creek
- NYSDEC ROD Summary
  - Excavate/Cap Landside Contaminated Areas
  - Remove Top 3’ of Contaminated Sediment from Creek, Cap with Clean Material
  - Restore 50’ of Creek Bank
  - Long-Term Monitoring
- Dredging completed
- Landside remediation scheduled to be completed in 2009

Coney Island Creek Drainage Area

Source Category	Drainage Area (acres)	Percent of Watershed
CSO	763	24.5
Stormwater	2,178	69.8
Direct Runoff	179	5.7
Total Watershed	3,120	100

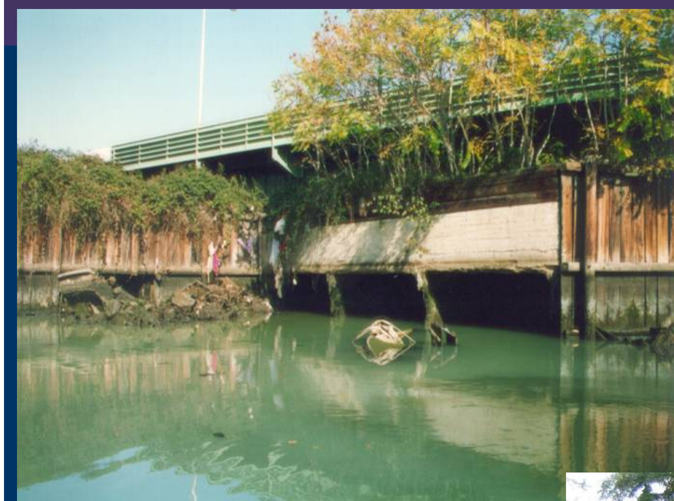
Coney Island Creek Collection System



Coney Island Creek Drainage Area		
Outfall	Source	Drainage Area (acres)
OH-021	**CSO**	**763**
OH-021	Stormwater	1310
CI-601	Stormwater	79
CI-602	Stormwater	108
CI-639	Stormwater	141
CI-640	Stormwater	66
CI-641	Stormwater	154
CI-653	Stormwater	113
CI-664	Stormwater	71
CI-665	Stormwater	76
OH-606	Stormwater	60
Direct Drain	Stormwater	179
		3,120

Coney Island Creek WB/WS Facility Plan

2008 WB/WS Facility Plan
1. Continued implementation of programmatic controls.
2. Upgrade Avenue V Pumping Station from 30 MGD to 80 MGD.
3. Construct 42" DW and 48" WW force mains to convey wet weather additional flows away from Coney Island Creek.
4. Periodic floatables skimming.



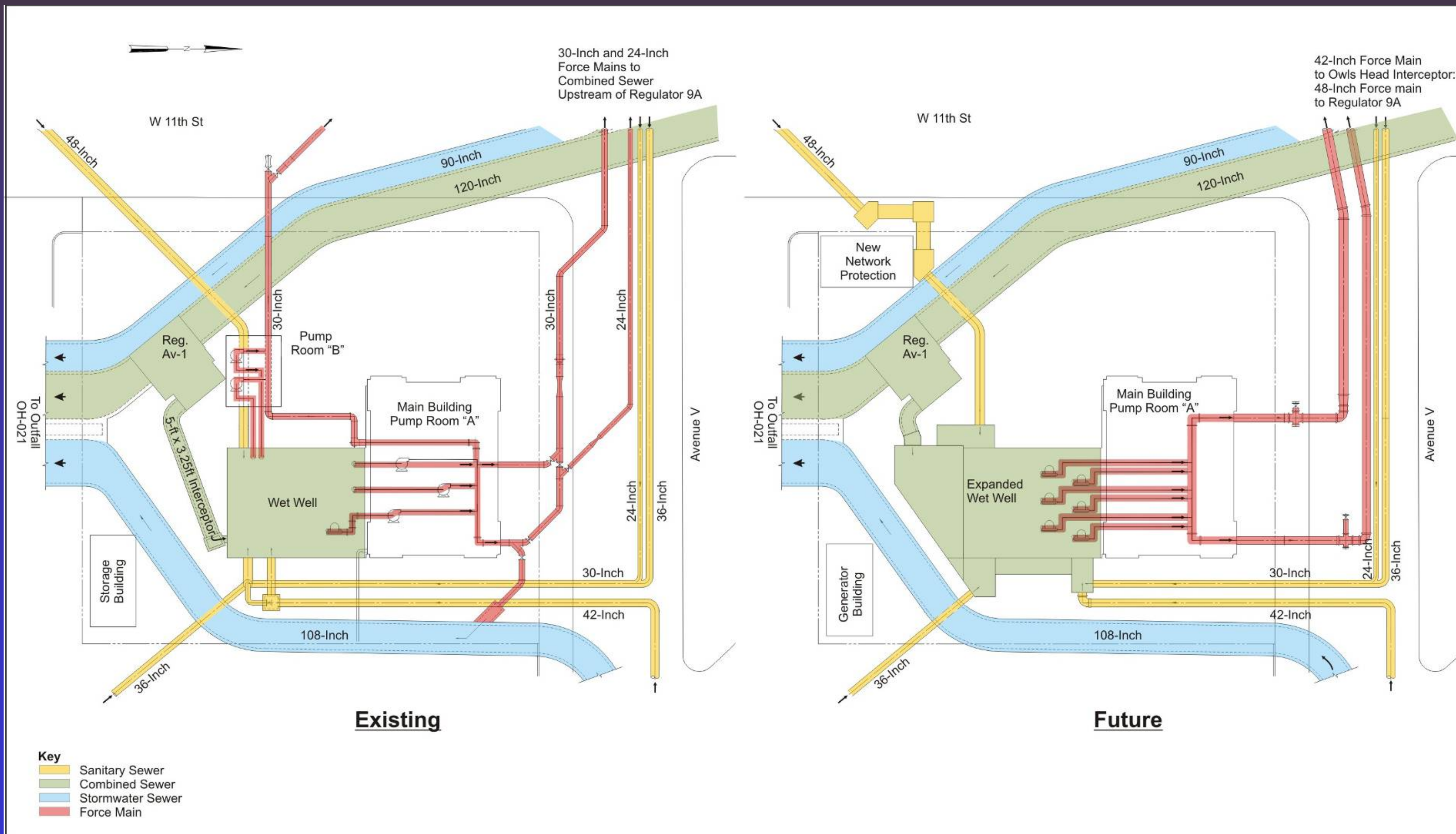
Programmatic Controls

- 14 BMPs for CSO Control
- Sustainable Stormwater Management
- City-wide Comprehensive CSO Floatables Plan
- Continue to Monitor and Abate, as necessary, Illegal Sanitary Connections to Storm Sewers

Avenue V Pumping Station Upgrade

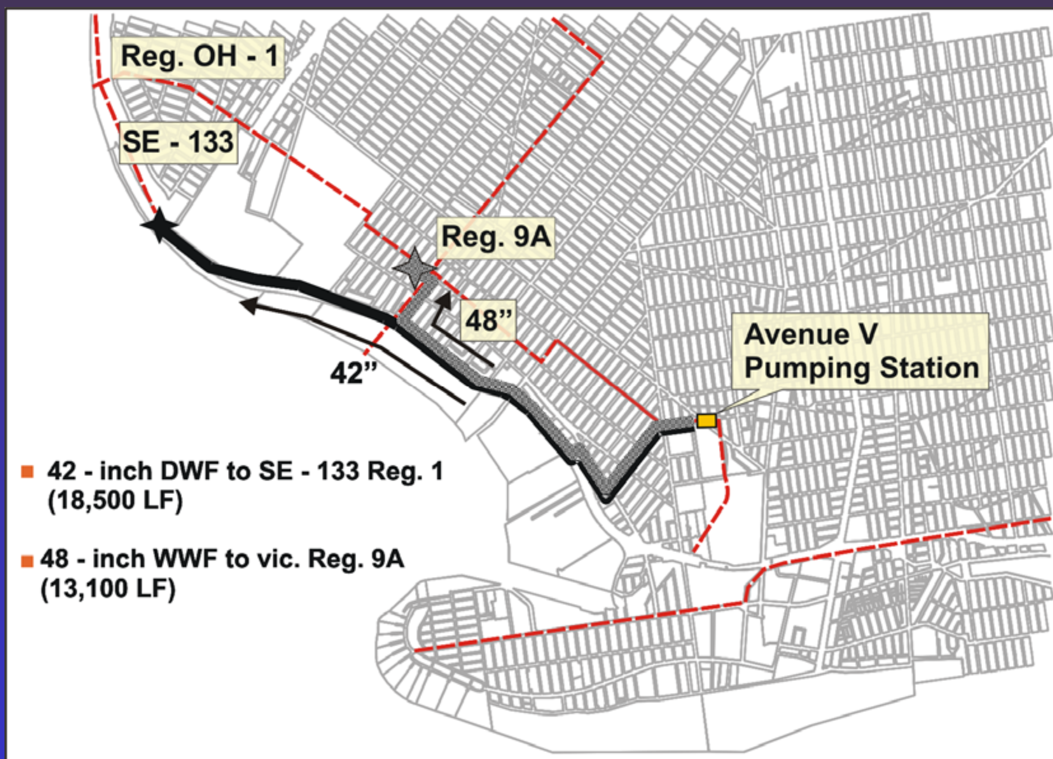
- Comprehensive upgrade to improve station reliability
- Increase station capacity from 30 mgd to 80 mgd
- Wet Well improvements to reduce sewer surcharges
- Architectural restoration of Beaux-Arts façade (originally built in 1913)
- $68,200,000
- 40% Complete

Avenue V Pumping Station Upgrade



Avenue V Pumping Station Upgrade

Avenue V Pumping Station Force Mains



- Install new and larger force mains to carry storm and wastewater flows
- 42 inch force main to convey dry weather flow
- 48 inch force main to convey wet weather flow
- $97,756,000
- 30% complete

Avenue V Pumping Station Force Mains

Results of WB/WS Facility Plan

- Reduce number of annual CSO events in Coney Island Creek from 54 to 15
- Achieve an 87% reduction in CSO volume entering Coney Island Creek
- Floatables discharges to Coney Island Creek greatly reduced
- Improvement in Water Quality (DO, Coliform)

Results of WB/WS Facility Plan

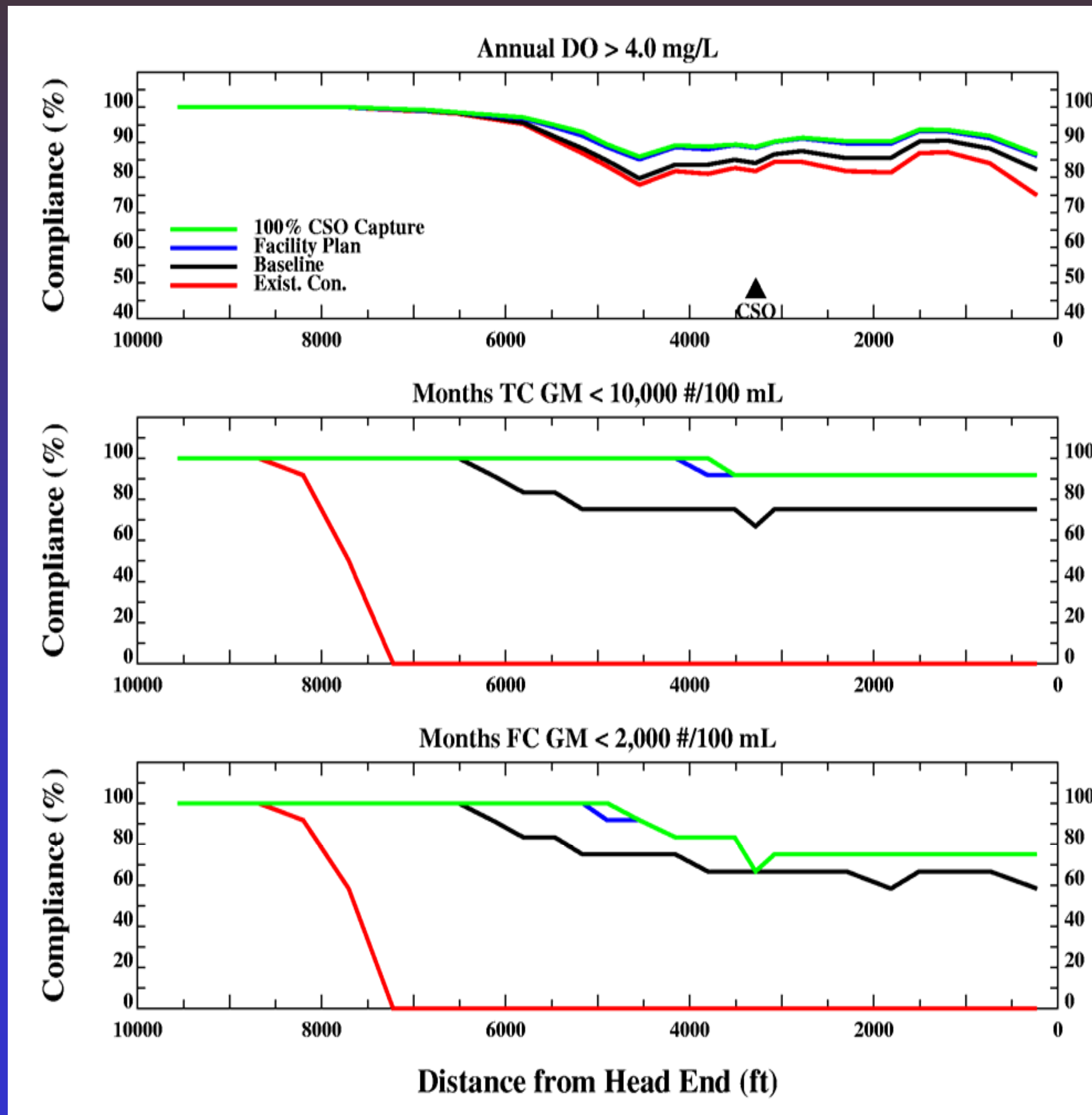
Outfall	Regulator(s)	Annual CSO Volume, MG: Baseline	WS/WB Facility Plan	Increase (Decrease)
OH-003	7, 7A, B,C	395	401	6
OH-002	6, 6A, B, C	411	418	7
OH-020	5	1	1	0
OH-019	8, 8A, 8B, 4	42	46	4
OH-018	2,3	160	181	21
OH-017	1	235	339	104
OH-015	9A, B, C	1,140	1,160	20
OH-021	10, 11	293	37	(256)
	Totals:	2, 677	2, 583	(94)

- Some CSO flow diverted from Creek discharged to Gravesend Bay and Upper NY Bay
- Gravesend Bay and Upper NY Bay are larger waterbodies with greater assimilative capacity
- South Beach, Staten Island is closest sensitive receptor
- WQ modeling shows no adverse impact on attainment of WQ standards

Alternatives & WQ Projections Evaluated

- Existing Conditions with former Sanitary Connections to Storm Sewers
- Baseline without Sanitary Connections to Storm Sewers
- WB/WS Facility Plan
- 100% CSO Capture (CSO Storage Tank)
- Flushing Tunnel
- WB/WS Facility Plan with In-Stream Aeration
- WB/WS Facility Plan + CSO Disinfection

Water Quality Projections – Class I
Facility Plan vs. 100% CSO Capture



Attainment of Water Quality Standards – Dissolved Oxygen

Annual Attainment Design Year

Location	Class I (>4.0 mg/L) Percent Attainment	
	Baseline	WB/WS FP
Head End	82%	86%
Mid-Creek	80%	85%
Mouth	100%	100%

Attainment of Water Quality Standards – Total Coliform

Annual Attainment

Location	Class I GM < 10,000 Percent Attainment	
	Baseline	WB/WS FP
Head End	75%	92%
Mid-Creek	75%	100%
Mouth	100%	100%

Recreation Season Attainment

Location	Class I GM < 10,000 Percent Attainment	
	Baseline	WB/WS FP
Head End	100%	100%
Mid-Creek	100%	100%
Mouth	100%	100%

Attainment of Water Quality Standards – Fecal Coliform

Annual Attainment

Location	Class I GM < 2,000 Percent Attainment	
	Baseline	WB/WS FP
Head End	58%	75%
Mid-Creek	75%	92%
Mouth	100%	100%

Recreation Season Attainment

Location	Class I GM < 2,000 Percent Attainment	
	Baseline	WB/WS FP
Head End	100%	100%
Mid-Creek	100%	100%
Mouth	100%	100%

Coney Island Creek WB/WS Plan Schedule

Component	Start	Completion
Avenue V PS Upgrade	2005	2011
Force Mains	2007	2012
Floatables Skimming	Ongoing	
Programmatic Controls	Ongoing	
Post-construction Monitoring	2011	2020

Next Steps

- Continue implementation of Coney Island Creek WB/WS Facility Plan
- Continue evaluation and implementation of stormwater BMPs
- Prepare Coney Island Creek LTCP report for NYSDEC and submit 6 months after approval of WB/WS Facility Plan
- Implement post-construction monitoring
- Combine individual LTCPs into a Comprehensive NYC LTCP

APPENDIX C

NYCDEP COMPLIANCE MONITORING SECTION

STATUS OF TRACK DOWN AND ABATEMENT

OF ILLEGAL SANITARY CONNECTIONS TO STORM SEWERS

WITHIN THE CONEY ISLAND CREEK DRAINAGE AREA

Coney Island Creek Investigation

NO	Name	Address	Date Opened	Date Closed
	CI-601			
1	Oriental Palace	3002 Mermaid Ave., Brooklyn, NY 11224	10/24/2002	12/6/2002
2	Bargain Variety World Inc	3002 Mermaid Ave., Brooklyn, NY 11224	10/29/2002	12/6/2002
3	Seaberry Gardens Homeowners	2801 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
4	Seaberry Gardens Homeowners	2803 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
5	Seaberry Gardens Homeowners	2805 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
6	Seaberry Gardens Homeowners	2807 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
7	Seaberry Gardens Homeowners	2809 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
8	Seaberry Gardens Homeowners	2811 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
9	Seaberry Gardens Homeowners	2813 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
10	Seaberry Gardens Homeowners	2815 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
11	Seaberry Gardens Homeowners	2817 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
12	Seaberry Gardens Homeowners	2819 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
13	Seaberry Gardens Homeowners	2821 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
14	Seaberry Gardens Homeowners	2823 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
15	Seaberry Gardens Homeowners	2825 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
16	Seaberry Gardens Homeowners	2829 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
17	Seaberry Gardens Homeowners	2831 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
18	Seaberry Gardens Homeowners	2833 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
19	Seaberry Gardens Homeowners	2835 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
20	Seaberry Gardens Homeowners	2837 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
21	Seaberry Gardens Homeowners	2839 W. 28th Street Brooklyn, NY 11224	8/23/2005	12/27/06
22	Coney Island Beauty Salon	2805 Mermaid Ave., Brooklyn, NY 11224	5/12/2006	8/8/2006
23	Bargain Land	2811 Mermaid Ave., Brooklyn, NY 11224	5/12/2006	8/22/2006
24	Maria's Cuchifrito Restarant	2803 Mermaid Ave., Brooklyn, NY 11224	5/17/2006	7/24/2006
	CI-602			
1	Chy Gear New York	3020 Mermaid Ave., Brooklyn, NY 11224	10/29/2002	12/6/2002
2	Island Dental Group	3023 Mermaid Ave., Brooklyn, NY 11224	10/29/2002	12/6/2002
3	S.Y Beauty One	3024 Mermaid Ave., Brooklyn, NY 11224	10/29/2002	12/6/2002

Coney Island Creek Investigation

NO	Name	Address	Date Opened	Date Closed
4	Gala Apple & Fruit Farm	3026 Mermaid Ave., Brooklyn, NY 11224	10/29/2002	12/6/2002
5	Stop 1 Mack III Deli Grocery	3030 Mermaid Ave., Brooklyn, NY 11224	10/29/2002	12/6/2002
	CI-664			
1	2691 Associates	2691 West 15th Street, Brooklyn	2/4/2005	2/17/2005
2	Direct Discharge	1427 Hart Place, Brooklyn	2/4/2005	Refered to NYSDEC
3	Direct Discharge	1425 Hart Place, Brooklyn	2/4/2005	Refered to NYSDEC
4	Javed Iqbal	2827 West 15th Street, Brooklyn, NY 11224	8/24/2005	12/7/2005
5	Nancy Torruellas	2828 West 15th Street, Brooklyn, NY 11224	8/22/2005	12/6/2005
6	Elaina Mei	2830 West 15th Street, Brooklyn, NY 11224	8/3/2005	12/6/2005
7	Eyal Amram	2839 West 15th Street, Brooklyn, NY 11224	8/4/2005	1/9/2006
	CI-665			
1	Seabeach Homeowners Association	2859 W. 21st Street, Brooklyn, NY 11224	8/19/2005	10/19/2005
2	Seabeach Homeowners Association	2861 W. 21st Street, Brooklyn, NY 11224	8/19/2005	10/19/2005
3	Seabeach Homeowners Association	2863 W. 21st Street, Brooklyn, NY 11224	8/19/2005	10/19/2005
4	Seabeach Homeowners Association	2865 W. 21st Street, Brooklyn, NY 11224	8/19/2005	10/19/2005
5	Seabeach Homeowners Association	2867 W. 21st Street, Brooklyn, NY 11224	8/19/2005	10/19/2005
6	Seabeach Homeowners Association	2869 W. 21st Street, Brooklyn, NY 11224	8/19/2005	10/19/2005
7	Seabeach Homeowners Association	2871 W. 21st Street, Brooklyn, NY 11224	8/19/2005	10/19/2005
8	Gui Yunlu Cheung	2201 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
9	Yee Yuk Lee	2203 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
10	HPD	2205 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
11	Wen Da Chen	2207 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
12	HPD	2209 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
13	Aracelis Vias	2211 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
14	Han Cai Ye	2213 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
15	Wing Lan Moy	2217 Mermaid Ave., Brooklyn, NY 11224	10/12/2005	10/19/2005
16	Hong Jie Wu	2219 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
17	HPD	2221 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
18	HPD	2223 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005

Coney Island Creek Investigation

NO	Name	Address	Date Opened	Date Closed
19	HPD	2225 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
20	Detroy Metayer	2227 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
21	Tiak Eng Chew	2229 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005
22	Margret Chutman	2231 Mermaid Ave., Brooklyn, NY 11224	10/11/2005	10/19/2005

Dry Weather Flow Abatement Update as of August 8, 2008:

CI-664 – West 15th Street & Coney Island Creek

The status of one of the two houses in Hart Place, Brooklyn, that were directly discharging into the creek due to the lack of sanitary sewer fronting the property, have been changed. By mid year, the house located at 1425 Hart place, Brooklyn, NY 11224 had evidently been demolished. The other house located at 1427 Hart place, Brooklyn, NY 11224, is still discharging sanitary waste directly into the creek. The case was referred to NYS DEC in 2006. The investigation has entered phase - II and is ongoing.

CI-655, Shell Bank Creek & Avenue Y

In response to a complaint by the NYSDEC of dry weather discharge at the outfall CI-655, NYCDEP personnel performed a preliminary investigation. During the inspection, neither sanitary discharge nor discoloration of the water was observed. Upon the request of the NYSDEC, the NYCDEP called-off further investigation.

APPENDIX D

AVENUE V PUMPING STATION UPGRADE

AND

NEW FORCE MAIN INSTALLATION

DETAILED PROJECT DESCRIPTION

New York State
Department of Environmental Conservation

Application Form NY-2C for Industrial Facilities

State Pollutant Discharge Elimination System (SPDES) for Avenue V Pumping Station Sewer Force Main Upgrade

Attachment No. 1

Project Description

Introduction

The New York City Department of Environmental Protection (NYCDEP) proposes to upgrade and rehabilitate the Avenue V Pumping Station to meet combined sewer overflow (CSO) abatement requirements and pumping station capacity and flow conveyance requirements established by the New York State Department of Environmental Conservation (NYSDEC), and to comply with the U.S. Environmental Protection Agency's (EPA) Final CSO Policy.

NYCDEP would increase wet weather flow capacity at the pumping station from approximately 30 million gallons per day (mgd) to 80 mgd. The Avenue V Pumping Station is located at 76 Avenue V at the corner of West 11th Street and Avenue V in the Bensonhurst section of Brooklyn, N.Y. (see Figure 1). The pumping station serves the southeastern portion of the Owls Head Water Pollution Control Plant (WPCP) service area, and has a service area of approximately 2,900 acres of primarily residential development with some commercial activity along the main thoroughfares (see Figure 2).

Proposed Project

As part of the project, NYCDEP would construct two new force mains. The two existing force mains would be capped, filled with slurry, and abandoned in place. One of the new force mains would connect to an existing sewer line known as SE-133 Section 1, which is an existing, but unused box sewer. The unused sewer was constructed in the early 1970's as part of the planning of future sewage connections; the proposed project fulfills such long term planning. The existing, unused sewer would be relined for corrosion control, and the bulkhead which blocks it off would be removed. This new force main would be used during dry weather to convey sanitary sewage to the Owls Head WPCP. The other force main would connect to the existing Regulator 9A (at 17th and Bath Avenues). During dry weather conditions, flow from Regulator 9A goes to Regulator 1, and then to the Owls Head WPCP. During wet weather, Regulator 9A overflows to NYCDEP Outfall OH-015 at 17th Avenue and the Shore Parkway. During rain events that result in flows greater than 35 mgd at the Avenue V Pumping Station, both force mains would be used to convey CSO flow. There would be no increase in dry or wet weather flows to the Owls Head WPCP from the proposed project. The locations and routes of the force mains are shown on Figure 1.

Proposed Plan

Pumping Station

The proposed Avenue V Pumping Station rehabilitation and upgrade would involve equipping the station to accommodate up to 80 mgd. The peak wet weather capacity of the pumping station would satisfy the EPA's Final CSO Policy using the presumptive approach for 85 percent capture of the expected maximum flow, including dry weather flow. Overflow to Coney Island Creek would only occur during large storms. Average sized storms would be completely re-conveyed and would not discharge into Coney Island Creek. The entire station upgrade would take place over an estimated 54-month period.

Force Mains

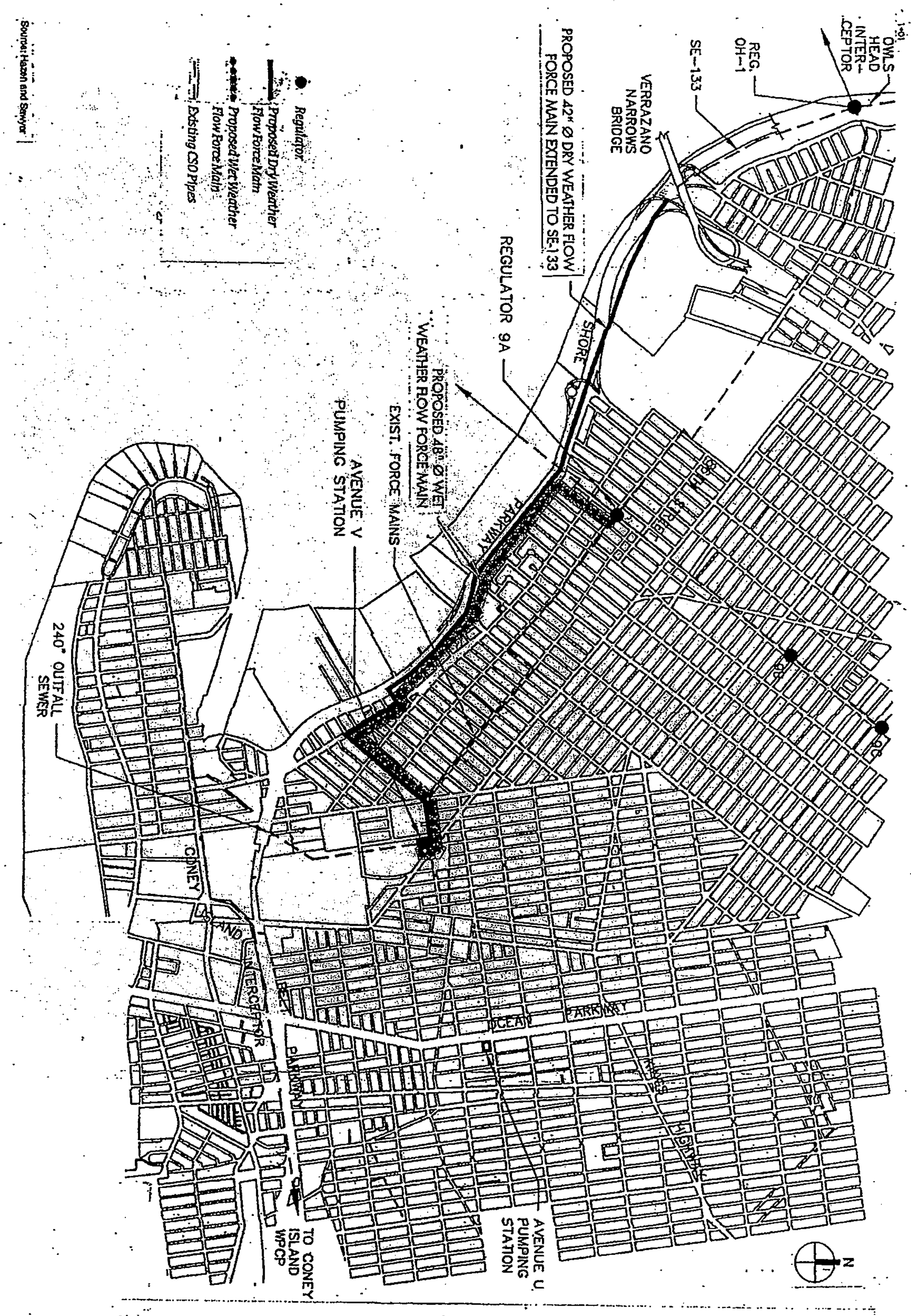
Two parallel force mains are proposed: a 42-inch diameter pipe to carry up to 35 mgd of dry weather sanitary sewage and a 48-inch diameter pipe to convey up to 45 mgd of combined wet weather sanitary and storm water sewage. The proposed routes are shown on Figure 1. The dry weather force main would be routed to convey discharge from the Avenue V Pumping Station to the existing SE-133 Section 1, a box sewer constructed in the early 1970's but never used (see Figure 1). The wet weather force main would follow the same routing as the dry weather force main up to Bay 16th Street. At Bay 16th Street, the proposed wet weather force main would turn northeast and terminate at Regulator 9A. The discharge route from Regulator 9A is under 17th Avenue (see Figure 1). Therefore, during wet weather, the re-conveyed CSO flows would no longer discharge into the constricted waters of Coney Island Creek, but would be rerouted to the Verrazano Narrows and Gravesend Bay, which have stronger tidal currents and better circulation. However, CSOs in excess of 80 mgd would discharge to Coney Island Creek.

The proposed force main routes would be constructed below grade within the bed of existing city streets and along the grassy shoulder of Shore Parkway. The force main trench would be designed with a minimum 4-foot cover and an overall average depth of 9 feet. Manholes for maintenance would be located about every 300 linear feet.

Along portions of the proposed force main routes, the force mains would be installed by microtunneling. Microtunneling involves digging 10- foot by 20- foot pits for one pipe and 20-foot by 20-foot pits for two pipes about every 750 feet and at bends in the pipeline route. A tunnel just large enough to fit the force main(s) would be bored and the pipes inserted. About 1,800 linear feet of single force main would be installed, and about 5,400 linear feet of dual force main would be installed via microtunneling. Microtunneling, while more expensive, minimizes disruptions to traffic, the community and exposed soils.

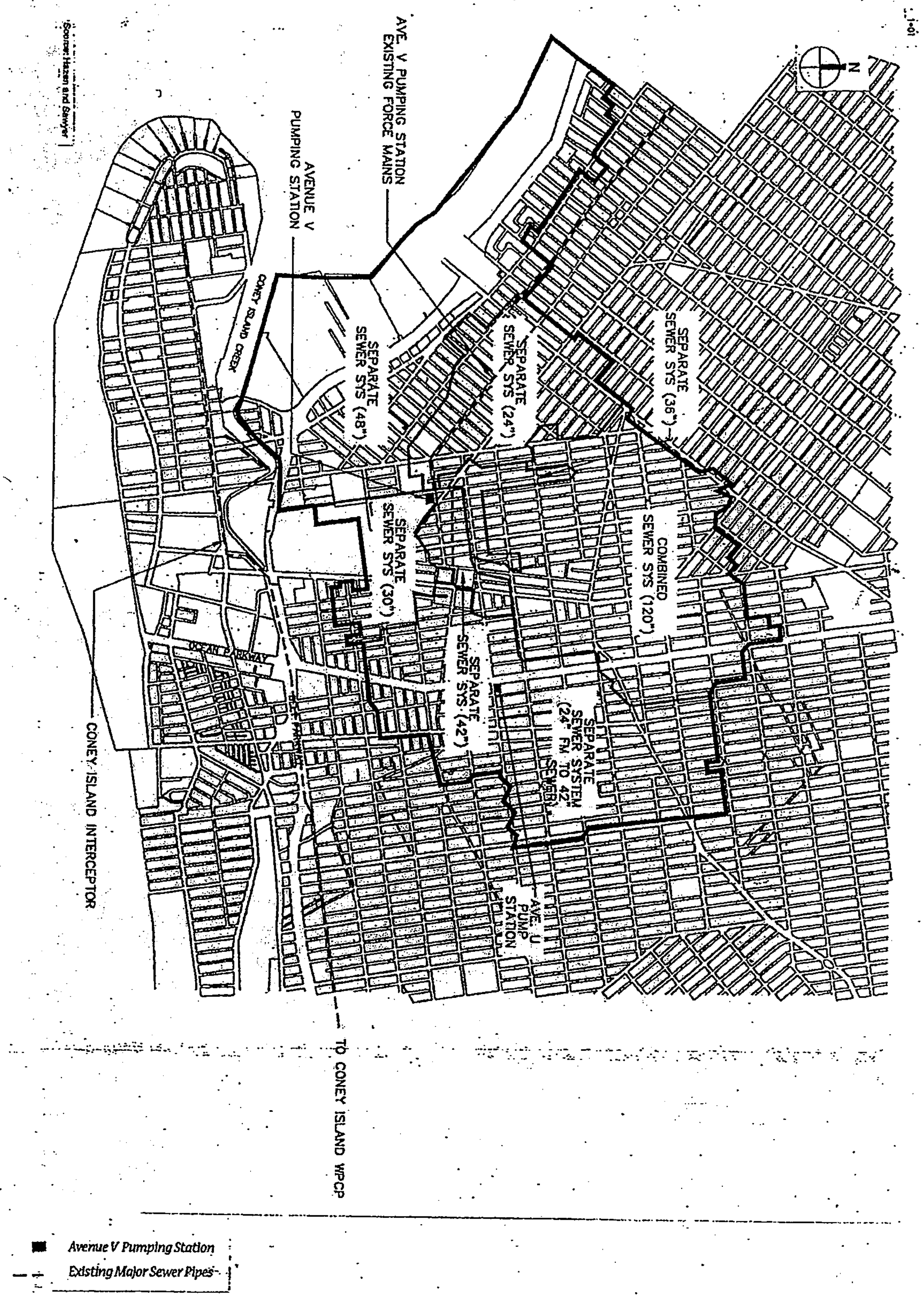
Along the shoulder of Shore Parkway, the force main(s) would be installed using cut and cover methods. A trench would be dug using surface equipment, bedding materials would be installed, and the pipelines laid in the trench. The trench would then be backfilled with the excavated materials, if they are suitable for that use. About 7,200 linear feet of single force main would be installed, and about 6,000 linear feet each of dual force mains would be installed.

The path of the dry weather force main would run near the U.S. Government's Fort Hamilton military base. NYCDEP has coordinated with the federal government to ensure that Fort Hamilton's security needs are met both during and after construction.



Pumping Station and Proposed Force Main Route

Figure 1



Location Plan and Tributary Area

Figure 2

APPENDIX E

SENTINEL MONITORING DATA

FOR

CONEY ISLAND CREEK

2003-2007

CITY OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTEWATER POLLUTION CONTROL
DIVISION OF POLLUTION PREVENTION AND MONITORING
COMPLIANCE MONITORING SECTION

Sentinel Monitoring Data for Coney Island Creek
2003-2007

Coliform	Date	
22	1/21/03	
70	4/28/03	
4	7/2/03	Baseline - 12
17	10/9/03	
230	3/1/04	
30	6/15/04	Baseline - 15
3000	8/9/04	
7	10/27/04	
130	3/31/05	
80	4/18/05	
16000	8/9/05	Baseline - 66
8	10/27/05	
800	2/22/06	
300	4/20/06	Baseline - 438
7	8/14/06	
23	11/6/06	
9000	2/13/07	
34	4/10/07	Baseline - 672
4	8/11/07	
130	10/18/07	