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July 15, 2010

Joseph DiMura, P.E.
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New York State Department of Environmental Conservation
625 Broadway, 4th Floor
Albany, NY 12233-3500

Re: Order on Consent (CSO Order)
DEC Case #CO2-20000107-8
Appendix A, X. Bronx River CSO, B. Comprehensive Watershed Planning, 1. Submit Approvable Bronx River Waterbody/Watershed Facility Plan Report

Dear Mr. DiMura,

As requested in your email dated February 3, 2010, enclosed for your approval is the final Bronx River Waterbody/Watershed Facility Plan (WWFP) Report. The report has been revised based on your comments on the December 2009 Bronx River WWFP. For your convenience, we have also attached a response to each DEC comment from your February 3, 2010 email. As requested by DEC during a phone call with DEP on July 6, 2010, the WWFP has not been substantively changed from the August 2009 version although DEP intends to release a CSO plan soon that may contain new or different information. Accordingly, a statement has been added to the Responsiveness Summary, to clarify that the WWFP is an accurate representation of DEP's plans as of August, 2009.

DEP looks forward to receiving DEC's approval of the submittal plan. As always, feel free to contact me regarding any questions you may have.

Sincerely,

Roy Tysvaer, P.E.
Director of Wastewater Treatment
and Water Quality

Enclosure

Waterbody/Watershed Facility Plan Distribution List

Send 4 hard copies and 2 electronic copies (CDs) to:

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Send 2 hard copies and 1 electronic copy (CD) to:

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Keith Mahoney, Art Spangel, Heather Donnelly, Matthew Osit, Julie Stein,
Dorothy Chao
+ 2 extra paper copies
+2 extra CD

<u>Review of DEP response to comments dated 10/20/09</u>: **2/3/10**

Specific #9: The DEP will need to work with Westchester County and its municipalities to gather the data required to evaluate the entire length of the Bronx River. All sources will need to be characterized and waste load allocations will need to be developed so the City's LTCP can propose appropriate levels of CSO reductions to address NYC's contribution to the non-attainment of water quality standards in the NYC portion of the River. This approach is consistent with the Department's position on the Hutchinson River.

Response: DEP looks forward to partnering with New York State, Westchester County, and upstream municipalities in the development of a TMDL for the Bronx River.

Also, Footnote #2 in Table 3-10 must be modified to reflect that the Hunts Point WPCP was at 400 MGD when the data in the table was collected.

Response: Table 3-10 has been modified to identify the sources of each piece of data.

Specific #10: The Department disagrees with DEP's characterization of the 2006-07 sampling program. Its purpose was not to provide information on pathogen inflows from Westchester County, but to determine current pathogen and dissolved oxygen concentrations at 11 locations along the length of the River over a one year period. DEP noted that the data was not used to calibrate or verify the model. Data gathered in future sampling events for the LTCP will be used to recalibrate and verify the model prior to model runs for the LTCP. Additionally, the bypass at HP-004 in 2006 (for which DEP discounted half of this data) could have been in existence for many, many years (per DEP's statements) making the data that was used to calibrate the original model suspect. The inadequacy of the characterization of the River and therefore of the original model, could make all of the engineering analyses and knee-of-curve evaluations suspect as well.

Response: As listed in the Receiving Water Quality Modeling Report Volume 1. Bronx River (October 2007), the primary purpose of the program was "to characterize the levels of bacteria that enter the tidal portion of the Bronx River, compare these levels to applicable standards, and, if possible, to develop a correlation to other physical or meteorological conditions (i.e. flow, rainfall). From these correlations a predictive tool can then be used to predict bacteria concentrations entering the tidal Bronx River at other projection conditions." Westchester County and NYCDEP simultaneously conducted sampling programs over the same yearly period. These data were used to develop a correlation between rainfall and bacteria concentrations at the model boundary and was used for model projections. Preliminary results of this analysis were presented at the Bronx River Public Meeting No. 3 on February 8, 2007.

The influence of the bypass at HP-004 that was present in 2006 will be reviewed as part of the LTCP. The review will focus on whether the bypass had an impact on the initial calibration and subsequent model projections and if so, DEP will recalibrate the pathogen model during development of the LTCP.

Specific #20: How long will the floatables facilities need to be operating before it can be determined if boom modifications can be made?

Response: This will be determined once the floatables facilities come on-line during the development of the Bronx River LTCP.

30. Page 7-11: second paragraph: The added text regarding I/I does not warrant having the evaluation of I/I being removed as an alternative for further evaluation. The I/I studies were done in the 1980s and early 90s, over 20 years ago. The sewers have aged considerably since. Only 6% of the sewers were ever televised and when no issues were found in those 18 miles of sewer, the program was abandoned. It only takes one or two problem areas to lead to significant I/I that could cause reduced capacity at the WPCP for CSO. This alternative must remain and be adequately evaluated in the LTCP.

Response: Agreed. This alternative will be retained for further consideration during the development of the LTCP. The text has been modified accordingly.

37. Section 7.3: DEP did not respond to the entire comment – Please respond to the following: Many of the alternatives given in this section are ruled out because it is stated that the Hunts Point WPCP cannot accept additional flows as it is already operating at capacity. The DEC does not agree with this statement. The WPCP should be able to receive 100 – 130 MG/year of additional flow, especially since it will be spread out over several dozen storms. The evaluations for these alternatives must be revised based on the above and be given more serious consideration for implementation. The resultant water quality achieved by implementation of these alternatives is to be modeled and stated in the text.

Response: Text ruling out alternatives on the basis of limited WPCP capacity has been removed from Section 7.3. However, as explained in this section other factors exist that make each of these alternatives infeasible and/or not cost effective. Because of these other existing factors, the determination for these alternatives remained unchanged.

39. Page 7-49: Table 7-8: DEP's response to this comment does not explain how 2,672 MG of CSO can be redirected to the East River and 2,581 MG of CSO can be diverted from the HP WPCP when there isn't that much CSO in the entire system.

Response: Model runs indicate that over 52 billion gallons is conveyed to Hunts Point WPCP annually with the plant at 400 MGD capacity. The automation of Regulators 5, 6, and 7, limits the conveyance of flow into the interceptor from these regulators. Excess flow in these regulators that would otherwise be conveyed to the WPCP is thereby directed to outfall HP-011 and discharged as CSO into the East River. Due to the large tributary area of Regulator 6, almost 2.6 billion gallons of the 52 billion gallons annually conveyed to the WPCP is expected to be redirected as CSO to the East River under the regulator automation scheme evaluated for Regulator 6.

<u>Review of Bronx River WWFP dated December 2009</u>:

1. **Page ES-1: First paragraph: Add reference to second CSO Order Modification #CO2-20090318-30, executed on September 3, 2009.**

Response: Agreed. The text has been modified as requested.

2. Page 1-3: First paragraph: The CSO Order was modified in 2008 and 2009.

Response: Agreed. The text has been modified as requested.

3. Page 1-8: First paragraph, last sentence: Change "WGS" to "WQS."

Response: Agreed. The text has been modified as requested.

4. Page 1-16: First paragraph: The CSO Order was modified on September 3, 2009 as well as April 14, 2008.

Response: Agreed. The text has been modified as requested.

5. Page 1-18: First sentence: "Subsequently" is used twice in same sentence.

Response: The text has been modified.

6. Page 3-5: First paragraph: The word "being" was removed and now the parenthetical does not make sense.

Response: Agreed. The text has been modified.

7. Page 3-14: Section 3.2.2: The sentence beginning "Table 3-4 lists…" is stated twice. Please remove one of the sentences.

Response: The first sentence has been removed.

8. Page 4-49: New text in second paragraph: First sentence references Class C. It should reference Class B.

Response: Agreed. The text has been modified.

9. Page 4-49: New text in second paragraph: Please strike the words "to estimate influent loads from Westchester County." See Specific Comment #10 above.

Response: The text has been modified as requested. The sediment blockage only impacted data collected in the tidal section. Therefore, the full year of data was used to develop the correlations to predict bacteria concentrations entering the tidal Bronx River from Westchester County.

10. Page 4-49: Third paragraph: Reference should be to Class C, not Class B.

Response: Agreed. The text has been modified.

11. Page 5-1: Table 5-1: Note: Dredging must be complete in 5 years, not 3; Paerdegat Basin: Construction Completion date for Foundations and Substructures is 12/2009, not 2/2009; Paerdegat Basin: Add the dredging requirements from the LTCP which are Design Completion = Permit + 18 months and Construction End = Permit + 60 months; Flushing Bay: Add the TI 2xDDWF project with Design End = 12/2010 and Construction End = 7/2015; and Jamaica Bay: Add Rockaway 2xDDWF project with Construction Completion = 12/2017.

Response: Table 5-1 has been modified as requested.

12. Page 5-7: Section 5.3.4: Add update that the WWOP is currently being revised to reflect the Phase I upgrade at the plant and the ongoing Phase II BNR work.

Response: This update has been added as requested.

13. Page 5-9: Section 5.3.7: The catch basin counts in the CSO Annual BMP Report are not broke down by drainage basin as is done here and therefore this information did not come from the annual report.

Response: The catch-basin counts presented in Section 5.3.7 are not broken down by drainage basin. The catch basin counts include the total number of catch basins cleaned in 2008 in the entire Bronx Borough (5,409) as reported in CY 2008 BMP Annual Report Table 7a-3, the total number of basins in the Hunts Point Sewershed (10,484) and those of which had hoods replaced in 2008 (346) as reported in CY 2008 BMP Annual Report Table 7a-2, and the number of catch basins that require reconstruction in the Hunts Point collection system after 2008 (55) as presented in CY 2008 BMP Annual Report Table 7a-5.

14. Page 5-33: Top of Page: It is Hutchinson River, not Creek.

Response: Agreed. The text has been modified as requested.

15. Page 5-34: Section 5.8.5: Leave in the first two paragraphs (description of BNR EBP projects) and the last paragraph. In the fourth paragraph, "using $2.9 M from the EBP Fund" is used twice in one sentence. Start the last paragraph with "Under the CSO EBP Plan, the actual BMP methodologies…"

Response: The text has been revised. However, the fourth paragraph was removed because it is not relevant to the Bronx River.

16. Page 6-16: Section 6.7: First sentence should read "In accordance with the NYSDEC public notification requirements, NYSDEC posted in the Environmental Notice Bulletin (ENB) a notice of a meeting held jointly by NYCDEP and NYSDEC…"

Response: Agreed. The text has been modified as requested.

17. Page 6-17: Fourth paragraph: First sentence should read "NYCDEP and NYSDEC responded to questions and comments regarding the compliance efforts by Westchester County…"

Response: Agreed. The text has been modified as requested.

18. Page 6-18: Last paragraph: Should read "…Official 30 Day Public Comment Period following the meeting with the responses to these questions and comments, are provided in Appendix B."

Response: Agreed. The text has been modified as requested.

19. Table 7-1: Recommend adding Class C to the table as it is discussed multiple times in the document.

Response: Agreed. Class C has been added to the table.

20. Page 7-5: Section 7.1.5: Where are the analyses that were conducted to assess the benefit of a 30 percent reduction in load?

Response: The analysis occurred prior to 2004. The analysis is no longer relevant, and Section 7.1.5 has been deleted.

21. Page 7-29: Netting Devices: Where is Little Bay?

Response: Little Bay is the embayment where the Throgs Neck Bridge lands. The location of TI-023 is correctly described as Little Bay as listed in the SPDES permit.

22. Page 7-37: First full paragraph, third to last sentence: Rewrite to read "The remaining flow will be diverted as secondary bypass flow and all flows will receive final chlorination."

Response: The text has been modified as requested.

23. Page 7-38: First paragraph, last sentence: This makes no sense.

Response: This sentence has been revised for clarification.

24. Page 7-43: New Parallel Interceptor, Bronx River Siphon to WPCP: What does Soundview Park have to do with this alternative that is wholly on the west side of the River?

Response: Agreed. Reference to Soundview Park has been removed from this section. However, discussion of Soundview Park is appropriate for the evaluation of the wet-weather pumping station alternatives and was inserted into this section.

25. Page 8-7 and 8: The LID/BMP Assessment title is used for both Sections 8.1.4 and 8.1.5.

Response: Section 8.1.4 is titled LID/BMP Assessment while Section 8.1.5 is titled LID/BMP Implementation.

26. Page 8-10: Section 8.4: This language is incorrect. When the WWFP is approved, it will become an enforceable part of the CSO Order.

Response: The CSO Order does not state that the an approved WB/WS Facility Plans will become an enforceable part of the CSO Order. According to the CSO Order, it is an approved Drainage Specific LTCP that will be made an enforceable part of the Order. Therefore, the text has not been modified.

City-Wide Long Term CSO
Control Planning Project

Bronx River Waterbody/Watershed Facility Plan Report

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

July 2010

City-Wide Long Term CSO Control Planning Project

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EXECUTIVE SUMMARY

The New York City Department of Environmental Protection (NYCDEP) has prepared this Bronx River Waterbody/Watershed (WB/WS) Facility Plan Report as required by the Administrative Order on Consent between the NYCDEP and the New York State Department of Environmental Conservation (NYSDEC). Designated as DEC Case #CO2-20000107-8 (January 14, 2005, as modified April 14, 2008 as DEC Case #CO2-20070101-1 and September 3, 2009 as DEC Case #CO2-20090318-30) and also known as the Combined Sewer Overflow (CSO) Consent Order, the Administrative Consent Order requires the NYCDEP to submit an "approvable WB/WS Facility Plan" for the Bronx River to the NYSDEC by June 2007. The NYCDEP submitted a draft report in June 2007 for the Bronx River. After receiving comments from NYSDEC in May 2009, NYCDEP submitted a revised Bronx River WB/WS Facility Plan report on July 10, 2009. NYCDEP received additional comments from NYSDEC in October 2009, and NYSDEC requested that NYCDEP finalize the revised Bronx River WB/WS Facility Plan report by December 18, 2009. This Bronx River WB/WS Facility Plan Report builds upon analyses and planning work previously done under the 2004 Bronx River WB/WS Facility Plan. The CSO Consent Order also required that NYCDEP submit an approvable Bronx River Long Term Control Plan (LTCP) by August 2009. NYCDEP submitted a milestone modification request to change the due date of the Bronx River LTCP to six months after approval of the Bronx River WB/WS Facility Plan. This request was granted by NYSDEC on July 10, 2009. NYCDEP is required by the CSO Consent Order to submit by December 2017 an approvable Citywide LTCP that incorporates elements from all of the approved LTCPs.

Purpose

The purpose of this WB/WS Facility Plan is to take the first step toward development of a LTCP for the Bronx River. This WB/WS Facility Plan assesses the ability of the existing 2004 Bronx River Waterbody/Watershed Facility Plan 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 Facility Plan for the Bronx River. 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 Facility Plan has been developed pursuant to the 2005 CSO Consent Order. It represents one of several WB/WS Facility Plans that will be developed prior to development of a final approvable Citywide LTCP. All WB/WS Facility Plans contain all the elements required by USEPA of a LTCP.

Goal of Plan

The goal of this WB/WS Facility Plan is to achieve the current water quality standards applicable to the Bronx River. Implementation of the Plan is expected to reduce CSO discharges to the Bronx River, reduce odors, greatly reduce floatables and improve dissolved oxygen concentrations to meet the existing water quality standards. The LTCP to be developed subsequent to this WB/WS Facility Plan may support a possible upgrade of water quality standards to support primary contact recreation throughout all reaches of the Bronx River, thereby supporting the Clean Water Act goals of fishable and swimmable water quality where attainable. This Waterbody/Watershed Plan assesses the effectiveness of CSO controls to attain water quality that complies with NYSDEC water quality standards currently applicable to the Bronx River, and considers existing controls or projects required under the Consent Order. This Waterbody/Watershed Plan also assesses additional cost-effective CSO control alternatives or strategies that can be employed to provide attainment with the water quality standards.

Adaptive Management Approach

Post-construction compliance monitoring (including modeling), discussed in detail in Section 8, is an integral part of the WB/WS Facility Plan, and provides the basis for adaptive management for this waterbody. Post-construction compliance monitoring will commence just prior to implementation of CSO controls and will continue for several years in order to quantify the difference between the expected performance (as described herein) and the actual performance once those controls are fully implemented. Any performance gap identified by the monitoring program can then be addressed through operations adjustments, retrofitting additional controls, or initiating a Use Attainability Analysis (UAA) if it becomes clear that CSO control will not result in full attainment of applicable standards.

If additional controls are required, protocols established by the NYCDEP and the City of New York for capital expenditures require that certain evaluations are completed prior to the construction of the additional CSO controls. Depending on the technology implemented and on the engineer’s cost estimate for the project, these evaluations may include pilot testing, detailed facility planning, preliminary design, and value engineering. Each of these steps provides additional opportunities for refinement and adaptation so that the fully implemented program achieves the goals of the original WB/WS Facility Plan.

Project Description

The Bronx River is a tributary of the East River and flows generally from north to south through Westchester County and central Bronx County. The headwaters of the Bronx River are at Davis Brook and the Kensico Dam and extend to the mouth between Hunts Point and Clason Point along the East River. The northern portion of the river upstream of East Tremont Avenue is freshwater. South of this point, the river is tidally influenced and generally brackish.

In the 17th Century the Bronx River was referred to as Aquehung or "River of High Bluffs" by the Mohican Indians who first lived off of the river. At the beginning of the 18th Century, roughly 12 water mills were producing paper, pottery, flour, tapestries, and snuff along the Bronx River. Much of the valley remained densely vegetated and forested well into the 19th Century. However, in the 1840s during railroad construction, the valley was turned into an industrial corridor. In 1905, Westchester County constructed the Bronx River Valley Sewer which discharged into the Bronx River. New York City's demand for water continued to rise and the construction of the Kensico Dam diverted the upper reaches of the Bronx River into the reservoir, cutting the river's water flow by approximately 25 percent in 1915. The river's history since the 1880s has been an effort to reclaim and protect it from urbanization. In 1888, Bronx Park was created by consolidation of surrounding properties to buffer against development on both sides of the river. The Bronx River Parkway was completed in 1925, and includes a collection of lakes, parks, and limited access roadways stretching from the Kensico Dam to Bronx Park. Throughout the 1960s and 1970s, city and state highway projects distanced the Bronx River communities from each other as well as the river. In 1974, as a response to the poor conditions of the Bronx River, local residents formed the Bronx River Restoration Project, Inc. The group was successful in removing debris from the shoreline of the Bronx River. In 1996, the Restoration Project was strengthened with the Bronx Riverkeeper Program, created in a partnership with the City of New York Parks and Consolidated Edison Corporation. In 1997 the Bronx River Working Group expanded the effort to include over 60 community groups, government agencies, schools, and businesses. Additionally, the Bronx River Alliance was created in 2001 as the next step in the effort to restore and protect the Bronx River. The City's LTCP program continues the on-going effort to improve the Bronx River.

As noted in Table ES-1, approximately 210,000 people currently live within the drainage area. This urbanization has resulted in an increase in annual stormwater 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. In a pastoral condition, runoff from the watershed typically reached the Bronx River through a combination of overland surface flow and subsurface transport, typically with ponding and other opportunities for retention and infiltration. Tidal wetland areas previously surrounding the lower Bronx River would have further attenuated wet-weather discharges. The urbanization of the Bronx River watershed reduced infiltration and natural subsurface transport and eliminated natural streams previously tributary to the Bronx River. Runoff is transported via roof leaders, street gutters and catch basins into the collection system, a portion of which can discharge directly into the Bronx River. The result is the discharge of about one billion gallons a year of combined sewage to the Bronx River through the permitted CSO outfalls shown in Table ES-2. As a consequence of these discharges, nuisance conditions resulting from floatables have impaired its recreational use. While restoring the Bronx River to its pristine condition is no longer possible due to the hydraulic modifications that removed the natural wetland habitat and man-made conditions that cannot be reversed, the community has indicated that the Bronx River should be restored to prevent nuisance conditions and make it acceptable for boating.

Table ES-1 Effects of Urbanization on NYC Bronx River Watershed

Watershed Characteristic	Pre-Urbanization(2)	Urbanized(2)
Drainage Area (acres)	5,100(1)	4,150
Population	Unknown	210,000
Imperviousness (%)	10%	35%
Annual Runoff Yield (MG)(3)	530	1,000
Peak Storm Runoff Yield (MG)(3)	32	145

Notes:
(1) Approximated from historical maps
(2) Pre-urbanized is estimated for year 1890; urbanized estimate based on Year 2000 U.S. Census.
(3) For an average precipitation year (JFK, 1988), including stormwater

Table ES-2 Bronx River CSO Discharge Summary (1, 2, 3)

Outfall	Discharge Volume (MG/yr)	Percentage of CSO Volume	Number of Discharges/yr
HP-009	814	81	51
HP-004	100	10	56
HP-007	88	9	21
HP-008	4	0.4	17
HP-010	0.6	0(4)	1
Total CSO	**1,006**	**100**	**NA**

Notes: (1) Baseline condition reflects design precipitation record (JFK, 1988) and sanitary flows projected for year 2045
(2) Totals may not sum precisely due to rounding
(3) Hunt Point Operating Capacity 259 MGD
(4) The model predicted only a trace discharge from HP-010, an estimated 0.06% of the total CSO volume.

The freshwater portion of the Bronx River within New York City is classified as a Class B waterbody with best usages of primary and secondary contact recreation and fishing. The tidal portion of the Bronx River 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 (DO) and bacteria concentrations have been established, but both the numerical and narrative standards require that contravention never occur. The freshwater portion is in compliance with DO standards. Historical dissolved oxygen concentrations are frequently found to show impairments and excursions below the allowable levels in the tidal section. However, recent water quality modeling shows compliance with the 4.0 mg/L standard in the tidal portion of the Bronx River varies from 83 to 100 percent.

Total and fecal coliform bacteria data indicate that recreational uses of the Bronx River are impaired in the freshwater section of the Bronx River and the first half mile of the tidal portion immediately downstream of the freshwater section. Water quality modeling indicates that upstream flows entering the City must be greatly improved for standards attainment to be realized. Upstream communities have been working to improve water quality, and Westchester County and the NYCDEP recently completed a joint sampling program to augment the limited data set available on existing water quality conditions.

A variety of CSO control alternatives have been examined to reduce the impact of CSO pollution in the Bronx River, to provide for compliance with water quality standards, and to improve water quality to attain stakeholder use goals. The Bronx River receives large quantities of combined sewage in short periods of time; therefore most of the alternatives involve reduction in the volume of combined sewage discharged. CSO control scenarios examined varied from floatables control and maximization of flow to the Hunts Point WPCP through headworks improvements to various storage methods including in-line storage using Real Time Control (RTC) and off-line storage using tunnels. The stored overflows would be sent to the Hunts Point WPCP for full treatment after the storm event. For comparison purposes, all alternative scenarios included improvements at the Hunts Point WPCP that were estimated to cost approximately $26 million; the Baseline condition was considered with the Hunts Point WPCP operating at the sustained wet weather capacity reported in the 2003 BMP Report (259 MGD).

After complete examination of the costs and benefits of a wide variety of CSO control alternatives, a WB/WS Facility Plan has been developed that aims at greatly reducing floatable inputs from CSOs and reducing the volume of CSO through a number of infrastructure improvements. This Bronx River WB/WS Facility Plan aims to abate the CSO associated aesthetic impairments found in the Bronx River and to reduce pollutant loads to the Bronx River in a cost effective manner. A number of the plan actions have already been initiated through the NYCDEP's ongoing CSO planning activities while others will need to be initiated in the future through the LTCP planning process. The WB/WS Facility Plan consists of the following components:

- The upgrade of Hunts Point WPCP to 2×DDWF (Design Dry Weather Flow) 400 MGD;
- The reduction of floatables discharges at Outfalls HP-004 and HP-009 via in-line netting and at Outfall HP-007 via mechanical screens at CSO 27 and CSO 27A;
- Continued implementation of programmatic controls

The success of these alternatives is predicated on the headworks improvements at the Hunts Point WPCP, so all scenarios included the cost of these improvements for comparison purposes. However, the cost of the WPCP upgrade is accounted for in the East River and Open Waters WB/WS Facility Plan to be submitted to the NYSDEC under separate cover. Thus, the total additional cost for implementing the proposed WB/WS Facility Plan is $26.4 million, which represents the actual construction bid price for the Bronx River Floatables Control Facilities received in February 2009. However, for comparison purposes all alternative scenarios included the construction bid price escalated to December 2009 ($28.7 million) in Section 7.

The WB/WS Facility Plan will reduce CSO volume discharges from the Baseline condition (Hunts Point WPCP at 259 MGD) from the Bronx River outfalls as shown in Table ES-3. The WB/WS Facility Plan is also expected to result in significant improvements in Bronx River aesthetics through floatables control from CSO sources in the Bronx River. These floatables controls will provide for near complete elimination of floatables from over 99 percent of the annual CSO discharged in the Bronx River. Except in the first half mile, total and fecal coliform levels in the tidal Bronx River will comply with secondary contact standards during the average year, allowing for the attainment of the current use of the tidal Bronx River for boating, canoeing and kayaking. However, water quality modeling indicates upstream flows and the associated pollutant loading from Westchester County heavily influence water quality in the tidal section of the Bronx River, and the entire tidal Bronx River would meet secondary contact standards if this load source were significantly reduced.

As enumerated in Section 5.9, low-impact development, stormwater BMPs, and other green solutions for stormwater management will continue to be evaluated for programmatic implementation by the City of New York through parallel planning efforts. NYCDEP has taken the lead on many of these efforts on behalf of the City and expects these evaluations to yield promising technologies suitable for implementation in its CSO program as information becomes available and opportunities arise. NYCDEP is undertaking a BMP Planning study within which analyses will be conducted to customize assessments of green infrastructure for specific drainage areas in addition to planned citywide evaluations as part of the LTCP development process. In addition, NYCDEP is working with other City agencies to incorporate BMPs in current and future development, and is evaluating potential regulatory changes to accomplish this effort. The results of these analyses and evaluations will be incorporated into LTCP submittals as developed and, dependent on these analyses, the LTCP for the Bronx River Watershed may provide a greater emphasis on green infrastructure than was included in the WB/WS Facility Plan.

Table ES-3. Bronx River WB/WS Facility Plan CSO Volume Reduction

Outfall Number	Baseline Annual Overflow Volume MG/year	WB/WS Plan Overflow Volume MG/year	Percent Reduction
HP-004	100	7	93%
HP-007	88	81	8%
HP-008	4	4	0%
HP-009	814	500	39%
HP-010	0.6	0.4	33%
Total	**1,006**	**592**	**41%**

Post-construction monitoring will be integral to the assessment of the WB/WS Facility Plan to achieve 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 WB/WS Facility Plan actions of the water quality in the Bronx River.

The operation of the Bronx River WB/WS Facility Plan will be carried out in conjunction with the existing Hunts Point WPCP Wet Weather Operating Plan (WWOP). The NYCDEP intends to operate these facilities in strict accordance with their WWOP. The annual analysis of monitoring data will trigger a sequence of detailed investigations if needed. The WWOP for the Hunts Point WPCP is presented in Appendix A. The wet weather operating plans for the floatables facilities will be developed during the final design of the facilities and will be appended to the final Bronx River Long Term Control Plan when it is developed and submitted six months after NYSDEC approves this Bronx River WB/WS Facility Plan.

1.0 Introduction

The City of New York owns and operates 14 water pollution control plants (WPCPs) and their associated collection systems. The system contains approximately 450 combined sewer overflows (CSOs) located throughout the New York Harbor complex. The New York City Department of Environmental Protection (NYCDEP) operates and maintains the wastewater collection system and WPCPs and has executed a comprehensive watershed-based approach to address the impacts of these CSOs on water quality and uses 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 the Bronx River (Item 13 in Figure 1-1).

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, other confined tributaries in Jamaica Bay, and 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 impacted by CSOs. In addition, occurrences of dry weather discharges – which NYCDEP has since eliminated – were also confirmed. 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. As part of that plan, the City was divided into eight individual project areas that together encompass the entire harbor area. Four open water project areas (East River, Jamaica Bay, Inner Harbor and Outer Harbor), and four tributary project areas (Flushing Bay, Paerdegat Basin, Newtown Creek, and Jamaica Tributaries) were defined. For each project area, water-quality CSO Facility Plans were developed as required under the State Pollutant Discharge Elimination System (SPDES) permits for each WPCP. The SPDES permits, administered by the New York State Department of Environmental Conservation (NYSDEC), apply to CSO outfalls as well as plant discharges, and contain conditions for compliance with applicable federal and New York State requirements for CSOs.

In 1992, NYCDEP entered into an Administrative Consent Order with NYSDEC which incorporated into the SPDES permits 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 superseded 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 (CWA) and New York 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. NYCDEP and

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LTCP Project Waterbody/Watershed Assessment Areas

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 subsequently modified in 2008 and 2009.

This WB/WS Report is required by the 2005 Consent Order, and is intended to be consistent with the United States Environmental Protection Agency's (USEPA) CSO Control Policy promulgated in 1994. This policy 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 in December 2000 with the passage of the Wet Weather Water Quality Act of 2000. The approach to developing a 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

Subsequent sections of this WB/WS Facility Plan report will discuss each of these elements in more depth, along with the simultaneous coordination with State Water Quality Standard (WQS) review and revision as appropriate.

1.1. WATERBODY/WATERSHED ASSESSMENT AREA

The Bronx River is a tributary of the East River and flows generally from north to south through Westchester County and central Bronx County. The headwaters of the Bronx River are at Davis Brook and the Kensico Dam. The river extends south to its mouth, located between Hunts Point and Clason Point, at which point it empties into the East River. The northern portion of the river, upstream of East Tremont Avenue, is freshwater. South of this point, the river is tidally influenced and brackish.

The Bronx River drainage area is approximately 24,260 acres and is illustrated in Figure 1-2. Eighty-three percent of the total Bronx River drainage area is located in Westchester County. The portion of the Bronx River drainage area tributary to the United States Geological Survey (USGS) flow gage location at Bronxville, New York is 16,960 acres, all of which is located within Westchester County. The drainage area does not include the 11,580 acres upstream of Kensico Dam from which nearly the entire flow is diverted for municipal water supply. Prior to discontinuance of the USGS gage in 1989, the 45 years of flow data indicates an average flow of 42.7 cubic feet per second (cfs), a one in 10-year seven consecutive day low flow (7Q10) of 3.7 cfs and a range of flows from 1 cfs to 2,500 cfs. The New York City portion of the Bronx River drainage area is approximately 4,160 acres, or 17 percent of the total drainage area. Figure 1-3 illustrates the Bronx River assessment area addressed in this WB/WS Facility

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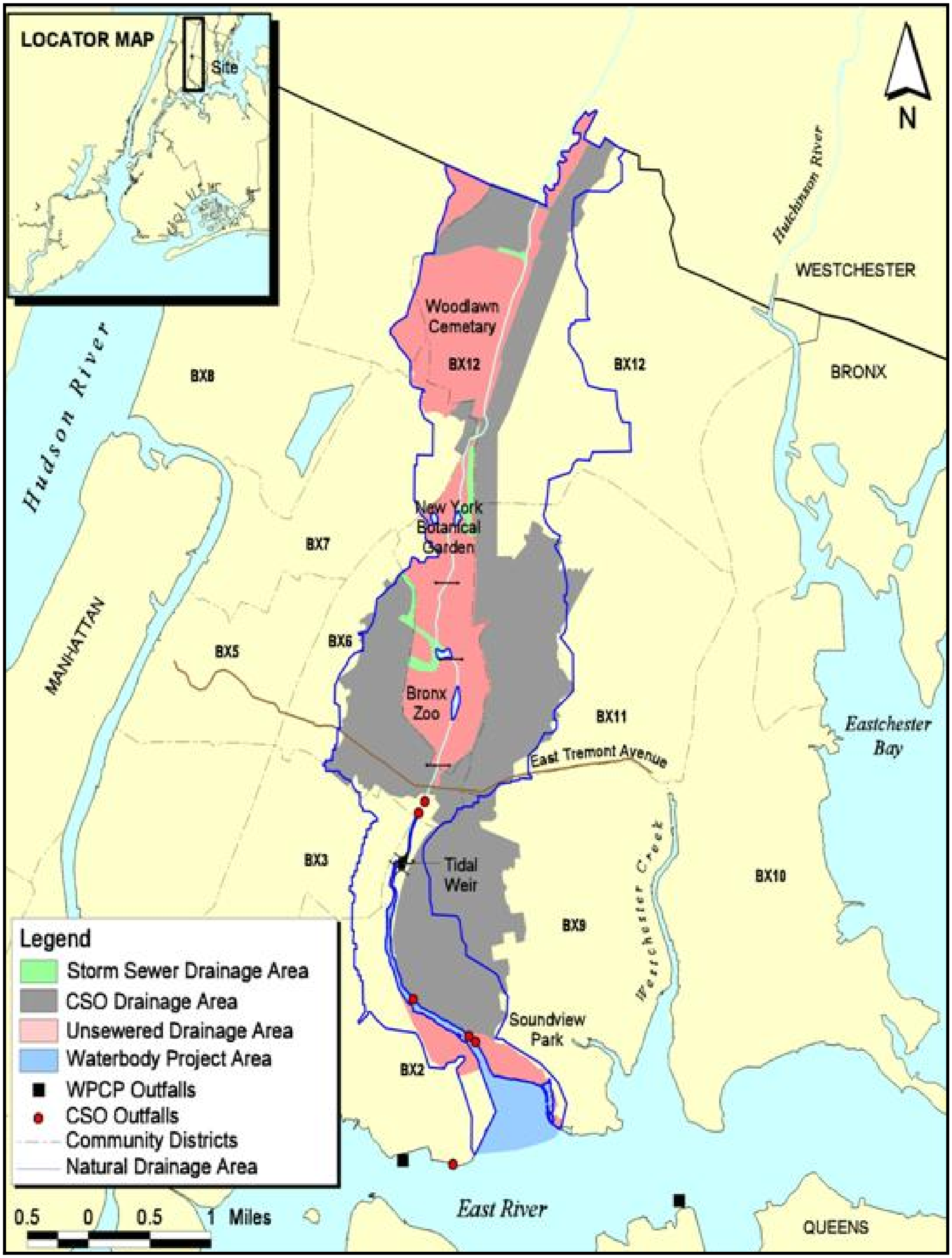
Bronx River Drainage Area

Bronx River Waterbody/Watershed Facility Plan

FIGURE 1-2



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Bronx River Assessment Area

Bronx River Waterbody/Watershed Facility Plan

FIGURE 1-3

Plan. The sewershed includes part of the combined sewer system serviced by the Hunts Point WPCP. The sewershed is located in central Bronx within Community Districts 2, 3, 6, 7, 9, 11, and 12 with five CSO outfalls that discharge to the Bronx River.

The legal definition of a waterbody is codified in Title 6 of the New York State Code of Rules and Regulations. The lower Bronx River is classified by New York State as Class I saline surface waters with best uses designated for secondary contact recreation and fishing. The middle Bronx River is classified as Class B with best uses for primary and secondary contact recreation and fishing. Both lower and middle sections of the Bronx River are within New York City. Finally, the upper Bronx River in Westchester County is Class C. All sections are suitable for fish propagation and survival. All three sections were listed on the 2008 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 the USEPA the authority to implement pollution control programs. Among the key elements of the CWA was the establishment of the National Pollutant 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 NYSDEC, through its State Pollutant Discharge Elimination (SPDES) program. New York State has had an approved SPDES program since 1975.

The CWA requires that discharge permit limits be based on receiving water quality standards (WQS) established 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 include an antidegradation policy for maintaining water quality at acceptable levels, and a strategy for meeting those 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 achieving WQS. TMDLs also allocate acceptable loads among the various sources of the relevant pollutants which discharge to the waterbody.

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.

In 1998, NYSDEC listed the lower segment of the Bronx River in the Section 303(d) List as high priority for TMDL development due to pathogens. NYSDEC added the upper and middle reaches of Bronx River in 2002 to the Section 303(d) List as high priority for TMDL development. As of the 2008 Section 303(d) List, the upper reach and tributaries of the Bronx River remain listed in Part 1 as impaired waters requiring TMDL development due to the presence of pathogens and low dissolved oxygen (DO). NYSDEC listed both the lower and middle reaches of the Bronx River, the segments located within New York City, in Part 3c of the 303(d) List – Waterbodies for which TMDL Development May be Deferred (Pending Implementation/Evaluation of Other Restoration Measures) due to the presence of pathogens and low DO in the lower reach and pathogens in the middle reach. A TMDL may not be required and may in fact delay the ability to meet the pathogen and DO requirements as compared to the various control measures currently being developed and implemented which include this WB/WS Facility Plan. If after implementation of this WB/WS Plan, the middle and lower reaches of the Bronx River achieve the pathogen and DO requirements associated with each waterbody segment, they would then be removed from the 303(d) list for these pollutants.

Another important component of the CWA is the protection of uses. USEPA regulations state that a designated use for a waterbody may be refined under limited circumstances through a Use Attainability Analysis (UAA), which is defined as *"a structured scientific assessment of the chemical, biological, and economic condition in a waterway"* (USEPA , 2000). In the UAA, the NYSDEC would demonstrate that one or more of a limited set of circumstances exists to make such a modification. It could be shown that the current designated use cannot be achieved through implementation of applicable technology based limits on point sources, or be a cost-effective and reasonable best management practice for non-point sources. Additionally, a determination could be made that the cause of non-attainment is due to natural background conditions or irreversible human-caused conditions. Another circumstance might be to establish that attaining the designated use would cause substantial environmental damage or substantial and widespread social and economic hardship. If the findings of a UAA suggest authorizing the revision of a use or modification of a WQS is appropriate, the analysis and accompanying proposal for such a modification must go through the public review and participation process 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 were to minimize impacts to water quality, aquatic biota, and human health 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 LTCP 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 the 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, 1995). 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 (NMCs) by 1997, after which long-term control plans should 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 overflow outfalls;

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, 2001d). 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 LTCP development, USEPA recommends that WQS authorities review the 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 a higher level of designated uses is attainable or if existing designated uses are not reasonably attainable. If the latter is true, then the 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 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 1-4) in its guidance for describing the coordination of LTCP development and water quality standards review and revision.

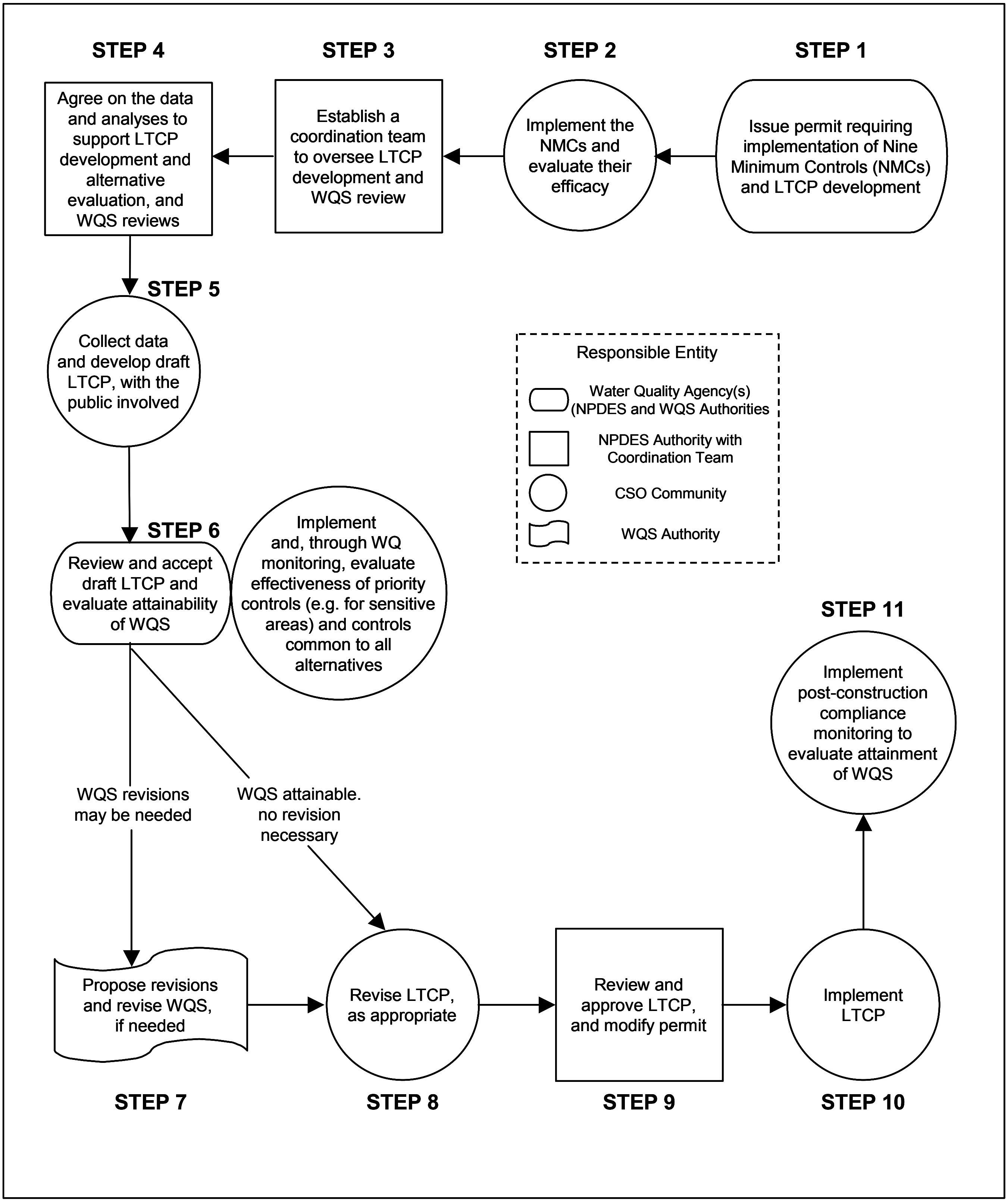
The NYC CSO control program for the Bronx River was initiated prior to the adoption of the CSO Policy, at which time Steps 1 through 5 were achieved with the completion of the 2004 Bronx River Waterbody/Watershed Facility Plan. With the requirement to develop a LTCP for the Bronx River, the NYCDEP has re-initiated some of the activities in Step 4 of the flow chart and re-examined a number of CSO control alternatives. Moving forward, the NYSDEC will need to evaluate the attainability of water quality standards in accordance with Step 6.

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, 1994). 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 waters within its jurisdiction. The State has developed a system of waterbody classifications based on designated uses that includes four freshwater and five marine classifications, as shown in Table 1-1.

The NYSDEC considers the A, B, SA and SB classifications to fulfill the Clean Water Act goals of fully supporting aquatic life and recreation. Class C, D, and SC support 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. It should also be noted that the NYSDEC regulations state that the total and fecal coliform standards for Classes B, C, D, SB, SC and I "shall be met during all periods when disinfection is practiced." As disinfection is practiced at all WPCPs year-round, these standards are applicable to all Class SA, SB, SC and I New York Harbor waters.



New York City
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Water Quality Standards Review Flow Chart

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

Class	Usage	Dissolved Oxygen (mg/L)	Total Coliform (number/100mL)	Fecal Coliform (number/100mL)
Freshwater				
A	Source of water supply for drinking, culinary or food processing purposes. Primary and secondary contact recreation; and fishing. Suitable for fish propagation and survival.	> 5.0 (7) >4	2,400 (4) 5,000 (5)	200 (6)
B	Primary and secondary contact recreation and fishing. Suitable for fish propagation and survival.	> 5.0 (7) >4	2,400 (4) 5,000 (5)	200 (6)
C	Limited primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	> 5.0 (7) >4	2,400 (4) 5,000 (5)	200 (6)
D	Best usage is fishing. Not conducive to propagation of game fishery and waters will not support fish propagation.	> 3.0	2,400 (4) 5,000 (5)	200 (6)
Saline				
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

$$DO_i = \frac{13.0}{2.80 + 1.84e^{-0.1ti}}$$

Where DO_i = DO concentration in mg/L between 3.0-4.8 mg/L and t_i = 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. DO_i is the lower bound of each interval (i) and t_i 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 (T_i). 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 80^{th} percentile of five or more samples
(6) Monthly geometric mean of five or more samples
(7) Daily avg. min for non-trout waters

Dissolved Oxygen

Dissolved oxygen is the numerical standard that NYSDEC uses to establish whether a waterbody supports aquatic life uses. The numerical DO standard for the lower reach of the Bronx River (Class I) requires that DO concentrations shall not be less than 4.0 milligram per liter (mg/L) at any time at any location within the waterbody. The numerical DO standard for the middle reach of the Bronx River (Class B) require that the minimum daily average DO concentration shall not be less than 5.0 mg/L, and at no time shall the DO concentration be less than 4.0 mg/L.

Bacteria

Total and fecal coliform bacteria concentrations are the numerical standards used by the NYSDEC to establish whether a waterbody supports recreational uses. The numerical bacteria standards for the lower reach of the Bronx River (Class I) require that total coliform bacteria must have a monthly geometric mean of less than 10,000 per 100 milliliter (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. The numerical bacteria standards for the middle reach (Class B) require that the total coliform bacteria monthly median value and more than 20 percent of the samples, from a minimum of five examinations, shall not exceed 2,400 and 5,000, respectively. Fecal coliform (Class B) must have a monthly geometric mean of less than 200 per 100 mL from a minimum of five examinations.

An additional NYSDEC standard for primary contact recreational waters (not applicable to the Bronx River 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, 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.

For areas of primary contact recreation that are used infrequently and are not designated as bathing beaches, 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 that the 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 required "none" in any amount, or provide a written clarification to this end" (Mugdan, 2004). 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 the NYSDEC definition of a prohibited dry weather discharge. 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 spatially coincide.

1.2.5. Administrative Consent Order

New York City's 14 WPCP SPDES permits include conditions which require compliance with federal and State CSO requirements. NYCDEP was unable to comply with deadlines included within their 1988 SPDES 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 NYCDEPs obligations for its CSO program. It also required that NYCDEP implement CSO abatement projects within nine facility planning areas in two tracks: those areas where dissolved oxygen and coliform standards were being contravened (Track One) and those areas where floatables control was necessary (Track Two). The 1992 Order was modified on September 19, 1996 to add catch basin cleaning, construction, and repair programs.

NYCDEP and NYSDEC negotiated a new Consent Order, signed January 14, 2005, 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 Clean Water Act and 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 signed on April 14, 2008 and again on September 3, 2009. 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 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 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 a 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 which, 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 in to which the policies would apply. The program was revised in 1999, and new policies were issued in September 2002. The revised WRP condensed the 12 original policies into 10 policies: (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 which provide geographic specificity to the WRP and acknowledge that certain policies are more relevant than others in 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 liaisons for the Community Districts were contacted to determine whether any proposals in process that required NYCDCP review might impact the WB/WS Facility Plan.

The NYCDCP proposed to rezone 19 full blocks and portions of 24 blocks in the northern Bronx neighborhood of Woodlawn in Community District 12. Some of this rezoning would occur on the western bank of the Bronx River. The Woodlawn neighborhood is bounded by Van Cortlandt Park to the west, Woodlawn Cemetery to the south, Webster Avenue to the east and the New York – Yonkers City Line to the north. Much of this neighborhood was rezoned in 1996 to promote development compatible with existing development patterns. More recently, there has been renewed pressure to redevelop vacant or underutilized lots in this area with semi-detached housing. Fourteen full blocks and portions of twenty-two blocks are proposed to be rezoned from R4-1 (single-and two-family detached, semi-detached zero lot line residence; community facility use) to R4A (single-and two-family detached residence; community facility use). New development would be limited to one- and two-family detached housing on blocks that are primarily developed with detached homes. Two full blocks and portions of two other blocks bounded by Van Cortlandt Park East, East 235th Street, Napier Avenue and East 236th and a line 100-feet west of Oneida Avenue are proposed to be rezoned from R5 to R4A. NYCDCP's proposed rezoning would limit development to single and two-family detached housing in this area. About 75 percent of the lots are currently developed with one- and two-family detached housing. All or portions of lots located just west of Katonah Avenue along 237th and 238th streets are proposed to be rezoned from R4-1 to R5B, extending the existing R5B district to a small area developed primarily with multifamily and attached housing.

On September 12, 2005 the NYCDCP certified the ULURP application (C 060110 ZMX) for the proposed zoning map amendments, beginning the formal public review process. Community Board 12 adopted a resolution recommending approval of the application on October 27, 2005. Subsequently the Borough President, on November 28, 2005, issued a recommendation approving the application. After holding a public hearing on December 7, 2005, the City Planning Commission adopted the resolution on January 11, 2006 (Calendar No. 12), and on February 15, 2006, the City Council adopted the zoning changes which are now in effect.

The NYCDCP is also proposing zoning map changes for thirty-six blocks in the northeast Bronx neighborhood of Olinville in Community District 12. The Olinville rezoning area is located in the southwestern portion of Community District 12, and includes areas between the Bronx River and White Plains Road from East 219th Street to Adee Avenue, together with an area to the south and east of Gun Hill Houses and Evander Childs High School. The proposed zoning would preserve the neighborhood's lower density residential character, while promoting new development consistent with the scale of the surrounding area. Furthermore, NYCDCP is proposing a zoning text amendment to establish a new citywide R5A district to address the unique detached housing stock found within Olinville. ULURP application C 060084 ZMX, together with application N 060083 ZRY for the establishment of the proposed R5A district, was approved by Community Board 12 in September 2005 and the resolution was adopted later approved by the City Planning Commission on November 16, 2005 (Calendar No. 7). On December 8, 2005, the City Council adopted the zoning changes which are now in effect.

In January 2005, The City of New York announced plans to replace industrial parks with Industrial Business Zones (IBZs) in the Bathgate neighborhood of the Bronx located in Community District 15. The Bathgate neighborhood is home to the 21.5 acre Bathgate Industrial Park which contains 11 buildings and covers 12 city blocks. The facility, owned by the Port Authority of New York and New Jersey is home to approximately 120 businesses that employ 1,350 workers and contains 522,000 square feet of space for distribution, light industrial, office and educational uses. The plan prohibits rezoning the area within the IBZ for residential use. The plan also outlines measures for employee training programs for manufacturers and improved sanitation services. The Bathgate IBZ will have the same boundaries as the current Bathgate Industrial Park.

In addition to the Woodlawn, Olinville, and Bathgate projects, other zoning changes anticipated by NYCDEP within in the Bronx River watershed include:

- Loral Project – The Loral project is located in Community District 9 just north of Soundview Park near the intersection of Storey and Colgate Avenues in the Bronx. The 15-acre triangular-shaped area is currently zoned M1-1 and property owners and developers may be interested in rezoning the area, most likely to R-6.
- West Farms Rezoning – Six sites located within Community District 6 containing abandoned spurs of elevated rail track are being investigated for possible rezoning to allow for development in these areas. The total area of all six sites is approximately 1.15 acres.
- Bronx River Arts Center Expansion adjacent to the Bronx River on East Tremont Avenue.

1.3.4. New York City Economic Development Corporation

The New York City Economic Development Corporation (NYCEDC) 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 Bronx River. 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.

Additionally, the NYCEDC serves as a policy instrument for the Mayor's Office and recently issued a white paper on industrial zoning (Office of the Mayor, 2005) intended to create and protect industrial land uses throughout the City. The policy directs the replacement of the current In-Place Industrial Parks (IPIP) with IBZs that more accurately reflect the City's industrial areas. Policies of this nature 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.

In the spring of 2003, a Hunts Point Task Force was created to provide a forum for addressing critical concerns about the Hunts Point peninsula. The Task Force led by the Office of the Deputy Mayor for Economic Development and Rebuilding, which brought in a multi-agency team, including NYCEDC, NYCDCP, New York City Department of Small Business Services (SBS), and New York City Department of Transportation (NYCDOT). Over the course of a year, the group worked together to identify action items that could promote a competitive business environment and sustainable community in Hunts Point. In the fall of 2004, the Task Force put forth the Hunts Point Vision Plan which sets the development framework and implementation timeline for the aforementioned action items. The Vision Plan aims to build upon discrete revitalization efforts on the Hunts Point peninsula and addresses the concerns of the Hunts Point community in a comprehensive and coordinated plan. Short-term goals of the plan include optimizing land use; creating greenway connections along the Bronx River; improving traffic safety and efficiency; and the development of Hunts Point Works that will serve as a new employment and training demonstration project.

The NYCDCP will promote a new land use policy that encourages growth and expansion of the food-related industry while protecting the adjacent neighborhood in an effort to discourage the expansion of waste-related uses in the area. Vacant lots within the Food Distribution Center will be marketed by the NYCEDC to attract new food-distribution/manufacturing companies for the food markets. The City plans to work with the Produce Market to redevelop it into a more environmentally friendly facility, while developing a business education campaign to encourage compliance with environmental standards and regulations. The City will also promote the reuse of vacant, underutilized, or contaminated sites by apprising community and business organizations of Brownfield programs and grant opportunities.

The Hunts Point WPCP, freight rail lines, the Department of Sanitation New York (DSNY) Marine Transfer Station, the prison barge, the Food Distribution Center and other privately owned industrial properties dominate the waterfront in Hunts Point, making it difficult to provide continuous waterfront access. Prior to 2007, the only official access to the waterfront was the Tiffany Street pier. Two new parks opened in 2007 that tripled the amount of legally accessible waterfront in Hunts Point; Barretto Point Park is located at the southern end of Tiffany Street, and Riverside Park is located at the terminus of Lafayette Avenue along the Bronx River. A long range goal of the plan is to provide continuous waterfront access around the entire Hunts Point peninsula. In the short-term, the City has committed to establishing a 30-foot setback for all properties within the food distribution center. Additionally, the City will work with other entities to secure funding in order to create critical access points to the Bronx River. A more long-term goal of the Plan is to establish a full South Bronx Greenway providing continuous access to the waterfront wherever it is feasible. A waterfront consulting team has been created to identify inland and waterfront routes to establish a greenway connection between the Bronx River Greenway and Randall's Island Park. The recently opened Riverside Park provides the southernmost link to the Bronx River Greenway and also includes a kayak launch.

1.3.5. Local Law

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 the 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 construction 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 Section 5 in detail.

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 ensure the highest level of safety for bathers.

1.4. REPORT ORGANIZATION

This report has been organized to clearly describe the proposed WB/WS 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 watershed, collection system, and waterbody 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 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	Section(s) within 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

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2.0 Watershed Characteristics

2.1. HISTORICAL CONTEXT OF WATERSHED URBANIZATION

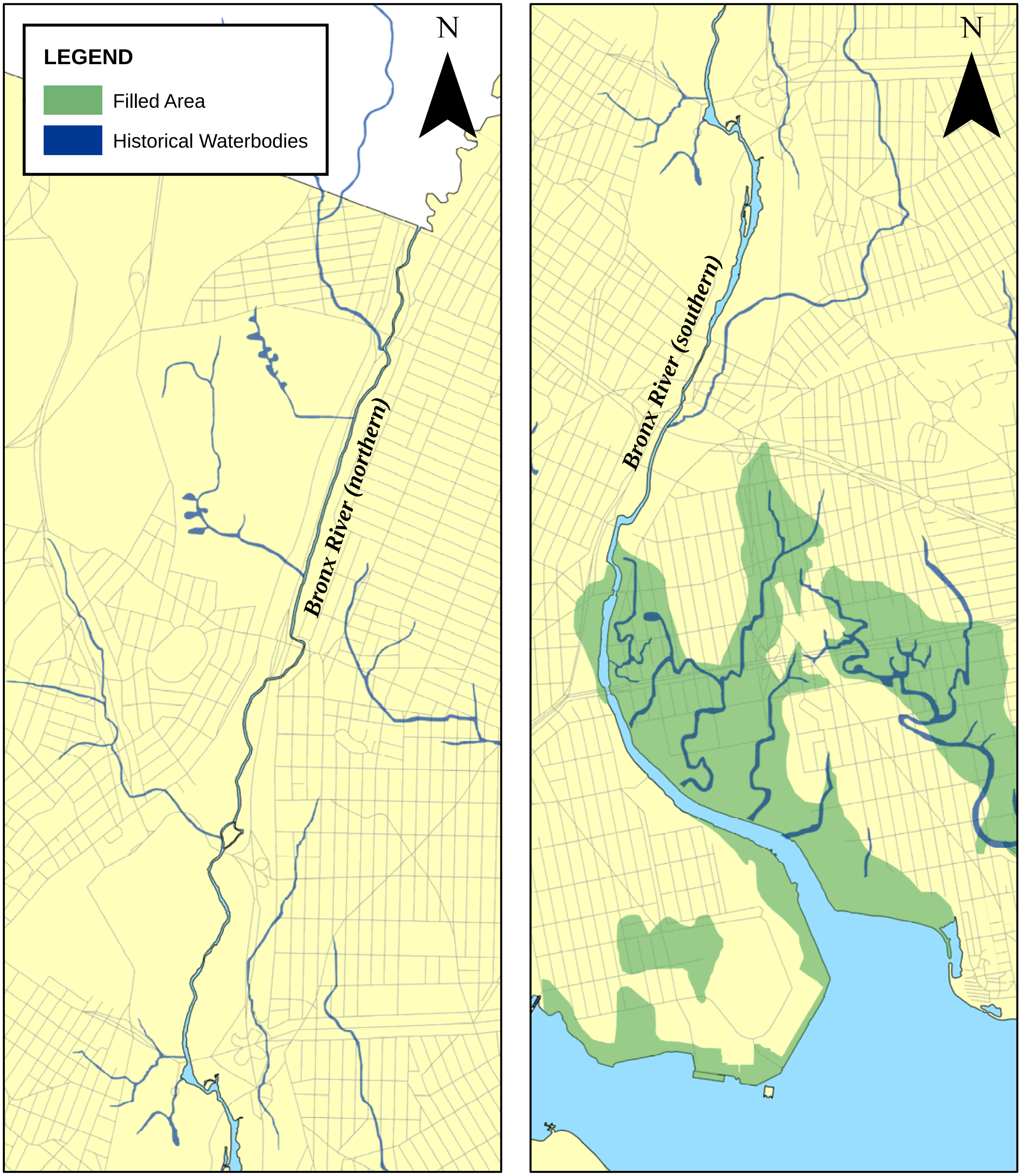
In the 17th Century the Bronx River was referred to as Aquehung or "River of High Bluffs" by the Mohican Indians who were the first to live off of the river. The river also attracted European traders in the 1600s who hunted for beavers that flourished along its banks. Jonas Bronk purchased 500 acres of land surrounding the river in 1639 and the river became known as Bronk's River, which is where the borough of the Bronx derived its name.

At the beginning of the 18th Century, roughly 12 water mills were producing paper, pottery, flour, tapestries, and snuff along the river. Throughout the 1820s and 1830s the New York City board of Aldermen debated ways to tap into the river to supply the growing city with drinking water as it was considered to be "pure and wholesome." Much of the valley remained densely vegetated and forested well into the 19th Century. However, in the 1840s during railroad construction, the valley was turned into an industrial corridor. In 1905, Westchester County constructed the Bronx River Valley Sewer that discharged into the river. Additional modifications were made to the river in 1915 when New York City's demand for water continued to rise and the construction of the Kensico Dam diverted the upper reaches of the river into the reservoir, cutting the river's water flow by approximately 25 percent.

Since the 1880s there has been an effort to reclaim the river and protect it from urbanization. In 1888, the 662-acre Bronx Park was created by consolidation of surrounding properties to buffer against development on both sides of the river. Since then Bronx Park has grown to 718.1 acres. The 15.5-mile Bronx River Parkway was completed in 1925, a collection of lakes, parks, and limited access roadways stretching from Kensico Dam to Bronx Park. Throughout the 1960s and 1970s, city and state highway projects divided neighborhoods in the Bronx. In particular, the construction of the Sheridan Expressway and Cross-Bronx Expressway distanced the Bronx River communities from each other as well as the river.

In 1974, in response to the poor conditions of the Bronx River, local residents formed the Bronx River Restoration Project, Inc. The group was successful in removing debris from the shoreline of the Bronx River. In 1996, the Restoration Project was strengthened with the Bronx Riverkeeper Program that was created in a partnership with the City of New York Department of Parks and Recreation (NYCDPR) and the Consolidated Edison Corporation. The partnership was further strengthened in 1997 with the formation of the Bronx River Working Group who expanded the effort to included 60-plus community groups, government agencies, schools, and businesses. Furthermore, in 2001 the Bronx River Alliance was created to restore and protect the Bronx River, building on the 27-year history of restoration work.

Figure 2-1 illustrates the changes that the lower Bronx River valley has experienced since 1897. The map was created by overlaying a current map of the area over a historic map surveyed in 1897. The figure is representative of filled marshlands, streams, and tributaries that



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Filled Marshlands and Streams Near Bronx River Since 1897

once surrounded the Bronx River. Approximately 950 acres of marshland have been filled in since 1897, primarily near the mouth of the river.

2.2. LAND USE CHARACTERIZATION

The following section describes current land uses and zoning within ¼ mile of the Bronx River, neighborhood and community characteristics, and consistency of land use and zoning with the City's Waterfront Revitalization Program.

2.2.1. Existing Land Use

Land uses for the portion of the Bronx River located within the limits of the City of New York are varied, but can generally be divided into three segments. The southern segment, encompassing lands from the mouth of the river to East 180th Street, includes mostly industrial, parkland and residential areas. This area also contains pockets of commercial, institutional and vacant land scattered along the waterfront. The central segment runs from East 180th Street north to East Gun Hill Road and consists of extensive parkland and small areas of residential, institutional and commercial uses. The northern portion, from East Gun Hill Road to the Westchester County border, contains large tracts of residential areas and parkland.

The west bank of the southern segment, extending from the mouth of the river to Lafayette Avenue, is dominated by industrial and manufacturing uses, including the Hunts Point Food Distribution Center. Between Lafayette Avenue and Bruckner Boulevard, the river is bordered by industrial and vacant land uses. Further west are mostly residential areas interspersed with vacant lots. At the end of Lafayette Avenue is an existing public Bronx River access area that has become a designated park. Immediately north of Lafayette Avenue is a scrap metal yard. Between Bruckner Boulevard and Westchester Avenue there is a long parcel of land that used to be occupied by a cement plant and is now NYCDPR property and recently developed as Concrete Plant Park. Inland of this area is a primarily residential area with several industrial and commercial parcels interspersed. The Amtrak Hellgate Line runs north-south along a portion of the southern segment of the river, crossing the river just north of Westchester Avenue. The Sheridan Expressway parallels the river from Bruckner Boulevard to the Cross Bronx Expressway. From Westchester Avenue to East 180th Street, slightly inland from the river, is a mixture of detached and semi-detached homes, town houses, brownstones and multi-story, multi-family apartment buildings. Straddling the river, between East 172nd Street and Boston Road, is Starlight Park with a school, IS 200, immediately to its west.

The western shore of the mouth of the Bronx River is known as Hunts Point, while the eastern shore is comprised of Clason Point and the Soundview neighborhood. Clason Point contains mostly one, two and three-family homes, vacant parcels and small commercial districts. The Soundview area, which extends from Clason Point to the Bruckner Expressway, contains Soundview Park, with medium density residential uses to the east, including the large, high-rise public housing complex, Soundview Park Homes.

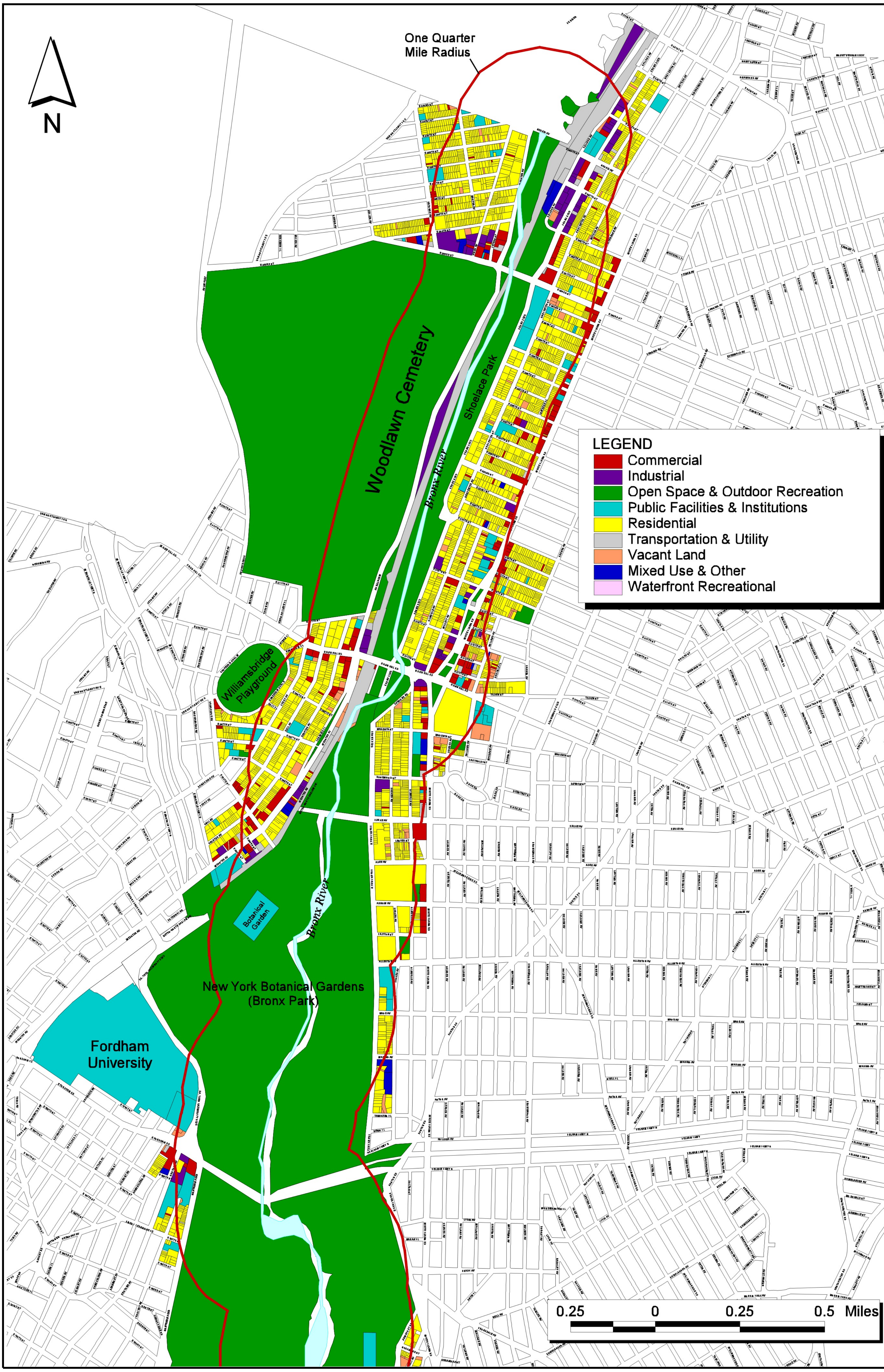
Industrial uses dominate the river's eastern shore from Lafayette Avenue to Westchester Avenue. Westchester Avenue to East 174th Street is largely industrial with commercial uses lining the ends of the blocks. Land use between the Cross Bronx Expressway and East 180th Street is generally evenly distributed among residential, industrial and transportation uses.

The central segment of the Bronx River area is dominated by Bronx Park, which includes the New York Botanical Garden and the Bronx Zoo. Surrounding the west side of the Park, along Southern Boulevard, is a mostly medium density apartment house district, Fordham University and a multi-family residential area. The east side of the Park is bordered by medium density housing, one to two family residential homes and light manufacturing uses along the southern edge of Bronx Park.

Adjacent to the western shore of the northern portion of the Bronx River, the land use is dominated by Woodlawn Cemetery and the Metro-North railroad, which runs parallel to and adjacent to the Bronx River. The area south of Woodlawn Cemetery is primarily residential, but also contains several industrial and commercial tracts and a large park, Williamsbridge Playground. The area immediately north of the cemetery between East 233rd Street and East 234th Street is mostly industrial, with a commercial strip along Webster Avenue. Further north and extending to the Westchester County border are largely residential uses with several institutional uses interspersed.

The east side of the river in this area is predominantly single-family and detached houses with an area of light manufacturing just south of the Westchester County border. In addition, a strip of parkland known as Shoelace Park straddles the river extending from the northern edge of Bronx Park to the Westchester County border. The Bronx River Parkway, which originates north of Soundview Park, runs north along the eastern shore of the River in this area before it crosses the river several times and continues into Westchester County.

Figures 2-2 and 2-3 show generalized land use within a ¼-mile radius of the Bronx River northern and southern section, respectively. The breakdown of land use in the riparian area (¼-mile radius) and the Bronx River drainage area is summarized in Table 2-1. The riparian area land use distribution generally matches the land use in the drainage area as a whole. The riparian area of the freshwater portion of the Bronx River has a larger fraction of parkland than the drainage area as a whole. Similarly, the tidal Bronx River riparian area is more industrial than the drainage basin as a whole.



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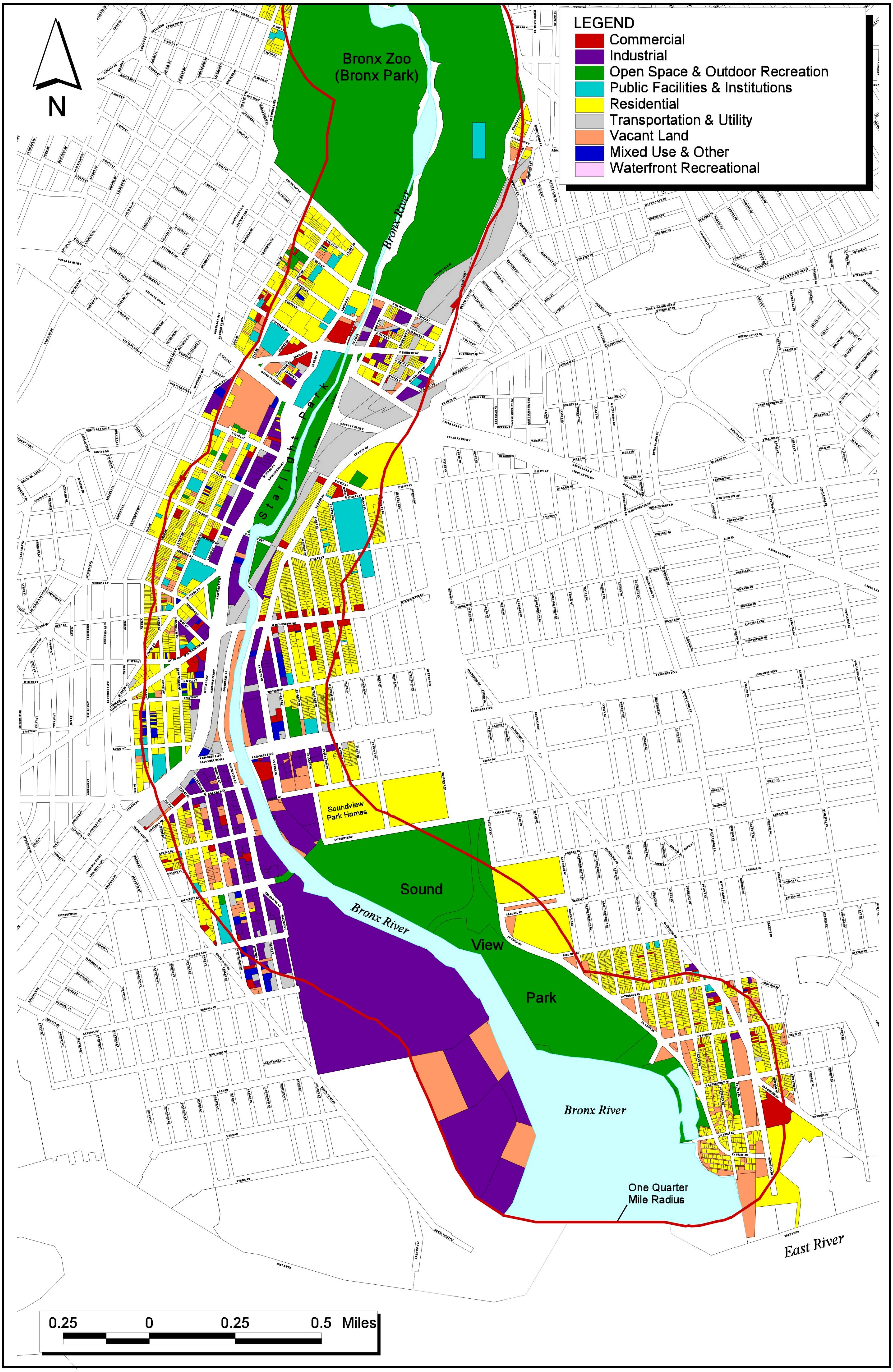
Generalized Land Use Map (1/4-mile radius)
Bronx River Northern Section



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Generalized Land Use Map (1/4-mile radius)
Bronx River, Southern Section

Table 2-1. Bronx River Land Use

River Section/Land Use Category	*FRACTION OF AREA (%)*	
	Riparian Area (¼-mile radius of river)	Drainage Area
Freshwater Bronx River		
Residential	18	31
Park	66	47
Industrial	2	1
Other	14	21
Tidal Bronx River		
Residential	27	23
Park	23	23
Industrial	29	16
Other	21	38

2.2.2. Zoning

The New York City zoning categories include R for General Residential, C for Commercial and M for Manufacturing. Subcategories are those designated by the NYCDCP. Zoning within a quarter mile of the Bronx River is primarily dominated by industrial and residential classifications along the southern reach of the river and parkland and residential zoning to the north. Along the southern portion of the river, an extensive area of industrial zoning is located on the western shore and extends further inland. These industrial areas include areas of M1-1, M2-1 and M3-1, which extend from the mouth of the river northward to Bruckner Expressway. The Hunts Point Market encompasses a large portion of this industrial zoning. Areas of residential zoning comprised primarily of R7-1 and R7A are generally located further west of the waterfront industrially zoned areas. A large area of R7A is located immediately adjacent to the Bronx River between East Bay Avenue to the south and the Cross Bronx Expressway to the north. A small area of R6 zoning is located further west between Spofford and Garrison Avenues. A large area of R7-1 residential zoning is also located west of the R7A zoning area bordering the Bronx River and is located north of the Bruckner Expressway and extending to Bronx Park. Finally an area of C4-2 zoning, a commercial zoning designation, is located along Vyse Avenue between East 174th Street and the Cross Bronx Expressway.

Along the eastern shore of the southern reach of the Bronx River is a large area of R3-2 residential zoning that extends south of Patterson Avenue. North of this area is Soundview Park which extends to Lafayette Avenue. Beyond Soundview Park is an extended area of residential zoning that extends northward to Bronx Park. This includes areas of R5, R7-1 and R7A which are largely located adjacent to the Bronx River with an area of R6 zoning that includes the Soundview Park Houses and is generally located between Lafayette Avenue to the south and the Cross Bronx Expressway to the north. An area of commercial zoning, specifically C4-2 is located along Westchester Avenue.

The central reach of the Bronx River located north of East 180th Street and south of Burke Avenue is comprised almost exclusively of parkland, which encompasses Bronx Park. In addition, an area of R6 zoning is located west of Bronx Park and encompasses Fordham University.

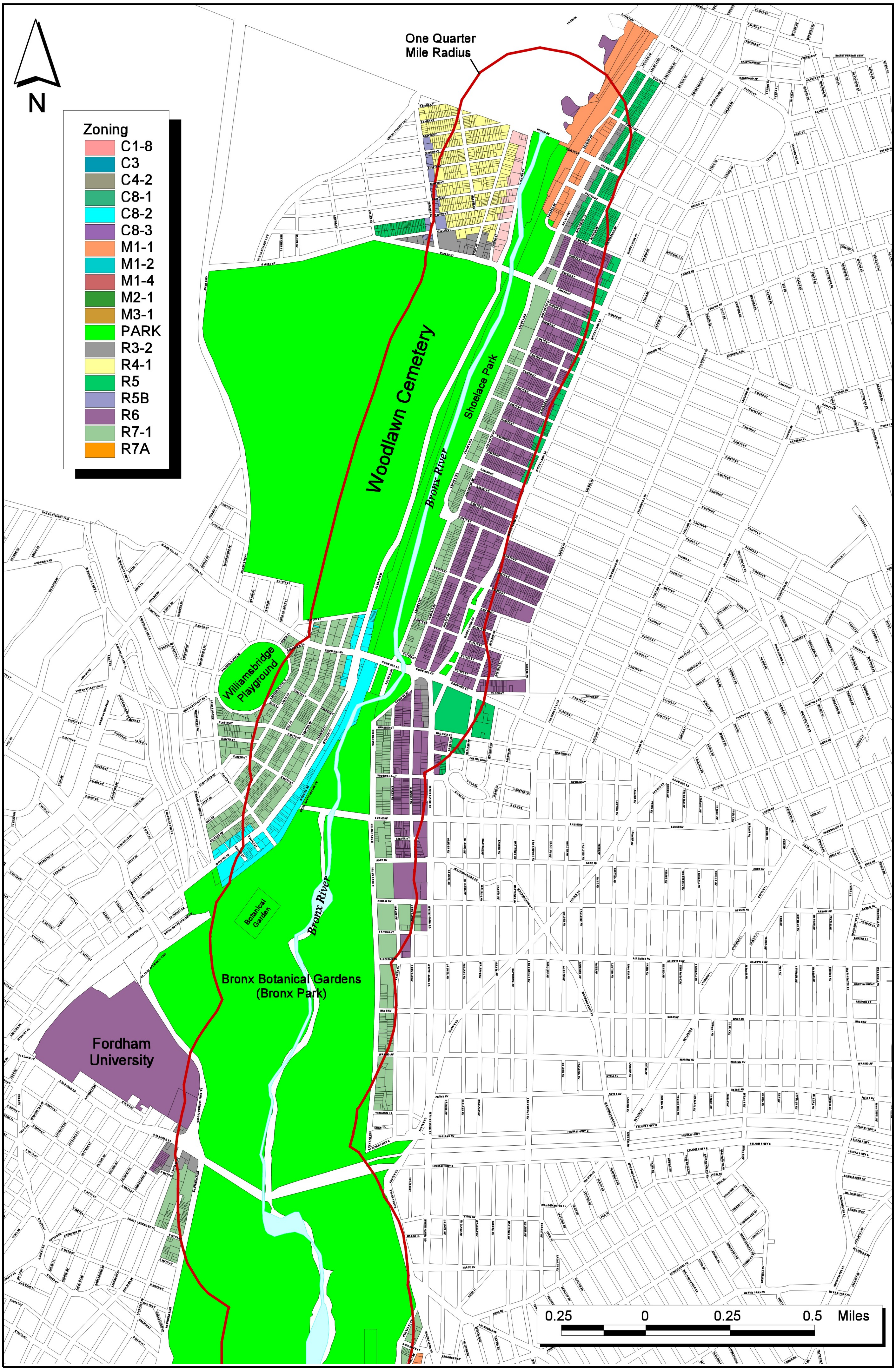
North of Bronx Park, zoning designations within ¼-mile of the Bronx River are dominated primarily by residential designations. Along the western shore the Bronx River, north of Bronx Park is an R7-1 zone. An area of commercial zoning, C8-2, is also located within this area along Webster Avenue. North of this area is a large R6 zone that encompasses Woodlawn Cemetery, which is considered open space. Finally, north of East 233rd Street and extending to the Westchester County line is an additional area of residential zoning. This area includes R4-1, R5B, and R7A residential zones with smaller areas of commercial zoning, primarily C8-1, located along East 233rd Street.

Along the eastern shore of the northern reach of the Bronx River are areas of almost exclusively residential zoning designations. These include areas of R6, R7-1, and R7A residential zoning. Areas of R6 zoning are located immediately adjacent to the eastern shore of the Bronx River, as well as east of Olinville and Carpenter Avenues that extend from Burke Avenue north to Nereid Avenue. These R6 zoned areas bound a strip of R7-1 zoning that is located between East 211th and East 233rd Streets. A small area of R5 residential zoning extends along White Plains Road from East 222nd to 236th Streets. North of 236th Street are areas of R5 and R7A zones. Figures 2-4 and 2-5 show zoning within a ¼-mile radius of the northern and southern section of the Bronx River, respectively.

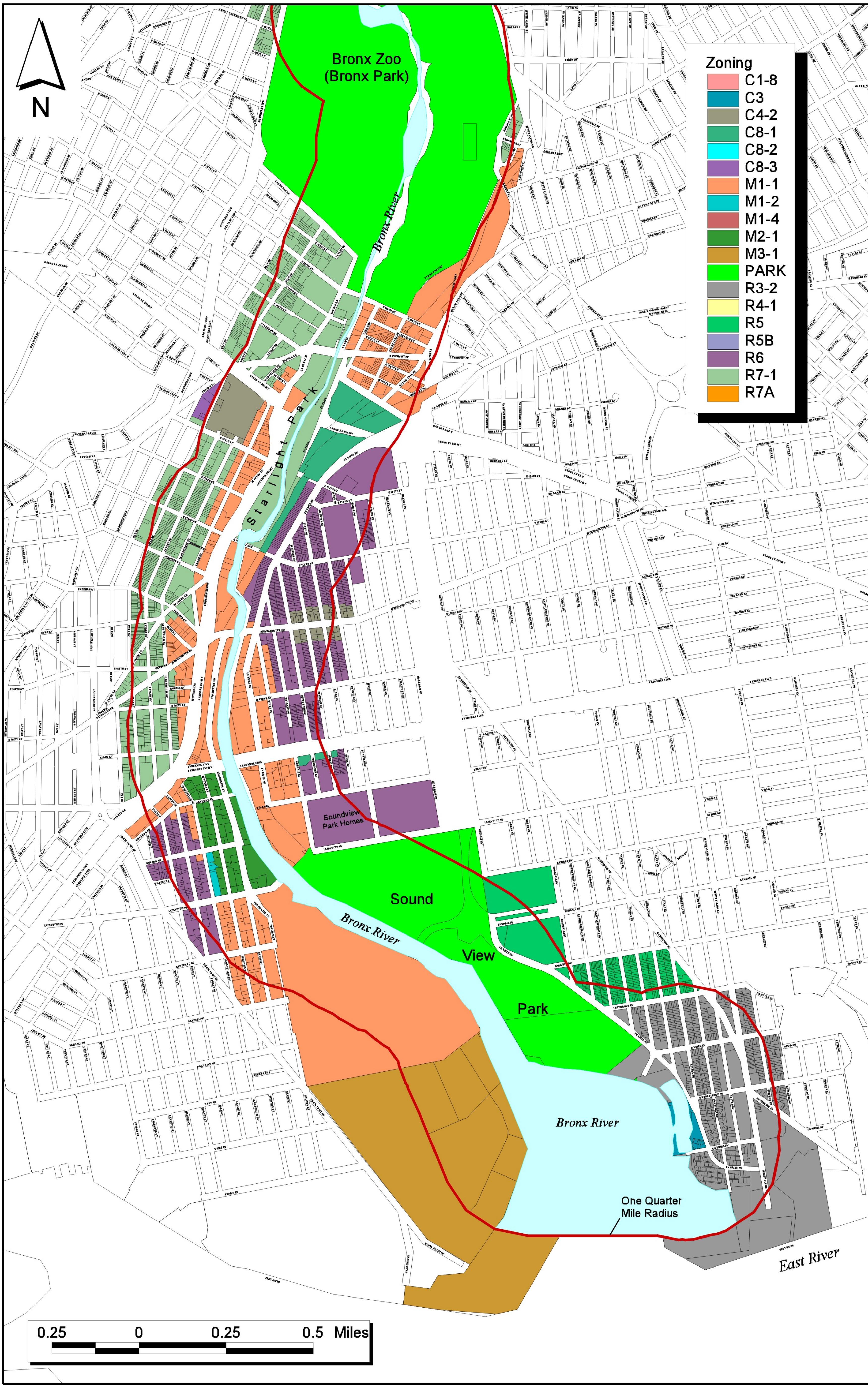
2.2.3. Proposed Land Uses

An assessment of currently proposed land uses (as of report date) or significant new developments was conducted for the Bronx River study area. Land swaps are being contemplated to continue the Bronx River Greenway south of East Tremont Avenue on the eastern shore. Immediately north of E. 174th Street are two parcels involved in the swap. One is owned by the Metropolitan Transportation Authority (MTA), while the other is under their jurisdiction. If the land swap is implemented, ownership of these parcels would be transferred to the NYCDPR. Northwest of these parcels is a 1.3- acre property that would be transferred from the New York State Department of Transportation (NYSDOT) to MTA. Two small parcels just south of East 177th Street, owned by NYCDPR and under MTA jurisdiction, would go to the NYSDOT to map the land as a New York City street.

In addition, the New Horizons shopping center was recently constructed west of the Bronx River. The site is situated on 10 acres and bounded by the Cross Bronx Expressway, Boone Avenue, East 174th Street and Vyse Avenue. A block away, 94,000 square feet of City-owned land was sold to develop a new retail/entertainment complex by CBC Associates, LLC. The site consists of two parcels of land south of the intersection of the Cross-Bronx Expressway, Boston Road and Southern Boulevard. The Hunts Point Riverside Park on the west bank of the Bronx River at the end of Lafayette Avenue underwent ULURP review and became a designated park in summer 2007. No other significant new land uses within a ¼-mile of the Bronx River were noted.



Zoning Map (1/4-mile radius)
Bronx River, Northern Section



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Zoning Map (1/4-mile radius)
Bronx River, Southern Section

2.2.4. Neighborhood and Community Character

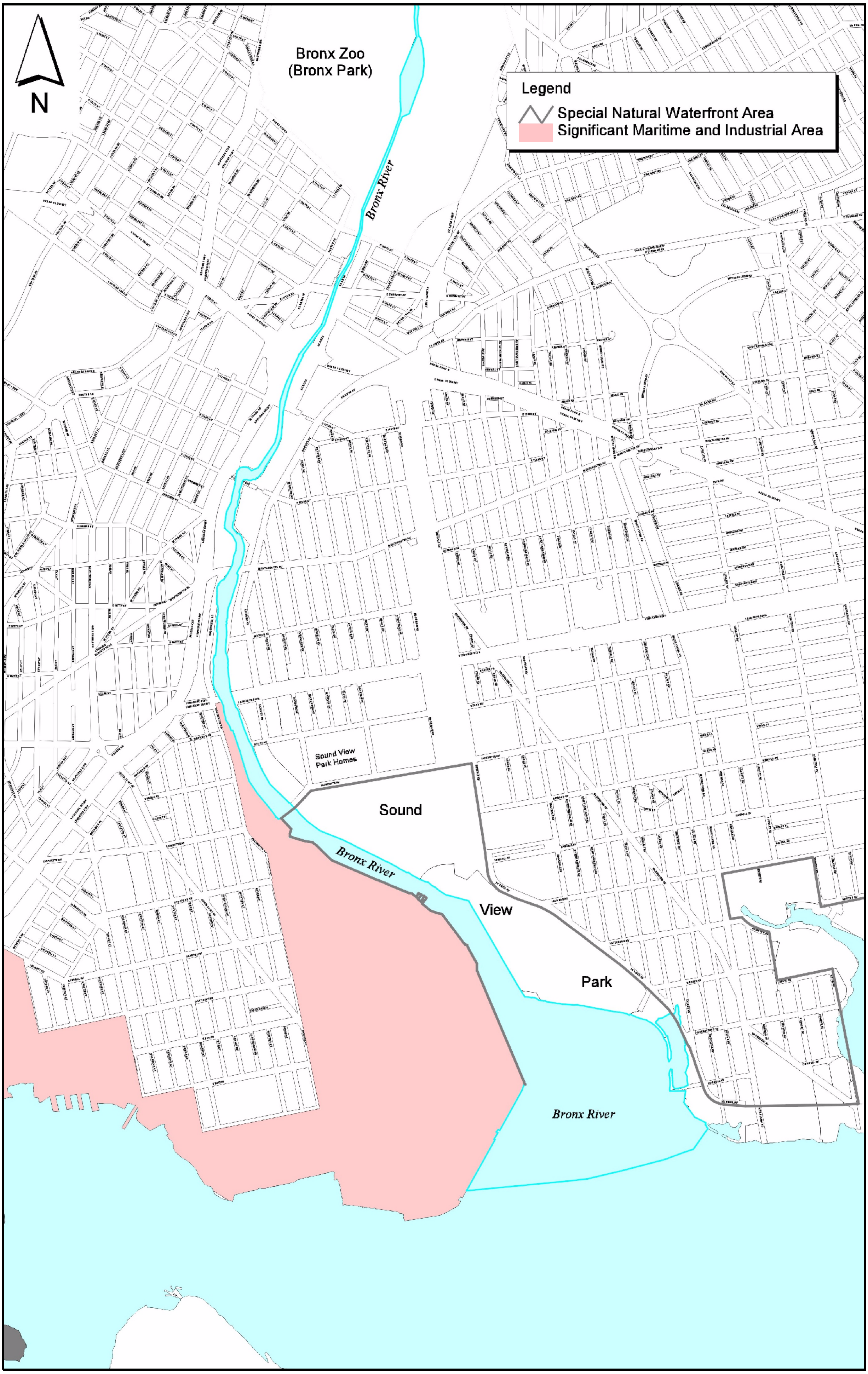
Neighborhood and community character immediately surrounding the Bronx River is dominated by industry to the south and residential and parkland in the central and northern segments. The Hunts Point Food Market and other industrial uses, such as scrap metal yards, occupy the western bank of the southern segment of the river south of Bruckner Boulevard. These uses are primarily comprised of warehouse structures of no more than one to three floors. Waterfront access is extremely limited in this stretch. The exception is the Hunts Point Riverside Park at Lafayette Avenue and the recently opened Concrete Plant Park on the western shore of the Bronx River between Bruckner Boulevard and Westchester Avenue. The NYCDPR has converted these areas into parkland. North of this area, between Bruckner Boulevard and East 180th Street, are detached and semi-detached homes, townhouses, brownstones and taller multi-family apartment buildings. Starlight Park, extending from approximately East 172nd Street to East Tremont Avenue, has opportunities for both passive and active recreation. It contains benches along trails, baseball/softball fields and basketball courts.

The eastern shore of the southern segment is mostly comprised of one, two and three-family homes, interspersed with vacant areas and commercial uses. Soundview Park contains large tracts of vegetated areas, along with baseball, football and soccer fields. The residential areas north of the Park consists of detached and semi-detached homes, townhouses, brownstones and multi-story apartment buildings. The Amtrak rail line holds a prominent place along the Bronx River. The rail line parallels and is adjacent to the river from approximately the Cross Bronx Expressway to Bruckner Boulevard.

Bronx Park contains many recreational opportunities including bike trails, nature trails, tennis courts and baseball fields, along with the educational programs that abound in the zoo and gardens. Fordham University, which draws students from many localities, borders the southwestern edge of the Botanical Garden. The residential areas between the University and Woodlawn Cemetery are mostly multi-family homes, while the eastern shore is single-family and detached houses. Shoelace Park runs along the eastern shore of the cemetery. The northern segment is much quieter in terms of industry than the southern areas, but does have light manufacturing uses located along both shores immediately south of the Westchester County border.

2.2.5. Consistency with the Waterfront Revitalization Program

The NYCDCP WRP has designated the western shoreline at the mouth of the Bronx River as a Significant Maritime Industrial Area (SMIA) and the eastern shoreline and the waterbody itself as a Special Natural Waterfront Area (SNWA). The SMIA is located along the western shore of the Bronx River. It extends along the East River and continues northward from Hunts Point to Bruckner Boulevard. The SNWA is primarily located along the mouth of the Bronx River and encompasses Soundview Park, the adjacent eastern and western shores and the mouth of the river. The SNWA continues south and east of Soundview Park and extends to Clason Point and points further east. Figure 2-6 shows the location of Bronx River areas designated as SMIA and SNWA.



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Significant Maritime and Industrial Area and Special Natural Waterfront Area Southern Bronx River

The current land uses, as of this report date, previously discussed for the Bronx River are generally consistent with the intent and goals of the WRP and the recommendations made in the "Plan for the Bronx Waterfront," the "New York City Comprehensive Waterfront Plan" and the "Greenway Master Plan: Soundview Park to Ferry Point Park." Plans include continuing efforts to restore natural conditions along the river and finishing the West Farms link of the Bronx River Trailway, both of which would be consistent with the WRP, CWP, the "Plan for the Bronx Waterfront" and the "Greenway Master Plan: Soundview Park to Ferry Point Park." In addition, shoreline and habitat environmental restoration efforts are being funded in part by grants from the National Oceanic and Atmospheric Administration (NOAA), USEPA and New York State Clean Water/Clean Air Bond Act. Development occurring north of Bruckner Boulevard is located outside the limits of the SNWA and the SMIA, and is not in conflict with the WRP, CWP, the "Plan for the Bronx Waterfront" or the Greenway Master Plan.

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 have the potential to affect water quality in the Bronx River. The extent of the study area was generally limited to the area in the immediate proximity of the Bronx River, typically within one block of the waterbody. For the purposes of this assessment, potential sources included the existence of underground storage tanks (UST), major oil storage facilities (MOSF), known contaminant spills, 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 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, Site Spill Identifier List (SPIL) and the National Priorities List (NPL). In addition to these federal databases, several databases managed by the 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 Corridor Study report was performed for areas immediately adjacent to the river and up to the nearest adjacent mapped street. This EDR report was primarily reviewed to provide additional information with regard to USTs, leaking storage tanks (LTANKS) and MOSFs.

Based upon a review of the USEPA databases, no known superfund sites or CERCLIS sites are located in the immediate vicinity of the Bronx River. RCRA databases indicate that there is one large quantity generator and 32 small quantity generators located in proximity to the Bronx River. The large quantity generator is Elco Processors Inc. located on Lafayette Avenue approximately 0.15 miles from the Bronx River. Under RCRA, large quantity generator produces over 1000 kilograms of hazardous waste or over 1 kilogram of acutely hazardous waste per month, while small quantity generators produce between 100 kilograms and 1000 kilograms of waste per month. RCRA sites in proximity to the Bronx River are listed in Table 2-2. As indicated in Table 2-2, there are three manholes listed as small quantity generators. According to available information, these manholes are access points to utilities as opposed to sewers.

Table 2-2. RCRA Sites Located Near the Bronx River (January 2006)

Site Name	**Address**
RCRA Large Quantity Generators	
Elco Processors Inc.	1399 Lafayette Avenue
RCRA Small Quantity Generators	
Empire Metal Box Co. Inc.	4338 Bullard Avenue
Muller USARC	555 East 238th Street
Great Bronx Auto Repair Inc.	3530 Webster Avenue
New York Botanical Gardens	Southern Boulevard and 200th Street
Clean Bright Process Co. Inc.	1899 West Farms Road
Public School I.S. 167	1970 West Farms Road
Boston Cleaners	2040 Boston Road
NYCDP&R Bronx River Greenway	Edgewater Road and Lafayette Avenue
Lois O. Beedee & Sons Inc.	1399 Lafayette Avenue
General Galvanizing & Supply Co. Inc.	810 Edgewater Road
Dexter Chemical LLC	845 Edgewater Road
Lockheed Martin Electronic Defense System	825 Bronx River Avenue
Abes Truck Repair Shop Inc.	900 Edgewater Road
911 Story Avenue	911 Story Avenue
U-Haul Center	1365 Bruckner Boulevard
Hamilton Sterling Corp.	1140 Bronx River Road
B S Auto Parts	1170 Bronx River Avenue
Getty Petroleum Corp.	1185 Bronx River Avenue
NYCDOT	Westchester Avenue Overpass
West Side Neon Inc.	1209 Bronx River Avenue
Hunts Point Auto Wreckers	1480 Sheridan Expressway
NYC Department of Sanitation- J. Schiavone	1661 West Farms Road
NYCDOT Bridges Bin 2066720	East 174th Street Bridge over Sheridan
NYC Economic Development Corp.	600-A Food Center Drive
National Foods	600 Food Center Drive
MTA NYCT	1142 Bronx River Avenue
NYC Department of Environmental Protection	615 Bullard Avenue
NYCDOT Bridge Bin 1067150	Nereid Avenue Bridge Over Bronx River
NYCT- East Tremont Station 2&5 Lines	East Treamont Street & Boston Post Road
Manhole Con Ed 27320	East 216th Street and Bronx Boulevard
Manhole 28802	East Bay Avenue and Halleck Street
Manhole 11155	S/E/C East Gun Hill Road and White

Review of the NYSDEC SPILL databases indicated that there were 51 spills that have occurred within a one-block radius of the Bronx River within the past 15 years. Of these 51 spills, only seven cases remained open as of August 2005. These sites are listed in Table 2-3. The majority of these spills affected soil; however, contamination to other medium was also noted. The largest of the open spills (NYSDEC Spill No. 9013329) occurred at Morris Park and East 180th Street, approximately 0.15 miles from the Bronx River. This spill, which occurred in 1995, resulted in the release of 2,000 gallons of dielectric fluid into the soil.

Table 2-3. NYSDEC Open Spills through August 2005 in the Vicinity of the Bronx River

Location	Date	Spill Number	Quantity	Material	Resource Affected	Spill Cause
591 East 236th Street	04/07/99	9900245	< 1 gallon	#2 Fuel Oil	Soil	Unknown
Drum Run- Parking Lane 1321 Bronx River Ave.	07/29/05	0505211	< 1 gallon	Waste Oil/ Used Oil	Soil	Abandoned Drums
Underground Transformer 1565 West Farms Road	01/30/98	9712148	525 gallons	Unknown	Sewer	Unknown
Bronx East 03A DOS-DDC 1661 West Farms Road	11/20/98	9810571	< 1 gallon	Diesel	Soil	Equipment Failure
Bronx East 03A DOS-DDC 1661 West Farms Road	02/02/01	0011836	50 gallon	Unknown Petroleum	Soil	Equipment Failure
V#4027 Treamont Avenue & Bronx Park Avenue	06/16/05	0503203	1 Gallon	Dielectric Fluid	Soil	Equipment Failure
Morris Park & East 180th Street	05/04/95	9013329	2000 Gallons	Dielectric Fluid	Soil	Equipment Failure

The NYSDEC Petroleum Bulk Storage Database identified several USTs in the immediate vicinity of the river. According to a review of the database, there are a total of 19 UST sites in proximity to the river. These sites contain USTs that are in-service or closed. The storage capacity of the USTs ranged from 350 to 20,000 gallons. These USTs store a variety of materials, including leaded or unleaded gasoline; diesel; No. 1, 2, 4, 5 and/or 6 fuel oil; or other materials. The UST sites are identified in Table 2-4.

Table 2-4. Underground Storage Tanks (UST) In Proximity to the Bronx River (August 2005)

Site	Address	Tank Capacity (Gallons)	Product Stored	Number of Tanks	Status
Our Lady of Mercy Medical Center	600 East 233rd Street	20,000 2,000 350	#5 or 6 Fuel Oil #1, 2, or 4 Fuel Oil #1, 2, or 4 Fuel Oil	2 1 1	In Service In Service Tank Converted to Non-Regulated Use
44220 Bronx	4220 Bronx	4,000	Unleaded Gasoline	2	In Service

Site	Address	Tank Capacity (Gallons)	Product Stored	Number of Tanks	Status
Boulevard Land Corp.	Boulevard	550	Unleaded Gasoline	3	Closed, Removed
Dallacco Service Center	4219 Webster Avenue	550 550	Leaded Gasoline Unleaded Gasoline	4 1	In Service In Service
Valente Gravel	Box 56 Road 5	4,000 5,000 4,000 2,000 1,000	Diesel Diesel Leaded Gasoline Unleaded Gasoline Other	1 1 1 1 1	Closed Closed Closed Closed, Removed Closed
3908 Bronx Boulevard	3908 Bronx Boulevard	7,500	#5 or 6 Fuel Oil	1	In Service
Walts Auto Repair	3530 Webster Avenue	5,500	#1, 2, or 4 Fuel Oil	1	In Service
Fordham Prep. School	East Fordham Road and Southern Boulevard	20,000	#1, 2, or 4 Fuel Oil	1	Closed, Removed
General Galvanizing & Supply	810 Edgewater Road	1,500	# 1, 2 or 4 Fuel Oil	1	In Service
Dexter Chemical Corp.	819 Edgewater Road	5,000	# 1, 2 or 4 Fuel Oil	1	Closed, In Place
Dexter Chemical Corp.	845 Edgewater Road	2,500 2,000 1,500 500	Other Other Other Diesel	1 1 1 2	Closed, Removed Closed, Removed Closed, Removed Closed, Removed
Bronx Iron & Metals Corp.	850 Edgewater Road	500	Unleaded Gasoline	1	Closed
886 Edgewater Avenue Corp.	886 Edgewater Road	4,000	Diesel	1	Closed, Removed
U-Haul Co.	1365 Bruckner Blvd.	550	Unleaded Gasoline	5	Closed
1150 Bronx River Avenue	1150 Bronx River Avenue	2,000	# 1, 2 or 4 Fuel Oil	1	Closed, In Place
Getty Service Station #268	1185 Bronx River Avenue	4,000 550	Unleaded Gasoline Unleaded Gasoline	1 4	In Service Closed, Removed
Getty Service Station #329	1441 Westchester Avenue	4,000 550	Unleaded Gasoline Unleaded Gasoline	4 1	In Service Closed, Removed
B & Proswky Service Station	1476 Edgewater Road	550 550	Leaded Gasoline Unleaded Gasoline	1 4	In Service In Service
Bronx 3A	1661 West Farms Road	1,000 1,000 2,000	Empty Empty Diesel	1 1 1	Closed, Removed Closed, In Place Closed, Removed
National Foods	600 Food Center Drive	6,000 2,000 4,000 4,000	#1, 2 or 4 Fuel Oil Unleaded Gasoline Unleaded Gasoline Diesel	1 1 1 1	Closed, Removed Closed, Removed Closed, Removed Closed, Removed

The LTANKS database, provided by EDR, identified 19 leaking storage tank sites in proximity to the Bronx River. The LTANKS list identifies leaking underground storage tanks or leaking above ground storage tanks. The 19 tanks were reported to leak No. 2 fuel oil, unknown petroleum, gasoline or diesel. These leaks were caused by tank test failures or tank failures. Of the 19 reported leaks identified, four remained open as of October 2005. Table 2-5 summarizes the four leaks that are still being investigated by the NYSDEC. Based on a review of available information, no other open spills were reported in the study area.

The results of a search of additional available environmental records indicated that there are no brownfield sites, MOSFs, Inactive Hazardous Waste Disposal sites, or New York State SPDES sites located within a one-block proximity of the Bronx River. A review of the databases and available information discussed above indicates that none of these potential sources of contamination are associated with existing or previous combined overflows.

Table 2-5. Open LUST sites in proximity to the Bronx River (August 2005)

Location	Date	NYSDEC Spill Number	Quantity Released	Material Spilled	Cause
1391 Lafayette Street	05/31/02	0202194	< 1 gallon	#2 Fuel Oil	Tank Failure
U-Haul 1365 Bruckner Boulevard	09/08/94	9407671	< 1 gallon	Unknown Petroleum	Tank Failure
Getty Service Station 1185 Bronx River Avenue	11/04/92	9209035	< 1 gallon	Gasoline	Tank Test Failure
Hunts Pt Auto Wreckers 1480 Sheridan Expressway	06/03/97	9702732	< 1 gallon	Diesel	Tank Failure

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3.0 Existing Sewer System Facilities

The NYCDEP operates and maintains 14 WPCPs. The communities surrounding Bronx River are served by the Hunts Point combined sewer system and WPCP. The Hunts Point combined sewer system covers 16,664 acres and serves a population of approximately 600,000 in the Bronx, New York.

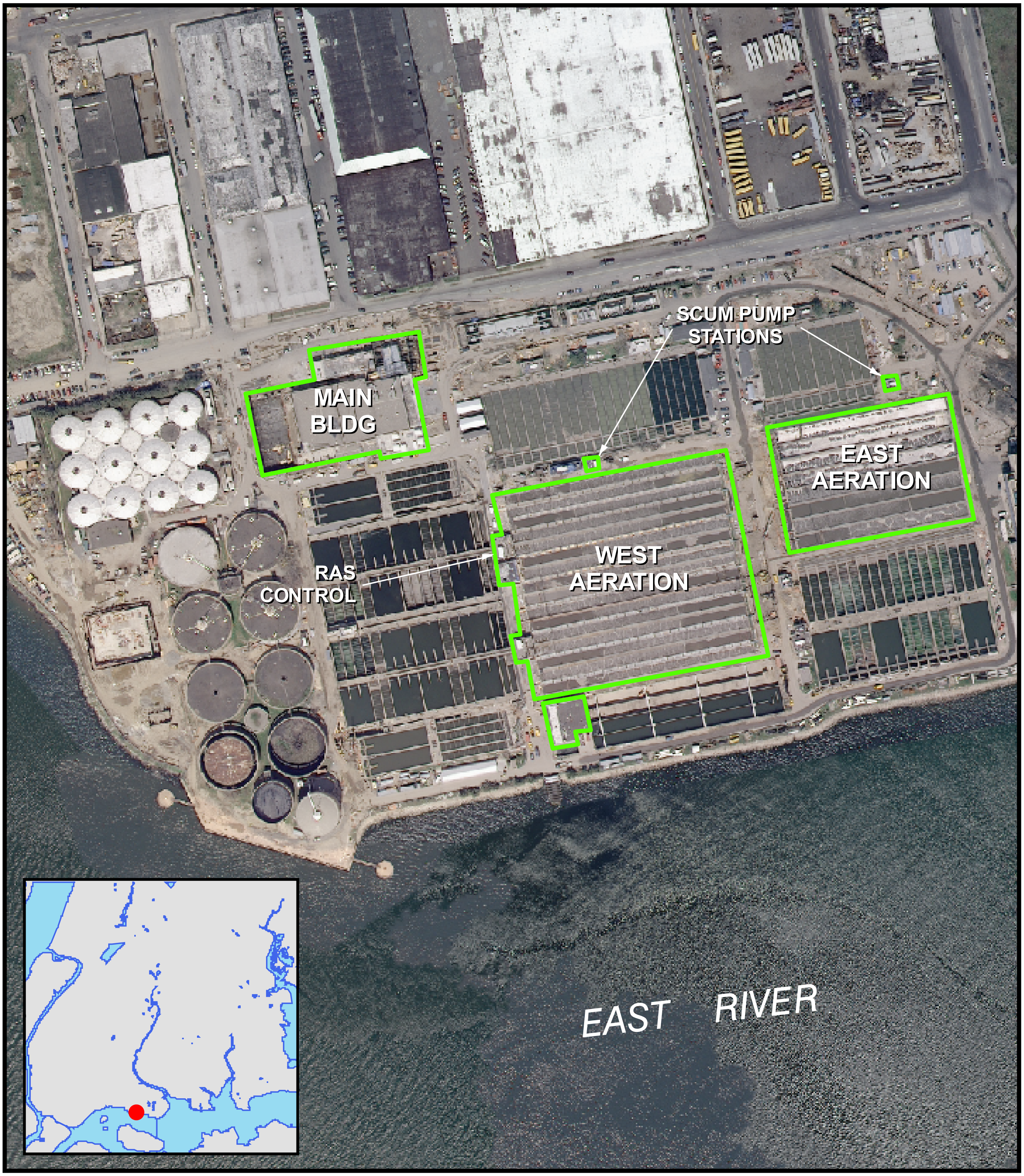
The following sections provide specific information on the configuration of the existing systems.

3.1. HUNTS POINT WPCP

The Hunts Point WPCP is permitted by the NYSDEC under SPDES permit number NY-0026191. The facility is located at 1270 Ryawa Avenue, Bronx, NY, in the Hunts Point section of the Bronx, on a 45 acre site adjacent to the Upper East River located between Halleck Street and Manida Street. The Hunts Point WPCP serves an area of 16,664 acres in the East Side of the Bronx, including the communities of City Island, Throgs Neck, Edgewater Park, Schuylerville, Country Club, Pelham Bay, Westchester Square, Clason Point, Castle Hill, Union Port, Soundview, Parkchester, Van Nest, Co-op City, Morris Park, Pelham Parkway, Pelham Gardens, Baychester, Olinville, Willimasbridge, Edenwald, Eastchester, Hunts Point, Woodlawn, Wakefield, East Tremont, West Farms, and Longwood. The total sewer length, including sanitary, combined, and interceptor sewers, that feeds into the Hunts Point WPCP is 424 miles. Figure 3-1 provides an aerial site plan of the Hunts Point WPCP.

The Hunts Point WPCP has been providing full secondary treatment since 1978. 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 3-2). The Hunts Point WPCP has a design dry weather flow (DDWF) capacity of 200 million gallons per day (MGD), and is designed to receive a maximum flow of 400 MGD (2×DDWF) with up to 260 MGD receiving secondary treatment, (1.3 times DDWF to protect BNR control processes). Flows over 260 MGD receive primary treatment and disinfection. During 2008, the Hunts Point WPCP processed a daily average flow of 132.2 MGD and a dry weather flow average of 119.5 MGD. Table 3-1 summarizes the Hunts Point WPCP permit limits.

The Hunts Point plant began operation in 1952, with a design average flow capacity of 120 MGD. The plant was expanded in capacity in 1962 to 150 MGD, and again in the 1970s to its current design average dry weather flow capacity of 200 MGD. The upgraded plant was designed to provide primary treatment and chlorination to a wet weather peak flow of twice design average dry weather flow (400 MGD) and secondary treatment to 1.5 times average dry weather flow. In the 1990s, a sludge dewatering building was constructed at the plant under the City-Wide Sludge Management System. In December 1999, construction was completed for Basic Step Feed Biological Nitrogen Removal (BNR) retrofit at Hunts Point. This included the installation of baffles in each pass of the aeration tanks to create anoxic zones, submersible mixers in each anoxic zone to prevent solids settling, and froth-control chlorine spray hoods for



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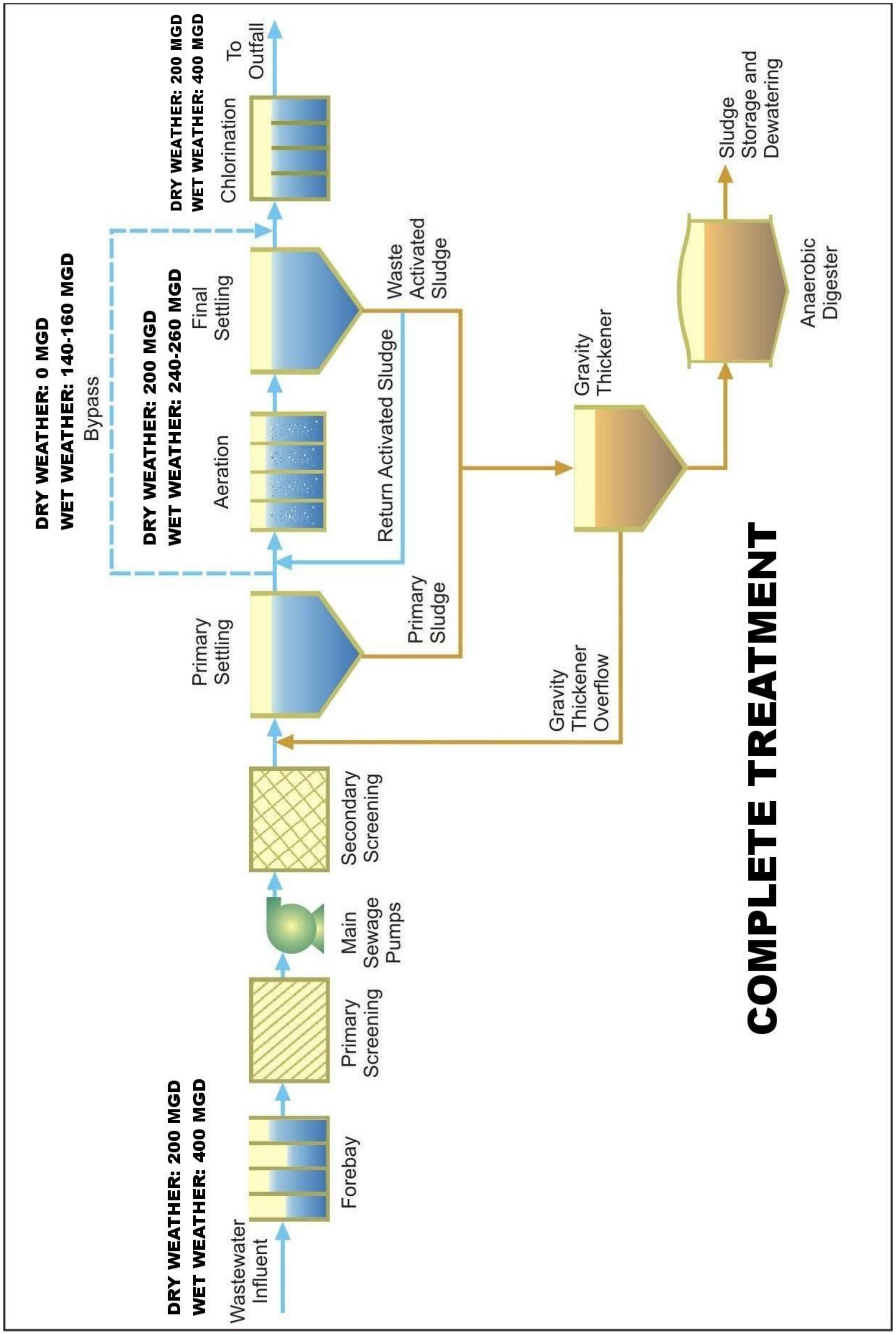
Hunts Point WPCP Aerial Photo and Layout

FIGURE 3-1



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Hunts Point WPCP Process Flow Diagram After Phase II BNR

filament suppression. Currently, the Hunts Point WPCP is undergoing construction to rehabilitate and upgrade its facilities to provide stable BNR operation. The original Nitrogen Consent Order called for the Phase II BNR upgrade to be completed by June 30, 2007. The Modified Phase I BNR Facility Plan calls for the Phase II upgrade to be completed by June 30, 2008. DEP did not meet this revised milestone and requested an additional extension of 20 months to March 2010.

Table 3-1. Select Hunts Point WPCP Effluent Permit Limits

Parameter	Basis	Value	Units
Flow	DDWF Maximum secondary treatment Maximum primary treatment	200 300 (1) 400	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	108,375 (2)	lb/day

Notes: (1) As recommended in the WWOP max. secondary flow should be 260 MGD upon completion of Phase II BNR upgrades to maintain biological nitrogen removal.
(2) Nitrogen limit for the Combined East River Management zone, calculated as the sum of the discharges from the four Upper East River WPCPs (Bowery Bay, Hunts Point, Wards Island, Tallman Island) and one quarter of the discharges from the 2 Lower East River WPCPs (Newtown Creek, Red Hook). This limit is effective through November 2009, then decreases stepwise until the limit of 44,325 lb/day takes effect in 2017.

3.1.1. Hunts Point WPCP Process Information

Figure 3-2 shows the current process treatment for the Hunts Point WPCP. Flow is conveyed to the Hunts Point WPCP via a 12-foot by 10-foot interceptor. The forebay gate chamber has recently been constructed, as part of the Phase I Modified BNR Facility Plan. It is located at the terminus of the 12-foot by 10-foot interceptor, approximately 50 feet north of the screening building. The hydraulically operated 10-foot by 9-foot roller gate is intended to be used to regulate flow from the interceptor. The forebay gate chamber is connected to the screening forebay by an influent conduit that splits into four screen channel influent conduits. The intent is for the high velocities from under the roller gate during wet weather throttling to be dissipated within the influent conduit, prior to entry to the screenings channels. At the entrance to the screen chamber, there is a set of stop log grooves in each channel that can isolate the flow to the screen channel in the event that repair work downstream becomes necessary.

Four screening channels connect the screenings forebay to the afterbay. Each screening channel has a 60-inch by 84-inch hydraulically operated influent sluice gate and an effluent sluice gate that can isolate the channel when the screen is not needed or in the event that screen or channel repair work becomes necessary.

The new screens are 6-feet wide with 1-inch openings and are cleaned with a vertical traveling rake. Each screen is designed to handle 133 MGD. Three screens are required for two times DDWF of 400 MGD, resulting in a plant rating of N+1 for primary screening capacity

("N" is the number of screens operated with "1" screen on standby and/or under repair). The primary screens were installed in 2004 as part of the Phase I upgrade project.

There are six new vertical, centrifugal, mixed-flow, bottom suction, flooded suction main sewage pumps. The pumps are rated at 98.6 MGD each, at a total dynamic head of 32.5 feet, at a speed of 360 revolutions per minute (RPM). The pumps are driven by 800 horsepower (HP), 360 RPM, vertical, close coupled, variable frequency drive motors. With a two times DDWF of 400 MGD, the plant pumping capacity rating is N+1+1, where four pumps are operated ("N" being the number of pumps operating with one in standby or brought in as needed, and one under repair or out of service). The pumps were installed in 2004 as part of the Phase I upgrade project and became fully operational in late October 2004.

Each pump draws flow from one of the two pump suction channels that are connected to the screening chamber afterbay. The cast-in-place pump suction conduit is 49 inches in diameter. Discharge from each pump is via a 42-inch line that includes a cone check valve. Each pump discharge line terminates in a separate enclosed discharge chamber. Each discharge chamber is connected to the secondary screen forebay with an opening that has a sluice gate and stop log channels.

There are five new secondary screens with 1/2-inch bar openings and vertical traveling rakes. The secondary screens were installed in 2004 as part of the Phase I upgrade project. Each screen is designed to handle 100 MGD. Four screens are required for two times DDWF of 400 MGD, resulting in a plant rating of N+1 for secondary screening capacity. There are two secondary screen bypass channels that are used to bypass some of the flow, if some of the secondary screens are out of service or become blinded with screenings.

Effluent from the secondary screens afterbay is conveyed through an effluent conduit and venturi meter to the primary settling tanks. The distribution structure divides the flow to three conduits to the primary settling tanks. There are six primary settling tanks with a total volume of 9.4 million gallons (MG) and a surface overflow rate of 1,914 gallons per day per square foot (gpd/sf) at average design flow.

Primary tank effluent is conveyed to the aeration tanks via a primary effluent channel. 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 260 MGD. The bypass channel hydraulic capacity is estimated to be 140 MGD.

Five 4-pass aeration tanks provide biological treatment and one aeration tank provides centrate nitrification. The total aeration tank volume is 27.9 MG and five 42,000 standard cubic feet per minute (scfm) blowers provide air through ceramic tube diffusers.

Aeration tank effluent is conveyed to the final settling tanks via an aeration tank effluent channel. There are 30 final settling tanks where solids are settled. The total volume of the final settling tanks is 25.8 MG with a surface overflow rate of 760 gpd/sf at average design flow.

Final settling tank effluent is conveyed to the two chlorine contact tanks via a final settling tank effluent channel. The two tanks have a total volume of 4.4 MG and a detention time of 16 minutes when both tanks are in service at wet weather peak flow (400 MGD). Chlorinated effluent is discharged to the East River via an outfall.

Primary sludge is degritted in cyclones and mixed with waste activated sludge. The combined mixed sludge is thickened in twelve 65-foot diameter gravity thickeners. Each thickening tank unit has a 10-foot side water depth (SWD) and a total surface area of 39,800 square feet. The gravity thickener overflow is returned upstream of the venturi meter, with effluent from the secondary screens, and the thickened sludge is sent to the anaerobic digesters. Sludge digestion is accomplished in four 118-foot diameter digestion tanks arranged so that all four tanks are run as primary digesters with a total volume of 11 MG. Five sludge storage tanks provide 9.2 MG for the storage of digested sludge. Digested sludge is dewatered via 13 centrifuges on site in preparation for final disposal and the centrate is recycled through the plant. Sludge cake, grit, scum, and screenings are removed from the plant by truck for disposal to an off-site facility

3.1.2. Hunts Point WPCP Wet Weather Operating Plan

The NYCDEP is required by its SPDES permit to maximize the treatment of combined sewage at the Hunts Point WPCP. The NYSDEC has approved the WWOP, which limits flow to 300 MGD through the secondary treatment processes and up to 260 MGD upon completion of Phase II BNR upgrades in March 2010. The Biological Nutrient Removal BNR process is more sensitive to flow variation than the conventional activated sludge process, thus there is a greater need to limit the flows through the BNR tanks to protect the BNR biology. This allowance permits the plant to remove a much greater amount of ammonia and nitrate, pollutants that impact fish populations in natural waterbodies. Further, to maximize combined sewage treatment, the SPDES permit requires flows of up to 400 MGD to be processed through all processes of the WPCP except in the aeration basins and final sedimentation tanks.

NYSDEC required the development of a 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 which is one of the nine elements of long-term CSO control planning. The NYCDEP has developed a WWOP for each of its 14 WPCPs. Table 3-2 summarizes the requirements for the Hunts Point WPCP. As noted in the table, flows above 1.3 times DDWF (260 MGD) could potentially cause excessive loss of biological solids in the aeration tanks. The most recent version of the WWOP for Hunts Point was submitted to the NYSDEC in September 2004 as required by the SPDES permit and is provided herein as Appendix A. NYSDEC approved the September 2004 version in November 2005.

Table 3-2. Wet Weather Operating Plan for Hunts Point WPCP after Completion of Phase II BNR

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. Put additional primary or secondary screens 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 afterbay level rises, put off-line pumps in service and increase speed of variable speed pumps up to maximum capacity.	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 one primary sludge pump per tank is 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	Open/lower the bypass gate to the bypass channel to maintain a flow of 260 MGD to secondary treatment if the primary clarifier weirs flood or if final clarifier blanket levels go over the weirs. The BNR treatment process must be protected against high wet weather flows due to the limitations on the secondary clarifier solids separation capability. The Step BNR process will demand a higher aerator effluent suspended solids concentration and higher solids load on the final settling tanks. Solids may be washed out of the final clarifiers due to the higher solids loading and deeper sludge blanket during major storm events. The BNR treatment process can be protected against such high wet weather flows due to the constraints on the secondary clarifier solids separation capability by limiting the secondary treatment flow to 1.3×DDWF.	To relieve flow to the aeration system and avoid excessive loss of biological solids and to relieve primary clarifier flooding. Also to maintain a nitrogen removal by limiting secondary treatment to 1.3 times DDWF.
Aeration Tanks	Keep all available aeration tanks in operation and adjust the airflow to maintain a dissolved oxygen greater than 2 mg/L.	To provide effective secondary treatment to storm flows up to 260 MGD.
Final Settling Tanks	Balance flows to the tanks to keep the blanket levels even, observe the clarity of the effluent and watch for solids loss, and increase the RAS/WAS rate to maintain low blanket levels.	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, and maintain the hypochlorite feed rates to maintain the target chlorine residual.	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

The NYSDEC and the 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. The Consent Order was partly a result of the Long Island Sound Study, which recommended a 58.5 percent load reduction of nitrogen discharge. The Consent Order specified process modifications at the four WPCPs that discharge into the Upper East River (Bowery Bay, Hunts Point, Tallman Island, Ward Island) and one of the WPCPs that discharge to Jamaica Bay (26th Ward) for nitrogen removal. "The Modified Phase I BNR Facility Plan for the Upper East River and the 26th Ward Water Pollution Control Plants" was prepared by the NYCDEP and submitted to the NYSDEC in 2005, and outlines the modifications necessary to upgrade these five WPCPs. The critical BNR upgrade items for Phase I construction are as follows:

1. Aeration tank equipment modifications:
   - Baffles for the creation of anoxic/switch zones and pre-anoxic zones
   - Mixers in the anoxic zones

2. Process aeration system upgrades:
   - New blowers or retrofit of existing blowers
   - New diffusers (fine bubble)
   - Air distribution control equipment
   - Metering and dissolved oxygen (DO) monitoring and control

3. Return activated sludge (RAS) / Waste activated sludge (WAS) systems:
   - Expanded capacity or upgrade of existing RAS/WAS system, as applicable

4. Froth control system:
   - Implemented to prevent or control filamentous growth

5. Chemical addition facilities:
   - Sodium hypochlorite for froth control (RAS and surface chlorination)
   - Alkalinity addition for nitrification and pH buffering (except at Tallman Island)

The NYCDEP has agreed to perform interim measures during the Phase I construction period to make best efforts to reduce the levels of nitrogen being discharged into the East River. These measures include:

1. Wards Island Battery E additional upgrades:
   - Enhanced Flow Control in the Aeration Tanks
   - Supplemental carbon addition facilities
   - Additional baffles to enhance flow distribution and settling in final settling tanks

2. The SHARON Process will be constructed at Wards Island including:

- Reactor tanks with both aerated and anoxic zones;
- Influent centrate pumping station and controls;
- Blowers and process air piping, distribution grid and diffusers;
- Mixers for the denitrification zone;
- Alkalinity storage and pumping station;
- Supplemental carbon (methanol) storage and pumping station;
- Recycle pumps;
- Temperature control units; and
- Electrical power substation.

3. Relocation of Bowery Bay and Tallman Island digested sludge and/or centrate via shipping with NYCDEP marine vessels or contract services. The NYCDEP can send this material to either a NYC facility or an out-of-city facility.

Concurrent with the BNR upgrades, the NYCDEP continues to perform extensive upgrade work as part of the Plant Upgrade (PU) Program at all WPCPs, including the five that are undergoing BNR retrofits. Plant upgrades are required to stabilize or replace equipment that has reached its intended design life to ensure reliable plant performance that is in compliance with the existing SPDES permits for each WPCP.

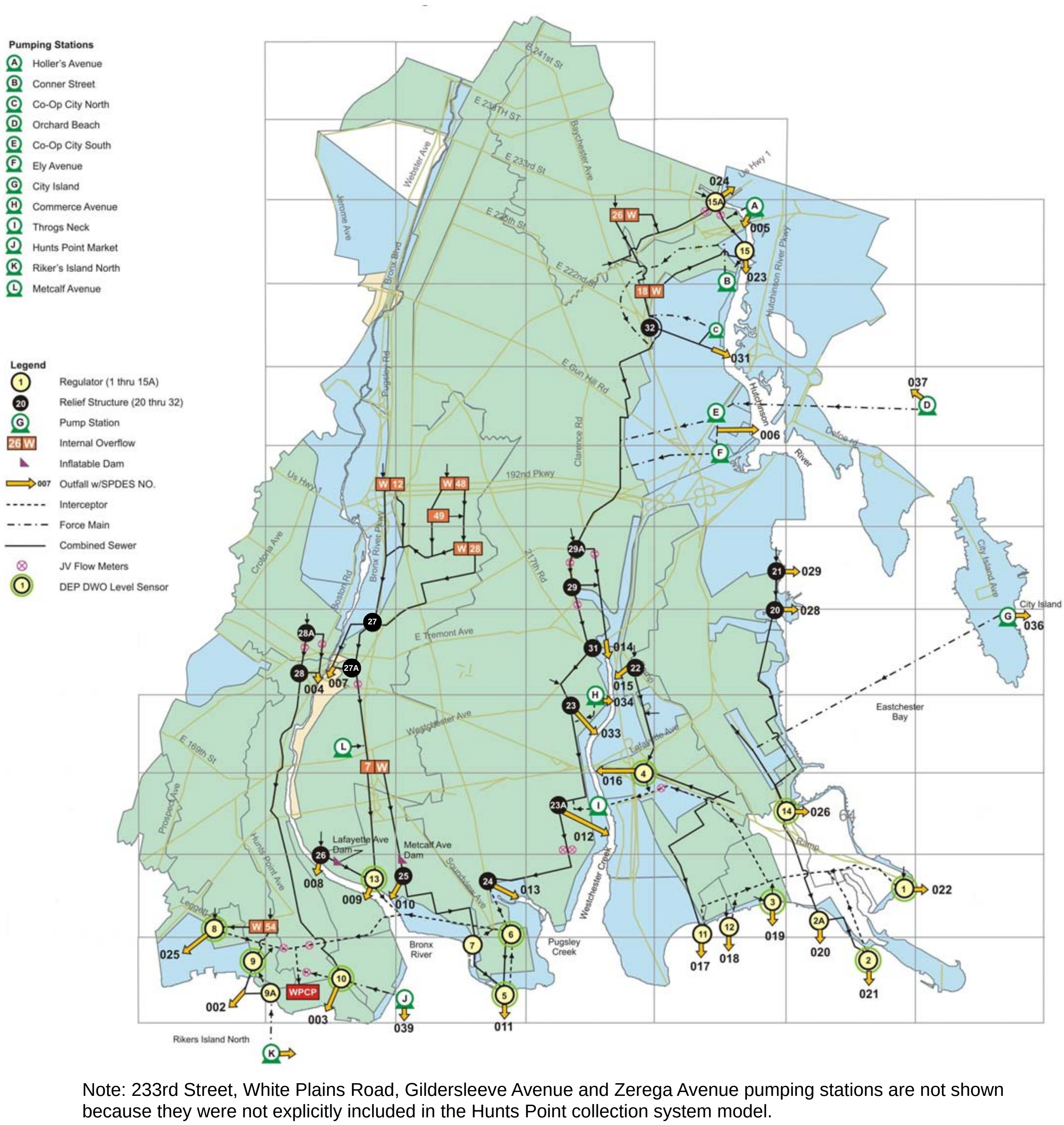
3.1.4. Hunts Point WPCP Upgrade

Although the Hunts Point WPCP had a design capacity to treat up to 260 MGD through secondary treatment and up to 400 MGD through screenings, primary treatment and disinfection, the WPCP had limitations at the headworks that precluded flows from reaching these levels. Through 2004, the Hunts Point WPCP was generally able to treat peak flows up to approximately 260 MGD. As part of CSO reduction activities and as required by the Omnibus IV Consent Order, NYCDEP redesigned the WPCP headworks as part of Phase I upgrade to the WPCP. To ensure treatment of 2xDDWF and prevent the level in the afterbay channel from exceeding elevation -8.00 feet BSD, a new forebay gate chamber with a new gate was installed under Phase I upgrade of the plant. As a result of this construction, in 2008 the WPCP processed influent flows during the top-ten storm events that averaged 396 MGD and had a maximum peak flow of 415 MGD. The cost for the headworks portion of the Hunts Point WPCP improvements in 2004 was $26.0 million. As discussed in Sections 7 and 8, this upgrade is included within the selected alternative for the Bronx River; however the cost of the upgrade is reflected in the East River Open Water WB/WS Facility Plan.

3.2. COLLECTION SYSTEM

3.2.1. Sewer System Overview

A schematic of the CSO outfalls, pump stations, regulators, and major conveyance pipelines is presented in Figure 3-3. There are 16 pumping stations located in the Hunts Point WPCP Drainage Area. Of these, 12 handle combined sewage; the remaining three pump storm water only. Table 3-3 lists the pump stations for the Hunts Point WPCP drainage area. Figure 3-4 shows the locations of the CSO outfalls along the Bronx River assessment area.



Note: 233rd Street, White Plains Road, Gildersleeve Avenue and Zerega Avenue pumping stations are not shown because they were not explicitly included in the Hunts Point collection system model.

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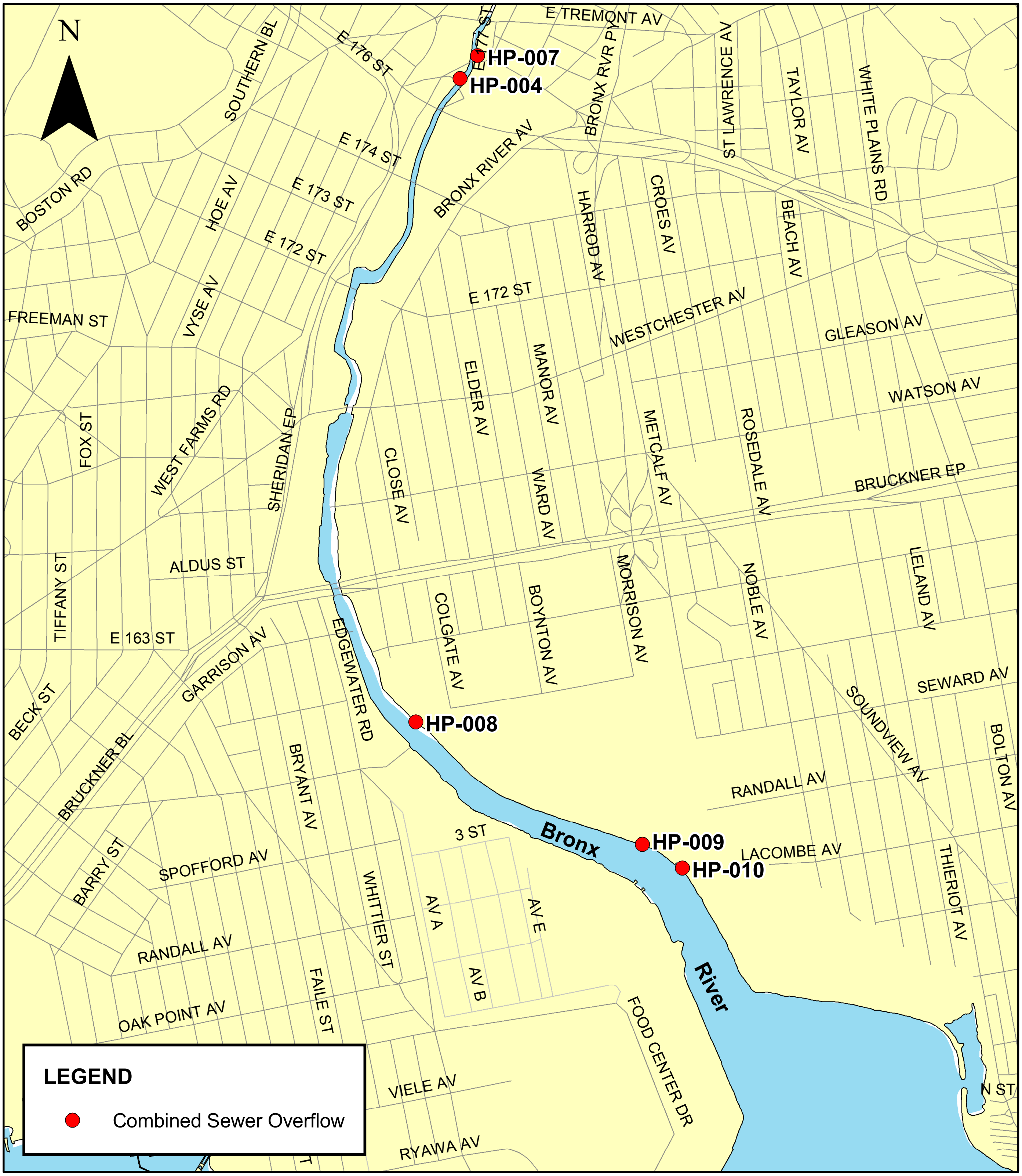
System Schematic for Hunts Point Drainage Area



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CSOs in the Bronx River Assessment Area

Table 3-3. Summary of Pump Stations

PS - Name	Address	Type	Capacity (mgd)	DWF (mgd)	PUMP DATA Total # of Pumps	Minimum # Req.
Conner St.	Foot of Conner St./Eastchester Creek, BX, NY 10475	Comb.	11.52	4.26	3	2
Commerce Ave.	Commerce Ave., Seabury Ave., & Ellis Ave., BX, NY 10473	Comb.	1.44	0.19	2	1
Throgs Neck	Lafayette Ave., East of Zerega Ave., BX, NY 10473	Comb.	36.70	22.70	3	2
Co-op City North	Co-op City Blvd. & Bellamy Loop, BX, NY 10475	San.	16.10	1.67	3	2
Ely Ave.	Ely Ave. & Waring Ave., BX, NY 10475	San.	1.55	0.41	3	2
Metcalf Ave.	Bronx River Pkwy & Westchester Ave., BX, NY 10472	Storm	20.20	N/A	3	2
Hollers Ave.	Foot of Hollers Ave. at Eastchester Creek, BX, NY 10475	San.	1.40	0.30	2	1
Co-op City South	Hutchinson Riv. Pkwy. E. & Einstein Loop, BX, NY 10475	San.	3.80	1.20	3	2
Hunts Pt. Market	Ryawa Ave. Extn. to Hunts Pt. Market, BX, NY 10474	San.	5.76	0.02	3	1
233rd St.	Entrance Ramp S/bound Bronx River Pkwy., BX, NY 10470	Storm	N/A	N/A	2	1
City Island	191 E. Schofield St., City Island, NY 10464	Comb.	5.20	0.82	3	2
White Plains Rd.	White Plains Rd. & Cross Bx. Expwy., BX, NY 10462	Storm	N/A	N/A	2	2
Orchard Beach	Bronx, NY 10464	San.	0.86	0.10	2	1
Rikers Island North	Rikers Island, NY 10370	San.	4.61	2.10	3	2
Gildersleeve Ave.	Int. of Gildersleeve Ave & Betts Ave	San.	N/A	N/A	N/A	N/A
Zerega Ave.	Int. of Zerega Ave (Castle Hill Ave) & Hart St.	San.	0.93	N/A	2	1

- Conner Street Pumping Station: This pump station has combined flow coming from Regulator 15 that has a drainage area of 107 acres. The station has three pumps. Two operate in lead/lag mode with the third reserved as a spare. A bubbler system controls the running status of the lead and lag pumps. The pump station overflow is Regulator 15.
- Commerce Avenue Pumping Station: This pump station has one incoming line with a stainless steel strainer for solids. The wet well has two submersible pumps controlled by a pressure sensor. The emergency overflow discharges to outfall HP-034.
- Throgs Neck Pumping Station: This pump station has one incoming line to a wet well. The station has three pumps. Two operate in lead/lag mode with the third

reserved as a spare. A bubbler system controls the running status of the lead and lag pumps. The wet well has two submersible pumps controlled by a pressure sensor. The emergency overflow discharges to Westchester Creek.

- Co-Op City North Pumping Station: This pump station serves a drainage area of 92 acres and has one incoming line. The station has two operable pumps and one standby pump that are operated in lead/lag mode. The emergency overflow discharges to the combined sewer to outfall HP-031. The pump station is scheduled for upgrades in the near future.
- Ely Avenue Pumping Station: This pump station has one incoming line. The station has three operable pumps that are operated in lead/lag mode. The emergency overflow discharges to outfall HP-006.
- Metcalf Avenue Pumping Station: This pump station discharges stormwater to a combined line that has an internal overflow upstream of Regulators 13 and 25. The station has three operable pumps.
- Hollers Avenue Pumping Station: This pump station has a drainage area of 58 acres and two operable pumps that are operated in lead/lag mode. The emergency overflow discharges to outfall HP-005.
- Co-Op City South Pumping Station: This pump station has a drainage area of 49 acres and two operable variable frequency drives (VFD) pumps and one standby pump. The emergency overflow discharges to outfall HP-006.
- Hunt's Point Market Pumping Station: This pump station has a drainage area of 126 acres with one incoming line and three operable submersible pumps in the wet well. The pumps are controlled by an ultrasonic level sensor. A pressure sensor in the force main is used to send telemetry. The emergency overflow discharges to outfall HP-039.
- City Island Pumping Station: This pump station has a drainage area of 267 acres with two incoming lines. The station has three operable variable speed pumps. A Doppler sensor in the force main is used for telemetry. The emergency overflow discharges to outfall HP-036.
- 233rd Street & White Plains Road Pumping Stations: 233rd Street pump station discharges stormwater to a combined line upstream of Regulators 27 and 27A, and White Plains Road pump station discharges stormwater to a combined line upstream of Regulator 23. These two pumping stations were not explicitly included in the Hunts Point collection system model: stormwater from these areas was modeled as runoff to the collection system.
- Orchard Beach Pumping Station: This pump station has one incoming line and an emergency overflow to outfall HP-037. The station has two operable pumps that are operated in lead/lag mode. Floats control the running status of the lead/lag pumps. An ultrasonic sensor in the wet well is used for telemetry.
- Riker's Island North Pumping Station: This pump station has one incoming line and three operable pumps operating in lead/lag mode. A bubbler system controls the running status of the lead and lag pumps. There is no emergency overflow at this pump station.
- Gildersleeve Avenue and Zerega Avenue Pumping Stations: Both of these pump stations serve local sanitary flows and do not include reliefs upstream of the pumping stations. These two pumping stations were not explicitly included in the Hunts Point

collection system model: sanitary flows from these areas were modeled as flowing by gravity into the collection system.

3.2.2. Combined Sewer System

The Bronx River watershed includes portions of Westchester County and the Bronx in New York City. The Westchester County watershed is 23,020 acres. In New York City, the topographical watershed of the Bronx River is 5,110 acres. However, sewer system construction, urban development and other alterations to the watershed and runoff pathways have altered the watershed such that 4,318 acres now drain to the Bronx River. Combined sewers serve 2,743 acres of this area and may discharge to the river during wet weather at five CSOs in the saline reach. There are over 100 stormwater and other discharges to the river along the entire length from Westchester County to the East River.

Current CSO Controls

CSO Regulators:

Regulators associated with each CSO outfall control the amount of flow diverted to interceptors, which convey wastewater to the WPCP. During wet weather events, the regulators divert combined sanitary and stormwater within the system up to design capacities. When flows resulting from larger storm events exceed WPCP design capacities, the excess flow is diverted to CSO outfalls. The frequency and amount of discharge varies depending on the relative capacity of the downstream interceptor, hydraulic geometry of the regulator overflow, the storm intensity and duration, and the size of the drainage area.

Table 3-4 lists the regulators associated with each CSO outfall in the Hunts Point WPCP collection system.

Table 3-4. Summary of Permitted CSO Outfalls and Regulators

SPDES Outfall No.	Permitted Outfall Location	Outfall Size (W x H)	Regulator(s)	Regulator(s) Location	Drainage Area (Acres)
HP-004	West Farm Rd. (CSO-28, 28A)	12' X 8'	CSO28 & CSO28A	CSO28 - West Farms Rd. e/o East Tremont Ave. CSO28A - 178th St. & Boston Rd.	505
HP-007	E. 177th St. (CSO-27, 27A)	DBL 11'-6"x 6'-6"	CSO27 & CSO27A	CSO27 - Van Buren St. & Bronx Park Ave. CSO27A - E. 177th St. & Bronx Park Ave.	1394
HP-008	Lafayette Ave. (CSO-26)	54" DIA	CSO26	Lafayette Ave. & Colgate Ave.	306
HP-009	Metcalf Ave. (REG #13)	14' X 8'	HP-13	Metcalf Ave. & Soundview Park	114
HP-010	Lacombe Ave. (CSO-25)	9' X 6'	CSO25	Randall Ave. & Metcalf Ave.	56

Interim Floatables Containment Boom:

A containment boom is located downstream of outfalls HP-004 and HP-007 in the area between Watson and Westchester Avenues. The boom is a specially fabricated floatation structure with suspended curtains and is designed to capture buoyant materials (floatables).The boom is regularly serviced by a subcontractor to NYCDEP who removes floatable debris with a skimmer boat. The material is off-loaded at the Bowery Bay WPCP for disposal.

In-System Storage:

NYCDEP evaluated two inflatable dams as part of the In-Line Prototype project. The objective of the project was to familiarize NYCDEP operational personnel with the technology and to identify operational challenges that may arise. The operations program conducted included the testing of the functionality and usability of controls, reliability of the fail-safe systems, and the robustness of the equipment. The testing also examined the maintainability of components, such as the dam fabric and the ultrasonic level transmitters, and the impact of dam operation on sewer debris build-up.

The inflatable dams were installed at two locations:

1. Lafayette Avenue – approximately 50 ft downstream of CSO 26
2. Metcalf Avenue – approximately 100 ft upstream of CSO 25

Each installation consisted of the dam, attachment hardware, mechanical inflation equipment, air piping and valves, an over-pressure blowoff tank, and an automatic control system. Testing completed in early 2007 and the equipment remained idle until August 2009, when decommissioning was completed. However, for the purposes of alternatives evaluations, the Hunts Point In-Line Prototype facilities were included in all model simulations because they were in service as of early 2004 and were not removed until after the June 2007 and July 2009 versions of this WB/WS Facility Plan were submitted. Modeling for the long-term control plan (LTCP) to follow this WB/WS Facility Plan will be updated with the removal of the inflatable dams.

Nine Minimum Controls:

As part of the National CSO Control Policy, the NYCDEP has implemented a Nine Minimum Controls (NMCs) program. The program is outlined in the report *Combined Sewer Overflow Best Management Practices* (2003) set forth in the SPDES permits for the 14 in-city WPCPs.

Wet Weather Operating Plan:

In order to maximize the delivery of flows during wet weather events to the Hunts Point WPCP, the NYCDEP developed a Wet Weather Operating Plan (WWOP). NYCDEP submitted the Hunts Point WWOP in July 2003. The WWOP was modified and submitted to the NYSDEC in September 2004. NYSDEC approved the September 2004 version in November 2005. This requirement was one of 14 Best Management Practices (BMPs) that New York includes in the SPDES permit requirements of plants with CSOs.

The purpose of the WWOP was to provide a set of guidelines to assist the staff in making operational decisions that would best meet their performance goals and the SPDES requirements including:

- Regulator Automation
- Throttling Gate Automation
- Step BNR Process Operational Improvements
- Future Construction Phases

3.2.3. Sanitary Sewer System

The previous section focused on the combined portions of the collection system. As a matter of terminology there are primarily three types of sewers within the collection system:

- Sanitary Sewers are those that collect only sanitary waste, such as home, commercial and industrial drains.
- Separate Storm Sewers collect rain and runoff primarily through street drains but also through roof leaders and foundation drains.
- Combined Sewers collect both sanitary waste and rainfall run-off in a single pipe.

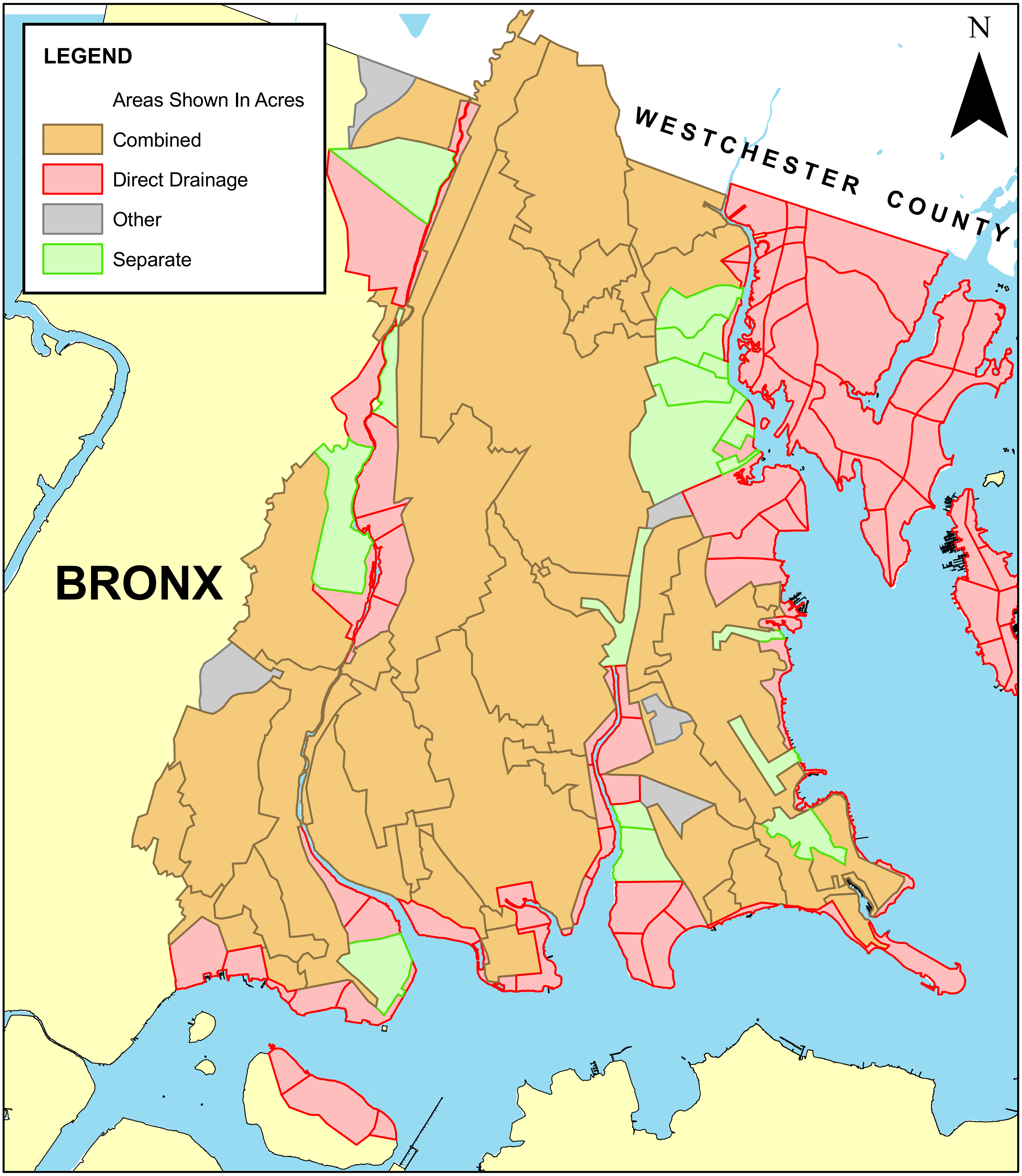
Figure 3-5 delineates areas labeled as “direct drainage,” which means that there are no combined sewers or storm sewers in these areas and that rainfall flows overland to the receiving waterbody. These areas are typically coastal parks or other undeveloped or underdeveloped areas.

There are areas in the collection system that contain only combined sewers, only sanitary sewers, only storm sewers or both storm and sanitary sewers. Areas that contain both storm and sanitary sewers are referred to as “separate areas” or “separate sewer systems” since the sanitary and storm waste are separated.

Portions of the Hunts Point Drainage Area are served by separate sewer systems. Approximately 572 acres of the New York City Bronx River watershed is served by separated sewer system. Figure 3-5 shows those separated areas in the Hunts Point drainage area and in the Bronx River drainage system. These areas have separate sanitary sewer systems that ultimately convey flow to the interceptors to Hunts Point WPCP. It is important to note that these separate sanitary lines convey flow into the combined system downstream of the separated area.

3.2.4. Stormwater System

As shown in Figure 3-6, several small areas in the New York City Bronx River sewershed are served by a separate storm sewer system. Table 3-5 lists the permitted storm sewer outfalls that discharge to the Bronx River. The NYCDEP is managing the water quality of storm water discharges through the MS4 program discussed below.



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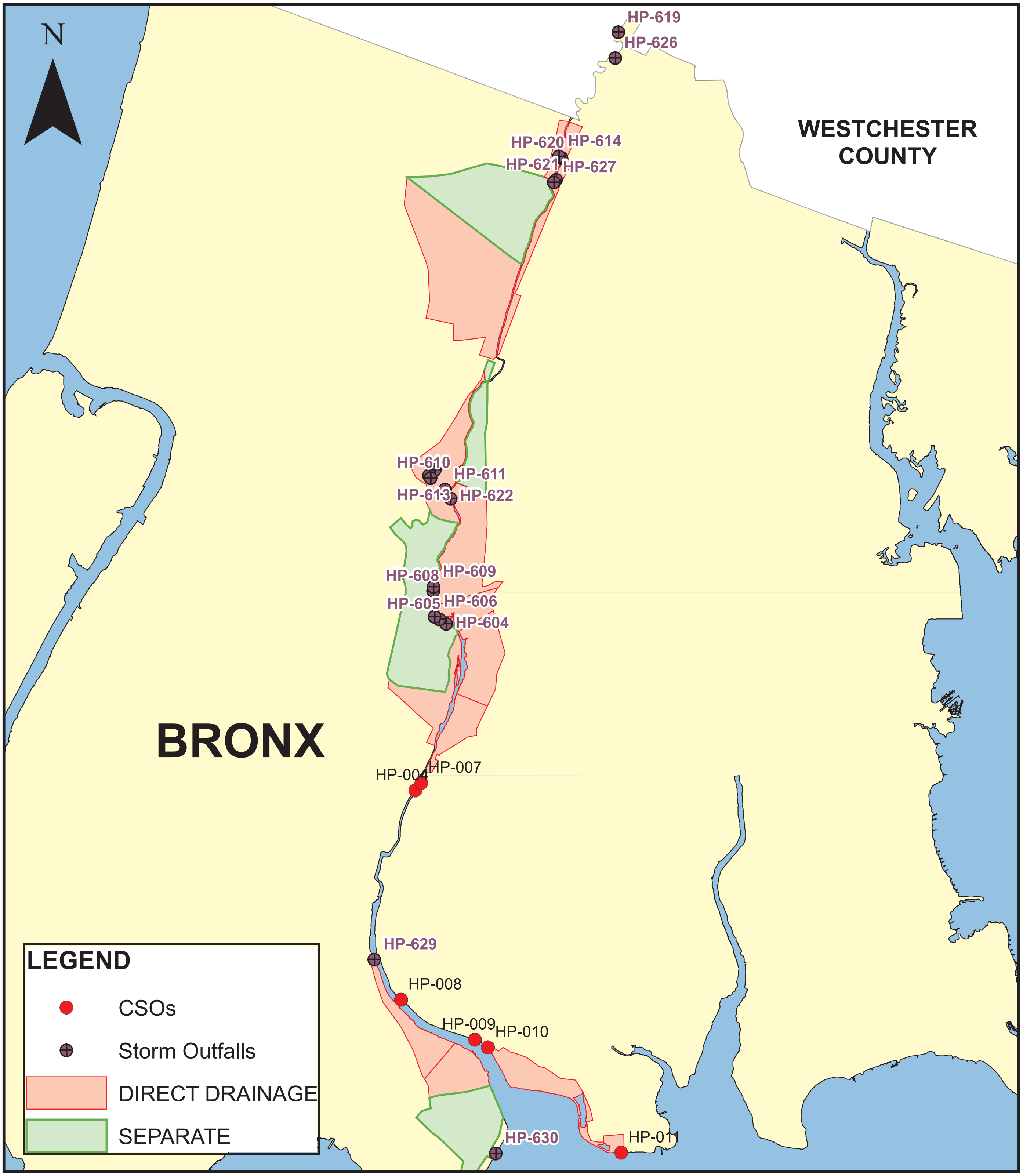
Hunts Point WPCP Collection System



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Separate Storm Areas

Bronx River Waterbody/Watershed Facility Plan

FIGURE 3-6

Table 3-5. Summary of Permitted MS4 Outfalls

SPDES Outfall No.	Permitted Outfall Location	Size	Waterbody
HP-608	S/O E Fordham Road	2' x 3'	Bronx River
HP-621	233rd Street	24" DIA	Bronx River
HP-626	242nd Street	36" DIA	Bronx River
HP-627	S/O 233rd Street	48" DIA	Bronx River

Municipal Separate Storm Sewer System (MS4)

In accordance with the MS4 Requirements section of NYCDEP's SPDES permit, the Stormwater Monitoring Program was developed to provide baseline analytical results and identify areas where pollutants of concern are repeatedly and significantly contributing to water quality violations. These pollutants of concern are: non-polar material, tetrachloroethylene, arsenic, cadmium, copper, mercury, nickel and lead. In addition, the Stormwater Monitoring Program may be used to monitor the effectiveness of other NYCDEP programs, such as industrial and commercial stormwater Best Management Practices (BMPs).

As of the submission of the Assessment of Controls Progress Report in April 2003, NYCDEP completed Phase I of the program to monitor and control toxicants of concern. This phase consisted of mailing surveys and conducting field inspections to gather data on the different types of industries in the MS4 areas. Of the industrial facilities under NYCDEP jurisdiction in MS4 regions, it was found that the automotive and transportation industries had the most likelihood of impacting storm water runoff. The types of facilities in these categories included: auto repair shops, auto salvage yards, gas stations, fuel wholesalers, auto dealers and parts retailers. The primary conclusion from the survey results and inspections was to continue onto Phase II by developing BMPs for the top priority, the automotive/transportation industries.

The goal of Phase II is to reduce possible storm water impacts by instilling better daily operative conditions through the use of BMPs. The BMPs are being developed to focus on the cleaning and daily upkeep of the facility along with waste management, spill control, and proper materials storage. The BMPs emphasize the importance of keeping work areas and floors clean as well as focusing the work to appropriate areas. The typical pollutants at these facilities are listed along with proper procedures to prevent them from contaminating storm water runoff. Training and employee awareness of storm water pollution prevention are also discussed. To reinforce the BMPs, the NYCDEP suggested the creation of a placard visible to the employees while in the workplace displaying simple daily practices.

When these initial BMPs are developed, a meeting between the NYCDEP, the citizen's advisory committee, and stakeholders in the MS4 regions will be conducted. The objective of the meeting is to allow both parties to discuss any concerns they may have with the proposed BMPs and how they can be implemented efficiently. Once the suggestions from the stakeholders have been taken in to consideration, a schedule for Phase III, the implementation of the BMPs, will be undertaken.

3.3. SEWER SYSTEM MODELING

Mathematical watershed models are used to simulate the hydrology (rainfall runoff) and hydraulics (sewer system flows and water levels) of a watershed, and are particularly useful in characterizing sewer system response to rainfall conditions and in evaluating engineering alternatives on a performance basis. In the hydrology portion of the model, climatic conditions (such as hourly rainfall intensity) and physical watershed characteristics (such as slope, imperviousness, and infiltration) are used to calculate rainfall-runoff hydrographs from individual subcatchments. These runoff hydrographs are then applied at corresponding locations in the sewer system as inputs to the hydraulic portion of the model, where the resulting hydraulic grade lines and flows are calculated based on the characteristics and physical features of the sewer system, such as pipe sizes, pipe slopes, and flow-control mechanisms like weirs. Model output includes sewer-system discharges which, when coupled with pollutant concentration information, provide input necessary for receiving-water models to determine water-quality conditions. The following generally describes the tools employed to model the Bronx River watershed. A more detailed write up describing the calibration of the model-calibration and model-projection process is provided under separate cover *City-Wide LTCP Landside Modeling Report, Volume 4- Hunts Point WPCP*.

3.3.1. InfoWorks CS™ Modeling Framework

The hydraulic modeling framework used in this effort is a commercially available, proprietary software package called InfoWorks CS™ (hereafter referred to as the sewer system model), developed by Wallingford Software of the United Kingdom. The sewer system model is a hydrologic/hydraulic modeling package capable of performing time-varying simulations in complex urban settings for either short-term events or long-term periods, with output of calculated hydraulic grade lines and flows within the sewer system network and at discharge points. The sewer system model solves the complete St. Venant hydraulic equations representing conservation of mass and momentum for sewer-system flow and accounts for backwater effects, flow reversals, surcharging, looped connections, pressure flow, and tidally affected outfalls. Similar in many respects to the USEPA's older Storm Water Management Model (SWMM), the sewer system model offers a state-of-the-art graphical user interface with greater flexibility and enhanced post-processing tools for analysis of model calculations. In addition, the sewer system model utilizes a four-point implicit numerical solution technique that is generally more stable than the explicit solution procedure used in SWMM.

Model input for the sewer system model includes watershed characteristics for individual subcatchments, including area, surface imperviousness and slope, as well as sewer-system characteristics, such as information describing the network (connectivity, pipe sizes, pipe slopes, pipe roughness, etc.) and flow-control structures (pump stations, regulators, outfalls, WPCP headworks, etc.). Hourly rainfall patterns and tidal conditions are also important model inputs. The sewer system model allows interface with geographical information system (GIS) data to facilitate model construction and analysis.

Model output includes flow and/or hydraulic gradeline at virtually any point in the modeled system, at virtually any time during the modeled period. The sewer system model provides full interactive views of data using geographical plan views, longitudinal sections, spreadsheet-style grids and time-varying graphs. A three-dimensional junction view provides an effective visual presentation of manholes. Additional post-processing of model output allows the user to view the results in various ways as necessary to evaluate system response.

3.3.2. Application of Model to Hunts Point Collection System

The sewer system model for the Hunts Point Collection System 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 48-inches in diameter plus other smaller, significant sewers, and control structures such as pump stations, diversion chambers, tipping locations, reliefs, regulators and tide gates. As presented in the LTCP WB/WS Facility Plan Landside Modeling Report, 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.

It should be noted that InfoWorks model simulations used for alternatives evaluations have included the two demonstration inflatable dam facilities at Lafayette Avenue and Metcalf Avenue, which were removed during the course of plan development. Inclusion of the inflatable dams in the InfoWorks model does not change the volume of flow to the Hunts Point WPCP, but does result in the relocation of a small volume of CSO discharge from the East River to the Bronx River. Therefore, for the purposes of alternative evaluations for the Bronx River WB/WS Facility Plan, CSO volumes may be considered conservative estimates.

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 in separated areas. Discharges and pollutant loadings were then post-processed and used as inputs to the receiving-water model, described in Section 4.

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 Hunts Point Model, the Baseline conditions parameters were as follows:

1. Dry-weather flow rates reflect year 2045 projections
2. Wet-weather treatment capacity of 259 MGD at the Hunts Point WPCP (capacity prior to the current upgrade to 400 MGD)

3. Documented sediments in sewers.

Table 3-6 shows the volumes of CSO discharged from each outfall to the Bronx River under these Baseline conditions. These values will be used as part of the alternatives analysis to determine the extent of proposed volume reductions for each alternative.

Table 3-6. CSO Discharge Volumes under Baseline Conditions

Outfall Number	Baseline Conditions(1,2)
HP-009	814
HP-004	100
HP-007	88
HP-008	4
HP-010	0.6
Total	**1,006**
Notes: (1) Hunts Point Operating Capacity 259 MGD. (2) All conditions include design precipitation record (JFK, 1988) and sanitary flows projected for year 2045	

Establishing the future Hunts Point WPCP dry weather sewage flow is a critical step in the WB/WS Planning analysis since one key element in City's CSO control program is the use of its WPCPs to reduce CSO overflows. Increases in sanitary sewage flows associated with increased populations will reduce the amount of CSO flow that can be treated at the existing WPCPs since the increase sewage flows will use part of the WPCP wet weather capacity.

Dry weather sanitary sewage flows used in the baseline modeling were escalated to reflect anticipated growth within the City. The Mayor's Office along with City Planning has 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 some 188 neighborhoods within the City. DEP has escalated these populations forward to 2045 by assuming the rate of growth between 2045 and 2030 could be 50% 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 for the Hunts Point WPCP service area and the year 2000 population of the Hunts Point WPCP area.

Increasing the sewage flows for the Hunts Point WPCP from the 2008 average dry weather flow of 119.5 MGD to an estimated dry weather flow of 130 MGD 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, the 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. Statistics were compiled to determine:

- Annual total rainfall depth
- Annual total number of storms
- Annual average storm volume
- Annual average storm intensity
- Annual total duration of storms
- Annual average storm duration
- Annual average time between storms

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. Table 3-7 summarizes some of the statistics for 1988 and a long-term (1970-2002) record at JFK. Furthermore, the JFK 1988 rainfall record also includes high-rainfall conditions during July (recreational) and November (shellfish) periods, which is 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.

Table 3-7. Comparison of Annual 1988 and Long-Term Statistics, JFK Rainfall Record (1970-2002)

Rainfall Statistic	1988 Statistics	Long-Term Median (1970-2002)
Annual Total Rainfall Depth (inches) Return Period (years)	40.7 2.6	39.4 2.0
Average Storm Intensity (inch/hour) Return Period (years)	0.068 11.3	0.057 2.0
Annual Average Number of Storms Return Period (years)	100 1.1	112 2.0
Average Storm Duration (hours) Return Period (years)	6.12 2.1	6.08 2.0

3.4. DISCHARGE CHARACTERISTICS

As discussed in Section 3.3, sewer-system modeling is useful to characterize discharges from the sewer system. Because long-term monitoring of outfalls is difficult and sometimes not possible in tidal areas, sewer-system models that have been calibrated to available measurements of water levels and flows can offer a useful characterization of discharge quantities. Sewer-system models can also be used to estimate the relative percentage of sanitary sewage versus rainfall runoff discharged from a CSO. This is particularly helpful when developing pollutant concentrations, since this sanitary/runoff split for discharge volume can be used to develop pollutant loadings based on concentrations associated with sanitary and runoff, which are somewhat more reliable than concentrations assigned based on pollutant concentrations measured in combined sewage, which are particularly variable.

Section 3.4.1 presents information related to the quantity (volume) discharged into the waterbody for the Baseline condition. Section 3.4.2 characterizes the quality (pollutant concentration) developed to assign pollutant concentrations to discharges. Section 3.4.3 summarizes the pollutant loadings discharged to Bronx River for the Baseline condition. Section 3.4.4 provides an overview of the effect of urbanization on discharges, and Section 3.4.5 discusses the potential for toxic discharges to Bronx River. Characterization of Discharged Volumes, Baseline Condition

3.4.1. Characterization of Discharge Volumes, Baseline Condition

The calibrated watershed models described in Section 3.3 were used to characterize discharges to Bronx River for the Baseline condition. Table 3-8 summarizes the results relating the annual CSO discharges from each point source outfall and the total stormwater discharge for the Baseline condition. Approximately, 81 percent of the total annual CSO volume to the Bronx River is discharged at HP-009, the outfall located near the mouth of the river. About 10 percent of the total annual CSO volume is discharged from HP-004, while 9 percent is discharged from HP-007. Less than one percent of the total CSO volume is discharged from HP-008 and HP-010.

Table 3-8. Bronx River Discharge Summary for Baseline Condition (1, 2, 3, 4, 5)

Outfall	Discharge Volume (MG)	Percentage of CSO Volume	Number of Discharges
HP-004	100	10	56
HP-007	88	9	21
HP-008	4	0.4	17
HP-009	814	81	51
HP-010	0.6	0(4)	1
Total CSO	**1,006**	**100**	**NA**
Total Separate Storm Sewer System Overflows	**3,298**	**100**	**NA**

Notes: (1) Baseline condition reflects design precipitation record (JFK, 1988) and sanitary flows projected for year 2045
(2) Totals may not sum precisely due to rounding.
(3) Hunt Point Operating Capacity 259 MGD
(4) The model predicted only a trace discharge from HP-010, an estimated 0.06% of the total CSO volume.
(5) Represents total discharge from MS4s HP-608, 621, 626, & 627.

3.4.2. Characterization of Pollutant Concentrations, Baseline Condition

Pollutant concentrations associated with intermittent, weather-related discharges are highly variable. For this reason, analyses to characterize discharged pollutants utilized estimates of the relative split of sanitary sewage versus rainfall runoff in discharged flows. Pollutant concentrations for sanitary sewage are attributed to the sanitary portion and concentrations for stormwater are attributed to the rainfall runoff portion of the discharged flow volumes.

Table 3-9 presents the pollutant concentrations associated with the sanitary and stormwater components of discharges to the Bronx River. Sanitary concentrations were developed based on sampling of WPCP influent during dry-weather periods, as described elsewhere in more detail (NYCDEP, 2002). Stormwater concentrations were developed based on sampling conducted citywide as part of the Inner Harbor Facility Planning Study (NYCDEP, 1994), and sampling conducted citywide by NYCDEP for the USEPA Harbor Estuary Program (HydroQual, 2005b).

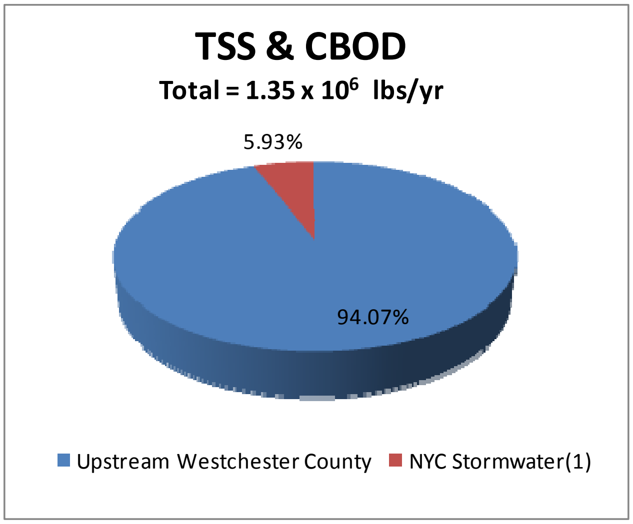
Table 3-9. Sanitary and Stormwater Discharge Concentrations, Baseline Condition

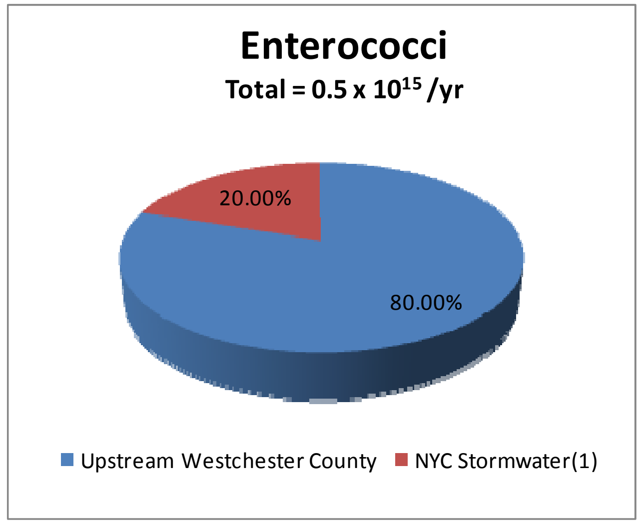
Constituent	Sanitary Concentration(1)	Stormwater Concentration(2,3)
CBOD (mg/L)	110	15
TSS (mg/L)	110	15
Total Coliform Bacteria (MPN/100mL)	$25x10^6$	300,000
Fecal Coliform Bacteria (MPN/100mL) (4)	$4x10^6$	120,000
Enterococci (MPN/100mL) (4)	$1x10^6$	50,000
Notes: (1) (NYCDEP, 2002) (2) (NYCDEP, 1994) (3) (NYCDEP, 2005) (4) Bacterial concentrations expresses as "most probable number" of cells per 100 mL.		

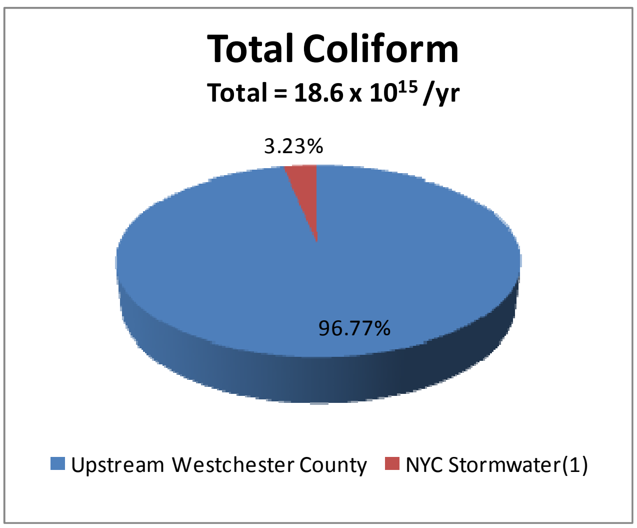
3.4.3. Characterization of Pollutant Loads, Baseline Condition

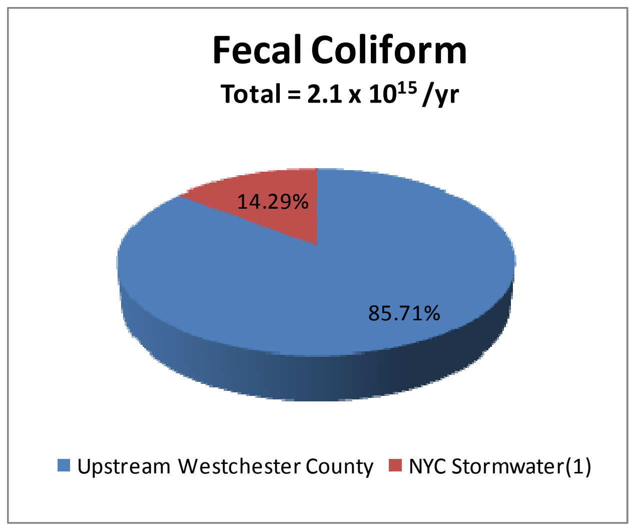
The upstream loadings from Westchester County to the NYC freshwater section of the Bronx River were estimated from data collected at 232nd Street during the 2006/2007 survey. Loads entering the NYC freshwater from NYC stormwater runoff were estimated from LMS, 1996. Bacteria loads from the NYC freshwater Bronx River to the tidal Bronx River were estimated from data collected at 180th Street during 2006/2007. CSO loadings were estimated from the calibrated watershed models using the flows on Table 3-8 and the concentrations on Table 3-9. Average freshwater flows were assumed to be 43 cubic feet per second (cfs) and 45.7 cfs at 232nd Street and 180th Street, respectively. Bacteria concentrations at 232nd Street and 180th Street were estimated through the Most Likelihood Estimator (MLE) which is an estimate of the average concentration for a constituent that is log-normally distributed.

Table 3-10 and Figures 3-7 and 3-8 show that most of the bacteria load entering the freshwater reach of the Bronx River is entering from the Westchester County boundary, whereas loading from CSOs dominate in the tidal section of the river. However, most of the CSO load (81 percent) enters the Bronx River near its confluence with the Upper East River, and only about 19 percent is discharged near the upper tidal section (south of Tremont Avenue) where CSOs HP-004 and HP-007 are located. Thus, although Figure 3-8 indicates over 95% of the pathogen load being associated with CSO discharges, in the upper tidal region it is about 80% for total coliform and 85% for fecal coliform and enterococci when local loadings are considered. Refer to Sections 4.5.2 and 7.4.1 for further discussion concerning the influence of bacteria loads from Westchester County on the water quality of the Bronx River within New York City.





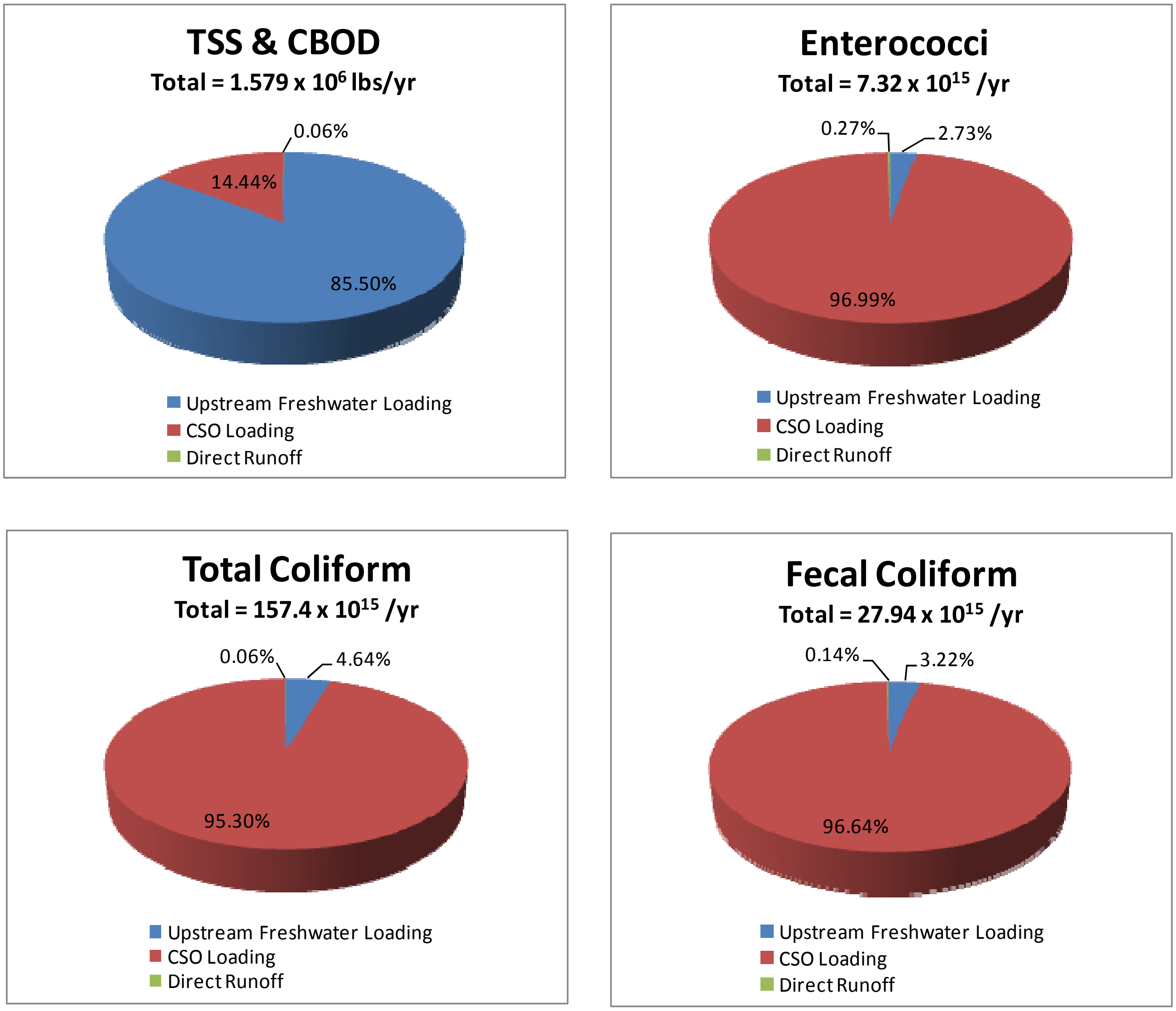




(1) Includes NYC stormwater, cemetery, Botanical Gardens, Bronx Zoo

NYC Freshwater
Bronx River Baseline
Loading Source

FIGURE 3-7



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Tidal Bronx River Baseline Loading Source

FIGURE 3-8

Table 3-10. Annual Loadings to Freshwater Bronx River and Tidal Bronx River under Baseline Conditions

Constituent	Freshwater Bronx River		Tidal Bronx River		
	Upstream Westchester County(1)	**NYC Stormwater(2)**	**Upstream Freshwater Loading**	**CSO Loading(4)**	**Direct Runoff(4)**
CBOD [1000lb/yr]	1270	80	1350	228	1
TSS [1000lb/yr]	1270	80	1350	228	1
Total Coliform $[(\#/yr)x10^{15}]$	18	0.6	7.3(3)	150	0.1
Fecal Coliform $[(\#/yr)x10^{15}]$	1.8	0.3	0.9(3)	27	0.04
Enterococci $[(\#/yr)x10^{15}]$	0.4	0.1	0.2(3)	7.1	0.02

Notes:
(1) Concentrations estimated from data collected at 232nd St. during 2006/2007 survey and using average daily river flow
(2) Loads estimated from LMS, 1996 concentration data and includes NYC stormwater, cemetery, Botanical Gardens, Bronx Zoo
(3) Concentrations estimated from data collected at 180th St. during 2006/2007 survey and using average daily river flow
(4) Loads estimated from the baseline Hunts Point watershed modeling

3.4.4. Effects of Urbanization on Discharge

The urbanization of the Bronx River drainage area from a pastoral watershed to an urban sewershed is described in Section 2. The pastoral condition featured undeveloped uplands that provided infiltration of incident rainfall and contributed continuous freshwater inputs. Urbanization brought increased population, increased pollutants from sewage and industry, construction of sewer systems, and physical changes affecting the surface topography and imperviousness of the watershed. Increased impervious surface area generates more runoff that is less attenuated by infiltration processes. Accordingly, the sewer systems replaced natural overland runoff pathways with a conveyance system that routes the runoff directly to the waterbody—without the attenuation formerly provided by surrounding wetlands. As a result, more runoff is generated, and it is conveyed more quickly and directly to the waterbody. These changes also affect how pollutants are transported along with stormwater runoff as it is conveyed to the waterbody. Furthermore, the urbanized condition also results in additional sources of pollution from CSOs and industrial/commercial activities.

Urbanization of the watershed has altered its runoff yield tributary to Bronx River by increasing its imperviousness. Imperviousness is a characteristic of the ground surface that reflects the percentage of incident rainfall that runs off the surface rather than is absorbed into the ground. While natural areas typically exhibit imperviousness of 10 to 15 percent, imperviousness in urban areas can be 70 percent or higher.

In a pastoral condition, runoff from a watershed typically reaches the receiving waters through a combination of overland surface flow and subsurface transport, typically with ponding and other opportunities for retention and infiltration. Tidal wetland areas previously surrounding the Bronx River would have further attenuated wet-weather discharges. The urbanization of the Bronx River watershed reduced infiltration and natural subsurface transport and eliminated natural streams previously tributary to the Bronx River. Runoff is transported via roof leaders, street gutters and catch basins into the combined and separate sewer system, which then discharges directly to Bronx River since the wetlands have been eliminated. Urbanization has thus simultaneously decreased retention and absorption of runoff during transport and decreased the travel time for runoff to reach the waterbody. When combined with the increased runoff due to increased imperviousness of the watershed, the end result is increased peak discharge rates and higher total discharge volumes to the waterbody during wet weather.

Urbanization has also altered the pollutant character of wet-weather discharges from the watershed. The original rural landscape of forests, fields and wetlands represents pristine conditions with pollutant loadings resulting from natural processes (USEPA, 1997). These natural loadings, while having an impact on water quality in the receiving water, are insignificant compared to the urbanized-condition loadings from CSO and stormwater point sources.

Wet-weather discharges from urbanized areas are significantly higher in pollutant concentrations than natural runoff. These pollutants include coliform bacteria, oxygen-demanding materials, suspended and settleable solids, floatables, oil and grease, and other materials.

A summary of the hydrologic changes caused by urbanization in the NYC Bronx River watershed is presented in Table 3-11. The pre-urbanized condition is assumed circa 1900. The table demonstrates that although the overall size of the watershed has been reduced by approximately 19 percent as a result of sewer construction, the runoff volume has increased. Runoff yield for an average precipitation year as calculated by the RAINMAN model has increased from approximately 530 MG of natural runoff to 1,000 MG discharged by combined and separate sewer systems to the Bronx River per year, an increase of 89 percent. Significantly larger discharges are now made directly to the Bronx River at higher rates since they are no longer attenuated, filtered, and mitigated by “natural” overland mechanisms.

A pollutant loading comparison is summarized in Table 3-12 using typical pollutant concentrations from literature sources. The table compares pre-urbanized pollutant loadings of total suspended solids and biochemical oxygen demand to the existing urbanized condition. The annual volumes used for this table were taken from those of Table 3-11 based upon an average precipitation year. Typical stormwater concentrations are used for the pre-urbanized condition. The urbanized condition accounts for existing CSO and stormwater discharges. The table demonstrates that urbanization of the watershed has increased pollutant loadings to the Bronx River Basin by an approximate factor of three.

Table 3-11. Effects of Urbanization on Watershed Yield

Watershed Characteristic	Pre-Urbanization	Urbanized (1)
Drainage Area (acres)	5100 (2)	4150
Population (4)	Unknown	210,000
Imperviousness (%)	10%	35%
Annual Runoff Yield (MG) (3)	530	1000
Peak Storm Runoff Yield (MG) (3)	32	145

Notes: (1) Existing condition
(2) Approximated from historical maps
(3) For an average precipitation year (JFK, 1988), including stormwater
(4) Pre-urbanized is estimated for year 1890; urbanized estimate based on Year 2000 U.S. Census.

Table 3-12. Effects of Urbanization on Watershed Loading

	Pre-Urbanization	Urbanized	Change (%)
Total Suspended Solids (TSS) [lbs/yr]	66,300	215,000	325
Biochemical Oxygen Demand (BOD) [lbs/yr]	66,300	215,000	325

Notes: (1) For an average precipitation year (JFK, 1988)
(2) Circa 1900, using stormwater concentrations
(3) Existing condition, including CSO and stormwater discharges

3.4.5. Toxics Discharge Potential

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. For industrial source control for separate and combined sewer systems, USEPA required 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 IPP is deemed acceptable, USEPA decrees the local municipality a "control authority." The 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 BMPs for several common discharges such as photographic processing waste, grease from restaurants and other non-residential users, and perchloroethylene from dry cleaning. The NYCDEP has been submitting annual reports on its activities since 1996. The 310 SIUs that were active citywide at the end of 2004 discharged an estimated average total mass of 38.2 pounds per day (lbs/day) of the following metals of concern: arsenic, cadmium, copper, chromium, lead, mercury, nickel, silver and zinc.

As part of the IPP, the 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 of the 177 lbs/day of regulated metals being discharged by regulated industrial users only 2.6 lbs/day (1.5 percent) were bypassed to CSOs. Of the remaining 174.4 lbs, approximately 100 lbs ended up in biosolids, and the remainder was discharged through the WPCP effluent outfall. Recent data suggest even lower discharges. In 2003, the average mass of total metals discharged by all regulated industries to the New York City WPCPs was less than 39.1 lbs/day, which would translate into less than 1 lb/day bypassed to CSOs from year 2003 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.

Currently there are no SIUs located within the sewershed associated with combined sewer outfalls that discharge to the Bronx River. In addition, the NYSDEC has not listed the Bronx River as being impaired by toxic pollutants. As such, metals and toxic pollutants are not considered to be pollutants of concern for the development of this WB/WS Facility Plan.

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4.0. Waterbody Characteristics

The Bronx River stretches over 20 miles through Westchester County and the western Bronx. The River contains both freshwater and saline surface waters. The freshwater portion of the Bronx River flows from its headwaters at Davis Brook and Kensico Dam to north of East Tremont Avenue. South of the East Tremont Avenue Bridge, the Bronx River is a tidal waterbody. The Bronx River is tributary to the East River.

Large natural and parkland areas are preserved adjacent to Bronx River, including the New York Botanical Garden, the Bronx Zoological Gardens, and Soundview Park. However, water quality in the Bronx River is influenced by CSO and stormwater discharges, as well as other discharges upstream in Westchester County. The following report section describes the present-day physical and water quality characteristics of the Bronx River as well as its current uses.

4.1. CHARACTERIZATION METHODOLOGY

The NYCDEP's comprehensive watershed-based approach to long-term CSO control planning follows the USEPA's guidance for monitoring and modeling (USEPA, 1999). The watershed approach "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, 1999). The guidance recommends identifying appropriate measures of success based on site-specific conditions to both characterize water quality conditions and measure the success of long-term control plans. The measures of success are recommended to be objective, measurable, and quantifiable indicators that illustrate trends and results over time. USEPA's recommended measures of success are administrative (programmatic) measures, end of pipe measures, receiving waterbody measures, and ecological, human health, and use measures. USEPA further states that collecting data and information on CSOs and CSO impacts provides an important opportunity to establish a solid understanding of the "baseline" conditions and to consider what information and data are necessary to evaluate and demonstrate the results of CSO control. USEPA acknowledges that since CSO controls must ultimately provide for the attainment of water quality standards, the analysis of CSO control alternatives should be tailored to the applicable standards such as those for dissolved oxygen and coliform bacteria. Since the CSO Control Policy recommends reviews and revision of water quality standards, as appropriate, investigations should reflect the site-specific wet weather impacts of CSOs. The waterbody/watershed assessment of the Bronx River therefore required a compilation of existing data, identification of data gaps, collection of new data, and cooperation with field investigations being conducted by other agencies.

NYCDEP has implemented its CSO facility planning projects consistent with this guidance and has developed the above noted categories of information on waterbodies such as the Bronx River. Waterbody/watershed characterization activities were conducted following the work plans and field sampling programs developed during the Use and Standards Attainment (USA) Project. These efforts yielded valuable information for characterizing the Bronx River and its watershed as well as supporting 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 the Bronx River and nearby waterbodies. The NYCDEP has conducted facility planning in the Bronx River since at least 1978, when the 208 study identified the waterbody for CSO abatement. Facility planning has been ongoing since that time, resulting in a large body of pertinent data. Several other parallel projects by the NYCDEP and others have also been conducted that further contribute to the data available (see Section 5). The NYCDEP continues to conduct investigative programs yielding useful watershed and waterbody data to address these limitations. Additional sources of data are available from other stakeholders in the New York Harbor, including the US Army Corps of Engineers.

4.1.2. 2006 Bronx River Sampling

To calibrate the model effectively and establish accurate boundary conditions, further data needed to be collected throughout the Bronx River, both in Westchester and Bronx counties. In order to collect the necessary data, 11 new monitoring station locations were established. Sampling began in March 2006 and continued for one year through March 2007. Three sampling stations were situated within the New York City portion of the river, while eight stations were located in Westchester County. The stations in New York City were positioned near the boundary of Westchester County upstream of Outfalls HP-004 and HP-007-010; in the middle of the river near the Bronx Zoo; and at the mouth of the river.

Bronx River sampling was performed weekly in NYC and monthly in Westchester County, beginning on March 3, 2006. Samples were tested for total coliform, fecal coliform, enterococci, e. coli, ammonia, nitrates, nitrites, phosphorus, and total suspended solids.

Figure 4-1 illustrates the locations of the monitoring stations used for this project, while Table 4-1 below describes the stations and their associated latitudes and longitudes. The data collected from the 2006 sampling initiative are presented Section 4.5.2.

Table 4-1. Bronx River Sampling Station Locations (March 2006 – March 2007)

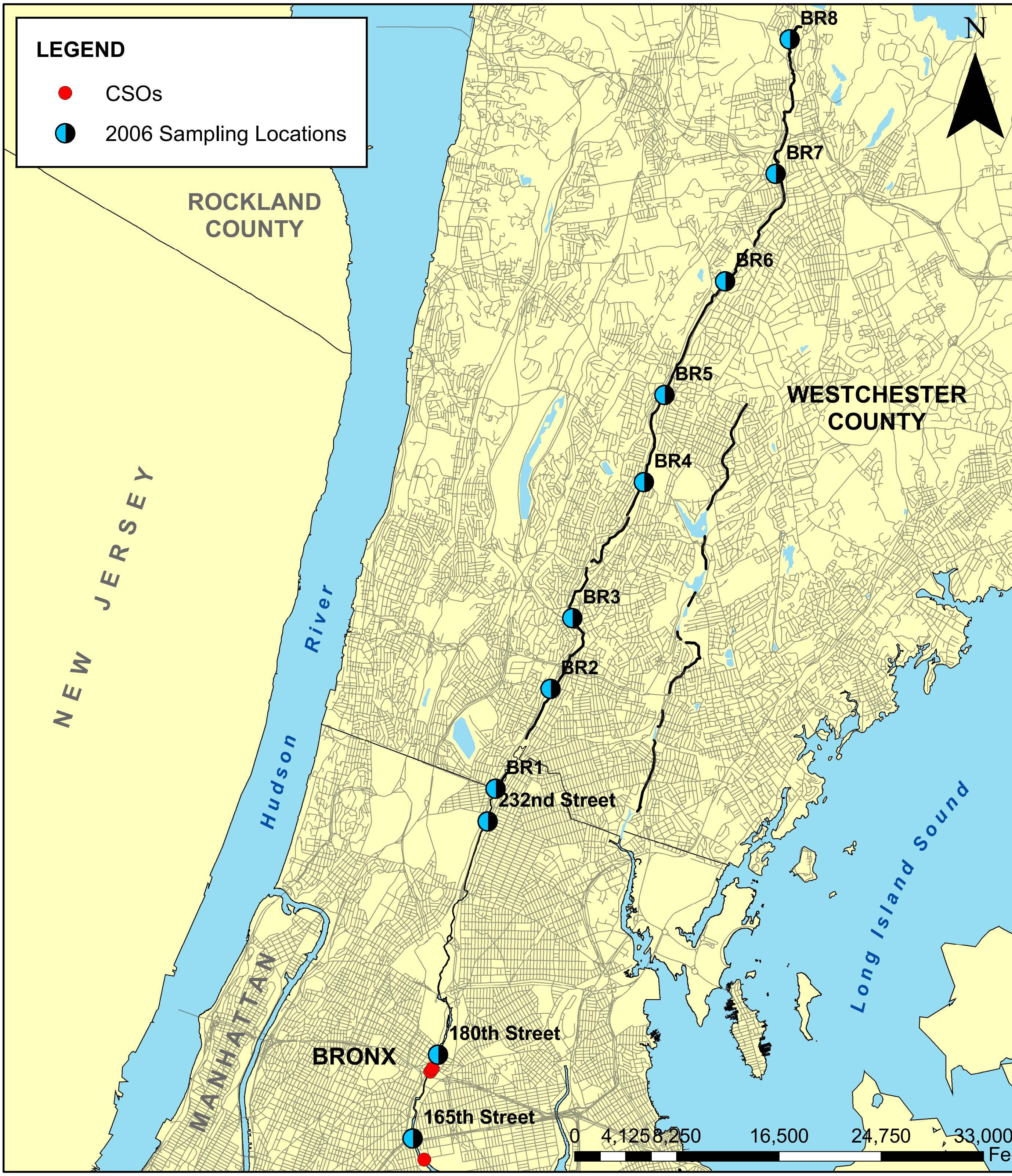
Sampling Station	Latitude/ Longitude	Location	Distance from Mouth (miles)
165th Street	40° 53’ 37.5” N; 73° 51’ 44.9” W	165th Street and the Bronx River, Bronx	1.73
180th Street	40° 50’ 31.5” N; 73° 52’ 37.6” W	180th Street and the Bronx River, Bronx	3.15
232nd Street	40° 49’ 24.5” N; 73° 53’ 04.3” W	232nd Street and the Bronx River, Bronx	7.20
No. 1	40° 54’ 03.7” N; 73°	Bronx River Parkway between McLean Avenue and	7.78

Sampling Station	Latitude/ Longitude	Location	Distance from Mouth (miles)
	51' 36.6" W	Wakefield Avenue, Yonkers	
No. 2	40° 55' 23.0" N; 73° 50' 38.9" W	Bronx River Parkway south of Cross County Parkway, Yonkers	9.55
No. 3	40° 56' 19.5 N; 73° 50' 15.7" W	Dewitt Avenue/ Paxton Avenue at the confluence with the Grassy Sprain Brook, Bronxville	10.91
No. 4	40° 58' 08.1" N; 73° 49' W	Bronx River Parkway at Leewood Drive, Eastchester	11.18
No. 5	40° 59' 17.6" N; 73° 48' 38" W	Intersection of Popham and Garth Road, Scarsdale	12.64
No. 6	41° 00' 47.9" N; 73° 47' 33.9" W	Brook Lane off Walworth Avenue, Hartsdale	14.63
No. 7	41° 02' 13.5" N; 73° 46' 40.5" W	Westchester County Center, Bronx River Parkway, White Plains	16.70
No. 8	41° 04' 00.8" N; 73° 46' 25.4" W	South Kensico Avenue, Valhalla	19.10

4.1.3. Biological and Habitat Assessments

USEPA has for a long time indicated that water quality based planning should follow a watershed based approach. Such an approach considers all factors impacting water quality including both point and nonpoint (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 based on what was most in 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).



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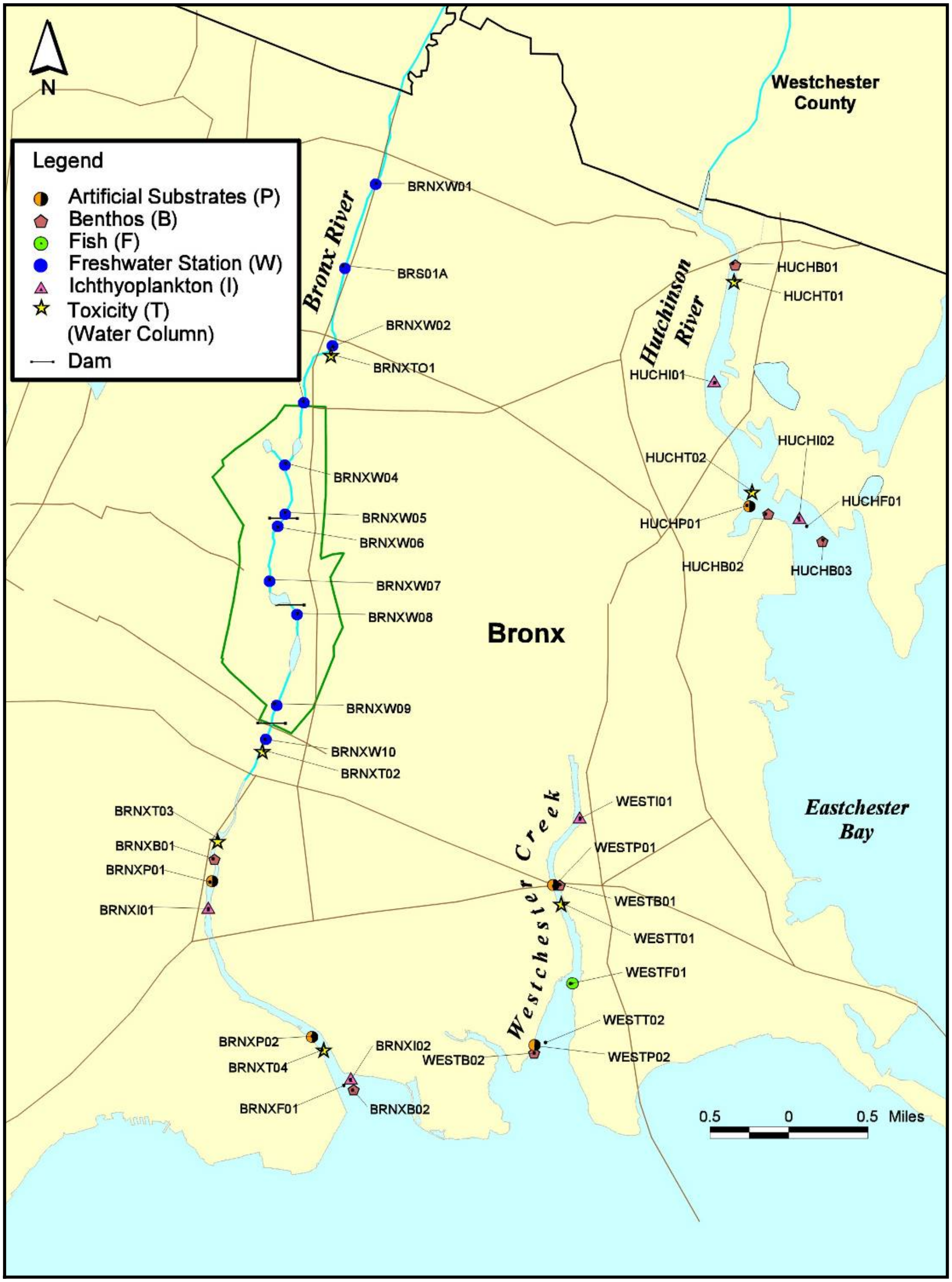
2006 Bronx River Sampling Locations

The waterbody/watershed assessment conducted a biological Field Sampling and Analysis Program (FSAP) designed to fill ecosystems data gaps for the Bronx River. NYCDEP's FSAPs were designed 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 Use and Attainability (USA) Project that included investigations of the Bronx River. Following review by the USEPA, NYSDEC, and other members of the Project Steering Committee, the Bronx River FSAP was initiated in early summer 2000. Simultaneously, other FSAPs were developed to complement this FSAP, while also providing data for each of the other USA Project waterbodies. These FSAPs, including one dealing with the East River and the rest of its tributaries (HydroQual, 2001a), one dealing with waterbody wide (i.e. all 23 waterbodies) assessment of fish propagation (HydroQual, 2001b) and one dealing with epibenthic invertebrate recruitment (HydroQual, 2001c), were implemented in 2001. In 2003, a tributary toxicity characterization FSAP (HydroQual, 2003c) was implemented that included sampling at three Bronx River stations in order to perform short-term chronic toxicity tests, sediment chronic toxicity tests, and sediment total organic carbon, percent solids, and grain size analyses. Figure 4-2 shows the locations of sampling stations used in the summer 2000 Bronx River FSAP. Figure 4-3 illustrates a composite of the Bronx River area sampling station locations deployed in the East River and related FSAPs conducted in 2001 through 2003.

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, 2001b). 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 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 would be assessed during the same temporal period. 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 4-4. Two stations were located in the Bronx River watershed. Samples were collected using fine-mesh plankton nets with two replicate tows taken at 50 stations in March, May, and July 2001. In August 2001, 21 of the stations were re-sampled to evaluate ichthyoplankton during generally the worst case temperature and dissolved oxygen conditions.

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, 2001c). The recruitment and survival of epibenthic communities on hard substrates was evaluated because these sessile organisms are



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Sampling Stations for Bronx River FSAP (HydroQual, 2000)

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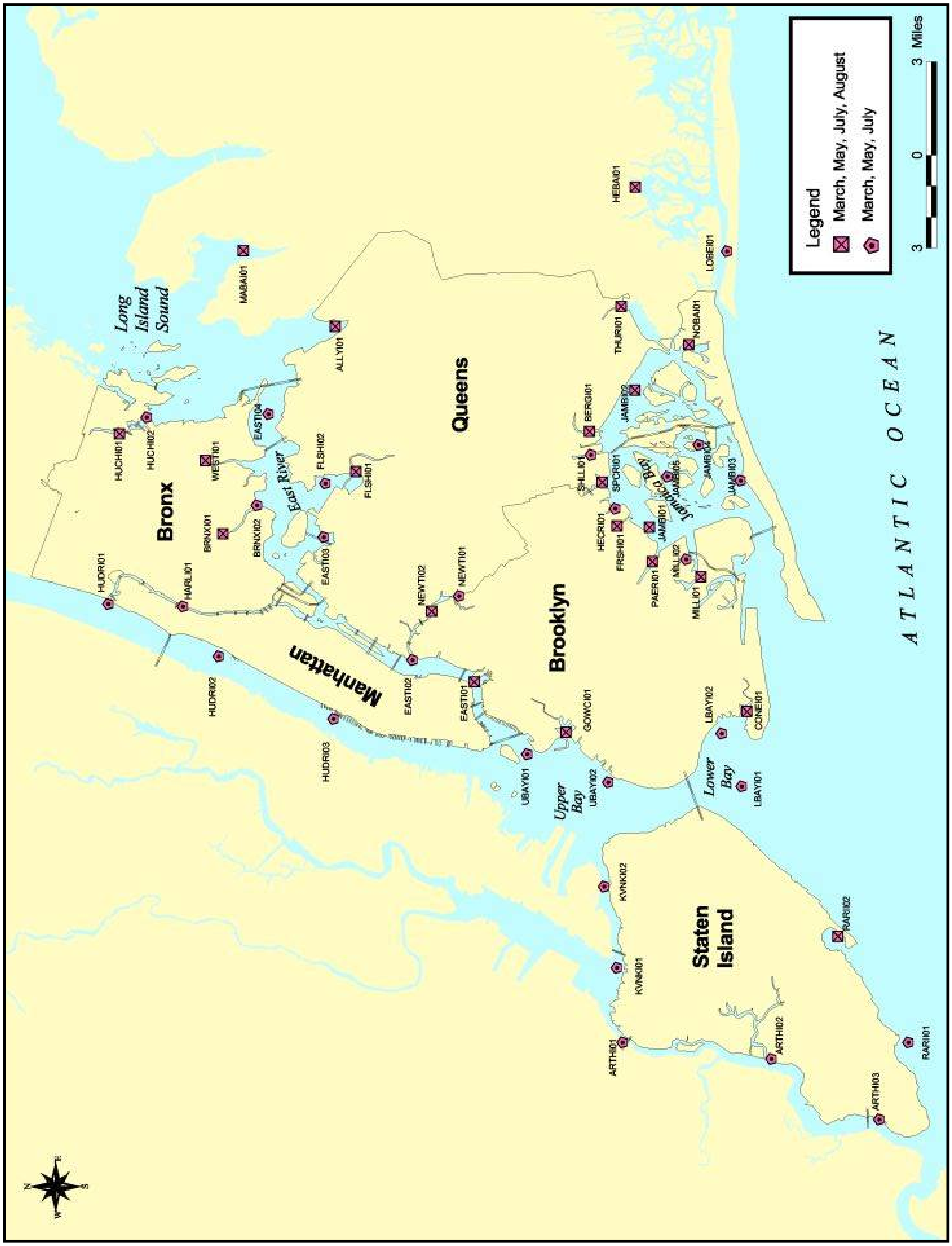
Bronx River FSAP Sampling Stations, 2001-2003

FIGURE 4-3



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Harbor-Wide Ichthyoplankton Sampling Stations

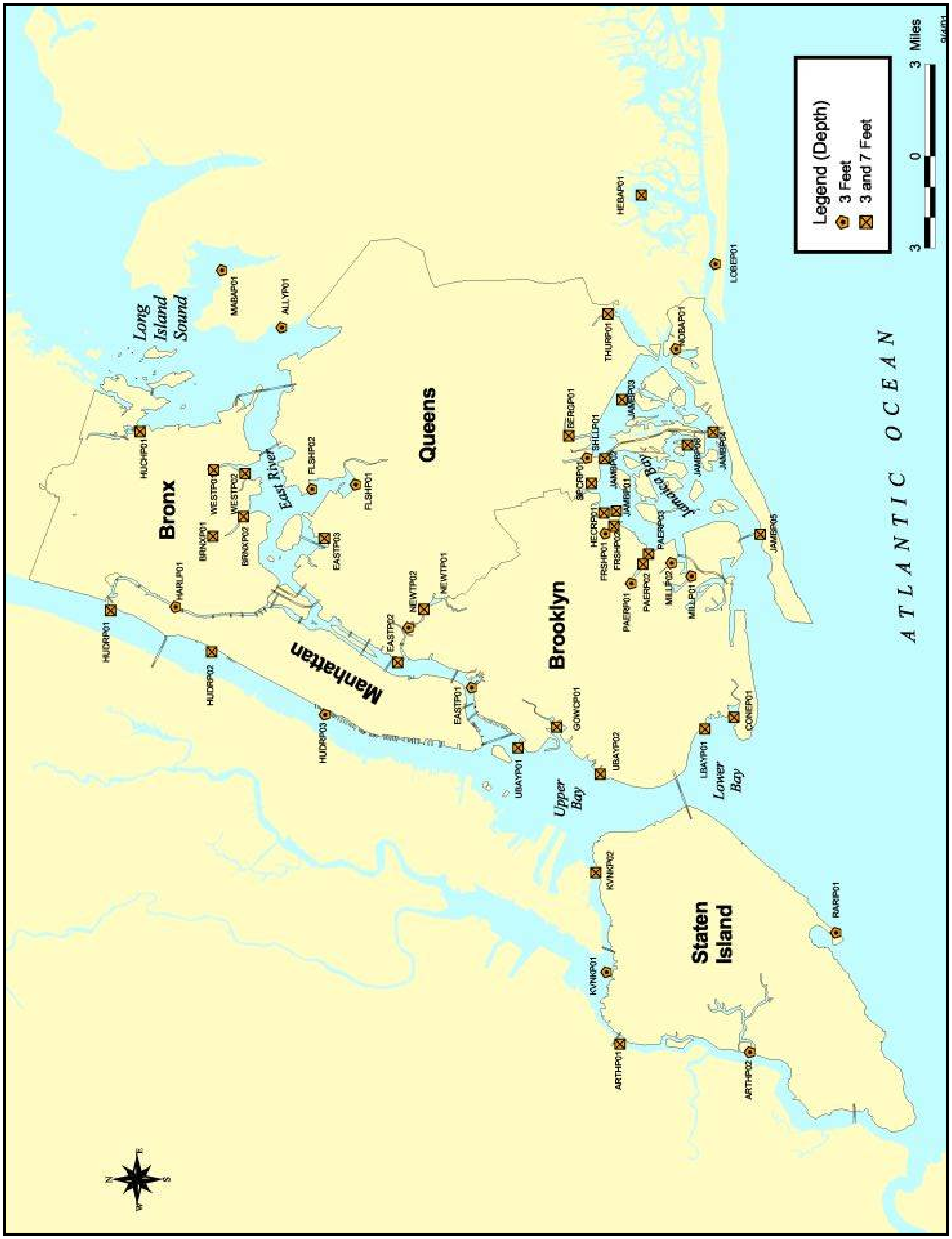
good indicators of long-term water quality. This FSAP provided a good indication of both intra- and inter-waterbody variation in organism recruitment and community composition. Artificial substrate arrays were deployed at 37 stations throughout New York Harbor, its tributaries, and at reference stations outside the harbor complex. The locations of sampling stations are shown on Figure 4-5. Two stations were located in the Bronx River. 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, 2002). The goals of this FSAP were to assist in the assessment of physical habitat components on overall habitat suitability and water quality and 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. These benthic organisms represent a crucial component of the food web, and, therefore, the survival and propagation of fish. 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 4-6. Five Stations were located in the Bronx River. Two samples from each station were tested for TOC, grain size, and percent solids.

4.1.4. Other Data Gathering Programs

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 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). Samples were collected from sewer discharges at several locations that characterized dry and wet weather discharges. Receiving water sampling locations were established from receiving water modeling support. Physical measurements of tidal dynamics, current velocity, and bathymetry were made in addition to sample collection for chemical analysis.

The NYCDEP and its predecessor city agencies have been monitoring water quality in New York Harbor waters since 1909, and reporting results annually as part of the New York City Regional Harbor Survey. The stated purpose of the program was “to assess the effectiveness of New York City’s various water pollution control programs and their combined impact on water quality” (NYCDEP, 2000). Among the harbor-wide sampling locations, data has been collected at four in the Bronx River and one near the mouth of the Bronx River in the East River (Station E14). Of the four stations sampled in the Bronx River, two were clustered in the upper segment near the Westchester County border (Stations BR1 and BR3).



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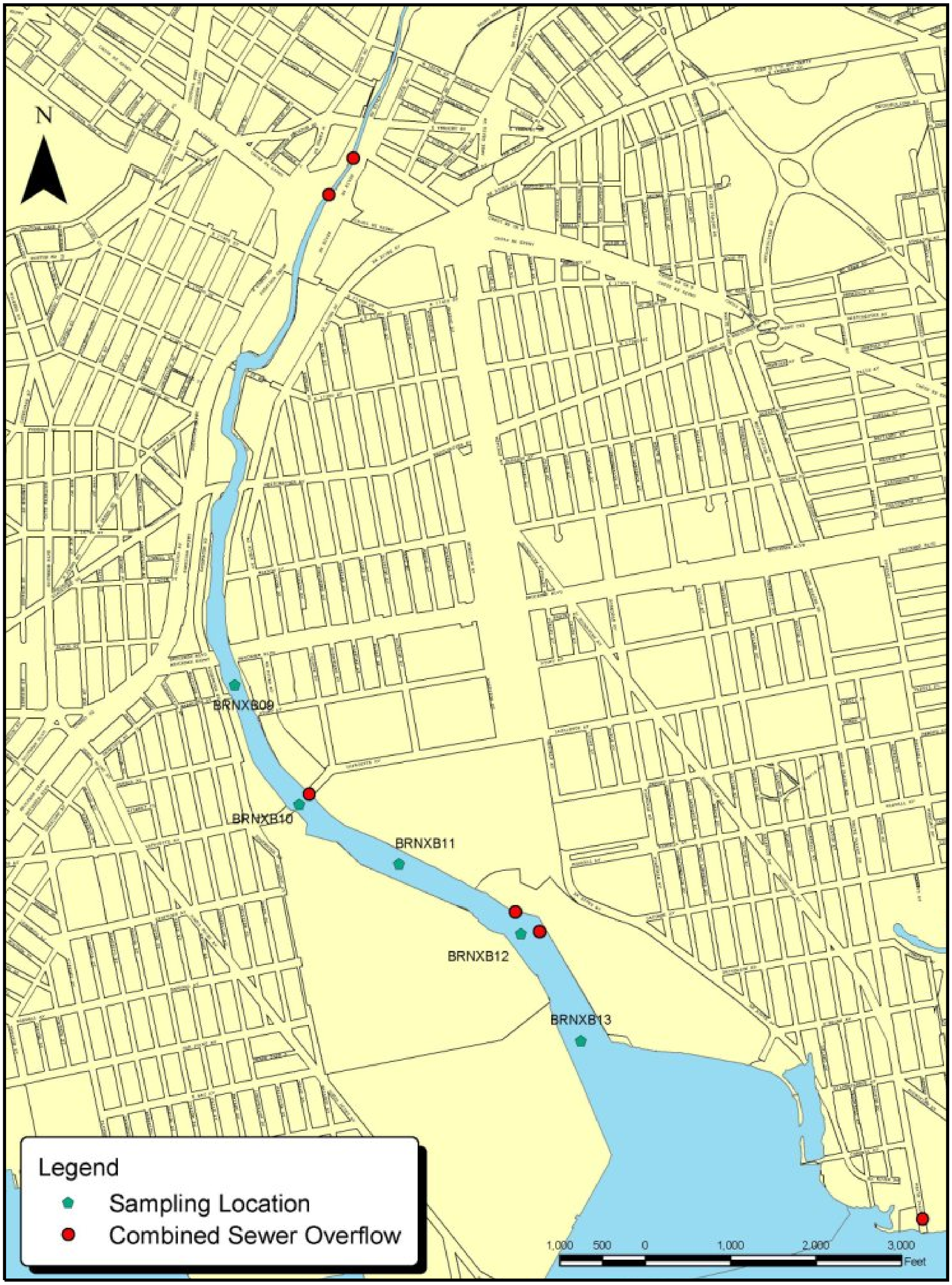
Harbor-Wide Epibenthic Recruitment and Survival Sampling Stations

FIGURE 4-5



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Tributary Benthos Characterization Sampling Stations

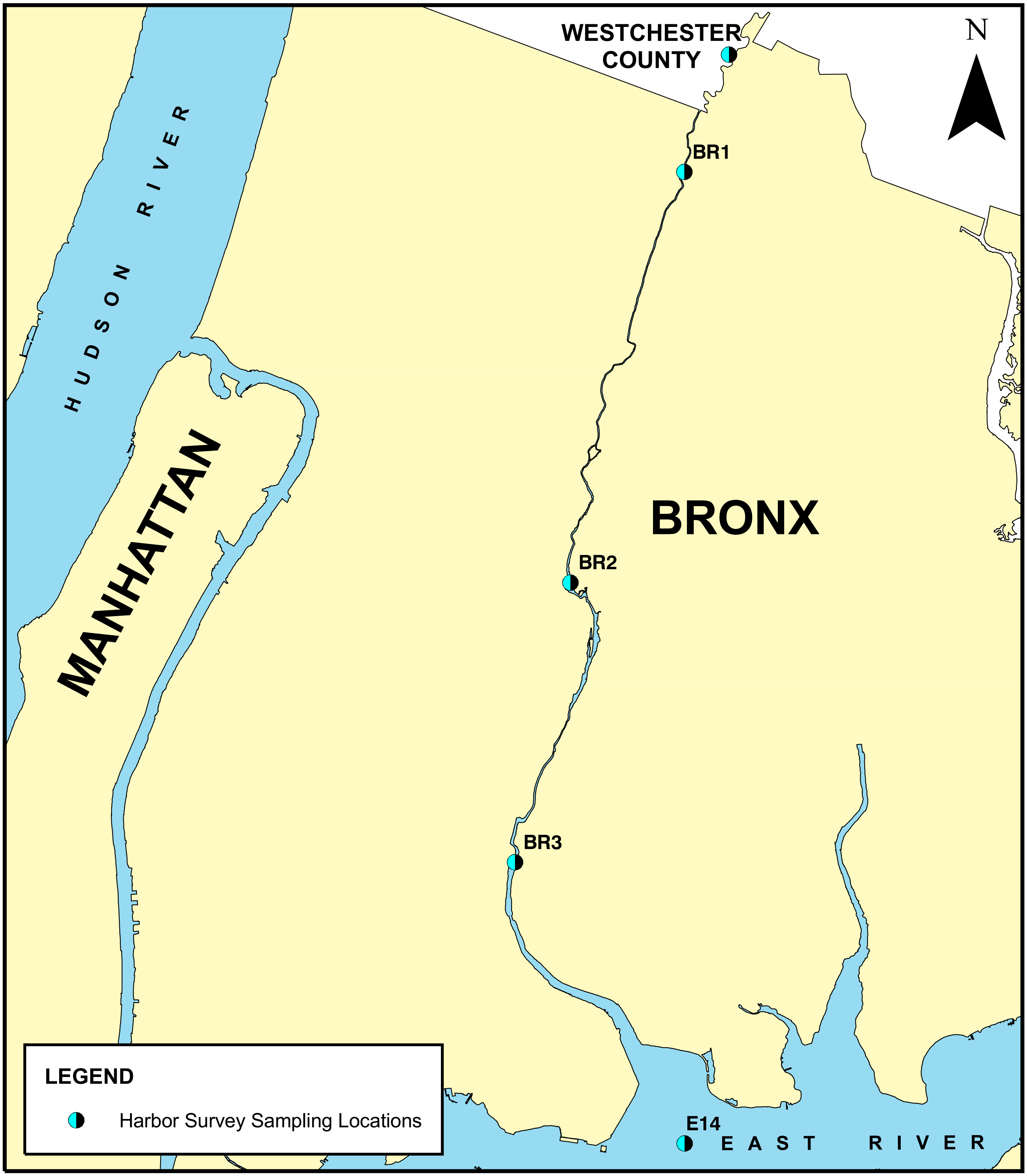
The NYCDEP and its predecessor city agencies have been monitoring water quality in New York Harbor waters since 1909, reporting annually in the New York City Regional Harbor Survey. The stated purpose of the program is "to assess the effectiveness of New York City's various water pollution control programs and their combined impact on water quality" (NYCDEP, 2000). Harbor Survey stations relevant to the Bronx River are shown on Figure 4-7.

Data has been collected by agencies and organizations throughout New York Harbor in addition to harbor monitoring and project-specific sampling programs conducted by the NYCDEP. The USEPA Regional Environmental Monitoring and Assessment Program (REMAP) (Adams et al., 1998) has evaluated sediment quality throughout New York Harbor, as has the agency's more recent five-year National Coastal Assessment (a.k.a. "Coastal 2000") program (Figure 4-8). The New York State Department of Transportation (YAMS, 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 Bay, Upper New York, Newark, Bowery and Flushing Bays during June and October 1995. In Upper New York Bay, the USACE conducted a two-year study of flatfish distribution and abundance. The data from these programs are useful for comparing the Bronx River to similar waterbodies in the New York Harbor to ascertain its relative aquatic and ecological health.

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 systems. 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 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 the effects of water pollution control efforts by the NYCDEP.

4.1.5. Receiving Water Modeling

A set of mathematical models were developed and calibrated to develop relationships between CSO/storm loads discharged to the Bronx River and the water quality in the waterbody. The CSO model (InfoWorks) was used to calculate the flows and loadings of pollutants that are fed to the receiving water models. Boundary condition input is provided by the Bronx River Model (BRM) in conjunction with the System-Wide Eutrophication Model (SWEM) of New York Harbor. The SWEM model has been calibrated, peer-reviewed and has been in use for



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Harbor Survey Sampling Locations

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Coastal 2000 Sampling Locations in New York Harbor

several years by the NYCDEP to evaluate the water quality effects of facility planning. BRM consists of a three dimensional, time-variable hydrodynamic and water quality model containing a 28 stat variable eutrophication model for computing nutrient forms and chlorophyll-a (algae) concentrations. A schematic of BRM and SWEM models are shown on Figures 4-9 and 4-10.

Parameters simulated in the BRM include: temperature, salinity, chlorophyll-a, nutrients in several particulate and dissolved forms, and dissolved oxygen. The capability to model pathogens is also included. The BRM also includes the sediment components included in SWEM to compute the interaction between the water column and the sediment.

SWEM is used to calculate and assign East River boundary conditions to the BRM. The Baseline conditions for the Harbor-wide SWEM model includes all WPCPs at two times design dry weather flow, 1988 rainfall, dry weather flow projected for year 2045, nitrogen removal at the Upper East River WPCPs to achieve the Long Island Sound (LIS) Total Maximum Daily Load (TMDL) and the Newtown Creek WPCP upgrade to full secondary treatment with organic carbon removal. The resulting East River water quality in SWEM, therefore, includes all water quality summaries as well as the assumptions used for the baseline simulation.

Table 4-2 states the assumptions for each model component in the baseline condition.

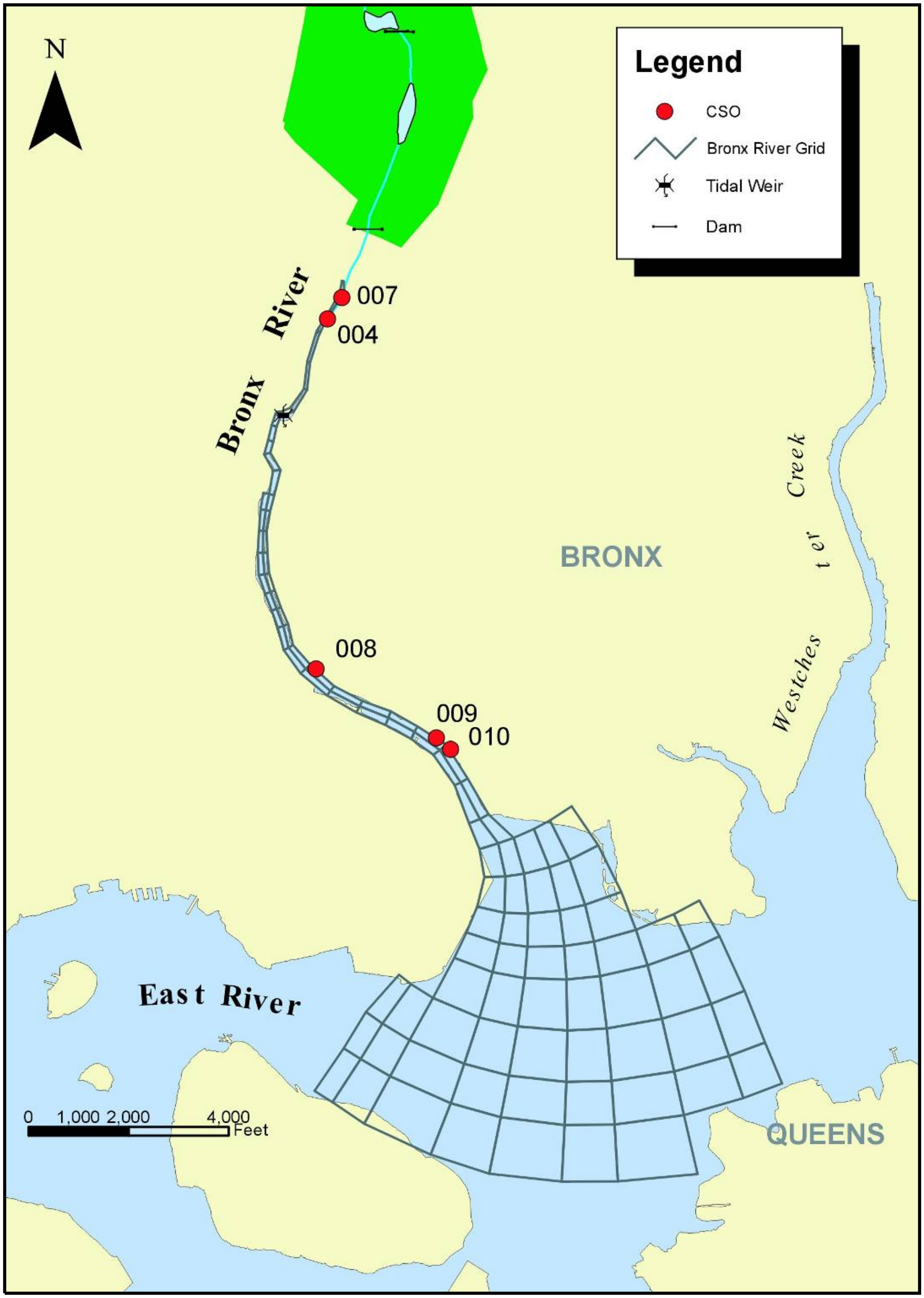
Table 4-2. Baseline Water Quality Modeling Conditions

Model Component	Model	Baseline Conditions
Watershed Pollutant Loads	InfoWorks CS	1988 precipitation for wet weather flows; 2045 population projection for dry weather flows; twice design dry weather flow capacity at Hunts Point WPCP
Boundary Conditions	SWEM	1988 rainfall for hydrodynamics; baseline in InfoWorks for city-wide flows; baseline in InfoWorks for city-wide loads; nitrogen reduction at Upper East River WPCPs to Long Island Sound TMDL; Newtown Creek WPCP upgraded to full secondary treatment for organic carbon reduction
Receiving Water	BRM	Apply SWEM Baseline output at East River boundary conditions; InfoWorks Hunts Point Baseline for CSO, storm sewer and direct overland loads; gauged Freshwater Bronx River, flow, quality from SWEM inputs

4.2. PHYSICAL WATERBODY CHARACTERIZATION

4.2.1. Physical Shoreline Characterizations

The Bronx River is located in Westchester and Bronx Counties. The river flows south from its head at Davis Brook and the Kensico Dam in Westchester County to its mouth on the East River, between Hunts Point to the west and Clason Point to the east in the south Bronx. For the purposes of this report, the study area only includes the shorelines of the Bronx River located within New York City.



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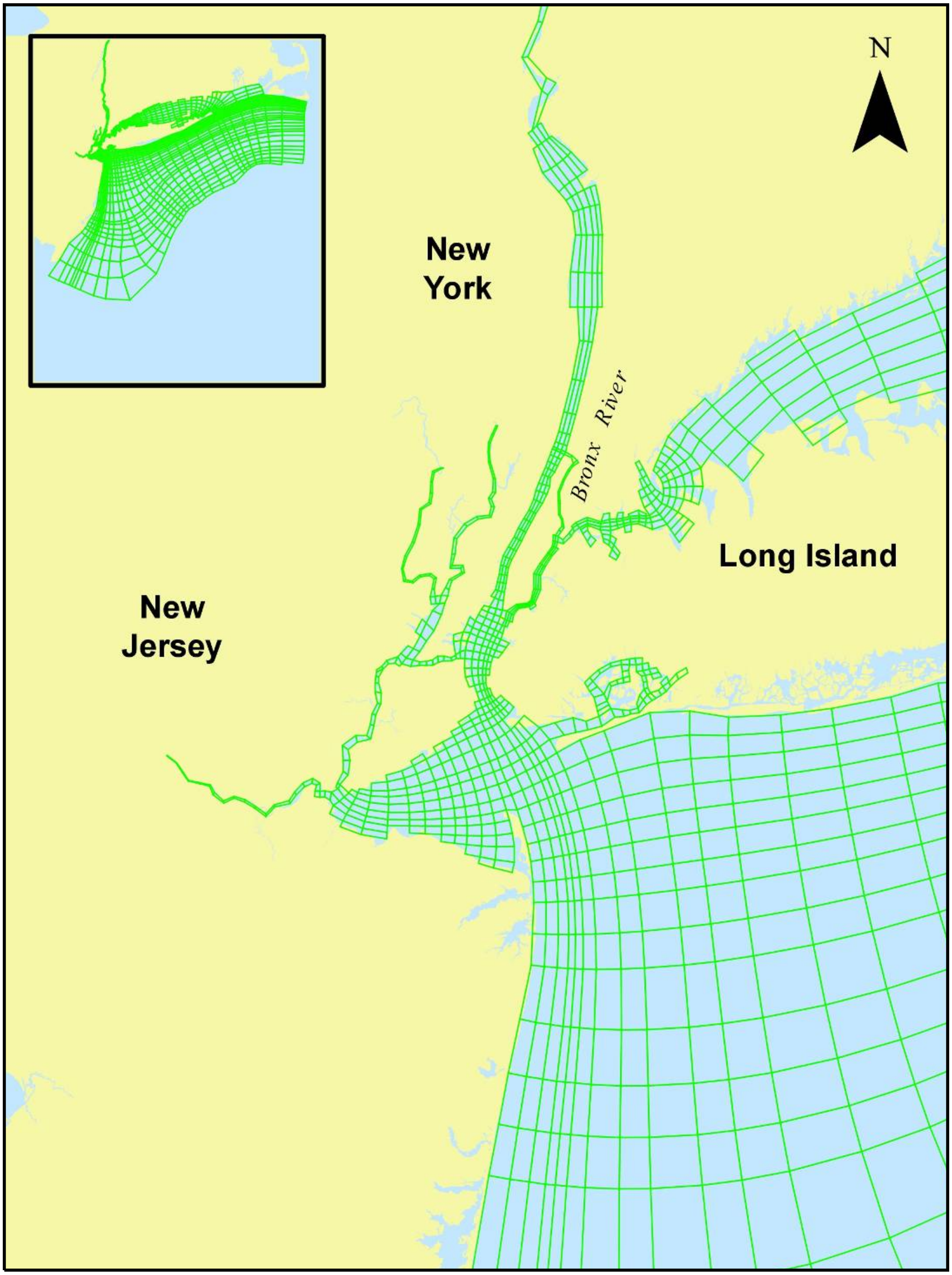
Bronx River Model (BRM) Segmentation Grid

FIGURE 4-9



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SWEM Segmentation Grid

FIGURE 4-10

The Bronx River exhibits diverse characteristics throughout its length in the Bronx, based on a review of several sources, including geology and natural feature descriptions from the NYCDCP New York City Comprehensive Waterfront Plan, Plan for the Bronx Waterfront; United States Geological Survey (USGS) topographic maps (i.e. Mount Vernon, NY Central Park, NY – NJ and Flushing, NY quadrangles); Field observations from February, July, August, September, and October, 2000, and September 2001 (HydroQual). Benthic grab samples from July and October 2000, September 2001 and July 2002 were the source of the qualitative descriptions of the Bronx River sediments (HydroQual). These samples were analyzed for total organic carbon, percent solids and grain size distribution.

Near the Westchester County border, the Bronx River is roughly 15 to 50 feet wide and 1 to 3 feet deep with a bedrock and cobble bottom and upland areas rising to roughly 150 feet in elevation. At its mouth, the river is roughly 3,500 feet wide and 17 feet deep with a mud/silt/clay bottom and upland areas rising to roughly 30 feet in elevation. River flows within the northern portion of the study area consist of fresh water. Saline waters are found within the southern portion of the study area. The East Tremont Street bridge marks the boundary between fresh and saline waters according to Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR).

Long stretches of natural shoreline exist in the parklands north of East 180th Street, including the Bronx River Parkway Preserve, Shoelace Park, the New York Botanical Garden, and the Bronx Zoo. Altered shorelines also exist within the study area, including the heavily industrialized areas south of East 180th Street. In addition, the small impoundments formed behind the four dams within the study area, as described below in Physical Characteristics, contrast with the free flowing areas of the river throughout the study area.

All of the Bronx River study area is within Coastal Zone Boundary as designated within the NYCDCP Local Waterfront Revitalization Plan (LWRP) in conjunction with the New York State Department of State (NYSDOS). The NYCDCP has also designated the western shore of the Bronx River south of the Bruckner Expressway a SMIA. This represents an area with characteristics that make it especially suited for maritime and industrial development. In addition, the mouth of the river east of the SMIA and south of Lafayette Avenue has been designated by the NYCDEP as part of a SNWA. A SNWA has large concentrations of important natural coastal features such as wetlands, wildlife habitats or buffer areas.

Based upon a review of various data sources, including USGS topographic maps, aerial photographs, NYCDCP land use maps and site reconnaissance, outside of the developed areas (e.g., SMIA), the shoreline of the Bronx River is predominantly composed of natural areas, many of which are located within parkland as shown in Figure 4-11. Although some portions of the park shoreline may have been modified historically (e.g., river rerouting near Snuff Mill) or may be actively maintained or managed, these shorelines are described as natural in the sense that the banks tend to support vegetation and lack rip-rap, bulkhead or other man-made structural modifications. More significantly altered shorelines are generally located in the industrial south of East 180th Street. A description of the physical conditions of the Bronx River shoreline from south to north is present below.

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Bronx River Existing Shoreline Physical Characteristics

In some areas, particularly in the northerly section of the river, the natural shorelines are experiencing erosion. The banks in these areas are undercut by the River current, causing trees and plants to eventually fall into the river. The erosion of pathways is also occurring. A major streambank stabilization and habitat restoration project is currently being conducted by NYCDPR with NOAA funding in Shoelace Park to remediate shoreline erosion and restore habitat.

East River to Watson Avenue

This portion of the Bronx River is tidal, and the shoreline is generally characterized by altered shorelines. The eastern shoreline from the mouth of the Bronx River to Lafayette Avenue consists of Soundview Park. The shoreline of Soundview Park is composed of rip-rap with vegetated areas directly landward of the rip-rap. From Lafayette to Story Avenue, the shoreline is comprised mainly of rip-rap. An existing bulkhead extends approximately 500 feet north of Story Avenue. North of this bulkhead, an area of rip-rap shoreline extends to Watson Avenue. In addition, a NYCDEP CSO floatables containment boom stretches the width of the river near Watson Avenue.

The western shoreline from the East River to Watson Avenue consists mainly of rip-rap with some areas of bulkhead.

Watson Avenue to East Tremont Avenue

This tidal portion of the Bronx River is characterized by a mix of natural and altered shoreline areas. The eastern shore consists of mainly altered areas, consisting of rip-rap interspersed with bulkheads, except for a stretch between Lowell Street and Westchester Avenue which consists of vegetated area.

The western shore generally consists of altered areas, both rip-rap and bulkhead.

East Tremont Avenue to East 180th Street

Between East Tremont and East 180th Street, both the eastern and the western shorelines are generally altered, consisting of stone rip-rap and tire and concrete bulkheads. The tire bulkheads are constructed of used tires, stacked to form a wall along the shoreline of the river. In many places, the tire bulkhead is fronted by stone rip-rap. The eastern shoreline is comprised of a mix of tire bulkhead and rip-rap from East Tremont Avenue to Lebanon Street. North of Lebanon Street to East 180th Street, the shoreline consists of a concrete bulkhead. The western shoreline consists of a mix of tire bulkhead and rip-rap from East Tremont Avenue to East 179th Street. North of East 179th Street to East 180th Street, the western shoreline consists of rip-rap.

North of East 180th Street to the Bronx-Westchester County Line

North of East 180th Street to the Westchester County Line, the shoreline generally consists of natural, vegetated areas which are located within areas of parkland. The Bronx Park extends from East 180th Street to Gun Hill Road and includes the Bronx Zoo and the New York Botanical Garden. North of Gun Hill Road to the county border, the Bronx River runs through the Bronx River Parkway Preserve. The shorelines within these areas of parkland generally consist of natural vegetated areas. Exceptions include the shoreline within the vicinity of Snuff Mill in the New York Botanical Garden. Both shorelines in this area consist of bedrock outcroppings. In addition, there are small areas of rip-rap and bulkhead interspersed throughout this section of the river's shoreline that are generally associated with roadway bridges.

Some of the rip-rap within this reach exhibits a more structured, uniform construction than other rip-rap noted within the study area. This structured rip-rap is composed of large blocks of rock or concrete blocks laid side by side, often connected with mortar, to form a cobblestone-like armor. These areas of structured rip-rap generally follow the slope of the bank and differ from bulkheaded areas, which tend to form a vertical wall at the water's edge.

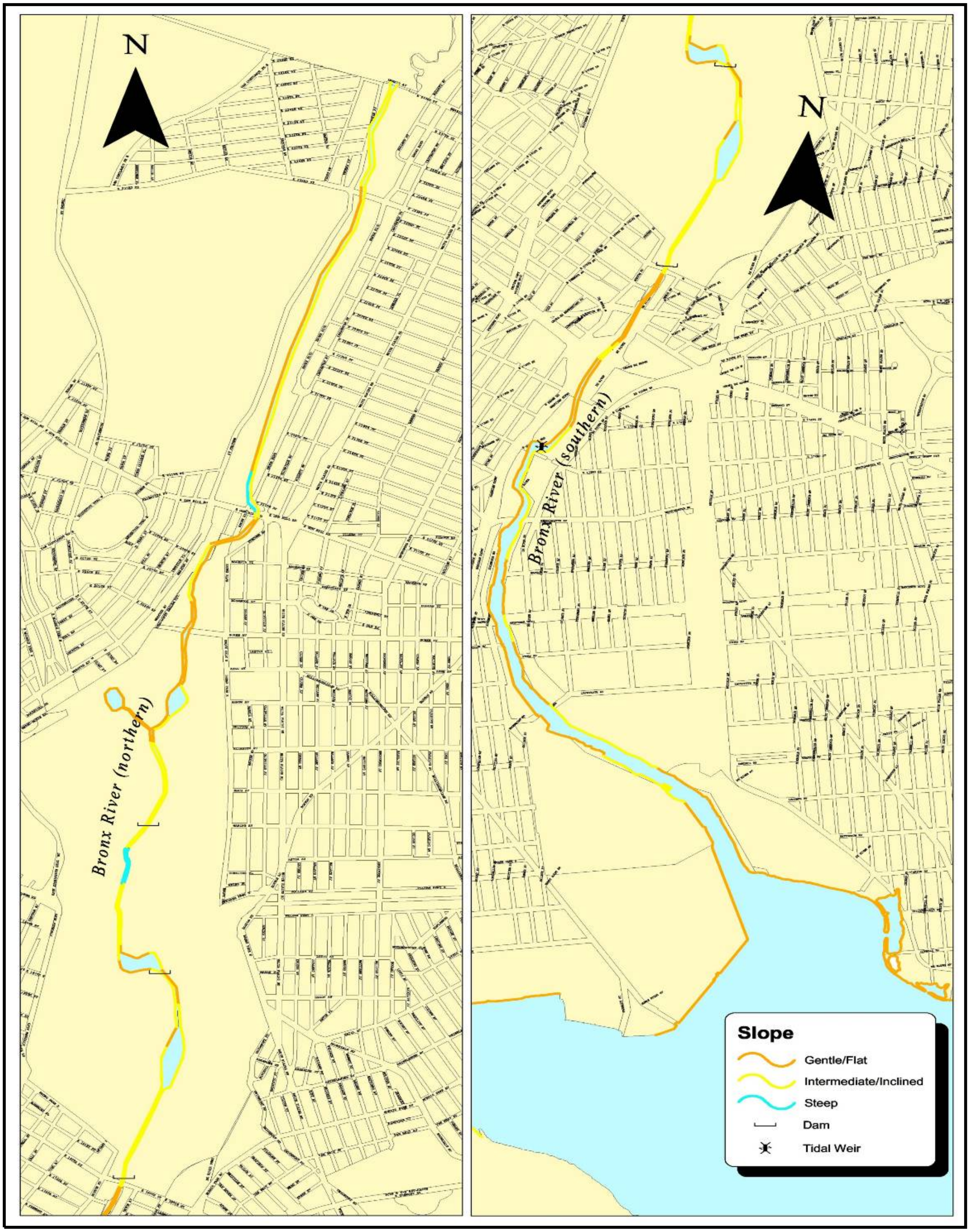
In addition, four stone dams are located between East 180th Street and the Westchester County border. One is located just north of East 180th Street in Bronx Park at the southerly end of the Bronx Zoo. A pair of dams is located in the northerly area of the Bronx Zoo. These dams are located on either side of a small island within the river. A fourth dam is located within the New York Botanical Garden just north of Snuff Mill. The immediately adjacent shorelines associated with each of the dams are generally comprised of stone bulkheads.

The slope of the Bronx River shoreline ranges from gentle (less than 5 degrees) to steep (greater than 20 degrees), with the majority of the shoreline being classified as gentle or intermediate as shown on Figure 4-12. Tables 4-3 and 4-4 list slope classifications for general locations along the Bronx River shoreline. These were determined through a review of USGS topographic maps and site reconnaissance.

For the purposes of this evaluation, slope was qualitatively characterized along shoreline banks where applicable and where the banks are not channelized or otherwise developed with regard to physical condition. Steep was defined as greater than 20 degrees or an 80-foot vertical rise for each 200-foot horizontal distance. Intermediate was defined as 5 to 20 degrees. Gentle was defined as less than 5 degrees or 18-foot vertical rise for each 200-foot horizontal distance.

In general, the slope classifications used in the project describes the Bronx River shoreline slope accurately. However, notable exceptions exist. For example, the portion of the shoreline located within the Botanical Garden near Snuff Mill is classified as intermediately sloped even though steep cliffs border the river in this area. These cliffs are nearly vertical at the river's edge, but beyond the cliff walls the elevation declines such that the total vertical gain over 200-feet of horizontal distance falls within the intermediate range.

Similarly, the western shoreline between East 211th and East 213th Streets was classified as intermediate. The shoreline in this area rises approximately 25 feet over a 20-foot horizontal distance.



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Bronx River Existing Shoreline Slope

Table 4-3. Shoreline Slope Classifications – Western Shoreline

General Location	General Slope	Field Observations
Mouth to Lacombe Avenue	Gentle	
Lacombe Avenue to Randall Avenue	Intermediate	
Randall Avenue to Seward Avenue	Intermediate	
Seward Avenue to Lafayette Avenue	Gentle	
Lafayette Avenue to north of Story Avenue	Gentle	
North of Story Avenue to Bruckner Avenue	Gentle	
Bruckner Boulevard to north Watson Avenue	Gentle	
North of Watson Avenue to East 173rd Street	Gentle	
East 173rd Street to Cross Bronx Expressway	Gentle	
Cross Bronx Expressway to Rodman Place	Intermediate	
Rodman Place to East 180the Street	Gentle	
East 180th Street to Brady Avenue	Intermediate	Areas of gentle and steep slopes interspersed along this stretch
Brady Avenue to Allerton Avenue	Intermediate	Areas of gentle and steep slopes interspersed along this stretch including Snuff Mill
Allerton Avenue to Adee Avenue	Gentle	
Adee Avenue to Rosewood Avenue	Gentle	
Rosewood Avenue to north of Magenta Street	Intermediate	
North of Magenta Street to East Gun Hill Road	Gentle	Areas of intermediate slope interspersed along this stretch
East Gun Hill Road to East 213th Street	Steep	
East 213th Street to East 233rd Street	Gentle	
Slope Gentle: Less than 5 degrees Intermediate: 5 to 20 degrees Steep: Greater than 20 degrees		

Table 4-4. Shoreline Slope Classifications – Eastern Shoreline

General Location	General Slope	Field Observations
Mouth to Lacombe Avenue	Gentle	
Lacombe Avenue to Randall Avenue	Gentle	
Randall Avenue to Seward Avenue	Intermediate	
Seward Avenue to Lafayette Avenue	Intermediate	
Lafayette Avenue to north of Story Avenue	Gentle	
North of Story Avenue to Bruckner Avenue	Intermediate	
Bruckner Boulevard to north Watson Avenue	Gentle	
North of Watson Avenue to East 173rd Street	Intermediate	
East 173rd Street to Cross Bronx Expressway	Gentle	
Cross Bronx Expressway to Rodman Place	Intermediate	
Rodman Place to East 180the Street	Gentle	
East 180th Street to Brady Avenue	Intermediate	
Brady Avenue to Allerton Avenue	Intermediate	Areas of gentle and steep slopes interspersed along this stretch including Snuff Mill
Allerton Avenue to Adee Avenue	Intermediate	Areas of gentle and steep slopes interspersed along this stretch

General Location	General Slope	Field Observations
Adee Avenue to Rosewood Avenue	Gentle	
Rosewood Avenue to north of Magenta Street	Gentle	
North of Magenta Street to East Gun Hill Road	Gentle	Areas of intermediate slope interspersed near East Gun Hill Road
East Gun Hill Road to East 213th Street	Intermediate	Areas of gentle and steep slopes interspersed along this stretch
East 213th Street to East 233rd Street	Intermediate	Areas of gentle and steep slopes interspersed along this stretch
Slope Gentle: Less than 5 degrees Intermediate: 5 to 20 degrees Steep: Greater than 20 degrees		

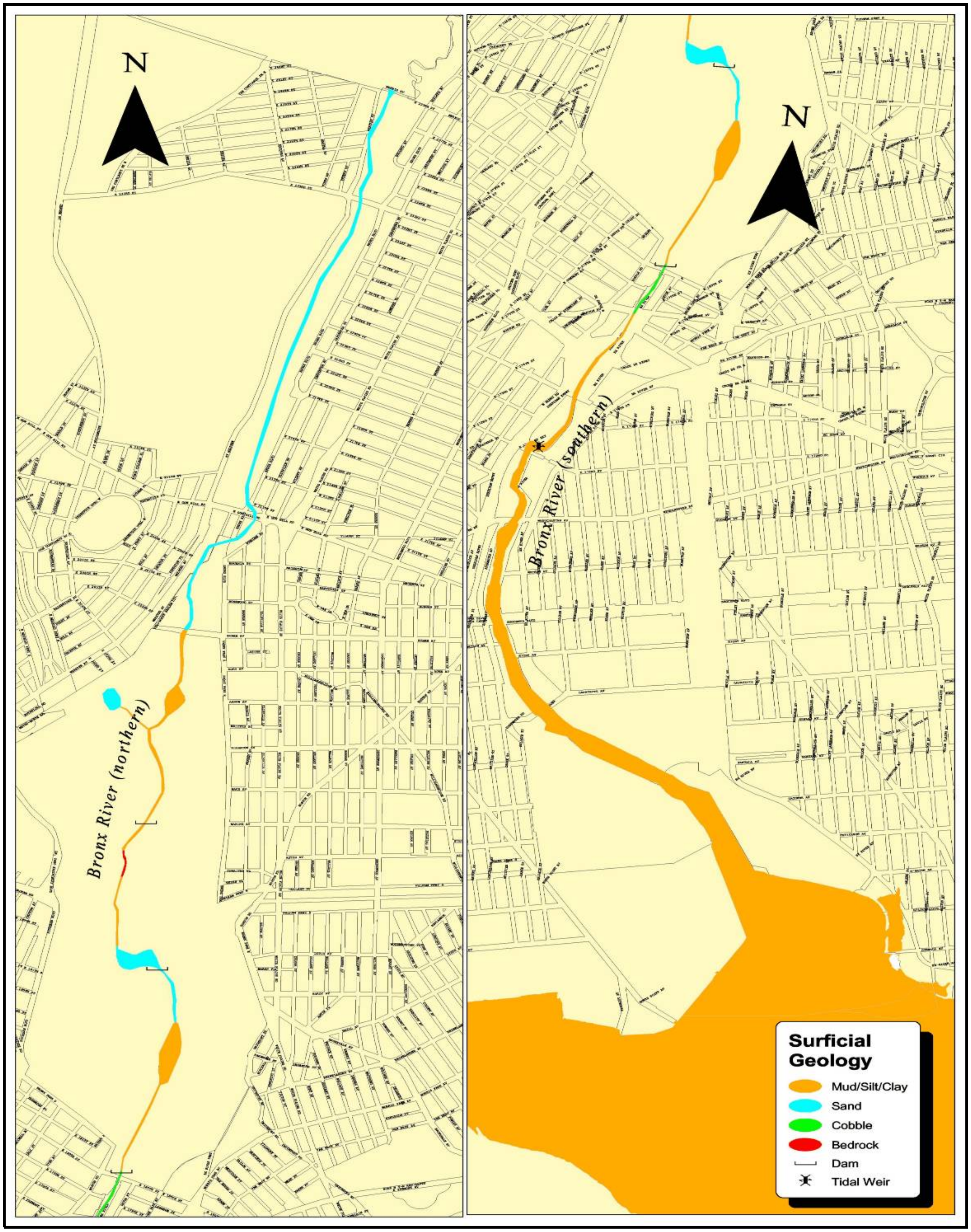
4.2.2. Surficial Geology/Substrata

The tidal Bronx River bottom varies with location, although it is generally sand or mud/silt/clay, with some areas of cobble and bedrock as shown on Figure 4-13. Surficial geology/strata are discussed qualitatively below. The primary source of information utilized to identify this information is from observations of river bottom characteristics and benthic sampling programs conducted in July and October 2000, September 2001, May 2002 and July 2002 (HydroQual). Samples were obtained using a Ponar® dredge.

The freshwater Bronx River bottom also varies with location. Qualitative description of the bottom were made by HydroQual during water quality sampling, geometry measurements and sediments oxygen demand sampling.

<u>East River to East Tremont Avenue</u>

In the lower reaches of the river from the mouth to Wyatt Street, the bottom generally consists of mud/silt/clay. This characterization was based on grab samples and sieve analyses from two stations south of Westchester Avenue. Grab samples (Ponar® dredge) taken in July 2000 at two sampling stations located between the mouth of the river and Westchester Avenue indicated silt and clay comprised 70 percent and 93 percent of the sample (HydroQual). Additional grab samples taken in July 2002 at five sampling stations located between the mouth of the river and south of Bruckner Boulevard had comparable composition with a silt and clay percent of total sample ranging from 86 percent to 93 percent (HydroQual). From Wyatt Street to East Tremont Avenue, the river bottom generally consists of cobbles, based on qualitative field observations conducted in July, August, September and October 2000 and September 2001. These qualitative observations upstream of the tidal weir were confirmed by grab bottom samples obtained in May 2002. The Ponar® dredge was not able to retrieve samples at many locations. Samples that were collected (6 stations, see Figure 4-2) exhibited low silt/clay fractions of 0 percent to 2.5 percent for locations between the Cross-Bronx Expressway and 174th Street. Silt/clay fractions in the vicinity of the upstream side of the tidal weir were 40 percent to 60 percent. At two samples immediately upstream of the weir, but on opposite sides of the river, silt/clay fractions were 64 percent and 14 percent.



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Bronx River Surficial Geology

Field notes of this area describe the sand as black and coarse with plant debris. The mud/silt/clay bottom areas have the look of black mayonnaise. In general, the area upstream of the tidal weir at 172nd Street had less soft sediment areas than downstream of the weir.

East Tremont Avenue to Bronx-Westchester County Line

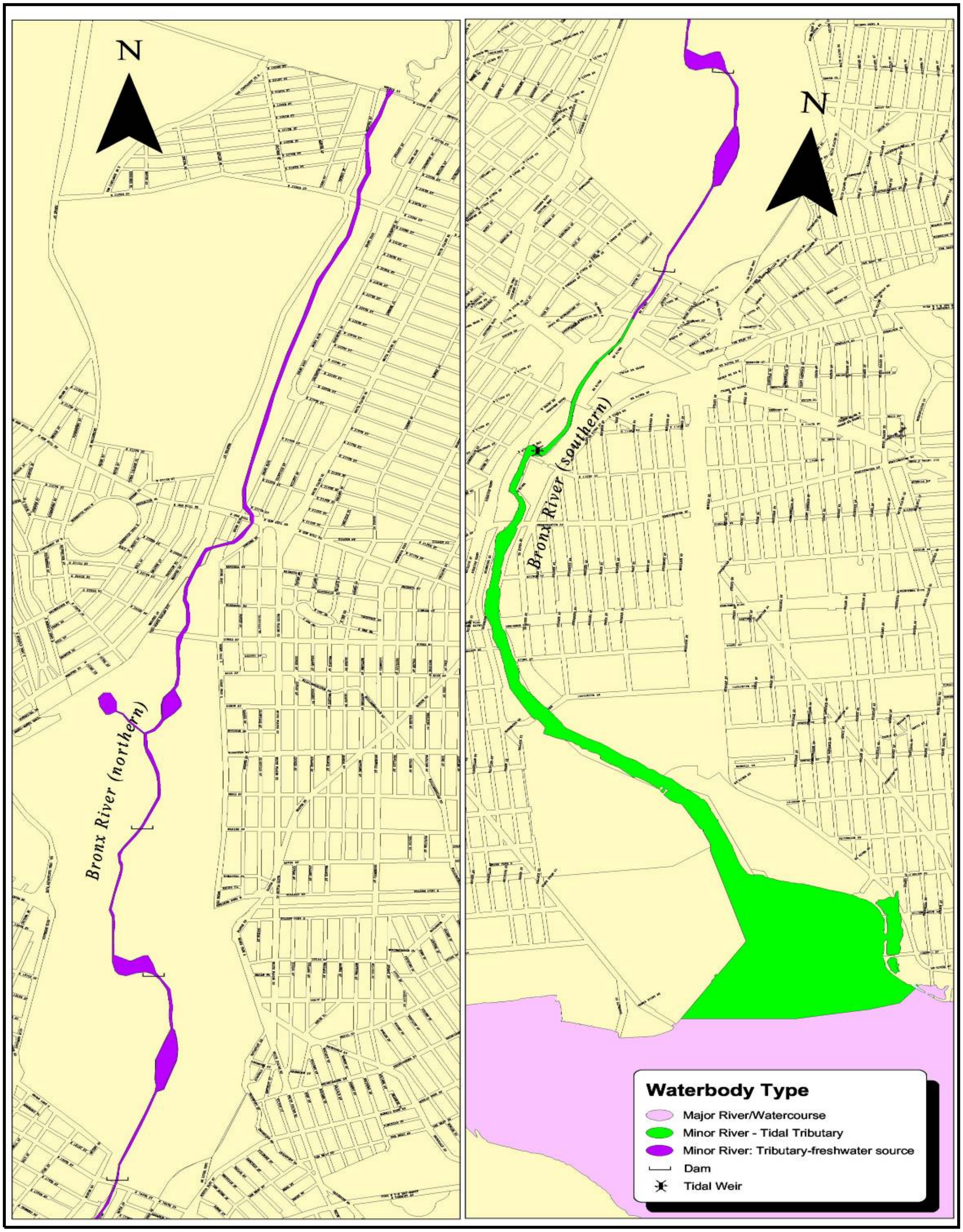
Qualitative field observations in July, August, September and October 2000 and September 2001, indicate that the bottom within this reach of the river is primarily of mud/silt/clay and sand, with one area of cobble and one of bedrock. From East Tremont to East 180th Street, the river bottom consists of cobble. Immediately north of the East 180th Street dam, the river bottom consists of mud/silt/clay. South of the intersection of Boston Road and Bronx Park East, the bottom consists of sand. In the vicinity of East Fordham Road and the Bronx and Pelham Parkway, the substrate is generally mud/silt/clay. The substrate in the upper reaches of the river, from the New York Botanical Garden to the Westchester border, is generally comprised of sand. The major exception to this is in the vicinity of the Snuff Mill within the New York Botanical Garden where the substrate is best defined as bedrock.

4.2.3. Waterbody Type

Based on Title 6 NYCRR, Chapter X, Part 935, the Bronx River boundary between fresh and saline surface waters is East Tremont Avenue. The river north of the East Tremont Avenue Bridge is classified as a minor river – freshwater source. South of the East Tremont Avenue Bridge, the Bronx River is classified as a tidal tributary influenced by the waters of the East River. Figure 4-14 shows the Bronx River waterbody type.

Freshwater Systems

A review of NYSDEC Freshwater Wetland Maps indicates that there are no freshwater wetlands located within 150 feet of the Bronx River. National Wetlands Inventory (NWI) maps, however, define numerous freshwater wetland systems along the shorelines of the Bronx River, many associated with impoundments behind the dams in the river. From East 174th Street to the dam north of East 180th Street, NWI classifies the shorelines as riverine, lower perennial, open water/unknown bottom, permanent (R20WH). (This NWI designation overlaps the NYSDEC littoral zone designation between 174th Street and East Tremont Avenue.) Further north, the impounded area behind the East 180th Street dam is classified as lacustrine, limnetic, open water/unknown bottom, permanent, diked/impounded (L1OWHh). The shoreline just south of the dam within the Bronx Zoo is classified as R2OWH, while the impounded area behind the dam is classified as palustrine, open water/unknown bottom, permanent, diked/impounded (POWHh), palustrine, scrub/shrub, broad-leaved deciduous, temporary (PSS1A) and palustrine, emergent, narrow-leaved persistent, temporary (PEM5A). North of this impounded area, from Fordham Road to Britton Street, the waterbody consists of R2OWH. Further north between Britton Street and Adee Avenue, the shorelines are classified as palustrine, forested, broad-leaved deciduous, temporary (PFO1A). In addition, an area of palustrine, open water/unknown bottom, intermittent/exposed permanent, diked/impounded (POWZh) is located to the west of the PFO1A area, within 150 feet of the Bronx River. North of Adee Avenue to the Bronx-Westchester County line, the shoreline is classified as R2OWH.



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Bronx River Waterbody Type

The wetland areas designated by NWI as lacustrine and palustrine systems are located where there are lakes and ponds in the Bronx River system. Of these freshwater wetlands, four are formed by areas of impounded water behind the existing dams. These include the lacustrine system located north of the 180th Street dam, the palustrine system located north of the dam in the Bronx Zoo, which is composed of two small ponds separated by an island, a riverine area of impounded water located behind Snuff Mill dam, and a palustrine pond located in the northern reaches of the New York Botanical Garden, which is dominated by duckweed and referred to as West Twin Lake. West Twin Lake is located west of the Bronx River between Arnow and Adee Avenues and is connected to the river via a small stream. Its sister lake, East Twin Lake, is a palustrine system that is the only lake or pond within the Bronx River system that is not formed by a dam. The Bronx River flows through East Twin Lake for approximately 450 feet.

Upland Habitat

Bronx River upland habitat can generally be divided into two separate and distinct areas. The first area stretches from the mouth of the river to East 180th Street, and can generally be described as altered, with the only major exception being Soundview Park. Upland habitat immediate vicinity of Soundview Park along the eastern shore of the river is generally natural and composed of herbaceous communities.

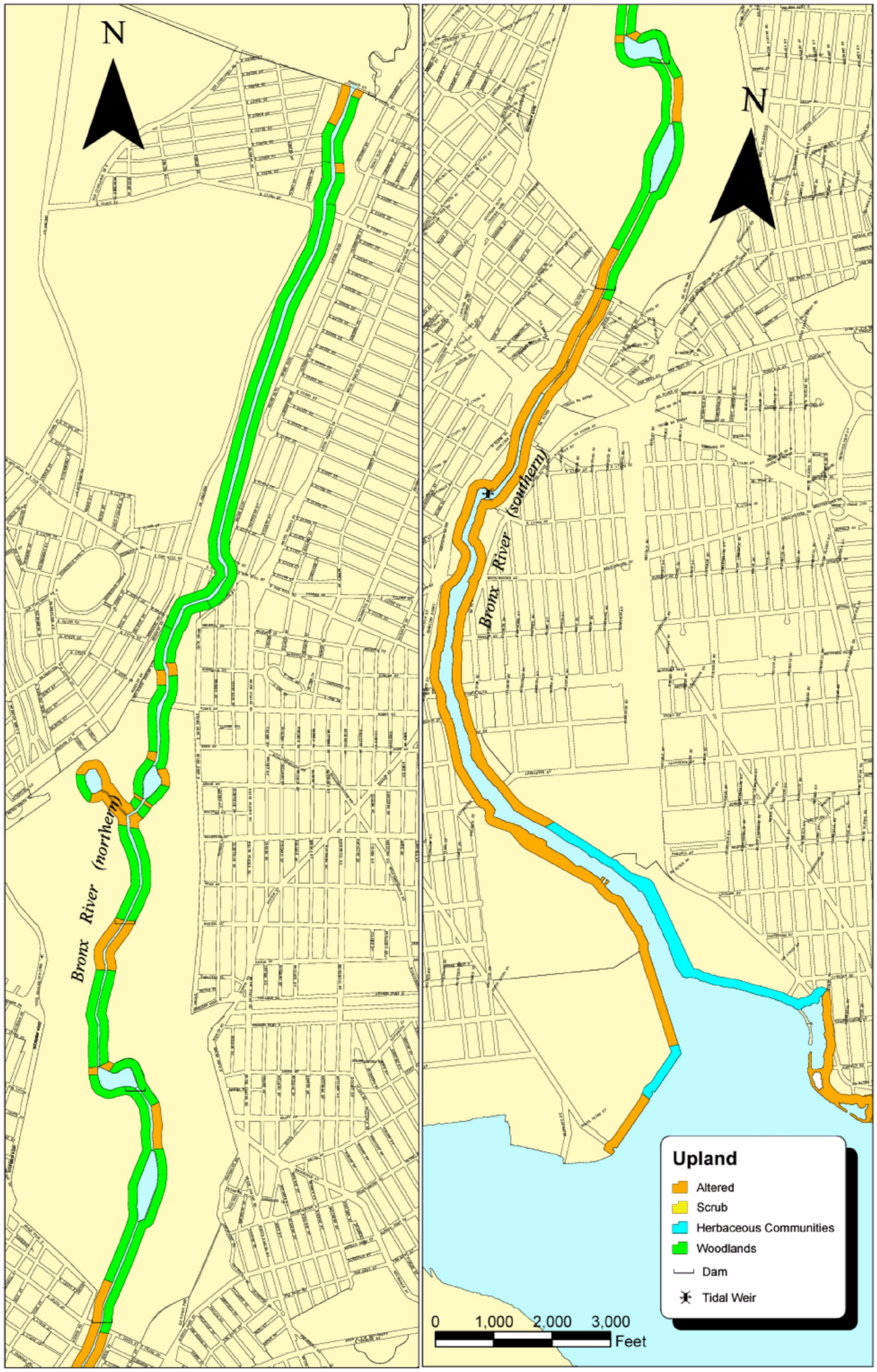
The second upland area is located between East 180th Street and the Bronx-Westchester County line and generally consists of natural, woodland areas. The vast majority of upland habitat within this portion of the river is located within areas of parkland. These upland park habitats are natural in the sense that they tend to support vegetation and possess few significant man-made developments. Many of these areas, however, may have been modified historically or are actively maintained and managed. Figure 4-15 shows Bronx River upland habitat types.

4.2.4. Waterbody Access

The waterfront area surrounding the Bronx River is dominated by industry to the south and residential and parkland in the central and northern reaches. Areas of access to the waterfront are shown in Figure 4-16. The following describes the location, type, and use access of these areas:

Muskrat Cove: This section of Bronx River north of 238th Street or Nereid Avenue will soon serve as the Bronx River Greenway link to Westchester County. Local groups continuously work to beautify the area by removing invasive plants, and reintroducing native trees and shrubs to reestablish the streambanks.

Shoelace Park: A narrow section of Bronx Park lies along the river from Gun Hill Road to 233rd Street. Shoelace Park has a canoe/kayak put-in at 219th Street, which serves as a launch site for public canoe tours and river-wide events.



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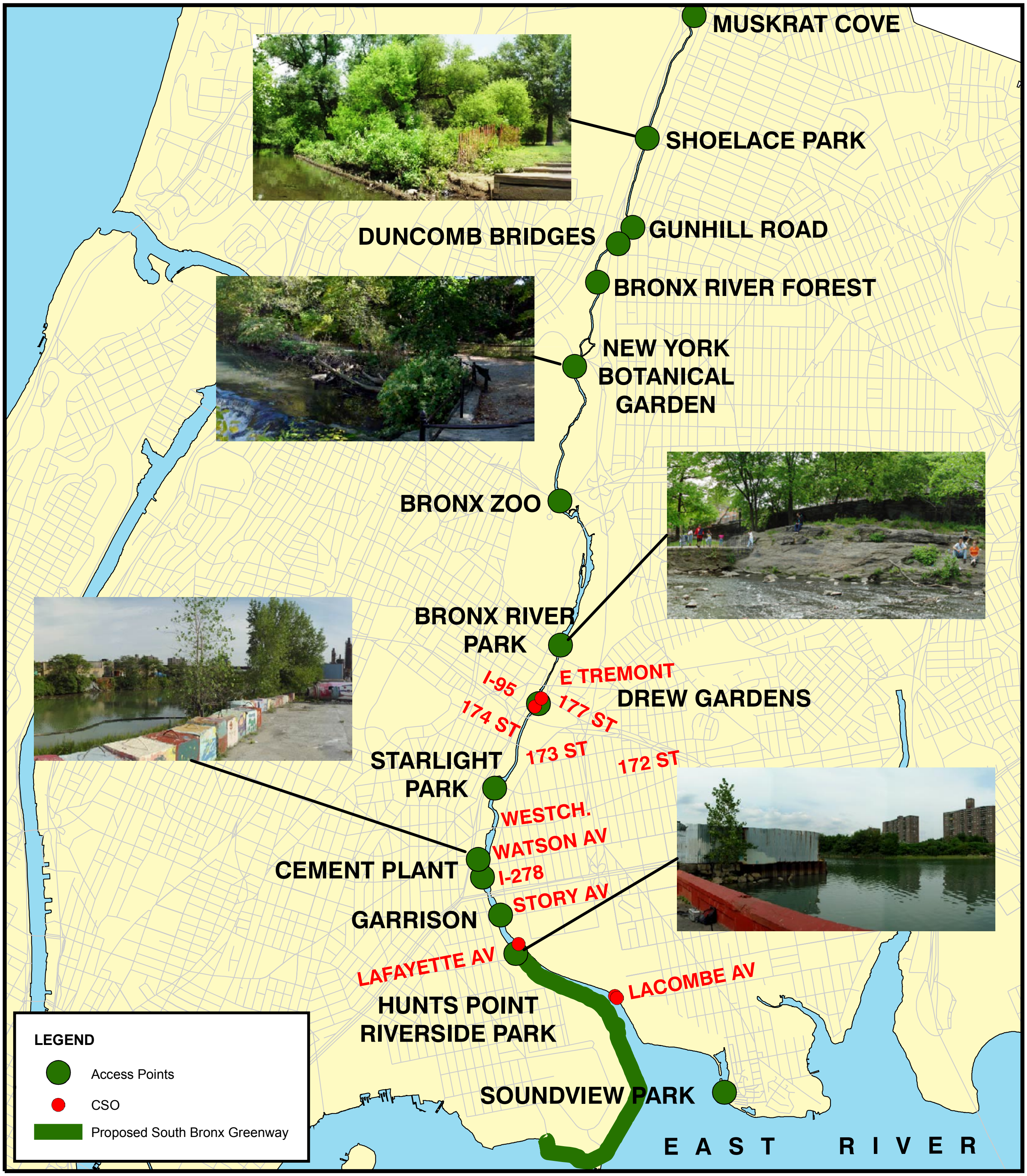
Bronx River
Existing Upland Habitat

Bronx River Waterbody/Watershed Facility Plan

FIGURE 4-15



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Bronx River Access Points

Bronx River Waterbody/Watershed Facility Plan

FIGURE 4-16

Gun Hill Road: This area south of Gun Hill Road is the last remaining oxbow in the NYC-section of the Bronx River. The Bronx River Alliance Restoration Crew along with community groups have cleaned the area of debris, and reestablished the vegetation along the western shore.

Duncomb Bridges: A pathway that runs under stone-arched Duncomb Bridges along the east side of the river. This area will be enhanced over the next few years and serve as a link along the Bronx River Greenway.

Bronx River Forest: Wooded pathways throughout the forest are used by local residents and serve as a peaceful refuge. Community groups have been active in bringing children into the old growth forest to teach them about native flora and fauna, as well as the value of community service.

New York Botanical Garden: This area of the river has 40 acres of forest that have been virtually undisturbed since the 17th century. The waterfall in the Garden is one of four waterfalls in the NYC-section of the river that were built to harness the river's energy. As an impediment to safe passing during canoe trips, it is necessary to portage around each of the waterfalls in this area.

Bronx Zoo: The stretch of river in the Zoo is marked by the double waterfalls, built to power the first mill that existed along the river in the middle to late 19th century. When built, the dam below the Zoo at River Park created an ideal area for boating and picnicking in the early 20th century.

River Park: The Bronx River flows along the eastern shore of River Park, whose most notable feature is the beautiful waterfall and dam that is located just outside of the southern boundary of the Bronx Zoo. The park is popular for barbecuing and picnicking next to the river. The waterfall/dam is the northern-most incursion of marine and estuarine fauna. Downstream, the river becomes increasingly more saline and tidally influenced.

Drew Gardens, West Farms: Restoration efforts originally began in West Farms in 1974 with the inception and work of Bronx River Restoration. Today, the one-acre vacant lot is a thriving community and school garden. Drew Gardens is located on the west side of the river just south of East Tremont Avenue and serves as an environmental learning space for the students at CS-204, The Bronx River Arts Center and for others in the community.

Starlight Park: The Sheridan Expressway on the west side and 174th Street Bridge to the north defines the park. Local groups have begun to monitor the conditions of the river, host canoe trips, pick up shoreline debris, and plant native trees. A future project involves the complete reconstruction of the park, including waterfront access, a comfort station, and a boat house.

Concrete Park: Local groups and government agencies have transformed an abandoned Concrete Plant into a waterfront accessible park along the western shoreline between Westchester Avenue to the north and the Bruckner Expressway to the south. The project included ecological restoration of the mudflats through large-scale salt marsh grass planting and the construction and planting of an aquatic nursery. The new park was completed in September 2009.

Garrison: This one-acre parcel of land, located immediately south of the Bruckner Expressway on the west side of the river was recently acquired by the Parks Department. When developed into a viable park, Garrison will serve as a key link along the Bronx River Greenway. Community groups working in conjunction with the Parks Department have interim plans to implement a salt marsh restoration project along the mudflats.

Hunts Point Riverside Park: Recently, this park has been transformed into a waterfront park, located at the intersection of Edgewater Road and Lafayette Avenue. Since its creation, the park has been at the heart of community involvement that is currently host to a locally led youth environment stewardship program, boating and fishing programs, scientific monitoring projects, and large-scale community events.

Soundview Park: Soundview Park is the largest park along the Bronx River at 163.5 acres. It has sports fields and walking path along this section of the river. The Soundview Lagoons are located at the southeastern end of the park. In recent years, efforts have been expended to clean up and restore the natural habitat of the lagoons and the adjacent parkland in the Harding Park community. Groups have hosted bioengineering and greenway planning workshops, as well as yearly Coastal Clean ups. The U.S. Army Corps of Engineers plans to implement a large-scale restoration project of the lagoons.

Many initiatives are planned for the Bronx River and surrounding areas that will improve waterfront access. These future projects are discussed in detail in Section 5 of this report.

4.2.5. Freshwater Flow

The total Bronx River drainage area is approximately 37.9 square miles (24,260 acres). The Bronx River drainage area in Westchester County to the location of the USGS flow gage at Bronxville, New York is 26.5 square miles (16,960 acres). This total does not include the 18.1 square miles of drainage area upstream of the Kensico Dam which creates a reservoir for municipal water supply. There is an additional 4.84 square miles (3,100 acres) of Westchester County Bronx River drainage area downstream of the Bronxville gage location. The Westchester County drainage area is 83 percent of the total Bronx River drainage area. Prior to discontinuance of the USGS gage in 1989, the 45 years of flow records indicate an average flow of 42.7 cfs (27.7 MGD), a one in 10-year 7 consecutive day low flow (7Q10) of 3.7 cfs (2.4 MGD) and a range of flow from 1 cfs to 2,500 cfs (0.6 MGD to 1,600 MGD).

The New York City portion of the Bronx River drainage area is approximately 6.5 square miles (4,160 acres) or approximately 17 percent of the Bronx River drainage area. The freshwater Bronx River passes through the New York Botanical Garden and the Bronx Zoo and then enters the tidal portion of the river downstream of East Tremont Avenue.

4.2.6. Tidal Characteristics

Based in Title 6 NYCRR, Chapter X, Part 935, the Bronx River boundary between fresh and saline surface waters is East Tremont Avenue. The river north of the East Tremont Avenue Bridge is classified as a minor river- freshwater source. South of the East Tremont Avenue

Bridge, the Bronx River is classified as a tidal tributary influenced by the waters of the East River. Figure 4-17 shows this boundary line and the corresponding drainage areas.

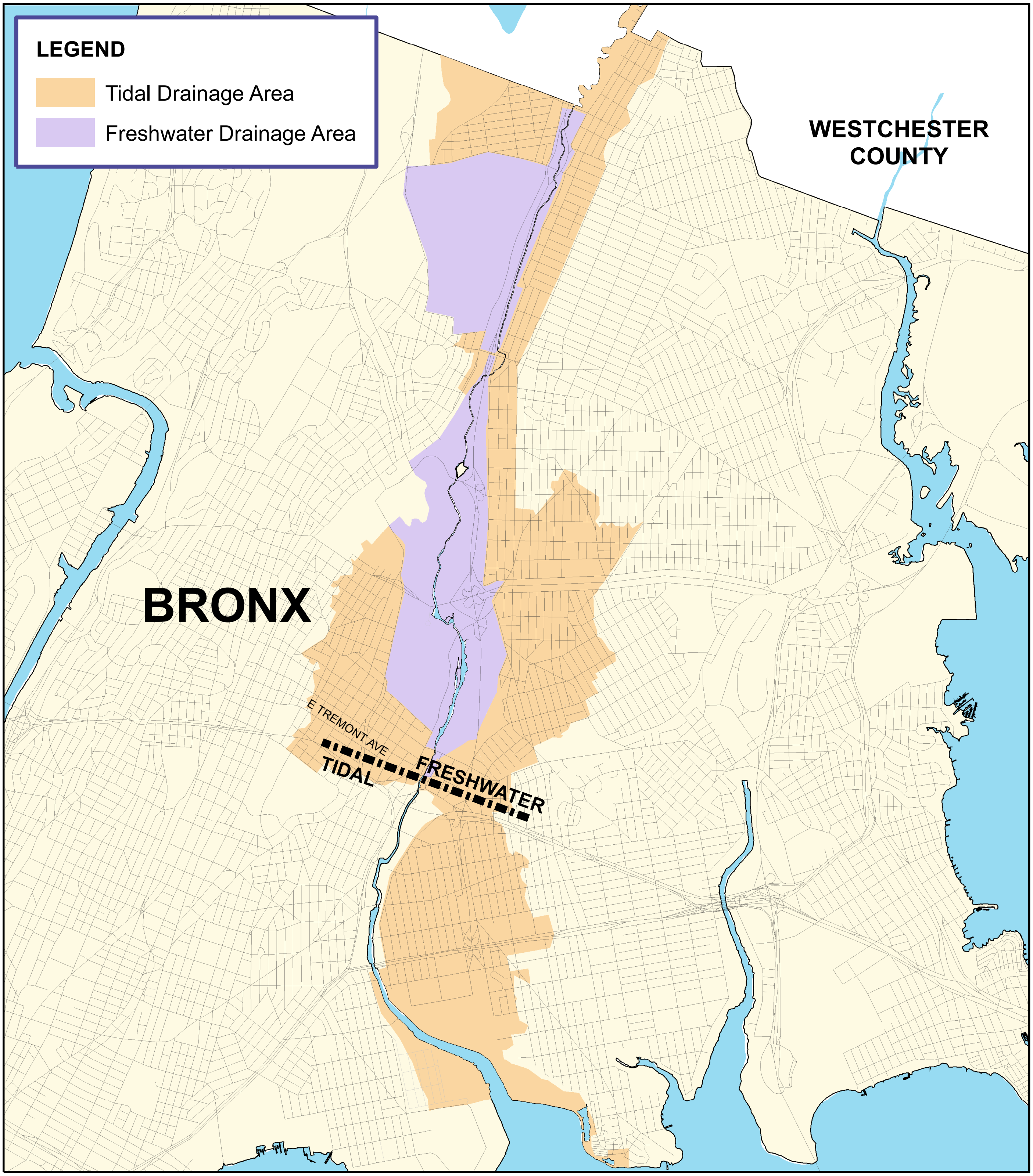
The Bronx River estuary portion has a tidal cycle diurnal with a tidal range of 6 to 7 feet. Freshwater input to the tidal Bronx River is the freshwater Bronx River, CSO, and stormwater discharges. Depths in the tidal Bronx River range from 4 to 6 feet at the head end to 17 feet at the mouth. Widths range from 100 to 150 feet at the head end to 3,500 feet at the mouth. At 173rd Street there is a tidal weir across the river. It was constructed to control the upstream propagation of the diurnal tidal wave. It effectively controls the diurnal tidal fluctuations. The tidal weir is submerged during high tide but its crest is exposed during low tide. A federal navigation channel starts at the mouth and extends upstream for approximately 2.5 miles to the vicinity of the tidal weir.

The tidal weir and Bronx River freshwater flows influence the salinity stratification in the Bronx River estuary. The estuary upstream of the weir is relatively well mixed. Downstream of the weir, however, there is a pronounced salinity stratification that is present during all flow conditions; freshwater on the surface and salty water on the bottom.

Lawler, Matusky and Skelly Engineers observed that velocities in the upper and lower tidal portions of the Bronx River were all less than three fps. Freshwater Bronx River velocities, observed by HydroQual, were also below three fps. The highest measurement was 1.35 feet per second.

4.3. CURRENT WATERBODY USES

The relevant criteria for recreational and bathing uses are total and fecal coliform concentrations. Under present regulation, there are two NYSDEC use classifications that apply to contact recreation; primary contact and secondary contact. Primary contact recreation is defined in NYSDEC regulation as “recreational activities where the human body may come in contact with raw water to the point of complete body submergence. Primary contact recreation includes, but is not limited to, swimming, diving, water skiing, skin diving, and surfing.” (NYSDEC). Secondary contact recreation is defined in NYSDEC regulations as “recreation activities whose contact with the water is minimal and where ingestion of the water is not probable. Secondary contact recreations includes, but not limited to boating.” (NYSDEC) The NYSDEC considers canoeing and kayaking to be secondary contact recreations activities (R. Draper, NYSDEC personal communication). Primary and secondary contact recreation is the designated use of Class B in freshwaters and Class SB in saline waters. Secondary contact recreation is the designated use for Class I in saline waters. Class C in freshwaters and Class SC in saline waters water quality are required to be able to support primary and secondary contact recreation use although the use may be limited by other factors. In addition, New York City Department of Health and Mental Hygiene (NYCDOHMH) has regulatory responsibility for designated bathing beaches in New York City waters. The following sections discuss existing uses and classifications, as well as existing conditions in the River.



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Tidal and Freshwater Sections and the Associated Drainage Areas

Existing waterbody uses of the Bronx River are power boating (limited to tidal sections), canoeing, kayaking and fishing. Wading and swimming occur in the Bronx River, although these activities are unauthorized. "No Swimming" signs are posted at the locations where swimming is known to occur. Riparian activities in the freshwater section include the New York Botanical Garden, Bronx Zoo, the Greenway and parks. The tidal portion of the Bronx River, also contain Greenway, parks and limited boat launch access at Lafayette Park.

4.4. OTHER POINT SOURCES AND LOADS

SPDES permits are issued to all entities that discharge from a point source to waters of the United States (or storm sewers connected to them). In addition to the combined- and storm-sewer discharges, nonpoint sources and other potential sources of loadings discussed in Sections 2 and 3, there are a number of other individuals/businesses that meet these criteria in the Bronx River watershed. Each of these permit holders has the potential to impact the water quality of the Bronx River.

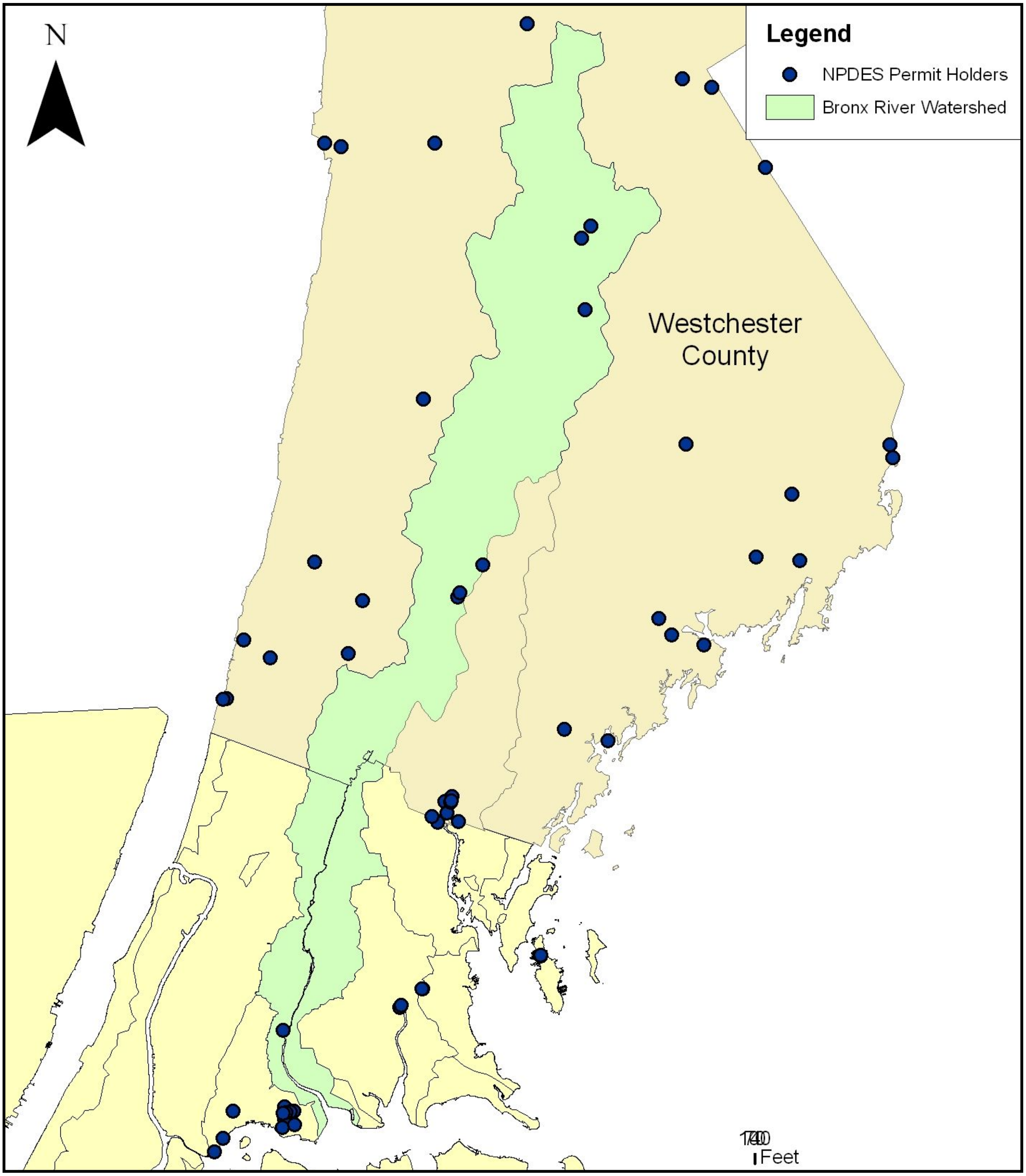
In order to determine the number and nature of SPDES permit holders in the Bronx River watershed, USEPA's Envirofact Warehouse (http://www.epa.gov/enviro/index.html) was used to query all NPDES permit holders in "Bronx, NY" and "Westchester County". This information was then assembled into a GIS database and overlaid with the natural water boundaries in the City and County. The review found that there are a total of eight SPDES permit holders in the Bronx River watershed. Six of these are in Westchester County and two are located within the City of New York. Table 4-5 provides a brief description of the permit holders. Figure 4-18 shows the location of the permit holders within the watershed.

Table 4-5. Bronx Watershed SPDES Permit Holders

Permit #	Locations	Industry	Pollutant
NYU700270	Bronx Borough	Automotive	Not listed online
NYU700260	Bronx Borough	Automotive	Not listed online
NYU300102	Westchester County	Concrete	Not listed online
NYR10G491	Westchester County	High School	Not listed online
NY0265039	Westchester	Energy/Power	1,2,3,4,5,6,7,8
NYP080843	Westchester County	Chemical/Pharmaceutical	Not listed online
NYP080951	Westchester County	Metallurgy	Not listed online
NY0264270	Westchester County	Railroad	1,3,4,8,9,10

Pollutants:
1) pH
2) Oil & Grease
3) Toluene
4) Benzene
5) Benzene, Toluene, Xylene (combination)
6) Ethylbenzene
7) Polychlorinated Biphenyls (PCBS)
8) Xylene
9) Flow Rate
10) Solids/Settables

For the various industries listed in Table 4-5, many of the respective pollutants are not listed. However the impact of these pollutants is expected to be small due to the size of the industries. The two SPDES holders located within New York City, both automotive industries, are not expected to discharge oxygen consuming substances or pathogens.



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NPDES Permit Holder Locations

Bronx River Waterbody/Watershed Facility Plan

FIGURE 4-18

This section provides a review and summary of the principal inputs of nutrients and oxygen demanding material to New York Harbor, Long Island Sound and the New York Bight. The New York Bight is a large gulf formed by the coastal indentation between the New Jersey and Long Island around the mouth of the Hudson River in New York Harbor. The inputs consisted of:

- WPCP and industrial discharges
- Fall-line tributary loadings (boundary conditions)
- CSO loadings
- Municipal Separate Storm Sewer System (MS4) loadings
- Non-point source loadings from stormwater runoff (SW)
- Atmospheric loadings falling directly on the surface water

Discharge and water quality are specified to assign the fall-line tributary inputs in SWEM. Discharge data was obtained from USGS surface water record for New York, New Jersey, and Connecticut on a daily basis as part of the development of the hydrodynamic submodel of SWEM. Tributary concentration data for individual water quality constituents collected during the monitoring program in support of SWEM for nine tributaries were used to assign concentrations for the fall-line tributary inputs on a monthly average basis. Monthly average upstream river loads for the Bronx River are tabulated in Table 4-6.

Table 4-6. Monthly Average Upstream River Loads for the Bronx River

Mo.	Flow MGD	TNH_3 lbs/d	TPON lbs/d	DON lbs/d	NO23 lbs/d	TPOP lbs/d	DOP lbs/d	TPO_4 lbs/d	$TBOD_5$ lbs/d	TPOC lbs	DOC lbs/d
Jan	28.5	88.6	46.8	64.6	216.7	19.7	2.5	1.7	383.2	332.7	689.1
Feb	62.3	180.4	101.9	140.4	495.4	42.8	5.3	3.8	839.4	733.0	1507.6
Mar	34.6	102.9	53.5	76.3	240.9	23.2	2.7	2.0	452.4	384.6	824.1
Apr	40.4	99.2	80.	93.2	236.6	23.2	2.5	4.3	614.3	503.0	938.4
June	15.9	37.8	56.7	37.2	99.6	14.8	1.1	5.1	417.6	343.1	377.7
July	31.1	79.6	70.8	77.3	189.1	19.0	2.4	3.8	511.	440.9	754.7
Aug	13.	34.8	39.8	31.2	72.9	9.1	0.9	3.2	288.7	237.2	303.3
Sept	16.3	41.1	32.8	39.9	99.3	9.3	1.3	1.4	242.9	207.6	393.6
Oct	15.7	45.3	33.7	36.2	108.9	9.5	2.1	2.0	271.1	235.9	391.8
Nov	56.2	143.5	100.8	131.3	328.3	29.5	5.9	4.1	821.9	741.0	1421.0
Dec	21.6	60.	34.9	49.0	154.9	14.8	1.8	1.2	288.7	250.4	524.2

Combined Sewer Overflow (CSO) and Stormwater (SW) Runoff Loadings

A simplified version of SWMM, InfoWorks was used to calculate the CSO, and SW volumes. Included in the SW volume are discharges from the four MS4 outfalls in the freshwater portion of the Bronx River, discussed previously in Section 3.2.4. During the NYC 208 project a Rainfall-Runoff Modeling Program (RRMP) was developed to estimate discharges driven by rainfall to the harbor. The model area accounts for New York City, Westchester County, Nassau County, Rockland County, and parts of New Jersey which drain into the Harbor. RRMP and RRMP II simulations were performed for a real unit rainfall which was then scaled according to the actual rainfall period. InfoWorks is a modern version of RRMP II that was calibrated to the more detailed hydraulic sewer system model used on this LTCP. The SWMM sewer system model accounts for dry weather flow, wet weather runoff, and regulator hydraulic capacities. In other harbor areas, such as New Jersey and Westchester County, the InfoWorks model was used, while areas of the Long Island Sound had runoff loadings based on loads developed during the Long Island Sound Study.

Data collected during the SWEM monitoring program was used to assign CSO and SW pollutant concentrations. Due to the limit fraction of the total possible locations sampled and the highly variable nature of CSO and SW quality, log mean concentrations of data were used. The log mean concentrations of CSO and SW in SWEM are listed in Table 4-7. CSO and SW flows accounted for about 5 percent of the total flow input into the model.

Table 4-7. Concentrations assigned to CSO and SW for SWEM calibration (1994-95)

Constituent	CSO	SW
Phosphorus		
Particulate Organic Phosphorus (POP)	0.70 mg P/L	0.09 mg P/L
Dissolved Organic Phosphorus (DOP)	0.13 mg P/L	0.02 mg P/L
Dissolved Inorganic Phosphorus (DIP)	0.60 mg P/L	0.08 mg/L
Nitrogen		
Particulate Organic Nitrogen (PON)	3.02 mg N/L	0.37 mg N/L
Dissolved Organic Nitrogen (DON)	1.63 mg N/L	0.40 mg N/L
Ammonium (NH4)	4.44 mg N/L	0.24 mg N/L
Nitrate & Nitrite (NO3+NO2)	0.49 mg N/L	6.33 mg O_2/L
Silica		
Dissolved Silica (DSi)	1.71 mg Si/L	1.77 mg Si/L
Carbon		
Particulate Organic Carbon (POC)	41.5 mg C/L	7.32 mg C/L
Dissolved Organic Carbon (DOC)	18.7 mg C/L	8.81 mg C/L
Oxygen		
Dissolved Oxygen (DO)	3.8 mg O_2/L	6.3 mg O_2/L

4.5. CURRENT WATER QUALITY CONDITON

4.5.1. Dissolved Oxygen

The Bronx River from its headwaters to the Westchester County/Bronx border is Class C. Class C dissolved oxygen standard is “minimum daily average of 5.0 mg/L, never less than 4.0 mg/l”. There are several sections and tributaries in Westchester also designed as trout (T) waters. The dissolved oxygen standard for Class C (T) is “minimum daily average of 6.0 mg/L, never less than 5.0 mg/L.”

The freshwater Bronx River in NYC is a Class B water. As such the dissolved oxygen standard to protect fish and aquatic life is “minimum daily of 5.0 mg/L, never less than 4.0 mg/L.” A comparison of available, recent dissolved oxygen data and data obtained during the

Project with Class B standards was performed. The data available from the NYCDEP Harbor Survey that were used for the analysis of existing conditions that were found to be available were for the year 2000 for two stations and the Bronx Zoo Management Plan (within the Zoo). Three surveys were conducted in September, October and December 2000 at seven river stations. In addition, as detailed in the Bronx River FSAP, surveys were conducted at ten stations by HydroQual during the summer of 2000 and included two wet weather stations and one dry weather station surveys with a diurnal component.

A plot of all summer 2000 temperature and dissolved oxygen data collected by HydroQual is presented on Figure 4-19. The data are plotted spatially from the Westchester/NYC border to the downstream end of the freshwater Bronx River section measured as river miles from the East River. It can be seen that all dissolved oxygen values are greater than the minimum value of 4.0 mg/L. Similarly, Table 4-8 summarizes all readily available data. The data are presented by sampling program and year. Data have been combined for all stations to characterize the entire Class B section of the Bronx River. The number of data points and statistics are given. Again, it can be seen that dissolve oxygen standard is met.

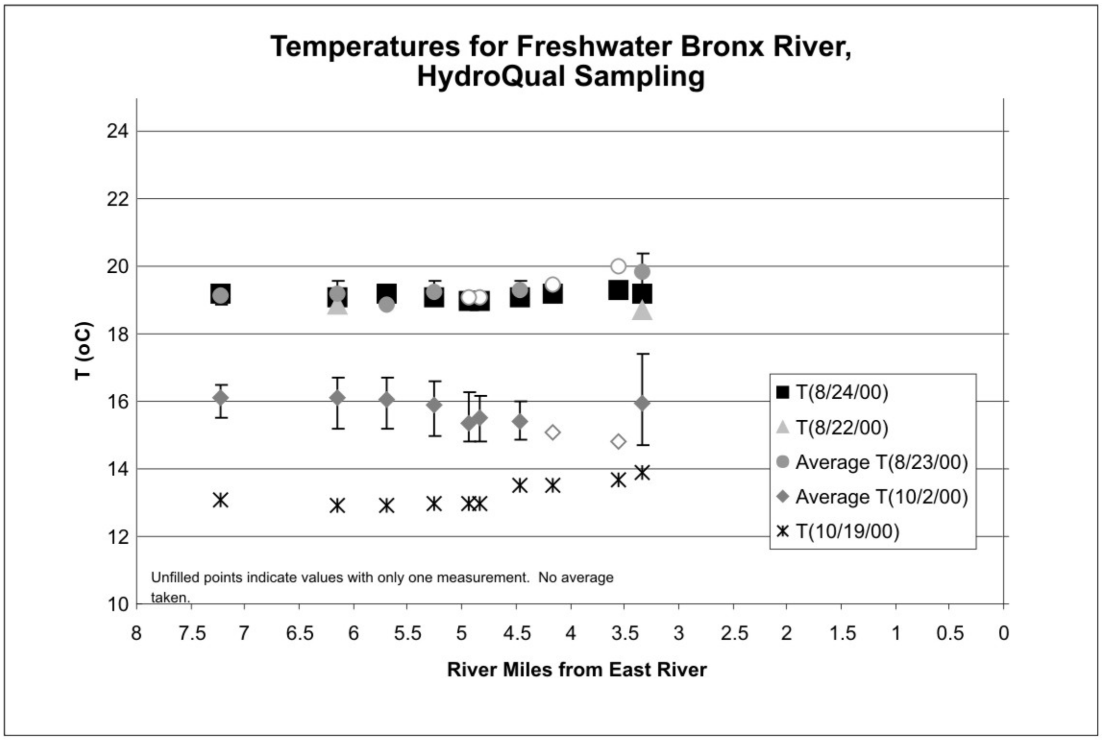
Table 4-8. NYC Freshwater Bronx River Dissolved Oxygen Data Summary

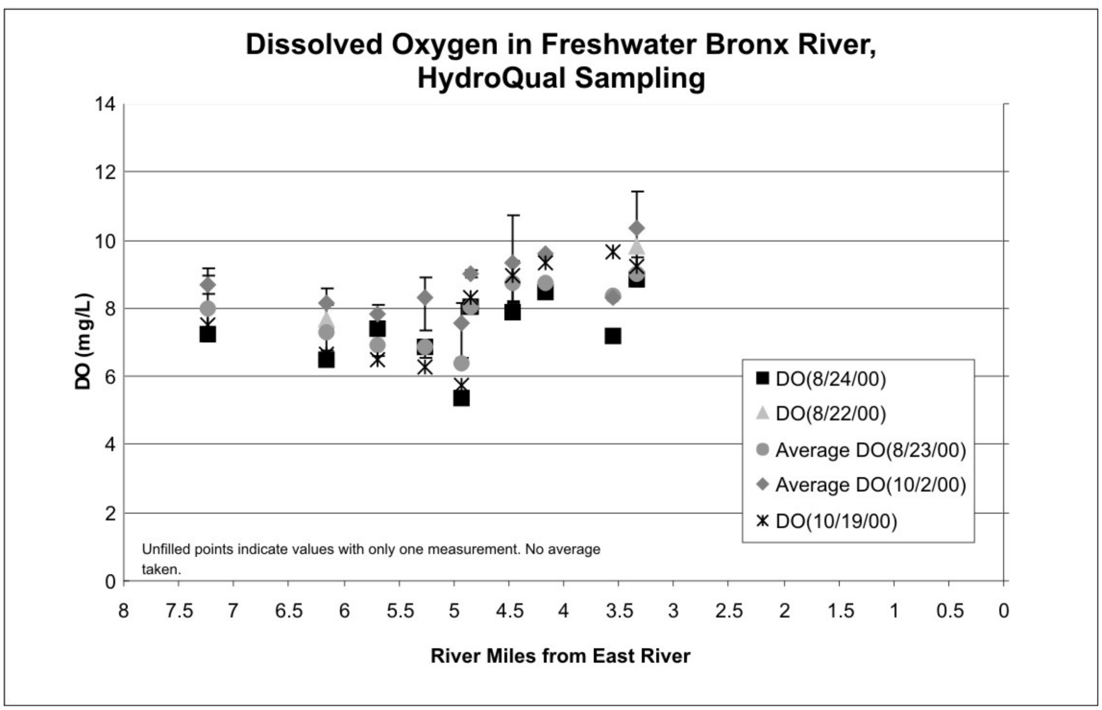
Data Program	**Data Period**	**No. of Stations**	**No. of Data Points**	**Dissolved Oxygen**	
				Average mg/L	**Minimum mg/L**
NYCDEP Harbor Survey	Summer 2000	3	6	6.2	5.6
USA Project	August 2002 October 2000	10 10	38 36	7.8 8.4	5.3 5.8
Bronx Zoo Management Plan	September 2000 October 2000 December 2000	7 7 4	7 7 4	7.1 7.1 8.1	6.5 7.1 5.6

Recent data indicate an improvement in dissolved oxygen in the NYC freshwater Bronx River, when compared to data from the CSO Facility Planning period (1988-89). Significantly lower BOD is also noted in the recent data, 2 to 4 mg/L, summer 2000, compared to 7 to 22 mg/L in 1988 and 1989. The conclusion is that the Bronx River flowing into New York City appears to meet Class C dissolved oxygen standards. Class B dissolved oxygen standards are met in the freshwater Bronx River, indicating fish and aquatic life use is protected.

The tidal Bronx River is currently classified Class I by the NYSDEC. The Class I dissolved oxygen standard is “never less than 4.0 mg/L.” Dissolved oxygen levels lower than this standard were observed in the bottom samples from all available historical data. As shown in Figure 4-20, the lowest levels were observed at the upstream portion of the tidal section and gradually improved towards the mouth of the Bronx River.

The Bronx River Model (BRM), a coupled hydrodynamic and water quality model of the tidal section of the river, was run initially for the Baseline Case to better understand the existing condition of the river since there was not very much water quality monitoring data available within the River. Among model results are concentrations at each model grid box for each time-step saved. Figure 4-21 presents a portion of the available model results for the Baseline Case.





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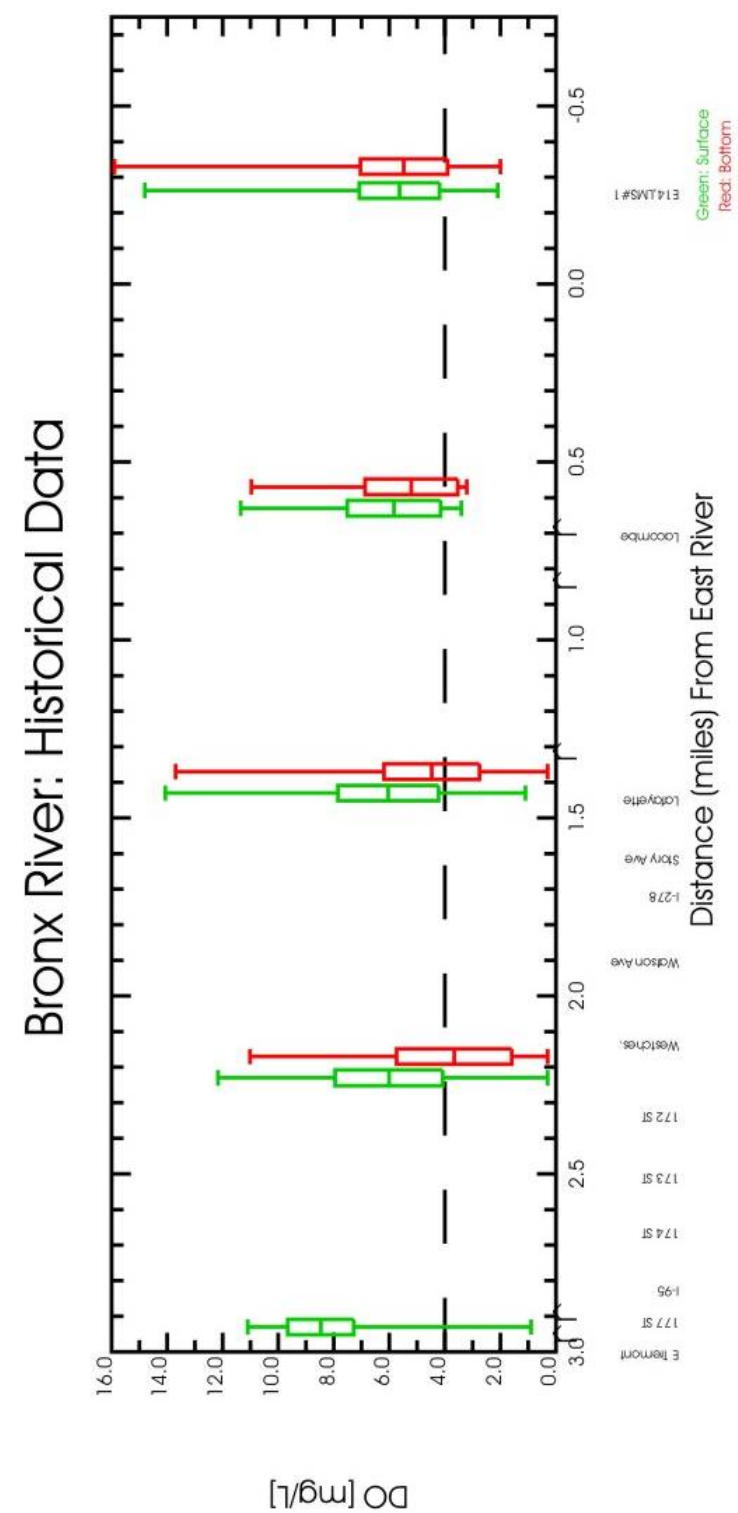
NYC Freshwater Bronx River FSAP, Temperature and Dissolved Oxygen Data, 2000

FIGURE 4-19



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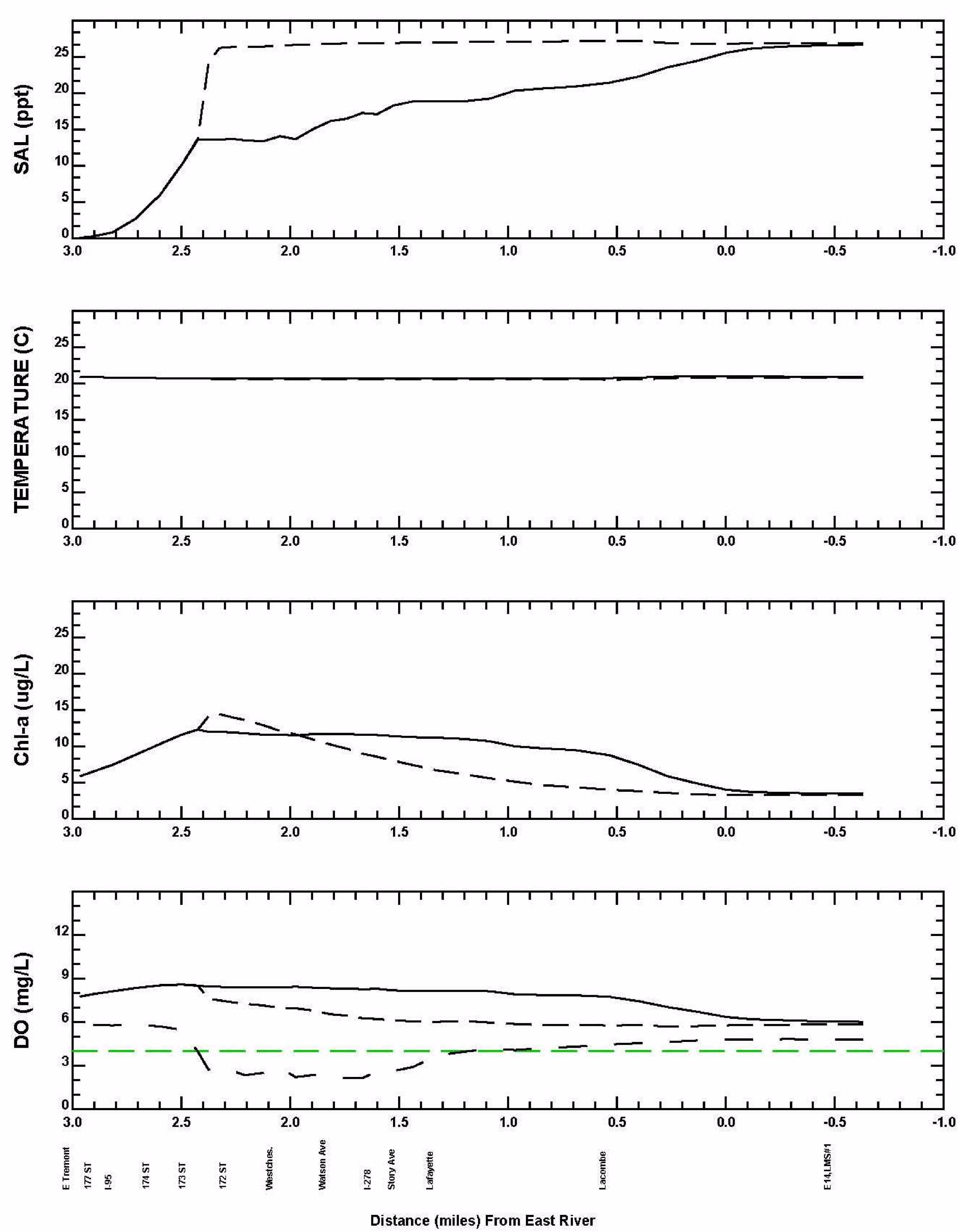
Bronx River Historical Data
Dissolved Oxygen



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Spatial Salinity, Temperature, Chlorophyll, and Dissolved Oxygen, July Baseline Condition

Concentrations of salinity, calculated temperatures, chlorophyll-a (algae), and dissolved oxygen calculated for July are plotted on the four panels. Results are presented spatially from the mouth of the Bronx River at the East River, 0 miles, upstream to East Tremont Avenue (~mile 3.0) and from the Bronx River mouth out into the East River. The dashed line on each panel is the average of the bottom layer. The solid model line is the top layer average. The top panel, salinity, shows the stratification typically noted in the Bronx River data. Salinity differences for top and bottom layers are small upstream of the tidal weir, mile point 2.35, and from the mouth into the East River. This indicates a mixing of the top and bottom layers. Large salinity gradients, up to 15 parts per thousand (ppt), however, are calculated for the river from the tidal weir to the mouth, indicating a large degree of salinity stratification. The second panel is the plot of top and bottom layer averaged temperature. The Bronx River is well mixed thermally throughout its length. The third panel depicts chlorophyll-a, which grows as a functions of nutrients, light, and serves as a surrogate measurement for phytoplankton. The monthly averaged top and bottom layers are shown. The bottom panel is the dissolved oxygen results for July. Again, the average monthly dissolved oxygen is plotted spatially. Dissolved oxygen stratification is noted which parallels that of the salinity. Also included on the dissolved oxygen panel is a plot of the minimum dissolved oxygen, hourly value, calculated for the month (the lower dashed line). The current Class I standard of 4.0 mg/L is included as the horizontal green dashed line for reference. The top and bottom model layer monthly averages meet the standard. The minimum monthly hourly mean dissolved oxygen, however, is below the Class I standard for the river from 172nd Street to river mile 1.2 which is approximately ¼ mile downstream of Lafayette Avenue.

4.5.2. Bacteria

The freshwater Bronx River from its headwaters to the Westchester County/Bronx border is Class C, best use fishing. Class C water should be suitable for primary and secondary contact recreation, although other factors may preclude primary contact activities. The freshwater Bronx River, from the Westchester County line to East Tremont Avenue, has been classified by NYSDEC as a Class B waterbody. The best uses of Class B waters are primary and secondary contact recreation, fishing and fish propagation and survival. The coliform standards for Class B and Class C are the same. The total coliform concentrations from the monthly median value and no more than 20 percent of the samples, from a minimum of five examinations, shall not exceed 2400 and 5000 per 100mL, respectively. Fecal coliform concentrations computed as a monthly geometric mean using a minimum of five examinations, shall not exceed 200 per 100mL.

Available coliform data were analyzed in order to determine compliance with standards or as noted above to determine relationship to reference levels in the freshwater river. An analysis was performed to determine the effort of coliform entering the NYC Bronx River from Westchester on coliform levels in the Bronx River and at the downstream end of the freshwater section at East Tremont Avenue. The quality of waters flowing into the Bronx from Westchester influences water quality in the freshwater NYC Bronx River. The quality in this section is also influenced by stormwater loads from the separately sewered areas and overland non-point runoff from tributary drainage areas.

Coliform data were available from East River CSO Facility Planning, NYCDEP Harbor Survey, Bronx Zoo Management Plan sampling, and the NYCDEP Sentinel Monitoring

Program. The Sentinel Monitoring Plan is used by the NYCDEP as a tracking tool to help identify illegal connections of sanitary flow to storm sewers as well as other dry weather discharges of sanitary flow. The NYCDEP has a vigorous program to eliminate dry weather discharge of sanitary sewage. Figures 4-22 through 4-24 are spatial plots of available Bronx River coliform data. Figures 4-22 and 4-23 are plots of total coliform and fecal coliform data sampled by Lawler, Matusky & Skelly (LMS, Receiving Water Quality Modeling, May 1995) during the Bronx River CSO Facility Planning Project in 1988 and 1989. The data are plotted on a log scale with the appropriate NYSDEC standard highlighted on each graph. As indicated in those graphics, water quality in the freshwater section of the Bronx River appears to have total and fecal coliform concentrations that are greater than the NYSDEC water quality standards.

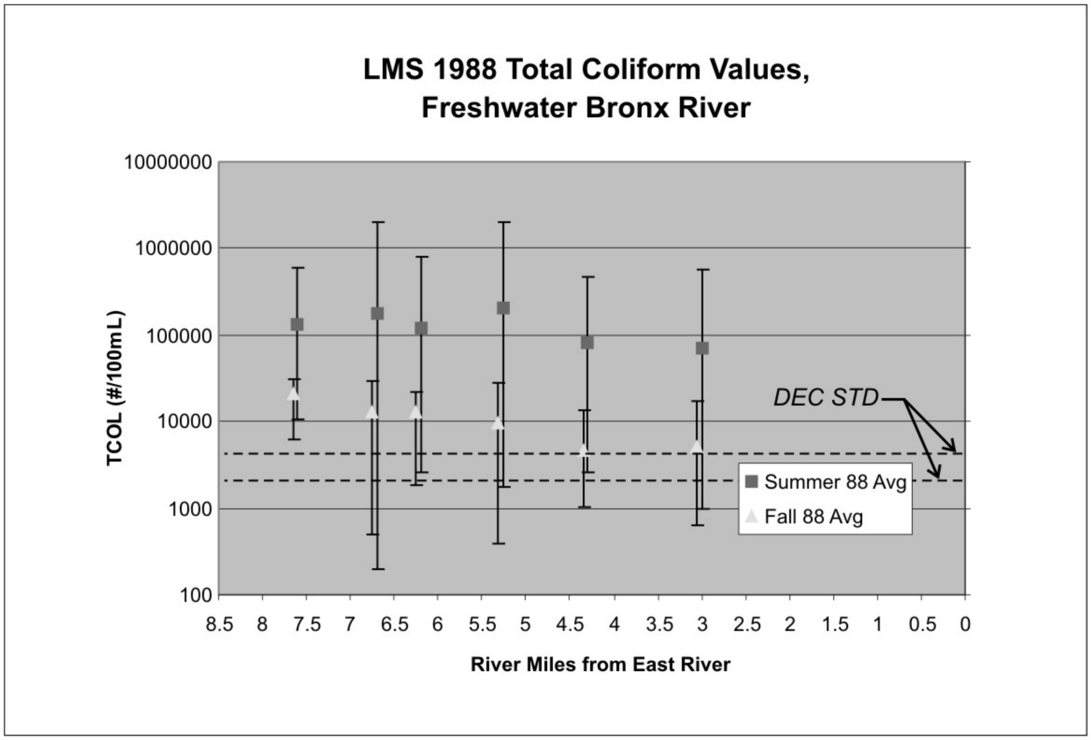
The NYCDEP Harbor Survey measured fecal coliform during 1993 and 2000 as shown on Figure 4-24. The data are presented on a log scale and also indicate non-compliance with criteria. The LMS, NYCDEP Harbor Survey and Sentinel Program data at the Westchester/Bronx border are presented as a probability function on Figure 4-25. The left side panel is total coliform data plotted on a log scale with the NYSDEC criteria of 2400 and 5000 indicated. The plot is constructed of 71 data points. The right side panel is fecal coliform plotted on a log scale with the NYSDEC criterion of 200 MPN/100mL indicated. Table 4-9 summarizes the coliform available at the Westchester/Bronx County border.

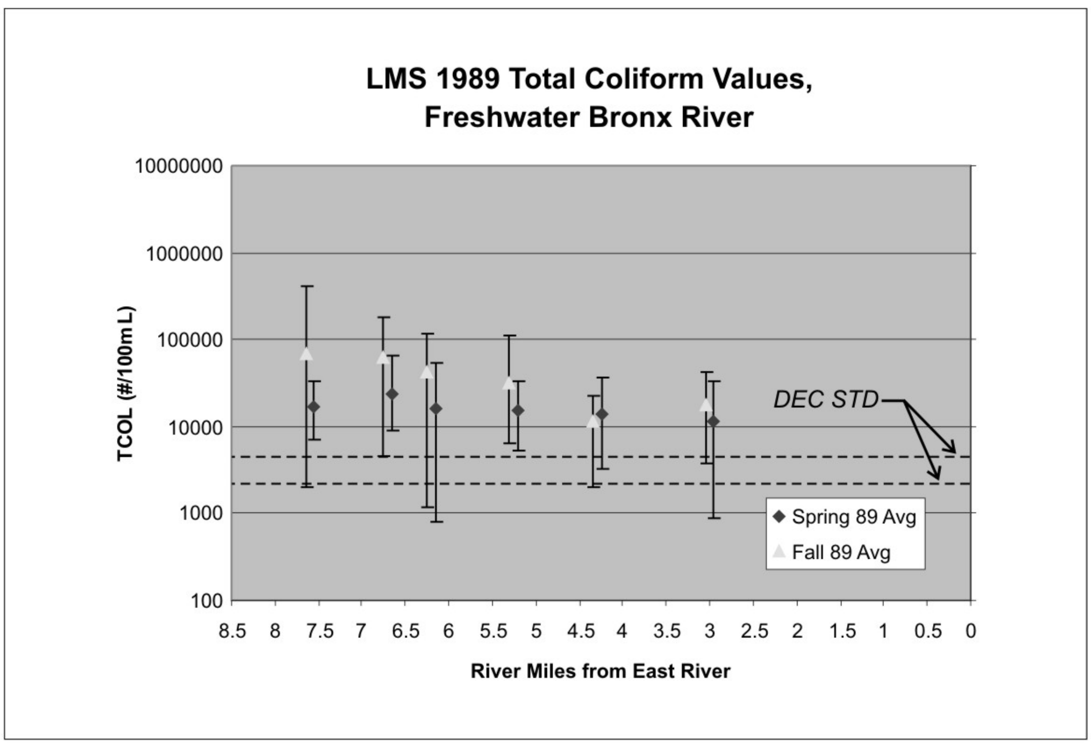
Table 4-9. Summary of Coliform Data at Westchester/Bronx County Border

Parameter	**NYCDEC Standard (MPN/100mL) as a reference level**	**Median Data (MPN/100mL)**	**+Standard Deviation (SD) (MPN/100mL)**
Total Coliform	Monthly median <2400 80percent of samples <5000	30,000	+SD = 100,000 -SD = 10,000
Fecal Coliform	Monthly geometric mean <200	10,000	+SD = 30,000 -SD = 4,000

It can be seen from Figure 4-25 that the coliform levels of the Bronx River entering NYC from Westchester are significantly above the reference level numerical values contained in the NYSDEC Class C standards. The total coliform median of data is more than an order of magnitude greater than the monthly median reference standard. The range of data expressed as plus one standard deviation indicates that most of the data are significantly greater than the reference standard. Only one measurement out of 71 is less than the total coliform monthly median reference standard of 2400 MPN/100mL. The fecal coliform data median is almost 2 orders (100x) of magnitude above the monthly geometric mean reference standard of 200 MPN/100mL. The range of data (± standard deviation) and all 88 data points are greater than the fecal coliform geometric mean reference standard of 200 MPN/100mL.

Pathogen concentration data was collected during the 2006 Bronx River cooperative sampling initiative in both NYC and Westchester County as described in Section 4.1.2. The data is plotted as the annual geometric mean with maximum and minimum whiskers displaying the range of measured concentrations.





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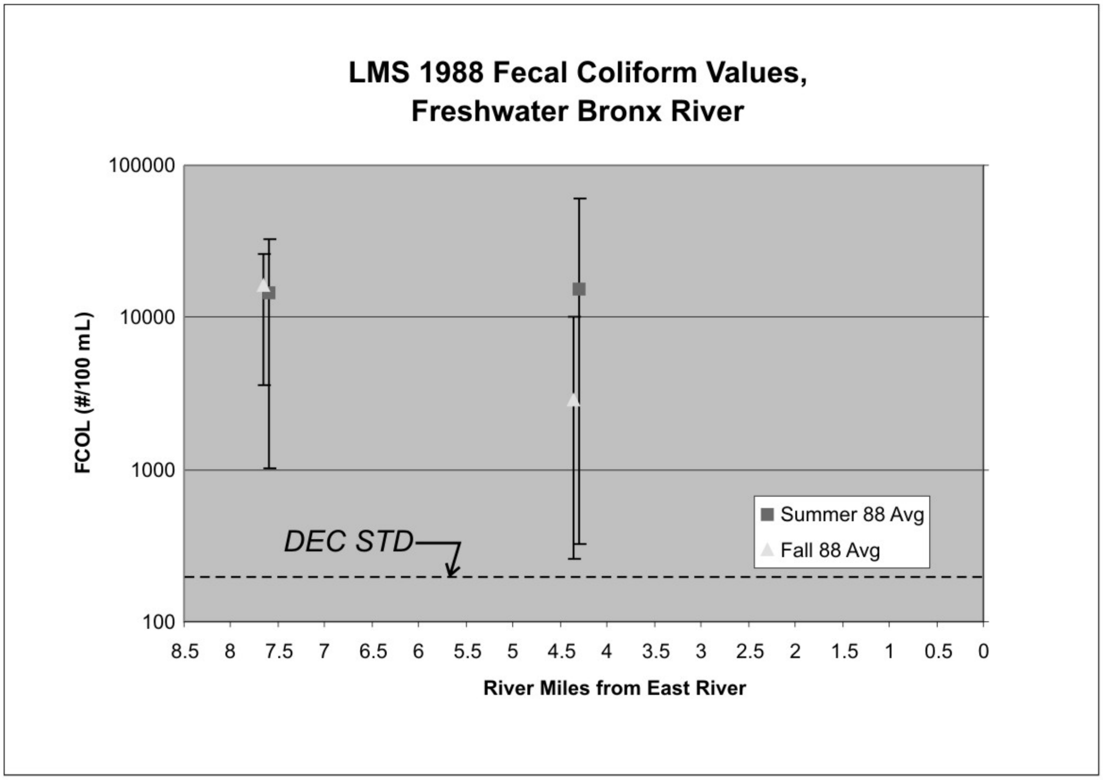
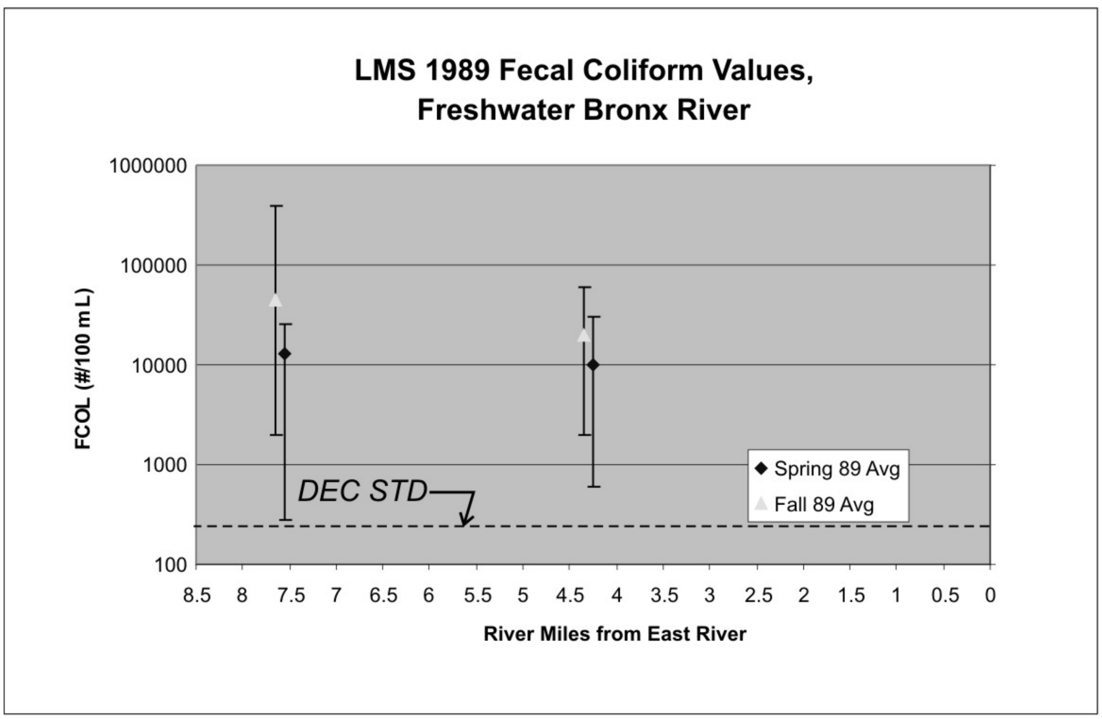
Freshwater Bronx River Total Coliform 1988 & 1989





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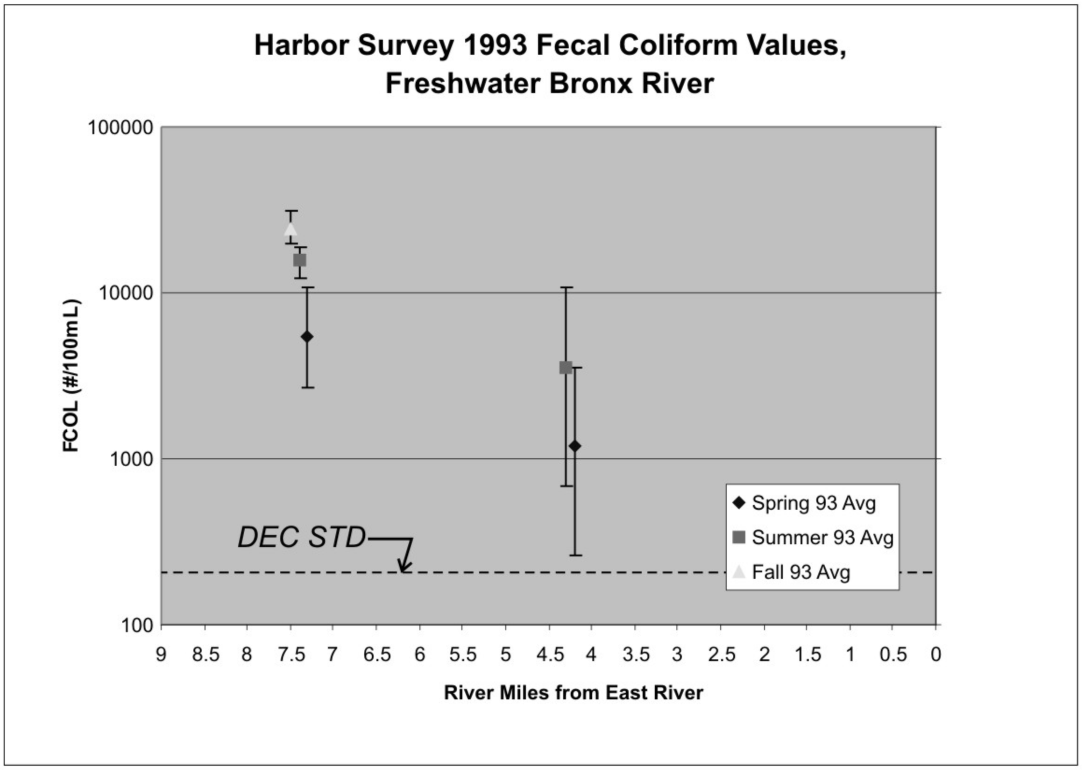
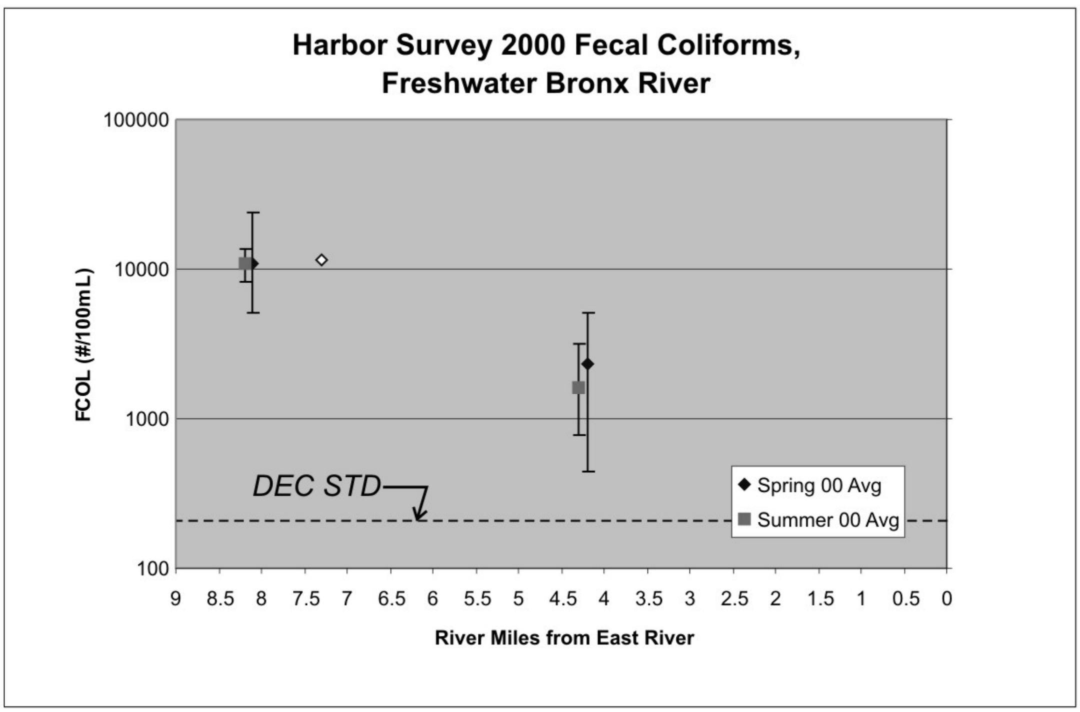
Freshwater Bronx River Fecal Coliform 1988 & 1989





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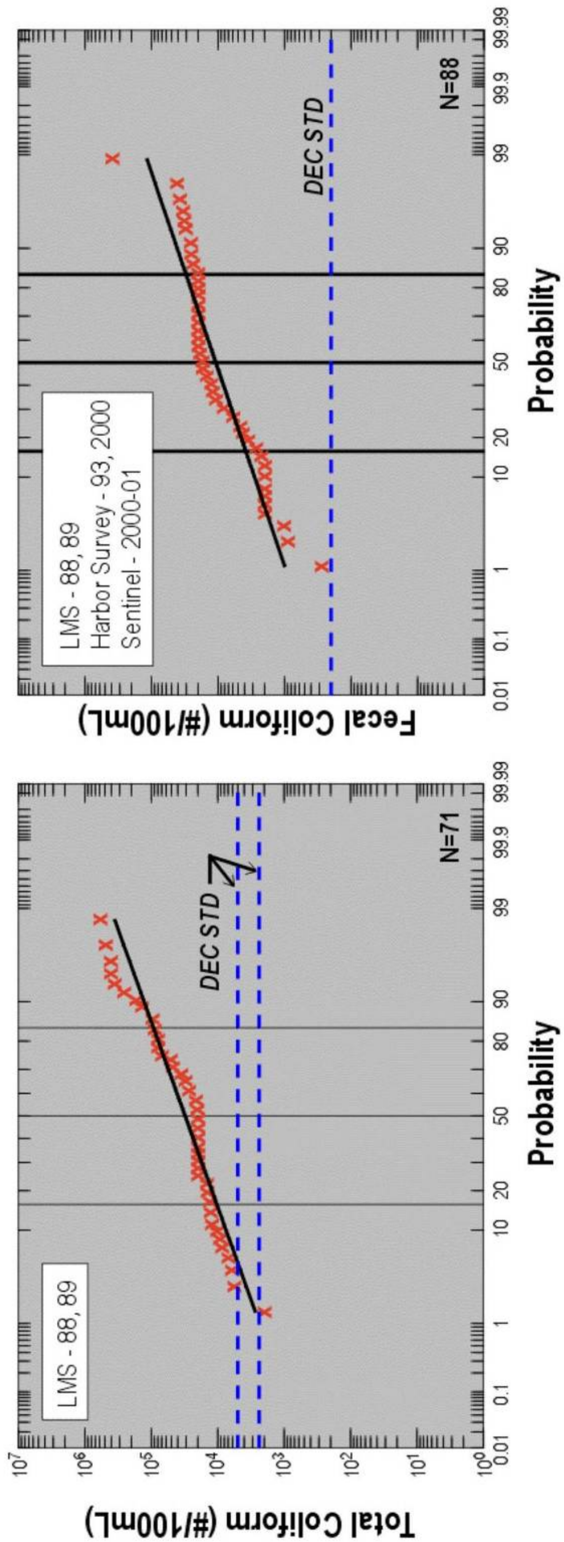
Harbor Survey Fecal Coliform, Freshwater Bronx 1993 & 2000



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Freshwater Bronx Fecal Coliform 1988 & 1989

In the freshwater section of the Bronx River in Westchester County, the fecal coliform concentrations generally increase in the downstream direction with the highest geometric mean found at the county border with NYC. During the sampling period, fecal coliform was above the Class C standard of 200 MPN/100mL at all sampling locations except seasonal variations at the most upstream location, labeled BR-8 on Figure 4-26. The total coliform concentrations increased slightly in the downstream direction. During the sampling period, the total coliform annual geometric mean was above the Class C standard of 2400 MPN/100mL at all sampling locations, except at the most upstream location. Occasionally during the winter and spring months, total coliform concentrations were measured below the Class C standard.

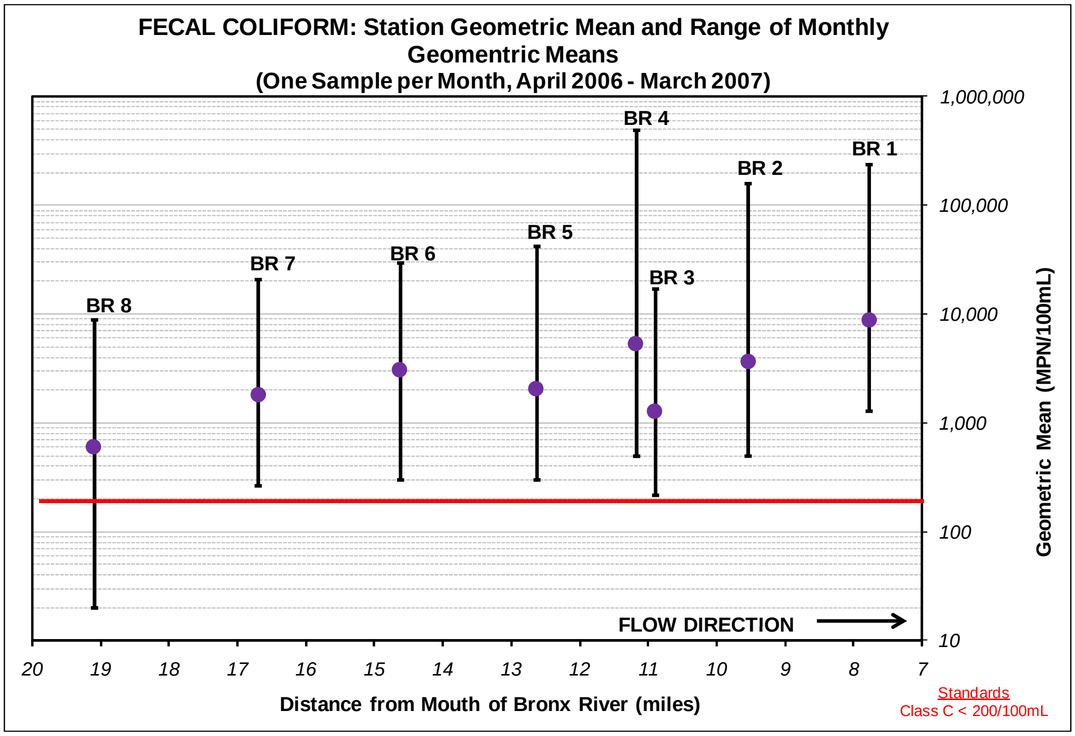
The sampling data collected from locations along the Bronx River within NYC are shown in Figure 4-27. During the sampling period, both fecal and total coliform annual geometric means and a majority of the individual measurements were above the Class B standard. Geometric means reported at the 165th Street sampling station were calculated using data collected in September 2006 through February 2007 only. Data collected prior to September 2006 was discounted because a large sediment blockage in the sewer near CSO-28 was removed in August 2006 that caused a Non-Compliance Event at HP-004. The size and nature of the blockage suggested that it most likely formed over time rather than occurred in an episodic manner, and there was no strong evidence to identify when its influence on water quality in the Bronx River began. It was therefore decided to discount all data prior to the Non-Compliance Event and only use data subsequent to the cleaning after the dry-weather overflow was eliminated. The geometric means of the fecal and total coliform data collected subsequent to the cleaning at this sampling station were below the Class I standards.

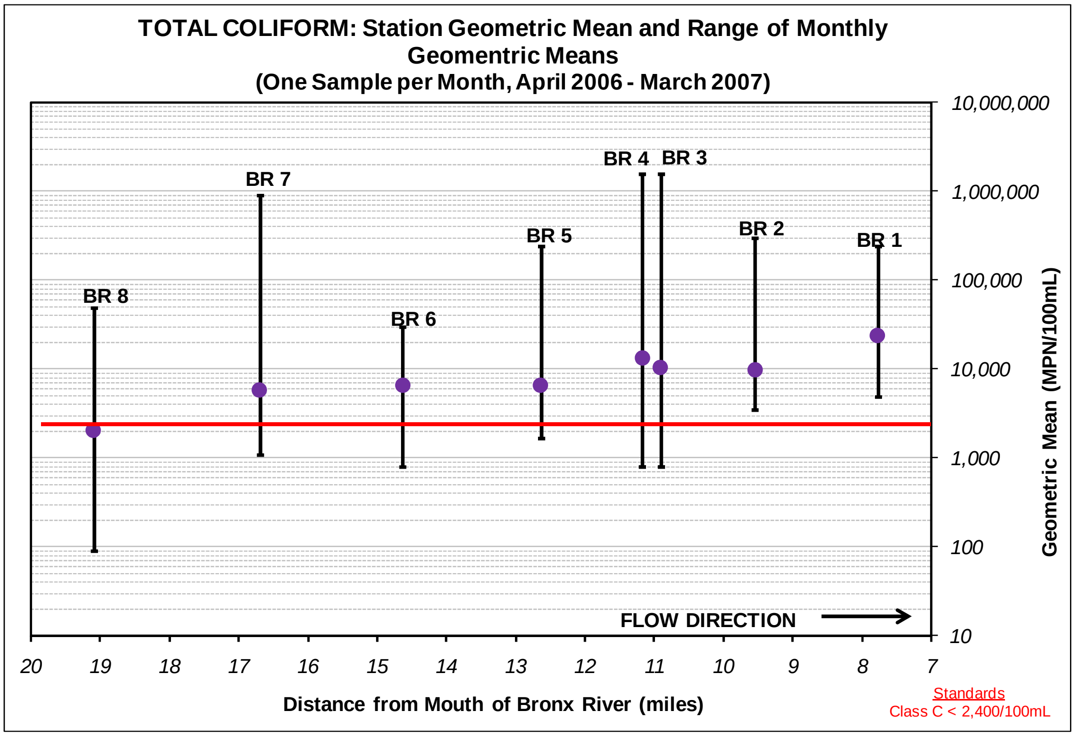
The 2006 Bronx River cooperative sampling initiative results show that high pathogen concentrations flow into the NYC section of the Bronx River from upstream in Westchester County. The fecal and total coliform concentrations directly upstream of the county border were greater than an order of magnitude higher than the Class C standards.

The conclusion from the freshwater coliform data analysis is that neither the Class C (Westchester County) nor the Class B (Bronx County) sections of the Bronx River meet standards. Primary and secondary contact recreation use is not supported.

As indicated above, a model of the freshwater portion Bronx River that is located within New York City was developed. The model extends from the Westchester County border to the freshwater/tidal interface at East Tremont Avenue. Overall, there are 28 model segments over a distance of approximately five miles. The model assumes steady-state conditions and uses first-order coliform decay kinetics. The purpose of the model was to estimate the impacts of various sources of coliform bacteria on the receiving waters, particularly at the freshwater/tidal interface of the Bronx River. The sources of coliform bacteria include upstream sources from Westchester County and the local Bronx sources: storm drains, and non-point source runoff from the Bronx Zoo and parks.

River geometry is approximated through cross-sectional area measurements taken during field sampling efforts performed as part of the FSAP. An average river flow (43 cfs) was assigned as measured historically at the Bronxville USGS gauging station. Stormwater flows





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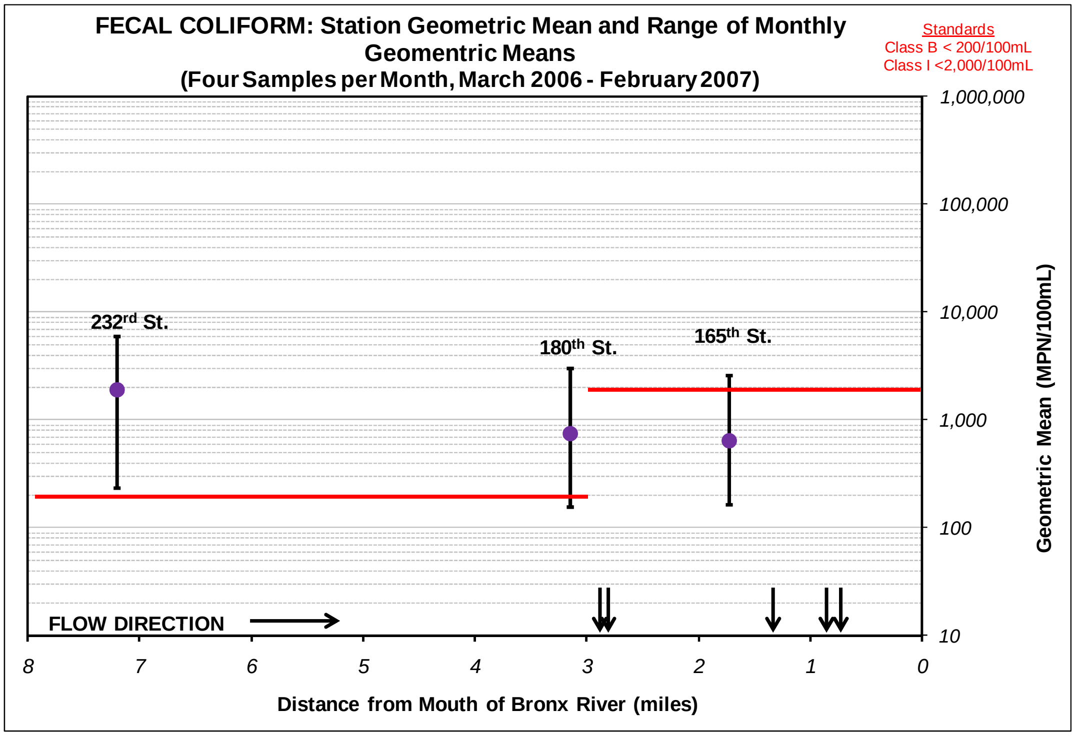
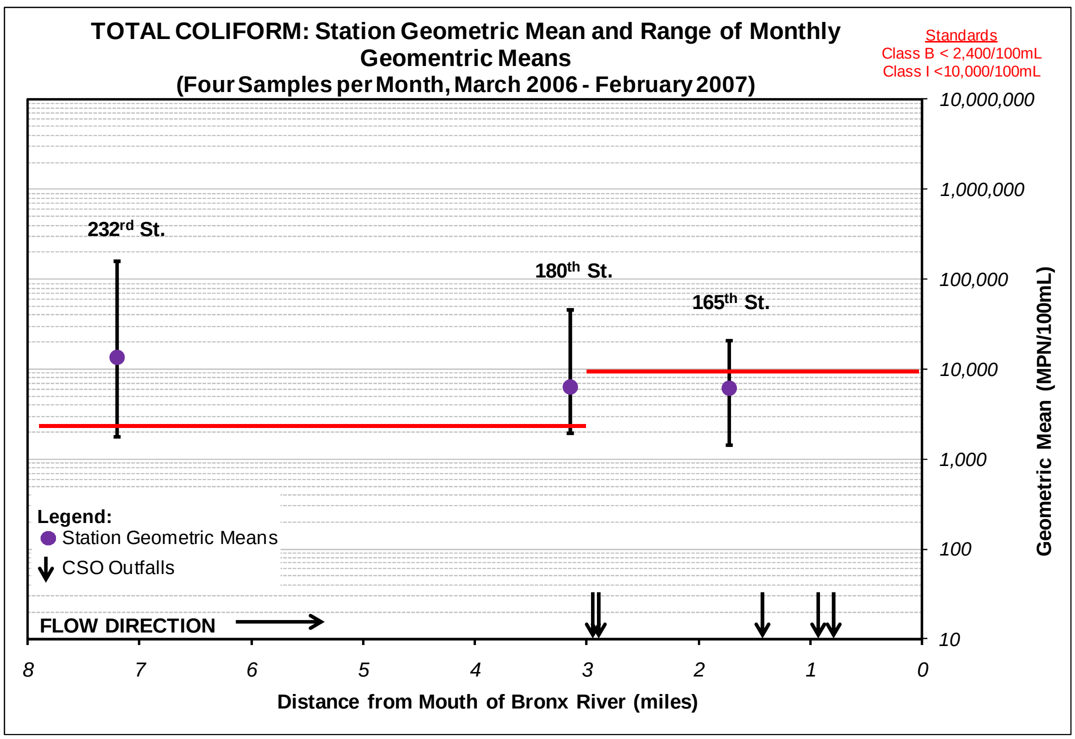
Bronx River Waterbody/Watershed Facility Plan

Bronx River 2006 Joint Sampling Westchester County

FIGURE 4-26





Note: 165th St. data from September 2006 - February 2007 only.

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FIGURE 4-27

and estimates of the flow from the Zoo and Bronx parks were assigned according to the estimates from LMS East River CSO Planning Project Report (June, 1990).

Fecal coliform concentrations were assigned based on observed data. The upstream boundary at the Westchester County line was assigned a concentration of 20,000MPN/100mL, the concentrations in the storm drains and from the Zoo/parks were 35,000 and 14,000 MPN/100mL (LMS, 1996), respectively. These concentrations are consistent with values measured in similar study areas:

Nationwide Urban Runoff Program (USEPA, 1983)
Urban Runoff Concentrations (MPN/100mL)
Range: 4,600-281,000
Median: 21,000

Mamaroneck Harbor Project (HydroQual, 1990)
Estimated Average Storm Runoff Concentration (MPN/100mL)
Mamaroneck River Basin: 15,900
Beaver Swamp Brook Basin: 11,100

Stormwater Characterization Report (NYCDEP, 2002)
Stormwater Geometric Mean Concentrations (MPN/100mL)
High Density Residential: 15,500
Low Density Residential: 25,000

Based on the estimated flows and concentrations, the calculated total load percentages from the various sources entering the freshwater Bronx River below the Westchester border are shown in Table 4-10.

A coliform decay rate was selected to reproduce the observed concentration at the downstream boundary (East Tremont Avenue). The assigned rate (3/day) is consistent with literature values for coliform decay in freshwaters. Using the model, a component analysis was performed to calculate the source distribution of coliform remaining in the freshwater flow at East Tremont Avenue that is entering the tidal portion of the Bronx River. Table 4-11 presents the source distribution at East Tremont Avenue calculated considering inputs, time-of-travel and decay.

Table 4-10. Sources of Fecal Coliform Contribution to NYC Freshwater Section of the Bronx River

Source	Contribution
Westchester County Upstream Watershed	91 percent
Bronx County Stormwater Zoo/Parks	8 percent 1 percent

Table 4-11. Relative Remaining Fecal Coliform at East Tremont Avenue

Source	Percent of Load at East Tremont Avenue from Each Source
Westchester County Upstream Watershed	84 percent
Bronx County Stormwater Zoo/Parks	 12 percent 4 percent

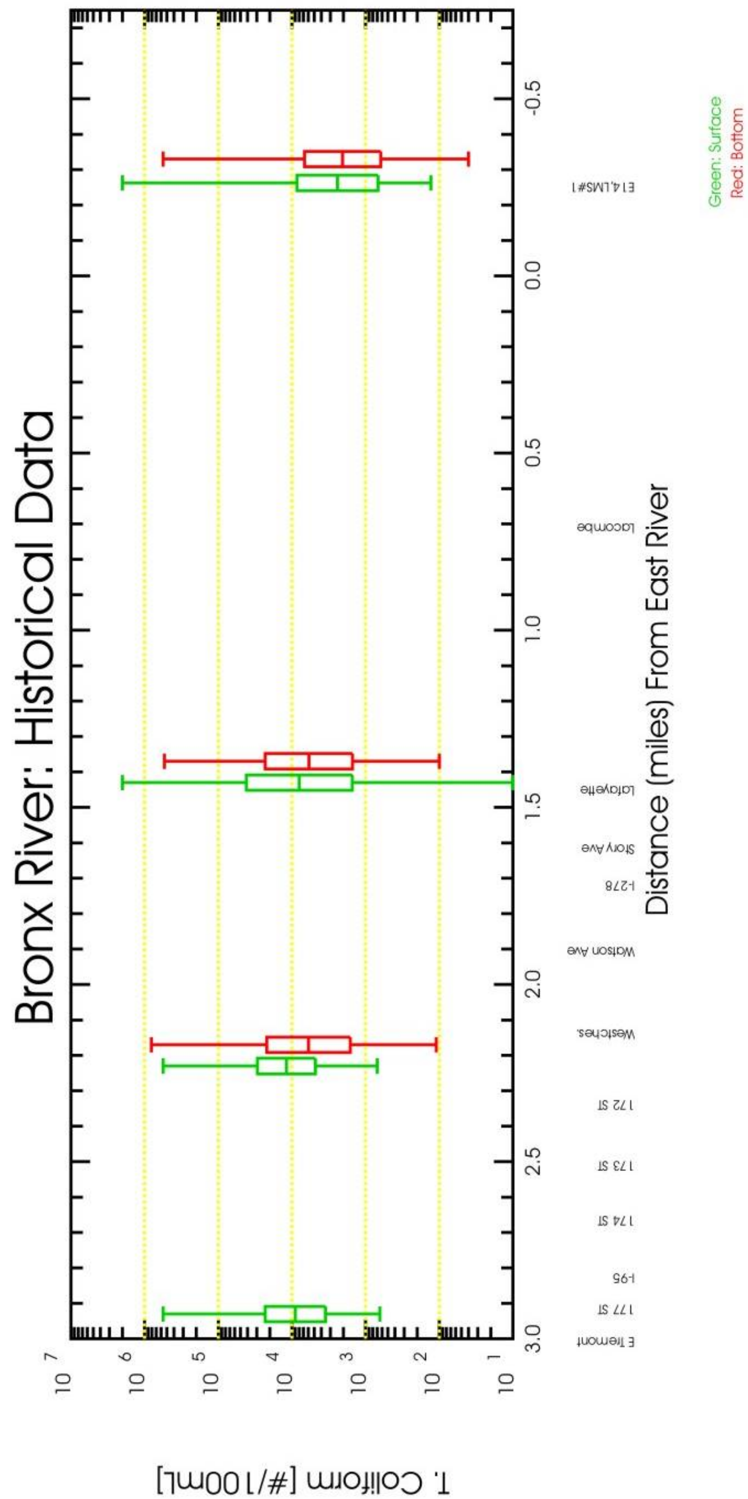
4.5.3. Other Pollutants of Concern

In 1998, NYSDEC listed Bronx River as a high priority waterbody for TMDL development with its inclusion on the Section 303(d) List. The cause of the listing was attributed to depressed DO levels with enough severity to preclude fish propagation in the lower sections of the Bronx River as discussed in Section 1.2. CSO discharge impacts on DO concentrations within the Bronx River are evaluated in Section 7 of this report.

The Bronx River was again listed on the NYSDEC 2002 Section 303(d) List. The Lower River (tidal portion) was listed for pathogens. The Middle Bronx (NYC freshwater) and Upper Bronx (Westchester County) were listed for the first time in 2002 for pathogens and oxygen demand, respectively.

The final 2004 Section 303(d) updated the Lower Bronx River as impaired for oxygen demand in addition to pathogens. The analyses discussed above in Section 4 confirm these findings. These analyses also indicate that pathogens are a pollutant of concern as well as the historical data for total coliform, as shown in Figure 4-28. Based on the 2004 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 Bronx River.

Both the Middle (freshwater) and Lower (tidal) Bronx River were moved to Part 3c of the 2006 303(d) List –Waterbodies for which TMDL Development May be Deferred (Pending Implementation/Evaluation of Other Restoration Measures). Both portions remain in Part 3 of the 2008 303(d) list. A TMDL may not be required and may in fact delay the ability to meet the pathogen and D.O. requirements as compared to the various control measures currently being developed and implemented, including this WB/WS Facility Plan. If after implementation of this WB/WS Plan, the middle and lower reaches of the Bronx River achieve the pathogen and D.O. requirements associated with each waterbody segment, they can then be removed from the 303(d) list for these pollutants. The Upper (Westchester County) section remains on Part 1 of the 2008 Section 303(d) List. The lower and middle portions of the Bronx River were delisted in 2008 for floatables as the cause/pollutant of the impairment due to the implementation of the Floatables Monitoring Program which is discussed in Section 5.4.



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Bronx River Waterbody/Watershed Facility Plan

Bronx River Historical Data
Total Coliform

FIGURE 4-28

4.6. BIOLOGY

The aquatic biological resources of NY/NJ Harbor are important components of the aquatic ecosystem because their collective health is a measure of how humans are managing natural resources and because fish and invertebrates can have substantial recreational and commercial value. The biological resources in tributaries and embayments receiving CSO discharges provide a basis for assessing the effectiveness of control technology alternatives which cover a wide range of costs. In the complex process of establishing a balance between ecosystem health and the cost of providing environmental protection, a biological baseline is needed to predict future conditions. Because the health of biological communities is an integration of the many factors which influence aquatic organisms, one can make judgments about the relative importance of various factors and how they may interact. A foundation of biological information is needed to advance the management of CSOs in NY/NJ Harbor.

The tidal portion of Bronx River supports aquatic communities which are similar to those found throughout the NY/NJ Harbor in areas of similar water quality and sediment type. The aquatic communities of the Bronx River contain typical estuarine species but have been highly modified by physical changes to the original watershed, shoreline, and to water and sediment quality. These changes represent constraints on Bronx River from 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 limit aquatic life when they are below thresholds for survival, growth, and reproduction, but when these thresholds are reached or exceeded, physical habitat factors tend to be limiting to diversity and productivity. Improvements to both water and sediment quality and to physical habitat can enhance aquatic life use in degraded areas such as Bronx River, but major irreversible changes to the watershed and the waterbody place limits on the extent of these enhancements. In addition, because Bronx River is part of a much larger modified estuarine/marine system, which is a major source of recruitment of aquatic life to Bronx River, its ability to attain use standards is closely tied to overall ecological conditions in NY/NJ Harbor.

This section describes existing aquatic communities in Bronx River and provides comparison to those found in the nearby Hutchinson River and Westchester Creek, as well as the open waters of NY/NJ Harbor. This baseline information, in conjunction with projections of water and sediment quality from modeling, technical literature on water quality and habitat tolerances of aquatic life, long-term baseline aquatic life sampling data from NY/NJ Harbor, and experience with the response of aquatic life to water quality and habitat restoration in the Harbor provides the foundation for assessing the response of aquatic life to CSO treatment alternatives for Bronx River.

4.6.1. Wetlands

Bronx River runs approximately 20 miles from Kensico Dam and Davis Brook to the East River wherein the terminal three miles of Bronx River are tidally influenced and mostly saline. A tidal weir prevents saltwater intrusion above the three-mile point, resulting in a freshwater system above the weir. While numerous wetlands exist within the Bronx River watershed today, it is likely that many others have been lost through development of the Bronx River corridor. For example, sections of the upper river were straightened during construction of the Bronx River Parkway in the early 20th century. Other areas were highly modified during industrial development of the riverbank and adjoining areas. Current information on wetlands along Bronx River is based on a review of United States Fish and Wildlife National Wetland Inventory (NWI) wetland maps, as shown in Figure 4-29. Cowardin et al. (1979) developed the classification scheme for these wetlands.

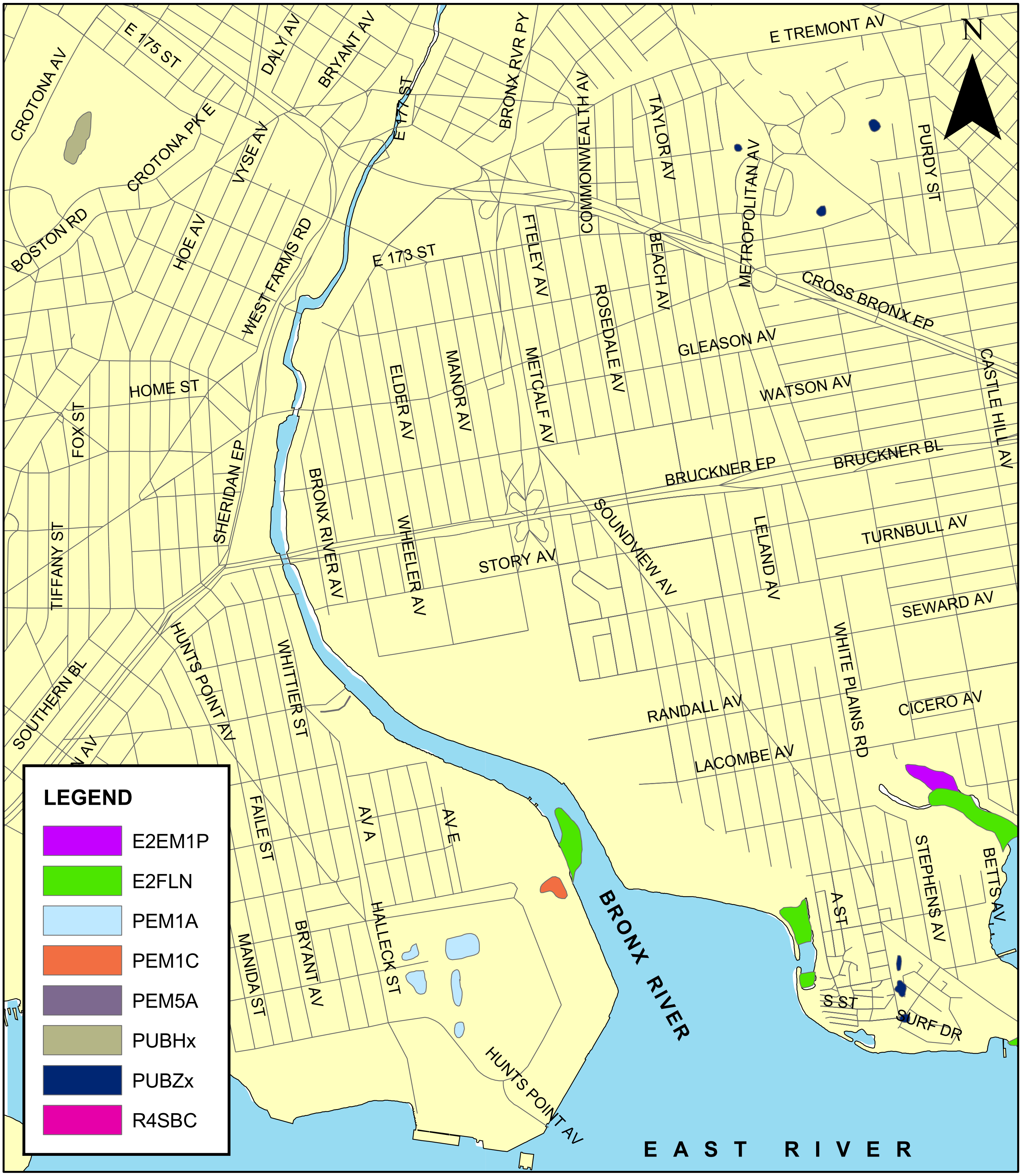
There are three relatively small tidal wetlands within Bronx River totaling 8.5 acres. All of these wetlands share the same classification, ECFLN, and thus are characterized as estuarine, intertidal, flat, and regularly flooded. Two of the wetlands are located on the east side of the mouth and measure 3.3 and 0.9 acres. The other is located on the west side of the river immediately upstream of the mouth and measures 4.3 acres. All tidal wetlands are regulated by the NYSDEC. At least ten freshwater wetlands, totaling approximately 30 acres, are located adjacent to or near Bronx River. These wetlands include freshwater emergent wetlands (PEM1C), riverine (R4SBC), freshwater forested/shrub wetland (PFOO1E, PFO1C, PFO1A, and PSS1/EMpercentA), lake (L1UBHh), and freshwater pond (PUBHx and PUBHh) wetland types. These freshwater wetlands are more or less evenly distributed along the length of the Bronx River and range in size from 1.1 (R4SBC) to 8.6 (L1UBHh) acres. There is one New York State regulated freshwater wetland (12.4 acres) adjoining Bronx River.

4.6.2. Benthic Invertebrates

The benthic community consists of a wide variety of small aquatic invertebrates which live burrowed into or in contact with bottom sediments, such as worms and snails. 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 have been conducted in Bronx River as part of the Bronx river Field Sampling and Analysis Program (FSAP) (HydroQual 2002). In July 2000, benthic sampling was conducted at the mouth of Bronx River and immediately downstream of the tidal weir. Subtidal benthic samples were collected using a Ponar® Grab. One sediment sample per station was taken for analysis of sediment grain size and total organic carbon (TOC) content.

Five taxa, at a density of 376 per m^2, were collected at the upriver sampling site. The polychaete mud worm *Streblospio benedicti* dominated the collection at this site shown in Table 4-12. This mud worm is common along the entire Atlantic coast including the NY/NJ Harbor estuary and is relatively tolerant to high levels of sediment organics (Reish, 1979). Another genus of polychaete worm, *Eulalia* sp. was collected along with fewer oligochaete worms. Anthropods collected include insecta and the amphipod *Ampelisca* sp. The benthic



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Bronx River NWI Wetlands

Hutchinson River Waterbody/Watershed Facility Plan

FIGURE 4-29

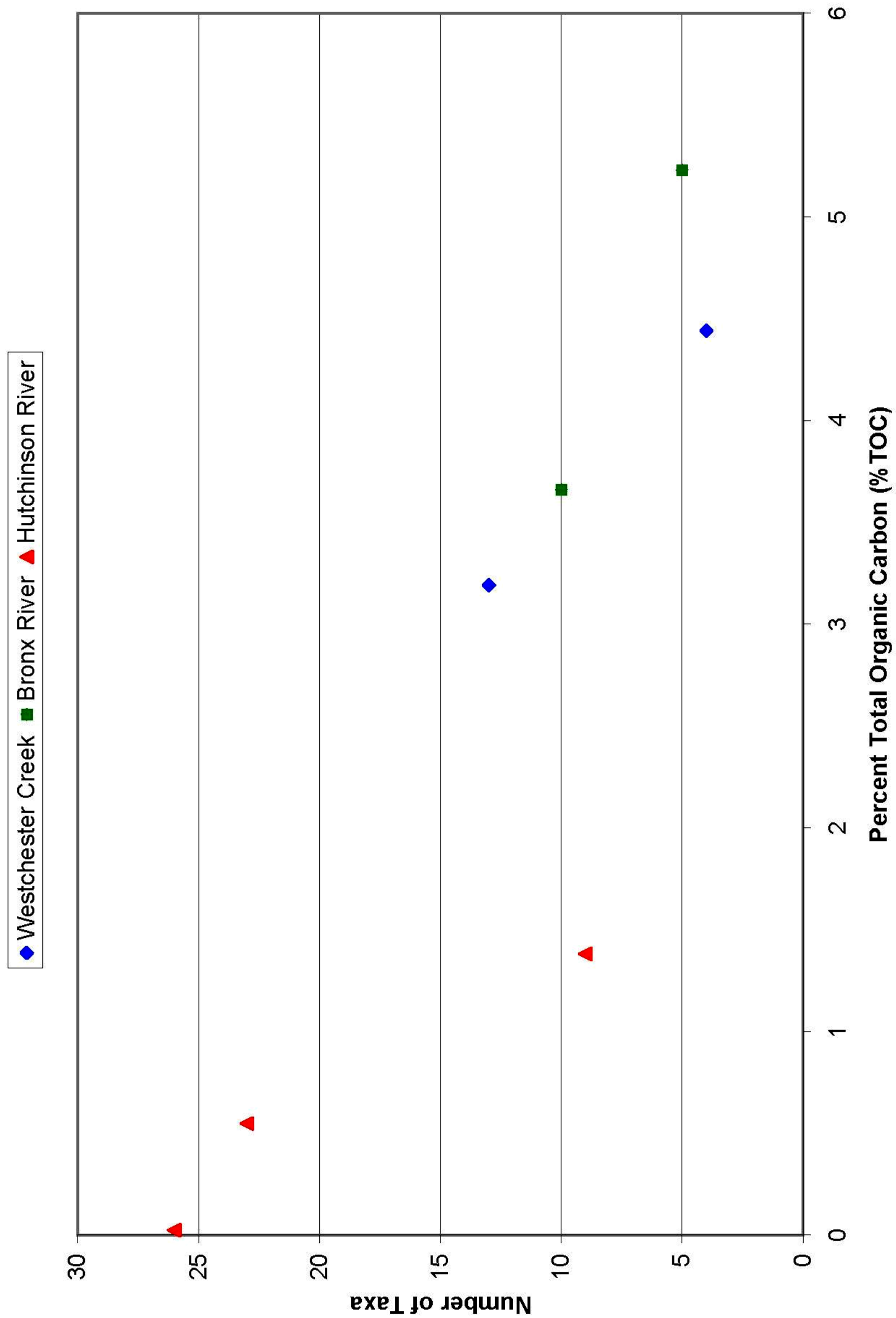
community at the mouth of Bronx River had both higher species richness (10 taxa) and higher benthic organisms density (432 per m^2) than in the upper portion of the tidal reach, shown in Table 4-12. Capitellidae and Oligochaete were the dominant organism in this area. Capitellidae, commonly known as "lugworms", are a family of polychaete worms many of which are considered indicators of anthropogenic, organically enriched sediment. Numerous other Annelids were collected, including a number of polychaete worms, as well as one mollusk (eastern mud snail) and one arthropod (sand shrimp). Polychaete worms are generally tolerant to organic enrichment pollution (Gosner, 1978; Weiss, 1995). Their presence in the mouth and upper reach of Bronx River suggests that overly enriched sediment may exist throughout this system.

Overall, the benthic community in Bronx River was low in abundance and diversity. Polychaetes and oligochaete were the dominant organisms, comprising 91 percent of the individuals in the community. The abundance, diversity, and composition of benthic species, in combination with their relative pollution tolerance, are indicators of habitat quality. The low species richness and high proportion of pollution tolerant organisms indicates degraded benthic habitat quality in tidal Bronx River. Based on the greater number of taxa and the presence of snails and shrimp, the habitat quality at the mouth of the river appears to be better than in the upper reach.

Table 4-12. Benthic inventories conducted in Bronx River

Phylum	**Lowest Practical Toxon**	**Bronx River Station Location (upper)**	**Bronx River Station Location (mouth)**
Annelida	Capitellidae	0	120
	Haploscoloplos sp.	0	8
	Haploscoloplos rubustus	0	24
	Eulalia So.	48	0
	Orbiniidae	0	8
	Tharyx sp.	0	8
	Polychaeta	0	8
	Streblospio benedicti	248	8
	Oligochaeta	32	224
Mollusca	Nassarius obsoletus	0	8
Arthopoda	Ampelisca sp.	40	0
	Crangon septemspinosa	0	16
	Insecta	8	0
Number of Species		**5**	**10**
Total Individuals/m^2		**376**	**432**

Increase in number of taxa at the mouth of the River reflects the relationship between benthic community diversity and percent TOC presented in the FSAP, as shown in Figure 4-30. The sediment in the upper reach of tidally influenced Bronx river had a percent TOC of 5.2 percent and the sediments near the mouth of the River had a percent TOC of 3.7 percent Both areas are dominated by fine-grained sediments and had high percent silt and clay, 65 percent in the upper River and 95 percent near the mouth . However, the upper River had a greater sediment oxygen demand, 2.9 $g/m^2/d$ compared to 2.4 $g/m^2/d$ near the mouth, lower percent solids, 22.7 percent compared to 27.3 percent near the mouth of the River. The sediment



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Number of Taxa versus Percent Total Organic Carbon (%TOC)

oxygen demand is the rate of oxygen consumption from the overlying water by the sediment and the percentage of solid in sediment infers the amount of water retained, i.e., a higher percentage of solids retains less water. Both measurements are correlated to the amount of organic material in the sediment, which is greater in the upper River than in the mouth.

The benthic community structure in Bronx River 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 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). The degree of impairment of the benthic community was greatest in the upper river, where sediment TOC was the highest.

4.6.3. 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 surface for settlement, species interactions, and water exchange rates. In Bronx River, pier piles and bulkheads 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 Bronx River epibenthic community was studied by suspending multi-plate arrays of 8” x 8” synthetic plates in the water column. Epibenthic arrays were deployed in July and October 2000 in the upper and lower reaches of the tidally influenced Bronx River. Plates were retrieved in October 2000 and in January and April of 2001, resulting in exposure times of 3, 6, and 9 months. Upon retrieval, the arrays were inspected and weighed and motile organisms clinging to or stuck in the arrays (i.e., crabs and fish) were counted and identified.

In Bronx River 14 taxa were identified on the epibenthic arrays in Table 4-13. The taxa collected in the highest total weight included barnacles (*Balanus eberneus*), Bryozoa, the polychaete worm (*Neries succinea*), and the Tunicate (*Molgula manhattensis*). Some plates contained amphipods (*Gammaridae*), sand shrimp (*Crangon septemspinosa*), grass shrimp (*Palaemontes* sp.) and Hydroida.

There were differences between the epibenthic community in the upper and lower reaches of Bronx River. Plates collected in the upper River had slightly higher species richness than those in the lower River (11 vs. 10 taxa). A total of four taxa found in the upper River were not collected in the lower River, while two taxa collected in the lower River were not collected in the upper River. Taxa collected in the upper River but not in the lower River included the polychaete worm *Nereis virens* and three Arthropods (*Crangon septemspinosa* or sand shrimp, Isopoda, and *Microdeutopus gryllotalpa*, a tube building amphipod). Taxa present in the lower River but not in the upper River were amphipods of the family Gammaridea.

The biomass of the barnacle Balanus ebureus was one to three orders of magnitude greater than each of the other taxa collected on bottom plates in both the upper and lower River and on the top plate in the lower River. While the biomass of this barnacle on the top plate in the upper River was greater than for any other taxa on this plate, it was on the same order of magnitude of each of the eight other taxa collected on that plate. Overall, and for reasons unknown, biomass collections on the upper River top plate were much smaller than on any of the other plates. The Palimonies amphipods were only collected on bottom plates while the Cnidarian, two arthropod taxa (Crangon septemspinosa and Microdeutopus gryllotalpa) and one annelid (Nereis virens) were only collected on the top plate.

Table 4-13. Total weight of epibenthic organisms collected from suspended multi-plate arrays (top and bottom) placed in the upper and lower reaches of Bronx River

Phylum	Lowest taxonomic level	Weight (g)			
		Upper River		Lower River	
		Top	Bottom	Top	Bottom
Annelida	Nereis succinea	0.1	0.6	0.1	0.5
	Nereis virens	0.1			
	Sabella microphthalma	0.2			0.1
Arthropoda	Balanus eburneus	0.3	191.1	305.9	292.5
	Crangon septemspinosa	0.1			
	Gammaridae				0.1
	Gammarus oceanicus				0.3
	Isopoda		0.1		
	Microdeutopus gryllotalpa	0.1			
	Palaemonetes pugio		0.2		0.2
Bryozoa	Bugula		10.9	0.1	
	Membranipora tenuis	0.1	0.4	0.2	0.1
Chordata	Molgula manhattensis	0.1			0.7
Cnidaria	Hydroida			0.1	
Total Number of Taxa	**14**	**8**	**6**	**5**	**8**

* Data were compiled from the FSAP database

The number of taxa collected from the top plates across the various suspension times was similar (no more than one taxa different) between the upper and lower reaches of Bronx River presented in Table 4-14a. The bottom plates, while also showing generally similar taxa richness between the upper and lower reaches, had differences as high as two taxa within various suspension times. Across sampling sites, species richness was highest for the July through

October suspension period. Taxa richness was much lower for the other two three-month suspension periods and remained low or increased only slightly over these suspension periods under six-month and nine-month exposures. The total weight of organisms collected on the plates followed somewhat different trends. Total weight was generally highest for the six-and nine-month suspension periods. Additionally, and for unknown reason, the top plate from the upper River consistently produced a very small total weight across exposure times. The total weight results can be seen in Table 4-14b.

Table 4-14a. Total number of taxa collected from suspended multi-plate arrays (top and bottom) placed in the upper and lower reaches of Bronx River

Length of Deployment	Upper River		Lower River	
	Top	Bottom	Top	Bottom
3 months (July – Oct)	4	3	5	5
3 months (Oct – Jan)	1	2	1	1
3 months (Jan – Apr)	1	1	1	1
6 months (July – Jan)	2	2	1	3
9 months (July – Aug)	1	2	1	3

Table 4-14b. Total weight (g) of all organisms collected from suspended multi-plate arrays (top and bottom) placed in the upper and lower reaches of Bronx River

Length of Deployment	Upper River		Lower river	
	Top	Bottom	Top	Bottom
3 months (July – Oct)	0.4	46.4	85.2	20.4
3 months (Oct – Jan)	0.1	12.4	0.1	0.1
3 months (Jan – Apr)	0.1	0.1	4.9	1.7
6 months (July – Jan)	0.2	97.4	137.8	116.5
9 months (July – Aug)	0.1	47.0	78.4	155.8

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 salinity stratification. The epibenthic community in Bronx River that developed on test plates did not exhibit a specific vertical distribution except for the upper river wherein both taxa richness and accumulated biomass were relatively low on the top plate. The lack of a clear vertical distribution in the lower reach of Bronx River suggests that the entire water column is being used as habitat of epibenthic organisms and that low DO levels do not limit epibenthic organism growth in the lower water column. This is not the case in the upper reach, suggesting salinity or other factors may have limited colonization of the experimental substrates. Dissolved Oxygen is likely not limiting the colonization and growth of epibenthos in the upper river as salinity stratification in this section of the river would impose low DO in the bottom, saline waters and not the less saline surface waters experiencing oxygen exchange with the atmosphere. In the lower reach of Bronx River, DO and salinity appear to be less limiting to the development of epibenthic communities than the amount of available hard substrate for settlement, recruitment and species (predation and competition).

4.6.4. Phytoplankton Zooplankton

There is little historical published data on the phytoplankton and zooplankton communities of Bronx River and sampling for these communities was not conducted as part of the Bronx River FSAP program (NYCDEP, 2004). As part of the New York Harbor Water Quality Survey, the NYCDEP collected plankton samples at a station in the mouth of Bronx River (Station E14) in the spring, summer and fall from 1991 to 1999. Eighty-three samples were collected during this time period. In addition, the phytoplankton and zooplankton communities of the lower East River were investigated in the 1980s (Hazen and Sawyer, 1981). The East River is the source of plankton in Bronx River.

a) Phytoplankton

Phytoplanktons are the dominant primary producers in the East River. Factors that affect phytoplankton community structure include: temperature, light, nutrients, and grazing by other organisms. Phytoplanktons are also affected by all hydrodynamic forces in a waterbody. Resident times of phytoplankton species within 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).

A total of 79 species of phytoplankton were collected in the mouth of Bronx River over the course of the NYCDEP sampling, as shown in Table 4-15. Diatoms were the dominant class of phytoplankton, followed by dinoflagellates and green algae. The most frequently collected species were *Nannochloris atomus* (green algae), *Skeletonema costatum* (diatom), *Rhizosolenia delicatula* (diatom), *Thallassoionema nitzchoides* (diatom), and *Peridnium* sp. (dinoflagellate).

Two toxic species of phytoplankton were collected in Bronx River over the course of the NUCDEP sampling. *Pseudo nitzchia pungens* (diatom) is associated with amnesic shellfish poisoning and was collected nine times. *Prorocentrum micans* (dinoflagellate) is associated with diarrhetic shellfish poisoning and was collected five times.

Table 4-15. Phytoplankton sampling results from the mouth of Bronx River

Species	Frequency of Collection (percent)	Species	Frequency of Collection (percent)
Class		**Class**	
Bacillario-phyta (Diatoms)		**Bacillario-phyta (Diatoms)**	
Skeletonema costatum	88.0	Lithodesmium undulatum	1.2
Rhizosolenia delicatula	48.2	Nitzschia seriata	1.2
Thalassionema nitzchoides	44.6	Thalassiothrix frauenfeldii	1.2
Thalassiosira norenskioldii	32.5	Bacteriastrum sp.	1.2
Asterionella japonica/ Asterionella glaciallis	31.3	Corethron hystrix	1.2
Pleorosigma sp.	30.1	Dactyliosolon sp.	1.2
Chaetoceros sp.	27.7	Rhizosolenia robusta	1.2
Melosira sulcata	20.5	Stephanodiscus sp.	1.2
Nitzschia closterium	20.5	Stephanopyxis turris	1.2
Eucampia zoodiacus	18.1	Synedra sp.	1.2
Ditylum brightsellii	15.7	Thalassiosira subtilis	1.2

Species	Frequency of Collection (percent)	Species	Frequency of Collection (percent)
Nitzschia longissima	14.5	Stephanopyxis nipponica	1.2
Cyclotella sp.	13.3	Leptpcylindrus minimum	1.2
Coscinodiscus sp.	13.3	Biddulphia aurita	10.8
Nitzschia pungens/ Pseudo nitzchia	10.8	Thalassiosira rotula	10.8
Ceratulina sp.	9.6	Schroderella delicatula	6.0
Thalassiosira decipiens	6.0	Amphirora sp.	4.8
Melosira moniliforms	4.8	Navicula sp	4.8
Lauderia borealis	4.8	Nitzschia delicatissima	4.8
Rhizosolenia alata	3.6	Surirella sp.	3.6
Biddulphia longicruris	2.4	Fragillaria sp.	2.4
Hemiaulus sp.	2.4	Hemiaulus hauckii	2.4
Leptocylindrus danicus	2.4	Rhizosolenia setigera	2.4
Coscinodiscus granii	2.4	Nitzschia paradoxa	2.4
Bidduphia alternans	1.2	Chaetoceros debilis	1.2
Chaetoceros vistualae	1.2	Climacodium frauenfeldianum	1.2
Class		**Class**	
Chlorophyta (Green Algae)		**Cyano-bacteria (Blue-green Algae)**	
Nannochloris atomus	95.2	Anacystis sp.	9.6
Chorella sp.	10.8	Anabaena sp.	4.8
Oocystis sp.	2.4	Comphophaeria sp.	1.2
Ankistrodesmus sp.	1.2	**Class**	
Desmidium sp	1.2	**Dino-flagellata (Dino-flagellates)**	
Scenedesmus caudatus	1.2	Peridinium sp.	38.6
Crucigenia sp.	1.2	Prorocentrum redfieldii	31.3
Hydrodictyon sp.	1.2	Peridinium trochoideum	19.3
Phytoconis sp.	1.2	Prorocentrum scutellum	14.5
Sphaerocystis sp.	1.2	Olisthodiscus luteus	7.2
		Prorocentrum sp.	6.0
		Prorocentrum micans	6.0
		Peridinium palatonium	3.6
		Ceratium fusus	1.2
		Helicostomella subulata	1.2
		Prorocentrum minimum	1.2

b) Zooplankton

A total of 15 zooplankton taxa were collected in the mouth of Bronx River over the course of the NYCDEP sampling, as shown in Table 4-16. Protozoans and copepods comprised the zooplankton community. Tintinnopsis sp. (Protozoa) and copepod nauplii were the most frequently collected forms.

Hazen and Sawyer (1981) identified 26 zooplankton species in East River. The zooplankton community was composed of three different groups based on biological and life cycle characteristics: holoplankton (organisms planktonic throughout their life cycle); meroplankton (free swimming larvae of benthic organisms) and tychoplankton (benthic organisms swept into the water column) (Hazen and Sawyer, 1981). Holoplankton comprised about 70 percent of the abundance of the zooplankton community and was dominated by larval and adult forms of the copepods *Acartia clause* and *A. tonsa* (Hazen and Sawyer, 1981). Barnacle larvae were dominant in the meroplankton. The tychoplankton was comprised of amphipods, isopods and benthic protozoans.

Table 4-16. Zooplankton sampling results from the mouth of Bronx River

Phylum	Species	Frequency of Collection percent
Protozoa	Tintinnopsis sp.	26.5
	Flavella sp.	12.0
	Helicostomella sp.	7.2
	Thalassicolla sp.	7.2
	Tintinnids sp.	7.2
	Acanthostmelia norvegica	4.8
	Eutreptia sp.	3.6
	Euglena sp.	2.4
	Un spec. ciliate	2.4
	Steenstrupia steenstrupii	1.2
	Strombidium sp.	1.2
	Strombilidium sp.	1.2
Anthropoda	Nauplius of copepods	18.1
	Acartia sp.	1.2
	Centropages typicus	1.2

Differences in the composition of the zooplankton measured by the two studies may be due to the fact that the NYCDEP study was targeting phytoplankton and zooplankton collections, whereas the study conducted by Hazen and Sawyer (1981) specifically targeted the zooplankton community.

4.6.5. 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 Bronx River or using its waters during the planktonic larval stage. Ichthyoplankton sampling was conducted in the mouth and in the upper reach of the tidally influenced Bronx River in March, July, and August (upper reach only) 2001. 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.

The ichthyoplankton community found in Bronx River varied over the months sampled. Table 4-17 presents the number of taxa collected increased from five in March to 12 in July and dropped just one in August. Clupeids (herrings and menhaden) were present during March through July while labirds (cunner and tautog) were present during May through August. The remaining species were generally collected during a single month (e.g., silversides, seaobin, Myoxocephalus, weakfish, etc.) and in some cases two months (fourbeard rockling and windowpane). The presence of these life stages is generally consistent with what is known about each species' spawning activity. The large reduction is species presences from July to August is likely attributable to the development of these organisms into older life stages. However, the fact that DO levels are typically lowest during August may be playing a role in the reduction in species in May and July suggests that DO levels during these months of typically low DO are sufficient to sustain these organisms.

Table 4-17. Seasonal distribution of fish eggs (E) and Larvae (L) collected in Bronx River

Lowest Practical Taxon	Common Name	March	May	July	August
Clupeidae	Herrings	L	E, L	L	
Brevoortia tyrannus	Atlantic menhaden		E, L	L	
Anchoa mitchelli	Bay anchovy			E, L	
Enchelyopus cimbrius	Fourbeard rockling	E	L		
Menidia sp.	Silversides		L		
Prionotus	Searobin			E	
Myoxocephalus	Myoxocephalus	L			
Stenotomus chyrsops	Scup			E	
Cynoscion regalis	Weakfish			L	
Tautoga onitis	Tautog		E	E	
Tautogolabrus adspersus	Cunner		E, L	E, L	E
Hypsoblennius hentzi	Feather blenny			L	
Gobiidae	True gobies			L	
Scophthalmus aquosus	Windowpane		E, L	L	
Pseudoleuronectes americanus	Winter flounder	L			
Unidentified	Unidentified	E	E, L	E, L	

*Compiled from FSAP database

Table 4-18. Number of fish eggs and larvae collected from Bronx River

Lowest Practical Taxon	Common Name	Total Eggs and Larvae Collected
Clupeidae	Herrings	488
Brevoortia tyrannus	Atlantic menhaden	202
Anchoa mitchelli	Bay anchovy	198
Enchelyopus cimbrius	Fourbeard rockling	3,766
Menidia sp.	Silversides	8
Prionotus	Searobin	2
Myoxocephalus	Myoxocephalus	26
Stenotomus chyrsops	Scup	2
Cynoscion regalis	Weakfish	6
Tautoga onitis	Tautog	806
Tautogolabrus adspersus	Cunner	2,908
Hypsoblennius hentzi	Feather blenny	12
Gobiidae	True gobies	152
Scophthalmus aquosus	Windowpane	166
Pseudoleuronectes americanus	Winter flounder	64
Unidentified	Unidentified	122
Number of Taxa		16
Total Collected		**8,928**

* Data compiled from the FSAP database

Overall, ichthyoplankton abundance was highest in March and May, when the majority of estuarine species are spawning. A total of 15 taxa plus "Unidentified" were collected in Bronx River and shown in Table 4-18. Fourbeard rockling and feather blenny dominated the catches with large contributions of eggs. Larval vetches were dominated by gobies and herrings.

Ichthyoplankton are planktonic (i.e., they drift with prevailing currents) and some questions remain as to whether fish are spawning in Bronx River or if fish are spanning in the East River with their eggs and larvae transported into the river 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 relatively higher degree of confidence that an egg found in the upper river may have been spawned there. The majority of the eggs collected in Bronx River were of structure oriented species such as cunner, tautog, and fourbeard rockling. The majority of structure in Bronx River is probably provided by pier pilings, rather than the natural structure such as rock piles and complex shorelines.

Table 4-19. Number of juvenile and adult fish collected from Bronx River in gill net and trawl samples

Species	Common Name	Total Collected
Alosa aestivalis	Blueback herring	155
Anchoa mitchelli	Bay anchovy	76
Brevoortia smithi	Yellowfin menhaden	2
Brevoortia tyrannus	Atlantic menhaden	22
Clupea harengus	Atlantic herring	6
Cynoscion regalis	Weakfish	544
Morone saxatilis	Striped Bass	35
Paralichthys dentatus	Summer flounder	3
Peprilus triacanthus	Butterfish	22
Pomatomus saltatrix	Bluefish	22
Prionotus sp.	Searobins	1
Prionotus evolans	Striped searobin	1
Prionotus scitulus	Leopard searobin	1
Pseudopleuronectes americanus	Winter flounder	7
Stenotomus chrysop	Scup	2
Tautogolabrus adspersus	Cunner	6
Total Number of Taxa		**16**
Total Number of Individuals		**898**

*Data compiled from FSAP database

4.6.6. Adult and Juvenile Fish

The fish community in the mouth of Bronx River was sampled in August 2000, July and August of 2001, and April and August 2002. Summer months are represented because this is the time of year when bottom water DO concentrations are at their lowest. Sampling was conducted near the mouth of the Bronx River with an otter trawl to catch bottom oriented species and a gill net suspended in the water column to capture pelagic species.

A total of 16 taxa were collected from Bronx River, as shown in Table 4-19. Weakfish dominated the catch accounting for 61 percent of the total catch. All of the weakfish were collected in three separate trawl samples conducted in August 2002. Blueback herring were the second most abundant species accounting for 17 percent of the total catch. Similar to weakfish, all but two individuals of this species were collected in August 2002. Weakfish are generally associated with structure while blueback herring are pelagic. Demersal species, such as a winter flounder and summer flounder were also collected, suggesting that juvenile and adult fishes are using the entire water column in Bronx River as habitat. The fact that the majority of the adult and juvenile fish were collected during the month of August, when DO is typically at its lowest, suggests that DO is not limiting use of the mouth of Bronx River by fishes.

4.6.7. Inter-Waterbody Comparison

The aquatic communities of Bronx River were compared with those in the Hutchinson River and Westchester Creek in order to further evaluate the potential of Bronx River to support fish propagation and survival, and to evaluate the interactions of the tributaries with the ecology of the Upper East River. The FSAP conducted in 2000 and 2001 included sampling stations located in the Bronx River, Westchester Creek, and the Hutchinson River. This study characterized the existing water quality and aquatic communities of these three tributaries of the Upper East River. The following sections briefly compare the results from these three tributaries.

The aquatic communities found in Bronx River are similar to those in the Hutchinson River and Westchester Creek in terms of the species composition of the invertebrate and fish communities. However, the differences in water quality, available substrate, and food resources have resulted in differences in relative abundance and diversity of the aquatic communities in these three tributaries of the East River.

As part of the FSAP, the benthic community was sampled to determine the community composition, number of species (richness), and the relationship between the number of species and their relative abundance (diversity). Sediment sampling was also conducted in order to determine grain size distribution and percent TOC. Results of the FSAP showed that the benthic community in Bronx River was not statistically different from that of Westchester Creek (Table 4-20), but it was significantly lower in taxa richness and abundance than the Hutchinson River (HydroQual, 2000; NYCDEP, 2004). The total number of individuals per station ranged from a low 326/m^2 in the middle of the Bronx River to 26,128/m^2 at the mouth of the Hutchinson River. The total number of species per station ranged from four species in the middle of Westchester Creek to 23 species at the mouth of the Hutchinson River. In all three tributaries, the upper stations generally had lower diversity than the stations near the mouth. Overall the benthic community was dominated by polychaetes and pollution tolerant organism in all three tributaries. The only exceptions were the two stations at the mouth of the Hutchinson River which had a large number of amphipods and the pollution sensitive fingernail clam, *Telina agilis*.

Table 4-20. Number of species collected from Bronx River as part of FSAP sampling

Phylum	Taxonomic Order	West-chester Creek (middle)	West-chester Creek (mouth)	Bronx River (middle)	Bronx River (mouth)	Hutchinson River (upper)	Hutchinson River (mouth)
Nematod	Unidentified Nematoda sp.	0	0	0	0	0	8
Annelida	Polygordius trieslinus	0	0	0	0	0	760
	Arabella iricolor	0	0	0	0	0	32
	Capitella capitata	24	16	0	120	0	1360
	Eteone sp.	0	0	0	0	0	16
	Eulalia sp.	0	0	48	0	0	0
	Haploscoloplosus sp.	2520	96	0	8	0	0
	Haploscoloplos rubustus	840	200	0	24	0	8
	Nereis succinea	0	0	0	0	40	200
	Orbiniidae	0	16	0	8	8	0
	Phyllodocidae	0	0	0	0	8	40
	Polychaeta	0	168	0	8	8	0
	Polydora sp.	0	0	0	0	0	8
	Sebella microphthalma	0	0	0	0	0	8
	Scolecolepides viridis	0	0	0	0	248	96
	Scoloplos sp.	872	0	0	0	0	0
	Streblospio benedicti	0	32	248	8	9000	22744
	Tharyx acutus	0	0	0	8	40	296
	Oligochaeta	0	184	32	224	32	72
Mollusca	Mulinia lateralis	0	8	0	0	0	0
	Spisula solidissima	0	8	0	0	0	0
	Tellina agilis	0	0	0	0	24	88
	Yoldia sp.	0	8	0	0	0	0
	Nassarius obsoletus	0	0	0	8	0	0
Arthropoda	Ampelisca sp.	0	16	40	0	0	104
	Corophium sp.	0	0	0	0	0	8
	Lysianopsis alba	0	0	0	0	0	160
	Lysianassidae	0	0	0	0	0	16
	Microdeutopus gryllotalpa	0	0	0	0	0	8
	Crangon septemspinosa	0	8	0	16	0	16
	Pagurus sp.	0	8	0	0	0	40

Phylum	**Taxonomic Order**	**West-chester Creek (middle)**	**West-chester Creek (mouth)**	**Bronx River (middle)**	**Bronx River (mouth)**	**Hutchinson River (upper)**	**Hutchinson River (mouth)**
	Sesarma sp.	0	0	0	0	0	40
	Insecta sp.	0	0	8	0	0	0
Number of Species		**4**	**13**	**5**	**10**	**9**	**23**
Total Individuals/m^2		**4256**	**768**	**376**	**432**	**9408**	**26128**

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 Westchester Creek, Bronx River and Hutchinson River. A total of 23 epibenthic taxa were identified at these three sites, as shown in Table 4-21. Barnacles, tunicates, hydrozoans, and polychaetes were the dominant organisms. Green alga was also identified on plates in the Hutchinson River and Westchester Creek. The epibenthic community in Westchester Creek was higher in abundance and moiré diverse that the epibenthic community in the Bronx River (See Tables 4-21 and 4-22a). The Bronx River community was dominated by barnacles. In Westchester Creek, barnacles were present but these communities did not exclude crabs, tunicates and a variety of polychaetes from setting. The total weight of organisms on top plates in Westchester Creek was less than the Bronx River plates, but total weight of organism on the bottom plates in Westchester Creek was greater than the Bronx River plates, as presented in Table 4-22b). The Hutchinson River epibenthic community on the top plates was more diverse than the Bronx River and Westchester Creek with tunicates, polychaetes, crabs, hydroids, and algae dominating the community. The differences in the epibenthic community between the three tributaries 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). Differences in salinity between the three tributaries may caused by differences in the amount of freshwater discharge. The Bronx River and Hutchinson River have non-tidal freshwater sources but Westchester Creek does not. Recruitment can also result from transport of plankton life stages from other areas, and this may differ between the tributaries.

Table 4-21. Total weight (g) epibenthic organisms collected from suspended multi-plate arrays placed near the mouth of Westchester Creek, Bronx River and Hutchinson River

Phlum	**Lowest Practical Taxon**	**Westchester Creek**		**Bronx River**		**Hutchinson River**	
		Top	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**
Porifera	Suberites ficus		0.1			0.1	
	Cliona sp.	1.3					
Cnidaria	Hydroida	0.8	10.9	0.1			
	Campanularia		10.1			5.1	1.0
Bryozoa	Bugula		2.0	0.1		1.8	
	Membrainipora tenuis			0.2	0.1		
Annelida	Sabella microphthalma	0.5	1.6		0.1	9.6	
	Polynoidae		0.2				

Phlum	Lowest Practical Taxon	Westchester Creek		Bronx River		Hutchinson River	
		Top	Bottom	Top	Bottom	Top	Bottom
	Nereis succinea	0.2	0.4	0.1	0.5	2.4	
	Onchidorididae		1.7				
Arthropoda	Balanus eburneus	149.3	453.6	305.9	292.5	0.1	0.2
	Palaemonetes pugio			0.2	0.5		
	Palaemonetes vulgaris					0.2	0.2
	Dyspanopeus sayi	0.1	1.9			3.9	
	Panopeus herbstii		2.0				
	Rhithropanepeus harrisii					0.1	
	Gammarus oceanicus		0.5		0.3		
	Gammaridea				0.1		
Chordata	Molgula manhattensis	30.3	35.2		0.7	0.1	
	Botryllus schlosseri		25.9			142.5	
Chlorophycota	Ulva lactuca	2.4					
	Cladophora					36	

Table 4-22a. Total number of all species collected from suspended multi-plate arrays (top and bottom) placed near the mouth of Westchester Creek, Bronx River and Hutchinson River

Length of Deployment	Westchester Creek		Bronx River		Hutchinson River	
	Top	Bottom	Top	Bottom	Top	Bottom
2months (Aug-Oct)	8	6	5	5	6	No Plate
3months (Oct-Jan)	0	1	1	1	2	No Plate
3months (Jan-April	1	3	1	1	3	3
6months (June-Jan)	1	6	1	3	6	No Plate
9months (June-April)	1	6	1	3	3	No plate

Table 4-22b. Total weight (g) of all species collected from suspended multi-plate arrays (top and bottom) placed near the mouth of Westchester Creek, Bronx River and Hutchinson River

Length of Deployment	Westchester Creek		Bronx River		Hutchinson River	
	Top	Bottom	Top	Bottom	Top	Bottom
2months (Aug0Oct)	77.5	121	85.2	20.4	38.2	No Plate
3months (Oct-Jan)	0	25.9	0.1	1.5	42.2	No Plate
3months (Jan-April	0.1	1.6	4.9	1.7	0.7	1.4
6Months (June-Jan)	30.8	204	138	116	116	No Plate
9months (June-April)	43.5	163	78	156	5.2	No plate

The ichthyoplankton community in upper Westchester Creek had the greatest diversity and similar abundance relative to the ichthyoplankton communities in the upper Bronx and Hutchinson Rivers, as shown in Table 23. Ichthyoplankton were not collected near the mouth of Westchester Creek, but the station near the mouth of the Hutchinson river had the highest diversity and abundance of all stations sampled. This could be due to the availability of several different habitat types not available in Westchester Creek and the Bronx River and its proximity to relatively good habitat conditions in Western Long Island Sound. 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.

The spawning season of 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 water and larvae are present in the spring, when hypoxia is infrequent. Despite the fact that DO levels in Bronx River are non-compliant with the 4.0 mg/L performance standard during certain times of the year, based on spring DO levels in Bronx River, winter flounder eggs and larvae would be able to survive there (HydroQual, 2000). However, winter flounder spawn on sandy substrates and the bottom substrates are dominated by fine grain sediments in the Bronx and Hutchinson Rivers and Westchester Creek. Thus, winter flounder eggs and larvae were not collected in large numbers of these tributaries.

Bay anchovy spawn in the summer, when DO levels are at their lowest, but their eggs and larvae are found in surface water. In May and July, bay anchovy eggs and larvae were present in all three tributaries, with the greatest abundances in the Hutchinson River. Anchovy larvae could be exposed to low DO conditions with their duration of exposure dependent upon the location of adult spawning and larval dispersal by tidal currents.

Table 4-23. Number of fish eggs and larvae collected from Westchester Creek, Bronx River and Hutchinson River

Species	Common Name	Westchester Creek (upper)	Bronx River (upper)	Bronx River (mouth)	Hutchinson River (upper)	Hutchinson River (mouth)
Ammodytes americanus	American sand lance	0	0	0	0	28
Anchoa sp.	Anchovies	34	0	0	0	0
Anchoa mitchelli	Bay anchovy	156	14	184	688	302
Brevoortia tyrannus	Atlantic menhaden	4	0	202	480	1532
Clupedidae	Herrings	470	244	244	18	2264
Cynoscion regalis	Weakfish	0	6	0	0	4
Enchelyopus cimbrius	Fourbeard rockling	1290	3196	570	144	788
Gobiidae	True goby	88	2	150	84	302
Hypsoblennius	Feather bunny	0	0	12	0	0

Species	Common Name	Westchester Creek (upper)	Bronx River (upper)	Bronx River (mouth)	Hutchinson River (upper)	Hutchinson River (mouth)
Labridae	Wrasse	14	0	0	0	6
Menidia Menidia	Atlantic silverside	2	0	8	4	20
Myoxocephalus	Sculpin	84	0	26	0	0
Prionotus	Searobin	11	0	2	0	8
Pseudopleuronectes americanus	Winter flounder	16	40	24	80	88
Scophthalmus aquosus	Window-pane	18	146	20	20	250
Syngnathus fuscus	Northern pipefish	3	0	2	2	10
Stenotomus chyrsops	Scup	0	0	2	0	10
Tautoga onitis	Tautog	80	240	566	520	1462
Tautogolabrus adspersus	Cunner	815	2470	438	1396	2914
Total Number of Taxa		**15**	**9**	**15**	**11**	**16**
Total Number		**3,085**	**6,358**	**2,450**	**3,436**	**9,988**

*Data compiled from FSAP database

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 structure oriented species such as cunner, tautog and fourbeard rockling dominated the ichthyoplankton community found in Bronx River. The majority of structure in Bronx River is probably provided by pier pilings, rather than natural structure such as rock piles and complex shorelines.

Fish are motile organisms that can choose which habitat they enter and utilize. As such, their presence or absence can be used to evaluate water quality. The lower Hutchinson River, with its more diverse and higher quality habitat, has the greatest fish diversity and abundance among the three tributaries. In addition, the Hutchinson River trawl samples caught more invertebrate taxa and greater numbers of organisms including starfish, sponges, clams, shrimp, and crabs than the other tributaries (NYCDEP, 2004). The Westchester Creek fish community was substantially lower in diversity and abundance than the other two tributaries, as shown in Table 4-24. The Hutchinson River had the highest diversity and the Bronx River had the highest abundance, due to collection of large numbers of weakfish.

Table 4-24. Number of juvenile and adult fish collected from Westchester Creek, Bronx River and Hutchinson River

Species	Common Name	Westchester Creek	Bronx River	Hutchinson River
Alosa aestivalis	Blueback herring	0	155	2
Anchoa mitchelli	Bay anchovy	0	76	94
Anguilla rostrata	American eel	0	0	0
Brevoortia tyrannus	Atlantic menhaden	8	22	91
Brevoortia smithi	Yellowfin menhaden	0	2	6

Species	Common Name	Westchester Creek	Bronx River	Hutchinson River
Caranx hippos	Crevalle jack	0	0	1
Centropristis striata	Black sea bass	0	0	3
Culpea harengus	Atlantic herring	0	6	0
Cynoscion regalis	Weakfish	7	544	53
Gobiosoma bosc	Naked goby	0	0	1
Menidia Menidia	Atlantic silverside	0	0	0
Morone saxatilis	Striped bass	31	35	66
Opansus pardus	Leopard toadfish	0	0	1
Paralichthys dentatus	Summer flounder	2	3	6
Peprilus triacanthus	Butterfish	0	22	0
Pomantomus saltatrix	Bluefish	13	15	9
Prionotus	Searobin	0	1	0
Prionotus carolinus	Northern searobin	1	0	0
Prionotus evolans	Striped searobin	0	1	8
Prionotus scitulus	Leopard searobin	0	1	0
Pseudopleuronectes americanus	Winter flounder	2	7	30
Scopthalmus aquosus	Windowpane	0	0	14
Sphoeroides maculates	Northern puffer	0	0	1
Stenotomus chrysop	Scup	0	2	185
Syngnathus	Pipefish	0	0	0
Tautoga onitis	Tautog	0	0	1
Tautogolabrus adspersus	Cunner	0	6	10
Total Number of Taxa		**7**	**16**	**19**
Total Number of Individuals		**64**	**898**	**582**

*Data compiled from FSAP database

4.6.8. Fish and Aquatic Uses

Fish and aquatic life use of Bronx River has been impaired since development in the watershed permanently modified virtually all of the factors that can have a major influence on the ecological health of an estuarine waterbody. The improvement in water quality conditions through CSO abatement will enhance aquatic life uses, but other factors, primarily physical habitat, may become limiting. Enhanced aquatic life use will reach a threshold that cannot be exceeded due to irreversible alterations to the physical environment. In addition, most of the adjacent waterbodies and tributary watersheds have undergone similar physical impairments.

Long term sampling for aquatic life throughout the NY/NJ Harbor has shown how fish and benthic life are distributed with regard to a range of DO and physical habitat conditions. Generally, a wide array of fish and benthic life can use habitats with DO levels slightly below the regulatory limit of 4.0 mg/L and that tolerant species can use habitats with very low DO. Harbor sampling has shown that many species will respond quickly to changes in DO by avoiding localized areas of low DO and by making use of habitat during seasonally elevated DO conditions. This response to changing DO is consistent with the adaptability of estuarine species to changing environmental conditions. Aquatic life use of existing habitats when DO is near the regulatory limit involves many desirable fish and invertebrates which are not regarded as pollution tolerant. As a result of these relationships, one can expect substantial aquatic life use of Bronx River at the projected DO levels for the selected treatment alternative.

The use of Bronx River by aquatic life is partially limited by its degraded physical habitat. Even with DO near or above the regulatory limit, the loss of extensive fringing wetlands, diverse natural shorelines, and benthic habitat suitable for colonization have substantially reduced biological diversity. Improvement in DO and a reduction in the discharge of organic matter will result in an improvement in the sediments through reduction of the percentage of sediment TOC. A reduction in TOC has been shown to correlate well with an increase in benthic diversity in the substrate (NYCDEP, 2004). A review of organic enrichment of estuaries and marine waters by Pearson and Rosenberg (1978) and a recent review by Hyland et al. (2000) under the auspices of the United Nations Educational, Scientific and Cultural Organization (UNESCO) confirm the general applicability of the relationship of TOC to benthic diversity. However, as long as the substrate is dominated by fine grain material, many invertebrate species will be excluded. Although the productivity of soft sediments can be high, because of lack of diversity in the benthic community, many fishes will make limited use of the habitat due to a lack of their preferred prey.

A comparison of the upper East River tributaries supports the position that physical habitat diversity is important for biological diversity. For example, the abundance of the eggs/larvae of cunner, tautog and fourbeard rockling in the upper East River suggests that these species could increase in number if desirable physical habitat were more abundant. These species prefer structure with irregularities and interstices. Vertical bulkhead walls and piles provide some of this habitat, but man-made bulkheads tend to be smooth and regular over extensive lengths. The high productivity among a few pollution tolerant species in fine-grained sediments represents another example of poor ecological conditions. The attainment of enhanced aquatic life usage in Bronx River is contingent upon a diverse physical habitat to support a variety of fish and benthic life. If such conditions could be attained, reproduction and growth would probably be enhanced which would contribute to a more balanced estuarine community than under existing conditions. The potential gain in aquatic life usage in Bronx River diminishes rapidly above the regulatory DO limit of 4.0 mg/L, due to the limitations of physical habitat.

However, the actual use of Bronx River for fishing may be limited by lack of access to the shoreline and the perception by the community that the River water quality is still degraded. Seasonal non-compliance with DO standards in Bronx River would not inhibit any habitat restoration programs or the development of waterfront amenities such as parkland and shoreline greenways that may be developed by other stakeholders. Use of these facilities for fishing or other recreational uses would not be contingent upon full compliance with water quality standards. Many of the target species for anglers in the NY/NJ Harbor, striped bass, bluefish, and weakfish are transient on a daily time scale so that angling success in not closely tied to water quality once the regulatory limit is approached or slightly exceeded.

The potential to re-establish migratory runs of clupeids (blueback herring and alewife) into the upper Bronx River would not be inhibited by the DO conditions that are projected for the WB/WS Facility Plan. Adult clupeids would be migrating upriver in spring when DO conditions are adequate in the lower Bronx River as they are passing through. Similarly, in the fall when the young-of-the-year juveniles are leaving the upper river, they would pass through the lower River when DO is adequate. If the clupeids spawning population were re-established, angling would likely be enhanced for striped bass and bluefish which feed on blueback herring and alewife.

Currently, there is a strong interest in waterfront amenities harbor wide which, in part, reflects the public recognition that water quality has improved over past conditions and that the aquatic resources can be used with some limitations. The cumulative effects of improving conditions for water quality and physical habitat throughout the NY/NJ Harbor minimizes the residual effects of small areas with temporary seasonal declines in water quality on the ecosystem scale. There are continuing trends of improving water quality in adjacent waterbodies such as major tributaries of the Upper East River. While these trends in water quality improvement continue, the significance of small areas of non-compliance with water quality standards will be minimized.

The extensive development of the shorelines for industrial, commercial and residential uses in Bronx River is a factor which places limits on both water quality and aquatic habitat availability and quality. Water quality in Bronx River is near its practical limit for improvement with respect to real gains in aquatic life use. In a highly modified system such as Bronx River, water quality and habitat will always be less than ideal due to irreversible changes in the watershed.

4.7. SENSITIVE AREAS

4.7.1. 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, 1995). 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;
- Water with primary contact recreation; and,
- Waters with threatened or endangered species and their habitat.

4.7.2. General Assessment

An analysis of the waters of the Bronx River with respect to the CSO Policy was conducted and is summarized in Table 4-25.

Table 4-25. Sensitive Areas Assessment

	Current Uses Classification of Waters Receiving CSO Discharges Compared to Sensitive Areas Classifications or Designations (1)						
CSO Discharge Receiving Water Segments	**Outstanding National Resource Water (ONRW)**	**National Marine Sanctuaries**	**Threatened or Endangered Species or Habitat**	**Primary Contact Recreation**	**Public Water Supply Intake**	**Public Water Supply Protected Area**	**Shellfish Bed**
Bronx River	None	None (2)	No (3)	No (4)	None (5)	None (5)	None

Notes: (1) Classifications or Designations per CSO Policy
(2) As shown at http://www.sactuaries.noaa.gov/oms/omsmaplarge.html
(3) No endangered or threatened animals/fish per correspondence from the U.S. Fish and Wildlife Service and the National marine Fisheries Services (NOAA Fisheries)
(4) Existing uses include secondary contact recreation and fishing
(5) These waterbodies contain salt water

4.7.3. Waters with Threatened or Endangered Species or their Habitat

Based on a review of Federal, State and Local listings, there are currently no threatened or endangered fish or marine animals present in the Bronx River.

4.7.4. Waters with Primary Contact Recreation

After an investigation into the Bronx River shoreline along the tidal reach, in which all New York City CSOs are located, it was found that there are no public access points along the river for primary contact recreation (swimming). NYCDOHMH has posted *No Swimming* signs at various locations.

4.7.5. Findings

There are no sensitive areas present within the Bronx River as defined by the USEPA Long Term Control Plan Policy.

NO TEXT ON THIS PAGE

5.0 Waterbody Improvement Projects

New York City is served primarily by a combined sewer system. Approximately 70 percent of the City is comprised of combined sewers totaling 4,800 miles within the five boroughs. The sewer system drains some 200,000 acres and serves a population of approximately 8 million New Yorkers. Approximately 460 outfalls are permitted to discharge during wet-weather through CSOs to the receiving waters of the New York Harbor. These discharges result in localized water-quality problems such as periodically high levels of coliform bacteria, nuisance levels of floatables, depressed dissolved oxygen, and, in some cases, sediment mounds and unpleasant odors.

The City of New York is committed to its role as an environmental steward of the New York Harbor and began addressing the issue of CSO discharges in the 1950s. To date, NYCDEP has spent or committed over $2.1 billion in its City-wide CSO abatement program. As a result of this and other ongoing programs, water quality has improved dramatically over the past 30 years (NYCDEP Harbor Survey Annual Reports). Implementation of many of these solutions within the current NYCDEP 10-year capital plan will continue that trend as NYCDEP continues to address CSO-related water quality issues through its City-Wide CSO Floatables program, pump station and collection system improvements, and the ongoing analysis and implementation of CSO abatement solutions. The following sections present the history of NYCDEP CSO abatement and describe the current and ongoing programs in detail.

5.1. CITY-WIDE CSO PROGRAMS PRIOR TO 1992

Early CSO assessment programs began in the 1950s and culminated with the Spring Creek Auxiliary WPCP, a 12-million gallon CSO retention facility 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 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 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 reinvigorated 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 area. 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 determined that medical wastes were a small component of the full spectrum of material found in metropolitan area waters and beach wash-ups, and that the likely source of the medical wastes was illegal dumping. The study also found that, aside from natural materials and wood from decaying piers and vessels, the primary component of the floatable material is street litter in surface runoff that is discharged to area waters via CSOs and storm sewers. The Floatables Control Program is discussed in Section 5.4.

5.2. CITY-WIDE CSO ABATEMENT ORDERS (1992, 1996, 2005, 2008, 2009)

In 1992, 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 1992 ACO was modified in 1996 to add a program for catch basin cleaning, construction, and repair to further control floatables.

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, 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 number of planned retention tank facilities was reduced from eight to six during the CSO facility planning phase. 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 141,000 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 one percent as of 2008 as reported in the 2009 BMP Annual Report for CY 2008) will be completed by 2010.

For CSOs discharging to the open waters of the Inner and Outer Harbors 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 control alternatives. 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.

NYCDEP and NYSDEC negotiated a new Consent Order that was signed January 14, 2005 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 Clean Water Act and Environmental Conservation Law. The new Order, noticed by NYSDEC in September 2004, 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. NYCDEP and NYSDEC also entered into a separate Memorandum of Understanding to facilitate water quality standards reviews in accordance with the CSO Control Policy. The 2005 Consent Order was modified in 2008 and 2009. Table 5-1 presents the design and construction milestone dates for capital projects in the most current CSO Consent Order.

Table 5-1. CSO Consent Order Milestone Dates for Capital Projects

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	Nov 2009
	In-Line Storage (Deleted per 2008 CSO Consent Order)	Nov 2006	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
	Gowanus Flushing Tunnel Modernization	-	Sep 2014
	Gowanus Pumping Station Reconstruction	-	Sep 2014
	Dredging Gowanus Canal	Dec 2010	See Note 1
Paerdegat Basin	Influent Channel	Mar 1997	Feb 2002
	Foundations and Substructures	Aug 2001	Dec 2009
	Structures and Equipment	Nov 2004	May 2011
	Dredging Paerdegat Basin	See Note 2	See Note 2
Flushing Bay/Creek	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	Sep 2009
	CS4-5 Tide Gates	Nov 1999	Apr 2002
	CD-8 Manual Sluice Gates	May 2003	Jun 2005
	Tallman Island WPCP 2xDDWF	Dec 2010	Jul 2015
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	Mar 2012
	Laurelton & Springfield Stormwater Buildout Drainage Plan	May 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

Planning Area	Project	Design Completion	Construction Completion
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 2007	Feb 2012
	26th Ward Wet Weather Expansion	Jun 2010	Dec 2015
	Rockaway WPCP 2xDDWF	-	Dec 2017

Notes: 1) Dredging must be completed with 5 years of final permit issuance.
2) Design Completion = Permit + 18 months; Construction Completion = Permit + 60 months.

5.3. CITY-WIDE BEST MANAGEMENT PRACTICES (BMPS)

The SPDES permits for all 14 WPCPs in New York City require the NYCDEP to report annually on the progress of 14 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 “determined on a best professional judgment basis by the NPDES permitting authority” and to be the best available technology based controls that could be implemented within two 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 excerpted directly from the most recent draft SPDES permits 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 CSO BMP 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.

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.

In 2008, CSO maintenance within the Bronx River drainage area was performed at regulator HP-13 and consisted of the following:

- Removed rocks from diversion chamber and removed rags, rope and plastic from the diversion chamber.
- In March and April, preventative maintenance was performed
- In October, corrective maintenance was performed on three separate occasions

The NYCDEP reports on the status of the City-wide program components and highlights specific maintenance projects, such as the Enhanced Beach Protection Program, where additional inspections of infrastructure in proximity to sensitive beach areas was performed.

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 provides general information describing the status of City-wide SCADA, regulators, tide gates, interceptors, and collection system cleaning in the CSO BMP Annual Report. Table 5-2 lists all of the maintenance performed within the Bronx River service area in the 2008 calendar year.

Table 5-2. Collection System Maintenance in the Bronx River (CY 2008)

Reg #	Status	Schedule	Scope	Comments
HP-13	Completed	Maintenance, cleaning and exercising of tide gate	Minor Repair	In house repair

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: 2×DDWF;

- Primary treatment capacity: 2×DDWF; and
- Secondary treatment capacity: 1.5×DDWF.

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.

In addition to describing WPCP upgrades and efforts underway to ensure appropriate flows to all 14 WPCPs, the CSO BMP Annual Report provides analysis of the largest 10 storms of the year and WPCP flow results for each of these storms at least during the peak portions of the events.

According to the CY 2008 Annual BMP Report, the Hunts Point WPCP operated at 2 x DDWF capacities for 79 hours during storm events in 2008. The WPCP processed 2xDDWF for at least a few hours during seven of the top ten storms, and sustained flow exceeded 80 percent of 2xDDWF for all of the top ten storms. A summary of the plant's performance during the top ten storm events is summarized in Table 5-3 below.

In addition, as part of the LTCP planning work, DEP worked with NYSDEC to examine a number of structurally intensive methods to convey additional wet weather flow to the Hunts Point WPCP. This included an examination of the construction of a parallel interceptor between the Bronx River and the WPCP; construction of a wet weather pumping station and a force main to transfer flow back from regulator HP-13 (the closest regulator); construction of a new sewer to redirect flow back from regulator HP-013 to the nearest combined sewer and restricting the outlet from regulator HP-13; and raising the overflow weir at regulator HP-024. Analyses of these system optimization alternatives are discussed in further detail in Section 7.3.3. NYCDEP will continue to examine certain alternatives as part of the development of the LTCP.

Table 5-3. Hunts Point WPCP 2008 Summary of Wet-Weather Capacity and Treated Flows (MGD)

Plant	Permitted Capacity$^{(1)}$	Top-Ten Storm Maximum Reported Capacity$^{(2)}$	Top-Ten Storm Maximum Sustained Flow$^{(3)}$	Top-Ten Storm Maximum Peak Flow$^{(4)}$	Top-Ten Storm Average Reported Capacity$^{(5)}$	Top-Ten Storm Average Sustained Flow$^{(6)}$	Top-Ten Storm Average Peak Flow$^{(7)}$
Hunts Point	400	400	413	415	400	396	405

Permitted Capacity represents the design wet-weather capacity of the WPCP, except as noted. The design wet-weather capacity is typically equal to two times design dry-weather flow (2xDDWF). The design capacity is applicable when all process units are in service. Construction and repaid activities can temporarily reduce capacity.
Maximum Reported Capacity represents the single largest WPCP capacity reported by the WPCP for any of the top ten storms. Capacities reported by the WPCP are based on the process units in service during each storm and area in accordance with each WPCP's approved wet-weather operating plan. Process units may be taken out of service during construction for upgrades mandated by Consent Orders or for other reasons such as emergency repairs. If all process units are in service during a storm, the reported capacity equals the design capacity.
Maximum Sustained Flow is the largest wet-weather "sustained flow" that occurred during any of the top ten storms. Sustained flows represent the average hourly WPCP flow during WPCP throttling periods or for events with no throttling, the average hourly flow over at least 3 hours including the peak wet-weather flow.
Maximum Peak Flow represents the highest hourly flow observed during the top ten storms.
Average Reported Capacity represents the average of the capacities reported by the WPCP for all top ten storms. Capacities reported by the WPCP are based on the process units in service during each storm and are in accordance with each WPCP's approved wet-weather operating plan. Process units may be taken out of service during construct for upgrades mandated by Consent Orders or for other reason such as emergency repairs. If all process units are in service during a storm, the reported capacity equals the design capacity.
Average Sustained Flow represents the average of the largest, multi-hour flows that occurred during each of the top ten storm periods. Sustained flows represent the average hourly WPCP flow during WPCP-throttling periods or, for events with no throttling, the average hourly flow over at least 3 hours including the peak wet-weather flow.
Average Peak Flow represents the average of the highest hourly flows observed during each of the top ten storms.

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 entitled *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 biological nutrient removal (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 CSO BMP Annual Report. The submittal dates listed in the CY 2008 CSO BMP Annual Report for the Hunts Point WPCP is September 2004. The Hunts Point WWOP will be updated per SPDES permit requirements.

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 the CSO BMP Annual Report.

5.3.6. Industrial Pretreatment

This BMP addresses three NMCs: No. 3 (Review and Modification of Pretreatment Requirements to Determine Whether Nondomestic Sources are Contributing to CSO Impacts); No. 7 (Pollution Prevention Programs to Reduce Contaminants in CSOs); and No. 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; and
- Prioritization of industrial waste containing toxic pollutants for capture and treatment by the POTW over residential/commercial service areas.

The CSO BMP Annual Report addresses the components of the industrial pretreatment BMP through a description of the City-wide program.

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.

The CSO BMP Annual Report provides summary information regarding the status of the catch basin, booming, skimming, and netting programs City-wide. Several catch basin cleaning and hooding activities took place in the Bronx River service area in 2008 as described in the 2009 CSO BMP Annual Report. In the entire borough of the Bronx 5,409 catch basins were cleaned in 2008. The Hunts Point service area includes 10,484 basins of which 346 had hoods replaced in 2008. Fifty-five (55) catch basins remain that require reconstruction in the Hunts Point collection system after 2008.

As part of its floatables plan, the NYCDEP maintains one floatables containment facility in the Bronx River, a boom downstream of outfalls HP-004 and HP-007. The NYCDEP has this facility inspected and serviced after significant rainstorms. Table 5-4 summarizes the quantity of floatables retrieved from the Bronx River containment facility in CY 2008, as reported in the 2009 CSO BMP Annual Report.

Table 5-4. Floatable Material Collected in Bronx River (2008)

Month of Year	Bronx River Boom (Downstream of Outfalls HP-004 and HP-007) (cy)
January	66
February	290
March	141
April	44
May	58
June	71.5
July	51
August	98
September	181
October	46.25
November	61
December	137
2008 Total	**1244.75**

The 1,245 cubic yards of floatables collected at the Bronx River boom equates to roughly 61 percent of the total volume of material captured City-wide by booms and nets in 2008. Previous years demonstrated similar trends. For instance, in 2007, the Bronx River boom captured approximately 64 percent of the entire IFCP floatables capture volume. Several characteristics of the waterbody contribute to the high capture of floatables at the Bronx River boom. They are as follows:

- This boom has the largest drainage area of all the booms in the IFCP. The Bronx River stretches over 20 miles from its headwaters at Davis Brook and Kensico Dam to its mouth on the East River. Its total drainage area is over 24,000 acres while the other IFCP booms and nets have a total combined drainage area of roughly 33,000 acres.

- The Bronx River boom collects floatables attributable to street litter and CSO as well as natural debris such as twigs, leaves, and branches from overhanging trees and natural areas adjacent to the river. Other booms and nets service areas that produce far less natural material.

- The Bronx River boom, unlike many of the other booms and nets, services a river with a near constant upstream flow source, as opposed to the other IFCP waterbodies that have tidal and intermittent CSO flow from upstream. This waterbody characteristic results in nearly constant collection by the boom, even outside of rain events.

As part of its service contract, NYCDEP regularly maintains the floatables containment boom. During 2008, the Bronx River boom was replaced and received minor maintenance as shown in Table 5-5.

Table 5-5. Bronx River Boom and Net Replacement and Repair (2008)

Date	Description	Primary Item
2/1/2008	Sections of boom replaced	Boom Repair
3/1/2008	Sections of Boom replaced	Boom Repair
4/1/2008	Boom Replaced	New Boom Installation
5/16/2008	Containment Boom System Replaced	New Boom Installation
10/29/2008	Re-attached boom to restore containment. Note: floatables recovered	Boom Repair

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 the 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. The CSO BMP Annual Report describes the general, City-wide plan and addresses specific projects occurring in the reporting year. As reported in the CY 2008 CSO BMP Annual Report, currently there are no planned combined sewer system replacement projects located within the Bronx River drainage area.

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 is provided in each CSO BMP Annual Report, including specific projects occurring in the reporting year. No combined sewer extension projects were completed in calendar year 2008.

5.3.10. Sewer Connection & 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 CSO BMP Annual Report contains a brief status report for this BMP and provides details pertaining to chronic sewer back-up and manhole overflow notifications submitted to NYSDEC when necessary.

For the calendar year 2008, no letter of notification was received from NYSDEC concerning chronic sewer backups or manhole overflows which would prohibit additional sewer connections or sewer extensions.

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 2009 CSO BMP Annual Report summarizes the three scavenger waste acceptance facilities controlled by NYCDEP, all of which are downstream of CSO regulators, and the regulations governing discharge of such material at the facilities. One of the scavenger waste sites is located near the Hunts Point WPCP. This site is described in further detail in the CY 2008 CSO Annual BMP Report.

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 the NYCDEP. This BMP ensures that only allowable flow is discharged into the combined or storm sewer system.

The CSO 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 the 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 the New York City Department of Health and Mental Hygiene (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 provides the status of the CSO signage program in the CSO BMP Annual Report and lists those former CSO outfalls that no longer require signs. NYCDEP is currently developing improvements to the CSO signs to increase their visibility and to include information relative to wet-weather warnings as required by the EPA CSO Policy. In addition, descriptions of new educational signage and public education-related partnerships are described. The NYCDHMH CSO public notification program is also summarized.

5.3.14. CSO BMP 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 December 2009, the most recent CSO BMP Annual Report was submitted on April 9, 2009 for calendar year 2008.

5.4. CITY-WIDE CSO PLAN FOR FLOATABLES ABATEMENT

In the late 1980s, New York City initiated the City-Wide Floatables Study, a multi-year investigation of floatables in New York Harbor (HydroQual, 1993, 1995a, 1995b). In addition to examining floatables characteristics, this study investigated potential sources of floatables, floatables circulation and beach-deposition patterns throughout the Harbor, and potential structural and non-structural alternatives for floatables control. Findings of the study showed that the primary source of floatables (other than natural sources) in the Harbor was urban street litter carried into waterways along with rainfall runoff.

NYCDEP developed a floatables abatement plan (Floatables Plan) for the CSO areas of New York City in June 1997 (HydroQual, 1997). The Floatables Plan was updated in 2005

(HydroQual, 2005c, 2005d) to reflect the completion of some proposed action elements and the addition of a monitoring program, as well as changes appurtenant to SPDES permits and modifications of regional Waterbody/Watershed Facility Plans and CSO Facility Plans. The NYSDEC approved the updated Floatables Plan on March 17, 2006.

The objectives of the Floatables Plan are to provide substantial control of 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 street litter levels City-wide and inform the Department of Sanitation of New York (DSNY) and/or the New York City Mayor's Office of Operations when changes in litter levels at or in City policies would potentially result in increased discharges of CSO floatables;
- Continue the three-year cycle to inspect catch basins City-wide for missing hoods and to replace missing hoods to prevent floatables from entering the sewer system. In addition, proceed with the retrofit, repair, or reconstruction of catch basins requiring extensive repairs or reconstruction to accommodate a hood;
- Maximize collection system storage and capacity;
- Maximize wet weather flow capture at WPCPs;
- Capture floatables at wet-weather CSO storage/treatment facilities;
- Capture floatables at end-of-pipe and in-water facilities, including the Interim Floatables Containment Program (IFCP);
- Continue the Illegal Dumping Notification Program (IDNP) in which 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;
- Engage in public outreach programs to increase public awareness of the consequences of littering and the importance of conserving water;
- As new floatables-control technologies emerge, continue to investigate their applicability, performance and cost-effectiveness in New York City;
- Provide support to NYSDEC to review and revise water quality standards to provide for achievable goals; and
- Develop a floatables monitoring program to track floatables levels in the Harbor and inform decisions to address both short- and long-term floatables-control requirements.

Overall, implementation of the Floatables Plan is expected to control roughly 96 percent of the floatable litter generated in New York City. 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 component of the Floatables Plan is self-assessment, 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). 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.

5.4.1. Pilot Floatable Monitoring Program

In late 2006, work commenced to develop the Floatables Monitoring Program to track floatables levels in New York Harbor (HydroQual, 2007a). This pilot work which was performed to develop a monitoring procedure and an associated visual floatables rating system based on a five-point scale (very poor, poor, fair, good, very good), involved observations at a number of different sites. At each site, observations were made for up to three categories: on the shoreline, in the water near the shoreline; and in the water away from the shoreline.

Among the various pilot program sites was a location in the Bronx River area at monitoring station E14-L, located at 174th Street along the Bronx River. Observations were made in July, November, and December 2006 and were rated according to two scales for each of the three categories. The first scale has a 2-Point rating of Good or Poor. The second scale has a 5-Point rating of Very Good, Good, Fair, Poor, or Very Poor. On the 2-Point Scale, a Good rating was given to 83 percent of the Open Water observations, 57 percent of the Near Shore observations, and 27 percent of the Shoreline observations. On the 5-Point Scale, the ratings were distributed as shown in Table 5-6. Although the observations, specifically in the Shoreline region, were often rated at Fair or below, these ratings may have taken into account natural, non-CSO related material. The Bronx River monitoring station is overhung by trees and a majority of the samples were taken during the autumn season. Further data collection, especially in other seasons, may show a decrease in the number of poor ratings.

Table 5-6. Summary of Bronx River Observations Rated on the 5-Point Scale

	Percent of Bronx River Observations Given the Following Ratings				
	Very Good	**Good**	**Fair**	**Poor**	**Very Poor**
Open Water	15%	70%	15%	0%	0%
Near Shore	7%	49%	27%	15%	0%
Shoreline	0%	25%	35%	27%	13%

5.4.2. Interim Floatables Control Program Contaminant Boom

In 1995, as part of the Interim Floatables Containment Program (IFCP), a boom was placed across the Bronx River to retain floatables as shown in Figure 5-1. The boom is located downstream of outfalls HP-004 and HP-007 in the area between Watson and Westchester Avenues. The boom is regularly serviced by a subcontractor to the NYCDEP who removes floatable debris with a skimmer boat as shown in Figure 5-2. The skimmer boat collected a volume of about 1,245 yd^3 of floatables in 2008. The material collected from the boom is off-loaded at the Bowery Bay WPCP for disposal.

Figure 5-1. Containment Boom on the Bronx River

Figure 5-2. UMI TrashCat™ skimming back bay wetland areas of New York City's Jamaica Bay

5.4.3. Shoreline Cleanup Program

As part of the Environmental Benefits Projects (EBP) program established under the Long Island Sound (LIS) Consent Judgment, the NYCDEP has implemented a beach clean-up program to clean up shorelines in areas where floatables are known to occur due to CSO overflows and stormwater discharges as well as careless behavior and illegal dumping. This project was undertaken in connection with the settlement of an enforcement action taken by New York State and the DEC for violations of New York State law and DEC regulations. NYCDEP has conducted cleanups at several areas deemed to benefit from these efforts including:

- Coney Island Creek, Brooklyn
- Kaiser Park, Brooklyn
- Sheepshead Bay (Kingsborough Community College) Brooklyn
- Cryders Lane (Little Bay Park), Queens
- Flushing Bay, Queens

- Owls Head, Brooklyn

These cleanup efforts consisted of will consist of the following methods:

- Workboat assisted cleanup – Mechanical Cleanup: Where debris is caught up in riprap on the shoreline, a high-pressure pump will be used to spray water onto the shoreline to dislodge and flush debris and floatables from the riprap back into the water. A containment boom placed in the water around the site will allow a skimmer vessel to collect the material for proper disposal.
- Workboat-Assisted Cleanup: At a few locations where the shoreline is not readily accessible from the land side, a small work boat with an operator and crewmembers collects debris by hand or with nets and other tools. The debris will be placed onto the work boat for transport to a skimmer boat for ultimate disposal.
- Manual Cleanup: At some locations, simply raking and hand cleaning will provide the most efficient clean up method. Debris then will be removed and placed into plastic garbage bags, containers, or dumpsters and then loaded onto a pickup truck for proper disposal.

On average, DEP will generally be performing three cleanups per site 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 NYCDEP will proceed in the future.

5.5. CITY-WIDE CSO LONG-TERM CONTROL PLAN (LTCP) PROJECT

In June 2004, NYCDEP authorized the LTCP Project. This work will 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 WB/WS Facility Plan reports and 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.

5.6. BRONX RIVER CSO FACILITY PLANS

In September 2003, NYCDEP submitted a Bronx River CSO Facility Plan updating previous facility planning reports. That plan provided for the development of an off-line underground CSO conveyance/storage conduit of 4.0 MG that would serve Outfall HP-007, a CSO outfall located on the east bank of the Bronx River near the intersection of Devoe Avenue, East 177th Street, and West Farms Road in the Bronx. As part of the plan, Outfall HP-007 was to be relocated downstream of its existing location. The proposed facility was to be sited south of East 177th Street, beneath the property of both the Metropolitan Transit Authority-New York City (MTA) and the NYSDOT. The proposed CSO storage conduit would reduce the frequency, duration, and severity of CSOs into Bronx River in the vicinity of Outfall HP-007.

The principal elements of the facilities proposed in the 2003 Bronx River CSO Facility Plan included:

- A 4.0 MG storage conduit to capture and store combined sewer overflows from Outfall HP-007, including the relocation of Outfall HP-007 approximately 265 feet downstream from its existing location.
- An underground pumping station with a rated capacity of approximately 4.0 MGD to transfer captured combined sewage from the storage conduit to the Hunts Point WPCP collection system for conveyance to the Hunts Point WPCP for treatment.
- An air treatment system to treat exhaust air from the CSO storage facility, screenings removal area, and the wet well of the pumping station. The air treatment system would consist of a one or two stage carbon adsorption system to reduce hydrogen sulfide concentrations to at least 1 part per billion at the nearest sensitive receptor. This criterion satisfies the NYCDEP's air quality requirements.
- An above-grade CSO operations building.
- Space for future disinfection facilities as well as dechlorination facilities if sodium hypochlorite is used.

Those facility planning activities did not reflect the watershed planning approach that has recently been determined by the USEPA as the most appropriate approach to assessing water quality improvements. In addition, the efforts showed that the proposed facility plan would not result in compliance with the current water quality standards. Therefore, the proposed 2003 Bronx River CSO Facility Plan was reevaluated as part of the NYCDEP's Use and Standards Attainment (USA) Project.

As documented in the 2003 Bronx River CSO Facility Plan, an improved Bronx River Model was used to calculate dissolved oxygen in response to pollutant loadings and water quality conditions according to Baseline, prior Facility Plan abatement levels, and Sewer Separation scenarios. The Baseline (no-build), previous Facility Plan, and Sewer Separation scenarios evaluated with the new model resulted in annual levels of compliance with the dissolved oxygen criteria that (assuming year-round spawning to occur) were the same. The 2003 Bronx River CSO Facility Plan documented that, building the 4 MG storage conduit, as previously proposed, would not improve aquatic life protection use attainment. The Sewer Separation case did not improve use attainment either. Bronx River Model testing showed that the natural salinity stratification acts to cause low bottom dissolved oxygen. Dissolved oxygen from the aerated surface water (lower salinity) cannot transfer readily through to the de-oxygenated bottom layer to replenish oxygen used up in the stabilization of organic materials. The influence of the East River was another contributing factor on the dissolved oxygen levels in the Bronx River. The analyses conducted indicated that construction of the 4 MG CSO storage conduit will not increase the use level in the tidal section of the Bronx River to provide fishable water quality and compliance with the Clean Water Act goal of providing a fishable water use. Neither dissolved oxygen levels nor the amount of benthic taxa are projected to be improved to any significant level with the construction of this facility. Further levels of CSO control were also found not to be able to improve the river's water use to attain fishable water quality.

The Bronx River Model was also utilized in the USA project to calculate total coliform levels in response to pollutant loadings and water quality conditions according to the project scenarios of the Baseline, 4 MG storage conduit, and Sewer Separation. Additional coliform projections were performed using the Bronx River Model to evaluate specific engineering alternatives and gain insight into the importance of sources of coliform. The Baseline, 4 MG storage conduit, and Sewer Separation total coliform cases all provide for compliance with the existing Class I standard for secondary contact recreation during the high recreation season (May through October) except for small upstream section that is affected strongly by Westchester inputs. Construction of the proposed 4 MG storage conduit would not bring this section of the river into compliance. The Westchester County coliform load was found to significantly impact the tidal Bronx primary recreation use attainment. To attain an upgrade in classification to primary contact recreation throughout the tidal Bronx River, the Westchester County load must be reduced by 60 percent and treatment (disinfection) or removal of HP-009 is required. A Westchester County load reduction of 98 percent is required to provide primary contact recreation in the freshwater portion of the River. Construction of a 4 MG storage conduit would not increase water quality through the reduction of Bronx River coliform bacteria concentrations to provide for attainment of primary contact use.

Evaluation of the recommendations of the 2003 Bronx River CSO Facility Plan, conducted as part of the USA project watershed analysis, concluded that not all designated uses for the Bronx River would be attained after construction of the storage conduit. For aquatic life protection use and attainment of primary contact the recreation use, the 4 MG storage conduit for Outfall HP-007 provides no improved or expanded use beyond the Baseline case conditions. Therefore, the storage conduit was eliminated from the 2004 Bronx River WB/WS Facility Plan as ineffectual in favor of increased floatables abatement at all active CSO outfalls in the Bronx River. Floatables abatement at HP-007 equivalent to that of the storage conduit is provided in the plan. In addition, CSO floatables abatement at outfalls HP-004 and HP-009 was included in the 2004 Bronx River WB/WS Facility Plan.

The principal elements of the 2004 Bronx River WB/WS Facility Plan included:

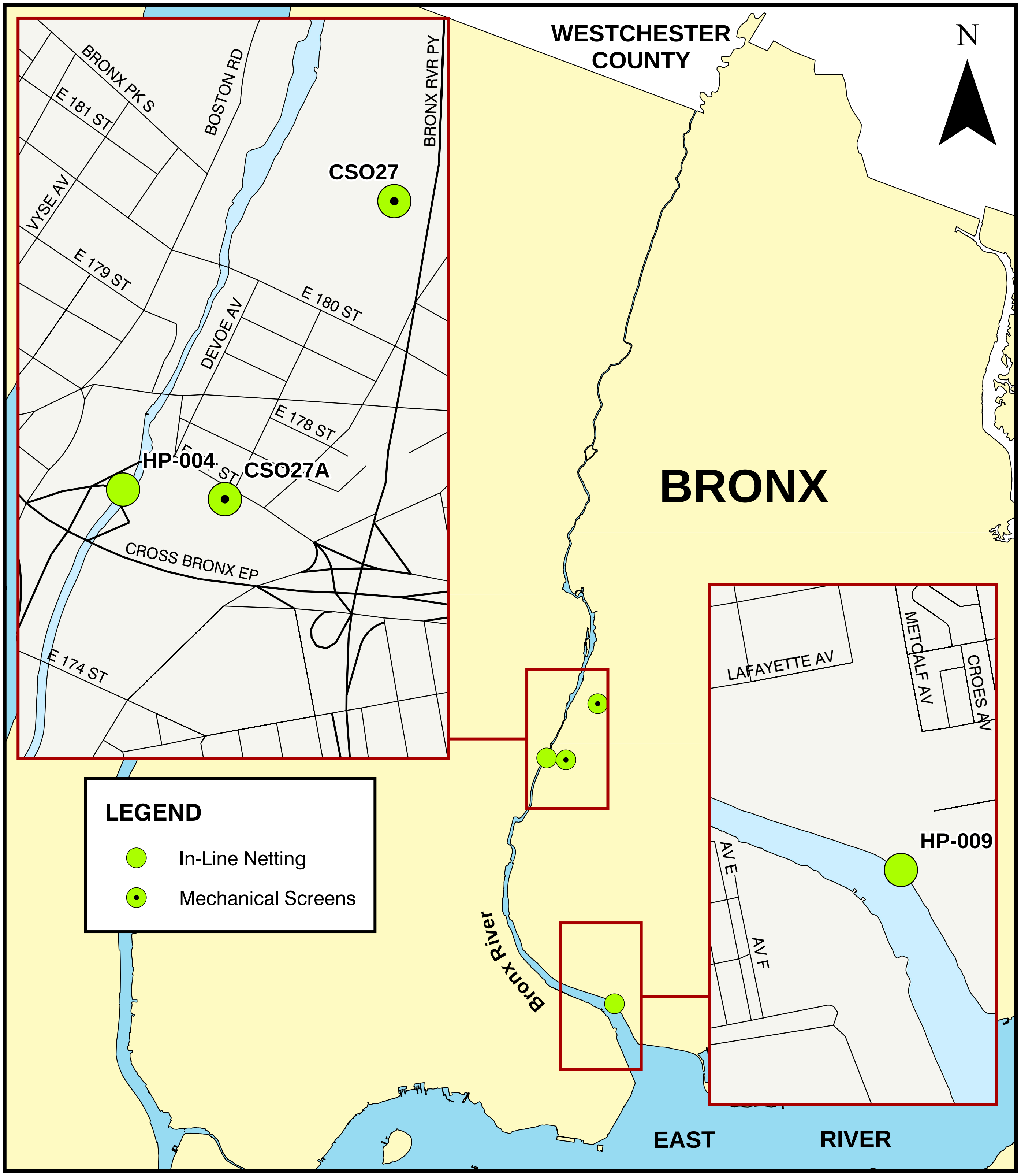
- Provide floatables control at HP-007, through installation of regulator-type screens at Regulators 27A and 27 that direct CSO flows to Outfall HP-007. Modify the regulators to accommodate the floatables control screens and the above-ground control box.

- Provide floatables control at HP-004 and HP-009, the other two active Bronx River CSO outfalls. Figure 5-3 illustrates the proposed locations of floatables control.

- Cooperate with Westchester County and USACE in watershed analyses of water quality factors governing recreation use.

- Cooperate in watershed planning to control non-CSO floatables, cooperate with other agencies conducting restoration and riparian use projects and coordinate floatables control facilities with the riparian use projects of other agencies.

- Re-evaluate the need to provide CSO disinfection after upstream improvements occur.



New York City
Department of Environmental Protection

2004 USA Project Proposed Floatables Control Locations

As a result of the 2004 WB/WS Facility Plan Report, the NYCDEP has progressed on all of these plan elements. First, a Conceptual Design Report was completed in November 2005 documenting the floatables removed facilities that the NYCDEP will be progressing. Further, final design of these facilities was initiated prior to the January 2006 CSO Consent Order milestones. Design was completed in July 2008 and Notice to Proceed to Construction was issued in June 2009. Second, the NYCDEP has been working with Westchester County on the subject of watershed planning in the fresh water section of the river and reduction of pathogen loadings. This effort has resulted in a joint NYC-Westchester County pathogen water quality sampling program (see Section 4). The NYCDEP has continued to cooperated and work toward addressing the Bronx River Alliance watershed planning recommendations outlined in Section 6. Further assessment of disinfection is also addressed in Section 7.

5.7. USACE RESTORATION

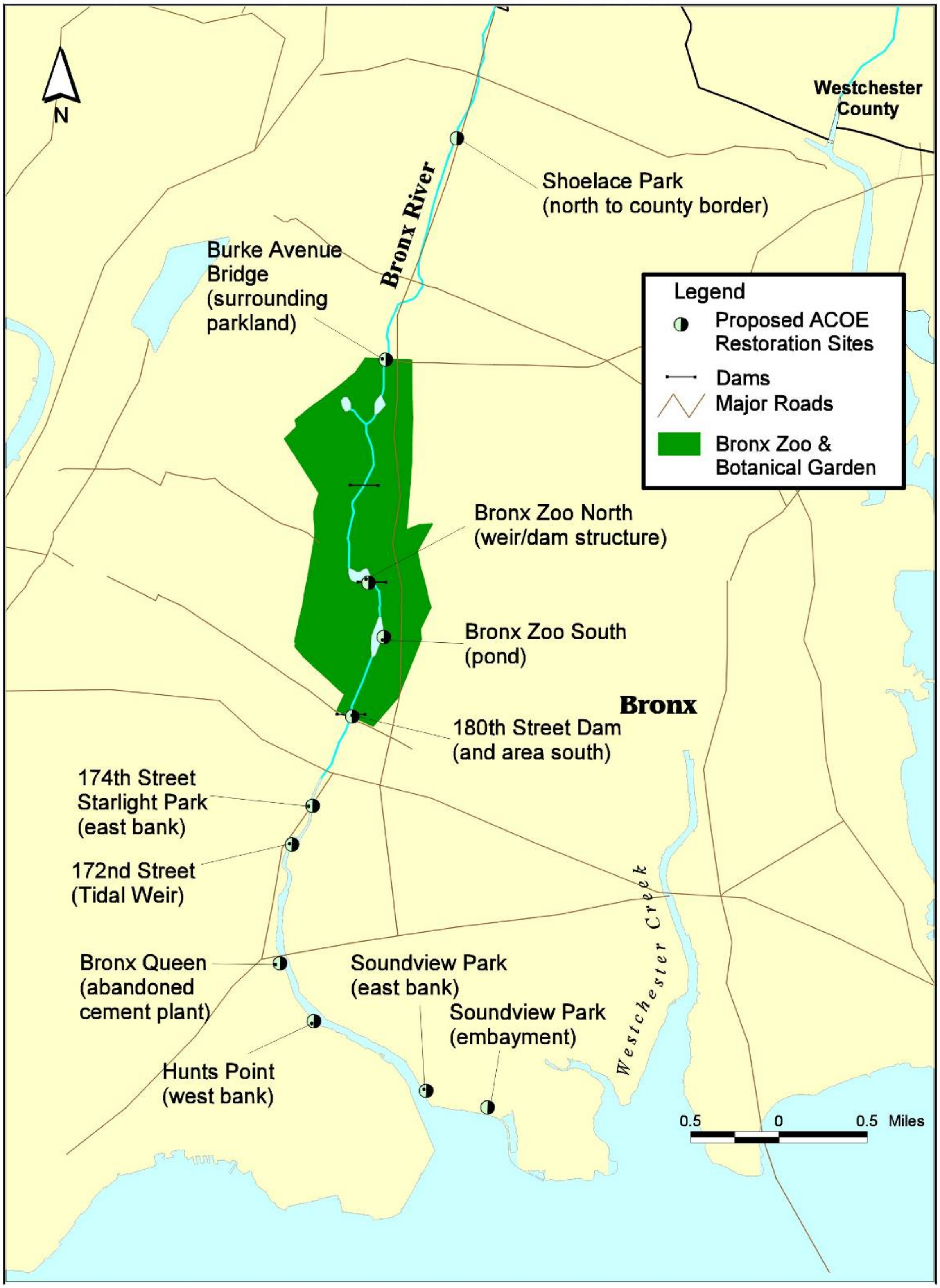
The United States Army Corps of Engineers (USACE) conducted an Expedited Reconnaissance Study on the Bronx River in August 1999 to determine Federal interest in providing solutions to flooding, restoring degraded habitat and solving water resource problems. The local cost sharing sponsors are the NYCDEP and the Westchester County Department of Parks, Recreation, and Conservation.

From this study, 11 sites along the river in Bronx County and seven sites in Westchester County were proposed for restoration as shown on Figures 5-4 and 5-5. Descriptions of the restoration projects are summarized on Table 5-7. A majority of the sites are planned for tidal or floodplain wetland restoration. A Draft Project Study Plan was prepared in April 2000 (USACE, 2000) once Federal interest in the project was demonstrated. It included the tasks, estimated costs and schedule for the feasibility phase of the project. In addition to the feasibility study, the USACE will prepare a Comprehensive Basinwide Watershed Management Plan that will include an inventory of natural resources, stream stability, water chemistry, and a management strategy that will allow for economic development and protection of natural resources (USACE, 2000). It will be included as an appendix to the feasibility report.

The USACE projects will assist in a variety of uses along the Bronx River, including: water quality improvements, access/shoreline recreation and aquatic habitat improvement in the form of streambank stabilization, wetland creation/restoration and dam reconfiguration/fish passage. An example of one of the projects is to increase stream flow and restore fish passage through a reconfigured dam structure at the 180th Street Dam at the southernmost point of the Bronx Zoo. It should be noted that several of the proposed projects and sites for restoration appear in the plans of other groups working on the Bronx River.

In Fiscal Year 2004, the USACE began to review existing information on the Bronx River Basin, identify and prioritize different restoration sites and began project related data collection. The Fiscal Year 2005 funds are being used to continue the feasibility study, including data collection and coordination with local interests. The following tasks were completed in 2005:

- Generate a GIS based map of the Bronx River Basin detailing all the restoration activities in different stages of completion. This map will be useful for the study by



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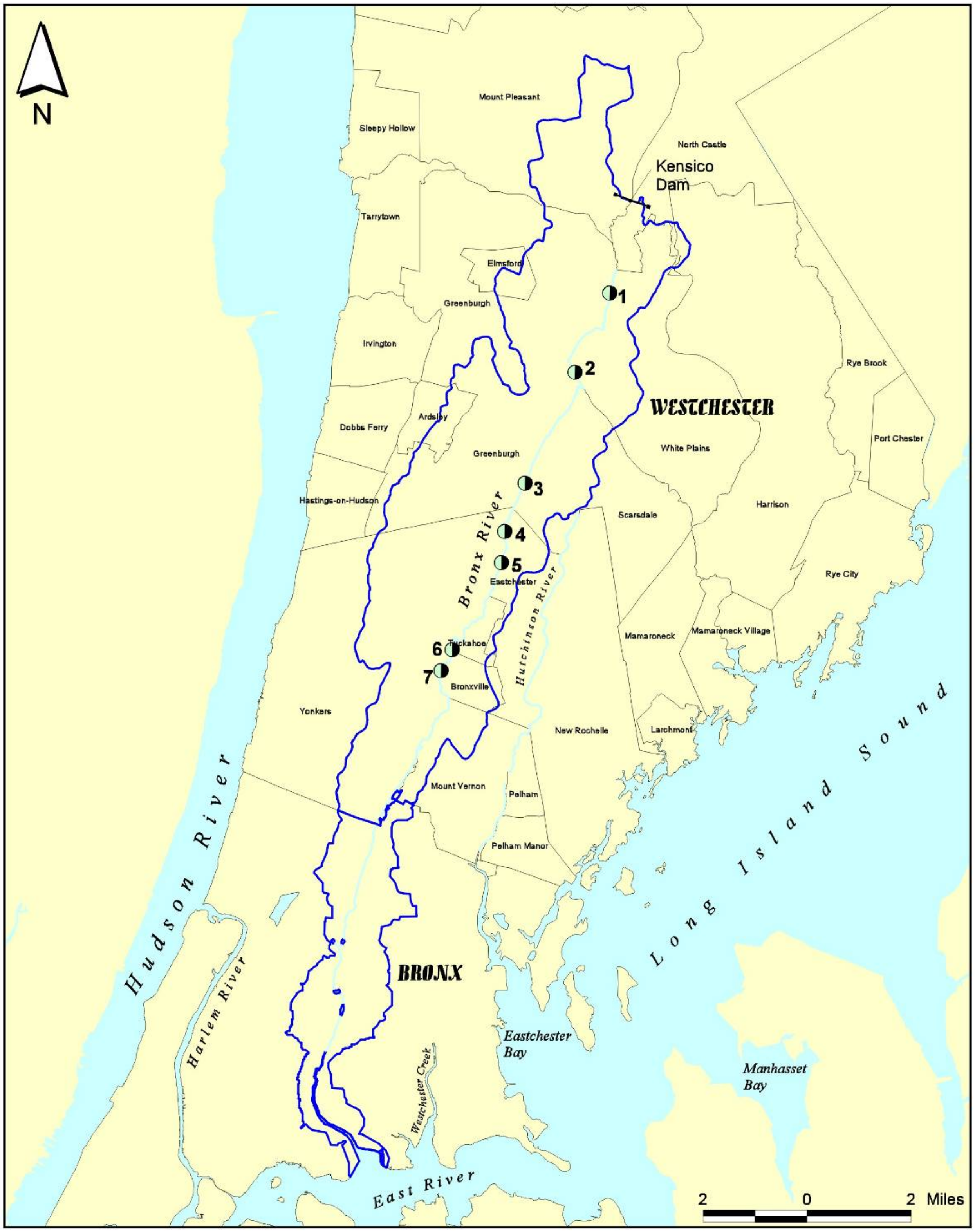
Restoration Sites in Bronx County



New York City
Department of Environmental Protection

Restoration Sites in Westchester County

Bronx River Waterbody/Watershed Facility Plan

FIGURE 5-5

better helping focus the resources of the cost-sharing partners.

- Hydrology and hydraulic modeling of Fisher Lane – this is part of the proposed restoration of natural channel and mixed floodplain habitats at Fisher Lane Pond.

- GIS database development of stream walk data.

- Initiate Environmental sampling program – Westchester County and the NYCDEP have planned to jointly sample the Bronx River for further water quality data. Further information on this sampling program can be found in Section 8.

The funds requested for fiscal year 2006 will be used to continue the feasibility phase of the study, including engineering modeling, environmental sampling, coordination with non-federal agencies, and formulation of alternatives.

Table 5-7. U.S. Army Corps of Engineers Proposed Restoration Locations and Project Descriptions

Location	Problem	Opportunity
Bronx - Site 1 - Shoelace Park and areas north to county border	Stream bank instability, filled in flood-plain areas, submerged hiking/biking trail, invasive, non-native vegetation	Restore floodplain wetlands, reintroduce native wetland and riparian forest species, reconstruct trail
Bronx - Site 2 - Burke Avenue bridge - surrounding parkland	Stream bank instability, sedimentation on floodplain, filled areas on flood plain, invasive non-native vegetation	Restore floodplain wetlands, stream bank stabilization, reintroduce native wetland and riparian forest species
Bronx - Site 3 - Bronx Zoo north - weir/dam structure	Flow impediment, blockage of fish passage	Reconfigure weir/dam structure to increase flow and allow fish passage, restore floodplain wetlands
Bronx - Site 4 - Bronx Zoo south - pond	Heavy sedimentation and stream channel aggradation, poor flow, areas of stagnant water, loss of native plant species	Increase flow and reduce sedimentation through reconfiguration of 180th Street dam, restore floodplain wetlands, reintroduce native wetland species (cattails, etc.)
Bronx - Site 5 - 180th Street Dam and area south	Flow impediment (dam), blockage of fish passage, built-up concrete banks, riparian corridor infringement	Increase stream flow and restore fish passage through reconfiguration of dam structure, create mossy outcrops on concrete structures
Bronx - Site 6 - 174th Street/Starlight Park - east bank	Filled in floodplain wetland area, rock armor banks	Restore wetlands for stormwater retention, increase habitat by bank reconfiguration
Bronx - Site 7 - 172nd Street weir	Flow impediment (weir), rock armor and concrete banks, large debris, non-vegetated mud flats, riparian corridor infringement, former wetland area	Improve stream flow and fish passage by removing weir, restore tidal wetland at mud flats, restore wetlands for stormwater retention on east banks, create vegetative buffer on west bank
Bronx - Site 8 - Bronx Queens/abandoned Cement Plant - west bank	Steep built-up banks, riparian corridor infringement, former wetland area	Create mussel and macrophytic algae habitat, restore access to former boat dock, create vegetative buffer

Location	Problem	Opportunity
Bronx - Site 9 - Hunts Point - west bank	Area is created land with little vegetative cover, rock armor banks, riparian corridor infringement, former wetland area	Restore tidal wetland and create vegetative buffer zone, increase habitat by (partial) removal of fill, and reconfiguration of banks, implement proposed greenway from Lafayette Street to NYCDEP sewage treatment plant and adjacent area
Bronx - Site 10 - Soundview Park - east bank	Area is created land with little vegetative cover, rock armor banks, former wetland area	Restore wetland and increase habitat by (partial) removal of fill and reconfiguration of banks; intercept and treat stormwater
Bronx - Site 11 - Soundview - embayment	Sedimentation, poor flushing, rock armor jetty and banks, wetland degradation	Reduce sedimentation by restoring tidal wetlands for stormwater retention, increase flushing by (partial) removal of rock armor jetty, reconfigure banks to increase habitat
Westchester - Site 1 - Pond at Fisher Lane	Flow impediment (weir/dam), heavy sedimentation and channel degradation, loss of habitat and bio-diversity	Increase stream flow, restore floodplain wetlands, reintroduce native wetland and riparian forest species
Westchester - Site 2 - County Center area north	Flow impediment (weir/dam), heavy sedimentation and channel degradation, stream bank instability, loss of habitat and bio-diversity	Increase stream flow, restore floodplain wetlands, reintroduce native wetland and riparian forest species, improve fish passage
Westchester - Site 3 - Green Acres Pond	Flow impediment (weir/dam), heavy sedimentation and channel degradation, loss of habitat and bio-diversity	Increase stream flow, restore floodplain wetlands, reintroduce native wetland and riparian forest species
Westchester - Site 4 - Pond North of Harney Road	Flow impediment (weir/dam), heavy sedimentation and channel degradation, loss of habitat and bio-diversity	Increase stream flow, restore floodplain wetlands, reintroduce native wetland and riparian forest species
Westchester - Site 5 - Crestwood Lake	Flow impediment (weir/dam), heavy sedimentation and channel degradation, loss of habitat and bio-diversity	Increase stream flow, restore floodplain wetlands, reintroduce native wetland and riparian forest species
Westchester - Site 6 - Old Yonkers Mill	Flow impediment (weir/dam), heavy sedimentation and channel degradation, loss of habitat and bio-diversity	Restore floodplain wetlands north of Old Yonkers Mill, remove or drop structure for canoe and fish passage
Westchester - Site 7 - Bronxville Lake	Flow impediment (weir/dam), heavy sedimentation and channel degradation, loss of habitat and bio-diversity	Increase stream flow, restore floodplain wetlands, reintroduce native wetland and riparian forest species
Sources: (1) "Expedited Reconnaissance Study, Bronx River Basin, Westchester and Bronx Counties, New York, Flood Control & Environmental Restoration Study, Section 905(b) (WRDA 86) Preliminary Analysis," U.S. Army Corps of Engineers, New York District, August 1999. (2) "Draft Project Study Plan, Bronx River Basin, New York, Regional Flood Control and Ecosystem Restoration Study," U.S. Army Corps of Engineers, New York District, April 2000.		

5.8. LOCALLY SPONSORED WATERBODY IMPROVEMENT PROJECTS

5.8.1. Yonkers Consent Order

On October 26, 2004, the State of New York brought action against the City of Yonkers for a permanent injunction compelling Yonkers to abate its discharges of untreated sewage into the Bronx River. Yonkers lies immediately north of the Bronx and is bounded by the Bronx River on the east and Hudson River on the west. The State claimed that Yonkers caused or allowed the discharge of untreated sewage into the Bronx River from multiple storm sewer outlets resulting in concentrations of coliforms in the River beyond the allowable limits of public health, safety, recreational use, and the propagation and maintenance of the Bronx River's fish population.

The Consent Order states that Yonkers is permanently enjoined from discharging untreated sewage or any pollutant other than storm water into the Bronx River from its storm sewers and storm sewer outfalls. Yonkers must also implement a Remedial Program to abate its discharges of untreated sewage. Investigations by the State and sampling performed in the River showed that 17 outfalls were discharging effluent with fecal coliform concentrations exceeding 200/100 mL during dry weather. The Remedial Program requires that the City of Yonkers perform the following actions:

- Investigate and remediate discharges of sewage from Yonkers storm sewer outfalls
- Investigate within the drainage areas of polluting storm sewer outfalls to identify all cross-connections, private connections, and other possible sources of sewage discharges to the Bronx River.
- Eliminate cross-connections, private connections, and other sources of sewage discharges.
- Submit a quarterly Remedial Program progress report.

According to the Consent Order, the City of Yonkers was to complete all of the work indicated above no later than 450 days from the date of the Order (10/26/2004). As such, the cross-connections should have been eliminated by January 2006. As of the issuance of this report, investigations in Yonkers were still ongoing.

5.8.2. White Plains, Mount Vernon, Greenburgh, and Scarsdale Assurance of Discontinuance

On November 28, 2006, the New York State Attorney General and the NYSDEC Commissioner announced Assurance of Discontinuances (AUD) or agreements with four Westchester County municipalities to discontinue discharging raw sewage into the Bronx River from their storm sewers. The cities of Mount Vernon and White Plains, along with the Town of Greenburgh and the Village of Scarsdale agreed to eliminate discharges from their storm sewers by May 1, 2007. In order to prevent future discharges, the municipalities also agreed to monitor their storm sewers. Combined, the municipalities will spend in excess of $150,000 to upgrade their stormwater systems and also pay civil fines. In addition to the elimination of their sewage discharges, the municipalities will also invest in stormwater pollution reduction projects. As of the issuance of this report, all municipalities have paid the initial civil fines as obligated by the

AUDs. However, each municipality is currently in a varying degree of non-compliance with respect to the obligated monitoring surveys and reporting of results to the New York State Attorney General.

5.8.3. Bronx Zoo Consent Order

In March 2001, New York State and the Wildlife Conservation Society (WCS), operators of the Bronx Zoo, came to an agreement on reducing water pollution in the Bronx River and to fund construction of a new recreational area in the Bronx. Approximately 20 years before the agreement between the State and WCS, as much as 200,000 gallons of untreated animal waste from the zoo had been discharged into the Bronx River each day. A Bronx River Cleanup Program will be conducted during spring and fall months over a period of 10 to 15 years following the agreement, and the zoo will hire local residents to remove garbage and debris from the Bronx River. The cleanup program will be coordinated with existing community groups. The Bronx Zoo is also constructing a new "Bronx River Walk," which will provide public pedestrian access to the Bronx River along with exhibits and information the Bronx River's ecology, protection, and restoration.

The WCS selected Biohabitats (http://www.biohabitats.com) to develop a woodland management plan and design water quality BMPs for the Bronx Zoo. Through the development of a new master plan, it became apparent that the zoo's 280 acres of wooded land in the center of the Bronx, adjacent to the Botanical Garden, is an extremely valuable asset worthy of long-term care.

In addition to the cleanup program, river walk, and woodland management plan WCS has also prepared and submitted a computerized Mapping Project concerning stormwater discharges and dry weather discharges that may come into contact with Bronx Zoo animal waste. The Mapping Project will assist WCS in developing the Animal Waste Pollution Prevention Plan. The goal of the Draft Animal Waste Pollution Prevention Plan is to identify measures to be implemented to identify, manage, and reduce Bronx Zoo Animal waste in stormwater and dry weather discharges. WCS also implemented a Sampling Program and will test its finish compost product for pathogens.

5.8.4. Bronx River Greenway

An initiative is in place that focuses on creating a continuous greenway along the Bronx River. The initiative includes greenway construction projects as well as land or easement acquisitions. Plans to acquire public rights-of-way exist only south of 180th Street, where significant sections of land are privately owned and inaccessible to the public. Greenway construction projects often overlap with park construction projects, especially north of 180th Street where land along the river is parkland. Park construction projects vary in scale and are generally conducted by New York City Department of Parks and Recreation (NYCDPR) staff.

The Bronx River Greenway is a multi-use bike and pedestrian path in progress that will provide continuous public access to the river and an 8-mile long park through the heart of the Bronx. The Greenway is located within multiple jurisdictions – within NYC parklands, on New York State lands administered by the NYS Department of Transportation, within the NY

Botanical Garden and the Bronx Zoo (WCS), and on City streets and rights-of-ways.

The NYCDPR retained Mathews Nielsen Landscape Architects, P.C. (MNLA) to develop three reports for the Greenway, with elements of each to be incorporated in an overall strategic plan developed by the Bronx River Alliance and its consultant, the Pratt Center for Community and Environmental Development. The Alliance worked jointly with MNLA in the development of these reports that include:

- Guidelines for Design Elements
- Best Management Practices
- Guidelines for Art

5.8.5. Bronx River Alliance Watershed Planning

The Center for Watershed Protection (CWP) (http://www.cwp.org) performed a baseline watershed assessment consisting of:

- A database screening to find potential water quality hotspots;
- Comparative sub-watershed analysis to assess the relative contribution of pollutants from different sub-watersheds;
- Summary of existing watershed data; and
- Watershed-wide recommendations and management strategies.

Other tasks included the identification of stream impairments, protection, and restoration opportunities. Additionally pollution prevention and retrofit opportunities within the stream corridor and upland portions of selected sub-watershed areas were identified. CWP also developed a Watershed Assessment and Management Report that includes the ranking of restoration projects, sub-watershed treatment analysis, identification of priority actions, planning budgets and schedules, and identification of potential financial and technical partners for restoration implementation.

The Bronx River Alliance is currently working on a draft plan for the lower Bronx River and planning to contract the CWP to assist in the development of a watershed assessment and management plan for that portion of the river. The lower Bronx River plan developed by the Bronx River Alliance will complement the plan being developed for Westchester County through the Bronx River Watershed Coalition.

5.8.6. Bronx River Drainage Area Improvement Projects

A water filtration plant for the Croton Water Supply System will be constructed under the Mosholu Golf Course in Van Cortlandt Park. Since previously available park space will be disrupted during construction, the NYCDEP has made an agreement with the NYCDPR to spend more than $220 million of NYCDEP funds generated from water and sewer revenue on improvements to more than 70 Bronx Parks. The agreement presents an opportunity to invest more than triple the amount that would normally be spent on Bronx parks over the next 5 years. Years of input from the community coupled with the assistance of community groups, elected officials, and Bronx residents helped to identify the Bronx Parks Projects. Additionally, the

NYCDPR focused on projects that would be challenging to fund through the capital budget. The projects fall into five categories including:

- Neighborhood Parks
- Regional Recreation Facilities
- Greening the borough
- Develop waterfront parks
- Expanding the Bronx greenway

Under the agreement, over 20 neighborhood parks and playgrounds will be renovated with new play equipment, comfort stations, seating areas, fencing, and landscaping. Regional recreation facilities, including ballfields, running tracks and tennis courts will be reconstructed or built throughout the borough. In addition, new waterfront parks will be developed along the Long Island Sound and East and Harlem Rivers.

The project will also complete major sections of the Bronx Greenway, including the Hutchinson River, Bronx River, and Soundview to Ferry Point sections. Work on the Greenway will include the restoration of existing parkland, with improvements to pathways and public access, as well as the transformation of underutilized property into new parkland. Shoelace Park and Muskrat Cove will be connected via a new pedestrian bridge over the Bronx River providing a major link in the Bronx River Greenway.

In addition to the various park improvements, a comprehensive program to "green" the Bronx will include the creation of Greenstreets, improvement and expansion of horticultural plantings, and the addition of street trees in under-served neighborhoods. The State Energy Research and Development Authority will also establish a comprehensive Urban Forestry Program for further greening of the Bronx. Table 5-8 discusses the projects that will be completed within the Bronx River drainage area.

Table 5-8. Bronx Parks Improvement Projects within the Bronx River Drainage Area

Project	Projected Cost	Description
Bronx River Greenway Facility/River House	$5,000,000	Creation of space for the administration and operational facilities required for Bronx River initiatives involving greenway implementation, ecological restoration, recreational, educational and arts programming.
Crotona Park Comfort Station and Operations Facility	$2,500,000	Construction of a comfort station with a maintenance and operations component in the northern portion of the park.
Bronx Park Solomine Ballfield *Completed*	$3,000,000	Renovation of two baseball fields, elimination of tennis courts and replacement with synthetic turf soccer field, and restoration of basketball court and landscaping.
Bronx Park219th Street Entrance *In Construction*	$400,000	Reconstruction of Bronx Park entrance at 219th Street.
Soundview Park *Completed*	$4,000,000	Development of park areas to provide active and passive recreation.
Crotona Park Amphitheater *In Construction*	$2,500,000	Construction of a natural amphitheater.
Crotona Park Lake Restoration	$4,900,000	Naturalization and slope stabilization of the lake shore, including picnic area.

Project	Projected Cost	Description
Bronx Park Soccer Field and Skate Park *Completed*	$1,500,000	Installation of synthetic turf soccer field north of Allerton Avenue and installation of new, unsupervised skate park.
Bronx River Greenway River Park *Completed*	$1,000,000	Reconstruction of playground, comfort station, and picnic area located adjacent to the greenway.
Bronx River Greenway Birchall to 180th Street Connection	$3,500,000	Study and implementation of a one mile Bronx River Greenway link within Bronx Park. Greenway will connect Birchall Avenue to 180th Street.
Bronx River Greenway Concrete Plant Park *Completed*	$10,000,000	Complete development of a new park and greenway link along the Bronx River. The site was formerly a concrete batch plant.
Soundview Park *In Construction*	$2,466,200	Lagoon area restoration.
Bronx Green House and Nursery	$3,000,000	The upgrade and expansion of the existing nursery. Work to include construction and renovation of cold frames, greenhouses, loading docks, irrigation lines, sewer lines, and access way.
Greening the Bronx	$10,000,000	Creation of Greenstreets, improvement and expansion of horticultural plantings in parks and playgrounds, and the addition of street trees in underserved neighborhoods.

5.9. 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 7.2.3). 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 NYC, it is easiest to incorporate green solutions into redevelopment and new construction.

Green solutions, including various BMPs and feasible implementation strategies, are currently being evaluated through the NYCDEP Bureau of Environmental Planning and Analysis 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 has a contractor on board to design and construct BMP pilot projects, evaluate citywide and watershed specific BMP effects, and develop a New York City specific urban BMP guidelines (see Section 5.9.2). The following subsections detail these and other stormwater management initiatives the City has recently undertaken. Although many initiatives are citywide in nature, several initiatives explicitly identify Bronx River for targeted pilot programs, and the remaining ones have broad implications within the Bronx River watershed as the City continues to refine its policies and practices pertaining to stormwater management.

5.9.1. BMP Pilots, Guidelines and Watershed Planning

As directed by Local Law 71 of 2005, NYCDEP developed a Jamaica Bay Watershed Protection Plan (JBWPP) with a myriad of ecological restoration and water quality improvement strategies with the general objective to restore and maintain the water quality and ecological integrity of the Bay through a comprehensive watershed approach. The Final JBWPP was submitted to the City Council on October 1, 2007 and the first update was submitted in October 2008. Following the development of the JBWPP, NYCDEP developed a contract to implement BMP strategies throughout the City. NYCDEP selected a contractor for an NYCDEP BMP contract, which began in mid-2009. A significant portion of the contract includes multiple stormwater BMP pilot projects that will be used to evaluate the efficacy of each BMP, maintenance needs, schedules, and uncertainties associated with 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 guidelines and watershed planning analyses. The specific pilots in the contract included:

- Stormwater BMP retrofits for open space;
- A high density residential complex retrofit 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;
- A location 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;
- Publicly owned rooftops will be retrofitted with blue roofs to evaluate retrofitting existing structures;
- The distribution of 1,000 55-gallon capacity rain barrels in 2008 and 2009 to gauge public acceptance of and interest in this technology, with focused distribution in the Jamaica Bay watershed.

The BMP Guidelines, 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 Guidelines 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.

Another noteworthy component of the contract is the evaluation of citywide BMP impacts as well as development of watershed plans 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.

5.9.2. 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 and with a sunset date of March 15, 2013.

5.9.3. 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 are 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.

5.9.4. NYCDEP 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 and a 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 a CSO EBP Work Plan in March 2008 (approved by the NYSDEC in April 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 bio-infiltration swales, enlarged street tree pits with underground water storage, constructed wetlands, and others would be evaluated. The CSO EBP Work Plan proposes pilots in the Bronx River, Flushing Bay and Creek, and Gowanus Canal watersheds using the $4 M which has been placed in an EBP Fund.

Using $2.9M from the EBP Fund, NYCDEP intends to establish a Request for Grant (RFG) program using $2.9 M from the EBP Fund that will enable local stakeholder groups to submit proposals for effective stormwater management projects that meet the objectives of capturing and treating stormwater (e.g., reduction of stormwater entering sewer system) within the Gowanus Canal and Flushing Bay and Creek watersheds covered by the CSO EBP Work Plan. The RFG process will be structured to allow for a variety of proposals for both small and larger groups. To help expedite these projects, it is anticipated that NYCDEP will follow the procedures similar to that of the Nitrogen Consent Order EBP program, and that Memorandums of Understanding (MOUs) will be developed between NYCDEP and the individual grant applicants.

The NYCDEP requested that the Bronx River portion of the CSO EBP Work Plan be placed on a separate track from the Gowanus and Flushing projects. A total of $850,000 will be used from the EBP Fund to construct various green infrastructure technologies at a specific two-block location within the Bronx River watershed. Funds for modeling associated with this work were obtained in September 2008 under a Long Island Sound Dissolved Oxygen Grant by Dr. Franco Montalto. The Bronx River watershed field survey analyses are underway, and detailed information resulting from the analyses will be submitted to NYSDEC for review and comment prior to submitting a Stormwater BMP Location Plan which will identify the technologies to be built. Construction should begin in 2010 with a three-year monitoring period to follow.

Under the CSO EBP Plan, the actual BMP methodologies and quantities will be determined once grant funds are made available. When completed, the proposed *Stormwater BMP Location Plan* resulting from the analyses will be submitted to NYSDEC for review and comment. In addition to the input based on the results of the field surveys currently underway, the plan will also have had input from local community representatives. Designs must be submitted to NYCDEP at least 120 days ahead of starting any work. The three-year minimum monitoring duration will extend the schedule out to 2013 before final results can be expected.

5.9.5. 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 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 in 2010.

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6.0 Public Participation and Agency Interaction

One of the nine elements of a long-term control plan is a public participation and agency interaction process that actively involves the affected public and regulators in decision-making to select long-term CSO controls. USEPA CSO guidance states that establishing early communications with both the public and regulatory agencies is an important first step in the long-term planning approach and crucial to the success of a CSO control program (USEPA, 1995a). The NYCDEP is committed to involving the public and regulators early in the planning process by describing the scope and goals of its facility planning projects and continuing public involvement during its development, evaluation, and selection of plan elements.

The CSO Control Policy emphasizes that state water quality standards authorities, permitting authorities, USEPA regional offices and permittees should meet early and frequently throughout the long-term planning process. It also describes several issues involving regulatory agencies that could affect the development of the long-term control plan, including the review and appropriate revision of water quality standards and agreement on the data, analyses, monitoring, and the modeling necessary to support the development of the long-term control plan. A Harbor-Wide Government Steering Committee was therefore convened by the NYCDEP consisting of city, state, interstate, and federal stakeholders representing regulatory, planning, and public concerns in the New York Harbor watershed.

The NYCDEP has also formed local and city-wide citizen advisory committees, and involved other municipal officials, local community government representatives, permitting agencies, and the general public in its planning process. Public meetings were conducted to present technical information and obtain input from interested individuals and organizations. Potential CSO alternatives, associated costs (to the NYCDEP and to the public via water usage rates) and associated benefits were discussed before completing engineering evaluations. Comments were sought regarding the selection of a recommended plan. This process has been executed by the NYCDEP during the Bronx CSO Facility Planning Project. The NYCDEP regularly met with its Citizens Advisory Committee on Water Quality to discuss the goals, progress and findings of its ongoing planning projects such as the waterbody/watershed assessment of the Bronx River. A local stakeholder team was specifically convened by the NYCDEP to participate in the waterbody/watershed assessment of the Bronx River.

The following section describes the formation and activities of the NYCDEP's Harbor-Wide Government Steering Committee, its Citizens Advisory Committee on Water Quality, and its Bronx River Waterbody/Watershed Stakeholder Team that represented the NYCDEP's public participation and agency interaction components of its waterbody/watershed assessment of the Bronx River.

6.1. HARBOR-WIDE STEERING COMMITTEE

The 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. A Steering Committee was 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, and 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 was 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 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 was represented by the Regional Engineer for the Region II Water Division.

Several departments of the City of New York were represented on the Harbor-Wide Government Steering Committee. The Deputy Commissioner of the Bureau of Engineering Design and Construction and its Director of Planning and Capital Budget represented 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 directed 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 were represented by the Executive Director and Chief Engineer of the 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 was responsible for reviewing the methodology and findings of NYCDEP water quality-related projects, and to offer recommendations for improvement. The Steering Committee reviewed and approved the waterbody work plan developed by the USA Project (HydroQual, 2001a), and was fully briefed on the on-going assessments and analyses for each waterbody. Among the recommendations provided by the Steering Committee was 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, to pursue ecosystem water quality restoration actions with USACE, and to coordinate use attainment evaluations with the NYSDEC. Representatives of the NYSDEC reported that its agency was awaiting the results of the NYCDEP waterbody/watershed assessment before completing the 303(d) evaluations.

6.2. WATER QUALITY CITIZENS ADVISORY COMMITTEE

NYCDEP's Citizens Advisory Committee on Water Quality (CAC) was formed in 1996 and was active through 2004. The CAC reviewed and commented on NYCDEP's water quality improvement program, was represented on the Harbor-Wide Government Steering Committee and separately monitored and commented on NYCDEP's progress. The CAC represented the interests of New York City agencies, borough offices, real estate interests, and non-governmental environmental advocacy groups. NYCDEP supported and regularly informed the CAC on all of its ongoing planning projects and programs related to water quality in New York Harbor waterbodies. In turn, the CAC commented on NYCDEP's activities and facilitated dissemination of information back to the organizations and constituencies it represents.

Recognizing the magnitude and complexity of planning, implementation and regulatory issues being addressed by NYCDEP in its water quality facility planning projects, the CAC was a proponent of conducting waterbody/watershed assessments of CSO waterbodies. Prior to and after initiation of NYCDEP's USA Project, the CAC was regularly informed of the goals and strategy of NYCDEP's waterbody/watershed assessment methodology. The CAC was regularly briefed on the approach, schedule and findings of the waterbody/watershed assessment of the Bronx River.

The city-wide CAC is being re-stated under the LTCP. The mission of this reorganized CAC will be to represent stakeholder group for the larger open waters of New York Harbor.

6.3. WATERBODY/WATERSHED STAKEHOLDER TEAM

Public participation is a component of each step in the long-term control planning process described in USEPA guidance. It is a recommended element of system characterization, development and evaluation of alternatives for CSO controls, and selection and implementation of a long-term plan. NYCDEP convened a local waterbody/watershed stakeholder team for the assessment of Bronx River that represented local residents, businesses, non-governmental organizations, community government, and riparian and waterbody users. The stakeholder team was specifically included in identifying existing conditions and goals for aquatic life, recreation and aesthetic uses. The following describes NYCDEP's efforts in convening the stakeholder team, its public representation, and its participation in the waterbody/watershed assessment of Bronx River.

6.3.1. Convening the Local Waterbody/Watershed Stakeholder

A local waterbody/watershed stakeholder team was convened specifically for Bronx River by NYCDEP. In order to create a representative and inclusive Stakeholder Team, NYCDEP reached out to the local Community Boards and to other organizations interested in the river. The resulting Stakeholder Team consisted of local government representatives, organizations, residents, and waterbody users. The stakeholder team was recruited through outreach meetings at the local community boards and other neighborhood organizations. The Stakeholder Team met periodically throughout 2001 during the waterbody/watershed assessment and once during 2004 to present the proposed revised plan and introduce the Long Term Control Plan project. At least one additional meeting is planned for this group to involve them in long term control planning activities.

The initial outreach for identifying Stakeholder Team members was through the Bronx Community Boards. New York City's community boards provide the first point of contact for public notification and participation for plans and activities of city agencies, including NYCDEP. The community boards play an advisory role in zoning and other land use issues, in the community planning and budgeting process, as well as in the coordination of municipal services. New York City is divided into 59 Community Districts and each district has an appointed Board of up to 50 unsalaried community members. A presentation of the Bronx River waterbody/watershed project and assessment goals was made to each of the Community Boards in the Bronx River watershed. Meetings were held on the following dates:

Community Board No. 3:	September 27, 2000
Community Board No. 12:	September 28, 2000
Community Board No. 9:	October 16, 2000
Community Board No. 7:	October 17, 2000
Community Board No. 11:	October 26, 2000
Community Board No. 6:	November 1, 2000
Community Board No. 2:	November 8, 2000

During each of these outreach meetings, presentations included an overview of the scope, goals and organization of the project, a brief description of the geography and water quality issues of the Bronx River, and an explanation of the nature of the participation requested of potential Stakeholder Team members The team consisted of representatives from government agencies, regulatory agencies, citizens groups and interest groups concerned about watershed and water quality issues in the Bronx. The organizations that were represented by each type of group are listed in Table 6-1.

Table 6-1. Bronx River Waterbody/Watershed Stakeholder Team Participants

Groups	Organizations
Citizen Groups	Youth Ministries for Peace & Justice The Point CDC Woodlawn Taxpayers The Bronx Council for Environmental Quality
Federal Government	Congressional District Representative U.S. Army Corps of Engineers
Interest Groups	Waterways & Trailways Museum of Natural History Mosholu Preservation Bronx River Parkway Reservation Conservancy Gaia Institute Bronx Riverkeepers New York Academy of Science New York Botanical Garden
Local/Multi-jurisdictional Government Agencies	Bronx Community Boards Nos. 2, 7, 9,11, 12 Soil and Water Conservation Attorney General EPB NYC Parks –Natural Resources Group North Bronx Bissel Gardens

6.3.2. Summary of Previous Stakeholder Team Meetings - Bronx River CSO Facility Plan

The Stakeholder Team met in the evening at local meeting sites within the watershed. Broad summaries, including the meeting date, are included in this section.

The first Bronx River Waterbody/Watershed Stakeholder Team meeting was held on January 17, 2001. After a general introduction, members of the Stakeholder Team were each prompted to express their areas of interest, concern and involvement with the Bronx River. Taken together, this yielded an initial statement of aspirations of the river in terms of recreational use, aquatic habitat, and land use. A waterbody fact sheet and summary of water quality issues was distributed and discussed. The waterbody/watershed assessment methodology and schedule was explained, and the Stakeholder Team was engaged in an initial discussion of land use and riparian issues. Concerns expressed by the stakeholders were as follows:

- The green areas of New York City are the smallest per capita of all major cities
- Protecting the food supply
- Educating people within the community to increase their interest in the river
- The floatables debris and trash along the river
- Shallow areas of the river should be deepened
- Improved water quality
- Pathways along the river
- A closer relationship with Westchester County to improve river water quality
- Make the river swimmable
- Bring illegal polluters into compliance
- Revegetation of the Hunts Point Peninsula

- Can fish taken from the Bronx River be eaten?
- Illegal dumping
- Restoration projects
- Monitoring approaches for current conditions
- Recreational uses on and along the river
- Quality of life issues
- Making people aware of the river and its uses
- Watershed approach to managing the water and exploring opportunities for its improvement

The second Stakeholder Team meeting was held on February 21, 2001. A review of land use and initial water quality field data were presented along with the proposed sampling plan. Water quality standards were introduced along with a brief description of those entities that could impact the standards. Draft land use and water use characterizations were presented, reviewed by the Stakeholder Team, and amended with their comments.

The third Stakeholder Team meeting was convened on April 25, 2001. During this meeting the stakeholders were updated on the status of the water quality and biological sampling and field studies. Field investigation of the river's shoreline characterization and wetlands investigations were also reviewed. The stakeholders, for the first time, were introduced to the proposed facilities plan for CSOs in the region, detailing some of the possible alternative for CSO abatement.

Stakeholder concerns, comments and actions during the second meeting included:

- Concerns about odors from the CSO; stakeholders were given contact information for further investigation
- Aesthetically displeasing exposed pipes at some locations along the river
- Interesting in incorporating "bioengineering" practices into some portion of the Bronx River riparian area
- Concerns regarding possible gaps in the sampling data presented
- Concerns regarding marine DO criteria and whether or not they were being achieved
- Sediments in the freshwater portion of the river needed to be addressed
- Concerned about the lack of flow from the Kensico Dam

The forth Stakeholder Team meeting was held on June 13, 2001. Goals for this meeting included diagnosing problems in and along the Bronx River, generating possible solutions and determining how those solutions might be applied to the river. The meeting began with a discussion of the Bronx Zoo and its three-part agreement with the State Attorney General's office to reduce its alleged impact on the Bronx River. One of the three parts included instituting BMPs at the Zoo; several of the stakeholders expressed an interest in being involved with the development of these BMPs and were given contact information to arrange for such participation. Waterbody and watershed issues from previous meetings were reviewed and several concerns and comments were added. Following this discussion these identified concerns were prioritized by the Stakeholder Team; the complete list is shown at the end of this sub-section. High priority items are marked with an asterisk.

Following the discussion of identified concerns, a discussion of waterbody uses was undertaken. The stakeholders identified the following additional concerns:

- Secondary Contact Recreation (boating) is impaired by lack of access and shallow water
- Primary Contact Recreation (swimming) while, not explicitly encouraged in the Bronx River, has been observed at:
  - Shoelace Park
  - Starlight Park
  - Adjacent to Concrete Plant Park
  - Downstream of the 180th Street Dam

<u>*Bronx River Stakeholder Team: Identified Issues (asterisk = high priority item)*</u>

Bronx River Freshwater Issues

- Control of floatables
- Sediment/Maintenance of river channel
- Non-compliance with coliform standard*
- Problems with upstream water quality*
- Enforcement action needed for polluters
- Potential to improve the ecological function through channel improvement
- Question of flow from Kensico Dam
- Jurisdictional coordination (NYC, Westchester, interdepartmental, etc)
- Temperature – implications for fish and plant survival

Bronx River Saline Water Issues

- Control of floatables
- CSO discharges*
- Non-compliance with coliform standard*
- DO Level*
- Enforcement action needed for polluters
- Question of safety as related to fish consumption
- Exposed outfall pipes at low tide
- Illegal drain discharges (e.g. dry-cleaning smell)
- Sedimentation/potential to improve the ecology through channel improvement
- "Boundary Conditions" with the East River

Bronx River Corridor Issues

- Increase green corridors
- Increase public awareness of watershed/waterbody issues*
- Improve public access to path system
- Improve boating access in saline sections
- Questions as to the appropriateness of land use in saline section
- Increase permeable area to reduce stormwater runoff
- Management and coordination mechanism needed for the entire watershed

Uses

- Public access (sedimentation, land use, water quality)
- Aesthetic impairments (floatables)
- Wildlife protection (toxics)
- Fish survival (DO, toxics)

- Fish propagation (DO, toxics)
- Secondary contact recreation (coliforms, sedimentation)
- Primary contact recreation (coliforms)
- Habitat and hydrological modification concerns

The fifth Stakeholder Team meeting was held on November 17, 2004. The intent of this meeting was to discuss the actions that had been taken as result of the previous four stakeholder meetings and to present the preliminary findings and recommendations of the 2004 Bronx River WB/WS Facility Plan report, which included preliminary collection system and water quality models. Comments were taken from stakeholders on these results for further consideration. The greatest interest was in the water quality model related to DO; it was found that the freshwater section of the Bronx River was in compliance with DO standards but that the saline sections were not. It was also found that the proposed 4MG storage tunnel did not alleviate this problem and that further investigation into the East River condition was needed to address this issue. Stakeholders felt that maintaining a fish population adequate to support recreational fishing was important.

Use attainment was then reviewed. It was determined in the preliminary model that there were no areas in the Bronx River that met the standards for primary contact recreation, however almost all of the river met the secondary contact criteria. Stakeholders were concerned about the lack of criteria attainment for primary contact. It was noted that there are people who use the river in this manner and that NYCDEP should not “abandon” the idea of meeting primary contact standards. Stakeholders also expressed increased interest in BMPs for stormwater control as a means of meeting these standards.

A presentation was made on the floatables control program followed by stakeholder comments. These comments expressed a concern for the unsightliness not only of floatables, but also of the method (boom) proposed to control them. There was also a concern raised that the boom would hinder the passing of canoes and other small water craft. These concerns have been considered and addressed in this WB/WS Facility Plan.

6.3.3. Summary of Current Stakeholder Team Meetings – WB/WS Facility Plan

The first Stakeholder Team meeting was held on July 20, 2006 in the community room at the Bronx Community Board 12. The meeting opened with team introductions and presentation of a general background of the CSO LTCP, describing the history of CSO policy and previous water quality planning, including the Use and Standards Attainment (USA) project. The distinction between the USA and CSO LTCP was noted, as the LTCP incorporates compulsory project specific milestones, and enforcement of the CSO LTCP will be supported by post-construction monitoring. The meeting continued with a description of the Bronx River waterbody/watershed, including the location of different CSO points and public access points. At two locations, it was noted that river access points coincide with CSO locations. Water quality sampling cooperation between NYCDEP and Westchester County was introduced and the last four months of data was reviewed. Landside modeling and a list of possible alternatives for CSO impact abatement were presented. The stakeholder team presented their requests, including funding for their own consultant to review the plan, an online copy of the USA project, and collaboration with the NYCDP&R and the Housing Authority to find sites for water control measures (LIDs). The meeting closed with an invitation to participate in the Open Waters CAC.

The second Stakeholder Team meeting was convened on October 12, 2006 in the community room at the Bronx Community Board 12. The meeting opened with the review of major issues discussed during an offline meeting with the chairpersons designated by the Stakeholder Team. These topics included groundwater effects on water quality modeling and the team's request for funding of an independent consultant. It was noted that an independent review of the plan would be taking place (already funded by NYCDEP) under the umbrella of the NYSDEC. The NYSDEC has engaged Ecology and Environmental Inc, a Buffalo-based firm, to assist in their review. The topic of LIDs was discussed in relation to the review of the fourteen WPCP SPDES BMPs. This review led to a discussion of NYCDEP's position on LIDs and the barriers preventing the inclusion of LIDs in the LTCP. Modeling and alternatives were again reviewed in more depth. A discussion of waterbody uses and goals was held, covering the issues addressed in the Bronx River Alliance's Ecological Restoration and Management Plan, such as need for access and boat launches. Also, the issue was raised as to whether the unsanctioned, existing use requires a change in water quality classification. Stakeholders added that their goals include a preference for solutions that offer multiple benefits, including recreational value and habitat improvement. The meeting closed with a number of additional requests. These included:

- A memo addressing the issue of storm water capture
- Distribution of presentation materials in advance of the meeting
- Posting of sign-in sheets, without addresses
- A change in venue for the next meeting
- A contact with the Office of Sustainability
- The implementation of a groundwater monitoring gauge. A stakeholder said that this data would establish a baseline from which to monitor the effectiveness of different LID alternatives.

The third Stakeholder Team meeting was held on February 8, 2007 at the Police Athletic League, 991 Longwood Ave. The meeting opened with the announcement of a project data-sharing web site to allow stakeholders to examine all the presentations, plans, and meeting notes for other project areas. Also reviewed were the activities of other stakeholder teams including the four teams that have completed their tasks of advising NYCDEP on their draft WB/WS Facility Plans. It was explained that two public meetings were required between the June 2007 submittal date for all WB/WS Facility Plans and the ratification of WB/WS Facility Plans as LTCPs, scheduled for 2009 for the Bronx River. The stakeholder team stated that it would like to see additional public participation, as two meetings were thought to be insufficient. A presentation explaining the differences between WB/WS Facility Plans and CSO LTCP was given. WB/WS Facility Plans were described to be immediate, interim measures to address compliance with existing standards. The LTCP is an ongoing living document that addresses the gap between the WB/WS plan and the attainment of targeted water quality through post-construction monitoring and reviews under SPDES permitting. It was stated that Class SB is a reasonable standard for the tidal portions of the Bronx River for the LTCP. Water quality modeling, viable alternatives, and water quality sampling was presented and discussed. Water quality sampling had raised the concern of water quality and pathogen concentrations in the waters upstream of the tidal portion. The LID pilot study in Jamaica Bay was discussed, including a review of the projects involved. The goal is to understand how LIDs function in New York City. It was stated that several soil types in the Jamaica Bay study area are similar to soil types in the Bronx River watershed. In those instances, data from the pilot study will be transferable. Stakeholders presented their concerns over inequitable treatment of LID alternatives and suggestions for studies, incentives, and implementation in the Bronx River watershed.

The fourth Stakeholder Team meeting was held on April 25, 2007 at the Police Athletic League, 991 Longwood Ave. It was announced that John McLaughlin (NYCDEP Bureau of Environmental Planning and Assessment) would not be in attendance due to unforeseen family circumstances and offered to meet with the stakeholders at a later date. The meeting opened with a presentation of an alternative CSO abatement plan developed by stakeholders. The stakeholder's alternative plan's aim is to abate CSO in the Bronx River drainage area by using a water budget approach and applying green infrastructure and low impact development (LID) to reach the water budget goals. The stakeholder presenting the alternative plan spoke about various problems related to large areas of impervious cover, reviewed various ways to the reduce the effects of imperviousness on stormwater quality and flow, and included a proposed streetscape project on Lafayette Avenue in the Bronx. Figures regarding proposed projects scope, costs, and proposed reductions were also presented. The presenting stakeholder stressed the need for green infrastructure practices not only in the LTCP, as other cities are doing, but also in policies for controlling stormwater runoff from new construction. To reach this end, the presenting stakeholder encouraged the adoption of the Bronx Council for Environmental Quality's Doctrine of Low Impact Development (LID).

Another stakeholder mentioned his disappointment that although the Mayor's PlaNYC 2030 has commendable overall goals, the time frame for their implementation is not progressive enough. This stakeholder sees the delay causing missed opportunities such as proposing a pilot program for five infiltration tree pits in Jamaica Bay when it could be beneficial to use these pit designs in the 16,000 street-tree plantings proposed by the Department of Parks and Recreation in the Bronx.

The meeting continued with a presentation of the proposed WB/WS Facility Plan for the Bronx River. The presentation reviewed alternatives for CSO abatement and evaluated the relevant alternatives using a knee of the curve analysis. The real time control alternative was discussed in relationship to public notification. A stakeholder noted that improved public notification is desired by the group; however, it was explained the real time control would not support public notification. Questions raised by stakeholders regarding attainment of water quality standards for primary contact by direct chlorination or potable water addition were also addressed. It was stated that this WB/WS Facility Plan is aiming to achieve the current standards of secondary contact. The selected WB/WS Facility Plan elements were reviewed, including floatable control measures, maintenance of the plant upgrade for Hunts Point WPCP, and modification of the Bronx River boom to facilitate passage by hand-powered boats. The modification was well received by the stakeholders and plans of the modification were requested.

Current water quality standards compliance in the Bronx River was reviewed, including the impacts of Westchester County loadings. Stakeholders requested a plot of the examined alternatives showing projected compliance with primary contact water quality standards. It was requested that the model analysis of the Bronx River compliance with primary standards evaluate two conditions, one with Westchester County's current water quality and one with Westchester County in compliance with applicable standards. It was stated that this analysis will be available in the WB/WS Facility Plan, when it is completed in June 2007. The stakeholder group stated that they would like to review the analysis of the attainment of primary contact standards sooner.

Returning to the discussion of additional public participation from earlier meetings, it was stated that the NYSDEC will hold two additional public meetings to review its suggested changes to the WB/WS Facility Plan and the proposed plan incorporating these changes. A larger meeting with the Mayor's Office of Sustainability and Long Term Planning and stakeholders from other waterbodies, was also being considered. The stakeholders also expressed interested in meeting with John McLaughlin during the upcoming meeting as well as continuing working with NYCDEP on further LID project development. Other public participation requests development of an oversight stakeholder group to ensure a coherent, citywide public participation process and improved educational material regarding the WB/WS Facility Plan.

Meeting notes for each of the four meetings, all approved by the Stakeholders, are included in Appendix B.

6.4. PUBLIC OPINION SURVEY

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 discretely and summarized to provide additional insight into the public's 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 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 all 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 at 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 interviewed 300 Bronx River watershed residents. The survey was analyzed to quantify the extent of existing uses of the river's waters or riparian areas, and to record interest in utilizing the waterbody and riparian areas. Elements of the survey focused on Bronx community awareness of the river, 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 Bronx River, overall perceptions of New York City waterbodies; and what improvements have been recognized or are desired.

6.4.1. Bronx River Awareness

Approximately 91 percent of the Bronx River area residents that participated in the survey were aware of the river but only 25 percent could identify the Bronx River as their primary waterbody without any prompting or aid in their response. The local awareness was considerably higher than the overall awareness of primary waterbodies for all New York City residents who participated in the survey. Most often, area residents identified the Bronx River or the Hudson River as the waterway closest to their home.

6.4.2. Bronx River Water and Riparian Uses

Approximately 15 percent of the Bronx River area residents that participated in the survey visit waterbodies in their community or elsewhere in New York City on a regular basis and 35 percent occasionally visit waterbodies. The remaining percentage of residents rarely visits or never visits waterbodies. In general, the Bronx River area residents visit the river less frequently than other New York City residents. Only 16 percent of area residents have visited the Bronx River at some point, and 21 percent have done so in the prior 12 months. Those who had visited the river within the prior 12 months responded that they visit the river an average of 10 times per year, but the median number of visits was only 2 visits per year. Amongst those area residents who are aware of the Bronx River but had never visited the river, 56 percent responded that there was no particular reason for not visiting the river, 21 percent responded that they do not visit the river because of waterbody conditions and 16 percent responded that it was because of riparian conditions. Trash in the water was the most common waterbody condition cited that discouraged people from visiting the Bronx River.

The number of residents that have participated in waterbody-related activities at the Bronx River represents 16 percent of those who have ever visited the river and only 5 percent of the total area residents surveyed. The most common response indicated that water activities such as boating, canoeing, kayaking or sailing on the Bronx River are the preferred activity amongst those who have ever visited the river. The second most common response was fishing. The least popular activity at the river is in-water activities such as jet skiing, surfing, swimming, and wading, and only 2 percent of respondents that have ever visited the river reported having partaken in these kinds of activities. Amongst the respondents who have never participated in water activities while visiting the Bronx River, 20 percent responded that there was no particular reason for not engaging in water activities, 11 percent stated that there were no water activities to engage in, 7 percent responded that pollution was the reason for not participating in water activities and 9 percent responded that garbage in or on the water and the dirty appearance of the water was their main reasons for not participating.

Riparian-based activities appear to be more popular than in-water activities for the Bronx River 53 percent of area residents who have visited the Bronx River and 17 percent of all residents surveyed responded that they had participated in activities in riparian areas along the Bronx River. The compilation of the Bronx River area responses suggest that picnicking is the favorite land-based activity occurring at or nearby the river. The second most likely activity was reported as walking or strolling along riparian areas.

6.4.3. Improvements to the Bronx River

Forty percent of area residents responded that they have noticed improvements in New York City waterways in the past five years, although only 5 percent noticed improvements in the Bronx River specifically. This response is generally consistent with other New York City residents interviewed during the telephone survey. Water quality, appearance, and color were the most frequently mentioned improvements by respondents. Although other improvements cited were cleaner and better waterways and improved availability of park benches.

Bronx River area residents who were aware of the river as their primary waterbody mostly agreed that, if funds were available, they would like to see further improvements to the river (42 percent). In general, this response was in agreement with and slightly stronger than other New York City residents (38 percent). Within the group of residents that identified a desire for Bronx River improvements, 45 percent felt that the improvements were extremely important and 22 percent felt that improvements were somewhat important. Additionally, it should be noted that 25 percent of the residents that responded that improvements were needed for the Bronx River, were not sure how strongly they felt about the improvements. Only a small percentage of the residents did not care much about or did not care at all for the identified improvements. Among those who specifically expressed a desire for water quality, appearance, and odor improvements, two thirds (66 percent) felt these improvements were extremely important and 24 percent felt it was somewhat important.

Additionally, amongst the residents that felt primary waterbody improvements were extremely important, 42 percent responded that they would be willing to pay a range of $10 to $25 a year for that improvement, but 15 percent responded that they would not be willing to pay for the desired improvement. 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 19 percent responded that they would not be willing to pay for anything.

Finally, of the area residents that felt water quality improvements in general were extremely important, 39 percent responded that they would be willing to pay a range of $10 to $25 a year for that improvement, but 15 percent responded that they would not be willing to pay for the 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.

6.5. BRONX RIVER ALLIANCE (BXRA) MEETINGS

The Bronx River Alliance (BxRA) is a community organization within the Bronx watershed with the stated objectives of:

- Managing, with City of New York/Parks & Recreation, the New York City Bronx River corridor and greenway, implement small scale restoration projects, coordinate larger scale restoration projects and support community-led or sponsored restoration and development projects
- Coordinating the implementation of a continuous Bronx River greenway from the New York City border to the East River and coordinating with Westchester County to make critical greenway linkages
- Providing technical assistance and support to community-based efforts to organize projects around the Bronx River
- Developing Bronx River curricula and train teachers to bring the Bronx River into the classroom and promote the Bronx River as an outdoor classroom
- Coordinating a Bronx River Watershed monitoring program to collect and share watershed quality data and to identify and address watershed quality problems (from www.bronxriver.org)

NYCDEP has sought to maintain a relationship with this organization throughout the project by encouraging attendance at NYCDEP led events and by providing a NYCDEP contact at a number of the BxRA meeting. NYCDEP personnel or project representatives attended a number of BxRA meetings throughout the project. Below are highlights from those meetings.

The first meeting attended by NYCDEP was on September 8, 2004. This meeting primarily focused on the NYSDOT Bronx River Greenway (BRG) project. The NYSDOT presented the design progress of the BRG project, which was scheduled to go out to bid in December 2006. The presentation included a segment-by-segment analysis of the Greenway from Westchester Ave. to East Tremont Ave. NYCDEP reported that the 2004 Bronx River WB/WS Facility Plan has eliminated the 4.0 MG storage conduit for the Combined Sewer Overflow (CSO) Outfall HP-007 and will implement floatables control devices. The NYSDOT described revisions to the BRG design, including the elimination of the proposed extension of Outfall HP-007. In addition to the BRG discussion there were talks related to the need to quantify improvements to the river and ecology by conducting vegetative surveys along the river.

The next meeting attended by NYCDEP was on October 27, 2004. This meeting focused on the BRG project and the associated ecological plan. An overview of the ecological plans was presented along with a segment-by-segment analysis of the Greenway in the middle section of the watershed. A landscape architect working on the Bronx River Art Center presented on the section of the Greenway pertaining to the Center.

NYCDEP attended a BxRA meeting on July 6, 2005. The BxRA worked with the design/builder of the BRG project to evaluate potential sustainable energy sources for the Greenway. Ideas included biomass energy from the Zoo and solar power. Stormwater controls along the Bronx River were also discussed at this meeting, relating to the BRG project. Previously, the idea of infiltration basins had been discussed. However, due to soil conditions along the river, these do not appear to be feasible. The NYSDOT discussed alternatives such as wetlands, wet ponds and rip-rap channels. NYCDEP commended the effort to include demonstration BMPs in the project. The BxRA stressed the desire for water features such as wetlands and wet ponds. The BxRA was interested in learning more about BMPs and requested a site visit to identify potential locations for stormwater BMPs along the river.

A meeting was attended by NYCDEP on February 1, 2006. The BxRA discussed the Long Term Control Plan approach and projects. NYCDEP expressed interest in evaluating innovative stormwater control options and LIDs to determine if it is feasible to implement some of the measures being considered under the Jamaica Bay study. The initial step in this evaluation was to determine if any publicly owned sites in the Bronx River watershed were appropriate for stormwater control applications. A tour to observe these possible sites was discussed at this meeting.

At the October 6, 2006 BxRA meeting, a presentation was given on water flows and water use reduction in buildings and the Bronx Zoo Masterplan discussion continued.

NYCDEP attended the meeting on December 6, 2006. Dr. Robert DeCandido started the meeting with a presentation on the plants and birds of NYC. The BxRA discussed the ecological priorities of 2007 and the need for oyster beds in the river and how they can effectively filter water.

A BxRA meeting was attended on January 31, 2007. The major focus of the meeting was to elect co-chairs and to set the BxRA priorities for 2007.

A BxRA meeting was attended on March 21, 2007. A presentation was given proposing the addition of a riparian buffer/fish habitat to the western side of the Bronx River at River Park. This would be accomplished by placing additional rocks at the location for slowing water flow and supporting new plant growth. On the eastern side of the Bronx River, bank terrace rehabilitation was proposed.

6.6. ADDITIONAL PUBLIC OUTREACH ACTIVITIES

Additional public outreach activities carried out during the USA phase of the waterbody analyses included the following:

1. Bronx River Alliance (BxRA) Ecology Team: A formal presentation on the Bronx River Waterbody/Watershed project and water quality findings was made to the group on November 20, 2002. Participation by NYCDEP representatives in the Bronx River Alliance (BxRA) Ecology Team meetings.

2. Inter-agency Coordination for Bronx River Planning:

   - Bronx River USA floatables evaluation and potential control measures were presented at the April 4, 2002, progress meeting of the Comprehensive Planning for Floatables Control (Comp Plan) Project.

- Westchester County Agencies (Planning and Health) presentation of Bronx River Project coliform data analyses results on October 18, 2002.
- NYC Departments of City Planning, Health and Parks and Recreation presentation of Bronx River Project primary and secondary contact recreation use results on February 6, 2003.
- Westchester County Advisory Committee 7 (WAC7) presentation of Bronx River coliform data analyses and recreation use attainability throughout the river on March 10, 2004.

3. US Army Corps of Engineers Bronx River Ecosystem Restoration Project: NYCDEP is a non-federal partner in this project and will provide USA Bronx River data and Bronx River Model analyses as contributions to the restoration projects and development of a Bronx River Watershed Management Plan.

4. Website: A website was set up to provide public information on the Waterbody/Watershed planning activities.

6.7. NYSDEC PUBLIC NOTIFICATION FOR THE BRONX RIVER WATERBODY/WATERSHED FACILITY PLAN

In accordance with the NYSDEC public notification requirements, NYSDEC 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 Bronx River Waterbody/Watershed Facility Plan process and a forum in which to ask questions and provide feedback. This meeting was held on August 19, 2009 at 6:00 p.m. at the Bronx District Attorney's Litigation Training Room, 198 161st Street, Bronx NY. At the meeting, and in communications to attendees inviting them to the meeting, NYCDEP apologized for the inconvenient date of the meeting. It was explained that the meeting was scheduled during the summer so that the WB/WS Facility Plan could remain on schedule for December 2009 approval, a requisite for the Bronx River floatables facilities project in order to receive federal stimulus funding. However, NYCDEP said it is no longer requesting stimulus funds for the project. As a meeting sponsoring host, a representative from the Bronx River Alliance spoke first and stressed the need for a comprehensive community based approach to long term control planning for the Bronx River. Next, NYSDEC presented the process for the overall Long Term Control Plan and the process for reviewing and approving the Waterbody/Watershed Facility Plan for the Bronx River. Representatives from NYCDEP Bureau of Engineering Design and Construction then presented the key elements of the July 2009 Bronx River WB/WS Facility Plan and provided a detailed description of the Bronx River floatables projects. The meeting continued with a representative from NYCDEP Bureau of Environmental Planning and Assessment discussing the status of the Best Management Practice pilot studies and NYCDEP's approach to the implementation of green infrastructure. The remainder of the meeting consisted of and concluded with a comment, question and answer discussion. Stakeholders provided a number of questions and concerns that largely echoed those which were expressed at previous public meetings.

The majority of questions and comments were related to the implementation of green solutions as part of the City's CSO Long Term Control Plan. Stakeholders requested that NYCDEP revise the Bronx River WB/WS Facility Plan to make a stronger commitment to use of green infrastructure in the Bronx River watershed. It was requested that the NYCDEP take the lead in coordination efforts with other city agencies to implement green infrastructure wherever possible. Because gathering and analyzing data from the NYCDEP BMP pilot studies will take years to compete, stakeholders requested NYCDEP to use data from other watersheds and other cities or areas to provide a basis for planning and implementing green infrastructure in the interim. A number of stakeholders requested more opportunities for public involvement in the green infrastructure planning and in the development of the LTCP.

Also reiterated was that swimming has occurred in the Bronx River for many years and, because of this, the Bronx River should be designated a sensitive area. A number of stakeholders requested that the Long Term Control Plan aim to attain water quality standards for current designated and existing uses, which include primary contact recreation. Stakeholders requested that the City better educate and inform the public about risks associated with swimming in the Bronx River.

NYCDEP and NYSDEC responded to questions and comments regarding the compliance efforts by Westchester County and coordination between Westchester and NYCDEP. Stakeholders requested that the Long Term Control Plan include the Westchester County Plan. It was stated that a TMDL is required for the entire waterbody to provide an enforceable performance standard to deal with pollutant loadings from both Westchester County and the Bronx.

With regard to the alternative evaluations in the Bronx River WB/WS Facility Plan, those at the meeting questioned the high cost of floatables control and requested that funds be allocated to projects in addition to floatables controls, such as BMPs and source control alternatives. A stakeholder also requested that the modeling of alternatives be modified to provide a better comparison to current conditions and that the Hunts Point WPCP upgrades be included in the baseline. In addition, modifications to the Bronx River containment boom were requested to be part of the LTCP for the Bronx River to allow better access and improved safety for boaters.

During the comment period that followed, additional comments were received concerning specific clarifications and corrections that should be made in the Bronx River WB/WS Facility Plan.

Suggestions were made to hold future meetings at a convenient time of the year when more people would be able to attend, as well as to convene the meetings closer to the Bronx River itself. Most of the meeting attendees were extremely interested in the Bronx River's improvements and in the efforts that community organizations are making to assist in improvements to the quality of the Bronx River and to its increased recreational use by the public.

A copy of the PowerPoint presentations (NYSDEC and NYCDEP) shown at this meeting and the Responsiveness Summary, which consists of the questions and comments submitted at the meeting and during the Official 30 Day Public Comment Period following the meeting with the responses to these questions and comments, are provided in Appendix B.

NO TEXT ON THIS PAGE

7.0 Evaluation of Alternatives

As described in Section 1.2.1, the Bronx River currently appears on the NYSDEC "Section 303(d) List of Impaired Waters" for low dissolved oxygen and pathogens associated with CSO and other urban inputs. The CSO Consent Order requires NYCDEP to complete an approvable Waterbody/Watershed Facility Plan for the Bronx River by June 2007. The NYCDEP submitted a draft report in June 2007 for the Bronx River. After receiving comments from NYSDEC in May 2009, NYCDEP submitted a revised Bronx River WB/WS Facility Plan report on July 10, 2009. NYCDEP received additional comments from NYSDEC in October 2009, and NYSDEC requested that NYCDEP finalize the revised Bronx River WB/WS Facility Plan report by December 18, 2009. Although a Waterbody/Watershed Facility Plan does not necessarily require consistency with federal CSO Policy for CSO Long Term Control Plans, it is NYCDEP's intention that this Waterbody/Watershed Facility Plan satisfies the requirements of a CSO LTCP.

As previously discussed in Section 5, the NYCDEP has been engaged for many years in water-quality improvement projects and CSO facility planning for the Bronx River waterbody and watershed. Section 5 documents a number of CSO controls that have been proposed, constructed and/or partially constructed prior to the requirement of New York City to conduct CSO Long Term Control Planning.

This section presents analyses performed to evaluate alternatives for CSO control. These analyses were performed in accordance with federal CSO LTCP guidance and hence satisfy the requirements associated with LTCP development. Section 7.1 summarizes aspects of the regulatory framework for the evaluation of alternatives. Section 7.2 identifies and provides an initial screening of CSO control alternatives currently available. Section 7.3 presents detailed evaluations of those technologies accepted through initial screening and their applicability to the Bronx River Waterbody/Watershed Facility Plan. Section 7.4 presents a performance versus cost analysis of the feasible alternatives, including a 100% reduction alternative, based on projected CSO volumes and frequencies and attainment of water quality standards. Section 7.5 describes the basis of selection and the costs and benefits of the Waterbody/ Watershed Facility Plan.

7.1 REGULATORY FRAMEWORK FOR EVALUATION OF ALTERNATIVES

The evaluation of alternatives to address CSO discharges and water quality problems in a particular waterbody involves regulatory considerations that are in addition to those presented in Section 1. The following subsections present a summary of these considerations.

7.1.1 Water Quality Objectives

As previously described in Sections 1.2.1, all reaches of the Bronx River appear on the 2008 NYSDEC "Section 303(d) List of Impaired Waters" due to the following impairments, all caused by "urban/storm/CSO" inputs:

- Bronx River Upper Reach and Tributaries – DO/Oxygen Demand and Pathogens
- Bronx River Middle Reach and Tributaries – Pathogens

- Bronx River Lower Reach – Pathogens and Oxygen Demand

The NYSDEC has designated the lower (tidal) reach of the Bronx River as a Class I waterbody and the middle reach (the freshwater reach within New York City upstream of East Tremont Avenue) as a Class B waterbody. The upper reach, located within Westchester County is classified as a Class C waterbody. The New York State numerical and narrative surface water quality standards for Class I and Class B waters are listed below in Table 7-1.

Table 7-1. New York State Numerical and Narrative Surface Water Quality Standards for Bronx River Reaches

Class	Class B (Freshwater)	Class C (Freshwater)	Class I (Saline)
Applicability	Bronx River Middle Reach: NYC freshwater reach upstream of East Tremont Ave.	Bronx River Upper Reach: Westchester freshwater reach upstream of County Boundary	Bronx River Lower Reach: tidal region south of East Tremont Ave.
Usage	Primary and secondary contact recreation and fishing. Suitable for fish propagation and survival.	Limited primary and secondary recreation, fishing. Suitable for fish propagation and survival.	Secondary contact recreation, fishing. Suitable for fish propagation and survival.
Dissolved Oxygen (mg/L)	> 5.0(1) >4	> 5.0(1) >4	≥ 4.0
Total Coliform (#/100mL)	2,400 (2) 5,000 (3)	2,400 (2) 5,000 (3)	10,000 (4)
Fecal Coliform (#/100mL)	200 (4)	200 (4)	≤ 2,000 (4)
Taste-, color-, and odor producing toxic and other deleterious substances	None in amounts that will adversely affect the taste, color or odor thereof, or impair the waters for their best usages.		
Turbidity	No increase that will cause a substantial visible contrast to natural conditions.		
Oil and floating substances	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.		
Garbage, cinders, ashes, oils, sludge and other refuse	None in any amounts.		
Phosphorus and nitrogen	None in any amounts that will result in growth of algae, weeds and slimes that will impair the waters for their best usages.		

(1) Daily avg. min for non-trout waters
(2) Monthly median value of five or more samples
(3) Monthly 80th percentile of five or more samples
(4) Monthly geometric mean of five or more samples

7.1.2 Range of Alternatives

The federal CSO Policy calls for LTCPs to consider a number of factors when evaluating CSO control alternatives, as described in Sections II.C.4 and II.C.5 of the Policy (40 CFR 122 [FRL-4732-7]). USEPA expects the analysis of alternatives to be sufficient to make a reasonable assessment of the expected performance and the cost of the alternatives. With regard to performance, USEPA expects the LTCP to "consider a reasonable range of alternatives" in the selection process. The LTCP should consider four or more alternatives, providing a range of control above the existing condition and extending to full elimination of CSOs, as measured in terms of CSO frequency or CSO capture.

7.1.3 "Presumption" and "Demonstration" Approaches

Whether a particular alternative provides sufficient control can be determined in two different manners. In the "Presumption Approach," alternatives that meet any of a number of discharge-based criteria may be "presumed" to provide sufficient CSO control as to meet the water-quality based requirements of the CWA. These discharge-based criteria, which are applicable for an entire combined-sewer system (CSS; e.g., a WPCP drainage area) and not necessarily the drainage area of a particular waterbody include:

i. No more than an average of four overflow events per year, provided that the permitting authority may allow up to two additional overflow events per year. For the purpose of this criterion, an overflow event is one or more overflows from a CSS as the result of a precipitation event that does not receive a minimum treatment specified below;
ii. The elimination or the capture for treatment of no less than 85 percent by volume of the combined sewage collected in the CSS during precipitation events on a system-wide annual average basis; or
iii. The elimination or removal of no less than the mass of the pollutants […] for the volumes that would be eliminated or captured for treatment under item ii above.

Combined sewer flows remaining after implementation of the Nine Minimum Controls and within the criteria specified at II.C.4.a.i or ii should receive a minimum of:

- Primary clarification (Removal of floatables and settleable solids may be achieved by any combination of treatment technologies or methods that are shown to be equivalent to primary clarification.);

- Solids and floatables disposal; and

- Disinfection of effluent, if necessary, to meet WQS, protect designated uses and protect human health, including removal of harmful disinfection chemical residuals, where necessary

In the "Demonstration Approach," alternatives providing sufficient CSO control are those that, through modeling and/or other analyses, are expected to provide sufficient CSO control as to meet the water-quality based requirements of the CWA. The criteria associated with the Demonstration Approach are:

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;
ii. The CSO discharges remaining after implementation of the planned control program will not preclude the attainment of WQS or the receiving waters' designated uses or contribute to their impairment. 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;
iii. The planned control program will provide the maximum pollution reduction benefits reasonably attainable; and
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.

7.1.4 Cost/Performance Consideration

USEPA expects the permittee to use the costs associated with each of these alternatives to demonstrate the relationships among a comprehensive set of reasonable control alternatives that correspond to the different ranges specified in Section II.C.4 of the federal CSO policy. This should include an analysis to determine where the increment of pollution reduction achieved in the receiving water diminishes compared to the increased costs. This analysis, often known as "knee of the curve," should be among the considerations used to help guide selection of controls.

7.1.5 Consideration of Other Parameters

Other parameters such as existing waterbody uses and stakeholder goals for waterbody use were taken into account when determining the necessary level of CSO control. Other parameters considered as part of the evaluations of alternatives for the Bronx River include the following:

- Waterbody Use: As discussed in Section 2.2.5, the western shoreline at the mouth of the Bronx River has been designated a Significant Maritime and Industrial Area (SMIA) and the eastern shoreline and the waterbody itself have been designated as a Special Natural Waterfront Area (SNWA) through the Waterfront Revitalization Program (WRP), which promotes public investment to protect and enhance the city's natural resources. This latter designation will help continuing efforts to provide better access and restore the natural conditions along the western shoreline of the Bronx River near its mouth.

- Aquatic Life Uses: Aquatic life in the Bronx River was characterized under the USA project and is described in detail in Section 4.

- Sensitive Areas: As discussed in Section 4, the NYSDEC, as the permitting authority, has not designated the Bronx River as a sensitive area. There are no areas within the River that satisfy the CSO Control Policy criteria for sensitive areas. Therefore, prioritization of goals, selection of control alternatives, and scheduled implementation of these alternatives can be given to those alternatives that most reasonably attain the maximum benefit to water quality throughout the river.

- Stakeholder Goals: As discussed in Section 6, the NYSDEC, stakeholder goals for the waterbody include enhancing secondary-contact recreational uses, and a reduction in pathogen levels and access to the River to support these recreational uses. There was consensus on the goal of making the water as clean as possible to support aquatic life. Finally, since planned projects for riparian zones will increase access to the River, improved aesthetic conditions are desired, including the removal of odors, oil slicks, and floatables.

7.2 SCREENING OF CSO TECHNOLOGIES

A wide range of CSO control technologies was considered for application to New York City's Combined Sewer System (CSS). These technologies are grouped into the following general categories:

- Source Control
- Inflow Control
- Sewer System Optimization
- Green Solutions
- Sewer Separation
- Storage
- Treatment
- Receiving Water Improvement
- Floatables Control

Each technology is described below along with a discussion of the suitability of implementing it as a control technology for the Bronx River. Table 7-2 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 provides the general effectiveness of each control technology for four performance criteria including: CSO volume reduction, bacteria reduction, floatables capture and suspended solids reduction. It should be noted that a technology receiving "low" or "none" rating for some performance parameters does not preclude that technology from being considered for the Bronx River waterbody. There are other areas where the control technology could be effective, such as improving dissolved oxygen in the waterbody, or the technology could be utilized in conjunction with another control technology. In some instances, technologies with a low or medium impact in a performance area could be effective when implemented in conjunction with another technology.

Table 7-2. Assessment of CSO Control Technologies

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume	Bacteria	Floatables	Suspended Solids	
Source Control					
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 and out of combined sewer area.
Inflow Control					
Stormwater 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 Stormwater	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					
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					
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 stormwater pollutant loads.

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume	**Bacteria**	**Floatables**	**Suspended Solids**	
Storage					
Closed Concrete Tanks	High	High	High	High	Requires large space, disruptive to affected area, cost intensive, aesthetically acceptable.
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					
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 with increased O&M.
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					
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.
Maintenance Dredging	None	None	None	None	Removes deposited solids after build-up occurs.
Solids and Floatables Controls					
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
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
Hinged Baffles	None	None	High	None	Relatively low, requires maintenance of mechanical emergency release mechanism
Floating Baffles	None	None	High	None	Moving parts make them susceptible to failure

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume	Bacteria	Floatables	Suspended Solids	
Catch Basin Modifications/Hooding	None	None	High	None	Requires suitable catch basin configuration and increases maintenance efforts
Skimmer Vessel	None	None	High	None	
1. Process includes pretreatment screening and disinfection.					

7.2.1 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 precipitation events. Public education programs cannot reduce the volume, frequency or duration of CSO overflows, but can help improve CSO quality by reducing floatable debris. Public education and information is an integral part of any LTCP. Public Education is also an ongoing NYCDEP program as described in the report New York City Floatable Litter Reduction: Institutional, Regulatory and Public Education Programs, (HydroQual, 2005e).

- Street Sweeping – The major objectives of municipal street cleaning are to enhance the aesthetic appearance of streets by periodically removing the surface accumulation of litter, debris, dust and dirt, and to prevent these pollutants from entering storm or combined sewer systems. 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. Increasing street cleaning frequency from two times per week to six times per week reduced floatables by approximately 42 percent on an item count basis, but at a very high cost. A significant quantity of floatables was found to be located on sidewalks that were not cleanable by conventional equipment. (HydroQual, 1995a). However, in spite of these limitations, the Department of Sanitation of New York City (DSNY) does have a regular street sweeping program targeting litter reduction. The DSNY also has 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, 2005c).

  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

EPA, 1983). The principal reason for this is that mechanical sweepers employed at that time could not pick up the finer particles (diameter < 60 microns). Studies have shown that these fine particles contain a majority of the target pollutants on city streets that are washed into sewer systems (Sutherland, 1995). In the early 1990s new vacuum-assisted sweeper technology was introduced that can pick up the finer particles along city streets. A recent study showed that these vacuum-assisted sweepers have a 70 percent pickup efficiency for particles less than 60 microns (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 fecal coliform and *E. coli* concentrations of CSOs would be expected.

- <u>Construction Site Erosion Control</u> – 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 (O&M) costs. New York City's CEQR requirements addresses potential impacts associated with sediment runoff as well as required measures to be employed to mitigate any potential impacts.

- <u>Catch Basin Cleaning</u> – 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 to 2 percent of the five day biochemical oxygen demand (BOD_5) produced by a combined sewer watershed (USEPA, 1977). As a result catch basins cannot be considered an effective pollution control alternative for BOD_5 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 to the combined sewer system. Thus, while hooding of catch basins will improve floatables capture, the hooding program is not expected to results in a need for 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 in place as discussed in Section 3 of this report.

As noted in the previous descriptions of the Source Control technologies, the City has programs in place to control pollutants at their source. Public education/information is an on-going program within the NYCDEP and the City's CEQR program addresses construction site erosion control. In addition, street sweeping and catch basin cleaning are two elements of the City's City-Wide Comprehensive CSO Floatables Plan. Finally, the City's industrial pretreatment program has been in-place since January 1987. Therefore, based upon this screening of technologies, source controls have been effectively implemented to a satisfactory level and will not be considered further herein.

7.2.2 Inflow Control

Inflow control involves eliminating or retarding stormwater 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 catch 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 city streets to a detention pond which would be built in a nearby vacant lot. Extensive public education and testing is required to build support for this control technology and to address public concerns such as resultant potentially unsafe road conditions and flood damage.

- 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. This device would limit the rate at which surface runoff enters the combined sewer system. The excess stormwater would be retained on the roadway and enter the catch basin at a controlled rate. Street storage can effectively reduce inflow during peak periods and can decrease CSO volume. However, it also would promote street flooding and must be carefully evaluated and planned to ensure that unsafe travel conditions and damage to roadway surfaces do not occur. For these reasons, street storage of stormwater is not considered a viable CSO control technology in New York City.

- Water Conservation - Water conservation is geared toward reducing the dry weather flow in the combined sewer system, thereby increasing the system's ability 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 similar 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 individual water meters on water service lines 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 water consumption city-wide 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 reduction in overall daily water consumption, even as the population increased by approximately nine 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, and New York City has achieved significant reductions in wastewater flow through its existing water conservation program.

- Infiltration/Inflow (I/I) Reduction - Infiltration and inflow is ground water and other undesired water that enters the collection system through leaking pipe joints, cracked pipes and manholes. Excessive amounts of infiltration and inflow take up the hydraulic capacity of the collection system. In contrast, the inflow of surface drainage is intended to enter the combined sewer system. Sources of inflow that might be controlled include leaking or missing tide gates and inflow in the separate sanitary system located upstream of the combined sewer system.

  NYCDEP conducted an Infiltration/Inflow (I/I) analysis in the late 1980s (O'Brien & Gere, 1986) and a follow-up Sewer System Evaluation Survey (SSES) in 1991 (O'Brien & Gere, 1991). These investigations identified excessive I/I within the Hunts Point WPCP service area by comparing measured nighttime flow rates to estimates of water usage developed from a derived per capita water usage rate and data from available records. The initial estimate of 66.7 MGD of extraneous flow led to the recommendation of the SSES, which focused on the 50 percent of the Hunts Point collection system believed to be responsible for about 80 percent of the extraneous flow volume. These sub-areas included 138.5 miles of sewer, most of which was within the Bronx River portion of the service area. An estimate of I/I was made based on the comparison of nighttime calculated and measured flows. After reevaluation of the base flow used in both the per capita water consumption and the diurnal flow variation used in the calculations and validated flow monitoring, the I/I estimate was adjusted downward to 21.6 MGD system-wide. For comparison, current NYCDEP drainage plan design criteria account for I/I by assuming 0.00242 cfs/ac, resulting in 18.8 MGD of I/I in the Hunts Point system (NYCDEP, 2000b). This would be the amount of I/I that DEP would consider normal when designing their sewers.

Despite a comprehensive track down program, the sources of only about 35 percent of the 21.6 MGD of I/I anticipated were positively identified in the field. The sewer system was generally found to be in good condition, and the TV program was stopped after 18 miles because only about 1 MGD of I/I had been positively identified where at least 13.5 MGD had been expected. The questionable validity of the base flow used to estimate the I/I, the inability to positively identify I/I sources, and the generally good conditions observed in the sewers suggest that infiltration and inflow are not significant problems in the Hunts Point service area with respect to inducing CSO and further reductions would be unlikely to result in appreciable reductions in CSO discharges to surrounding waters. Infiltration and inflow control will be reevaluated during the development of the Drainage Basin Specific LTCP.

7.2.3 Green Solutions

For the purposes of this WB/WS Facility Plan, "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 stormwater runoff to reduce both its volume and peak overflow rate while improving its quality. 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 associated with the application of 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 of such solutions 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 retain 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 for 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 or connected to the downspout through a diverter to capture and hold runoff from roofs. The water in the barrel must be manually emptied onto the ground or put to beneficial use to water vegetation. The barrel top typically has a completely sealed lid; the overflow can be directed back to the downspout through the diverter.

- Cisterns – an oversized or underground tank that stores rain water 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 rain water off a building's rooftop via a controlled-flow roof drain.

- 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 soil.

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 constructed 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 for the purpose of constructing green solutions alone. Green solutions tend to be more cost-effective when applied with new development or construction within an urban area. Coordinating construction of BMPs with excavation for street and sidewalk construction provides substantial construction cost savings. Additionally, municipal requirements for new development allow green solutions to be incorporated as part of site plan reviews and building design, which minimizes the 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.

As described in the Mayor's Sustainable Stormwater Management Plan, NYCDEP and other agencies 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, 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 stormwater BMP technologies rather than to combined and storm sewers that discharge 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 5.9 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, which contains the highest concentration of nitrogen, other nutrients and urban pollutants, and the reduction of 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 treat a greater volume of sanitary wastewater and reduce the volume of sanitary wastewater discharged to waterbodies via 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 is described in Section 5.9 and will extend beyond the Consent Order milestones for delivery of approvable Waterbody/Watershed Facility Plans to NYCDEC. 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. These evaluations will be incorporated into LTCP submittals as developed which may provide a greater emphasis on green infrastructure, dependent on evaluation results, than was included in the WWFP.

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, the 5-year update of a Drainage Basin Specific Long Term Control Plan or in the subsequent City-Wide Long Term Control Plan.

7.2.4 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.

- Real Time Control (RTC) – RTC is any response – manual or automatic – made in response to changes in the sewer system condition. For example, the depth of flow of sewage within the sewer system and flow data can be monitored in "real time" at key points in the sewer system and transferred to a control device such as a central computer where decisions can be made to operate control components such as gates, pump stations or inflatable dams to maximize use of the existing sewer system and 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 use of weather forecast data is also possible, but is complex and requires sophisticated operational capabilities. RTC can reduce CSO volumes when 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 the storm event when capacity for treatment becomes available. Technologies available for equipping sewers for in-system storage include inflatable dams, mechanical gates and increased overflow weir elevations. RTC has been used in other cities such as Louisville, Kentucky; Cleveland, Ohio; and Quebec, Canada. Refer to Figure 7-1 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 pilot study involved the use of inflatable dams and RTC at two locations (Metcalf Avenue and Lafayette Avenue) in the Bronx. Testing completed in early 2007 and the equipment remained idle until August 2009, when decommissioning was completed. From this study, the City found that the technology was feasible for further consideration. However, widespread application of inflatable dams and RTC is limited in NYC as it does not provide for storage of large enough volumes of combined sewage to adequately improve water quality, especially in areas where tributary water quality is degraded.

  In addition to these factors, the City's has considerable doubts about the viability of inflatable dams. At other locations in the city where inflatable dam systems were being designed, acquiring a bidder was difficult. Historically, there were only two manufacturers of inflatable dam systems. One no longer manufactures the dams and the other has curtailed service in the United States market. This creates a problem purchasing the system and does not ensure a reliable supply of replacement parts. While the use of dams may be manageable for a limited number of facilities, wide spread application of dams may lead to ineffective operation creating a massive maintenance and operation issue and possible flooding due to malfunctions.

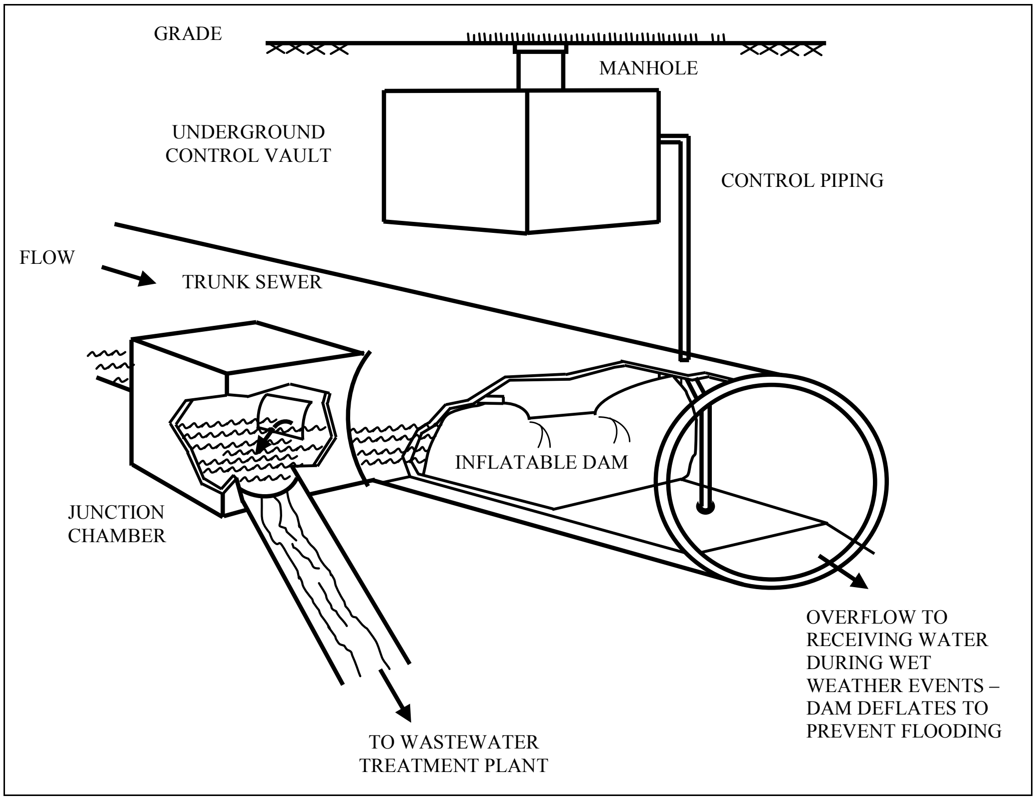


Figure 7-1. Inflatable Dam System

Both optimization of the existing system and real time control will be retained for further consideration when evaluating potential alternatives for CSO control in the Bronx River.

7.2.5 Sewer Separation

Sewer separation is the conversion of a combined sewer system into a system of separate sanitary 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 at the downstream WPCP. 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 city-wide excavation that would exacerbate traffic problems within the City. Varying degrees of sewer separation could be achieved as described below and illustrated in Figure 7-2:

- <u>Rain Leader (Gutters and Downspouts) Disconnection</u> – Rain leaders are disconnected from the combined sewer system with storm runoff diverted elsewhere. Depending on the location, leaders may be run to a dry well, vegetation bed, a lawn, a storm sewer or the street. Unfortunately, this scheme contributes to nuisance street flooding and may only briefly delay the water from entering the combined sewer system through catch basins. For this reason, rain leader disconnection will be eliminated from further consideration.

- Partial Separation – Combined sewers are separated in the streets only, or other public rights-of way. This is accomplished by constructing either a new sanitary wastewater system or a new storm water system. In NYC, "High Level" separation projects involving construction of storm sewers picking up catch basins have been constructed. Therefore, this CSO control technology will be retained for further consideration.

- Complete Separation – In addition to separation of sewers in the streets, storm water runoff from private residences or buildings (i.e. rooftops and parking lots) is also separated. Complete separation is almost impossible to attain in New York City since it requires re-plumbing of apartment, office, and commercial buildings where roof drains are interconnected to the sanitary plumbing inside the building. In urban areas there is a lack of pervious surface areas to disperse the storm runoff into the ground, which could lead to nuisance flooding, and wet foundations and basements. These risks have led to the prohibition of stormwater disconnections from the combined sewers in the City Building Code. In addition, the widespread excavation and lengthy timeframes required to broadly implement separation would lead to unacceptable street disruptions and may not be feasible in areas with dense buried infrastructure. Accordingly, no further consideration will be given to this CSO control technology.

Figure 7-2 shows a diagram of these methods of separation.

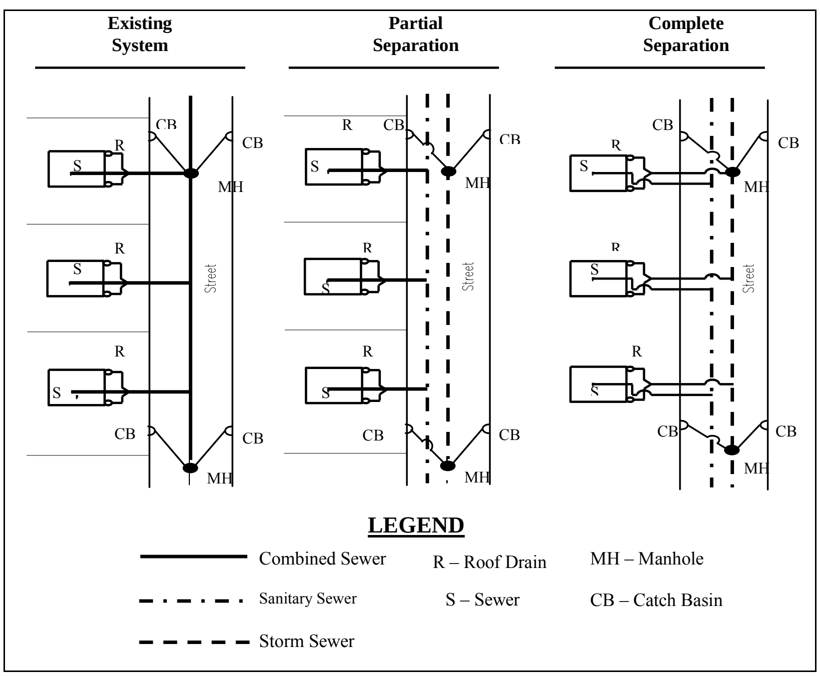


Figure 7-2. Sewer Separation Alternatives

In areas adjacent to the waterbody, particularly those undergoing new development projects, partial separation through construction of high level storm sewers (HLSS) is a potentially feasible alternative that is featured in the New York City Mayor's "PlaNYC 2030" initiative. Therefore, the NYCDEP will continue to promote and support opportunities for local partial separation in select locations throughout those areas of the City undergoing new development. This technology is retained for further consideration on a site specific basis and is believed to be most viable in small areas near the shorelines where there is no need to build large diameter and long storm sewers to convey the separated stormwater to the receiving water body.

7.2.6 Storage and Conveyance

The objective of retention basins (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 the WPCP after the storm event. Retention basins can provide a relatively constant flow into the treatment plant thereby reducing their hydraulic impact on downstream WPCPs. Retention basins have had considerable use and are well documented. Retention facilities may be located at overflow points or near dry weather or wet weather treatment facilities. A major factor determining the feasibility of using retention basins 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 stormwater flows, including those in Richmond, Virginia; Chippewa Falls, Wisconsin; Boston, Massachusetts; Milwaukee, Wisconsin; Columbus, Ohio; and the Spring Creek Auxiliary WPCP constructed by the NYCDEP in 1972. Closed concrete tanks, storage pipelines and conduits and tunnels are types of CSO retention facilities. Due to the operating history of this technology both in New York City and in other locales, the three types of storage and conveyance technologies will be retained for further consideration. The following describes the storage and conveyance technologies evaluated:

- 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 of the tank. 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. The pipelines are fitted with some type of 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 to downstream WPCPs for ultimate treatment. A pipeline has the advantage of requiring a relatively small right-of-way for construction. The primary disadvantage is that it takes a relatively large diameter pipeline or cast-in-place conduit to provide the volume required to accommodate large periodic CSO flows requiring a greater construction effort than a pipeline used only for conveyance. For large CSO areas, pipeline size requirements 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 beneath the city and therefore would not impact traffic. The ability to construct tunnels at a reasonable cost depends on the geology. Tunnels have been used in many CSO control plans including Chicago, Illinois; Rochester, New York; Cleveland, Ohio; Richmond, Virginia; and Toronto, Canada, among others. A schematic diagram of a typical storage tunnel system is shown in Figure 7-3. The storage tunnel stores flow and then conveys it to a dewatering station where floatables are removed at a screening house and then flows are lifted for conveyance to the WPCP.

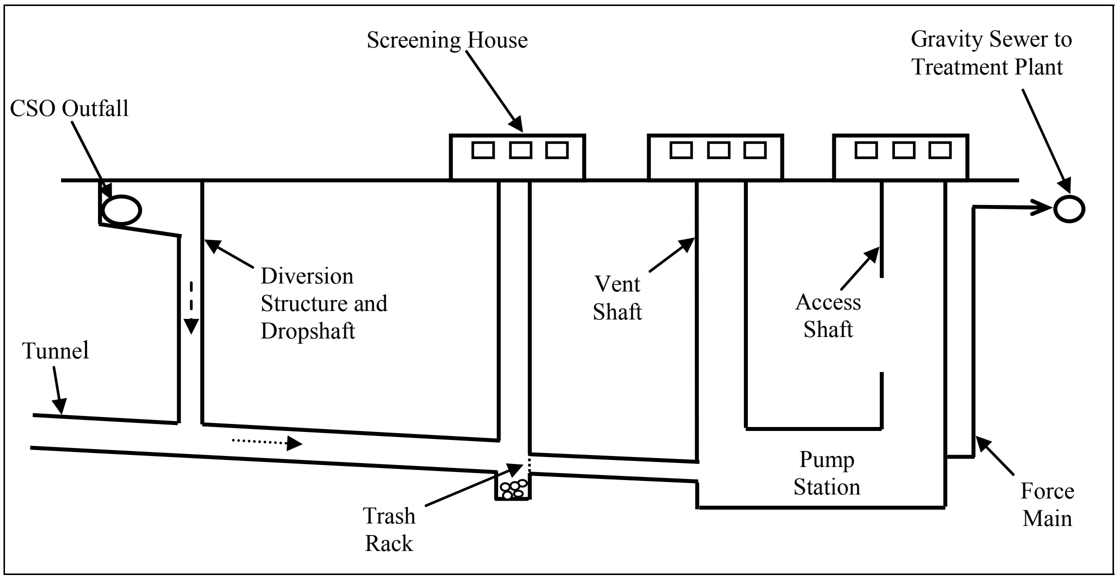


Figure 7-3. Storage Tunnel Schematic

7.2.7 Treatment

Treatment alternatives include technologies intended to separate solids and/or floatables from the combined sewer flow, disinfect for pathogen treatment or provide secondary treatment for some portion of the combined flow. The following are types of treatment technologies:

- 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.

  - Trash Racks and Manually Cleaned Bar Racks – Trash racks are intended to remove large objects from overflow and have a clear spacing of between 1.5 to 3.0 inches. Manually cleaned bar racks are similar to trash racks and have clear spacings of between 1.0 and 2.0 inches. Both screens must be manually raked and the screenings must be allowed to drain before disposal.

- Netting Systems – Netting Systems are intended to remove floatables and debris at CSO outfalls. A system of disposable mesh bags is installed in either a floating structure at the end of the outfall or in an underground chamber on the land side of the outfall. Nets and captured debris must be periodically removed using a boom truck and disposed of in a landfill.

- Mechanically Cleaned Bar Screens – Mechanically cleaned bar screens typically have clear spacing between 0.25 and 1.0 inches. Bars are mounted 0 to 39 degrees from the vertical and rake mechanisms periodically remove material trapped on the bar screen. Facilities are typically located in a building to house collected screenings that must be collected after a CSO event and then transported to a landfill.

- Fine Screens – Fine screens in CSO facilities typically follow bar screens and have openings between 0.010 and 0.5 inches. 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. Proprietary screens such as ROMAG have been specifically designed for wet weather applications. These screens retain solids on the dry weather side of the overflow diversion structure so they can be conveyed to the wastewater treatment plant with the sanitary wastewater thereby minimizing the need for on-site collection of screenings for truck transport.

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 odor facilities may be required 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. These include Dallas, Texas; Saginaw, Michigan; and Mt. Clements, Michigan (USEPA, 1978). Studies on existing storm water basins indicate suspended solids removals of 15 to 89 percent; BOD_5 removals of 10 to 52 percent (Fair and Geyer, 1965; USEPA, 1978; Oliver and Gigoropolulos, 1981; Ferrara and Witkowski, 1983).

The NYCDEP's WPCPs are designed to accept their respective 2×DDWF 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 currently marketed include: USEPA Swirl Concentrator, Storm King Hydrodynamic Separator of British design, and the FluidSep vortex separator of German design. Although each of the three is configured somewhat differently, the operation 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 Decatur Illinois; Columbus, Georgia; Syracuse, New York; West Roxbury, Massachusetts; Rochester, New York; Lancaster, Pennsylvania; 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. BOD_5 removals from 29 to 79 percent have been achieved with the swirl concentrator prototype in Syracuse New York (Alquier, 1982).

  New York City constructed the Corona Avenue Vortex Facility (CAVF) in the late 1990's to evaluate the performance of three swirl/vortex technologies at a full-scale test facility (133 MGD each). 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, completed 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 CSOs 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, 2003; HydroQual, 2005), and the general lack of available head, vortex separators have been removed from further consideration in New York City in general and from consideration within the Bronx River watershed.

- High Rate Physical Chemical Treatment (HRPCT) – High rate physical/chemical treatment is a traditional gravity settling process enhanced with flocculation and settling aids to increase loading rates and improve performance. 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 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. The two principal manufacturers of HRPCT processes are Infilco Degremont Incorporated, which manufacturers the DensaDeg process, and US Filter, which manufactures the Actiflo process. Each is described in more detail below:

  - IDI DensaDeg – Infilco Degremont offers the DensaDeg 2D and 4D processes, both of which require upstream screening. The 2D process requires upstream grit removal as well, but the 4D process integrates grit removal into the coagulation stage. Otherwise the 2D and 4D processes are identical.

  - DensaDeg performance varies with surface overflow rate and chemical dosages, but in general removal rates of 80 to 95 percent for TSS and 30 to 60 percent for BOD can be expected. Phosphorous and nitrogen can also be removed with this process, although the removal efficiencies are dependent on the solubility of these compounds present in the wastewater. Removal efficiencies are also dependent on start-up time. Typically the DensaDeg process requires approximately 30 minutes before optimum removal rates are achieved to allow for the build-up of sludge solids.

- U.S. Filter Actiflo – The US Filter Actiflo process is different from the DensaDeg process in that fine sand is used to ballast the sludge solids. As a result, the solids settle faster, but specialized equipment must be incorporated in the system to accommodate the handling sand throughout the system. Figure 7-4 shows the components of a typical US Filter Actiflo system.

  The US Filter Actiflo process does require screening upstream. Grit removal is recommended, but since the system uses microsand as ballast in the process, the presence of grit is tolerable in the system. If grit removal does not precede the process, the tanks must be flushed of accumulated grit every few months to a year, depending on the accumulation of grit and system run times.

  Actiflo performance varies with surface overflow rate and chemical dosages, but in general removal rates of 80 to 95 percent for TSS and 30 to 60 percent for BOD are typical. Phosphorous and nitrogen are also removable with this process, although the removal efficiencies are dependent on the solubility of these compounds present in the wastewater. Phosphorous removal is typically between 60 and 90 percent, and nitrogen removal is typically between 15 and 35 percent. Removal efficiencies are also dependent on start-up time. Typically the Actiflo process takes about 15 minutes before optimum removal rates are achieved.

Pilot testing of HRPCT was performed at the 26th Ward WPCP in Brooklyn, and consisted of evaluating equipment from three leading HRPCT manufacturers from May through August 1999. The three leading processes tested during the pilot test were the Ballasted Floc Reactor^{TM} from Microsep/US Filter, the Actiflo^{TM} from US Filter, and the Densadeg 4D^{TM} 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 BOD_5. 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. Facility planning at that time did not reveal any opportunities to apply this technology for CSO abatement in New York City, so the demonstration project was indefinitely postponed. For the purposes of this evaluation, it is presumed that the operational challenges identified would be overcome once testing was re-initiated, and the technology is therefore retained for further consideration.

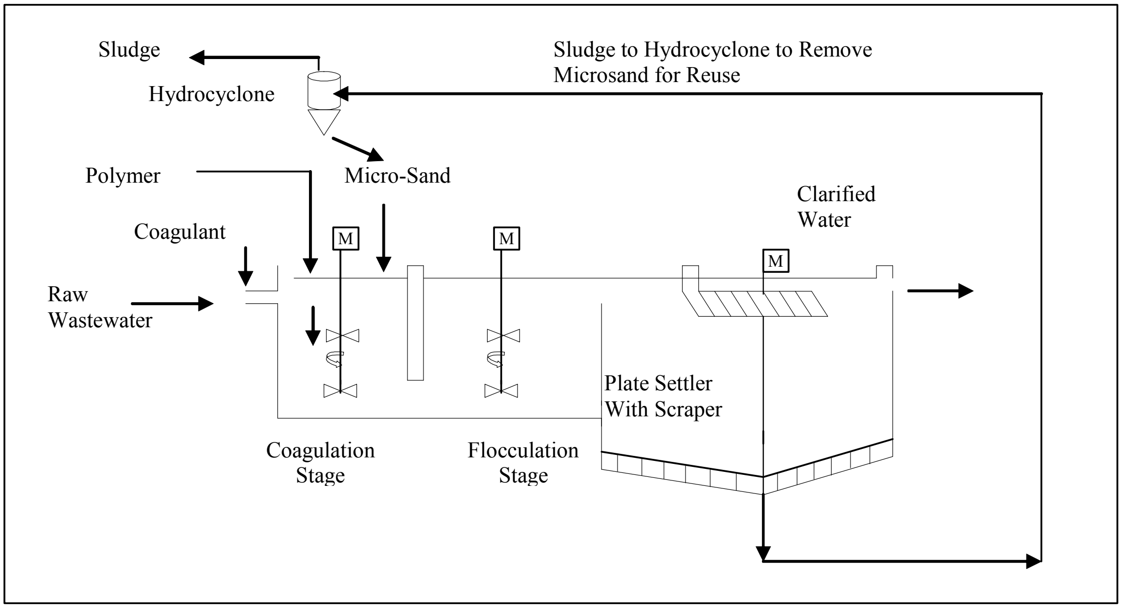


Figure 7-4. Kruger Actiflo HRPCT

- 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, D.C.; Boston, Massachusetts; Rochester, New York; and Syracuse, New York. 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. The chemicals are all oxidizing agents that are corrosive to equipment and in concentrated forms are highly toxic to both microorganisms and people. Each is described below.

  - Chlorine gas – Chlorine gas is extremely effective and relatively inexpensive. However, it is extremely toxic and its use and transportation must be monitored or controlled to protect the public. Chlorine gas is a respiratory irritant and in high concentrations can be deadly. Therefore, it is not well suited to populous or potentially non-secure areas.

  - Calcium or Sodium Hypochlorite – Hypochlorite systems are common in wastewater treatment installations. For years, large, densely populated metropolitan areas have employed hypochlorite systems in lieu of chlorine gas for safety reasons. The hypochlorite system uses sodium hypochlorite in a liquid form much like household bleach and is similarly effective as chlorine gas although more expensive. It can be delivered in tank trucks and stored in aboveground tanks. The storage life of the solution is 60 to 90 days.

  - Chlorine Dioxide – Chlorine dioxide is an extremely unstable and explosive gas and any means of transport is potentially very hazardous. Therefore, it must be generated on site. The overall system is relatively complex to operate and maintain compared to more conventional chlorination.

- Ozone – Ozone is a strong oxidizer and must be applied to CSO as a gas. Due to the instability of ozone, it must also be generated on site. The principle advantage of ozone is that there is no trace residual chlorine remaining in the treated effluent. Disadvantages associated with ozone use as a disinfectant is that it is relatively expensive, with the cost of the ozone generation equipment being the primary capital cost item. Operating costs can be very high depending on power costs, since ozonation is a power intensive system. Ozonation is also relatively complex to operate and maintain compared to chlorination. Ozone is not considered practical for CSO applications because it must be generated on site in an intermittent fashion in response to variable and fluctuating CSO flow rates.

- UV Disinfection – UV disinfection uses light with wavelengths between 40 and 400 nanometers for disinfection. Light of the correct wavelength can penetrate cells of pathogenic organisms, structurally altering DNA and preventing cell function. As with ozone, the principle advantage of UV disinfection is that no trace chlorine residual remains in the treated effluent. However, because UV light must penetrate the water to be effective, the TSS level of CSOs can affect the disinfection ability. As such, to be effective UV must be preceded by thorough separation of solids from the combined sewage. Pretreatment by sedimentation, high-rate sedimentation, and/or filtration maybe required to reduce suspended solids concentrations to less than 20 to 40 mg/l or so depending on the water quality goals.

Disinfection reduces potential public health impacts from CSOs but needs to be used in conjunction with other technologies, as it cannot reduce CSO volume, settleable solids, or floatables.

In order to protect aquatic life in the receiving waters, dechlorination facilities would need to be installed whenever chlorination is used as a disinfectant. Dechlorination would be accomplished by injection of sodium bisulfite in the flow stream before discharge of treated CSO flow to waterways. Dechlorination with sodium bisulfite is rapid; hence no contact chamber is required. However, even with the addition of dechlorination, the NYCDEP believes that there could be a residual of as much as 1 mg/L from a CSO disinfection facility and has considered this factor in analyses contained herein.

- Expansion of Hunts Point WPCP – Hunts Point WPCP recently completed a major headworks upgrade to consistently achieve primary treatment and disinfection for wet weather flows up to 400 MGD. Prior to this upgrade, the plant was only capable of handling a wet weather flow of approximate 259 MGD. A Wet Weather Operating Plan for the Hunts Point WPCP (July 2003, as modified September 2004) was required as part of the Nitrogen Consent Order to provide recommendations for maximizing treatment of wet weather events during construction. The report outlined three primary objectives in maximizing treatment for wet weather flows: (1) consistently achieve primary treatment and disinfection for wet weather flows up to 400 MGD; (2) consistently provide secondary treatment for wet weather flows up to 260 MGD before bypassing the secondary treatment system (the plant will have the ability to provide a secondary level of treatment for 1.3×DDWF); and (3) do not appreciably diminish the effluent quality or destabilize treatment upon return to dry weather operations.

The Citywide Comprehensive Nitrogen Management Plan (March 30th, 2001) recommends that the maximum flow through the BNR System is to be 1.2×DDWF along with plant recycles, for a total of 1.3×DDWF. The remaining flow would be diverted as secondary bypass flow, based on calculations and field observations.

The BNR treatment process must be protected against high wet weather flows due to the limitations on the secondary clarifier solids separation capability. The Step Feed BNR process will require a higher aerator effluent suspended solids concentration and higher solids load on the final settling tanks. Solids may be washed out of the final clarifiers due to the higher solids loading and deeper sludge blanket during major storm events. The BNR treatment process can be protected against such high wet weather flows due to the constraints on the secondary clarifier solids separation capability by limiting the secondary treatment flow to 1.3×DDWF, altering pass configurations under Construction Phase II, and by changing flow configurations to contact stabilization mode during the wet weather flow in order to minimize the loss of the autotrophic organisms essential for BNR.

7.2.8 Receiving Water Improvement

Receiving waters can also be treated directly with various technologies that improve water quality. Below are described the different treatment options that could aid in improving water quality in conjunction with CSO control measures:

- Outfall Relocation – Outfall relocation involves moving the combined sewer outfall to another location. For example, an outfall may be relocated away from a sensitive area to prevent negative impacts to that area.

- In-Stream Aeration – In-Stream Aeration would improve the dissolved oxygen content of the river by adding air directly to the water column via diffusers placed within the waterbody. Air could be added in large enough volumes to bring any waterbody into compliance with the ambient water quality standards. However, depending on the amount of air that would be required to be transferred into the water column, the facilities necessary and the delivery systems required 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 continues to investigate in-stream aeration as a method of meeting dissolved oxygen standards at the recently constructed English Kills in-stream aeration facility. The first of three years of testing was completed in the summer of 2009 and preliminary data analysis is expected to be completed by February 2010.

- Maintenance 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 by recreational boaters and kayakers, as well as abate nuisance conditions such as odors. The concept would be to conduct dredging periodically or routinely to prevent the use impairment/nuisance conditions from occurring. Dredging would 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.

This technology allows CSO settleable solids to exit the sewer system and settle in the waterbody generally immediately downstream of the outfall, but without regular or periodic dredging, such mounds can extend a thousand feet or more. The settled solids usually combine with leaves and accumulate into a “CSO” mound. This CSO mound would then be dredged and removed from the water environment. The assumption is that dredging would occur prior to the CSO mound creating an impairment or nuisance condition. Generally, it is envisioned that maintenance dredging would be performed prior to a CSO mound building to an elevation that it becomes exposed at low tide or mean lower low tide. The extent and depth of dredging would depend on the rate of accretion, or build-up of settleable solids, and preferred years between dredging.

Dredging can be accomplished by a number of acceptable methods. Methods of dredging generally fall into either floating mechanical or hydraulic techniques, with a variety of variants for both techniques. The actual method of dredging selected would depend on the physical characteristics (grain size, viscosity, etc.) of the sediments that require removal, the extent of entrained pollutants (metals, etc), the local water currents, the depth and width of the waterbody, and other conditions such as bridges that could interfere with dredge/barge access. It is likely that CSO sediments would require removal with a closed bucket mechanical dredge or an auger/suction-head hydraulic dredge. Removal techniques, however, would be site specific.

After removal of CSO sediments, the material would likely be placed onto a barge for transport away from the site. On-site dewatering may be considered as well. Sediments would then be off-loaded from the barge and shipped by land methods to a landfill that accepts New York Harbor sediments. Recently, harbor sediments have been shipped to a landfill in Virginia for final disposal.

In the 2004 Bronx River WB/WS Facility Plan, in-stream aeration and outfall relocation were analyzed. The volume of air necessary for the in-stream aeration system to have the desired benefit required an extremely large diffuser array covering essentially all of the tidal area. Because such a system would be counterproductive to creating a natural estuary system, in-stream aeration will not be considered further for the Bronx River. Outfall relocation was found to be very expensive and resulted in no improvement in dissolved oxygen conditions. Therefore, outfall relocation was also eliminated from further consideration in the Bronx River.

The Bronx River does not have a sediment mound issue at its outfalls and so maintenance dredging did not need to be evaluated.

7.2.9 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 "toilet litter" 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. NYCDEP has installed a floating end of pipe netting system at CSO TI-023 located in Little Bay.

- Containment Booms - Containment booms are specially fabricated floatation 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. An illustration of a containment boom is shown in Figure 7-5.

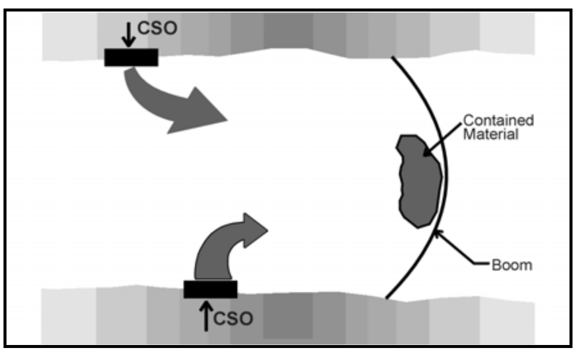


Figure 7-5. Containment Boom

- 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 City. 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.

- Manually Cleaned Bar Screens - Manually cleaned bar screens can be located within in-line CSO chambers or at the point of outfall to capture floatables. The configuration of the screen would be similar to that found in the influent channels of small wastewater pumping stations or treatment facilities. Retained materials must be manually raked and removed from the sites after every storm. For multiple CSOs, this would result in very high maintenance requirements. Previous experience with manually cleaned screens in CSO applications has shown these units to have a propensity for clogging. In Louisville, KY, screens installed in CSO locations became almost completely clogged with leaves from fall runoff. Because of the high frequency of cleaning required, it was decided to remove the screens. Thus, manually cleaned bar screens will be eliminated from further consideration.

- Weir-Mounted Screens - Mechanically Cleaned - Horizontal mechanical screens are weir-mounted mechanically cleaned screens driven by electric motors or hydraulic power packs. The rake mechanism is triggered by a float switch in the influent channel and returns 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 Mounted in Regulator

  - Fixed Underflow Baffles - Underflow baffles consist of a transverse baffle mounted in front of and typically perpendicular to the overflow pipe. During a storm event, the baffle prevents the discharge of floatables by blocking their path to the overflow pipe. As the storm subsides, the floatables are conveyed to downstream facilities by the dry weather flow in the interceptor sewer. The applicability and effectiveness of the baffle depends on the configuration and hydraulic conditions at the regulator structure. Baffles are being used in CSO applications in several locations including Boston, Massachusetts and Louisville, Kentucky. However, the typical regulator structures in New York City are not amenable to fixed baffle retrofits. Therefore, fixed underflow baffles will be eliminated from further consideration.

  - Floating Underflow Baffles - A variation on the fixed underflow baffle is the floating underflow baffle developed in Germany and marketed under the name HydroSwitch by Grande, Novac & Associates. The floating baffle is mounted within a regulator chamber sized to provide floatables storage during wet weather events. All floatables trapped behind the floating baffle are directed to the WWTP through the dry weather flow pipe. By allowing the baffle to float, a greater range of hydraulic conditions can be accommodated. Although this technology has not yet been demonstrated in the United States, there are operating units in Germany.

- Hinged Baffle – The hinged baffle system incorporates two technologies, the hinged baffle and the bending weir. The system design is intended to retain floatables in regulators during storm events. During a storm event, the hinged baffle provides floatables retention while the bending weir increases flow to the plant. After a storm event, retained floatables drop into the regulator channel and then into the sewer interceptor to be removed at the treatment plant. During large storm events that exceed the capacity of the regulator, more flow backs up behind the baffle. To prevent flooding, the hinged baffle opens to allow more flow to pass through the regulator. The bending weir provides additional storage of stormwater and floatables within the regulator during storm events by raising the overflow weir elevation. Similar to the hinged baffle, the bending weir also helps to prevent flooding during large storm events by opening and allowing additional combined sewage to overflow the weir. The bending weir allows an increasing volume of combined sewage to overflow the weir as the water level inside the regulators rises. The major benefit of the system is that it includes a built-in mechanical emergency release mechanism. This feature eliminates the need for the construction of an emergency bypass that many other in-line CSO control technologies require. In addition, the system has no utility requirements and therefore has low O&M costs. A three dimensional view of a bending weir installation is shown in Figure 7-6 (from John Meunier, Inc).

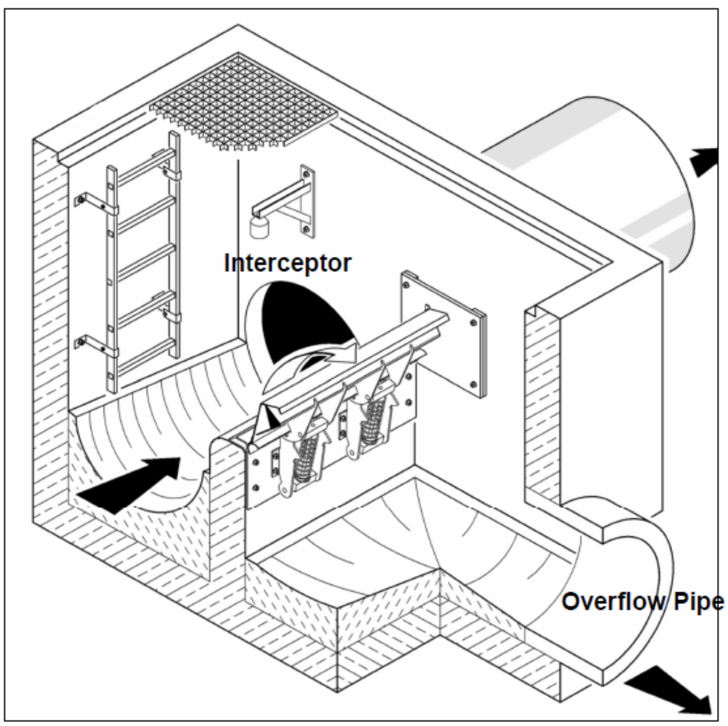


Figure 7-6. Bending Weir Diagram

- Catch Basin Modifications - Catch basin modifications consist of various devices to prevent floatables from entering the CSS. 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 CSS. 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 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.

- Best Management Practices (BMPs) – BMPs such as street cleaning and public education have the potential to reduce solids and floatables in CSO. These are described in the beginning of this section.

Table 7-3 provides a comparison of the floatables control technologies discussed above in terms of the effort to implement the technology, its 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.

Table 7-3. Comparison of Solids and Floatable 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
Hinged Baffle	Low	Low	Moderate	Low
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
Skimmer Vessel	High	High	High	High

7.2.10 Initial Screening of CSO Technologies

Table 7-4 presents a tabular summary of the results of the preliminary technology screening discussed. Technologies that will advance to the alternatives development screening phase are noted under the column entitled "Retain for Consideration." These technologies have proven successful and have the potential for producing some measurable level of CSO control.

Other technologies were considered as having a positive impact on CSOs but either could only be implemented to a certain degree or could only provide a specific benefit level and, thusly, would 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 which did not advance through the preliminary screening process.

Table 7-4. Screening of CSO Control Technologies

CSO Control Technology	Retain for Consideration	Implemented to Satisfactory Level	Consider Combining with Other Control Technologies	Eliminate from Further Consideration
Source Control				
Public Education		X		
Street Sweeping		X		
Construction Site Erosion Control		X		
Catch Basin Cleaning		X		
Industrial Pretreatment		X		
Inflow Control				
Storm Water Detention				X
Street Storage of Storm Water				X
Water Conservation		X		
Infiltration/Inflow Reduction	X			

CSO Control Technology	Retain for Consideration	Implemented to Satisfactory Level	Consider Combining with Other Control Technologies	Eliminate from Further Consideration
Green Solutions			X	
Sewer System Optimization				
Optimize Existing System	X			
Real Time Control	X			
Sewer Separation				
Complete Separation				X
Partial Separation	X			
Rain Leader Disconnection				X
Storage				
Closed Concrete Tanks	X			
Storage Pipelines/Conduits	X			
Tunnels	X			
Treatment				
Screening (see Floatables Control below)	X			
Primary Sedimentation		X		
Vortex Separator				X
High Rate Physical Chemical Treatment	X			
Disinfection	X			
Expansion of WPCP	X			
Receiving Water Improvement				
Outfall Relocation				X
In-stream Aeration				X
Maintenance Dredging				X
Solids and Floatable Controls				
Netting Systems	X			
Containment Booms	X			
Manual Bar Screens				X
Weir Mounted Screens	X			
Fixed baffles				X
Floating Baffles				X

CSO Control Technology	Retain for Consideration	Implemented to Satisfactory Level	Consider Combining with Other Control Technologies	Eliminate from Further Consideration
Catch Basin Modifications		X		
Hinged Baffle	X			

The technologies successively moving through the preliminary screening process were formed into alternatives that were further screened in subsequent sections.

7.3 WATERSHED ALTERNATIVES

This section describes the development of preliminary control plan alternatives and the factors used to evaluate the alternative plans. The landside modeling results of the proposed alternatives are compared against the baseline conditions as defined in Section 3.3.3 and shown in Table 7-5 to determine the level of CSO reduction provided.

Table 7-5. Bronx River Discharge Summary for Baseline Condition (1, 2, 3)

Outfall	Discharge Volume (MG/yr)	Number of Events per year
HP-009	814	51
HP-004	100	56
HP-007	88	21
HP-008	4	17
HP-010	0.6	1
Total CSO	1,006	NA

Notes:
(1) Baseline condition reflects design precipitation record (JFK, 1988) and sanitary flows projected for year 2045
(2) Totals may not sum precisely due to rounding.
(3) Hunts Point Wet Weather Capacity 259 MGD

7.3.1 Evaluation of Viable Waterbody Alternatives

The development of viable waterbody alternatives continues from the 2004 Bronx River WB/WS Facility Plan (HydroQual, 2004). This report builds upon the previous report findings by analyzing alternatives in the context of CSO Policy requirements. The alternatives were evaluated based on criteria such as ability to comply with regulatory requirements, public acceptance, feasibility, and ease of operation and maintenance. The viable alternatives include:

- Maximization of Flow to the WPCP
- System Optimization
- Green Alternatives/Low Impact Development (LID)
- Floatables Control

- Real-Time Control (RTC)
- Storage Facilities
- Sewer Separation
- Treatment Technologies

7.3.2 Maximization of Flow to the WPCP

Prior to 2004, Hunts Point WPCP had a design capacity to treat up to 300 MGD through secondary treatment and up to 400 MGD through screenings, primary treatment and disinfection, but the WPCP had limitations at the headworks that precluded flows from reaching these levels. Through 2004, the Hunts Point WPCP was generally only able to treat peak flows up to about 260 MGD. As part of CSO reduction activities and as required by the Omnibus IV Consent order, the NYCDEP redesigned the WPCP headworks as part of BNR Phase I upgrades to the WPCP. Headworks improvements included new pumps, headworks influent structures, screens, and influent throttling facility (see Section 3.1.1). These new facilities were installed at a cost of $26.0 million in 2004 as part of a recently completed a major headworks upgrade. To ensure a treatment of 2×DDWF (400 MGD), a new forebay gate chamber to improve throttling of wet weather flows to the plant and an upgrade of the headworks and main sewage pump station (6 new VFD pumps) were accomplished as part of Phase I of the construction upgrade. Since November 2004, the NYCDEP has been going through the start-up debugging efforts of the new headworks equipment. As a result of this construction Hunts Point WPCP experiences peak flows up to 415 MGD as of 2008.

The design capacity of the WPCP allows 1.5×DDWF through the secondary portions of the WPCP. Prior to late 2004, the WPCP passed almost all of the influent flow through secondary treatment as at that time, sustained wet weather flows were generally at or below 265 MGD. Since completion of the headworks improvements in late 2004 and the ability to process influent flows on the order of 400 MGD, the WPCP normally processed about 300 MGD through secondary treatment. Upon completion of the Phase II BNR upgrade in March 2010, the City plans to reduce secondary flows to 1.3×DDWF (260 MGD). This will be the practice at the WPCP since the base sanitary flow is now only about 110 MGD and processing 300 MGD (1.5×DDWF) through the aeration/BRN tanks would upset the process as this would result in a total of 2.7 times the actual dry weather flow being processed. The Citywide Comprehensive Nitrogen Management Plan (March 2001) recommended that the maximum flow through the BNR System is to be 1.2×DDWF along with plant recycles, for a total of 1.3×DDWF. The remaining flow will be diverted as secondary bypass flow, and all flows will receive final chlorination. Model results for this alternative included the plant upgrade and the Bronx River Floatables Control Facilities. Construction began on the Bronx River Floatables Control Facilities in summer 2009 and is discussed further in Section 7.3.4.

The Hunts Point sewer system model indicates that the upgrade reduced overflow volume to the Bronx River by approximately 414 MG per year. The discharge volume was reduced to 500 MG per year at HP-009, 81 MG at HP-007, and 6.5 MG at HP-004. There was minimal affect on the other Bronx River outfalls. The frequency of events was reduced from 56 to 37 per year. The NYCDEP will maintain the Hunts Point WPCP's ability of delivery 2×DDWF (400 MGD) to the plant. Therefore, all subsequent alternatives were modeled to incorporate the improvements to Hunts Points WPCP headworks. As such, the actual cost ($26 million) for this alternative will be included in all subsequent alternatives for comparison purposes only. The cost of the Hunts Point WPCP upgrades will not be included in the total cost of the Bronx River WB/WS Facility. Instead, this cost is included in the East River and Open Waters WB/WS Facility Plan.

7.3.3 System Optimization

Removal of Baffles in CSO 27, 28, and 29

In conjunction with sewer cleaning, the baffle in CSO 28 was removed in the summer of 2007 to reduce excessive build-up of sediments in the regulator and ease operation and maintenance. Prior to the demolition, the baffle hung from the ceiling of the regulator to divert flow over a side weir to outfall HP-004. Removal of the baffle in CSO 28 reduces the discharge from HP-004. This reduction, however, is offset by a comparable increase of discharge in the East River. Effectively, demolition of the baffle transferred flow from poorly mixed waters of the Bronx River to the more well-mixed Upper East River. As such, the effects of the demolition of the baffle in CSO 28 are reflected in all of the modeling results presented in the following sections excluding the baseline modeling results.

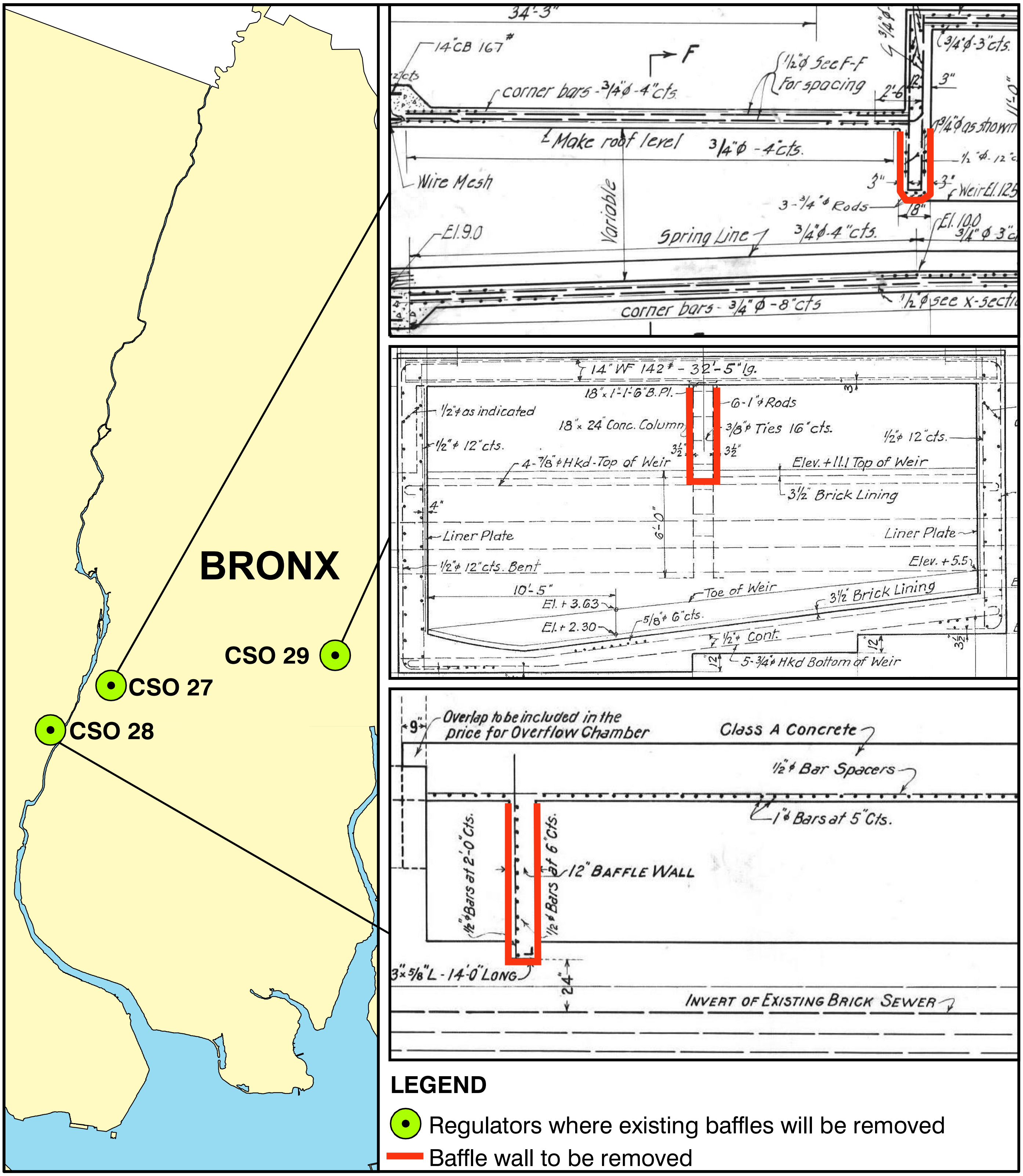
The removal of baffles at CSO 27 and CSO 29 was also investigated as a means to reduce CSO in the Bronx River. However, this alternative has no effect on discharges to the Bronx River and slightly increases discharges to the East River. Therefore, this alternative was not considered further. Figure 7-7 shows the location of the baffles and the modifications evaluated.

Weir Modifications

This alternative involves lowering weir crest elevations at the five regulators, HP-017, 018, 019, 020, and 021, along the southeast portion of the service area to reduce flow to the Throgs Neck Pumping Station in an attempt to transfer flow from poorly mixed Bronx River waters to the Upper East River. Model results indicate, however, that this alternative will not decrease CSO in the Bronx River nor will it result in an improvement in water quality attainment. Therefore, this alternative will not be retained for further consideration.

Close HP-13

This alternative evaluates whether CSO-24 could be modified so that overflows to HP-013 in Pugsley Creek would not increase due to upstream increases in capture and conveyance. The original objective was to convey more flow from CSO-29 and CSO-29A at the head end of Westchester Creek through the collection system without triggering more overflows at HP-013 at the head end of Pugsley Creek. However, the overflow weirs in CSO-24 are already within two feet of the ceiling of the pipe, so blocking those weir openings was presumed to be the only way to reduce overflows to HP-013. Any weir modification at CSO-24 would be constrained both in length (the weir length is effectively a closed loop and cannot be extended) and height (two feet of clearance over a weir is a minimum to avoid clogging). The only opportunity at this location is to close the regulating structure completely and determine whether upstream flooding is exacerbated under design storm conditions.



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System Optimization
Removal of Baffles Alternative

Closure of HP-013 eliminates CSO in Pugsley Creek and transfers this 181 MG to CSO discharges along the Bronx River and the Upper East River. Although this transference of flow might have water quality benefits (debatable considering the increase to the Bronx River) as well as use benefits (ecological restoration and community amenities have been ongoing in the Pugsley Creek open space), there is a fatal flaw: the critical design event shows severe surcharging in the pipes upstream of HP-013 and, thus, increased flooding at certain locations upstream of the outfall. Because of this flooding concern, this alternative cannot be implemented, and is therefore not retained for further consideration.

New Gravity Sewer, Regulator 13 to WPCP

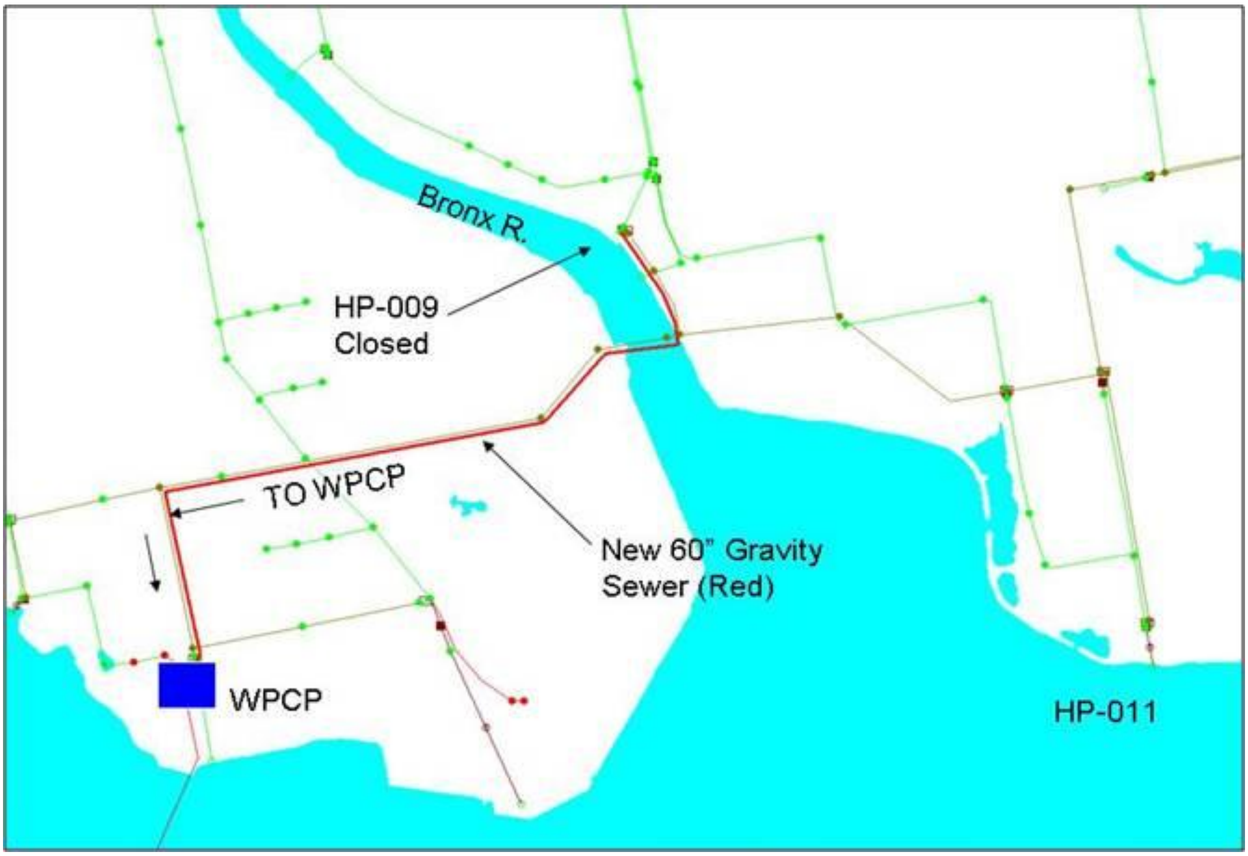
This alternative includes construction of a new 60-inch gravity sewer between Regulator 13 (HP-009) and the Hunts Point WPCP. The sewer would convey flow from the east side of the Bronx River directly to the WPCP wet well, crossing the river near the existing siphon. Figure 7-8 illustrates the approximate route of the new sewer. Model Runs indicate that this alternative will produce a large reduction in CSO volume in the Bronx River of 485 MG beyond what is achieved by Hunts Point WPCP upgrades. However, the reduction will be offset by large increases in CSO volume discharged to the East River and Westchester Creek, 320 MG and 12 MG respectively, and an additional 153 MG of flow to Hunts Point WPCP.

This diversion of CSO flows and point of discharge is due to combined sewer interconnectedness within the Hunts Point sewer system area and the fact that both the existing interceptor from HP-009 to the WPCP and the siphon under the Bronx River have limited capacities. It would be necessary to close HP-009 to generate the driving hydraulic head for gravity flow to occur. Closing outfall HP-009 increases the hydraulic grade line in this existing interceptor, which is expected to be surcharged under wet weather conditions before the outfall closure. This will not be an acceptable approach since flood protection during larger wet weather events may be compromised by the substantial increase in water level that this approach would cause. Additional surcharging upstream in the collection system may cause basement flooding in residences, a significant health risk.

In addition to the flood risks associated with these approaches, constructing a gravity sewer beneath the Bronx River is not a realistic option. The invert elevations of a gravity sewer crossing the Bronx River would have to be constructed at an elevation above the river bed elevation, which would be an unacceptable alignment for numerous reasons. Even if it was constructible, the cost of such an improvement would be disproportionate to its expected environmental benefit. Therefore, this alternative will not be retained for further consideration.

High-Level Interceptor Connection

This alternative involves constructing a new 72-inch high-level relief connection between the Bronx River interceptor and a nearby combined sewer that conveys flow to HP-011. The intent is to relieve the interceptor into the combined sewer, thus transferring CSO from the Bronx River to the East River, which has more assimilative capacity. Since the local combined sewer is approximately 4 feet higher than the interceptor, the interceptor would have to surcharge high enough to convey flow to the local sewer, and for this to occur, the overflow weir at R-13 (HP-



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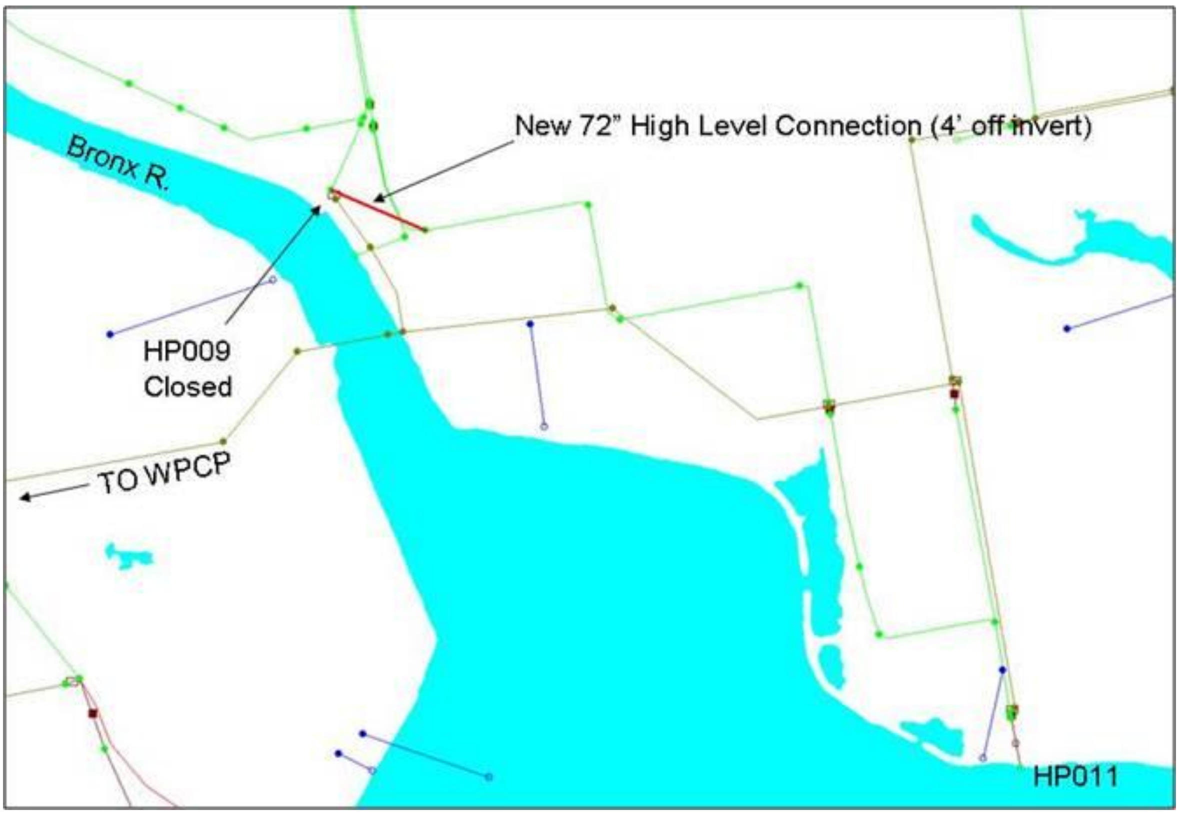
Gravity Sewer Alternative



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High-Level Interceptor Connection Alternative

Bronx River Waterbody/Watershed Facility Plan

FIGURE 7-9

009) would need to be blocked. Otherwise, flow would simply overflow at this regulator (weir crest el. -5.0 ft). Figure 7-9 illustrates this alternative.

Model Results indicate that this alternative will produce a CSO volume reduction during a typical rainfall year of 472 MG per year in the Bronx River beyond what is achieved by WPCP upgrades, but it would increase annual CSO discharge to the East River by 342 MG and flow to the Hunts Point WPCP by 122 MG. It would also be necessary to close HP-009 to generate enough driving head as was the case with the gravity sewer alternative. Blocking overflow HP-009 is not a viable option, given the need for flooding protection during larger wet weather events. This alternative would increase the hydraulic grade line in the interceptor, which is already surcharged. In addition, the net CSO reduction is small because a large portion of the transferred flow discharges to the East River as CSO. Due to the flood hazards and limited environmental benefits associated with this alternative, it will not be retained for further consideration.

New Parallel Interceptor, Bronx River Siphon to WPCP

This alternative involves the construction of a new parallel 60-inch interceptor from the downstream end of the Bronx River inverted siphon to the Hunts Point WPCP wet well. The parallel interceptor size is intended to be consistent with the previous alternative of conveying flow via a 60-inch gravity sewer from HP-009 to the WPCP. The parallel interceptor was assumed to follow the same alignment as the Hunts Point East Interceptor. Model results indicates that this alternative would result in a reduction of annual CSO volume in the Bronx River of only 28 MG beyond what is achieved by WPCP upgrades and an increase in CSO in the East River of 24 MG. Also, this alternative will not improve attainment of water quality standards. This alternative would be very expensive to construct. Due to the lack of benefits to justify the costs, this alternative will not be retained for further consideration.

Wet-Weather Pumping Station from Regulator 13.

This alternative involves constructing a wet weather pumping station (i.e., a facility that only operates to convey storm flows) to lift flow from R-13 to a nearby combined sewer to divert CSO from HP-009. For this alternative, three pump station capacities were analyzed (75, 150, and 250 MGD) to evaluate a reasonable range of CSO captures based on discharge flow rates in a typical year.

Modeling results indicate that this alternative would not capture any additional CSO, but would transfer CSO from the Bronx River to East River. Depending on the pump station capacity, CSO discharge would be reduced in the Bronx River by 249 to 317 MG per year beyond what is achieved by the Hunts Point WPCP upgrades and increase CSO discharges to the East River by a nearly identical amount. This transference would not improve water quality attainment in the Bronx River. In addition, the use of wet weather pump stations (i.e., facilities that only operate to convey storm flows) presents numerous challenges to NYCDEP operational staff, which currently operates and maintains nearly 100 pumping stations City-wide. The biggest challenge is that these facilities generally require large flow capacities and operate relatively infrequently. HP-009 overflows approximately 40 times in a typical year and has a peak flow rate of over 250 MGD. A pump station of this size would be larger than the main sewage pumping station at 9 of the 14 WPCPs in New York City, and would be the largest pumping station in the collection system. Also, because it would be designed to convey a peak flow which occurs infrequently, the pumps would be operating outside their window of optimal efficiency the majority of the time. Total pumping time would be less than 100 hours. As a consequence of these limitations, wet weather pump stations are infeasible from a cost-benefit and operational standpoint. In addition, the pump station would alienate a large portion of Soundview Park in a neighborhood that places a high value on parkland. Therefore, this alternative will not be retained for further consideration.

7.3.4 Floatables Control

The 2004 Bronx River WB/WS Facility Plan recommended that floatables control facilities be provided at CSO Outfalls HP-004, HP-007 and HP-009, within the Hunts Point WPCP drainage area, to minimize the discharge of unsightly floatable material. For CSO Outfall HP-004 the recommended floatables control facility consists of in-line netting within a new conduit located upstream of the outfall along West Farms Road. Mechanical screens within Regulators 27 and 27A located upstream of the outfall were proposed for CSO Outfall HP-007. The floatables control facility recommended for CSO Outfall HP-009 consists of in-line netting within Regulator 13, located within Soundview Park upstream of the outfall. Design of the Bronx River floatables control facilities was completed in July 2008. The construction contract has been awarded and the Notice to Proceed for the start of construction was issued summer 2009. The actual contractor bid price for the Bronx River Floatables Control Facilities was received in February 2009 for $26.4 million. This construction bid price is further escalated to December 2009 ($28.7 million) for comparison purposes only in Section 7.

There will not be a need for full time staff dedicated exclusively to the floatables control equipment. However, operation and maintenance of the Bronx River floatables control facilities will include the following additional items described in Table 7-6.

Table 7-6. Floatables Control Facilities Annual O&M Costs

Category	Discipline/Item	Quantity per year	Unit	Unit Rate	Cost per year	Note(s)
Labor	Crew chief	270	M-H	$50.00	$13,500	
	Laborer	640-	M-H	$35.00	$22,400	Hours are split between 3 laborers
Equipment	Vehicle with boom, hoist, dumpster, pressure washer	1	Truck	$225,000.00	$47,736	Annualized distribution over 5 years
Material	Nylon nets	264	Nets	$275.00	$72,600	$175 per net plus $100 per net for disposal
	Hydraulic oil and filters	1	Year	$400.00	$400	Service Year
				Total	**$156,636**	

An additional floatables project under consideration is one that was identified by the community during the stakeholder process. The NYCDEP has installed a floatables containment boom within the Bronx River to contain CSO, stormwater and upstream floatables from exiting the Bronx River and entering the upper East River. The configuration of the boom is such that it stretches across the entire river and retains all materials floating on the surface. This configuration is an obstruction to boats and prevents canoes and kayaks from passing the boom. During the stakeholder process, the community requested that if the NYCDEP were to keep the boom for floatable control, that they modify the boom to allow for passage of boats. The NYCDEP has developed a possible alternative configuration that will both retain floatables and will allow recreational boaters to pass from downstream to upstream. This boom modification will be revisited during LTCP development after the proposed floatables control facilities have been in service for a period of time.

Figures on the proposed floatables facilities are included in Section 8.

7.3.5 Green Alternatives / Low Impact Development (LID)

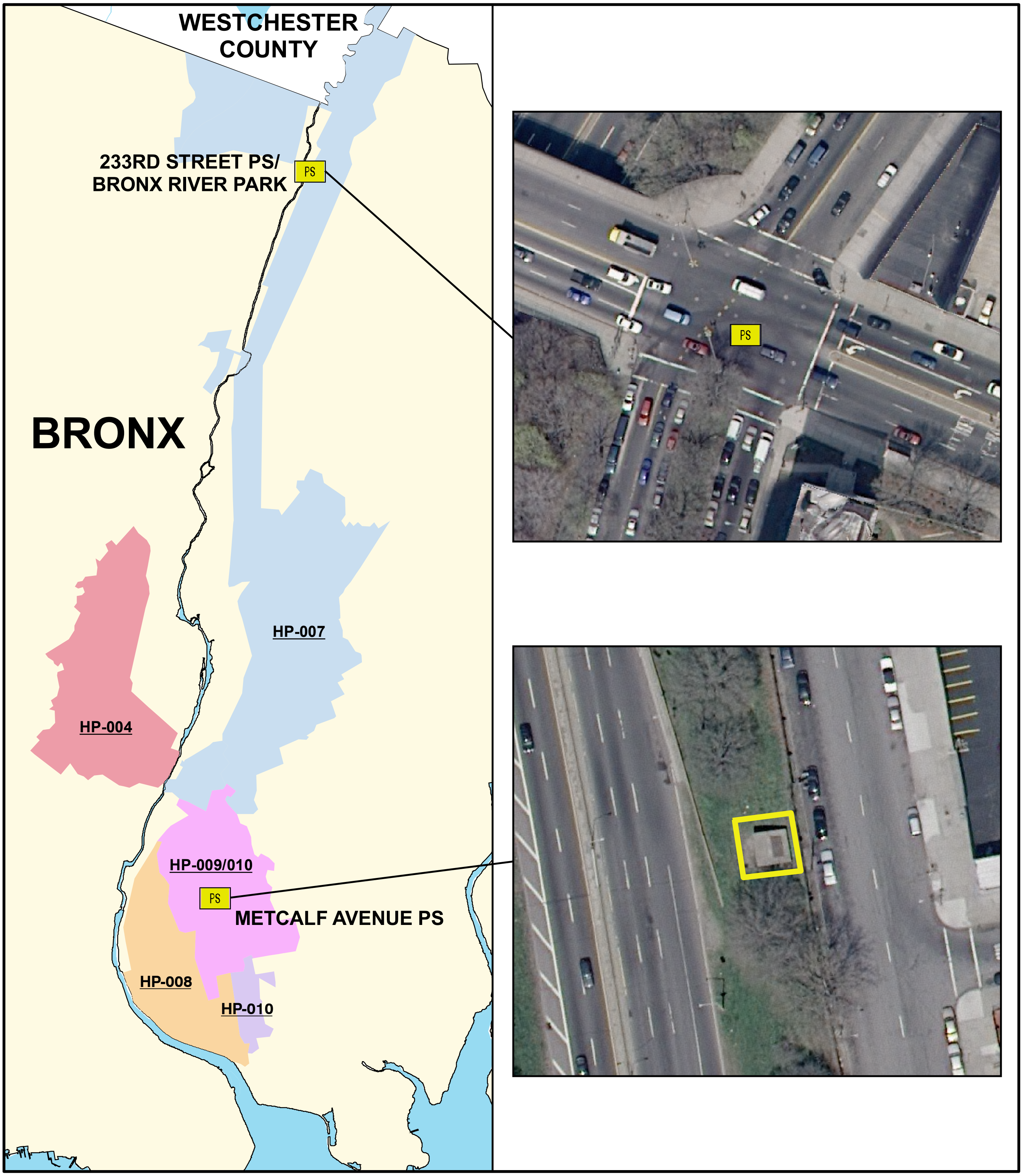
Public comments indicated a preference for consideration and inclusion of Low Impact Development (LID). LID technologies are described in detail in Section 7.2. Examples of such facilities include biofilters, tree planting, rain gardens, sand filters, porous pavement, storm water detention, rooftop greening and others. LID technologies have positive benefits of storm water control, and can also have quality of life and other benefits. However, there are implementation issues associated with LIDs. To apply LID technologies current properties may require substantial modification. This would pose a problem because the City of New York is highly developed and most areas are privately owned. The most practical and cost effective way to implement LID is during redevelopment and the construction of new developments.

For this evaluation, NYCDEP considered properties under its jurisdiction. The alternative involved analyzing NYCDEP-owned facilities located in the Bronx River combined sewer shed drainage area to determine potential LID techniques that might be suitable for the facilities.

The Bronx River drainage area contains two NYCDEP Pump Stations, 233rd Street and Metcalf Avenue. The 233rd Street station is underground and the Metcalf Avenue station has a small above-ground building located on a grassy highway median as shown in Figure 7-10. Therefore neither is a suitable candidate for LID, since one is completely underground and the other has only a small impervious area, the roof, which already drains to a grassy area. There are no other NYCDEP-owned facilities in the combined sewershed.

However, the NYCDEP will continue to review opportunities for the use of LID technologies. Additional research into BMPs will be conducted to assess the potential benefits for CSO reduction and water quality improvement through the recently initiated Jamaica Bay Watershed Protection Plan (JBWPP) effort described in Section 5.9.

The findings of that effort will be utilized by the NYCDEP when working with communities and private development throughout the City. NYCDEP will look for opportunities to work with the Bronx community to identify sources of funding to possibly pilot BMPs identified in the JBWPP effort.



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NYCDEP Facilities within the Bronx River Sewershed

Bronx River Waterbody/Watershed Facility Plan

FIGURE 7-10

As discussed in Section 5.9, NYCDEP is currently implementing an Environmental Benefit Project (EBP) in the Bronx River as well as in Flushing and Gowanus to quantify BMP performance. A total of $850,000 will be used from the EBP Fund to construct various green infrastructure technologies at a specific two-block location within the Bronx River watershed. The Bronx River watershed field survey analyses are underway, and detailed information resulting from the analyses will be submitted to NYSDEC for review and comment prior to submitting a *Stormwater BMP Location Plan* which will identify the technologies to be built. Construction should begin in 2010 with a three-year monitoring period to follow.

7.3.6 Real Time Control (RTC)

The following real time control (RTC) alternatives discussed previously in Section 7.2 were investigated for the Hunts Point collection system in order to reduce CSO discharge to the Bronx River. Figures 7-11 through 7-13 show the locations of the RTC alternatives investigated.

Automation of Regulators

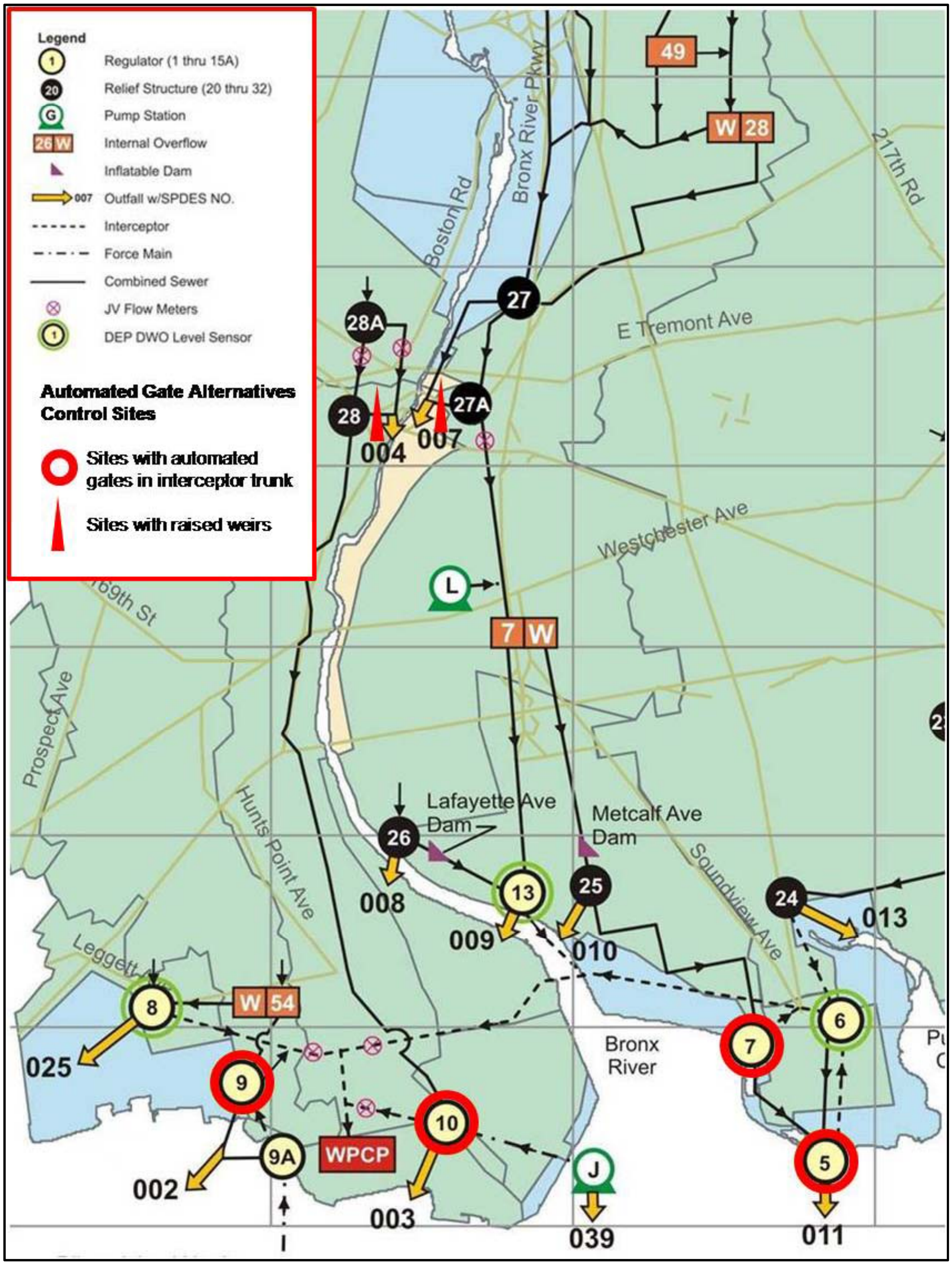
This alternative includes the application of real-time control to a number of regulators in the Hunts Point system. A sluice gate at each location would be controlled based on the flow rate at the regulator. If the flow conveyed into the interceptor trunk increased by a certain amount, the gates would begin to close. The goal is to make volume available within the interceptor in order to convey more CSO to the East River, and thereby reduce CSO in the Bronx River. Automation of Regulators 5, 7, 9, and 10 were evaluated separately. Automation of Regulator 9 was also evaluated in conjunction with raising the weir heights in CSO 27A and CSO 28 by 12-inches and 24-inches respectively to create additional in-line storage. The locations of these sites are depicted in Figure 7-11.

Except for the automation of Regulator 5, which has minimal effect, the automation of Regulators 7, 9, and 10 is expected to reduce CSO to the Bronx River as shown in Table 7-7. Table 7-7 also shows the increase in CSO to the East River as a result of implementing these alternatives. The automation of the regulators, except for Regulator 10, has little effect on the flow conveyed to the WPCP. Automating Regulator 10, which is closer to Hunts Point WPCP, reduces the flow to the plant by 41 MG per year.

Table 7-7. Estimated CSO Reduction by Implementing Regulator Automation Alternatives [1, 2, 3, 4, 5]

Alternative	CSO Volume Reduction (MG/yr)					
	HP-004	HP-007	HP-009	Total Bronx River CSO Reduction	Total East River CSO Reduction	Total WPCP Flow Reduction
Automation R-7	0	0	6	6	-10	2
Automation R-9	0	0	21	21	-24	-3
Automation R-10	0	0	12	12	-55	41
Automation R-9 + Raised Weirs	3	15	8	25	-28	-3

Notes: (1) Reductions beyond those achieved by WPCP upgrades.
(2) Negative volume denotes volume increase.
(3) Minimal volume changes were experienced at HP-008 with all options.
(4) Minimal volume reductions were experience at HP-010 with automation of Regulators 9 and 10. A minimal volume increase was experienced at HP-010 for automation of Regulator 7.
(5) Totals may not sum precisely due to rounding



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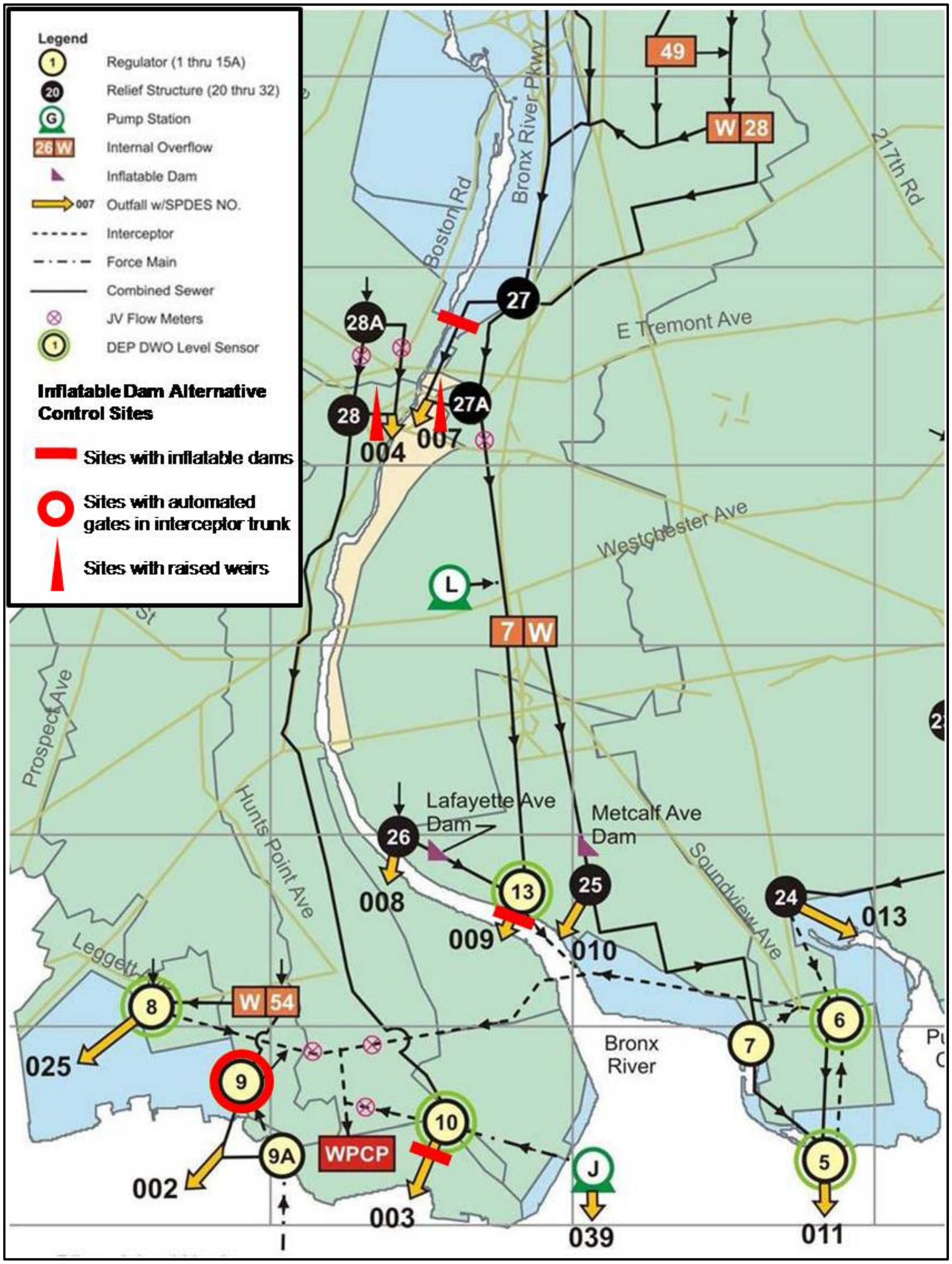
Regulator Automation RTC Alternatives

Inflatable Dams

This alternative involves additional in-line storage (ILS) within the Hunts Point CSS. ILS is a viable alternative to retain combined sewer overflows. ILS is basically the utilization of the available storage volume within the combined sewers upstream of diversion structures such as regulators. This storage can be utilized by "holding back" the combined sewage during wet weather through dynamic blockades in the combined sewers, thus reducing the overflows. One of the most effective means for ILS is inflatable dams. An inflatable dam is constructed from a nylon-reinforced, ethylene-propylene (EPDM) rubber compound. The dam is installed in a sewer by simple components such as stainless steel clamps and a bolting mechanism without causing any major damage to the sewer structure itself. The dam is inflated using air delivered from a high-capacity low-pressure blower. When fully inflated, the rubber fabric forms a broad-crested transverse weir. The dam is deflated by valves equipped with electrical actuators. When fully deflated, the dam collapses to take the form of the sewer in which it is installed. The dams can be full closure or partial closure.

In the Bronx River drainage area, three areas were identified as potential sites for the installation of inflatable dams. One site is in the 10-foot×8-foot sewer pipe just downstream from CSO 27. The second potential site is in the 14-foot×8-foot sewer downstream of Regulator 13 and before Outfall HP-009. The third and final site identified for in-line storage was downstream of Regulator 10, which feeds Outfall HP-003. In order to provide additional in-system storage and ensure the performance of the inflatable dams, it was proposed to raise the overflow weirs of CSO 27A and CSO 28. Modifying the weir in CSO 27A such that it is equivalent to raising it by 12-inches was investigated and found to decrease the volume of combined sewage that discharges to HP-007. Modifying the weir in CSO 28 such that it is equivalent to raising it by 24-inches was investigated and found to reduce overflows from HP-004. In addition, a second inflatable dam alternative was investigated that also included the automation of Regulator 9. The locations of the sites for each control are depicted in Figure 7-12.

The PTPCs for implementing these alternatives for the Bronx River is estimated at approximately $19.8 million for the inflatable dams and weir modifications and approximately $21.1 million for the alternative with the inflatable dams and weir modifications plus the automating Regulator 9. Implementing the inflatable dam alternatives is expected to reduce annual average CSO volume to the Bronx River as shown in Table 7-8. No reduction occurred at HP-008, HP-010, or HP-004 with either of the inflatable dam alternative implementation. Expected annual average CSO volume reductions in the East River as a result of the inflatable dam alternatives are also shown in Table 7-8.



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Inflatable Dam RTC Alternatives

Table 7-8. Estimated CSO Reduction by Implementing Inflatable Dam Alternatives (1, 2, 3, 4)

Alternative	CSO Volume Reduction (MG/yr)				
	HP-007	HP-009	Total Bronx River CSO Reduction	Total East River CSO Reduction	Total WPCP Flow Reduction
Inflatable Dams + Raised Weirs	24	58	82	53	-133
Inflatable Dams + Raised Weirs + Automation R-9	24	90	115	12	-131

Notes: (1) Reductions beyond those achieved by WPCP upgrades.
(2) Negative volume denotes volume increase.
(3) Minimal volume changes were experienced at HP-004, HP-008, and HP-004 with all options.
(4) Totals may not sum precisely due to rounding

Inflatable dams have several disadvantages. Certain purchase, installation and operation and maintenance issues must be considered prior to selecting any plan that uses inflatable dams. At other locations in the city where inflatable dam systems were considered, acquiring a bidder was difficult. Competition in the market has diminished. Previously, there were two manufacturers of inflatable dam systems, Sumitomo and Bridgestone. These companies manufactured and serviced the parts for inflatable dam systems. For the foreseeable future, Bridgestone will no longer manufacture the dam fabric. Sumitomo has curtailed direct service in the United States market, although a third company, Dyrhoff, has purchased the rights to furnish Sumitomo dam systems in the United States. Dyrhoff also has located a fabric supplier from China that can supply fabric similar to Bridgestone's, although they cannot use the Bridgestone clamping arrangement and there are no tests of the Chinese fabric or tests of a hybrid Sumitomo clamp/Chinese fabric combination in New York City. Essentially, there would be only one potential distributor with one tested system. This creates a problem purchasing the system and does not ensure a reliable supply of replacement parts. Furthermore, inflatable dams will at times cause static water levels in the sewers causing sediment to eventually accumulate over time. Confined space entry with a front end loader would be required to remove this sediment.

Bending Weirs

Four bending weir alternatives were investigated for the Bronx River. The alternatives consisted of a bending weir at HP-009 alone, bending weirs at both HP-009 and HP-011, and a bending weir at HP-009 along with two combinations of regulator automations. A bending weir has the effect of raising the weir height during smaller storms. However, during larger storms they "bend" out of the way to pass the larger overflows. The bending weir is designed to ensure that a constant maximum storage level is maintained upstream so that full utilization is made of all the available upstream storage capacity.

The proposed bending weir would be operated based on a real-time control rule that initiates bending when the hydraulic grade line reaches elevation -1.0 feet BSD. Implementing a bending weir for HP-009 includes installing a new four foot high bending weir at Regulator 13 mounted with its hinge at the existing weir crest level (el. -5.0 ft BSD) and occupying the same width as the existing weir (21 ft). A similar bending weir would be installed in Regulator 5 to reduce flows to HP-011. The alternatives were analyzed to evaluate the synergistic impacts of several modifications to the system. Table 7-9 shows the CSO reduction expected from the implementation of each alternative and also the effect that each alternative will have on CSO to the East River and flow to the WPCP. The locations of each control for the bending weir alternatives are depicted in Figure 7-13.

Table 7-9. Estimated CSO Reduction by Implementing Bending Weir Alternatives [1, 2, 3]

Alternative	**CSO Volume Reduction (MG/yr)**		
	Total Bronx River CSO Reduction	**Total East River CSO Reduction**	**Total WPCP Flow Reduction**
BW HP-009	61	-21	-40
BW HP-009 + HP-011	43	63	-105
BW HP-009 + Automation of R-5 & R-7	67	-31	-37
BW HP-009 + Automation of R-5, R-6, & R-7	265	-2,672	2,581

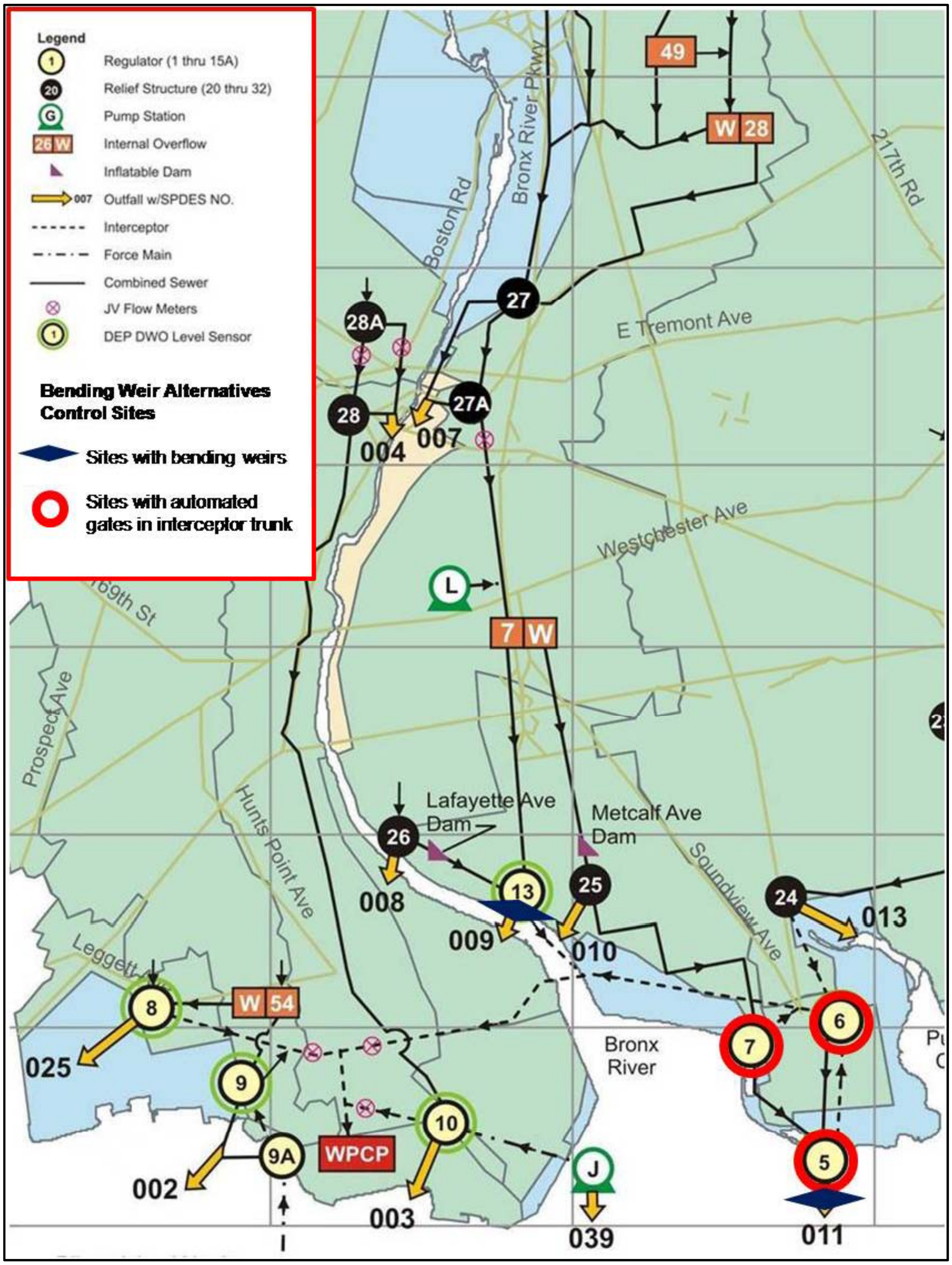
Notes: (1) Reductions beyond those achieved by WPCP upgrades.
(2) Negative volume denotes volume increase.
(3) Minimal volume changes were experienced at all Hunts Point outfalls besides HP- 009.

Installing a bending weir on HP-009 achieves a moderate reduction of CSO in the Bronx River along with a relatively small increase in CSO to the East River and flow to Hunts Point WPCP. However, this alternative would not provide further attainment of water quality standards. There is minimal benefit to adding a bending weir at HP-011. The CSO reduction is less in the Bronx River than with a bending weir on HP-009 alone. Automation of Regulators 5 and 7 also provide minimal benefit beyond what is achieved by a bending weir at HP-009 alone. The addition of automation at Regulator 6 increases the CSO volume in the East River dramatically and will, therefore, not be retained for further consideration.

A bending weir at HP-009 has the potential to reduce CSOs in the Bronx River at a moderate cost. However, implementation of the bending weir is contingent upon further hydraulic analysis and constructability evaluation. In addition to determining the likely CSO reduction, analyses would need to be performed to evaluate the potential for flooding in the service area as a result of installing bending weirs. Assuming the hydraulics are feasible, the constructability of the weir within the existing regulator structure would need to be evaluated. The construction of the bending weir in Regulator 13 will be subject to approval of the NYCDEP Bureau of Water and Sewer Operation and NYCDEP Bureau of Wastewater Treatment and to a successful pilot test of bending weir technology by BWT. Therefore, bending weirs are not included within this plan but will be reconsidered during the development of the Drainage Basin Specific LTCP.

7.3.7 CSO Storage Facilities

As described in Section 7.2.6, CSO storage facilities include closed concrete tanks, storage pipelines/conduits, and deep tunnels. Several plans involving storage conduits and tanks were considered for the Bronx River. As described in Section 5.6, the 2003 Bronx River CSO Facility Plan recommended a 4.0 MG storage conduit to capture and store CSO from outfall HP-007. However, the 2004 Bronx River WB/WS Facility Plan eliminated this element from the facility plan because the storage conduit was not expected to improve attainment of water quality



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Bending Weir RTC Alternatives

standards. Thus, the high cost for such a facility could not be justified. Storage tanks were also considered, but these alternatives were determined to be potentially infeasible due to siting restrictions along the Bronx River. Specifically, the proximity of HP-009 to Soundview Park limits the type of CSO control that can be considered for this outfall. Tunnel storage was identified as potentially more feasible and effective than tank or conduit storage. A tunnel does not have the same site requirements as a tank and has the potential to mitigate CSO more effectively than other storage alternatives because it is able to capture CSO from multiple outfalls.

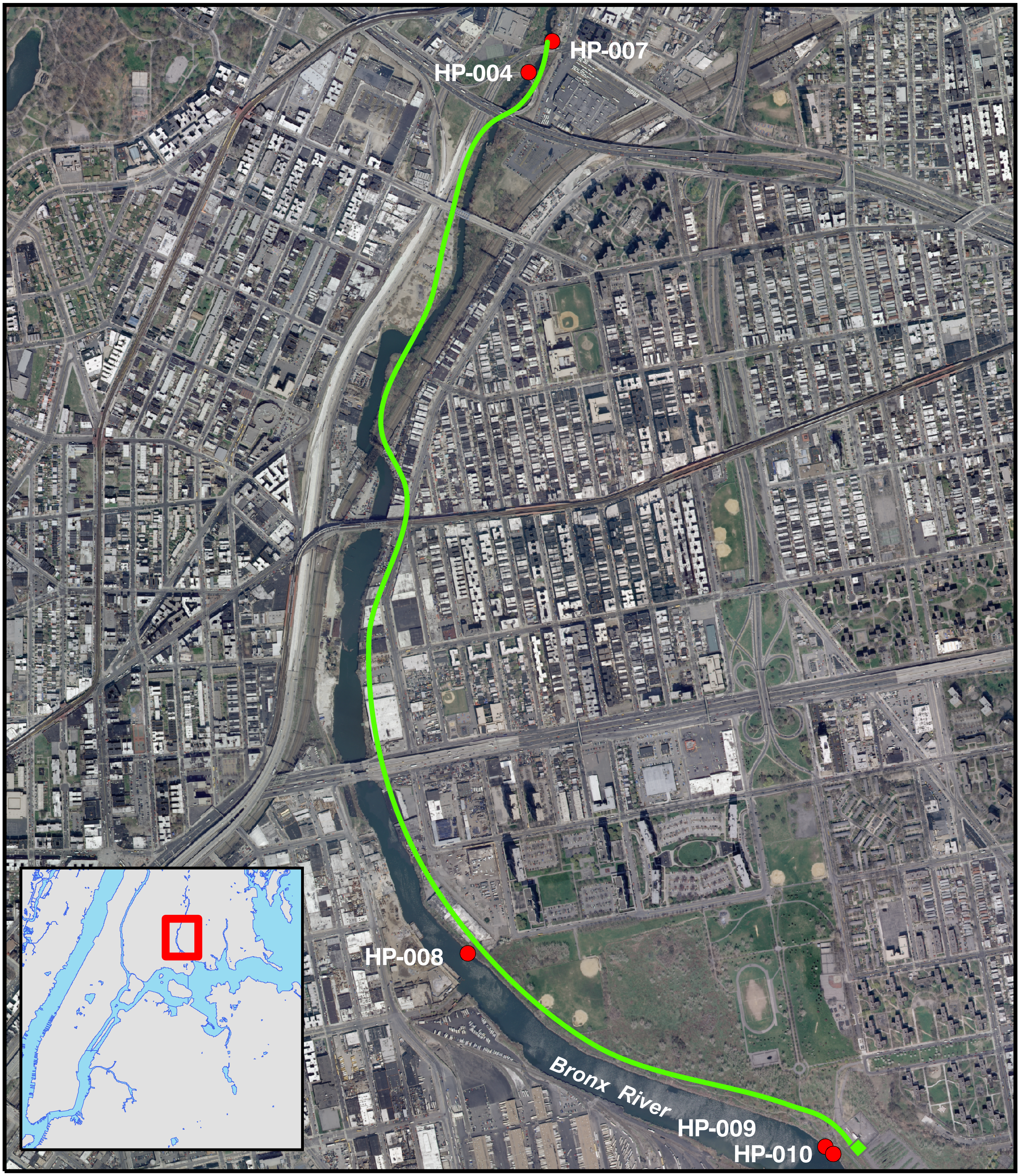
Tunnel systems were evaluated to reduce CSOs in the Bronx River to a range of 0 to 12 overflow events per year and the associated percent reduction in overflow volume was calculated. The geology of the area surrounding the Bronx River allowed for the use of rock tunnels. The type of bedrock in the vicinity of the Bronx River outfalls of concern is Hartland Formation (Middle Ordovician to Lower Cambrian). Tunnels are similar to storage pipelines that provide significant storage volume in addition to offering the ability to convey flow. Excavation to construct the tunnel is carried out deep beneath the City, and would therefore not impede traffic during construction and operation. This alternative includes the connection of the active Outfalls HP-007, HP-004 and HP-009, with drop shafts and deaeration chambers to the tunnel to store overflows from the collection system. Regulator structures at CSO locations would direct overflow to drop shafts and into the tunnel. After the storm event, the tunnel would be dewatered via a dewatering pump station over a period of 24 hours, with the stored wastewater being sent to the Hunts Point WPCP for treatment. Figure 7-14 illustrates the rock tunnel system alignment for the Bronx River. Table 7-10 shows the volume required and the overflow volume remaining after implementation, the percent reduction from the baseline and the probable total project costs (PTPC) adjusted to December 2009 dollars..

Table 7-10. Storage Tunnel Alternatives Analysis

Overflow Events (#/yr)	Tunnel Volume (MG)	Overflow Volume Remaining (MG/yr)	Percent Reduction (MG/MG)	PTPC ($M)
12	20.3	156	72.0%	$693.9
8	27.1	101	81.9%	$743.3
4	37.3	42	92.5%	$842.2
0	55.6	0	100%	$1,010.6

7.3.8 Partial Sewer Separation

The construction of High Level Storm Sewers (HLSS) is one partial sewer separation strategy that would alleviate pressure on the combined sewer system and limit CSO events. Recent initiatives by NYCDEP have led to the implementation of HLSS installation in targeted areas where they would be beneficial. HLSS are created by removing the catch basin connections from the combined sewers under streets or in the public right-of-way and connecting to a new storm sewer. This new storm sewer would divert flows directly into the waterways through permitted outfalls, reducing the volume of flows that pass through the treatment plants and the combined sewer system. In addition, they alleviate street flooding in problematic areas. In developed combined sewer areas where the replacement of existing old combined sewer systems with separate storm and sanitary sewers is not feasible, like in the Bronx River sewershed, HLSS



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Bronx River Waterbody/Watershed Facility Plan

Storage Tunnel Alternative

FIGURE 7-14

build-out may be an alternative. However, since HLSS require the construction of a separate pipe and outfall, this strategy is only cost-effective for developments near the water's edge.

NYCDEP will continue to analyze development sites in the Bronx River drainage area on a case-by-case basis to determine the appropriateness of this strategy.

7.3.9 Treatment Technologies

High Rate Physical Chemical Treatment (HRPCT)

High rate physical chemical treatment (HRPCT) is an effective treatment alternative at CSOs with high instantaneous flow rates. HRPCT would be a viable alternative for HP-009, which discharges over 800 MG during a typical year. However, due the high flow rates that discharge from HP-009, a large HRPCT facility would be required. Siting restrictions along the Bronx River prevent the implementation of alternatives that require a large footprint. Therefore, this application of HRPCT will not be retained further for the Bronx River.

Another effective way to apply HRPCT is as a component of a large storage tunnel. Under this configuration, the tunnel's pumping station would discharge to a HRPCT facility located on the same site as the pump station, which would then discharge directly to the waterbody. Such configuration would allow dewatering of the tunnel to be independent of the available capacity at the WPCP. As such, dewatering could start at the onset of a capture event and run throughout the event until it is over and the tunnel is fully dewatered. This configuration thus reduces the required tunnel volume or the required HRPCT capacity that would otherwise be required by either of these stand alone technologies. This application of HRPCT is only considered a cost-effective application for very large tunnels or where WPCP capacity is consistently at 2×DDWF even when wet-weather is over. A HRPCT component was not considered for the tunnels analyzed in 7.3.7 because of their relative small size and the determination that flow to Hunts Point WPCP will recede below 2×DDWF after a storm event. Also, siting restrictions would make the addition of a HRPCT facility to the proposed configuration of a Bronx River tunnel potentially infeasible. Consequently, HRPCT is not retained for further consideration.

Disinfection Technologies

Three disinfection technologies were preliminarily evaluated based upon technical feasibility, effectiveness, adverse side effects (e.g., residuals), and comparative cost. Chlorination, the least expensive of the three technologies by far, has the advantages of low complexity, adequate contact time, and NYCDEP experience. The other two, ozonation and ultraviolet light (UV) exposure, have had successful applications in the potable water and wastewater industry at treatment plants, but are relatively untested technologies for CSO on the scale necessary for the Bronx River. Chlorine disinfection using sodium hypochlorite was considered the preferred option because of its demonstrated ability and because of the high costs associated with UV and ozonation.

The actual ability of a disinfection system to perform consistently, when applied to a CSO discharge, remains a technical challenge in the industry and is a subject that the NYCDEP has investigated on several occasions. The highly variable nature of CSO flows and water quality (i.e., chlorine demand) would make it difficult to flow pace chlorine addition to maintain the appropriate dosage for disinfection. Because total residual chlorine (TRC) is toxic to the aquatic ecosystem and has a marine standard of 7.5 micrograms per liter, and because there is presently a lack of a defined spatial or time-variable mixing zone, dechlorination would be required. The dechlorination operation envisioned would use sodium bisulfite, and would require virtually no residence time. However, the same difficulties noted above for a chlorination system would apply to a dechlorination system as well. Use of this technology could result in fluctuating chlorine and sodium bisulfite feeds that may not be appropriately timed and, as a result, could potentially discharge ecologically damaging levels of these chemicals in receiving waters whenever the system was utilized.

Even if it was possible to establish flow pacing control, the required level of disinfection (the kill rate) remains undefined at this time. The disinfection operation would need to be highly automated to ensure proper disinfection of all overflows whenever they may occur. This would add a substantial degree of complexity to the operation. It should be noted that siting disinfection facility in the vicinity of HP-004 and HP-009 appears to be very difficult, based on limited space at HP-004 and placing a disinfection facility at HP-009 would impact Soundview Park during construction and require chemical deliveries through the park for operations.

Regardless of these caveats, the feasibility of applying disinfection systems at the major active overflow location in the Bronx River (outfall HP-009) was evaluated to determine whether primary contact bacteria concentrations could be attainable without exceeding the toxic limits of TRC in the receiving water. Findings in regard to primary contact attainability are discussed in Section 9.

An effluent TRC of 1 mg/L was assumed for these analyses, a conservative value in the sense that dechlorination may yield a much lower number but operational difficulties could lead to higher effluent TRC concentrations. A 2-log-kill of total coliform, fecal coliform, and enterococci was assumed to be attainable.

Chlorine residual in a receiving waterbody is toxic to aquatic life survival and NYSDEC water quality standards require chlorine residuals to never be greater than 13ug/l for acute protection and the 4-day running average to never be greater than 7.5 μg/l for chronic protection. A model simulation was performed assuming disinfection at CSO 009. The results of the modeling analysis indicate that chlorine residual concentrations near the outfall location could reach levels of about 130 μg/L for a typical storm event, about ten times greater than the acute standard. Calculated TRC concentrations that are greater than the standard during an event extends for about ½ mile in each direction around the discharge; giving a total impacted area of about one mile. The extent of impacted areas would increase if CSO outfalls 004 and 007 were also disinfected with chlorine. Because this system has a high potential to result in toxic TRC levels in the Bronx River and is not needed to attain current water quality standards, disinfection was eliminated from consideration as a component of the WB/WS Facility Plan.

7.4 WATER QUALITY BASED ALTERNATIVES ANALYSIS

7.4.1 Freshwater Bronx River

As indicated in Section 7.1 and discussed in more detail, in Section 4 the water quality pollutants of concern in the freshwater section of the Bronx River are pathogens as they currently have been observed to exceed the numerical limits of 2,400 org/100ml. Dissolved oxygen concentrations in the freshwater river were in compliance with the Class B requirements.

New York City does not discharge any combined sewage into the freshwater section of the river. As such, no CSO controls would be required. As discussed in Section 3.2.4, New York City discharges stormwater into the freshwater portion of the Bronx River through four SPDES permitted MS4 outfalls. Stormwater also runs off into the Bronx River from the adjacent Bronx Zoo, New York Botanical Gardens, and Woodlawn Cemetery.

Section 4.5.2 describes an analysis which was performed to determine the relative importance of various bacteria sources on the non-compliance with numeric standards in the NYC freshwater Bronx River and what levels of reduction are required to attain primary contact standards. The analysis indicates that greater than 90% of the bacteria loading to the NYC freshwater Bronx River originate from upstream inflow at the Westchester/Bronx border. Further, it is estimated that on the basis of available data, a 98% reduction in the geometric mean fecal coliform bacteria concentration at this location is required in order to attain the numeric primary contact water quality standard.

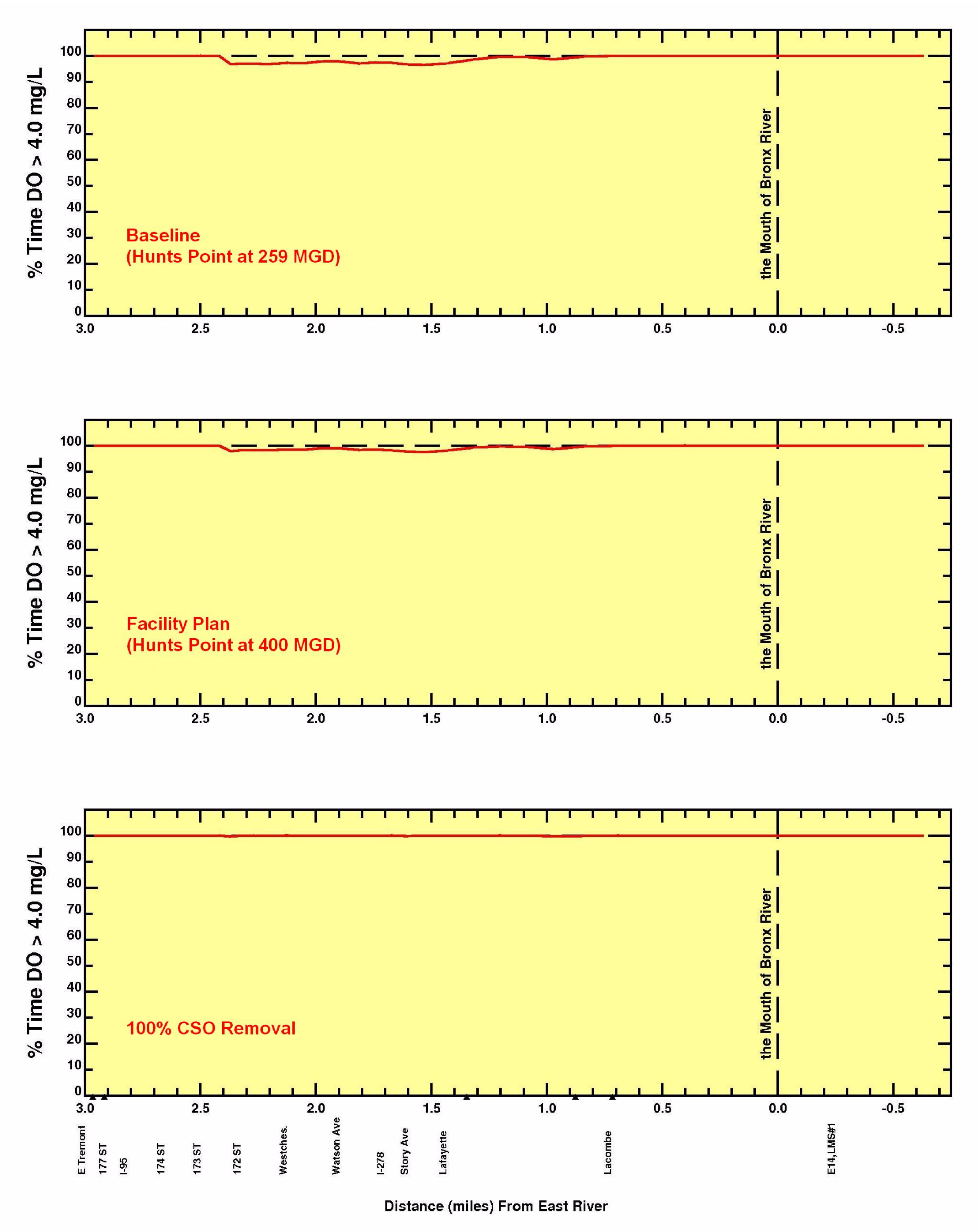
7.4.2 Tidal Bronx River

In the tidal river, both dissolved oxygen and pathogens have been shown to be pollutants of concern. Figure 7-15 presents modeled compliance with the existing dissolved oxygen standard for baseline conditions, Hunts Point WPCP upgrade, and complete CSO removal. Little difference between the alternatives and the baseline is discernable.

The factors influencing dissolved oxygen balance in the Bronx River include the following:

- CSO Carbon and Nitrogen
- CSO Dissolved Oxygen Deficit
- Stormwater Carbon and Nitrogen
- Stormwater Dissolved Oxygen Deficit
- East River Dissolved Oxygen Deficit
- East River Carbon and Nitrogen Load
- Freshwater (upstream) Dissolved Oxygen Deficit
- Freshwater (upstream) Carbon and Nitrogen
- Algal Photosynthesis and Respiration

The dissolved oxygen in a water body results from the overall combination of sources of dissolved oxygen and the effects of materials whose stabilization in the aquatic environment uses oxygen. The amount of oxygen that can be dissolved in water is called the dissolved oxygen saturation concentration; DO saturation is a function of temperature and salinity. The difference between the actual dissolved oxygen concentration and the saturation value is called the dissolved oxygen deficit.



Bronx River
Dissolved Oxygen Compliance

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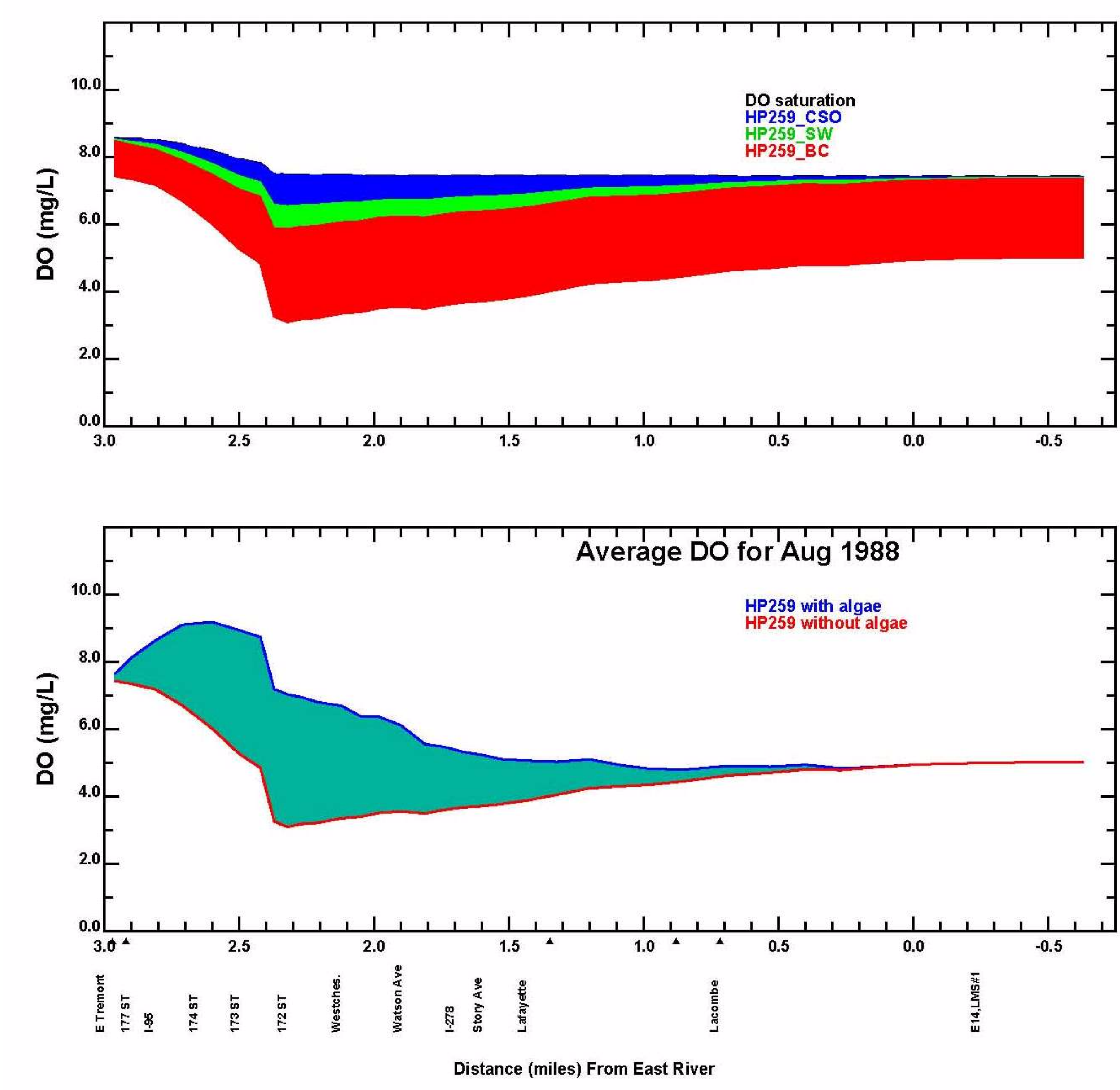
In the Bronx River, the algal influences provide a net increase in dissolved oxygen (a decrease in dissolved oxygen deficit). Since the purpose of the analyses is to determine the factors causing dissolved oxygen depletion, the effects of all algal influences were initially removed from the model calculation.

The remaining factors act to reduce dissolved oxygen (increase the dissolved oxygen deficit) and were evaluated for their relative importance. These factors were grouped into three major components: CSOs, stormwater, and boundary conditions (upstream freshwater and the East River. The carbon and nitrogen sources from CSOs, stormwater, and boundary conditions are considered "loads" to the Bronx River. It is noted that the dissolved oxygen concentration of these components waters that enter the Bronx River also influence dissolved oxygen balance. The difference between dissolved oxygen saturation and the dissolved oxygen of these waters is their DO deficit. Therefore, the DO deficit associated with each component is also included in the component analysis.

The Bronx River baseline condition for was used as the basis for the analysis. The month of August was selected for the analysis. Each component loading and DO deficit source was individually simulated at baseline conditions. For example, to evaluate the effect of CSO carbon, nitrogen loads and DO deficit, the Bronx River Model was run with only these loads; all other loads were set equal to zero and the DO from the other components were set equal to saturation (deficit = 0.0). The average DO for each component is calculated for the month of August. Then, the difference between the resulting DO and the water column saturation is calculated; this difference is the DO deficit caused by the respective component. For example, if at a certain location the calculated DO for the CSO component is 6.0 mg/L and the saturation value at that location is 7.0 mg/L, then the DO deficit due to the CSOs at that location is 1.0 mg/L.

The results of the analyses are shown on Figure 7-16. The top panel of the figure shows the dissolved oxygen effect of the three components acting to reduce the Bronx River dissolved oxygen. These results are for the bottom layer of the model. The top line on the figure is the DO saturation as calculated from salinity and temperature. The saturation at the head end of the model (river mile 3.0) is higher than the downstream areas because the salinity upstream is lower than the salinity downstream. Each of the three components is then subtracted sequentially from first, saturation, then from the resulting DO of the previous subtraction. Therefore, in the figure, the blue area represents the DO deficit due to CSOs, the green area represents the DO deficit due to stormwater, and the red area represents the DO deficit due to the boundary conditions. In this way, the bottom line on the figure represents the calculated dissolved oxygen concentration with all components in the simulation. As shown in Figure 7-16, the relative importance of each component is demonstrated. For example, at river mile 2.3, the calculated dissolved oxygen concentration is about 3.2 mg/L with a saturation value of about 7.5 mg/L, for a total deficit of 4.3 mg/L. From the figure, it shown that of the total deficit of 4.3 mg/L, about 1.0 mg/L is from CSOs, 0.7 mg/L is from stormwater, and 2.6 mg/L is from the boundary conditions.

As discussed earlier, the algal influences were removed from these component simulations. However, the influence of the algae can be determined by the difference of the DO concentrations between the total Baseline run with algae, and the simulation without algae. These results are shown on the bottom panel of Figure 7-16. The top line is the DO of the total



Bronx River Dissolved Oxygen Components for August 1988

New York City
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Dissolved Oxygen Deficit Component Analysis Bronx River

simulation with algae and the bottom line is the simulation without line; the bottom line is the same as that shown in the top panel. Therefore, the shaded area in the bottom panel represents the algal influence. Therefore, as demonstrated on the figure, the overall algal influence in the Bronx River has a net positive impact on DO concentrations.

Figure 7-17 shows the compliance with secondary contact standards with baseline upstream loads from the freshwater Bronx River and indicates that only a small section immediately adjacent to the fresh water section does not currently meet standards. As discussed in Section 4, improvement in the upstream conditions is necessary to attain standards in this small section of the tidal river. When upstream conditions meet Class B compliance, as shown in Figure 7-18, the entire tidal section of the Bronx River meets Class I standards. Therefore, disinfection or other alternatives are not needed.

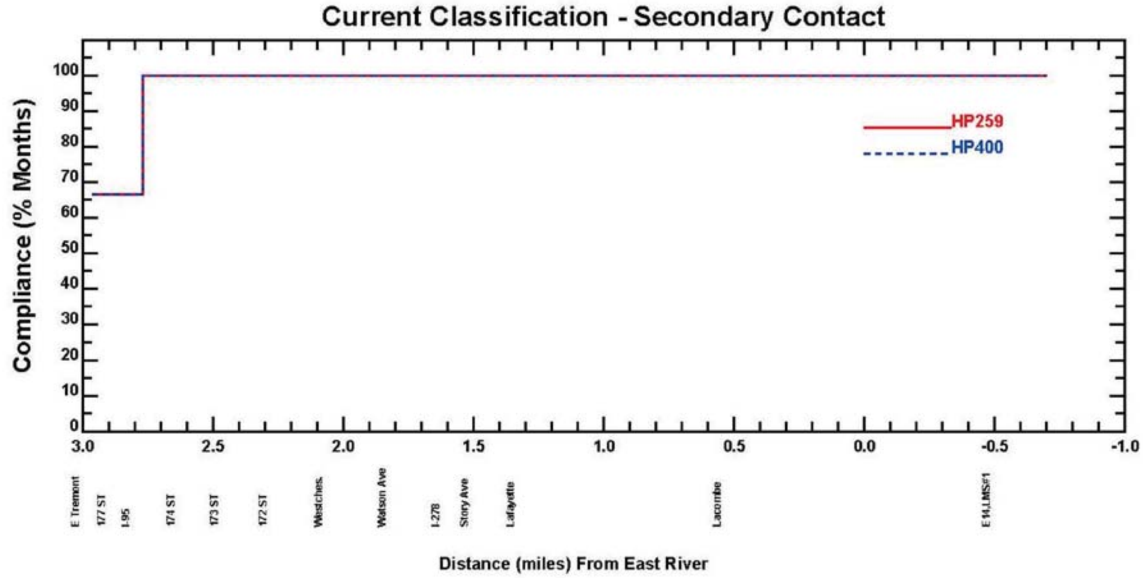
As a result, the plan was developed based on maximization of CSO reduction in a cost effective way since no other controls are needed for compliance with Class I water quality standards. In addition the WB/WS Facility Plan will significantly reduce the floatables in the Bronx River. Accordingly, the aesthetic conditions in the tidal Bronx River should improve to a level consistent with the other attained water uses and the nature of the adjacent shoreline uses.

7.5 COST PERFORMANCE

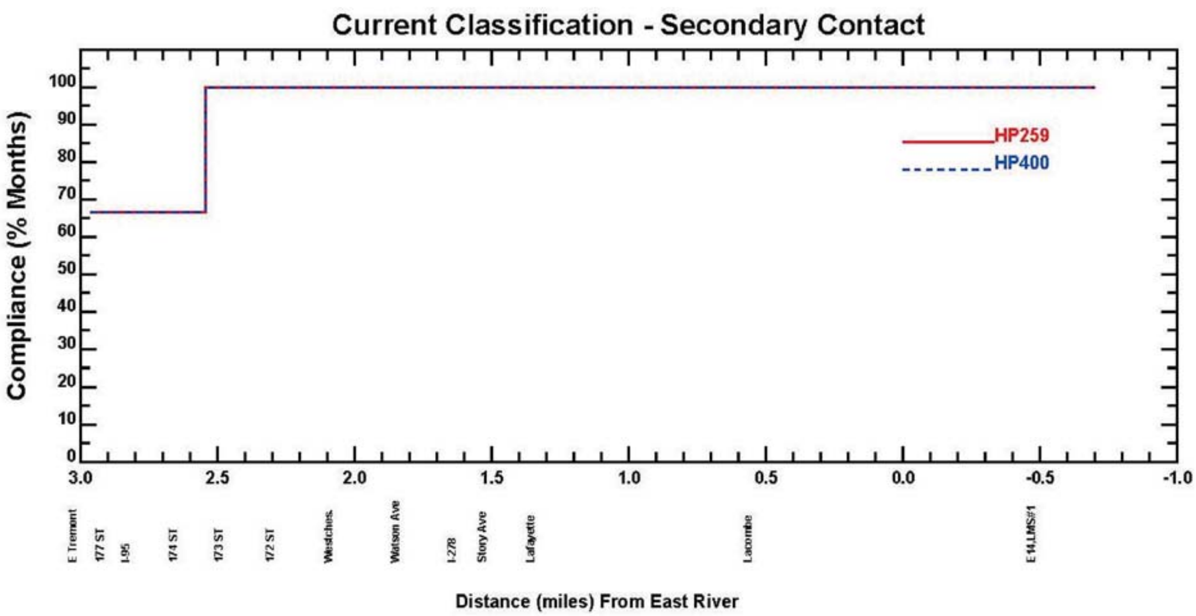
Figure 7-19 presents the cost effectiveness or “knee of the curve analysis” of the discussed alternatives in terms of CSO reduction. The PTPCs to implement the alternatives adjusted to December 2009 dollars were plotted against the percent reduction in overflow volume and overflow events.

Additionally, modeled percent compliance was plotted against current water quality standards for dissolved oxygen and pathogens to evaluate the water quality benefits achieved by the alternatives that were retained for consideration.

Figures 7-20 and 7-21 show the cost benefit analysis for Total and Fecal Coliform, respectively. The top panel in both figures shows compliance in the Bronx River with upstream pathogen loads at baseline conditions. The bottom panel in both figures shows compliance in the Bronx River with upstream pathogen loads meeting Class B standards. Both figures show that total and fecal coliform standards can be reached in the tidal section of the Bronx River most effectively with the reduction of pathogen loading from the upstream freshwater portion of the Bronx River, to which the Westchester County watershed contributes over 90 percent.



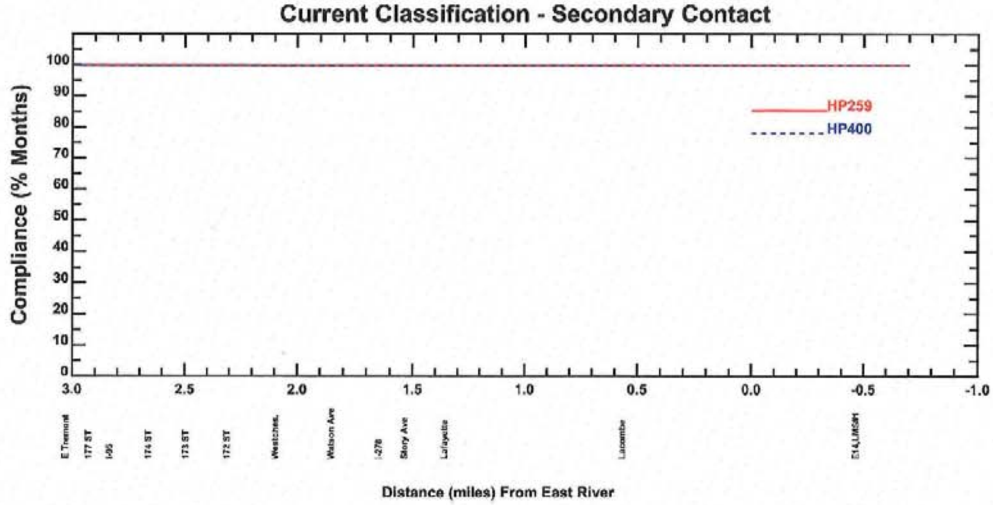
Bronx River Fecal Coliform June - August Compliance with NYSDEC Class I Standards Monthly GM < 2,000 #/100mL



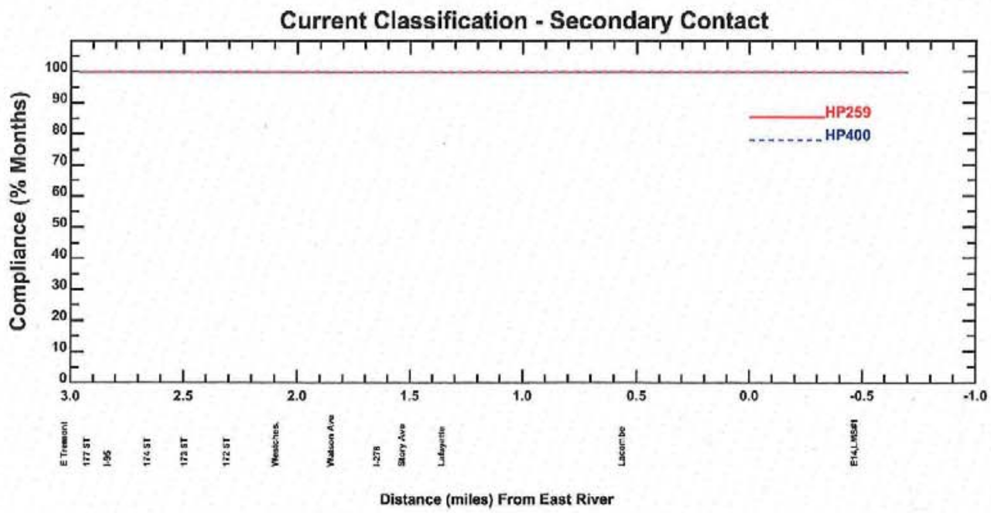
Bronx River Total Coliform June - August Compliance with NYSDEC Class I Standards Monthly GM < 10,000 #/100mL

Secondary Contact Compliance (Tidal)
June-August Compliance

(Baseline Upstream Conditions)



Bronx River Fecal Coliform June - August Compliance
with NYSDEC Class I Standards Monthly GM < 2,000 #/100mL
Upstream BC at Class B Standard



Bronx River Total Coliform June - August Compliance
with NYSDEC Class I Standards Monthly GM < 10,000 #/100mL
Upstream BC at Class B Standard

Secondary Contact Compliance (Tidal)
June-August Compliance
(Upstream at Class B Standard)

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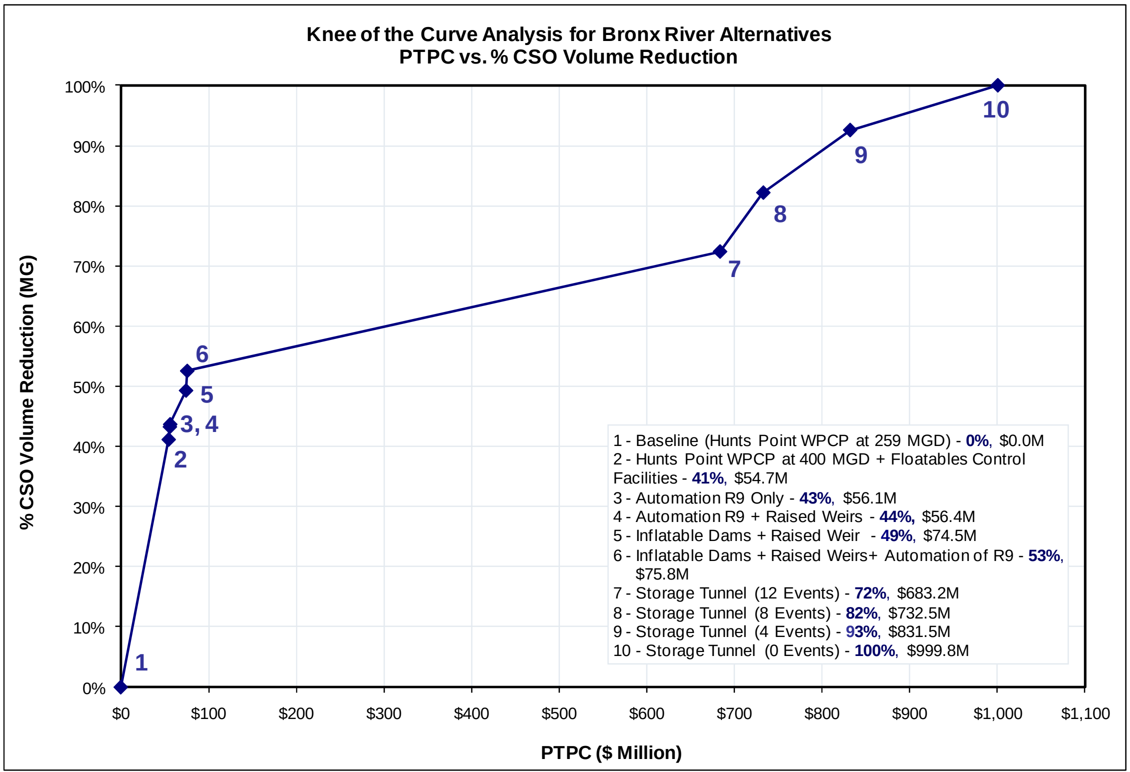

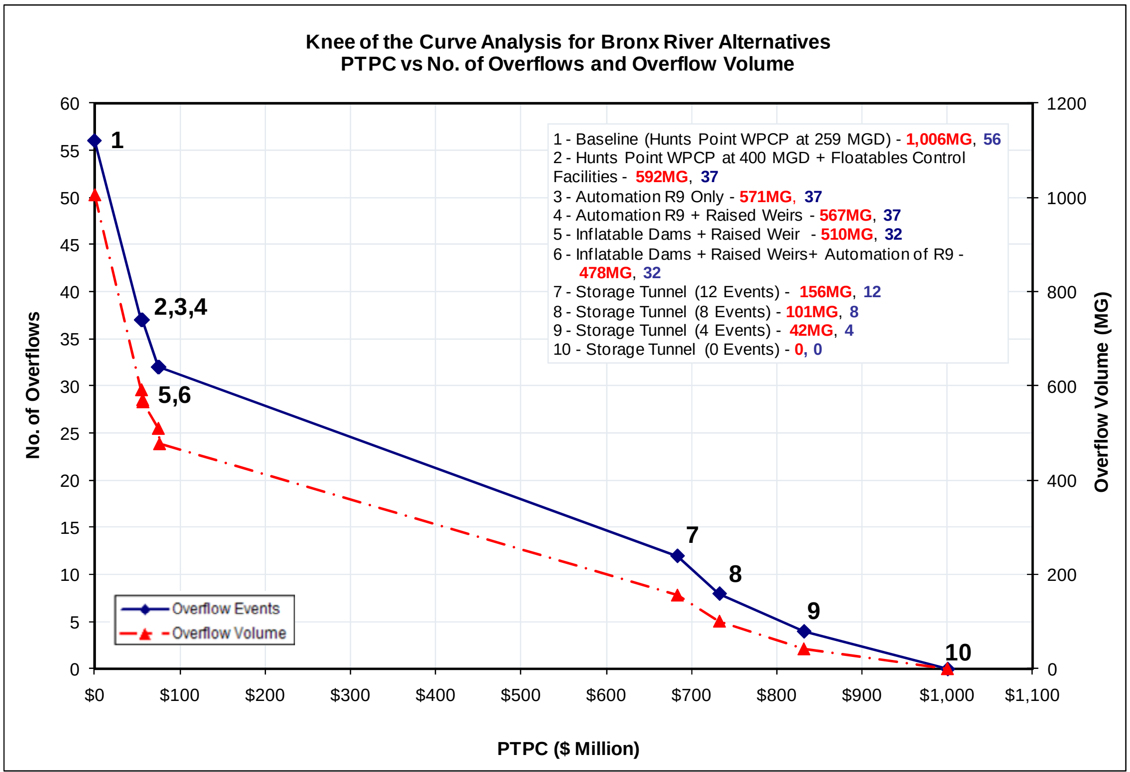

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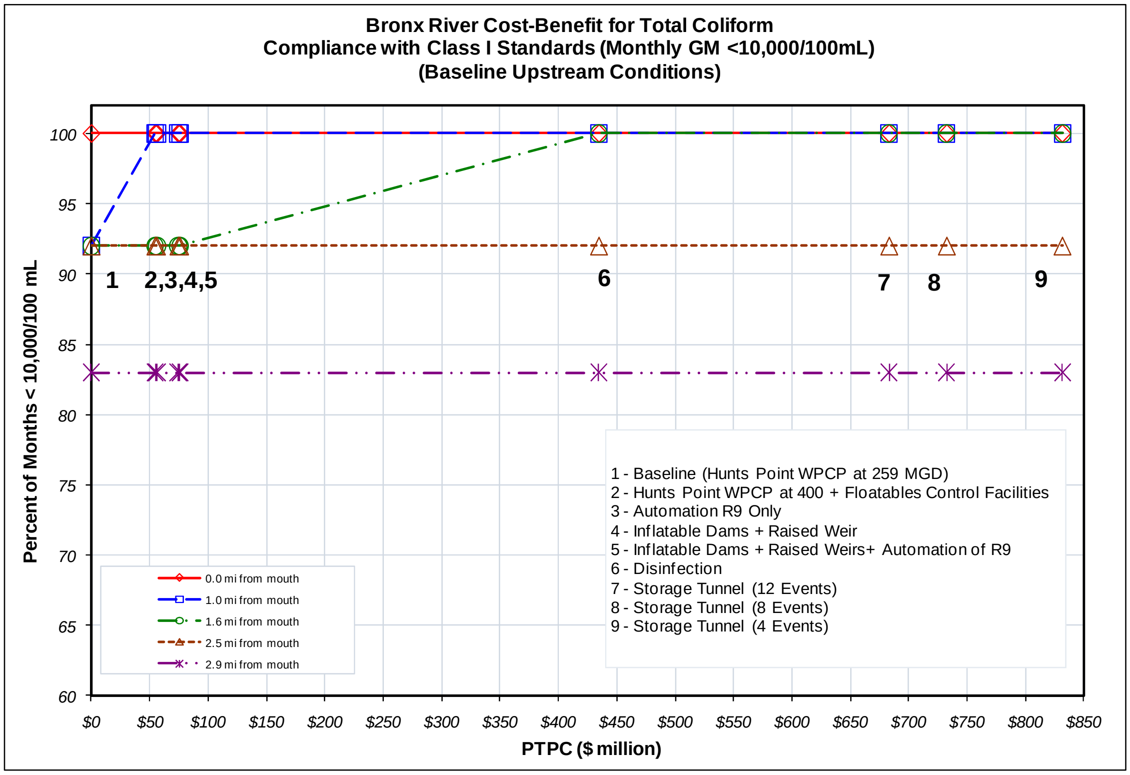
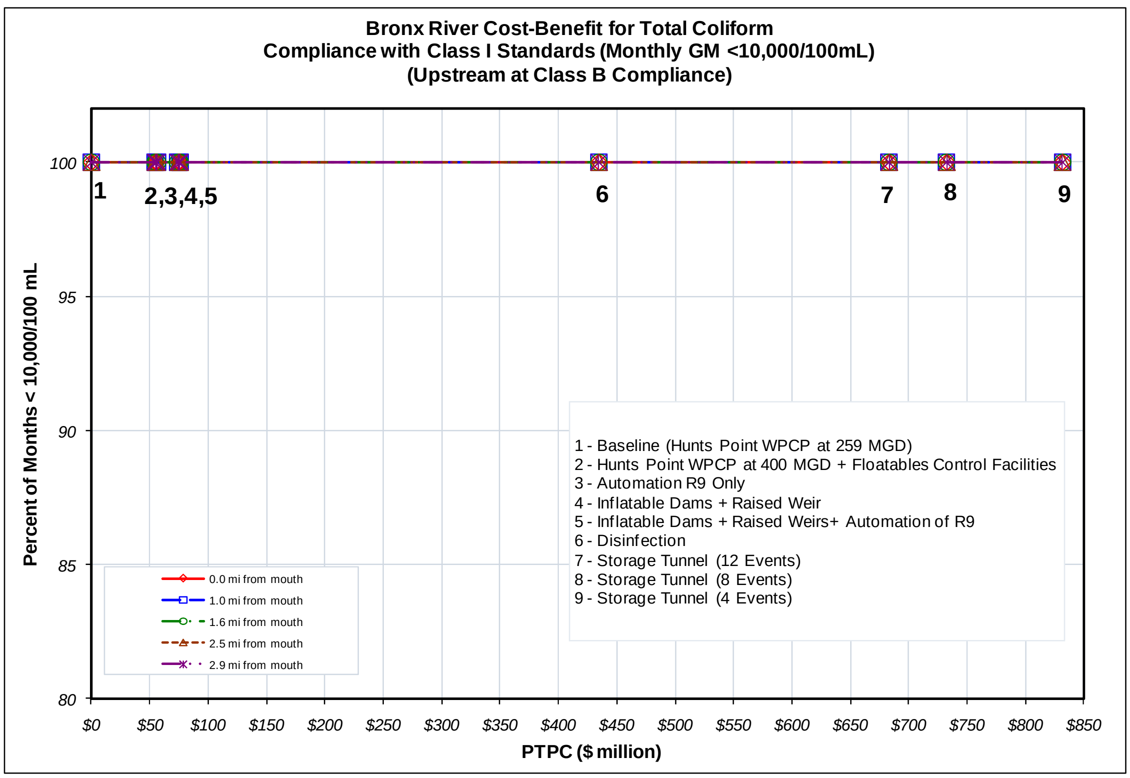
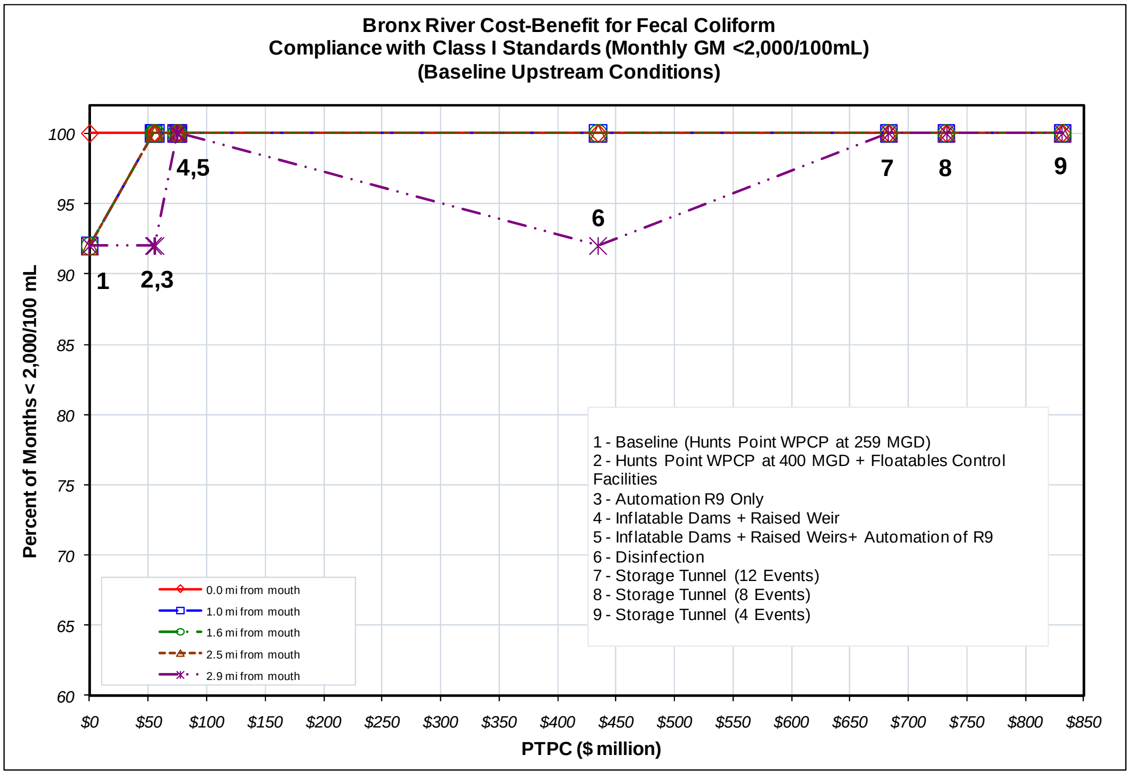
Bronx River
Knee of the Curve Analysis

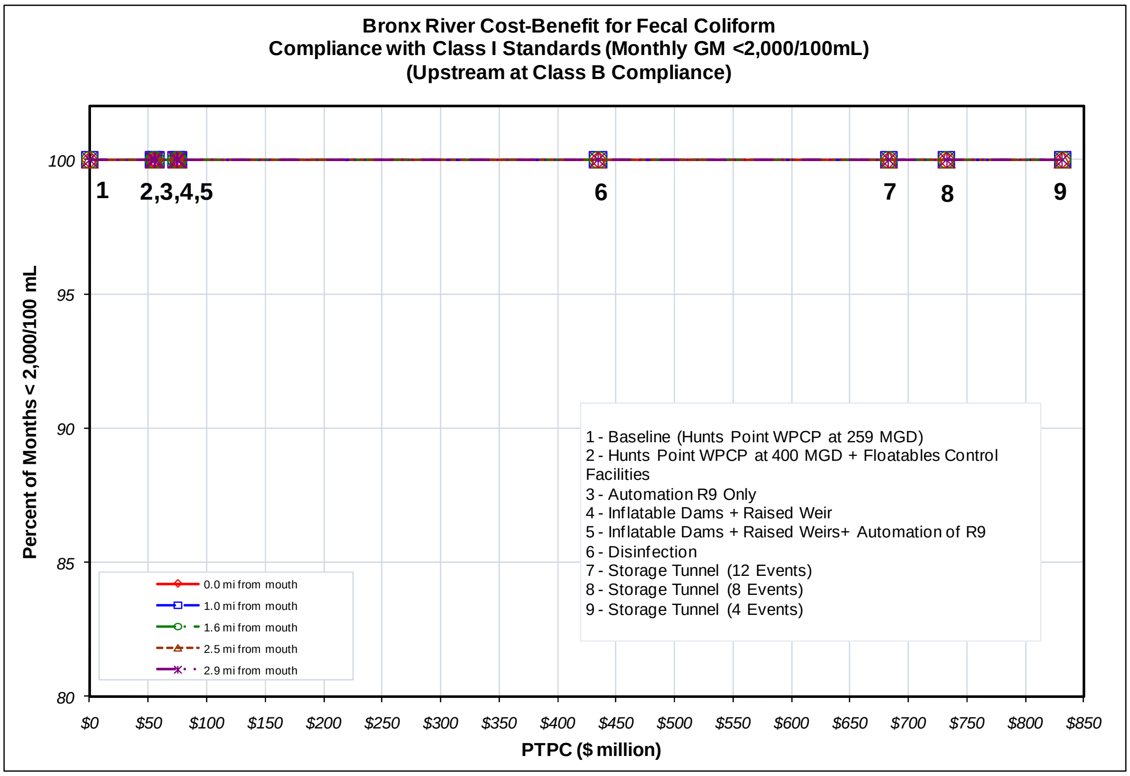




Bronx River Total Coliform Cost Benefit Curves

FIGURE 7-20





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Bronx River Fecal Coliform Cost Benefit Curves

7.6 SELECTED ALTERNATIVES

7.6.1 Basis of Selection

After complete examination of the costs and benefits of a wide variety of CSO control alternatives a WB/WS Facility Plan has been developed that aims at greatly reducing floatable inputs from CSOs and reducing the volume of CSO through a number of infrastructure improvements. This Bronx River WB/WS Facility Plan aims to abate the CSO associated aesthetic impairments found in the River and to reduce pollutant loads to the River in a cost effective manner. The plots above indicate that baseline system configuration achieves Class I pathogen standards and additional measures are not need to the water quality standard for pathogens. However, NYCDEP has already implemented a significant plant upgrade that reduces CSO significantly below the baseline conditions.

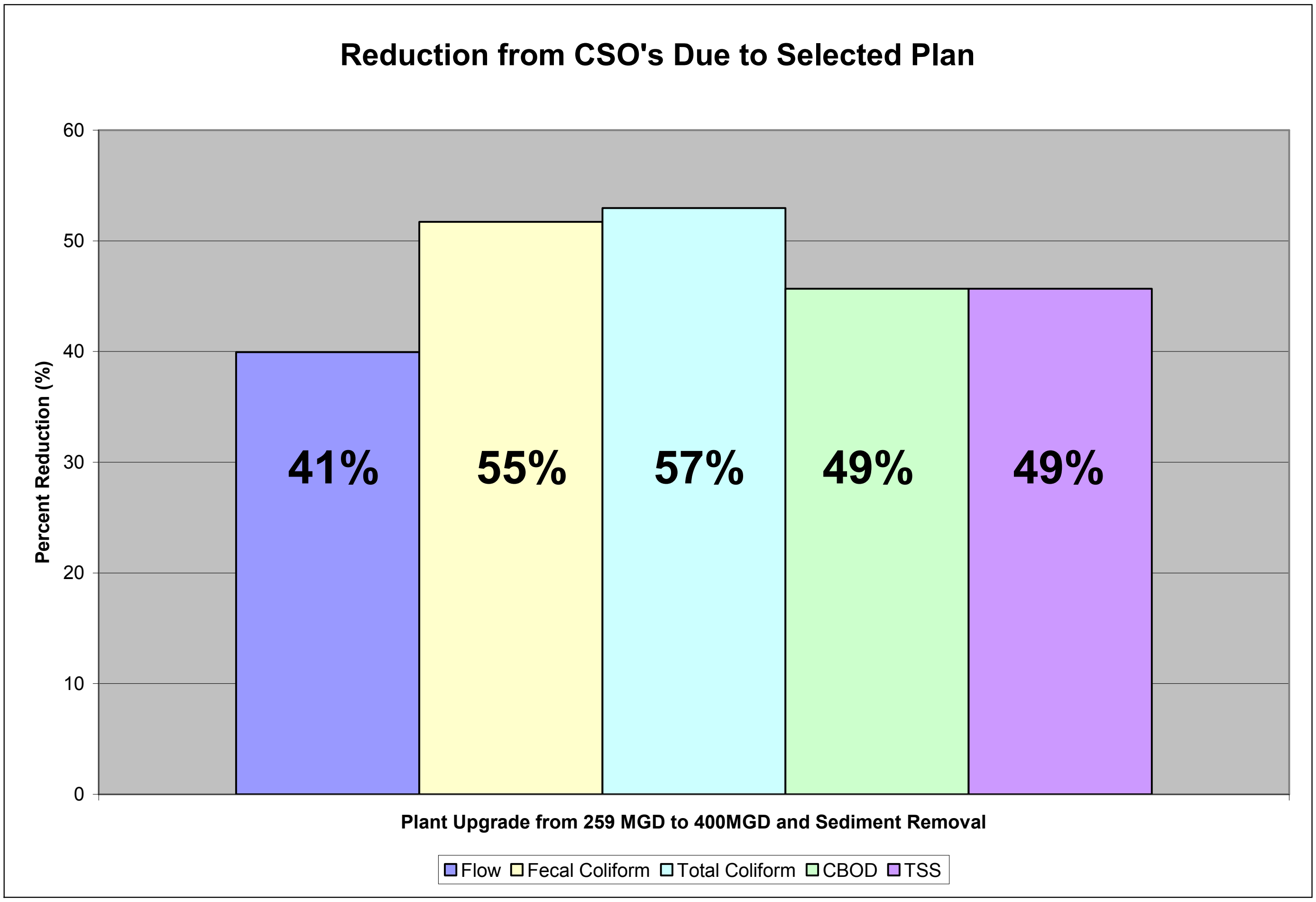
The selected alternative components of the Bronx River WB/WS Facility Plan are listed below. The plan will reduce CSO overflow events and volumes and control floatables.

- The upgrade of Hunts Point WPCP to 2×DDWF (400 MGD) (completed previously);
- The reduction of floatables discharges at Outfalls HP-004 and HP-009 via in-line netting and at Outfall HP-007 via mechanical screens at CSO 27 and CSO 27A, and;
- Continued implementation of programmatic controls.

The WB/WS Facility Plan is expected to result in significant improvements in Bronx River aesthetics through floatables control from CSO sources in the Bronx River. These floatables controls will provide for near complete elimination of floatables from over 99 percent of the annual CSO discharged in the River. Total and fecal coliform will comply with secondary contact standards during the average year, allowing for the full attainment of the current use of the tidal Bronx River for boating, canoeing and kayaking.

7.6.2 Cost and Benefits

The cost of the selected alternative is $26.4 million, which represents the actual contractor bid price for the Bronx River Floatables Control Facilities received in February 2009. For comparison purposes, in Figures 7-19 through 7-21 the construction bid price was escalated to December 2009 ($28.7 million) and the cost of the Hunts Point WPCP headworks upgrade ($26 million) was included in the total cost for each alternative. The benefits of the load reduction from the plan are shown Figure 7-22. In addition, the plan will treat an estimated 99% of the CSO discharged to the river for floatables.



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Percent Reduction of Flow and Pollutant Loads with Implementation of Selected Alternatives

FIGURE 7-22

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8.0 Waterbody/Watershed Facility Plan

The central element of the Bronx River Waterbody/Watershed (WB/WS) Facility Plan Report is floatable control facilities at the CSO Outfalls of HP-004, HP-007 and HP-009, which are frequently active during the 1988 average year. As outlined in Section 7.0, a variety of CSO control alternatives to reduce CSO pollution impacts to Bronx River, ranging from watershed management approaches to total CSO retention/storage, have been examined based on a "knee of the curve" type analysis. This analysis was used to select a cost effective program appropriate for existing water quality standards and highest reasonably attainable uses. The facility planning phase for the floatables control facilities was completed in 2005 and the design phase for the floatable control facilities at the outfalls was initiated in January 2006 and completed in July 2008. Notice to Proceed to Construction was issued in June 2009.

This WB/WS Facility Plan is expected to result in significant improvements to floatables control from CSO sources in the Bronx River. Water quality modeling indicated that total and fecal coliform will comply with secondary contact standards during the high use recreation season of the average year, allowing for the full attainment of the current use of the tidal Bronx River for boating, canoeing and kayaking. In addition, the NYCDEP will continue its ongoing program to maintain the capability to convey 2×DDWF to the WPCP utilizing its recently completed CSO reduction initiative consisting of the headworks upgrade at Hunts Point WPCP, which has reduced CSO overflow volumes and their pollutant loads. In addition best management practices such as sewer cleaning will continue to reduce CSO overflows and improve water quality in the Bronx River. Commitments as local sponsor to USACE ecosystem restoration programs will continue to be honored. The NYCDEP remains committed to attaining the highest reasonable use of Bronx River, and the WB/WS Facility Plan coupled with the flexibility of adaptive management and the continuation of proven programs will further advance this cause.

The subsections that follow present the recommended CSO control components of the proposed WB/WS Facility Plan needed to attain water quality standards as well as present some additional assessments required to ensure the full implementation of the Bronx River WB/WS Facility Plan goals. 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 the Bronx River.

If post-construction monitoring indicates that additional controls are required, protocols established by the NYCDEP and the City of New York for capital expenditures require that certain evaluations are completed prior to the construction of the additional CSO controls. Depending on the technology implemented and on the engineer's cost estimate for the project, these evaluations may include pilot testing, detailed facility planning, preliminary design, and value engineering. Each of these steps provides additional opportunities for refinement and adaptation so that the fully implemented program achieves the goals of the original WB/WS Facility Plan.

8.1. WATERBODY/WATERSHED FACILITY PLAN COMPONENTS

The components of the Waterbody/Watershed Facility Plan for the Bronx River are listed as follows:

- The upgrade of Hunts Point WPCP to 2×DDWF (Design Dry Weather Flow) 400 MGD (previously completed);
- The reduction of floatables discharges at Outfalls HP-004 and HP-009 via in-line netting and at Outfall HP-007 via mechanical screens at CSO 27 and CSO 27A;
- Continued implementation of programmatic controls

Locations of the selected alternatives for the Waterbody/Watershed Facility Plan are shown on Figure 8-1. The total cost of the Waterbody/Watershed Facility Plan is $26.5 million. This cost represents the actual contractor bid price for the Bronx River Floatables Control Facilities received in February 2009. The construction bid price was further escalated to December 2009 ($28.7 million) for comparison purposes in Section 7. The total cost of the Waterbody/Watershed Facility Plan excludes the costs of the Hunts Point WPCP upgrade and annual O&M.

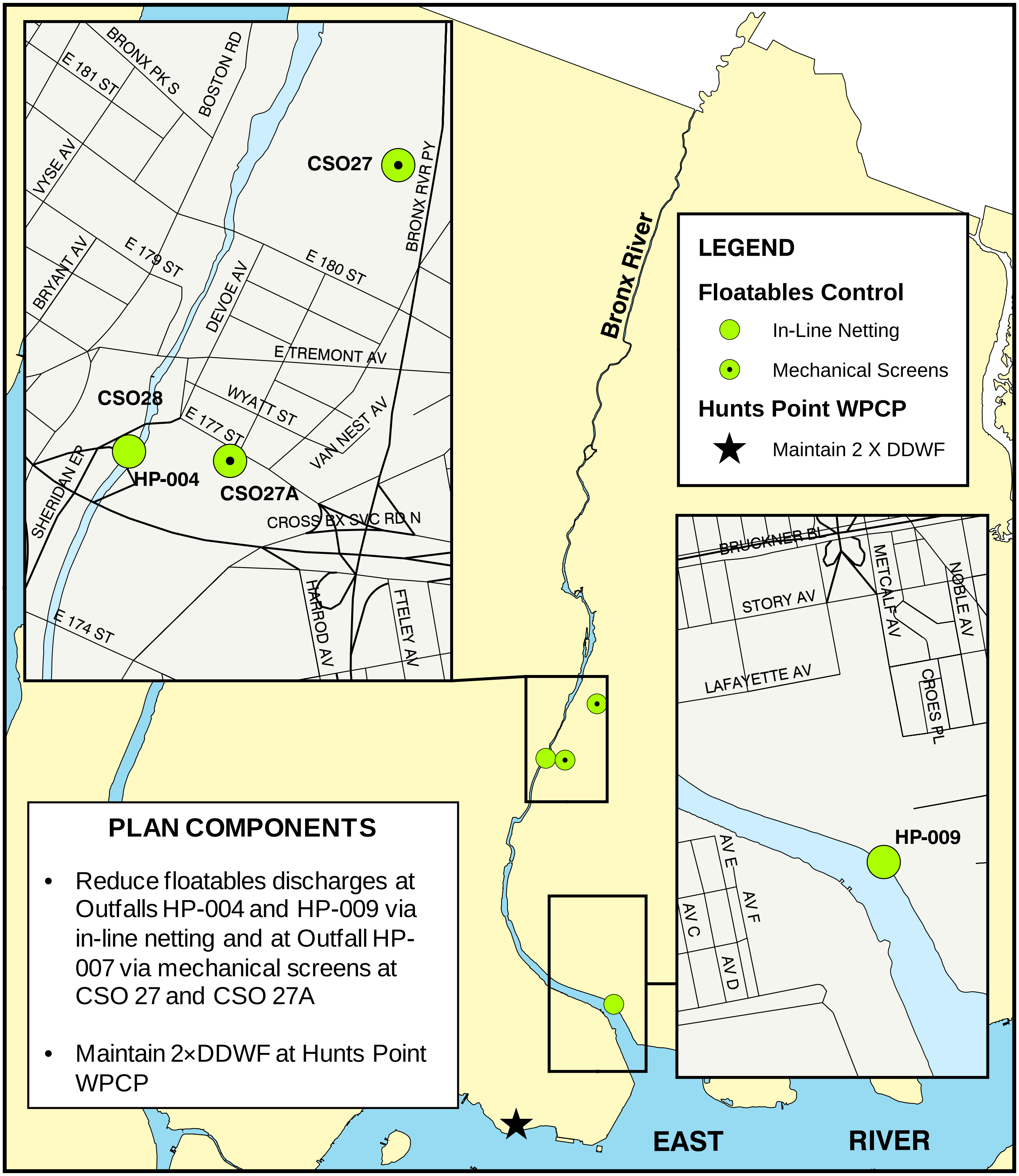
8.1.1. Hunts Point WPCP Upgrade

Although the Hunts Point WPCP had a design capacity to treat up to 300 MGD through secondary treatment and up to 400 MGD through screenings, primary treatment and disinfection, the WPCP had limitations at the headworks that precluded flows from reaching these levels. Through 2004, the Hunts Point WPCP was generally only able to treat peak flows up to approximately 260 MGD. As part of CSO reduction activities and as required by the Omnibus IV Consent Order, NYCDEP redesigned the WPCP headworks as part of the BNR Phase I upgrade to the WPCP. To ensure treatment of 2xDDWF and prevent the level in the afterbay channel from exceeding elevation -8.00 feet BSD, a new forebay gate chamber with a new gate was installed under Phase I of the plant upgrade project. As a result of this construction, in 2008 the WPCP processed influent flows during the top-ten storm events that averaged 396 MGD and had a maximum peak flow of 415 MGD. The cost for these Hunts Point WPCP improvements in 2004 was $26.0 million. This cost, however, is included in the East River and Open Waters WB/WS Facility Plan and not the Bronx River WB/WS Facility Plan.

8.1.2. Floatable Control Facilities

The Bronx River Floatables Control Facilities are designed to capture floatables via in-line netting systems for outfalls HP-004 and HP–009. Regulator screening equipment will be used at regulators CSO-27 and CSO-27A which direct flow to outfall HP-007. A schematic of the proposed facilities is shown in Figure 8-2.

As discussed in Section 5.4, a floatables boom was placed downstream of outfalls HP-004 and HP-007 in the area between Watson and Westchester Avenues as part of the Interim Floatables Containment Program (IFCP). In light of the expected reduction in floatables, it may be possible to modify the existing floatables boom as requested by the community during the stakeholder process to allow passage of the existing boom by canoes and other recreational watercraft without portage, as shown in Figure 8-3. This boom modification will be revisited during LTCP development after the proposed floatables control facilities have been in service for a period of time.



PLAN COMPONENTS

- Reduce floatables discharges at Outfalls HP-004 and HP-009 via in-line netting and at Outfall HP-007 via mechanical screens at CSO 27 and CSO 27A
- Maintain 2×DDWF at Hunts Point WPCP

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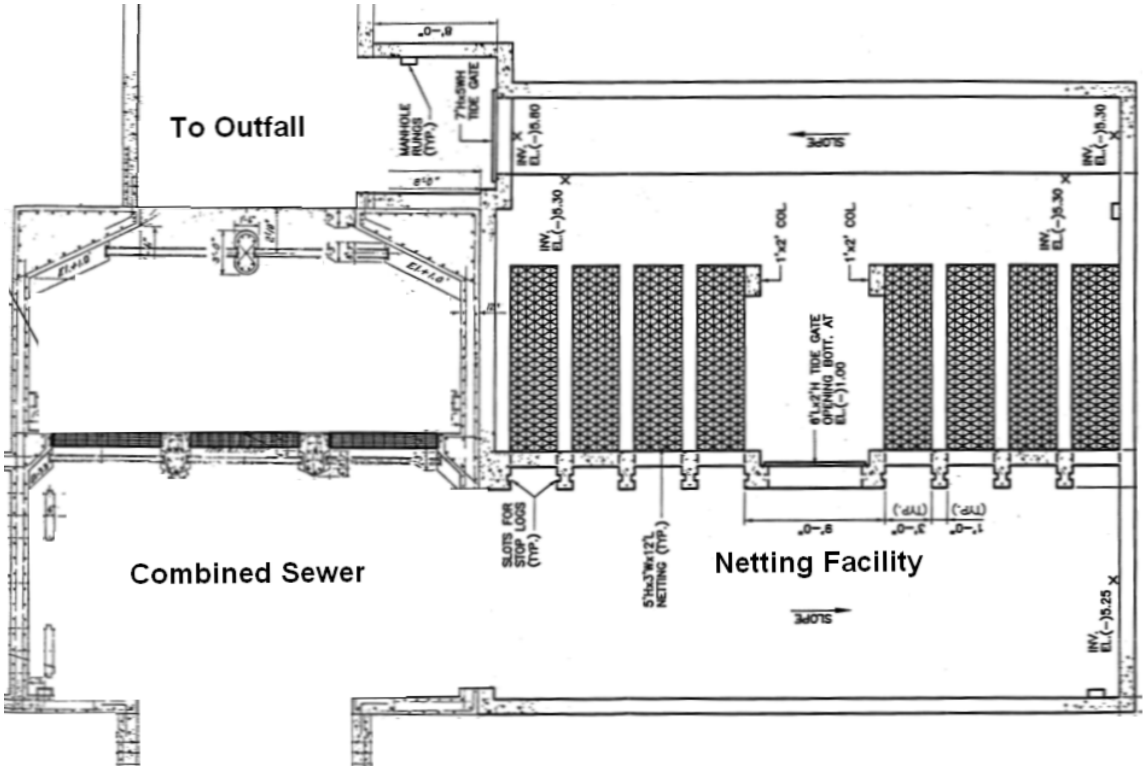
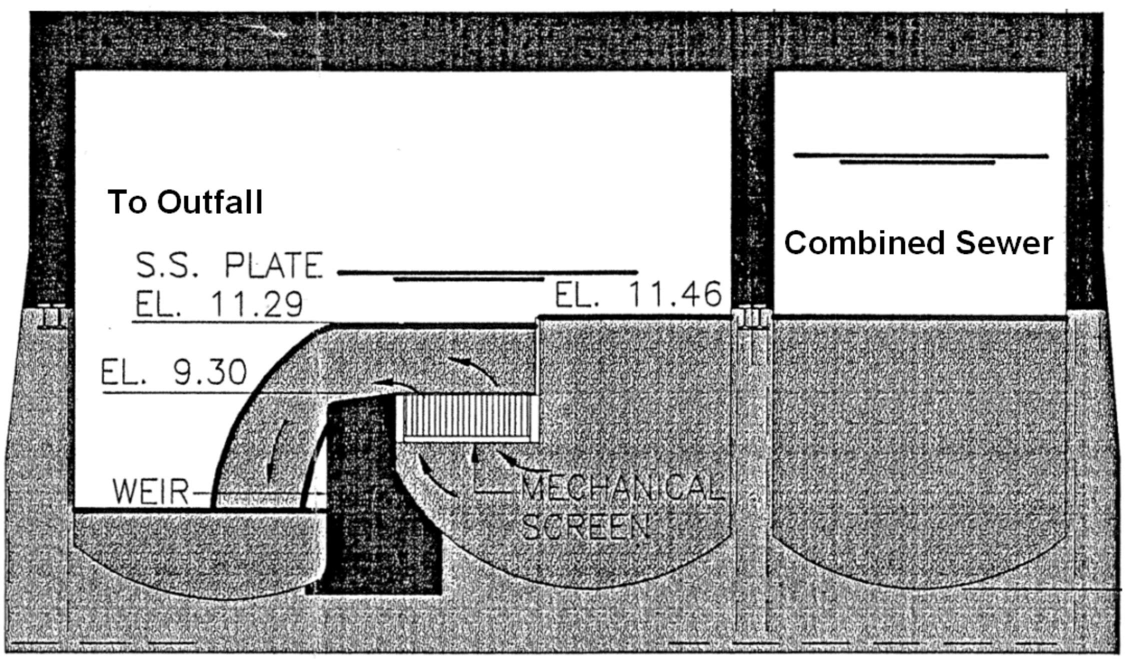
Locations of Waterbody/Watershed Facility Plan Components





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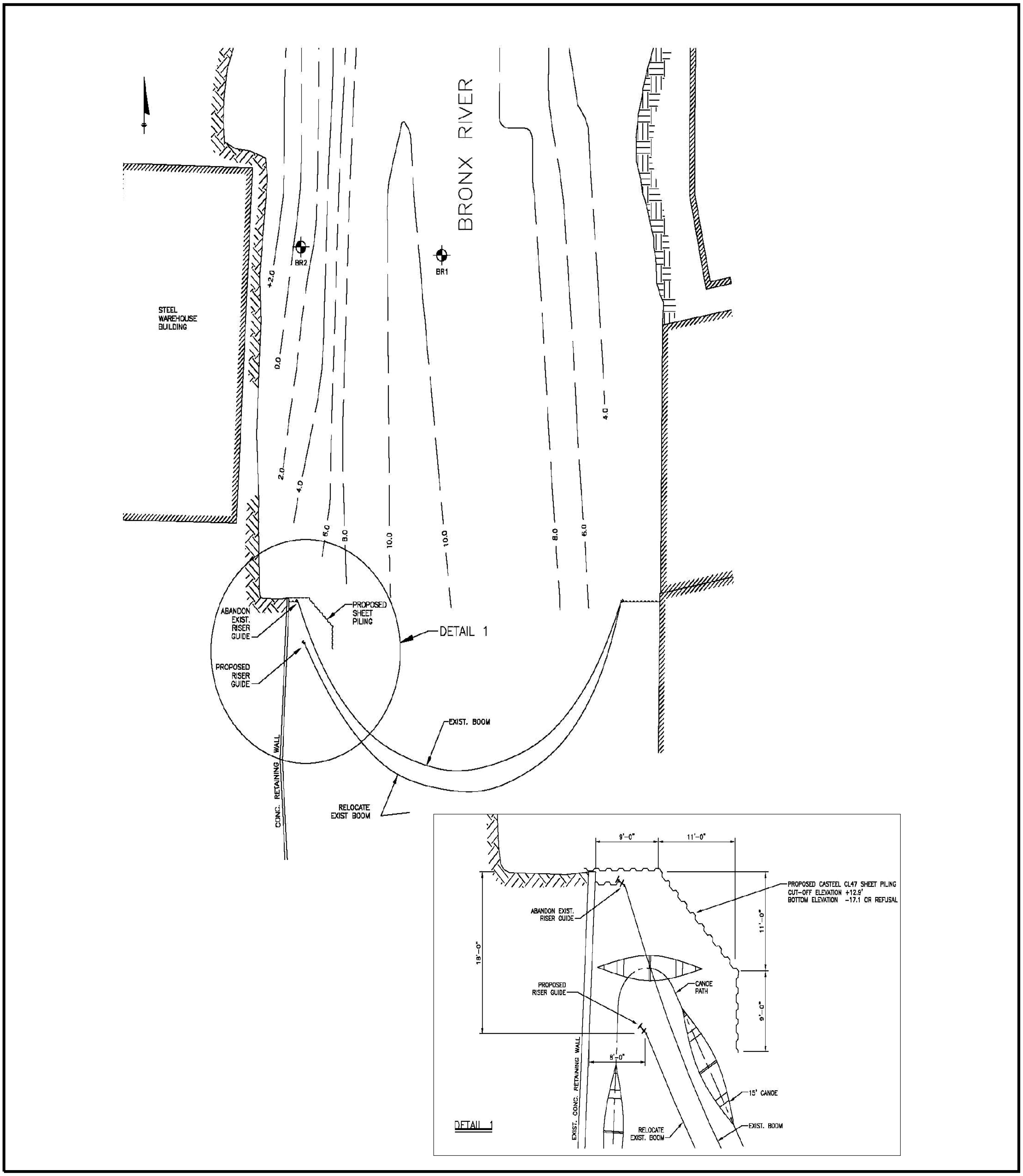
Floatables Control Schematics: Netting Facility and Mechanical Screen



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Bronx River Floatables Control, Boom Modification Concept

8.1.3. Continue Implementation of Programmatic Controls

As discussed in detail in Section 5.0, NYCDEP currently operates several programs intended to reduce CSO to a minimum and provide treatment levels appropriate to protect waterbody uses. As the effects of the WB/WS Facility Plan and subsequent LTCP 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 WPCP SPDES permits will continue. In general, the BMPs address operation and maintenance procedures, maximum use of existing systems and facilities and reduce contaminants in the combined sewer system, thereby reducing water quality impacts. A detailed discussion of the existing BMP program is included in Section 5.3.

- Maintaining the capability of the recently constructed headworks upgrade at the Hunts Point WPCP to convey up to 400 mgd (2×DDWF) through preliminary treatment, primary clarification and chlorination along with a portion of the wet weather flow through secondary treatment is a key component of Bronx River WB/WS Facility Plan to capture CSO.

- Sustainable Stormwater Management – The NYCDEP will continue to fully develop green solutions for stormwater management and the programmatic implementation of sustainable stormwater practices in cooperation with other City agencies. 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 drainage basin specific LTCP, or when the subsequent city-wide LTCP is developed.

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

- The City, along with Westchester County, is a non-federal local sponsor for the USACE Bronx River Restoration project. The project includes additional general restoration concepts for the Bronx River, including planting tidal marshes, and other improvement efforts. The goals of these actions are to improve habitat for waterfowl and aquatic organisms and improve fish and wildlife habitat diversity. The study is ongoing and specific locations for improvement actions are discussed in Section 5.7. The NYCDEP plans to continue cooperation with USACE as part of its WB/WS Facility Plan.

  In particular, the NYCDEP partnered with Westchester County to carry out a water quality sampling program along the freshwater section of the Bronx River in 2006 through in kind service for the USACE restoration program to augment the limited water quality data set currently available. The data will be used in cooperation with Westchester County for future planning and to monitor the impact of upstream communities' current programs to improve water quality in the Bronx River. The NYCDEP portion of the program consisted of collecting water samples at three locations along the Bronx River in Bronx County during both dry and wet weather conditions. The following stations have been selected and the details of sampling and testing program are shown in Table 8-1:

1. East 165th Street and Edgewater Road (near the mouth of the river)
2. East 180th Street and Bronx River (downstream of Bronx Zoo)
3. East 232nd Street/Bronx Boulevard and Bronx River (near Bronx/Westchester County Border)

Table 8-1. Analytical Parameters and Methods

Parameter	Method	Limit of Detection (LOD) or Limit of Quantification (LOQ)
Total coliform	SM18 MPN 9221B	< 20 MPN/100 mL (upper limit 200,000 MPN)
Fecal coliform	SM18 9221E	< 20 MPN /100 mL (upper limit 200,000 MPN)
Enterococci	EPA Method 1600	< 2 MPN /100 mL (upper limit 50,000 MPN)
E. coli	EC with Mug Test SM18 9221E	
Ammonia	EPA Method 350.1	0.05 mg/L
Nitrates	EPA Method 353.2	0.05 mg/L
Nitrites	SM20-4500NO2B	0.01 mg/L
Phosphorus	SM2O-4500P	0.03 mg/L
Total Suspended Solids	EPA Method 160.2	2.0 mg/L

8.1.4. LID/BMP Assessment

NYCDEP is currently evaluating LIDs and BMPs as part of two parallel efforts. One effort, in cooperation with the Mayor's Office of Long-term Planning and Sustainability, is evaluating the most practical BMPs and LIDs. As part of this effort, NYCDEP is working with other City agencies to encourage adoption of these practices to understand where new or modified regulations would be required to implement these BMPs/LIDs.

The second effort is being undertaken as a follow-up to the Jamaica Bay Watershed Protection Plan initiative. As part of this initiative, NYCDEP will be conducting a number of pilot studies to assess the effectiveness of innovative stormwater treatment technologies and volume reduction stormwater BMPs. These technologies are being evaluated for improving the quality of the stormwater that is captured, reducing stormwater volume that enters the combined sewer system thereby reducing the frequency and volume of CSOs, benefiting ecological communities and providing opportunities for open space.

In parallel with these efforts, NYCDEP will undertake an evaluation of citywide BMP impacts as well as development of watershed plans that will be based on a comprehensive water quality and ecological approach. The watershed plans will focus on those technologies that prove to be most effective at reducing stormwater flow into the combined sewer system.

8.1.5. LID/BMP Implementation

Where feasible, NYCDEP will implement LIDs/BMPs that cost-effectively increase soil infiltration and detain stormwater flows, thereby reducing peak and total stormwater flow volume into the combined sewer system and maximizing pollutant removal. NYCDEP is optimistic that the ongoing evaluations and proposed facility planning efforts will identify NYCDEP projects or partnering efforts that are large enough in number and scale to provide an appreciable reduction in CSO volumes and frequencies and have an observable impact on water quality.

8.2. ANTICIPATED WATER QUALITY IMPROVEMENTS

The WB/WS Facility Plan will reduce CSO volume discharges from the baseline condition (Hunts Point WPCP at 259 MGD) from the Bronx River outfalls as noted in Table 8-2. The WB/WS Facility Plan is also expected to result in significant improvements to floatables control from CSO sources in the Bronx River. With upstream pollutant loading from the freshwater portion of the Bronx River at Baseline conditions, total and fecal coliform levels will not comply with secondary contact standards in the first half mile of the tidal Bronx River. However, if the freshwater entering the tidal portion were meeting current classification standards (B) then the upper half mile of the tidal Bronx River would comply with current secondary contact classification standards allowing for the full attainment of the current use of the tidal Bronx River for boating, canoeing and kayaking.

Table 8-2. Summary of WB/WS Facility Plan Overflow Reductions (based on 1988 Average Year)

Outfall Number	Baseline Annual Overflow Volume MG/year	Facility Plan Overflow Volume MG/year	Percent Reduction
HP-009	814	500	39%
HP-004	100	7	93%
HP-007	88	81	8%
HP-008	4	4	0%
HP-010	0.6	0.4	33%
Total	**1,006**	**592**	**41%**

8.3. OPERATIONAL PLAN

The operation of the Bronx River WB/WS Facility Plan will be carried out in conjunction with the existing Hunts Point WPCP WWOP. The NYCDEP intends to operate these facilities in strict accordance with their WWOP. The annual analysis of monitoring data will trigger a sequence of detailed investigations if needed. The WWOP for the Hunts Point WPCP is presented in Appendix A. The Hunts Point wet weather operating plan will be updated to incorporate these floatables facilities, and the updated WWOP will be appended to the final Bronx River Long Term Control Plan when it is developed (6 months after approval of the WB/WS Facility Plan).

8.4. IMPLEMENTATION SCHEDULE

Figure 8-4 shows the proposed construction schedule for the Bronx River Floatables Control Facilities. 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 Order on Consent (Section III.C.2) "once the Department approves a Drainage Specific LTCP, the approved Drainage 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 submitted as an LTCP in accordance with dates presented in Appendix A of the Order on Consent.

8.5. POST-CONSTRUCTION COMPLIANCE MONITORING

Post-construction compliance monitoring will commence just prior to implementation of CSO controls and will continue for several years in order to quantify the difference between the expected performance (as described in this report) and the actual performance once those controls are fully implemented. Any performance gap identified by the monitoring program can then be addressed through operations adjustments, retrofitting additional controls, or initiating a Use Attainability Analysis (UAA) if it becomes clear that CSO control will not result in full attainment of applicable standards. Due to 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.

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 the Bronx River, with the ultimate goal of improving water quality and fully attaining compliance with water quality standards. The monitoring will contain two basic components:

1. Modification to the current NYCDEP Harbor Survey program to more rigorously collect data in the Bronx River and nearby upper East River locations; and
2. Modeling of the Bronx River to characterize attainment with numerical water quality standards.

These programs are discussed in detail below, along with anticipated data analyses and mechanisms for responsiveness.

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Bronx River WB/WS Facility Plan Schedule

8.5.1. Receiving Water Monitoring

The New York City Harbor Survey 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 pathogens, each parameter is collected and analyzed at surface and bottom locations, which are three feet from the surface and bottom, respectively, to eliminate influences external to the water column chemistry itself, such as wind and precipitation influences near the surface or benthic and near-bottom suspended sediments and aquatic vegetation near the bottom. The 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.

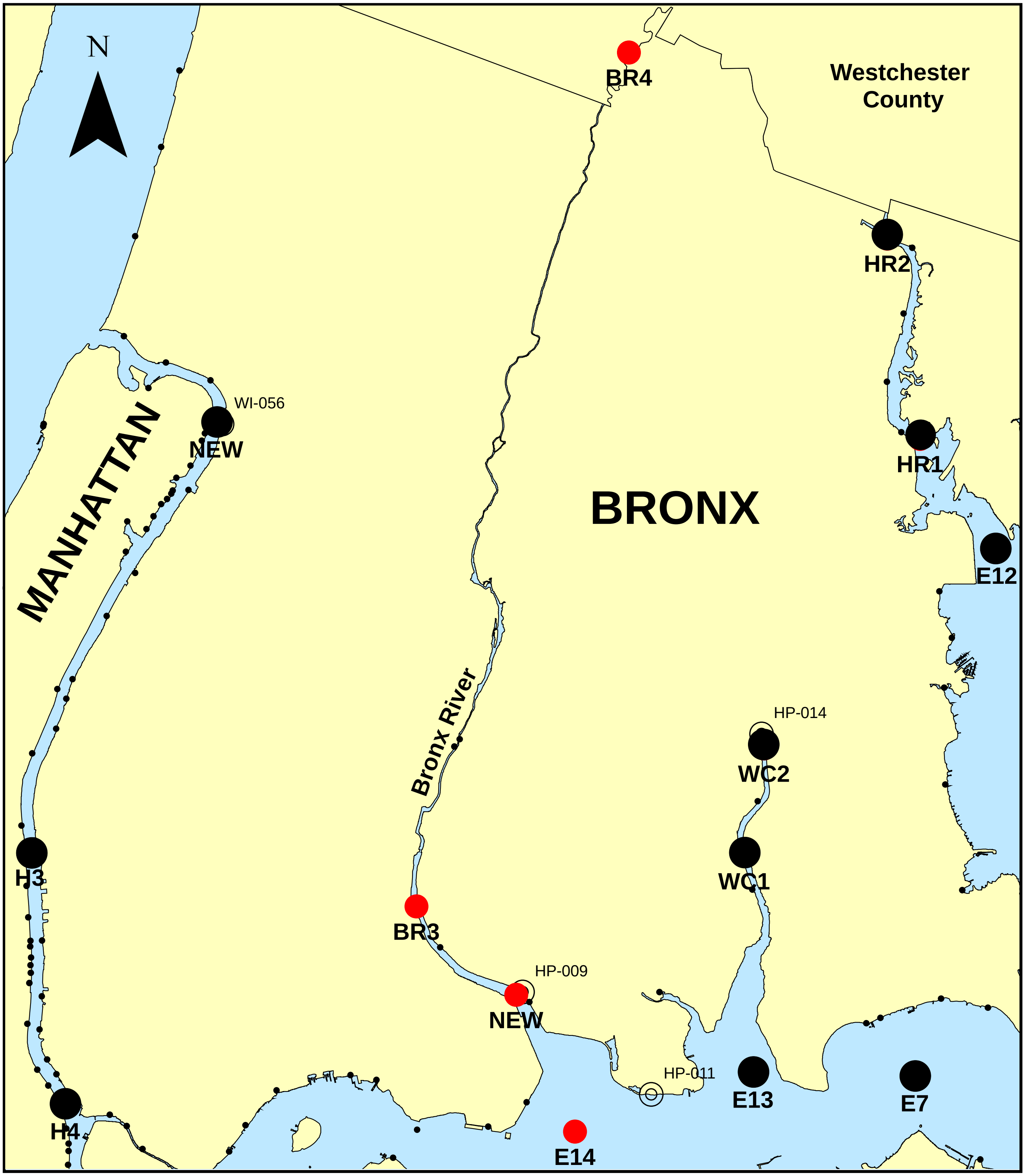
The post-construction compliance monitoring program will continue along the protocols of the Harbor Survey initially. As shown in Figure 8-5, the Bronx River contains three locations that are currently sampled or have been sampled historically. These three stations will serve as the WB/WS Facility Plan post-construction monitoring sites. All stations related to the WB/WS Facility Plan post-construction compliance monitoring program will be sampled a minimum of twice per month from May through September and monthly during the remainder of the year.

Data collected during this program will be used primarily to verify the water quality model that will be used to demonstrate relative compliance levels in the Bronx River. Therefore, during each annual cycle of compliance monitoring, the data collected will be evaluated for its utility in model verification, 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 numerical water quality criteria (e.g., 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.).

Post-construction monitoring protocols, QA/QC, and other details are being fully developed under the City-wide LTCP to assure adequate spatial coverage and a technically sound sampling program. The monitoring within each waterbody under NYCDEP's purview will commence no later than the activation of any constructed CSO abatement facility. In those waterbodies where constructed facilities are not proposed, sampling will commence no later than the summer following NYSDEC approval of the WB/WS Facility Plan.

8.5.2. Floatables Monitoring Program

This WB/WS Facility Plan incorporates by reference the City-Wide Comprehensive CSO Floatables Plan Modified Facility Planning Report (NYCDEP, 2005a) and Addendum 1 – Pilot Floatables Monitoring Program (December 2005) to the Floatables Plan. These documents



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Post Construction Monitoring Sampling Locations

Bronx River Locations shown in Red

contain a conceptual framework for the monitoring of floatables conditions in New York Harbor and a work plan for the ongoing pilot program to develop and test the monitoring methodology envisioned in the framework. The objectives set forth in the Floatables Plan provides a metric for LTCP performance, and floatables monitoring will be conducted in conjunction with post-construction compliance monitoring with regard to staffing, timing, and location of monitoring sites. 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 WB/WS Facility Plan if monitored floatables trends indicate impairment of waters relative to their intended uses.

8.5.3. Meteorological Conditions

The performance of any CSO control 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 control may be expected to eliminate CSO completely. The 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 on Table 8-3, and includes the return period for 1988 conditions.

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 beach season 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.

Table 8-3. 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

Given the uncertainty of the actual performance of the facility and the response of the Bronx River with respect to widely varying precipitation conditions, rainfall analysis is an essential component of the post-construction compliance monitoring. Multiple sources of rainfall data will be compiled as part of the post-construction monitoring. The primary source of rainfall data will be from the local airports (JFK and La Guardia) and from the meteorological station at Central Park. A second source of rainfall data will be from the rain gages maintained by the NYCDEP at its WPCPs and other facilities. A final source of rainfall data will come from the National Weather Service radar NEXRAD data. NEXRAD provides cloud reflectivity data, which must be calibrated to local rainfall data before application. For the purpose of this analysis, one month of radar based rainfall will be purchased for use in the landside modeling analysis. This will provide interpolated data over the entire Bronx River tributary drainage area for use in the assessments described in the following section. If any of these data sets is determined to be of limited value in the analysis of compliance, the NYCDEP may discontinue its use for that purpose.

8.5.4. Analysis

The performance of the WB/WS Facility Plan will be evaluated on an annual basis using landside mathematical computer models as approved by the NYCDEP. The collection system model that was used in the development of the present WB/WS Facility Plan is expected to serve as the basis for future model-related activities. The NYCDEP believes that the analysis of water quality compliance is best accomplished using computer modeling supported and verified with a water quality monitoring program. Modeling has several advantages over monitoring:

1. Modeling provides a comprehensive vertical, spatial and temporal coverage that cannot reasonably be equaled with a monitoring program;

2. Modeling provides the data volume necessary to compute aggregate statistical compliance values, such as a geometric mean, an absolute limit (e.g., “never-less-than” or “not-to-exceed”), or a cumulative statistic (e.g., the 66-day deficit-duration standard for dissolved oxygen to be promulgated by NYSDEC in the near future);

3. Discrete grab sampling for data collection is necessarily biased to locations and periods of logistical advantage, such as navigable waters, safe weather conditions, daylight hours, etc.; and

4. Quantification of certain chemical parameters must be performed in a laboratory setting which either (a) complicates the use of a smaller sampling vessel that is necessary to access shallower waters not navigable by a vessel with on-board laboratory facilities or (b) limits the number sampling locations that can be accessed due to holding times and other laboratory quality assurance requirements if remote laboratory (non-vessel mounted) facilities are used.

CSO volumes will be quantitatively analyzed on a monthly basis to isolate any periods of apparent noncompliance or performance issues and their impact on water quality. Water quality modeling re-assessment will be conducted every two years based on the previous two years 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 based on Station E14. Results will be compared to the relevant Harbor Survey data to validate the water quality modeling system, and 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 o/s, pump repair, etc.) were adequately documented;
- Evaluate specific periods of noncompliance to identify attributable causes;
- Confirm that all 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 conduct Use Attainability Analysis (UAA) and, if necessary, revise the WB/WS Facility Plan.

Following completion of the tenth annual report containing data during facility operation, a more detailed evaluation of the capability of the WB/WS Facility Plan to achieve the desired water quality goals will take place, with appropriate weight given to the various issues identified during the evaluations documented in the annual reports. If it is determined that the desired results are not achieved, the NYCDEP will implement additional measures to improve levels of attainment under typical precipitation conditions. 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 monitoring annual reports. 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.

8.5.5. Reporting

Post-construction compliance monitoring will be added to the BMP Annual Report submitted by the NYCDEP in accordance with their SPDES permits. The monitoring report will include an overview of the performance of the Bronx River Floatable Control Facilities, and will provide summary statistics on rainfall, the amount of floatables captured. The SPDES DMR requirements will remain in force and will continue in addition to the reporting modifications to the annual BMP described above.

8.6. CONSISTENCY WITH FEDERAL CSO 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 the Bronx River. The LTCP addresses each of the nine elements of long-term CSO control as defined by federal policy and shown in Table 8-4.

Table 8-4. Nine Elements of Long-Term CSO Control

Element	Report Section	Summary
1.Charcterization, Monitoring, and Modeling of the Combined Sewer System	3.0	Addressed during facility planning (1990s), and supplemented during the USA Project (2000-2001), the March 2004 WB/WS Facility Plan, and current WB/WS Facility Plan development (2006).
2.Public Participation	6.0	The WB/WS Facility Plan was developed with active involvement from the affected public and other stakeholders during plan development and environmental quality assessments.
3. Consideration of Sensitive Areas	4.7	There are no sensitive areas identified within Bronx River that are directly impacted by CSO discharges.
4. Evaluation of Alternatives	7.0	Detailed evaluations during facility planning point to floatables control.
5. Cost/Performance Considerations	7.0	Facility planning evaluations of cost suggest that higher level controls such as sewer separation, storage, and 100% CSO capture do not provide water quality benefits that merit their inordinate costs.
6. Operational Plan	8.0	NYCDEP will continue to satisfy the operational requirements of the 14BMPs for CSO control, including the Hunt's Point WPCP Wet Weather Operating Plan. 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	Implementation of wet-weather protocols at the Hunt's Point WPCP and its recent upgrade to 2XDWF will enable the WPCP to receive and treat a large portion of the tributary combined sewage.
8. Implementation Schedule	8.0	Facility plan complete and all components operational by 2012.
9.Post-Construction Compliance Monitoring	8.0	Bronx River Floatable Control Facilities will be monitored per SPDES requirements; Monitoring data will be used to assess effectiveness, to optimize facility performance, and to trigger adaptive management alternatives.

9.0 Water Quality Standards Review

The Bronx River Waterbody/Watershed Facility Plan is a component of the NYCDEP's Combined Sewer Overflow Long-Term Control Plan (LTCP). This WB/WS Facility 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 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 Bronx River Waterbody/Watershed 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 long-term rainfall records. Baseline and Waterbody/Watershed 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 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 may become applicable to the NYC freshwater and tidal Bronx River are shown in Tables 9-1 and 9-2, respectively. The freshwater Bronx River is classified as Class C in Westchester County and as Class B in NYC. The best usage of Class C waters is fishing. Class C waters shall be suitable for fish propagation and survival with water quality suitable for primary and secondary contact recreation although other factors may limit the use for the recreational purposes. The best usages of Class B waters are primary and secondary contact recreation and fishing and these waters shall be suitable for fish propagation and survival. These waterbody classifications are consistent with the "fishable/swimmable" goals of the CWA. The tidal Bronx River is classified as Class I at present with best usages as secondary contact recreation and fishing. This classification is also considered to be suitable for fish propagation and survival, a goal of the CWA, but the recreational classification of secondary contact is not consistent with the "swimmable" or primary contact use goal. Satisfaction of this goal would require reclassification of the tidal Bronx River to Class SB or SC which are suitable for primary contact recreation.

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

Class	Dissolved Oxygen	Coliform Bacteria (Pathogens) Total	Fecal
B, C	>5.0 mg/L daily average >4.0 mg/L	Monthly median <2,400/100 mL 80% <5,000/100 mL	Monthly geometric mean <200/100 mL

Notes: The total and fecal coliform standards for Class B and Class C shall be met during all periods when disinfection is practiced.

Table 9-2. New York State Numeric Surface Water Quality Standards (Saline)

Class	DO (mg/L)	Bacteria (Pathogens) Total Coliform[(1,4)] (per 100 mL)	Fecal Coliform[(2,4)] (per 100 mL)	Enterococci[(3)] (per 100 mL)
1	≥4.0	≤10,000	≤2,000	NA
SB, SC	≥5.0	≤2,400	≤200	≤35

Notes: [(1)] Total coliform criteria are based on monthly geometric means for Class I, and on monthly medians for Classes SB and SC; second criterion for SC and SB is for 80% of samples.
[(2)] Fecal coliform criteria are based on monthly geometric means.
[(3)] The enterococci standard is based on monthly geometric means per the USEPA Bacteria Rule and applies to the bathing season. The enterococci coastal recreation water infrequent use reference level (upper 95% confidence limit) = 501/100 mL.
[(4)] Per 6 NYCRR 703.4(c), bacteria standards are only applicable when disinfection is practiced. n/a: not applicable.

It is noted that a reclassification of the tidal Bronx River to the fishable/swimmable Class SB/SC requires more stringent numerical coliform bacteria criteria and also increases the minimum dissolved oxygen requirement to never-less-than 5.0 mg/L from 4.0 mg/L.

The Interstate Environmental Commission (IEC) waterbody classifications applicable to waters within the Interstate Environmental District are shown in Table 9-3. The East River and its tidal tributaries including the Bronx River are classified as Class B-1 with best intended uses of secondary contact recreation and fishing.

Table 9-3. Interstate Environmental Commission Classifications, Criteria and Best Uses

Class	Dissolved Oxygen	Best Intended Use
A	>5.0 mg/L	Suitable for all forms of primary and secondary contact recreation and for fish propagation. In designated areas, they also shall be suitable for shellfish harvesting.
B	>4.0 mg/L	Suitable for fishing and secondary contact recreation. They shall be suitable for the growth and maintenance of fish life and other forms of marine life naturally occurring therein, but may not be suitable for fish propagation.
C	>3.0 mg/L	Suitable for passage of anadromous fish and for the maintenance of fish life in a manner consistent with the criteria established in Sections 1.01 and 1.02 of these regulations.

IEC bacterial standards apply to effluent discharges from municipal and industrial wastewater treatment plants and not to receiving waters.

9.1.2. Narrative Water Quality Standards

The New York State narrative water quality standards applicable to the Bronx River and all waterbody classifications are shown in Table 1-2 and restated here in Table 9-4.

Table 9-4. 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.

It is noted that, in all cases, the narrative water quality standards apply a limit of “no” or “none” and only for selected parameters are these restrictions conditioned on the impairment of waters for their best usages.

The IEC narrative water quality regulations which are applicable to the Bronx River and all waters of the Interstate Environmental District are shown in Table 9-5.

Table 9-5. 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 Numeric Water Quality Standards

The Freshwater Bronx River

<u>Attainment of Currently Applicable Standards</u>

Table 9-6 summarizes available dissolved oxygen data for the NYC freshwater Bronx River.

Table 9-6. NYC Freshwater Bronx River Dissolved Oxygen Data Summary

Data Program	Data Period	No. of Stations	No. of Data Points	Dissolved Oxygen Average mg/L	Dissolved Oxygen Min mg/L
NYCDEP Harbor Survey	Summer 2000	3	6	6.2	5.6
USA Project	August 2000	10	38	7.8	5.3
	October 2000	10	36	8.4	5.8
Bronx Zoo Management Plan	September 2000	7	7	7.1	6.5
	October 2000	7	7	7.4	7.1
	December 2000	4	4	8.1	5.6

These data indicate an improvement in dissolved oxygen in the NYC freshwater Bronx River, when compared to data from the CSO Facility Planning period (1988, 89). On the basis of this information, it is concluded that Class B dissolved oxygen standards are met in the freshwater Bronx River, indicating fish and aquatic life uses are protected.

The NYCDEP and Westchester County began a sampling program in March, 2006 to characterize bacteria levels in the freshwater Bronx River. The freshwater Bronx River is classified for primary contact recreation (NYSDEC Class B). Of the 17 miles of river, approximately 12 miles is in Westchester County and approximately 5 miles is in New York City.

Westchester County sampled monthly at eight locations for total coliform, fecal coliform and enterococci bacteria. Results of the Westchester County sampling indicated that, in almost all cases, the geometric concentrations are at least 10 times higher than the water quality standards for these bacteria indicators.

NYCDEP sampled weekly for total coliform, fecal coliform, and enterococci bacteria at two freshwater locations: one at the Westchester County border and one upstream of the tidal Bronx River. Similar to the Westchester County results, at the Westchester/Bronx border, the geometric mean concentration is about 10 times greater than the standard. Upstream of the tidal Bronx River, the geometric mean concentrations are lower than at the Westchester/Bronx border but are still about 4 times higher than the standard. A summary of the data collected near the Westchester/NYC border and upstream of the tidal Bronx River is shown on Table 9-7. It is indicated from these data that the NYC freshwater Bronx River is significantly above the numeric Class B bacteria water quality standards and that bacteriologic water quality conditions in the NYC freshwater Bronx River are affected by the quality of the Bronx River upstream in Westchester County.

Table 9-7. Summary of Bacteria Data at Westchester/Bronx County Border and Upstream of Tidal Bronx River

Parameter	Class B/C Bacteria Standard (number/100 mL)	Westchester County Data Geometric Mean (MPN/100 mL) Count Border	NYCDEP Data Geometric Mean (MPN/100 mL) County Border	NYCDEP Data Geometric Mean (MPN/100 mL) Upstream of Tidal
Total Coliform	Monthly median <2,400 80% of samples <5,000	23,700	19,800	7,700
Fecal Coliform	Monthly geometric mean <200	8,900	2,700	760
Enterococci	Geometric mean <33	350	610	160

Attainment of Potential Future Standards

The freshwater Bronx River is currently classified for "fishable/swimmable" uses consistent with the goals of the CWA.

The Tidal Bronx River

Section 7.6 describes water quality modeling evaluations which were performed to assess the attainability of water quality standards under Baseline and WB/WS FP conditions. The results of these analyses are summarized graphically in the Appendix and in tabular form in Tables 9-8 through 9-18.

Attainment of Currently Applicable Standards

Table 9-8 summarizes projected annual attainability for dissolved oxygen for current Class I water quality standards for Baseline and Waterbody/Watershed Facility Plan (WB/WS FP) conditions. Results are presented near the head end at 177th Street, at mid-river (half the length of the tidal river) near Lafayette Avenue, and at the mouth (the confluence with the East

River). As shown in the table, 100 percent compliance is expected at the head end for both Baseline and WB/WS FP conditions. At mid-river, the WB/WS FP is projected to improve annual compliance from 98 percent to approximately 99 percent. At the mouth, 100 percent compliance is expected for both loading conditions.

Table 9-8. Annual Attainability of Dissolved Oxygen Criteria for Design Year

Location	Class I & IEC Class B-1 (>4.0 mg/L) Percent Attainability	
	Baseline	**WB/WS FP**
Head End	100%	100%
Mid-River	98%	99%
Mouth	100%	100%

Table 9-9 summarizes projected percentage annual attainability of total coliform for current Class I secondary contact criteria. Two potential ambient conditions are shown: an upstream condition in the freshwater Bronx River with bacterial concentrations at existing levels and an upstream condition where bacteria concentrations are at Class B standards. Table 9-9 indicates that 92 percent attainability is expected to occur at the head end with present upstream conditions for both the Baseline and WB/WS FP conditions. Similarly, at Mid-River, the attainability at Baseline and WB/WS FP conditions are 92 and 100 percent, respectively. At conditions whereby the upstream bacteria are at Class B concentration criteria, the tidal section would result in 100 percent attainability. Attainment of the secondary contact criteria is expected at all other locations under both loading conditions.

Table 9-9. Annual Attainability of Total Coliform Criteria for Design Year

Location	Class I GM ≤10,000 Percent Attainment			
	Existing Upstream		**Class B Upstream**	
	Baseline	**WB/WS FP**	**Baseline**	**WB/WS FP**
Head End	92	92	100	100
Mid-River	92	100	100	100
Mouth	100	100	100	100

Table 9-10 presents expected compliance during the recreation season for Class I total coliform criteria for secondary contact recreation. The recreation season is defined as the three months: June, July, and August. The table indicates that during the recreation season the upstream section of the tidal Bronx River near the head end is expected to achieve 67 percent attainability at existing upstream conditions for both baseline and WB/WS FP cases and is expected to achieve 100 percent attainability at Class B upstream conditions.

Table 9-10. Recreation Season Attainability of Total Coliform for Design Year

Location	Class I GM ≤10,000 Percent Attainment			
	Existing Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	67	67	100	100
Mid-River	100	100	100	100
Mouth	100	100	100	100

Tables 9-11 and 9-12 summarize projected percentage compliance for fecal coliform for current Class I secondary contact criteria. The tables indicate that for both annual and recreation season conditions, the current Class I fecal coliform standards are expected to be achieved throughout the tidal Bronx River with Class B upstream conditions. At existing upstream conditions, on an annual basis, the WB/WS FP improves attainability from 83 to 92 percent at the head end and from 92 to 100 percent at mid-river.

Table 9-11. Annual Attainability of Fecal Coliform for Design Year

Location	Class I GM ≤2,000 Percent Attainment			
	Existing Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	83	92	100	100
Mid-River	92	100	100	100
Mouth	100	100	100	100

Table 9-12. Recreation Season Attainability of Fecal Coliform for Design Year

Location	Class I GM ≤2,000 Percent Attainment			
	Existing Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	67	67	100	100
Mid-River	100	100	100	100
Mouth	100	100	100	100

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 upgrade would not be necessary for full use attainment in the tidal Bronx River. However, the Class I secondary contact use is not considered consistent with the “swimmable” goal. For the tidal Bronx River 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. Tables 9-13 through 9-18 summarize projected percentage annual and recreational season attainability with these potential criteria.

Table 9-13 presents annual compliance results for total coliform for Class SB/SC standards. As before, two upstream conditions are considered for the Baseline and WB/WS FP cases. The attainability is based on whichever requirement of the Class SB/SC standards becomes limiting in a given month, the median value or upper 80 percent limitation. For existing upstream conditions, annual compliance would not be expected throughout the tidal Bronx River but the WB/WS FP will increase attainability from 17 to 33 percent at mid-river. If the freshwater Bronx River were to achieve primary contact numerical criteria upstream, attainability with Class SB/SC standards are expected in the tidal river near the head end but full compliance is not expected in downstream reaches although the WB/WS FP is projected to improve compliance annually from Baseline results. The information in Table 9-13 indicates the importance of bacterial quality in the freshwater section on the achievability of primary contact criteria in the upstream half of the tidal section.

Table 9-13. Annual Attainability of SB/SC Total Coliform Criteria

Location	Class SB/SC Median ≤2,400 80% ≤5,000 Percent Attainment			
	Existing Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	0	0	100	100
Mid-River	17	33	25	67
Mouth	75	75	75	83

Table 9-14 presents recreation season (June, July, and August) attainability with Class SB/SC total coliform criteria for primary contact recreation. The table indicates recreational season attainability is significantly improved if the upstream condition is at Class B criteria. The WS/WB FP also shows improvements in attainability over Baseline for both upstream conditions.

Table 9-14. Recreation Season Attainability of SB/SC Total Coliform Criteria

Location	Class SB/SC Median ≤2,400 80% ≤5,000 Percent Attainment			
	Existing Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	0	0	67	100
Mid-River	33	67	67	67
Mouth	67	67	67	67

Table 9-15 presents expected annual attainability with Class SB/SC fecal coliform criteria. The table indicates that full attainability with the primary contact fecal coliform criteria is not projected for any of the cases analyzed. The impact of the upstream freshwater bacterial loading is evident. Control of the upstream quality to the Class B numerical criterion would improve attainability in the tidal section for primary contact uses, but full attainability throughout the tidal river is not expected from WB/WS FP implementation.

Table 9-15. Annual Attainability of SB/SC Fecal Coliform Criteria

Location	Class SB/SC GM ≤200 Percent Attainment			
	Existing Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	0	0	92	92
Mid-River	25	33	58	83
Mouth	83	92	92	100

Table 9-16 presents projected seasonal attainability with Class SB/SC fecal coliform standards during the recreational period. As before, the table shows the effect of the freshwater input of upstream bacteria, which is most pronounced near the head end of the tidal section. However, the projected results indicate that if the Class B numerical criteria for fecal coliform can be achieved in the freshwater inflow to the tidal section, the Class SB/SC primary contact fecal coliform criterion can be achieved downstream during the recreation period.

Table 9-16. Recreation Season Attainability of SB/SC Fecal Coliform Criteria

Location	Class SB/SC GM ≤200 Percent Attainment			
	Existing Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	0	0	67	67
Mid-River	67	67	67	100
Mouth	100	100	100	100

Table 9-17 presents recreation season compliance with the USEPA primary contact geometric mean criterion for both upstream conditions under Baseline and WB/WS FP conditions. The table presents results seasonally averaged over the three month recreation period. At existing upstream conditions in the freshwater section, the head end of the tidal section is not projected to comply with the enterococci criterion. If upstream conditions can be improved to achieve the geometric mean requirement in the inflow to the tidal section, then full attainment with the primary contact enterococci criterion is projected.

Table 9-17. Recreation Season Attainability of Enterococci Bacteria Criteria

Location	Class SB/SC GM ≤35/100 mL Percent Compliance			
	Existing Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	0	0	100	100
Mid-River	0	0	100	100
Mouth	100	100	100	100

Table 9-18 presents calculated seasonal compliance with USEPA's infrequent use coastal recreation water reference level (upper 95 percent confidence limit). The table indicates that if the reference level could be achieved in the freshwater inflow to the tidal section, a relatively high level of attainability with this value could be achieved in the tidal section.

Table 9-18. Recreation Season Attainability of Enterococci Bacteria

Location	Class SB/SC Infrequent Use Reference Level <501/100 mL Percent Compliance			
	Existing Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Head End	87	87	95	96
Mid-River	77	82	77	82
Mouth	90	91	90	91

Disinfection

Disinfection of HP-009 was investigated. With upstream influent conditions at Class B, downstream water quality standards are not completely attained, although improvements are realized; at least 91 percent attainment is achieved for total and fecal coliform bacteria. However, as discussed in Section 7.3.9, calculations show that residual chlorine levels could reach levels ten times higher than the NYSDEC acute standard.

9.1.4. Attainment of Narrative Water Quality Standards

Table 9-4 summarizes NYSDEC narrative water quality standards which are applicable to the Bronx River and all waters of the state. The existing CSO discharges to the tidal river and the stormwater from the separately sewered and unsewered areas in the freshwater section discharge some amounts of materials which affect most or all of the listed parameters to some degree. Although odors are not a noticeable problem in the Bronx River, there is some deposition of organic solids particularly in the tidal section; some turbidity is evident after significant rainfall events; oil, floating substances and floatable materials (refuse) are discharged; and phosphorus and nitrogen are present in CSO and stormwater discharges.

The WB/WS FP will not completely eliminate, but will significantly reduce, the discharge of these materials to the Bronx River. The upgrade of the Hunt Point WPCP to accept 400 MGD of combined sewage will reduce the discharge of the parameters of concern by 41 percent based on volumetric capture and heavy solids that would settle near the CSO outfalls will be substantially reduced. For floatable materials, the in-line netting systems and regulator screening equipment proposed as part of the WB/WS FP are expected to greatly reduce the discharge of these materials to the tidal section. An additional safe guard for floatable materials will be the retention and upgrade of the floatables boom and continuation of skimmer vessel operations. Consequently, the adverse impacts of the current CSO discharges will be substantially diminished and virtually eliminated as required by the narrative standards

The WB/WS FP, although not completely eliminating all of the parameters of concern, will reduce turbidity, the deposition of organic solids and floatable materials and restore aesthetic uses of the Bronx River. Phosphorus and nitrogen discharges from the CSOs will be reduced by more than 41 percent and the remaining amounts are not significant in comparison to other sources of these materials to the East River and western Long Island Sound. The discharge of floatable materials and other narrative impacts will be reduced to the maximum extent practicable.

9.1.5. Water Use Restoration

Fish and Aquatic Life Protection Use

Table 9-6 is a summary of more recent dissolved oxygen data available in the freshwater Bronx River. As shown, all data are greater than the dissolved oxygen standards for Class B waters. These data are greater than historical data collected during the CSO Facility Planning period (1988, 89). Therefore, the fishing and fish propagation and survival use in the freshwater Bronx River is considered attained.

Table 9-8 presents the expected dissolved oxygen compliance values under Baseline and WB/WS FP conditions in the tidal Bronx River. As shown on this table a high level of annual attainability is projected. During a critical summer month (July), at the most affected area near 172nd Street, the WB/WS FP is projected to improve attainability from 85 percent under the Baseline condition to 90 percent. Thus, the fish and aquatic life protection use is expected to be protected for more most of the year but not completely.

Modeling calculations at baseline conditions have shown that approximately 23 percent of the oxygen depression at 172nd Street, on the order of 1.0 mg/L, is caused by the CSO discharges to the tidal Bronx River. Almost all of the remainder is due to oxygen depression at the East River boundary intruding into the tidal Bronx River and exacerbated by the salinity stratification in the tidal section. This stratification is caused by the discharge of the upstream freshwater Bronx River to the saline water in the tidal river. The salinity stratification inhibits the transfer of atmospheric oxygen to the lower layers of the tidal reach where the low dissolved oxygen occurs and is considered, in this regard, a natural condition.

Primary and Secondary Contact Recreation Use

Table 9-7 summarizes coliform data observed near the Westchester/Bronx County border in the freshwater Bronx River. Additional data in the NYC freshwater section are shown on Figures 4-22, 4-23 and 4-24. All data are significantly greater than the numerical coliform bacteria standards for Class B/C freshwaters. As such, these waters are not suitable for primary contact at present.

Analytical calculations performed on the NYC freshwater section of the Bronx River and the available data indicate that greater than 90 percent of the bacteria loading to this reach originate from upstream sources in Westchester County with 80 percent of the drainage area. The bacteria concentration values measured at the border, while indicating a correlation to rainfall, is consistent with available data showing contamination levels in urban runoff from populated areas. Attainment of bacterial water quality in the freshwater area suitable for primary contact usage may therefore require control of urban runoff to a very high level which may not be technically feasible.

Tables 9-9 through 9-12 summarize projected total and fecal coliform attainability in the tidal Bronx River for the current Class I secondary contact recreation criteria. The tables indicate that this water use is mostly attained in the tidal section for both criteria. The exception is non-attainability on an annual basis for total coliform in a one-half mile section at the head end below East Tremont Avenue. Although HP-004 and HP-007 are contributing factors to the non-attainability of current Class I secondary contact criteria, Tables 9-9 through 9-12 indicate that full attainment of the criteria would be achieved if the freshwater Bronx River was attaining Class SB primary contact criteria.

Tables 9-13 through 9-18 present projected attainability values for total and fecal coliform and enterococci bacteria for a potential Class SB/SC primary contact designation in the tidal Bronx River for conformity with the “swimmable” goal of the CWA. Tables 9-13 and 9-15 show that, on an annual basis, full attainment with Class SB/SC total and fecal coliform criteria is not expected in the tidal Bronx River for any of the cases considered. Both tables show the importance of the upstream freshwater loading on attainment results and indicate some improvement achieved by the WB/WS FP.

Table 9-17 and 9-18 show projected attainment results during the recreation season for Class SB/SC enterococci criteria. The results are similar to those for the other indicator bacteria. The effect of the upstream loading is apparent. It is also projected that if the upstream enterococci levels can be maintained at a geometric mean of 35/100 mL, that attainment with the enterococci seasonal geometric mean criterion of 35/100 mL can be maintained in the tidal section.

In summary, except for an isolated location under existing conditions, the current Class I secondary contact recreation use is attained annually at present in the tidal Bronx River. For an upgraded Class SB/SC primary contact use, the WB/WS FP and attainment of the Class B numerical bacterial criteria in the freshwater section are expected to achieve at least 67 percent attainment of primary contact criteria.

Aesthetic Use

As discussed in Section 9.1.4, the WB/WS FP will not completely eliminate all regulated parameters in the NYSDEC narrative water quality standards to zero discharge levels, but will significantly reduce the volumetric discharge of such substances. The effect of floatable materials from CSOs will be virtually eliminated by the proposed positive floatables controls, upgraded retention boom and skimmer vessel operations, and the effect of narrative materials from NYC-based stormwater inputs will be reduced to the maximum extent practicable. Accordingly, the aesthetic conditions in the tidal Bronx River should improve to a level consistent with the other attained water uses and the nature of the adjacent shoreline uses.

9.1.6. Practical Considerations

Fish and Aquatic Life Protection

Section 9.1.5 describes the level of attainment with Class I dissolved oxygen standards which is expected to result with the WB/WS FP implementation in the tidal Bronx River. As noted, the attainment of dissolved oxygen is projected to be about 99 percent on an annual basis and about 95 percent for a critical July period.

For the majority of months, complete compliance throughout the Bronx River is expected. In the confined period where criterion exceedances are expected, it should be noted that the impact on fish larval propagation is likely to be limited. Fish larvae spawning in the tidal Bronx River will be exchanged with, and transported to, East River waters where dissolved oxygen will be greater. The organisms will therefore not be continuously exposed to Bronx River dissolved oxygen which may be depressed below the criterion. Consequently, the impact on larval survival will be less than expected based on laboratory studies where organisms are essentially caged and exposed continuously to the same depressed dissolved oxygen level. Because of the significant amount of larval transport which occurs in the Bronx River, and in the East River and its other tributaries, 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 East River and the New York Harbor ecosystem in its entirety rather than by individual tributary or sub-region for purposes of fish and aquatic life protection.

Additionally, direct kills of juvenile fish at the head end of the tidal Bronx River should not occur as there exists no fish passage and the organisms would avoid any temporarily depressed dissolved oxygen. Minimum dissolved oxygen projected for the tidal section should be sufficient for restoration and protection of benthic organisms.

Section 4.6.8 presents a detailed discussion of fish and aquatic life uses based on the biological Field Sampling and Analysis Program for the Bronx River.

Primary and Secondary Contact Recreation Use

As described in Section 9.1.5, the exceedance of Class B primary contact standards in the freshwater Bronx River is primarily caused by urban runoff and other sources in the upper Westchester County watershed. Implementation of BMP technology in the upper watershed, a possible regulatory approach, may reduce the urban runoff component of the bacterial exceedences. The BMP technologies and their effectiveness are presently being investigated by NYCDEP.

With regard to the effect of NYC discharges to the freshwater section, no CSO discharges occur or contribute to the non-attainment with Class B primary contact criteria. Further, modeling calculations indicate that if waters entering the NYC portion of the Bronx River from Westchester County were at Class B/C standards, the minor amount of stormwater, direct and distributed, from NYC sources would not cause nor contribute to non-attainment with Class B standards.

As far as regulatory requirements are concerned, it is noted that the requirement for attainment of the numerical bacteriological criteria for Class B/C waters is contingent upon the practice of chlorination in a particular waterbody. As chlorination (at a sewage treatment plant, for example) is not practiced in the freshwater Bronx River watershed, attainment of the numerical bacteriological criteria is not mandated. However, as water quality conditions in any waterway must protect downstream usage, the elevated bacteria concentrations in the freshwater section would become problematic were the tidal Bronx River to be reclassified to Class SB/SC for primary contact.

9.2. WATER QUALITY STANDARDS REVISION

9.2.1. Overview of Use Attainability and Recommendations

As discussed previously, bacterial levels in the freshwater Bronx River exceed numerical requirements for Class B primary contact. As noted, New York City will cooperate with Westchester County through the USACE Bronx River Restoration Project to augment the existing data base and identify the causes of criteria exceedance. It is therefore recommended that the Class B designation be retained for the NYC freshwater Bronx River at present until more is known regarding the practical attainability of the numerical criteria for primary contact. If this level of water use does not appear to be achievable, then consideration can be given to the reclassification of the Class B section to Class C with a best usage of fishing for consistency with Westchester County waters.

The preceding discussion has indicated that the secondary contact recreation requirement in the Class I tidal section is virtually attained. It is recommended, therefore, that the Class I classification for the tidal Bronx River be retained at this time. Analysis indicates that attainment of a Class SB/SC primary contact use would require achievement of Class B numerical criteria in the inflow from the freshwater section. If this is demonstrated to be achievable from cooperative work conducted as part of the USACE Bronx River Restoration Project, and if the long term monitoring program described elsewhere in this report demonstrates that the WB/WS FP will attain primary contact conditions during the three month recreation season, then consideration could be given to redesignation of the Bronx River tidal section to Class SC with seasonal primary contact use.

As discussed, 92 percent attainment annually with Class SB/SC primary contact criteria would require Class B achievement upstream, and environmentally undesirable chlorination/ dechlorination or expensive CSO outfall HP-009 relocation. Such a step would probably only be considered if the open waters of the East River were also reclassified from Class I to Class SC. It should be noted, however, that while implementation of the foregoing engineering steps may result in attainment with the numerical requirements for primary contact, bathing would not be recommended and should be prohibited due to frequent elevated bacterial concentrations from regional CSO discharges and stormwater outflows.

As noted previously, expected levels of water quality standards compliance 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 FP be assessed from the multi-year long-term monitoring program described elsewhere in this report. The monitoring program will document the actual attainment of uses: whether the current Class I uses are attained as expected; whether higher levels of usage would be achieved supporting a higher waterbody classification; or whether CWA "fishable/swimmable" goals are not attained therefore requiring additional Use Attainability Analyses and subsequent water quality standards revision.

Sections 9.1.4 and 9.1.5 discuss the attainability of the narrative criteria in the State Water Quality Regulations. As noted, the WB/WS FP will achieve a substantial reduction in, but not completely eliminate, the discharge of materials referenced in the narrative water quality standards. It is therefore recommended that a water quality based effluent limit (WQBEL) variance for the narrative standards be applied for, approved, and extended until sufficient long term water quality monitoring data are obtained to document actual conditions attained.

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 the Bronx River. 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 © 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 Bronx River LTCP, when finalized, approved and when referenced in the Hunts Point WPCP SPDES permit, along with other presumed actions necessary to attain Class I water quality standards can be interpreted as the equivalent of an “effluent limitation.”

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. If “pollutant” cannot be interpreted in the plural, then multiple variances may need to be requested, with a separate application for each. In the Bronx River, a variance would be needed for total and fecal coliform for a short section of the tidal river near 177th Street where Class I secondary contact criteria would not be attained if upstream bacteria levels cannot be remediated and for effluent constituents covered by narrative water quality standards. A bacteriological variance would not be requested in the remainder of the Bronx River as the WB/WS FP is expected to attain Class I requirements.

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 40 CFR 131.10(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. Factor (3), human caused conditions, is applicable in the Bronx River to the variance request for coliform and for narrative water quality standards.

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. No significant increased human health risk is foreseen due to the absence of full compliance with bacteriological criteria in a short section of the tidal river near the head end and with the narrative water quality standards.

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 Bronx River LTCP to NYSDEC 18 months before the Facility Plan is placed in operation. The application will be accompanied by the Bronx River LTCP report, a Bronx River Use Attainability Evaluation , as well as any other supporting documentation pertaining to Subdivisions (b) and (c) or as required by any other subdivisions of the variance requirements that might assist NYSDEC in their review of the application.

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 LTCP construction, will be based upon the performance characteristics of the LTCP as agreed upon between NYSDEC and NYCDEP.
- 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 LTCP 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 the Bronx River, various City-wide 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 Bronx River LTCP 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 Bronx River LTCP would require renewals to allow for sufficient long-term monitoring to assess the degree of water quality standards compliance.

At the completion of the variance period(s), it is expected that the results of the long-term monitoring program and related analyses will demonstrate each of the following:

- The degree to which the LTCP attains the current Class I classification water quality standards and uses;
- The degree to which the LTCP achieves water quality criteria consistent with the fishable/swimmable goals of the CWA, whether any new low-cost technology is available to enhance the LTCP performance, if needed, whether the waterbody classification for the Bronx River can be revised upward, or whether additional Use Attainability Analyses should be conducted.

In this manner, the approval of a WQBEL variance for the Bronx River together with an appropriate long-term monitoring program can be considered as a step toward a determination of the following:

- Can the Bronx River be reclassified in a manner which is wholly or partially compatible with the fishable/swimmable goals of the Clean Water Act or
- Are additional Use Attainability Analyses needed for the Bronx River in addition to that recommended and for which water quality criteria?

Although the Bronx River's current waterbody classification, Class I, is not wholly compatible with the goals of the Clean Water Act and would normally require upward 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 LTCP implementation enable a proper determination for the appropriate waterbody classification for the Bronx River and perhaps avoid unnecessary, repetitive and possibly contradictory rulemaking.

9.2.4. Future Considerations

Urban Tributary Classification

The possibility is recognized that the long-term monitoring program recommended for the Bronx River, and ultimately for other confined waterbodies throughout the City, may indicate that the highest attainable uses are not fully compatible with the use goals of the Clean Water Act at all times. It is therefore recommended that 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
- Secondary contact recreation

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 Bronx River LTCP when completed and approved would apply 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 occur after controls. Therefore, it is recommended that NYSDEC review the application of the narrative standards, provide for wet weather exclusion with demonstrated need, or make all narrative standards conditional upon the impairment of waters for their best usage.

Synopsis

At the current water quality classification in the tidal section of the Bronx River (Class I), the dissolved oxygen criterion is expected to be attained 99 to 100 percent of the time after implementation of the WB/WS Facility Plan components. The bacteria will also be in compliance with existing water quality standards if the upstream freshwater is in compliance with the Class B water quality standards. The WB/WS Facility Plan will not completely eliminate but will significantly reduce the discharge of solids, oil, floating substances and floatable materials. For floatable materials, the in-line netting systems and regulator screening equipment proposed as part of the WB/WS Facility Plan are expected to greatly reduce the discharge of these materials. An additional safeguard will be the retention of the floatables boom and continuation of skimmer vessel operations. Consequently, the adverse impacts of the current CSO discharge on the narrative standards will be substantially diminished.

10.0 References

Adams, D.A., J.S. O'Connor, S.W. Weisberg. 1998. Sediment Quality of the NY/NJ Harbor System. An Investigation under the Regional Environmental Monitoring and Assessment Program (REMAP), March 1998.

Aliquier, M. et. al. 1982. "Improvement of Swirl Concentrator", *Journal of the Environmental Engineering Division*, ASCE, Vol. 108, No. EE2, April 1982.

Attorney General of the State of New York, Environmental Protection Bureau. 2001. Assurance of Discontinuance: Pursuant to Executive Law § 63(15). March 2001.

Bronx River Alliance. 2006. *Ecological Restoration and Management Plan* (Draft).

City of Indianapolis. 1996. *Implementation of early Action CSO Control Projects: Pilot Facilities for In-System Storage and Solids/Floatables Control*.

City of New York. 2005. New York City Industrial Policy: *Protecting and Growing New York City's Industrial Job Base*. January 2005.

City of New York and Hunts Point Task Force. Fall 2004. *Hunts Point Vision Plan*.

The Coastal Zone Management Act of 1972. U.S. Code Title 16, Chapter 33, Sec. 1251-1465.

Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service. 103 pp.

Day, J.W., C.A.S. Hall, W.M. Kemp and A. Yanez-Aranciba. 1989. Estuarine Ecology. John Wiley & Sons, New York, NY, USA. 558 pp.

Dean, T.A. and V.J. Bellis. 1975. Seasonal and Spatial Distribution of Epifauna in the Pamlico River Estuary, North Carolina. Journal of Elisha Mitchell Scientific Society 91(1): 1-12.

EEA, Inc. 1991. East River Landing Aquatic Environmental Study Final Report. Prepared for the New York City Public Development Corporation, April 1991.

ENSR Consulting. 1999. East River Repowering Project at the East River Generating Station, New York, NY, September 1999.

Environmental Management Ltd. 2000. *Sampling Work Plan for Bronx Zoo Wildlife Conservation Park*. Prepared for the Wildlife Conservation Society (WCS). August 14, 2000.

Fair, G. and Geyer, J. 1965. *Elements of Water Supply and Wastewater Disposal*, John Wiley & Sons, Inc. New York.

Ferrara, R. A. and Witkowski, P. 1983. <u>Stormwater Quality Characteristics in Detention Basins</u>, Journal of Environmental Engineering ASCE, Vol. 109, No. 2.

Gosner, K.L. 1978. "A Field Guide to the Atlantic Seashore." Peterson Field Guides. Houghton Mifflin Company. New York.

Greeley and Hansen. 1995. *Memorandum Report on CSO Swirl Concentrator Facility (Vortex Separator) Testing Program*.

Hazen and Sawyer Engineers. 1981. Newtown Creek Water Pollution Control Plant Final Report Monitoring program (May – October 1980). Prepared for the New York City Department of Environmental Protection.

HydroQual Environmental Engineers & Scientists. 1995. *City-Wide Floatables Study*, Department of Environmental Protection, Bureau of Environmental Engineering, Division of Water Quality Improvement, New York City.

HydroQual Environmental Engineers & Scientists, P.C. 2000. Bronx River Field Sampling and Analysis Program – Years 2000-2001. Prepared for the City of New York Department of Environmental Protection, Bureau of Environmental Engineering.

HydroQual Environmental Engineers & Scientists, P.C. 2001a. East River Field Sampling and Analysis Program – Years 2001-2002. Prepared for the City of New York Department of Environmental Protection, Bureau of Environmental Engineering.

HydroQual Environmental Engineers & Scientists, P.C. 2001b. Ichthyoplankton Field Sampling and Analysis Program – Years 2000-2001. Prepared for the City of New York Department of Environmental Protection, Bureau of Environmental Engineering.

HydroQual Environmental Engineers & Scientists, P.C. 2001c. Epibenthic Recruitment and Survival Field Sampling and Analysis Program – Year 2001. Prepared for the City of New York Department of Environmental Protection, Bureau of Environmental Engineering.

HydroQual Environmental Engineers & Scientists, P.C. 2002. Supplemental Aquatic Life Characterization of East River and Jamaica Bay, Field Sampling and Analysis Program, Year 2002. Prepared for the City of New York Department of Environmental Protection, Bureau of Environmental Engineering.

HydroQual Environmental Engineers & Scientists, P.C. 2002. Tributary Benthos Characterization Field Sampling and Analysis Program, Year 2002. Prepared for the City of New York Department of Environmental Protection, Bureau of Environmental Engineering.

HydroQual Environmental Engineers and Scientists, P.C. 2003c. Tributary Toxicity Characterization Field Sampling and Analysis Program - Year 2003. Prepared for New York City Department of Environmental Protection, Bureau of Environmental Engineering.

HydroQual. 2005a. City-Wide Comprehensive CSO Floatable Plan, Modified Facility Planning Report. Prepared for the City of New York Department of Environmental Protection, Bureau of Engineering Design & Construction, July 2005.

HydroQual. 2005b. NY/NJ Harbor Estuary Program Model Application of Stormwater Sampling Results, Memorandum to C. Villari, NYCDEP, from C. Dujardin and W. Leo, May 4, 2005.

Hyland, J., I. Karakassis, P. Magni, A. Petrov and J. Shine. 2000. Ad hoc Benthic Indicator Group – Results of Initial Planning Meeting. Intergovernmental Oceanographic Commission (IOC) Technical Series No. 57. SC-2000/WS/60. United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France.

Interstate Environmental Commission, A Tri-State Water and Air Pollution Control Agency, Organization and Regulations. Revised October 27, 2000.

Lawler, Matusky and Skelly Engineers (LMS). 1992. *Task 4.0 Receiving Water Quality Modeling*, Prepared for the New York City Department of Environmental Protection. May 1992.

Levin, Sondra. "Zoo agrees to stop animal waste runoff into Bronx River." *Bronx Times Reporter*, March 22, 2001.

Michael, G.Y. and T.F. Moore. 1997. A suggested framework for conducting UAAs and interpreting results. Project 91-NPS-1. Prepared for the Water Environment Research Foundation.

Martinez, Jose. "New shopping center; Builders start $30M Crotona Park Site." *Daily News*, February 12, 2001.

Metropolitan Council of Governments (MWCOG). 1983. *Urban Runoff in the Washington Metropolitan Area*, Final Report, Washington, D.C. Area, Urban Runoff Project, U.S. EPA Nationwide Urban Runoff Program, Water Resources Planning Board.

New York City Council. 2005. *Moving Towards a Sustainable City: Accomplishments & Agenda*. September 2005.

New York City Department of City Planning (NYCDCP). 1990. *Zoning Handbook, A Guide to New York* City's *Zoning Resolution*.

New York City Department of City Planning (NYCDCP). 1992. New York City Comprehensive Waterfront Plan, Reclaiming the City's Edge.

New York City Department of City Planning (NYCDCP). 1994. *Plan for the Bronx Waterfront*.

New York City Department of City Planning (NYCDCP), City Planning Commission. 1994, continuously updated. *Zoning Resolution, The City of New York*.

New York City Department of City Planning (NYCDCP). 1989. Land Use Maps 2, 3, 4, 5 and 7.

New York City Department of City Planning (NYCDCP), New York City Comprehensive Waterfront Plan, Plan for the Bronx Waterfront, 1993.

New York City Department of City Planning (NYCDCP), Waterfront and Open Space Division. 1999. *The New Waterfront Revitalization Program- A Proposed 197a Plan*, September, 1999.

New York City Department of City Planning (NYCDCP). Retrieved November 28, 2005, *Olinville Rezoning* http://www.nyc.gov/html/dcp/html/olinville/index.shtml

New York City Department of City Planning (NYCDCP). Retrieved November 28, 2005, *Woodlawn Rezoning*, http://www.nyc.gov/html/dcp/html/woodlawn/index.shtml.

New York City Department of City Planning (NYCDCP). 2006. *New York City Population Projections by Age/Sex & Borough, 2000-2030*, December 2006. Retrieved from website: http://www.nyc.gov/html/dcp/html/census/popproj.shtml

New York City Department of Environmental Protection (NYCDEP). 1993. *New York City Shoreline Survey Program, Hunts Point WPCP*.

New York City Department of Environmental Protection (NYCDEP). 1993-2000. New York Harbor Water Quality Survey.

New York City Department of Environmental Protection (NYCDEP). 1994. Inner Harbor CSO Facility Planning Project, Facilities Planning Report. Prepared for the NYCDEP by Hazen and Sawyer, P.C., and HydroQual.

New York City Department of Environmental Protection (NYCDEP). 1995. *City-Wide Floatables Study*, January 1995.

New York City Department of Environmental Protection (NYCDEP). 1997. CSO Abatement in the City of New York: Report on Meeting the Nine Minimum CSO Control Standards.

New York City Department of Environmental Protection (NYCDEP). 1999. *Quarterly Report on Status of City-Wide Floatables Plan April 1999 - July 1999*.

New York City Department of Environmental Protection (NYCDEP). 2000. Harbor Survey Annual Report.

New York City Department of Environmental Protection (NYCDEP). 2000b. Design Criteria and Procedures for the Preparation of Drainage Plans. Prepared by the Drainage Section of the Department of Water Resources March 1, 1973 as revised April 26, 2000.

New York City Department of Environmental Protection (NYCDEP). 2001. *New York City's Combined Sewer Overflow Program Quarterly Report*. Prepared for the New York State Department of Environmental Conservation, Third Quarter 2001.

New York City Department of Environmental Protection (NYCDEP). 2002. New York City Department of Environmental Protection, Bureau of Wastewater Treatment, Process Engineering Section Operating Data Fiscal Year 2002.

New York City Department of Environmental Protection (NYCDEP). July 2003. Wet Weather Operating Plan for Maximizing Treatment of Wet Weather Flows at the Hunts Point Water Pollution Control Plant.

New York City Department of Environmental Protection (NYCDEP). 2003c. Evaluation of Corona Avenue Vortex Facility, 2-volumes, City of New York Department of Environmental Protection, September 29, 2003.

New York City Department of Environmental Protection (NYCDEP). 2004. DRAFT: The Bronx River Waterbody/Watershed Facility Plan. March 2004.

New York City Department of Environmental Protections (NYCDEP). 2005a. New York City Floatable Litter Reduction: Institutional, Regulatory and Public Education Programs. April 29, 2005.

New York City Department of Environmental Protections (NYCDEP). 2005b. City-Wide Comprehensive CSO Floatables Plan, Modified Facility Planning Report, City of New York, Department of Environmental Protection, July 2005.

New York City Department of Environmental Protection (NYCDEP). 2005c. Corona Avenue Vortex Facility Underflow Evaluation, City of New York, Department of Environmental Protection, October 2005.

New York City Department of Health. 1977. New York City Health Code, Article 167 Bathing Beaches.

New York City Economic Development Corporation (NYCEDC). May 13, 2002. *NYC Economic Development Corporation Announces Entertainment/Retail Complex for the Bronx.* newyorkbiz.com Press Releases.

New York State Department of Environmental Conservation (NYSDEC). 1999. 6 NYCRR Part 703, Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations, Subsection 703.2 Narrative Water Quality Standards, September 1999. Subsection 703.3 Water Quality Standards for pH, Dissolved Oxygen, Dissolved Solids, odor, Color, Turbidity, September 1991. Subsection 703.4 Water Quality Standards for Coliform, January 1994.

New York State Department of Environmental Conservation (NYSDEC). 1999. 6 NYCRR Part 701, Classifications – Surface Waters and Groundwaters.

New York State Department of Environmental Conservation (NYSDEC). 2002. The 2000 Atlantic Ocean Long Island Sound Basin Waterbody Inventory and Priority Waterbodies List. April 2002.

New York State Department of Environmental Conservation (NYSDEC) Freshwater Wetland Maps, Flushing, NY, Central Park, NY - NJ, and Mount Vernon, NY, 1975.

New York State Department of Environmental Conservation (NYSDEC) Tidal Wetland Maps, 1974.

New York State Department of Health. 2000. New York State Sanitary Code, Section 6-2.19-Bathing beach design standards.

New York State Department of State, Division of Coastal Resources and Waterfront Revitalization. 1992. *Significant Coastal Fish and Wildlife Habitats Program*.

New York State Department of Transportation and Metropolitan Transit Authority (NYS DOT and MTA). 2004. Second Avenue Subway in the Borough of Manhattan, New York County, NY. Final Environmental Impact Statement. Chapter 15.

Novotny, V., J. Braden, D. White, A. Capodaglio, R. Schonter, R. Larson, and K. Algozin. 1997. A Comprehensive UAA Technical Reference. Project 91-NPS-1. Prepared for the Water Environment Research Foundation.

O'Brien & Gere. 1986. Hunts Point Infiltration/Inflow Analysis. Prepared for New York City Department of Environmental Protection.

O'Brien & Gere. 1991. Hunts Point Sewer System Evaluation Survey (SSES). Draft Final Report prepared for the City of New York Department of Environmental Protection by O'Brien & Gere, February 1991.

O'Brien & Gere. 2004. Hunts Point Inline Storage Prototype Project, Draft Operations Report, May 2004.

O'Brien & Gere. 2006. "Comparative Cost Analysis for CSO Abatement Technologies - Costing Factors." Memorandum from P. Ripkey to P. Young et. al., April 25, 2006.

Office of the Mayor. 2005. New York City Industrial Policy: Protecting and Growing New York City's Industrial Job Base, January 2005.

Office of New York State Attorney General Eliot Spitzer. 2001. “Bronx Zoo Agrees to River Cleanup: Settlement with State Creates ‘Bronx River Walk’ Trail.” March 15, 2001.

Oliver, L.J. and Grigoropoulos, S.G. 1981. <u>Control of Storm Generated Pollution Using a Small Urban Lake</u>, Journal WPCF, Vol. 53, No. 5, May 1981.

Pang, Gary. “New Plan for Old Bathgate Industrial Park.” *Community Gazette for District 15*, February 4, 2005.

Pearson, T.H. and R. Rosenberg. 1978. Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanography and Marine Biology Annual Review 16: 229-311.

The River of High Bronx. (n.d.). Retrieved July 5, 2005, from, http://www.thirteen.org/edonline/studentstake/water/bronxriver.htm

Reish, D. J. 1979. Bristle worms (Annelida: Polychaeta). Pp. 78-15. *In:* C. W. Hart & S. L. Fuller (Eds.). Pollution Ecology of Estuarine Invertebrates. Academic Press. New York.

Supreme Court of the State of New York, County of Westchester. 2004. The State of New York Against the City of Yonkers. October 26, 2004.

Sunset Energy Fleet. 2002. Summary of data from the East River Generating Station for Article X Application Gowanus Bay. New York State Public Service Commission, Case 99-F-0478.

Sutherland, R. 1995. Street Sweeper Pick-up Performance. Kurahashi and Associates, Inc., Seattle, WA.

URS Consultants and Lawler, Matusky and Skelly Engineers. 1996. *East River Combined Sewer Overflow Facility Planning Project*, Prepared for the New York City Department of Environmental Protection.

URS Consultants. 2005. *Bronx River Floatables Control Facilities Report*, Prepared for the New York City Department of Environmental Protection. September 2004. Revised November 2005.

United States Army Corps of Engineers (USACE) New York District. 1999. Expedited Reconnaissance Study, Bronx River Basin, Westchester and Bronx Counties, New York, Flood Control & Environmental Restoration Study, Section 905(b) (WRDA 86) Preliminary Analysis.

United States Army Corps of Engineers (USACE) New York District. 2000. Draft Project Study Plan, Bronx River Basin, New York, Regional Flood Control and Ecosystem Restoration Study.

United States Environmental Protection Agency (USEPA), Municipal Environmental Research Laboratory, Office of Research and Development, 1977. Catchbasin Technology Overview and Assessment, EPA-600/2-77-051, May 1977.

United States Environmental Protection Agency (USEPA), 1978. *Construction Costs for Municipal Wastewater Treatment Plants 1973-1977*. EPA 430/9-77-013.

United States Environmental Protection Agency (USEPA). 1983. *Results of the Nationwide Urban Runoff Program, Executive Summary*, Water Planning Division. December 1983.

United States Environmental Protection Agency (USEPA). 1986. *Ambient Water Quality Criteria for Bacteria*. EPA 440/5-84-002.

United States Environmental Protection Agency (USEPA). 1994. *Combined Sewer Overflow (CSO) Control Policy*. EPA 830-B-94-001.

United States Environmental Protection Agency (USEPA). 1995. Combined Sewer Overflows, Guidance for Long-Term Control Plan, EPA-832-B-95-002, Office of Water, Washington, DC, September 1995.

United States Environmental Protection Agency (USEPA). 1997. Technical Guidance Manual For Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication, EPA 823 B 97 002. Office of Water, Washington, DC, March, 1997.

United States Environmental Protection Agency (USEPA). 1998. EPA Guidance for Quality Assurance Project Plans, EA QA/G-5. EPA/600/R-98/018, February 1998.

United States Environmental Protection Agency (USEPA). 1999a. *Combined Sewer Overflow Control Fact Sheet – Screens*. EPA 832-F-99-040.

United States Environmental Protection Agency (USEPA), 1999b. *Combined Sewer Overflow Control Fact Sheet – Chlorine Disinfection*. EPA 832-F-99-034.

United States Environmental Protection Agency (USEPA), 1999c. *Combined Sewer Overflow Control Fact Sheet – Alternative Disinfection Methods.* EPA 832-F-99-033.

United States Environmental Protection Agency (USEPA). 2000a. Wet Weather Water Quality Act of 2000. H. Rept. 106-943.

United States Environmental Protection Agency (USEPA). 2000b. Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Code to Cape Hatteras. EPA-822-R-00-012. November 2000.

United States Environmental Protection Agency (USEPA), 2001a. EPA Requirements for Quality Management Plans, EPA QA/R-2. EPA/240/B-01/002, March 2001.

United States Environmental Protection Agency (USEPA), 2001b. EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5. EPA/240/B-01/003, March 2001.

United States Environmental Protection Agency (USEPA), 2001c. Guidance for Preparing Standard Operating Procedures (SOPs), EPA QA/G-6. EPA/240/B-01/004, March 2001.

United States Environmental Protection Agency (USEPA) 2001d. Guidance: Coordinating CSO Long-Term Planning with Water Quality Standards Reviews. EPA-833-R-01-002. July 2001.

United States Fish and Wildlife Service National Wetland Inventory Maps, Flushing, NY, Central Park, NY - NJ, and Mount Vernon, NY, 1994.

United States Geological Survey (USGS), 1897. New York – New Jersey: Harlem Quadrangle. N4045-W7345/15.

United States Geologic Survey (USGS) Quadrangle Maps, 1979. Flushing Quadrangle, New York, Central park Quadrangle, New York - New Jersey, and Mount Vernon Quadrangle, New York 7.5 Minute Series (Topographic).

Weiss, H.M. 1995. Marine Animals of Southern New England and New York. State Geological and Natural History Survey of Connecticut. Department of Environmental Protection.

Wildish, D. and D. Kristmanson. 1997. Benthic Suspension Feeders and Flow. Cambridge University Press: NY.

Woodland Management and Water Quality BMPs come to the Bronx Zoo. *Leaf Litter*, Vol. 2, No. 1. Retrieved January 5, 2006, from http://www.biohabitats.com/ndg_newsite/newsletter/number.03/news.htm#bronx

Zappala, S. 2001. Growth and Development of Epibenthic and Benthic Communities Associated with Waterfront Shipping Piers of the Upper Bay of New York Harbor. Masters Thesis.

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 a 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 a 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.

Contextual Zoning: Contextual Zoning districts regulate the height and bulk of new buildings, their setback from the street line, and their width along the street frontage, to produce buildings that are consistent with existing neighborhood character. Medium- and higher- density residential and commercial districts with an A, B, D, or X suffix are contextual districts.

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 (eg, 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

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, analyse 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 period 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.

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 a 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 a 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 aagency 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 a 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”.

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

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 unforseen pipe blockages or breaks, unforseen 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): An 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 technologybased 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

HUNTS POINT
WATER POLLUTION CONTROL PLANT
WET WEATHER OPERATING PLAN

City of New York
Department of Environmental Protection

Hunts Point WPCP
Wet Weather Operating Plan

September 2004

Hunts Point Water Pollution Control Plant
Bronx, New York

Wet Weather Operating Plan for Maximizing Treatment of Wet Weather Flows at the Hunts Point Water Pollution Control Plant

Prepared by:
The New York City Department of Environmental Protection
Bureau of Wastewater Treatment

9/30/04

Table of Contents

SECTION 1

INTRODUCTION

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 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 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).

The Nitrogen Administrative Order on Consent, DEC Case # CO2-2001O131-7 (the "Order" entered into by the City of New York ("City") and the New York State Department of Environmental Conservation ("DEC") was effective as of April 22, 2002. Pursuant to Appendix A: Upper East River WPCPs Upgrade Schedule and Compliance Deadlines, the City must submit a Wet Weather Operating Plan (WWOP) for the Hunts Point Water Pollution Control Plant (WPCP) by July 20,2003. The WWOP shall describe procedures to maximize treatment during wet weather events while the Hunts Point WPCP is under construction. This shall be accomplished by having the WWOP specify procedures for the operation of unit processes to treat maximum flows, without materially diminishing effluent quality or destabilizing treatment upon return to dry weather operation. The WWOP will establish process control procedures and set points to maintain stability and efficiency of Biological Nutrient Removal (BNR) Processes. The WWOP will specify the treatment facilities that will be available at each WPCP during the construction period, as identified in the Hunts Point plan. The WWOP shall be based on operations of process units that are available during the construction period operated at the peak hydraulic loading rate. The actual process control set points will be established by the WWOP. Upon completion of construction, the WWOP shall be revised to reflect the operation of the fully upgraded Facility. The revised WWOP for Hunts Point shall be submitted to DEC within 18 months of the completion of the construction of the Facility.

This document contains the WWOP for the Hunts Point WPCP operation during construction. 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

The Hunts Point Water Pollution Control Plant (WPCP) is located in the Hunts Point section of the Bronx, New York, on the shore of the upper East River (see **Figure 1-1**). The Hunts Point WPCP treats wastewater from a combined sewage collection system, which serves a population of approximately 600,000 and which drains stormwater flow from an area of almost 16,000 acres.

The Hunts Point plant began operation in 1952, with a design average flow capacity of 120 mgd. The plant was expanded in capacity in 1962 to 150 mgd, and again in the 1970's to its current design average dry weather flow capacity of 200 mgd. The upgraded plant was designed to provide primary treatment and chlorination to wet weather peak flow of twice design average dry weather flow (400 mgd), and secondary treatment to 1.5 times average dry weather flow. In the 1990's, a sludge Dewatering Building was constructed at the plant under the City –Wide Sludge Management Program.

The Hunts Point WPCP design average dry weather flow capacity is 200 mgd. In fiscal year 2000, flow to the plant averaged 121 mgd. The trend of actual influent flow to the plant has been downward over the past several years, from 148 mgd in the early 1990's when the Hunts Point Stabilization began, to 121 mgd in 2000. The average readings from temporary meters installed under Task 8 (of the additional facility planning phase of the Hunts Point Interim Plant Upgrading) corroborated the plant operating records.

The Long Island Sound Study determined that a 58.5% load reduction of nitrogen discharge is necessary to meet the water quality standards in the western Long Island Sound. In response to this study, The New York State Department of Environmental Conservation (NYSDEC) modified New York City's Water Pollution Control Plants (WPCPs) State Pollutant Discharge Elimination System (SPDES) permits to reduce their allowable nitrogen discharge, thereby initiating nitrogen control actions. The Nitrogen Control Order or Consent requires completion of construction of a Step BNR Upgrade at the Hunts Point WPCP by June 30th, 2007.

The Step BNR process will be operated at a higher sludge age, which will require a higher aerator effluent SS concentration and higher solids load on the final settling tanks. During storms, solids may be washed out of the final clarifiers because of the higher solids loading and deeper sludge blanket. The BNR treatment process must be protected against such high wet weather flows due to the constraints on the secondary-clarifier solids separation capability.

MAP SOURCE:
USGS 7.5 MINUTE SERIES
TOPOGRAPHIC QUADRANGLE
MAP OF CENTRAL PARK, N.Y.

0 2000 4000
SCALE IN FEET

URS | NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION DEP

WP-56 HUNTS POINT WPCP
PLANT UPGRADE
SITE LOCATION MAP

FIGURE 1-1

Maximum design wet weather flow to the plant is 400 mgd. The design maximum flow to secondary treatment is 1.5 times average flow, or 300 mgd. In order to protect the secondary BNR treatment process during storms, the secondary bypass system at Hunts Point will be designed with the capability to limit the peak flow to secondary treatment to 1.3 x DDWF, or 260 mgd. The design maximum capacity of the bypass system will be 140 mgd, or 0.7 time design average flow. This figure is referenced from Table 5.2 of the March 30th, 2001 Citywide Comprehensive Nitrogen Management Plan: Revised Interim Plant Upgrade Guidance Technical Memorandum. The table indicates that the maximum flow through the BNR System for Hunts Point is recommended to be 1.2 x DDWF + plant recycles or a total of 1.3 DDWF, the remaining flow would be diverted as Secondary Bypass Flow. Peak wet weather flow to secondary treatment should be reduced below 1.5 x DDWF only if problems develop with the BNR process and nitrogen effluent limits are not being met

Another design objective developed to protect the BNR process includes the diversion of excess wet weather flow to Pass C of the Aeration Tank during wet weather events. This operational procedure is outlined further on in this manual under Section 2.6 Aeration Tanks.

1.2 Drainage Area

The Hunts Point regulation system is comprised of fifteen regulator stations (twelve of which incorporate tide gate chambers) and two independent tide gate chambers. A typical regulator consists of one or more float controlled sluice gates, which regulate the flow to the interceptors.

During dry weather the sluice gate is wide open to admit all sanitary flow. During storms each sluice gate is positioned to maintain a predetermined sewage depth downstream of the gate. Excess flow is discharged to tidal waters directly or through tide gates. In addition to the fifteen regulators, the City Island pumping station has an associated regulator. This regulator is controlled by wet well level in the pump station.

There are fifteen pumping stations located in the Hunts Point WPCP Drainage Area. Of these, twelve pump combined sewage; the remaining three pump storm water only. The following Tables **1-1, 1-1A & 1-1B** list the regulators, outfalls and pump stations for the Hunts Point WWTP drainage area. **Figure 1-2** is a schematic diagram of the wastewater collection system for the Hunts Point Drainage Area.

Table 1-1 Regulator Locations				
Regulator No.	**Regulator Location**	**Outfall Location**	**SPDES No.**	**Outfall Size**
	Hunts Point		**NY0026191**	
1	E 177th St. s/o Tierney Pl.	E. 177th St. & Eastchester Bay	022	8'-0"x 8'-0"
2	Ivy Pl. s/o Pennyfield Ave.	Pennyfield Ave. & East River	021	6'-3'x6'-6"
2A	Oak Ave. s/o Chaffee Ave.	Throgs Neck Blvd. & East River	020	8'-0'x6'-6"
3	Calhoun Ave. s/o Schurz Ave.	Calhoun Ave., & East River	019	7'-0'x5'-6"
4	Brush Ave., & Bruckner Blvd.	Bruckner Expwy & Westchester Creek	016	10'-0"x9'-6"
5	White Pl. Rd. s/o River Ave.	White Plains Rd. & East River	011	DBL 13'-0"x9'-0"
6	White Pl. Rd. & O'Brian Ave.	White Plains Rd. & East River	011	DBL 13'-0"x9'-0"
7	Leland Ave. & O'brian Ave.	White Plains Rd. & East River	011	DBL 13'-0"x9'-0"
8	Truxton St. & Oakpoint Ave	Truxton St. & East River	025	11'-6"x7'-3"
9	Tiffany St. & East Bay Ave.	Tiffany St., & East River	022	12'-0"x8'-2"
9A	Tiffany St. & Viele Ave.	Tiffany St., & East River	002	12'-0"x8'-2"
10	Hunts Point Ave & Ryawa Ave.	Faragut St. & East River	003	DBL 12'-0"x9'-5 3/4"
11	Emerson Ave. & Schurz Ave.	Emerson Ave. & East River	017	14'-0"x8'-0"
12	Robinson Ave. & Schurz Ave.	Robinson Ave. & East River	018	48" Diam.
13	Metcalf Ave. & Soundview Park	Metcalf Ave. & East River	009	14'x0"x8'-0"
14	Edgewater Park	Ellsworth Ave. & East River	026	9'-0"x9'-0"
15	Conners St e/o Hutchinson Ave.	Conners St e/o Hutchinson River	023	12'-0"x6'-6"
15A	E 233rd St. & Boston Post Rd.	E233rd St. & Hutchinson River	024	12'-6"x10'-0"
CSO	Bayshore Ave. & Griswold Ave.	Outlook Ave. & Eastchester Bay	028	12" Diam.
CSO	Watt Ave. & East chester Bay	Watt Ave. & Eastchester Bay	029	15" Diam., 12" Diam.
CSO	Barkley Ave. & Shore Drive	Barkley Ave. & Eastchester Bay	030	15" Diam.
CSO	Balcom Ave. & Latting St.	Latting St., & Westchester Creek	015	4'-9"x4'-0"
CSO	Waterbury Ave., & Zerera Ave.	Lafayette Ave., & Westchester Creek	012	12'-0"x9'-0"
CSO	Barrett Ave. & Lacombe Ave.	Newman Ave. & Pugsley's Creek	013	10'-6"x8'-0"
CSO	Metcalf Ave. & Watson Ave.	Lacombe Ave. & Bronx River	010	9'-0"x6'-0"
CSO	Randell Ave. & Metcalf Ave.	Lacombe Ave. & Bronx River	010	9'-0"x6'-0"
CSO	Lafayette Ave. & Colgate Ave.	Lafayette Ave. & Bronx River	008	54" Diam.
CSO	Van Buren St. & Bronx Park Ave.	E. 177th St. & Bronx River	007	DBL 11'-6"x6'-6"
CSO	E. 177th St. & Bronx Park Ave.	E. 177th St. & Bronx River	007	DBL 11'-6"x6'-6"
CSO	Potters Place & Waterbury Ave.	Westchester Ave. & Eastchester Bay	027	12" Diam.
CSO	West Farm Rd. e/o East Tremont Ave.	West Farm Rd. & Bronx River	004	12'-0"x8'-0"
CSO	Eastchester Rd. & Waters Place	East Tremont Ave. & Westchester Creek	014	14'-0"x8'-6"
CSO	Morris Park Ave. & Eastchester Rd.	East Tremont Ave. & Westchester Creek	014	14'-0"x8'-6"
CSO	178th St. & Boston Rd.	West Farm Rd. & Bronx River	004	12'-0"x8'-0"
CSO	Pelham Pkway & Bronx Park East	E. 177th St. & Bronx River	007	DBL 11'-6"x6-'6"
CSO	Hollers Ave. Pump Station	Holler Ave & Hutchinson River	005	12" Diam.
Overflow	Co-op City (South) Pump Sation	Bartow Ave. & Hutchinson River	006	15'-0"x8'-6"
Overflow	Co-op City (North) Pump Sation	Bellamy Loop North & Hutchinson River	031	72" Diam.
Overflow	Rikers Island (North) Pump Station	Pump Station & East River	032	14" Diam.

Source: New York City Regulator Improvement Program, April 1985

Table 1-1A Regulator Weir Elevations						
Reg. No.	Regulator Location	Outfall Location	SPDES No.	Sluice Gate Size (W x H)	Weir Length	Weir Elevation
	Hunts Point		NY0026191			
1	E 177th St. s/o Tierney Pl.	E. 177th St. & Eastchester Bay	022	18" x 12"	9' 2"	-5.00
2	Ivy Pl. s/o Pennyfield Ave.	Pennyfield Ave. & East River	021	30" x 30"	8'-0"	-4.77
2A	Oak Ave. s/o Chaffee Ave.	Throgs Neck Blvd. & East River	020	-	-	-
3	Calhoun Ave. s/o Schurz Ave.	Calhoun Ave., & East River	019	12" x 12"	8'-0"	-2.88
4	Brush Ave., & Bruckner Blvd.	Bruckner Expwy & Westchester Creek	016	30" x 30"	8'-10"	-4.50
5	White Pl. Rd. s/o River Ave.	White Plains Rd. & East River	011	18" x 12"	26'-0"	-4.50
6	White Pl. Rd. & O'Brian Ave.	White Plains Rd. & East River	011	(2) 72" x 48"	8'-0"	-5.00
7	Leland Ave. & O'brian Ave.	White Plains Rd. & East River	011	36" x 30"	8'-9"	-2.35
8	Truxton St. & Oakpoint Ave	Truxton St. & East River	025	24" x 24"	9'-0"	-2.92
9	Tiffany St. & East Bay Ave.	Tiffany St., & East River	022	48" x 36"	12'-0"	-3.60
9A	Tiffany St. & Viele Ave.	Tiffany St., & East River	002	-	4'-0"	-2.33
10	Hunts Point Ave & Ryawa Ave.	Faragut St. & East River	003	(2) 36" x 30"	15'-0"	-3.65
11	Emerson Ave. & Schurz Ave.	Emerson Ave. & East River	017	18" x 18"	16'-6"	-4.00
12	Robinson Ave. & Schurz Ave.	Robinson Ave. & East River	018	12" x 12"	4'-0"	-2.72
13	Metcalf Ave. & Soundview Park	Metcalf Ave. & East River	009	36" x 30"	21'-0"	-5.00
14	Edgewater Park	Ellsworth Ave. & East River	026	-	-	-
15	Conners St e/o Hutchinson Ave.	Conners St e/o Hutchinson River	023	30" x 24"	14'-0"	-4.50

Source: New York City Regulator Improvement Program, April 1985

Table 1-1B Pump Station within Hunts Point WPCP Tributary Area			
Name	**Location**	**No. Pumps**	**Pump Size**
	A. Storm Water		
Metcalf Avenue P.S.	Metcalf Ave. & Gleason St.	3	7000 gpm
White Plains Road P.S.	Cross Bronx Exp. & White Plains Rd.	3	7000 gpm
Seton Park P.S.	Marolla & Pratt Aves. (NYC Pks. & Rec.)	N/A	N/A
Bronx River Pkwy	South of 233rd Street	2	1430 gpm
	B. Sanitary / Combined		
Hollers Ave. P.S.	Eastchester Creek & Hollers Ave.	2	610 gpm
Conners St. P.S.	Conners St. & Eastchester Creek	3	4000 gpm
Co-op City North P.S.	Co-Op City Blvd.	3	5600 gpm
Co-op City South P.S.	Co-Op City Blvd. & Einstein Loop	3	2620 gpm
Throgs Neck P.S.	Zerega & Lafayette Avenues	3	13,600 gpm
Ely Ave. P.S.	Ely & Waring Ave.	3	540 gpm
Commerce Ave. P.S.	Commerce, Seabury & Ellis Aves.	2	850 gpm
Hunts Point Market P.S.	Rywawa Ave. and Hunts Point Ave.	4	900 gpm
Pelham Bay Park P.S.	Pelham Bay Park (NYC Pks. & Rec.)	2	N/A
City Island P.S.	Schofield St. & City Island Blvd.	3	1800 gpm
Orchard Beach P.S.	Orchard Beach	2	600-1000 gpm
Rikers Island North P.S.	Rikers Island Oppos. Auto Mainten. Bldg.	2	1000 gpm
Waters Place P.S.	Bronx Occupational Training Center	2	N/A
Hart Island P.S.	Hart Island (No longer in use)	N/A	N/A
Zimmerman P.S.	Britton Olinville & Barker Aves. (NYC Pks. & Rec.)	2	N/A

N/A - Not Available

Source: Hunts Point I/I Analysis Report, December 1986

URS

URS Corporation
Hunts Point WPCP Drainage Area Map
Wet Weather Operating Plan

FIGURE 1-2

1.3 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.

Under Phase I of the upgrading, a new forebay gate chamber is being constructed in Ryawa Avenue to improve throttling of wet weather flows to the plant. The new forebay gate chamber is located far enough upstream from the influent bar screens to eliminate problems with high velocity flow impinging on the screens. The plant's headworks and main sewage pump station are also being upgraded under Phase I to ensure that the plant can reliably accept and treat two times design dry weather flow (DDWF), as required by the Omnibus IV Consent Decree.

1.4 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. The existing aeration tanks have been retrofitted with the basic Step BNR (Biological Nutrient Removal) process to provide an intermediate degree of nitrogen removal. Sludge treatment consists of cyclone degritting of primary sludge, gravity thickening of combined waste activated and primary sludge, anaerobic digestion and centrifuge dewatering. Sludge from other DEP plants is transported to the plant by vessel and is stored and dewatered along with the Hunts Point plant's sludge. Centrate from the sludge dewatering facility is recycled through the plant, which adds a significant nitrogen load on the plant. Sludge cake, grit, scum and screenings are removed from the plant by truck for disposal to an off-site facility. The capacities of the unit processes at the existing Hunts Point plant are shown in **Table 1-2.**

Table 1-2 Unit Process Capacities			
Process Equipment	**Number of Units in Service**	**Maximum Plant Influent Flow / MGD**	**Maximum Secondary Treatment Flow / MGD**
Screens	1 Primary & 2 Secondary Screens	133	
	2 Primary & 3 Secondary Screens	267	
	3 Primary & 4 Secondary Screens	400	
Main Sewage Pumps* **	1 Pump	70	
	2 Pumps	140	
	3 Pumps	210	
	4 Pumps	280	
	5 Pumps	350	
Primary Settling Tanks	1 Tank	140	
	2 Tanks	220	
	3 Tanks	300	
	4 Tanks	370	
	5 Tanks	400	
	6 Tanks	400	
Aeration Tanks	1 West Tank		60
	2 West Tanks		120
	3 West Tanks		180
	4 West Tanks		240
	1 East Tank		300
	2 East Tanks		300
	Total Design Capacity *		300
Final Settling Tanks **	West Tanks Numbered 31 thru 34, 41 thru 44 51 thru 54 & 61 thru 64		12 tanks @ 9.1 mgd each
	West Tanks Numbered 35, 45, 55 & 65		4 tanks @ 3.2 mgd each
	North & South Tanks 10, 20, 70, & 80		4 tanks @ 14.6 mgd each
	East Tanks 91 thru 96		6 tanks @ 23.4 mgd each
	Total Capacity, All Tanks in Service		320 MGD
Chlorine Contact Tanks****	1 Tank		330 MGD
	2 Tanks		400 MGD

*One east tank is used for centrate treatment.

**Maximum capacity based on maximum overflow rate of 1,200 gpd/sf.

***Indicates reduced capacity of existing pumps due to wear; to be increased to 100 mgd per pump under the plant upgrade.

**** Indicates chlorine contact tank capacity with East River Tide Elevation at or below mean high tide.

Plant Upgrading

Construction of the plant upgrading has been divided into multiple phases. The proposed master site plan of the plant is shown in **Figure 1-3.** Phase I of the plant upgrading for the Hunts Point WPCP will include installation of facilities to improve the plant's overall wastewater treatment process reliability and operation. The schedule for Phase I includes a milestone under the Omnibus IV Consent Decree to complete construction of all facilities required to treat 2X DDWF (400MGD) by October 31st, 2004. The proposed Phase I improvements include the following:

Phase I, Wastewater Treatment Facilities Improvements:

- Main Building improvements including new forebay gate chamber, screen chamber modifications, new main sewage pumps, personnel facilities expansion, new centralized residuals handling facilities with odor control, new boiler room, secondary screen replacement and architectural repairs.
- Primary sludge and degritting system, including primary sludge pump and piping replacement, architectural repairs to Primary Sludge Pump Stations, and degritting equipment replacement.
- Aeration system upgrade, including replacement of the foam spray system, new froth chlorination hoods and architectural repairs to Aeration Buildings.
- Chlorination system improvements, including replacement of hypochlorite feed and storage equipment, new fill station spill containment, CCT sludge and floatables removal equipment, and architectural repair of the Chlorination Building.
- Return Activated Sludge Pump, Waste Activated Sludge Pump and East Effluent Pump replacements, new RAS Control Room and VFDs, and upgrade of the east effluent pump station.
- New Scum Processing System, including new scum removal equipment in primary and final settling tanks, six new scum pumping stations, and a new centralized scum concentration system.
- Site work improvements, including raw sewage conduit modifications, city water service loop replacement, new site security booth, new handrails, paving and landscaping.
- All associated controls and instrumentation, electrical HVAC, and plumbing work.

Phase II, Step BNR Facilities:

Phase II of the plant upgrading will include improvements required to enhance nitrogen removal as required by the plant's State discharge permit and the Nitrogen Order of Consent. The milestone date for completing the step BNR facilities is June 30th, 2007.

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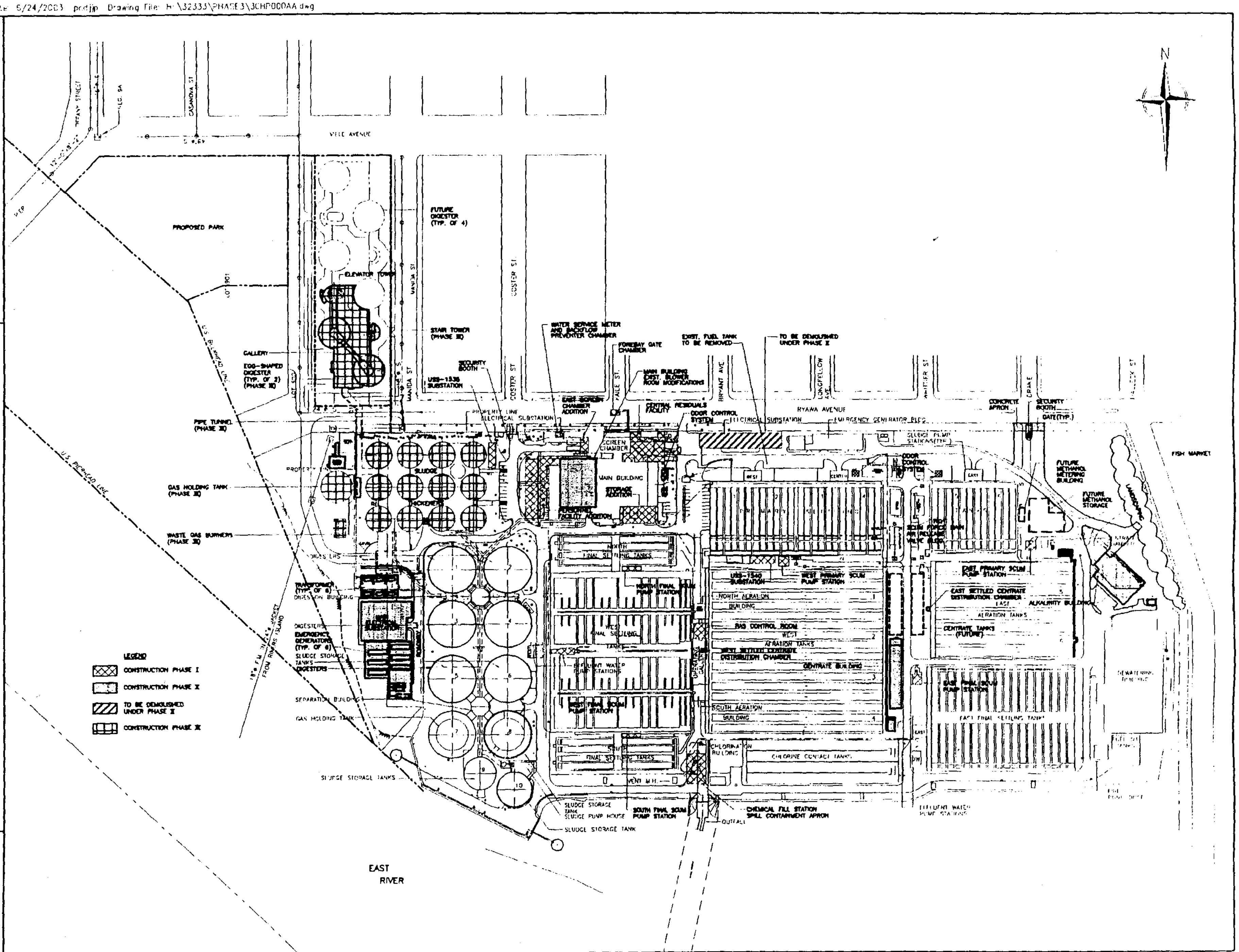


WP-56 HUNTS POINT WPCP
PLANT UPGRADE

PROPOSED MASTER SITE PLAN

Fig 1-3

The proposed Phase II improvements include the following:

- Process air system improvements including new blowers, silencers, air filters, and diffusers.
- New channel air system including blowers, filters, silencers, piping, and diffusers.
- Aeration tank improvements, including new anoxic mixers, baffles, and motor operated influent gates.
- New alkalinity feed and storage facility.
- New centrate pumping and distribution facilities
- Associated instrumentation and control systems, including automatic DO control, flow monitoring and control systems, and ammonia, nitrate, and pH analyzers.

New main electrical substation and emergency generators

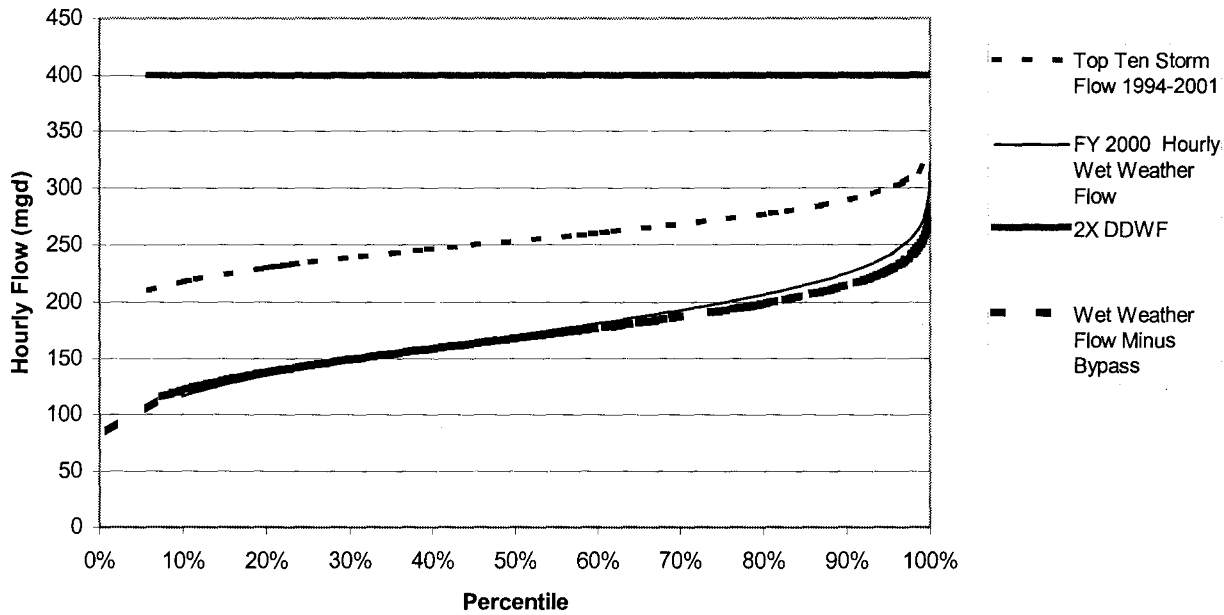
1.5 Observed Wet Weather Treatment Capacity

An analysis was performed for the top ten storms of the year for the Hunts Point WPCP. These storms are sufficient to produce CSO's; therefore, the plant should be at its maximum wet weather capacities during these events.

Figure 1.4 shows a statistical plot of the Top Ten Storm Data (1994 through 2001) including a plot of hourly flow data for Fiscal Year 2000. This was done to determine how the near-term operations (hourly) compare with the long-term operations (Top Ten Storm Data). It would be expected that there would be some peak hourly data that exceeds the Top Ten Storm data because the Top Ten Storm data is based on sustained peak flows lasting 3 to 4 hours or more. This however is not the case. The statistical distribution demonstrated in Figure 1.4, indicates that the plant handled flows since 1994 as high as 327 MGD (peak Top Ten Storm) and 320 MGD (peak hourly). This difference at the extreme end of flows is only 7 MGD at the extreme end, but diverges significantly as the percentile range decreases.

The average by-pass flow for the Fiscal year 2000 during wet weather events is approximately 29 MGD over four hours or ten percent of the average peak hourly flow rate for the same data set. This means that roughly 90% of the wet weather influent received full secondary treatment.

Figure 1.4
Hunts Point - Probability Distribution of Wet Weather Flows



The review of the Hunts Point WPCP operating data indicates that wet weather flows have not caused any excursions in effluent quality or any permit compliance violations. This suggests that the plant has capacity to accept additional wet weather flow. The flow analysis suggests an observed wet weather capacity of 320 MGD.

The Hunts Point WPCP currently cannot meet 2 x DDWF (400 mgd) because of limitations to the plant headworks and main sewage pump station (examples include throttling and/or influent gate controls, screening operations, pump capacity, and grit/sludge handling capacities) which is not outlined in the performance data. The limitations to plant facilities will be corrected under Phase I of the plant upgrading. Until Phase I construction is complete, the plant will not be capable of treating 2 x DDWF. Even after Phase I is complete, removal of tanks from service during Phase II construction will impact the plant's secondary treatment capacity.

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 Hunts Point WPCP and, in doing so, reduce the volume of untreated CSO being discharged to the Long Island Sound and its tributaries. The Hunts Point WPCP will be maintained in continuous operation by the NYCDEP during the entire construction period of the stabilization contracts. The major operating requirements include:

- The minimum acceptable level of treatment at the plant throughout the duration of the construction period shall be secondary treatment and disinfection.
- Dewatering and trucking of sludge, screenings, scum and grit, and the delivery of chemicals and fuel oil shall proceed throughout the duration of the Contract.

There are three primary objectives in maximizing treatment for wet weather flows:

1. Consistently achieve primary treatment and disinfection for wet weather flows up to 400 MGD. In doing so this, the plant will satisfy the SPDES requirement of providing this level of treatment for 2 xDDWF.

2. Consistently provide secondary treatment for wet weather flows up to 300 MGD before bypassing the secondary treatment system. The plant will have the ability to provide a secondary level of treatment for 1.3 x DDWF (an amount adjusted downward from the original goal of 1.5 x DDWF). A lower volume treatment configuration will be instituted if needed in order to maintain and protect the Step BNR Process, which is more susceptible to wet-weather shock loads. This scenario is in accordance with the recommendations of the Comprehensive Nitrogen Management Team found in their March 2001 Refined Plant Upgrading Guidance Technical Memorandum.

3. Do not appreciably diminish the effluent quality or destabilize treatment upon return to dry weather operations. (This objective ties into the previous goal of protecting the dry weather Step BNR operation by providing secondary treatment for 1.3 x DDWF.)

1.7 Purpose of This Manual

The purpose of this manual is to provide a set of operating guidelines to assist the Hunts Point WPCP staff in making operational decisions which will best meet their performance goals and the requirements of the SPDES 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 controlled through influent pump operations and adjustment of regulators. 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 Hunts Point 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 Hunts Point 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 additions 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 Hunts Point 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 in the future after automation is complete. Currently, Regulator HP-6 has an existing remote control system, which has been in operation for over five years. Approximately one-third to one half of the rainfall in the sewer system is controlled by Regulator HP-6. The plant has experienced problems with signal telemetry between the regulator and the plant.

- **Throttling Gate Automation**- A new forebay gate chamber with a new gate actuated by a hydraulic cylinder will be installed under Phase I of the plant upgrading. The objective of the Forebay throttling gate system is to automatically throttle maximum flow into the plant to 400 MGD during wet weather conditions, and to prevent the level in the Afterbay channel from exceeding Elevation (-) 8.00. The revisions to the operating procedure for the gate should be incorporated into this manual after automation is complete.

- **Step BNR Process**- The increased sensitivity of the Step BNR system to wet weather flows and possible upsets will have to be alleviated with possible process flow changes during wet weather. Increased monitoring of system components such as flow, dissolved oxygen, sludge blankets, froth etc will certainly be a part of the new flow train. The operation protocol for this type of treatment should be reviewed and revised as necessary and incorporated into this manual after completion.

- **Future Construction Phases-** Future construction phases may impact the operation of the plant and may require revisions to this manual.

SECTION 2
UNIT PROCESS OPERATIONS

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. A flow diagram of the plant headworks following completion of the plant upgrading is shown in **Figure 2-1.**

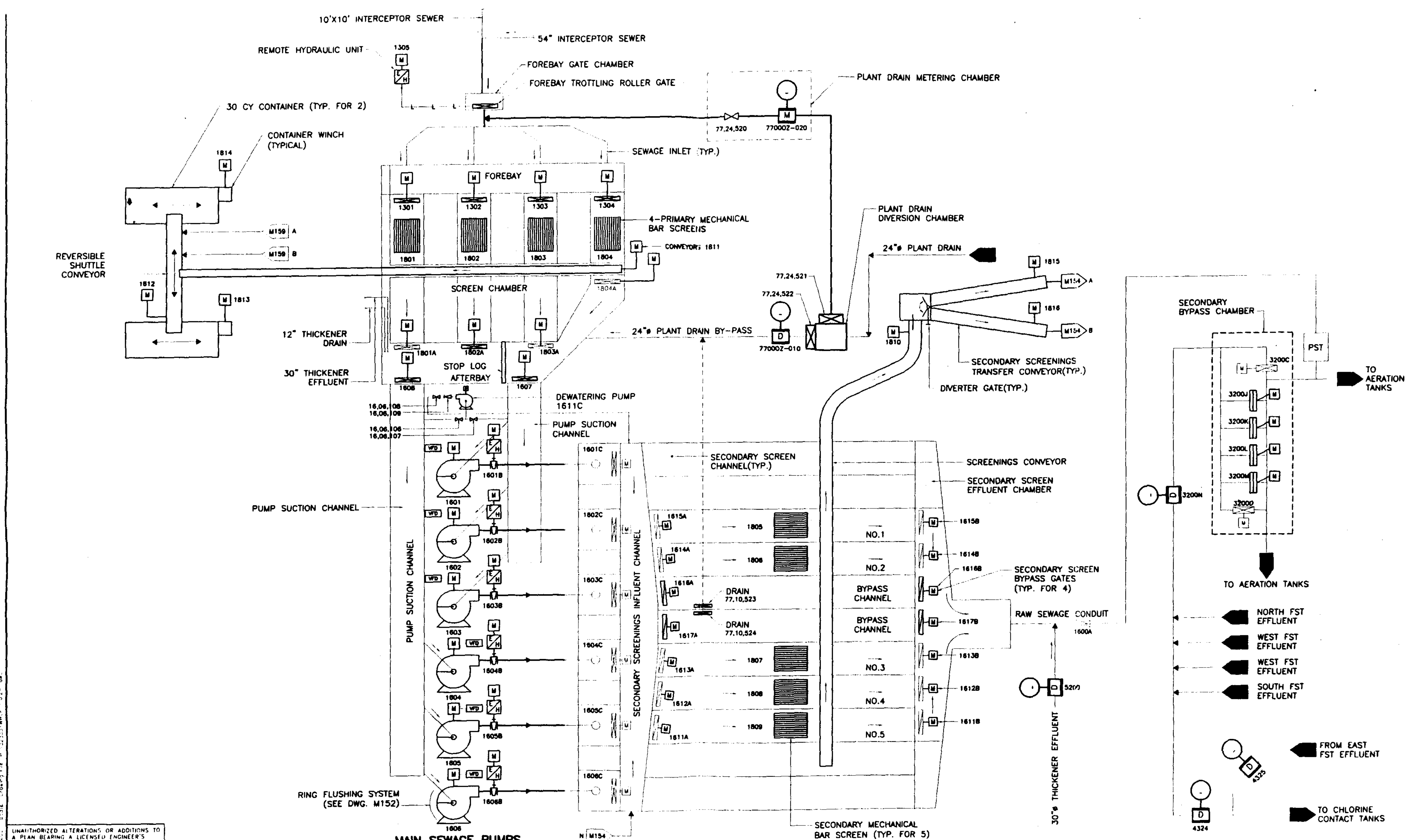
An analysis of Hunts Point wet weather flow performance has shown favorable results with respect to effluent quality at the high end of observed flows. Unfortunately the peak flow to the plant never reached NYS DEC's objective of 2 x DDWF. The FY 2000 data suggests that the first half of the year 2000 was an unusually low flow year. The Hunts Point WPCP cannot meet 2 x DDWF because of limitations with the headworks and main sewage pump station that include problems with: throttling and/or influent gate controls, screening operations, pumping capacity, or grit/sludge handling capacities. These limitations are being corrected under Phase I of the plant upgrading.

2.1 Throttling Gate

Forebay Chamber (Proposed)	
Number of Gates	1
Service	Throttling
Type Operator	Hydraulic Actuator

During the plant upgrading, a forebay gate chamber will be constructed without interrupting flow in the interceptor sewer. A cofferdam shall be installed inside the existing interceptor to anchor the roller gate frame to the conduit walls.

The objective of the future forebay throttling gate system is to automatically throttle flow into the plant when flows exceed 400 mgd during maximum wet weather conditions, and to prevent the level in the Afterbay channel from exceeding Elevation (-) 8.00. To achieve both objectives the gate shall be controlled inversely proportional to the level in the Afterbay. The gate shall be fully open when the level in the Afterbay falls below Elevation (-) 10.5, and shall be at its lowest position when the level rises above Elevation (-) 8.00. The closure of the gate is physically limited such that the gate cannot be lowered below a fixed elevation corresponding to the maximum wet weather flow of 400 mgd



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DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL ENGINEERING
DIVISION OF FACILITIES DESIGN
WP-56 HUNTS POINT WPCP
INTERIM PLANT UPGRADE

CONTRACT NO. 1G
STRUCTURES & EQUIPMENT
MECHANICAL

HEADWORKS FLOW DIAGRAM

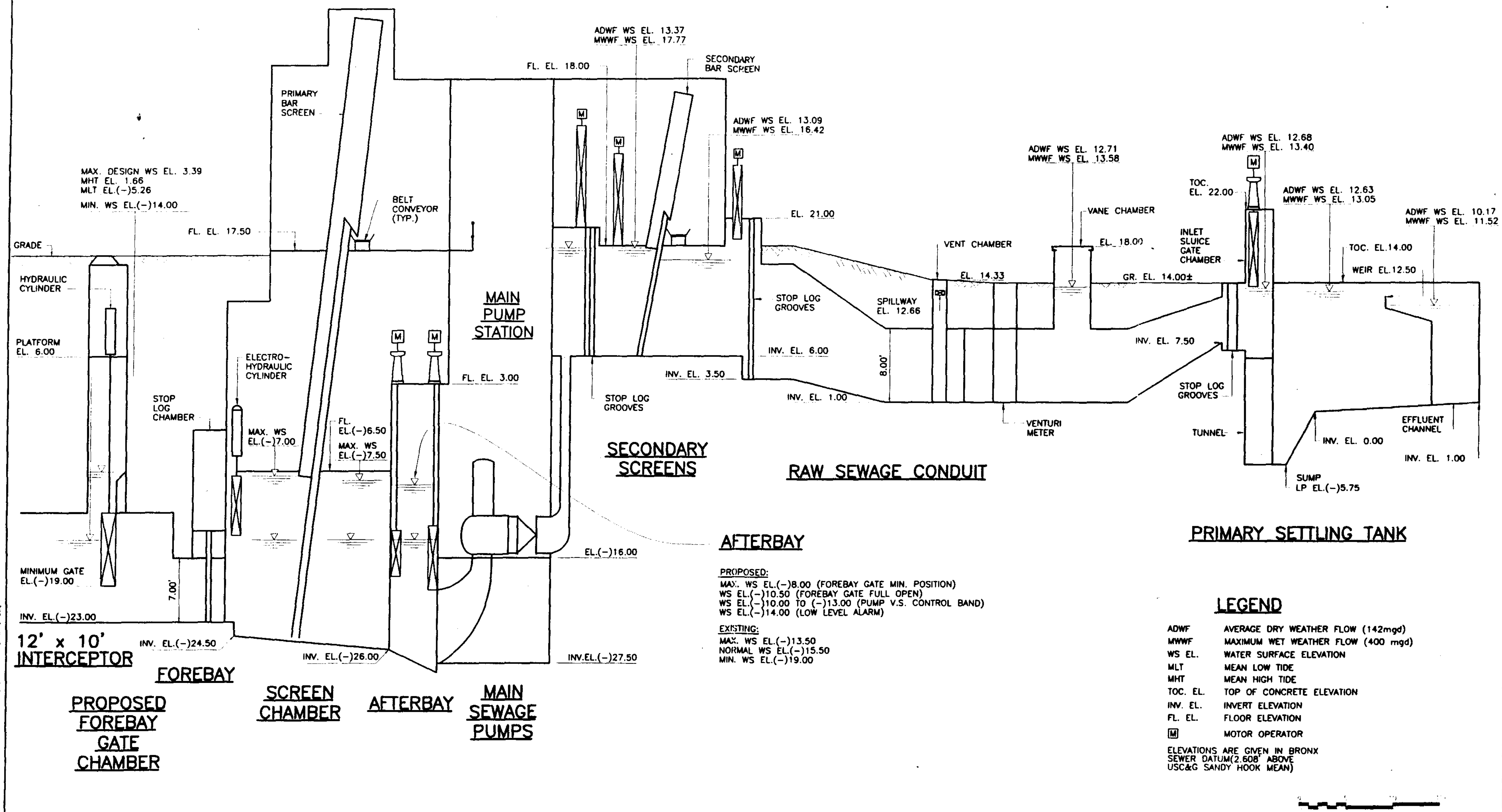
DATE
SHEET OF
FIGURE 2-1

entering the plant. Key hydraulic control elevations for the plant headworks are shown on **Figure 2-2**. The hydraulic elevations in the screen chamber shown on Figure 2-2 are the operating levels after Phase I of the upgrading is complete. These levels are higher than the current operating levels and can not be used until the existing primary bar screens are modified to prevent submergence of the bar screen drive motors.

Until the new forebay gate chamber is complete, wet weather flow to the plant will be throttled by the current practice of manually positioning the existing screen channel influent gates as described below. If the telemetry to Regulator 6 is operational, the gates at the regulator should be throttled before the screen channel influent gates are throttled.

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• Gates should be in full open position during dry weather and prior to wet weather. • Check gate operation.

During Wet Weather Event		
SEE	SSTW/STW	• Leave gate in full open position until: a. Plant flow approaches capacity of pumps in service or b. Screen channel level exceeds acceptable level with maximum pumping, or c. Bar screens become overloaded with screenings or d. Grit removal exceeds the plants grit handling capacity • Set the gate to maintain acceptable wet well water level. • Record all throttling gate adjustments on the Throttling Gate Log. • As wet weather event subsides open the gate to maintain the wet well water level until the gate is completely open.



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WP-56 HUNTS POINT WPCP
PLANT UPGRADE

WET WEATHER OPERATING PLAN
HYDRAULIC PROFILE PLANT HEADWORKS

FIGURE 2-2

After Wet Weather Event		
SEE	SSTW/STW	• Make sure the throttling gate is in the full open position. • Conduct maintenance or repair of the throttling gate as necessary.

Why Do We Do This?

- To regulate flow to the WWTP and prevent excessive flows from destabilizing plant performance.

What Triggers the Change?

- High water levels in the screen channels or other unacceptable plant conditions related to high flows.

What Can Go Wrong?

- If the throttling gate is not operated when necessary, or fails to operate, high water levels in the wet well may result.
- Flooding of the screen chamber may occur.
- If the forebay gate fails to operate, flow to the plant should be manually throttled with the screen channel influent gates.
- If extreme high tide or storm surge conditions occur, the water level in the interceptor may exceed the maximum design water level of the throttling gate (EL. +3.39). If this occurs, the screen chamber influent gates should be throttled manually.

2.2 Wastewater Screening

The Hunts Point Plant has primary bar screens upstream of the main sewage pumps and secondary screens downstream. The following information and protocol apply to the existing screens. At the time of preparing this protocol the existing screens are being renovated. This protocol will be revised as appropriate when upgrading of the screens is completed. At design average conditions, approach velocities to the screens should be no less than 1.25 feet per second to prevent settling in the channel. The velocity through the bars should normally be no greater than 3.0 feet per second to prevent forcing material through the openings.

Screens	
Primary Screens	
Number of Units	4 units
Bar Openings	1"
Screen Channel Width (nominal)	8' - 0"
Screen Channel Invert Elevation @ Screen	(-)23.5'
Operating Lower Floor Elevation	(-)6.5
Operating Higher Floor Elevation	17' - 6"
Secondary Screens	
Number of Units	5 units
Bar Openings	1/2"
Screen Channel Width (nominal)	7'-0"
Screen Channel Invert Elevation @ Screen	6'-0"
Operating Floor Elevation	18' -0"

Secondary Screen Bypass Channel

Under the plant upgrading, existing channels will be modified to provide a bypass around the secondary screens to prevent flooding. The proposed secondary screen bypass channel operation will be designed to operate as follows: The screen channel bypass gates shall open on high influent channel level and an alarm shall sound. As wastewater in the screen influent channel reaches high level, both upstream and downstream gates in the LEAD channel shall open. If the water level does not drop after a certain time period, the gates in the LAG bypass channel will fully open for additional relief. A sustained drop in the wastewater level will cause the gates in the LAG and LEAD channels to close in reverse order. LEAD/LAG selector switches shall be provided on the process control panel. Alarms shall be sounded at the process control panel and the DCS. Gate position shall be transmitted to the DCS.

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
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 guides for number of primary and secondary screens in service for various flow ranges and the containers usage associated with the flow ranges during maximum and average conditions follows:

		Primary Screens			Secondary Screens		
	Flow, mgd	Number of Channels in Service	Flow per Channel, mgd	Approach Velocity, fps	Number of Channels in Service	Flow per Channel, mgd	Approach Velocity, fps
Minimum DWF	60	1	60	1.79	1	60	1.89
Current Average DWF	130	2	65	1.57	2	65	1.95
Daily Maximum DWF	170	2	85	1.64	2	85	2.43
Design Maximum DWF	300	3	100	1.93	3	100	1.98
Maximum WWF	400	3	133.3	2.58	4	100	1.96

SEE	SSTW/STW	• Rotate screen operation to ensure that all available screens are in working order. • Make sure sufficient empty screenings containers are available. Additional empty containers should be kept on-site before weekends and large storms.

During Wet Weather Event		
SEE	SSTW/STW	• Put additional primary or secondary screens into operation. • Set all screen rakes to continuous operation. • Regulate the plant flow with the throttling gate if the screens become overwhelmed or the water elevation in the screen channel exceeds EL. -14.0 (or EL. -8.0 when Phase I upgrading is complete). • Remove and replace screenings containers as necessary.

After Wet Weather Event		
SEE	SSTW/STW	• Take extra screen out of operation. Return to two screens online. • Remove screenings for disposal.

Why Do We Do This?

- Two primary screens can accommodate the plant design average dry weather flow of 200 mgd.
- Three primary screens are required to handle peak wet weather flows up to 400 mgd.
- This leaves the fourth screen on standby in case of a screen failure or excessive loadings.
- The same logic applies to the secondary screens except that there is an additional secondary screen so that the fifth can be left as standby.

What Triggers The Change?

- Flows in excess of 267 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. If this occurs the fourth screen should be put on line.

What Can Go Wrong?

- If an insufficient number of screens are online the screen channel may surcharge above acceptable levels (EL. -14.0 currently; EL. -8.0 after Phase I upgrading is complete).
- If screens clog with debris, the level in the screen channel may flood above acceptable levels. The influent gate to the clogged screen channel should be throttled to reduce flow. To clear an obstruction, the screen mechanism can be manually reversed and jogged forward. If doing this does not clear the obstruction, a standby screen channel should be placed in service, and the obstructed channel removed from service.
- If an overload or other alarm condition occurs and the screen mechanism automatically stops, place a standby channel in service and attempt to determine the cause of the failure.
- If the screening belt conveyors fail, the conveyor bypass chute should be installed, and screenings removed manually using 1¼ cu. yd. containers and a forklift truck.

2.3 Wastewater Pumping

At the time of preparing this protocol, the existing main wastewater pumps are being upgraded. The design capacities of the existing and proposed pumps are indicated in the following table. It should be noted that the impellers of the existing pumps are worn, and the existing pumps have an actual capacity of about 70 mgd per pump.

Wastewater Pumping		
	Existing	***Proposed***
Number of Pumps	6	6
Number of Standby Pumps	1	2
Type of Pump	Mixed flow Centrifugal pumps	Vertical, mixed flow pumps
Suction and Discharge Size, In.		42/48
Motor Horsepower/Type of Drive	600 Hp/WRM	800 HP/VFD
Maximum Speed , RPM		345
Minimum Speed, RPM		232
	Rating Point At Maximum Speed	
Flow, MGD	80	100
Head, Ft.	35	32.5

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• Monitor afterbay elevation. • Number and speed of pumps in service are selected and manually adjusted by operator in the pump control room • Adjustments made based on maintaining the level in the screen chamber afterbay at a nominally constant level • Check that afterbay level monitors are functional. • If possible, prior to an anticipated wet weather event, draw down the interceptor by 1 to 3 feet.

During Wet Weather Event		
SEE	SSTW/STW	• Monitor afterbay elevation. • As afterbay level rises put off-line pumps in service and increase speed of variable speed pumps as necessary • Pump to maximum available capacity during wet weather events. • All adjustments are made manually by operators in the pump control room based on maintaining a nominal reference level of -15.0 ft. +/- 6″ in the afterbay. The reference level was chosen to allow the most efficient operation of both the screening equipment and main pumps. • Restrict flow through influent screen gates if pumping rate is maximized and wet well level continues to rise (see influent gate operations)

After Wet Weather Event		
SEE	SSTW/STW	• Maintain pumping rate as required to keep wet well level in operating range. • If the influent gates have been throttled, maintain maximum pumping rate until all previously constricted influent gates are returned to fully open position and flow begins to decrease lowering wet well level. • Reduce pump speeds and number in service to maintain wet well level and return to dry weather operation. The operator will decrease pumping by 10 MGD if the afterbay level drops below -15.5 ft. After an interval of approximately 10 minutes, the level remains below –15.5 ft, the operator will again decrease pumping.

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 chamber afterbay.
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.

2.4 Primary Tanks

The primary settling tanks are designed to effectively treat approximately 80 MGD each. If taking tanks out of service increases the flow to each tank above this amount, the primary settling effluent quality should be checked to avoid overloading and degradation of the secondary treatment process.

Number of Primary Settling Tanks in Service	Maximum Tolerable Flow Rate (Approx.)
6	432 MGD
5	432 MGD
4	370 MGD
3	300 MGD
2	220 MGD
1	140 MGD

Number of Tanks	4 Units - West Side	2 Units - East Side
Unit Dimensions (Ft)		
Length	168.0	
Width	108.5	
Sidewater Depth	12.0	
Total Weir Length (Ft)	3,822	
	Design Average	Design Peak
Overflow Rate (gpd/sf)	1,829	3,657
Weir Loading (gpd/lf)	52,389	104,657
Detention Time (Hr)	1.17	0.59

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. • 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 one primary sludge pump per tank is 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. • Reduce flow (sewage pumps and throttling gate) if: a. Sludge cannot be withdrawn quick enough from the primaries, b. Grit accumulation exceeds the plants ability to handle it, c. A primary tank must be taken out of service and maximum tolerable flow rate is exceeded. • Postpone dewatering tanks until storm has subsided.

After Wet Weather Event		
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.

2.5 Secondary Bypass Channel

Secondary Bypass		
	Existing	***Proposed***
Bypass Channel	2 Bypass Control Sluice Gates	4 Weir Gates
Location of Sluice Gates	Chamber 1 North of Aeration Gallery	Chamber 1 North of Aeration Gallery

That portion of the primary settling tank flow, which is in excess of the secondary treatment process capacity, must be bypassed around secondary treatment. This bypass is performed in control chamber Number 1 by a motor operated bypass sluice gate. Under the plant upgrade, downward opening weir gates will be installed to improve control of secondary bypass flow. The bypass gates will automatically lower to limit flow to secondary treatment to 300 MGD (1.5 times DDWF).

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• Conduct routine bypass gate preventative maintenance. • Check the bypass flow meter operation.

During Wet Weather Event		
SEE	SSTW/STW	• Open or lower the bypass gate to bypass channel to maintain a flow of 260 to 300 mgd to secondary treatment. • Open or lower the bypass gate if the primary clarifier weirs flood. • Open or lower the bypass gate to protect final clarifier blanket levels from going over the weirs. • During bypasses record the bypass flow rate on the Bypass Log. • Bypassed primary effluent flow will exert a higher chlorine demand than secondary effluent. Increase hypochlorite dose to maintain target residual.

After Wet Weather Event		
SEE	SSTW/STW	• As the plant flow drops and stays below 300 mgd close or raise the bypass gate. • Repair faulty equipment

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?
• High blankets in final clarifiers, as well as primary and/or secondary treatment system flooding.
What Can Go Wrong?
• If the bypass gate is not used properly the primary clarifiers may flood and secondary clarifier sludge blankets could rise and discharge large amounts of biological solids.

2.6 Aeration Tanks

During plant upgrade work only one aeration tank at a time may be taken out of service. The upgraded aeration tanks will require a higher air pressure than the existing tanks and can only be operated with the new process air blowers. The Contractor will coordinate the blower installation with the aeration tank upgrade.

Plant operations will attempt to maintain centrate nitrification in a separate aeration tank during construction. Centrate is currently being treated in Aeration Tank No. 5. The improvements to Aeration Tank No. 4 and the centrate pump station and distribution piping shall be completed and placed in service before Aeration Tank No. 5 is taken out of service for upgrading.

Aeration Tanks		
Number of Tanks	4 Units - West Side	2 Units - East Side
Unit Dimensions (Ft)	**West Side**	**East Side**
Length	438	355
Width	25	30
Number of Passes Per Tanks	4	4
Sidewater Depth	15	15

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• During normal dry weather operations, at least 5 aeration tanks should be in operation, including one for centrate treatment. • The plant operates in a Step BNR feed mode with Inlets at the Head of Passes A, B, C, and D. • Check the dissolved oxygen levels and control the airflow to maintain greater than 2 mg/l in the oxic zones of the aeration tanks. • Monitor Filamentous Growth

During Wet Weather Event		
SEE	SSTW/STW	• Monitor the dissolved oxygen and adjust the airflow to maintain greater than 2 mg/l in the oxic zones. • During wet weather operations, all available aeration tanks should be in operation

After Wet Weather Event		
SEE	SSTW/STW	• Monitor the dissolved oxygen, and maintain greater than 2 mg/l dissolved oxygen in oxic zones.

Why Do We Do This?

- The Hunts Point WPCP is hydraulically designed to convey peak flows up to 1.5 times the Design Dry Weather Flow (DDWF) through secondary treatment under typical operating conditions; however, the plant may not be able to maintain nitrogen removal under these conditions. The BNR treatment process can be protected against such high wet weather flows due to the constraints on the secondary clarifier solids separation capability by:
    a. Limiting the secondary treatment flow to 1.3 x DDWF with the balance bypassing the secondary system.
    b. After the installation of electric actuators at the aeration tank influent gates under Construction Phase II, pass configurations can be easily altered. During wet weather flows, flow configurations can be changed to Contact Stabilization Mode where all of the wet weather flow is diverted into Pass C (4- Pass System) in order to minimize the loss of the autotrophic organisms essential for BNR. BNR is more sensitive to biomass loss due to the relative low growth rate of the autotrophs.

What Triggers The Change?

- Increasing speed and/or starting raw wastewater pumps to accommodate high wet weather flows.

What Can Go Wrong?

- Potential impacts of wet weather events on the activated sludge process include:
    a. Loss of biomass from the aeration tanks and secondary clarifiers
    b. Overloading of the aeration system resulting from high BOD loadings caused by solids washout from the sewer system and solids washout from the primary clarifiers
    c. Decreased BOD and Nitrogen removal efficiency due to shortened hydraulic retention time in the aeration tanks.
- Wet weather impacts on the activated sludge system can be corrected by decreasing the maximum flow to secondary treatment to 1.3 x DDWF.
- The operator must be careful not to let the dissolved oxygen levels drop much below 2.0 mg/l in the Oxic Zones because this can adversely affect secondary treatment and nitrogen removal efficiency.

2.7 Final Clarifiers and Distribution

Minimum operating requirements for the settling tanks include that no more than one East Final Settling Tank, and one West, North or South Final Settling Tank may be taken out of service for construction at a time.

Final Settling Tanks			
	North-South Tanks	**East Tanks**	**West Tanks**
Number of Units	4	6	16/4
Sidewater Depth (Ft)	12.5	12.1	14
Unit Dimensions LxW (Ft)	300 x 40.5	325 x 60	
Unit Dimensions LxW (Ft) West Tanks No. 31-34, 41-44, 51-54 & 61-64			94.5 x 80
Unit Dimensions LxW (Ft) West Tanks No. 35, 45, 55 & 65			94.5 x 28.5

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. • Observe blanket levels, tank surface. • 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 flow to the tanks to keep the blanket levels even. • Observe the clarity of the effluent and watch for solids loss. • Monitor the sludge blanket levels. • If necessary, increase the RAS/WAS rate to maintain low blanket levels. • Open the secondary bypass if: a. Secondary treatment flow exceeds 300. b. Sludge blankets rise to within 6 feet of the effluent weirs. c. Secondary clarifier weirs are flooded.

After Wet Weather Event		
SEE	SSTW/STW	• Modify the sludge wasting based on MLSS levels. • Close the secondary bypass when flow drops below 300 mgd. • Observe the effluent clarity. • Monitor the secondary clarifier blanket levels. • Skim the clarifiers if necessary.

Why Do We Do This?
• High flows will substantially increase solids loadings to the clarifiers, which may result in high clarifier sludge blankets or 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?
• Rising sludge blankets that cannot be controlled.
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.

2.8 Chlorination

Chlorination System		
Number of Contact Tanks	2	
Number of Bays Per Tank	2	
Hypochlorite Storage Tanks	5	
Total Capacity Hypochlorite Tanks	60000	
Detention Time - Minutes	**2 Tanks in Service**	**1 Tank in Service**
Design Average Flow, 200 mgd	32	16
Dry Weather Maximum, 300 mgd	22	11
Peak Weather Maximum, 400 mgd	16	8

Due to foaming problems at the chlorine contact tanks the overflow weirs were lowered to Elevation +1.00 from Elevation +3.00 to create a smoother flow and less agitation. Unfortunately this solution to the foaming problem created another problem with respect to flooding the effluent weirs when the tide surpasses Elevation +1.00.

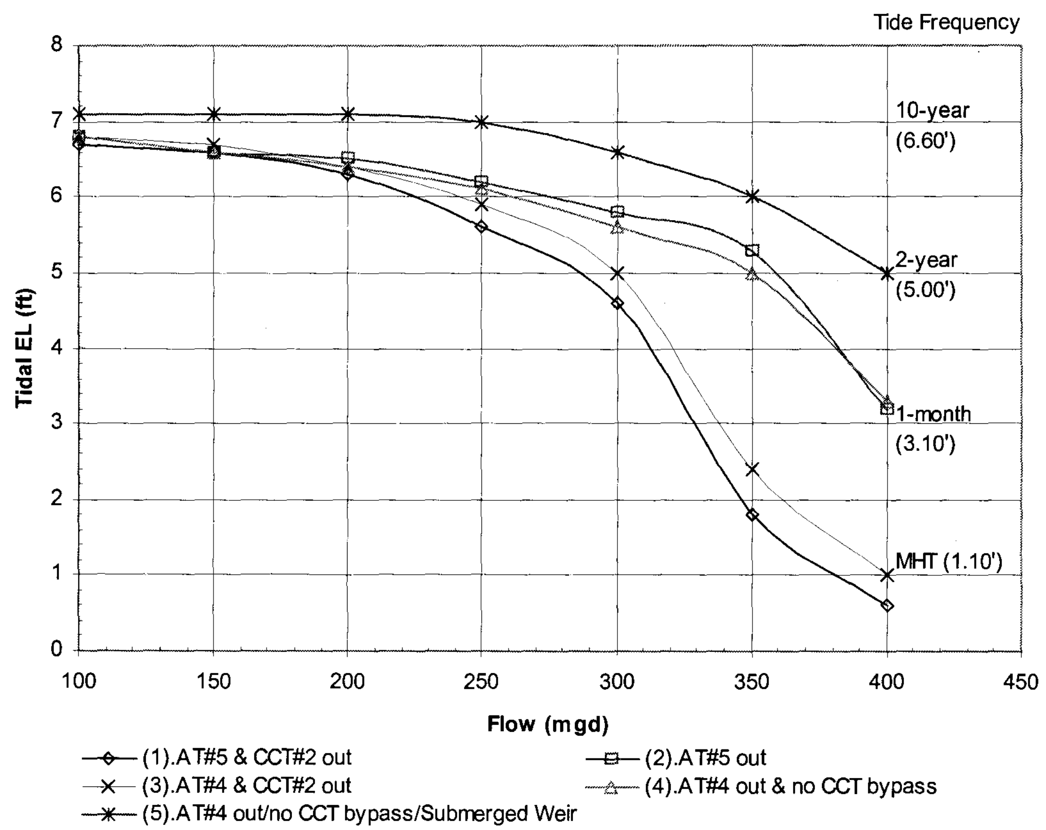
Hydraulic computer modeling indicates that the weirs of the upstream final settling tank will be flooded under the following conditions:

- Tide elevation +1.66 (Mean High Water)
- One chlorine contact tank is out of service
- Aeration Tank No. 5 used for centrate treatment
- Plant influent flow exceeds 330 mgd

Influent flow to the plant should be throttled under these conditions to avoid submerging the final settling tank weirs.

Figure 2-3 is a graph that indicates the plant hydraulic capacity versus tidal elevations and tank operating conditions. The graph indicates that with two chlorine contact tanks (CCTs) in service, the plant could accept a peak weather flow of 400 mgd if the tide elevation does not exceed EL. +3.10. However, if one CCT is out of service, and Aeration Tank No. 4 is being used for centrate treatment, influent flow would have to be throttled below 400 mgd to avoid submerging the final settling tank weirs if the tide elevation exceeds El. +1.10. If the weirs in the west final settling tanks (Crest El. 7.00) are allowed to be submerged, but the tank walkways (El. 8.50) are not flooded, then the plant could accept 400 mgd at a tide elevation of +5.0 with two CCTs in service, Aeration Tank. No. 4 out, and the CCT bypass closed

Figure 2-3 - Plant Flow vs Tidal EL



Proper chlorine disinfection relies on exposure time to adequately disinfect secondary effluent. Excessive solids in secondary effluent resulting from high flows can hinder disinfection. In spite of the potential for reduced effectiveness, it is preferable to send as much flow through the disinfection units as possible to achieve some level of disinfection. Recommendations for maximizing chlorine disinfection efficiency during high flows include:

- Experiment with chlorine dosage at high flows. Adequate kills may be achievable at detention times of less than 15 minutes with the proper chlorine dosage.
- Optimize chlorine mixing. Poor mixing will greatly reduce chlorination effectiveness.

During construction, when one chlorine contact tank will be taken out of service, the capacity of the plant to pass peak weather flows will be severely restricted as indicated above. Contract stipulations that stem from this construction activity include:

- Two chlorine contact tanks shall be maintained in service during the summer bathing season from May 15th to September 30th
- And all improvements to the chlorine contact tanks shall be completed prior to completion of the upgrading of the main wastewater pump station to 400 mgd capacity.

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	• Both chlorination tanks must be in service between May 15th and September 30th. • Normal operation is to maintain hypochlorite storage tanks full during the construction period. The Contractor shall provide access for sodium hypochlorite deliveries to the Chlorination Building at all times. • Make sure there are sufficient chlorine residual test kit supplies. • Report problems immediately. • Perform preventative maintenance on equipment if necessary.

During Wet Weather Event		
SEE	SSTW/STW	• Check, adjust and maintain the Hypochlorite feed rates to maintain the target chlorine residual. Chlorine demand will increase as primary effluent bypass flow increases. • Increase the chlorine residual measurement frequency up to an hourly reading. • Check and maintain the Hypochlorite tank levels.

After Wet Weather Event		
SEE	SSTW/STW	• Drop the Hypochlorite feed rates as needed to maintain the chlorine residual. • Maintain the Hypochlorite tank levels. • Repair equipment as necessary.

Why Do We Do This?
• Hypochlorite demand will increase as flow rises and secondary bypasses occur. Increase the Hypochlorite feed rates to maintain the target chlorine residual.
What Triggers The Change?
• High flows and secondary bypasses will increase Hypochlorite demand and usage.
What Can Go Wrong?
• 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.

2.9 Sludge Thickening, Digestion and Storage

Sludge Dewatering and the tracking of sludge, screenings, scum and grit shall proceed unimpeded throughout the duration of the Stabilization Contracts.

Sludge Thickening Digestion and Storage

	Design Condition	Present Condition
Sludge Thickeners		
Installed	12	12
Operating	10	6
Anaerobic Sludge Digesters		
No. of Units	4	4
No. of Units Operating	4	3
Sludge Storage		
No. of Storage Tanks	5	5
Storage Capacity (Days)	20	35
Sludge Dewatering		
No. of Centrifuges	13	13
Unit Capacity	300	300

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
During Wet Weather Event		
SEE	SSTW/STW	• Sludge handling activities should proceed as they normally would during dry weather flow. A major component of the plant return stream is centrate, which is related to dewatering operations. • Balance-Water flow to the thickeners can also be reduced before any changes in sludge wasting are made.

SECTION 3
PROPOSED PLANT UPGRADING

The Hunts Point WPCP is undergoing a major upgrading. Construction of the plant upgrading has been divided into phases. Phase I of the Plant Upgrading will include installation of facilities to improve the plant's overall wastewater treatment process reliability and operation. The schedule for Phase I includes a milestone under the Omnibus IV Consent Decree to complete construction of all facilities required to treat two times DDWF (400MGD) by October 31st, 2004. Phase II of the Plant Upgrading will include improvements required to enhance nitrogen removal as required by the plant's State discharge permit and the Nitrogen Order of Consent. The milestone date for completing the Step BNR facilities is June 30th, 2007. The upgrading of the plant's solids handling systems is included under Phase III of the project.

This section summarizes the major improvements implemented under the Plant Upgrading.

3.1 Influent Throttling, Screening and Main Sewage Pumping

A new throttling gate chamber will be constructed in the existing plant forebay to improve the control of influent flows to the plant. The forebay gate chamber will be constructed without interrupting flow in the interceptor sewer. The existing primary bar screens, Main Sewage Pumps, and secondary screens will be taken out of service one unit at a time for upgrading.

The original capacity of the six Main Sewage Pumps at Hunts Point was 80 mgd per pump. Due to wear on the pump impellers and other components, the current capacity of the Main Sewage Pumps is 65 to 70 mgd per pump. This limits the plant wet weather tyeatment capacity to about 325 mgd. Under the plant upgrading, the existing pumps will be replaced with new pumps with a unit capacity of 100 mgd. This will allow pumping of the design plant wet weather peak flow (400mgd) with two pumps out of service in accordance with standard NYCDEP "n+1+1" design policy. The net positive suction head requirements for the new Main Sewage Pumps will require that the existing screen channels be operated with a higher water depth. The existing bar screen mechanisms will be modified to prevent submergence of the bar screen drive motors while operating with a higher channel water level.

3.2 Primary Settling Tanks

The number of primary settling tanks will remain at 6. The scum and grit handling systems will be upgraded, and scum and grit will be directed to a new central residuals building. The building will contain new scum concentrators, cyclone degritters, grit washers, and container handling systems. New vanes will be installed in the raw sewage conduit to improve the distribution of grit and solids to the primary settling tanks. The primary influent channel will be covered and exhaust air treated with activated carbon to control odors.

3.3 Aeration Tanks

The number of aeration tanks will remain at 6. One aeration tank is currently dedicated for centrate nitrification, and plant operations will attempt to maintain separate nitrification of centrate during construction. The upgrade of the aeration tanks includes installation of new blowers and diffusers to allow the plant nitrogen loads to be completely nitrified. The tanks will have anoxic/oxic switch zones constructed to allow the flexibility of changing the aerobic volume for nitrification. New submersible mixers will be installed in the anoxic zones. Automated gates will be installed to allow automatic diversion of peak storm flows to pass C to protect the biomass and prevent the washout of nitrifiers. Operation of the Step BNR process may require bypassing of the secondary process at flows less than 300 mgd (1.5 times DDWF). New downward opening weir gates are being installed that will increase the bypass channel capacity to allow the peak flow to secondary treatment to be limited to 260 mgd (1.3 times DDWF). This will be done if necessary if nitrification is lost following storms as determined from actual operating experience. New hypochlorite froth spray hoods, spray water piping, and a selective froth wasting system will be installed in the aeration tanks to control froth. The existing aeration tanks and blowers will be upgraded one unit at a time.

3.4 Final Settling Tanks

The number of final settling tanks will remain at 30. The improvements to the existing final settling tanks will include an upgrade of the scum removal system, new baffles to reduce short-circuiting, and new motor operated influent gates. No more than three tanks will be taken out of service at a time for upgrading.

3.5 Effluent Disinfection

The two existing chlorine contact tanks will be upgraded to reduce short-circuiting, improve mixing efficiency, and increase the accuracy of flow measurements. Hypochlorite feed systems will be upgraded to include hypochlorite feed to aeration tank froth control hoods, scum and froth wells, and RAS chlorination.

3.6 RAS and WAS Systems

The existing RAS and WAS pumps will be replaced with new pumps with variable speed drives with the capacity to return 100% of the DDWF. New motor operated telescoping valves will be installed to control the withdrawal of return sludge from the final settling tanks, and new RAS and WAS flow meters will be installed.

3.7 Alkalinity Building

A new Alkalinity Building will be constructed to house the systems to feed sodium hydroxide to the aeration tanks to enhance nitrification.

3.8 Centrate System

A new centrate pump station will be constructed to improve the distribution of centrate to the aeration tanks. The centrate pumping station will also house new channel air blowers.

3.9 Gravity Thickening

Under Phase III of the upgrading, which is currently under design, ten of the twelve existing gravity thickeners will undergo a complete rehabilitation, including new sludge collection mechanisms, thickened sludge pumps, valves, and piping. Polymer will be added to the gravity thickeners to improve the capture of solids and reduce recycled BOD and TKN loads on the main wastewater flow.

3.10 Sludge Digestion and Storage

Under Phase III of the upgrading, two new egg-shaped digesters will be constructed. The new egg-shaped digesters would be operated in conjunction with the existing conventional digesters in a two-stage mesophilic configuration designed to meet PSRP requirements. Improvements will be made to the four existing digesters, including reconstruction of roofing, sealing of steel liner plates, and modifications to overflow boxes. A new Wiggins gasholding tank and three new high efficiency enclosed digester waste gas flares will be constructed. The five existing sludge storage tanks will be renovated and reused.

3.11 Main Electrical Substation

A new Main Electrical Substation building will be constructed. Six new electrical feeders will be installed to power the new process air blowers and other plant loads. Six new emergency generators will be installed to power essential plant equipment during electrical power failures.

Appendix No. 1

AMENDMENT NO. 1
TO THE
WET WEATHER OPERATING PLAN
FOR THE
HUNTS POINT WPCP
MAY 12, 2004

SECTION 1, INTRODUCTION

In Table 1-2, Unit Process Capacities, on page 1-8, add four asterisks (****) following "Chlorine Contact Tanks," and add the following new footnote to the table:

> "**** Indicates chlorine contact tank capacity with East River Tide Elevation at or below mean high tide."

SECTION 2, UNIT PROCESS OPERATIONS

Page 2-15, Section 2.8, Chlorination, add the following after "Influent flow to the plant should be throttled under these conditions to avoid submerging final settling tank weirs.":

> "Figure 2-3 is a graph that indicates the plant hydraulic capacity versus tidal elevations and tank operating conditions. The graph indicates that with two chlorine contact tanks (CCTs) in service, the plant could accept a peak weather flow of 400 mgd if the tide elevation does not exceed EL. +3.10. However, if one CCT is out of service, and Aeration Tank No. 4 is being used for centrate treatment, influent flow would have to be throttled below 400 mgd to avoid submerging the final settling tank weirs if the tide elevation exceeds El. +1.10. If the weirs in the west final settling tanks (Crest El. 7.00) are allowed to be submerged, but the tank walkways (El. 8.50) are not flooded, then the plant could accept 400 mgd at a tide elevation of +5.0 with two CCTs in service, Aeration Tank. No. 4 out, and the CCT bypass closed."

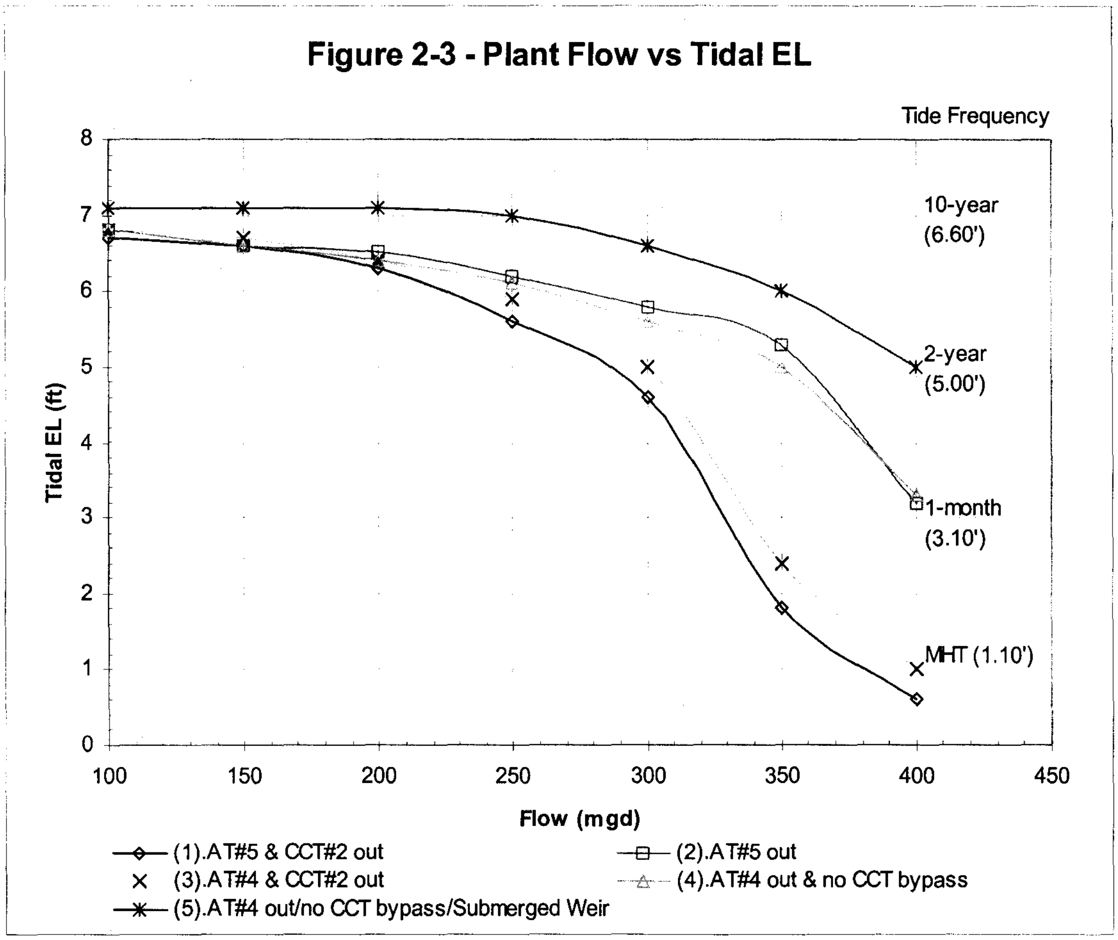


Figure 2-3 - Plant Flow vs Tidal EL
Tide Frequency
10-year
(6.60')
2-year
(5.00')
1-month
(3.10')
MHT (1.10')
Tidal EL (ft)
0
1
2
3
4
5
6
7
8
100
150
200
250
300
350
400
450
Flow (mgd)
(1).AT#5 & CCT#2 out
(2).AT#5 out
(3).AT#4 & CCT#2 out
(4).AT#4 out & no CCT bypass
(5).AT#4 out/no CCT bypass/Submerged Weir

APPENDIX B

PUBLIC PARTICIPATION PROGRAM:

B.1. MEETING MINUTES

B.2. NYSDEC PRESENTATION, AUGUST 19, 2009

B.3. NYCDEP PRESENTATION, AUGUST 19, 2009

B.4. RESPONSIVENESS SUMMARY

B.1. MEETING MINUTES

Long Term Control Plan
Bronx River Stakeholder Team
Meeting No. 1 July 20th, 2006

The first meeting of the Bronx River Stakeholder Team for the Long Term Control Plan (LTCP) for Combined Sewer Overflow took place on July 20th, at 6:30, at the community room of the Bronx Community Board 12, at 4101 White Plains Road. Mark Klein, Project Director from the Department for Environmental Protection (DEP), opened the meeting, introducing himself and the consultant team. Stephen Whitehouse, DEP consultant for public participation from Starr Whitehouse, presented a general background of the LTCP, describing the history of CSO policy and previous water quality planning, including the Use and Standards Attainment (USA) project in which the Bronx River was one of the two first 'pilot' sites out of 26 planned study areas. A consent order was issued in 2004 by the New York State Department of Environmental Conservation (NYS DEC) which was the impetus for the LTCP. Stephen explained that many elements of the USA project have become part of the LTCP project. The LTCP, in contrast to the USA project, incorporates compulsory project specific milestones. Some of these are mandated by the 2004 consent order, including floatables control on the Bronx River, and others have yet to be developed. Post-construction monitoring will help to enforce the plan. The project team is preparing Waterbody/Watershed Facility Plans, which must all be submitted to the NYS DEC by June 2007. The subsequent detailed review of the Waterbody/Watershed Facility Plan by the State, along with any required refinement by DEP, will lead to the State's regulatory approval of the LTCP document.

Ray Hyland, project engineer from Greeley and Hansen, described the Bronx River. He stated that there are no sensitive areas, defined by the CSO Policy as drinking water, sanctioned bathing areas, and endangered species habitat. He noted that NY State has classified the portion of the Bronx River within NYC limits as Class B fresh and as Class I saline. He listed the concerns for the waterbody: dissolved oxygen (DO) levels and pathogens. Ray went on to locate and describe the different CSO points and the public access points. He showed two locations, Drew Gardens and Soundview Park, where river access points coincide with CSOs. Two additional locations have since been identified: Hunt's Point Riverside Park and the State D.O.T. portion of the Greenway.

Angela Essner, project manager with Greeley and Hansen, described the water quality sampling data reviewed and analyzed over the last four months (March-June 2006). Angela mentioned that NYCDEP and Westchester are cooperating to review data from 8 sampling stations in Westchester in addition to the DEP points. A stakeholder asked whether they have included the Attorney General's sampling locations. Angela responded that while they send data to the Attorney General, they do not receive any data from the Attorney General.

Angela displayed a schematic illustration of the Hunts Point land side model of major collection sewers and surcharge conditions. She showed data of the average yearly volume at each of the CSO points. A stakeholder asked about the larger volume at the HP-009 outfall in Soundview Park. Angela explained that the main pipe that carries sewage under the Bronx River to the Hunts Point Water Pollution Control Plant also receives flow from the Throg's Neck area, which is "upstream" in the collection system from the Bronx River sewers. If the pipe under the Bronx River is near capacity due to this upstream wet weather flow, it can only receive a limited flow from the Bronx River drainage area, so larger volumes are discharged at the HP-009 outfall.

Next, Angela shared information showing that most of the Bronx River flow derives from Westchester County. Several stakeholders asked for more information about the relationship of overland flow and groundwater contribution to flow. Concern was expressed that if most of the flow comes from Westchester, all water quality issues could be pinned on the county. Several stakeholders asked for a description of the model for the next meeting, including groundwater.

Angela went over the types of alternatives to be examined for the abatement of CSOs, including optimizing the existing system, sewer separation, storage tunnels, conveyance enhancements, and screening of floatable materials. One stakeholder asked if other stormwater management practices, such as LIDS or on-site stormwater retention, are being considered. A DEP representative answered that analytic work is being carried out in Jamaica Bay in the ongoing Watershed Protection Plan that will help to quantify these measures. This work will assist modeling and planning in the other watersheds. A stakeholder asked for similar pilot work to be carried out in the Bronx. DEP clarified that the analytic work of the Jamaica Bay study will be applicable to other watersheds and does not need to be separately performed for the Bronx River. In response to stakeholder interest in swales, infiltration basins, and increased detention of overland flows within the Bronx River basin, Stephen responded that site-specific landscape elements have not been identified in the plan and added that large tracts of land, hard to come by and not under the control of DEP, would be necessary to yield measurably significant improvement to water quality. The stakeholders urged the DEP team to seek out ways that it can partner with the Parks Department.

Angela explained that the model would be used to examine the different alternatives, their levels of CSO reduction, and their impact on water quality. This analysis will be used in conjunction with costing analysis to determine preferred alternatives. A stakeholder asked whether recent improvements in Westchester would be included in the model. Angela affirmed that they would.

Residents expressed concern that there had been such a long interval between meetings. They discussed different ways that the group could participate, including developing a stakeholder driven plan and researching BMPs. The team said that were unable to add alternatives that had not been proven and did not have enough time to prove them. Stephen said that these alternatives are being explored in the Open Water CAC of the

LTCP. The stakeholders reiterated that they would like to see these elements in the plan. Stephen agreed to follow up with the project managers to see what alternatives could be considered. Stephen explained that, the project is under consent order and follows an enforceable schedule

The stakeholder team made a number of requests:

- Funding for their own consultant to review the plan
- An online copy of the USA project
- Collaboration with the Parks Department and the Housing Authority find sites for water control measures.

DEP said that they would review the requests and respond.

In response to an invitation to participate in the Open Waters CAC, the stakeholders said that Paul Mankiewicz, Dart Westphal, Ajamu Kitwana, and Teresa Crimmens will represent the Bronx River Stakeholders.

Stephen acknowledged the receipt of a copy of the letter from of 7/17 to DEP Commissioner Emily Lloyd from Ajamu Kitwana on behalf the Bronx River Alliance. A stakeholder read the letter and the project team gave initial responses in advance of the formal DEP written reply.

Linda Cox, of the Bronx River Alliance, closed the meeting by encouraging the stakeholders and DEP to continue to work together productively. The action points were taken note of and the team set the next meeting date for October 12th.

Long Term Control Plan
Bronx River Stakeholder Team
Meeting No. 2 October 12th, 2006

The second meeting of the Bronx River Stakeholder Team for the Long Term Control Plan (LTCP) for Combined Sewer Overflow (CSO) took place on October 12, 2006, at 6:30, at the Bronx Community Board 12, 4101 White Plains Road. Mark Klein, Project Director from the New York City Department for Environmental Protection (DEP), opened the meeting and reviewed the major issues discussed at an offline meeting with the chairpersons designated by the Stakeholder Team. In response to a query about the inclusion of groundwater in modeling, the DEP representive stated that groundwater within New York City has a negligible effect on predicting water quality in the Bronx River. The model includes groundwater contribution from Westchester County, because it is within the total flow obtained from flow gauge records from a Bronxville location. A stakeholder asked that DEP provide the group with the percentage of groundwater contribution in overall flow. The DEP stated that the information was not necessary for the LTCP and was not readily available. The stakeholder asked for a memo on groundwater and the model. The dry weather overflow at HP-004 and low impact development (LIDs) were also discussed at the offline meeting, and it was stated that the sampling would continue through the fall and would be shared at the next meeting. The DEP also stated that the group's request for funding for an independent consultant had been turned down, since an independent review of the plan would be taking place (already funded by DEP) under the umbrella of the New York State Department for Environmental Conservation (DEC). DEC has engaged Ecology and Environmental Inc, a Buffalo-based firm, to assist in their review.

Stephen Whitehouse, Starr Whitehouse, reviewed the meeting notes of the July 20th meeting. In response to comments, the notes have been revised to include: "a prior request from the stakeholders to have the DEP partner with the Parks Department, and fund sites for LIDs; and the confirmation of two additional public access sites located at CSOs. "

The DEP spoke about the dry weather overflow incident and subsequent abatement at HP-004. It was stated that a DEP crew was on site within 24 hours of receiving a 311 call. The in-house crew removed 2,000 cubic yards of material downstream of the outfall to eliminate the overflow condition. It was stated that the DEP would award an emergency contract for the removal of additional sediment in the system. Recent sampling suggests that bacteria levels have since decreased since the start of the abatement work. A stakeholder requested that data. Angela Essner, Greely and Hansen, said that the decrease would be manifest in the data presented at the next meeting.

At the request of the team chairs, Stephen reviewed the fourteen SPDES BMPs that are ongoing and required as part of the 2004 Consent Order. He noted that LIDs —including green roofs and site detention— were not included as part of this SPDES treatment/collection system management plan requirement. One stakeholder commented that the 14 BMPs could include LIDs under the category of runoff control. Stephen said that, while that interpretation was possible, the phrase typically referred to control of runoff by connection to the sewer system. Following this presentation, a discussion was had concerning DEP's position on LIDs with two main focuses: the inclusion of potential LID projects on the list of alternatives that produce an improvement towards meeting Water Quality standards for this waterbody; and the possibility for DEP-funding for LID pilot projects. DEP stated several times during the meeting, that as the group within DEP (BEPA) overseeing the analysis and evaluation of LIDs were not present, those questions could not be fully answered at this time.

A stakeholder asked what other barriers prevent the inclusion of LIDs in the LTCP. Stephen explained that the quantitative analysis of the benefits of LIDs is incomplete and the schedule for area-wide implementation is unpredictable; by the CSO Consent Order, DEP must submit a plan to the DEC with quantified water quality benefits and an enforceable schedule. A stakeholder asked if the consent order schedule could be extended, given that the timeframe is curtailing the inclusion of LIDs, an important goal for stakeholders. The DEP agreed to bring this request to the attention of the DEC. (DEP understands that subsequent to this meeting, representatives of the stakeholders group met with a representative of the DEC at the Open Water CAC meeting and the Stakeholders are now aware of the DEC's unwillingness to alter the schedule of the Order**.**) A stakeholder asked why Paul Mankiewicz and Franco Montalto's studies, which quantify the effects of BMPs, were not funded. He argued that if the missing piece is quantifying BMPs, these studies are important. Paul Mankiewicz said that his green roof projects could easily be used to collect quantifiable data, for hard costs ranging from $5-6K. The DEP stated that the studies going on in the Jamaica Bay Watershed Protection Plan will provide quantitative analysis that can be applied to other watersheds in the city. A stakeholder said that there may be different site specific issues in the Bronx not addressed in the research in Jamaica Bay. Stephen stressed that engineering and green solutions are not oppositional but offer potential to be complementary. He said that looking at environmental improvements is an ongoing process and that DEP will continue to search out improvements that balance performance and cost.

Angela Essner, Greely and Hansen, showed maps of the Bronx River Drainage Area and Bronx River outfalls. She discussed HP-008 and HP-010 which are currently collapsed. Angela said that DEP is investigating the outfalls but that the manholes are buried under 10-15 feet of earth and difficult to access. Angela discussed the water quality models for the Bronx River. The landside model calculates CSO volumes relative to rainfall patterns. The receiving waters model uses a grid system that analyzes loads from the landside model and water flows to produce water quality forecasts. The model was developed to use as a predictive tool to compare the benefit of different plan alternatives.

Angela then reviewed a list of assessed alternatives. A stakeholder expressed concern over the bias towards engineering solutions. He advocated solutions which retain and filter runoff. He felt that developing a plan that looks exclusively to engineering solutions will not set up a framework which can evaluate LIDs, thereby eliminating them from further consideration.

A stakeholder asked for an update on interagency efforts. It was stated that the DEP welcomes the idea of an interagency group, with the Staten Island Bluebelt group as a model. A stakeholder said that she was encouraged as she had been previously concerned that the Parks Department and DEP do not coordinated, particularly on the LTCP.

Angela spoke about specific alternatives, including floatables control, real time control, modifications to the Hunt's Point Water Pollution Control plan, boom modifications and storage alternatives. A stakeholder stated that she was pleased that the boom modification would facilitate boating. Angela then reviewed an initial analysis of the benefits of different alternatives, including the calculated reduction in the number and volume of CSO events. Angela said that this data, with water quality results from the model, would feed one branch of the cost-benefit analysis, which will be presented at the next meeting. A stakeholder asked how the storage tunnels will be configured to capture increments of 85% to 100% of CSO volume. Angela said that the length of the tunnel is a constant function of the geographic spacing of the CSO outfalls from HP-004 to HP-009. A conceptual layout is a single linked facility. The different capture volumes are obtained by increasing the cross-sectional area of the tunnel along its length.

Another stakeholder asked why LIDs were not included on the analysis table. She stated that the chart should be set up to integrate information about LIDs, even if that information is currently unavailable. The DEP stated that although it might be possible to include a placeholder for the information, still the group within DEP (BEPA) overseeing the analysis and evaluation of LIDs were not present, and therefore those questions could not be responded to at this time. The stakeholders strongly suggested setting up the table to hold that information, so that, at the least, it can be integrating in the future. The stakeholder's requested that the DEP find a contact in the Office of Sustainability. The stakeholders discussed how LIDs could be included in the preliminary alternative analysis chart, including using a range of figures or quantifying the effects of LIDs in some measurable entity, such as reconstruction of school yards. DEP noted the issue and will take it to BEPA, the bureau within DEP overseeing the analysis and evaluation of LIDs.

Another stakeholder said that rainfall assumptions will alter with climate change. He said that the LTCP team should coordinate with DEP's team researching climate change. Angela responded that post-construction monitoring will indicate the plan's performance. Under the LTCP, DEP is obligated to adjust the plan so as to meet compliance.

Stephen Whitehouse moderated a discussion of waterbody uses and goals. Issues addressed in the Bronx River Alliance's Ecological Restoration and Management Plan, such as need for access and boat launches, will be considered desired uses and goals for the Bronx River. Additionally, stakeholders raised the issue of unsanctioned bathing at:

181st Street below Tremont Avenue, 174th Street, Hunt's Point River Park, and Concrete Plant Park. They said that while bathing is not a dedicated use, it exists and is likely to continue. The issue was raised as to whether the unsanctioned, existing use requires a change in water quality classification.

Stakeholders added that their goals include a preference for solutions that offer multiple benefits, including recreational value and habitat improvement. As such, they prefer green solutions because they generate other benefits. They feel strongly that LIDs have a place in the LTCP analysis. As a goal, it was stated that the revival of the Bronx River should continue to be a national model of sustainability. They urged DEP to consider the Bronx River as a site for pilot projects, research, and demonstration and said that they can offer a number of resources, including capital and human investment, to aid these efforts. They asked DEP to fund a model Green Streets project in the area, partnering with the Bronx River Alliance. The DEP stated that the stakeholders points throughout the meeting were noted, and will be taken back to the Department.

A number of additional requests were made including:

- A memo addressing the issue of groundwater capture.
- Distribution of presentation materials in advance of the meeting
- Posting of sign-in sheets, without addresses
- A change in venue for the next meeting
- A contact with the Office of Sustainability
- The implementation of a groundwater monitoring gauge. A stakeholder said that this data would establish a baseline from which to monitor the effectiveness of different LID alternatives.

A response to each of the above requests will be posted in advance of the next meeting. The group set a next meeting date for February 8th. The stakeholders will receive ongoing updates as DEP responds to their questions and requests.

Long Term Control Plan
Bronx River Stakeholder Team
Meeting No. 3 February 8th, 2007

The third meeting of the Bronx River Stakeholder Team for the New York City Department for Environment Protection's (NYCDEP) Long Term Control Plan (LTCP) for Combined Sewer Overflow (CSO) took place on February 8th, 2007, at 6:30pm, at the Police Athletic League, 991 Longwood Avenue. Stephen Whitehouse, Starr Whitehouse, opened the meeting. He said that the project team will hold a fourth and final meeting with the stakeholder group in April. He said that a master password, 'watershed,' was created for the project data-sharing web site to allow stakeholders to examine all the presentations, plans, and meeting notes for other project areas. Stephen reviewed the notes from the Bronx River Stakeholder team meeting of October 12, 2006; the notes were accepted without changes.

A stakeholder asked about a memo from the project team on how groundwater is factored into the modeling for the Bronx River. Charlie Dujardin, Hydroqual, said that LTCP modeling is looking chiefly to water quality as measured by dissolved oxygen and pathogens. Flow measuring data from the Bronxville gauge captures the upstream groundwater component; the groundwater contribution downstream from the gauge does not significantly affect dissolved oxygen or the bacteria levels, so it is not included in the model. A stakeholder stated that without the inclusion of groundwater, LTCP modeling cannot examine the impact of low impact developments (LIDs), which will also decrease CSOs.

Stephen reviewed the activities of other stakeholder teams. Four teams have completed their tasks of advising NYCDEP on the draft Waterbody/Watershed Facility (WB/WS) Plans. All of these teams had advanced facility plans at the onset of the LTCP project. Looking forward, Stephen said that two public meetings were required between the June 2007 submittal date for all WB/WS plans and the ratification of WB/WS plan as LTCPs, slated for 2009 for the Bronx River. The first is at the time of the New York State Department for Environmental Conservation's (NYSDEC) response to WB/WS plans and the second is prior to the approval of the LTCP. Sue McCormick, NYSDEC, added that the first meeting will occur during the 60 day period in which NYCDEP responds to NYSDEC's comments on the WB/WS plan. Several stakeholders stated that they would like to see additional public participation, as two meetings would be insufficient. Stephen stated that NYCDEP is considering additional public participation activities.

Next, Sue spoke about the differences between WB/WS Facility plans and the LTCP. The WB/WS plans are immediate, interim measures to address compliance with existing standards before the LTCP can be drafted and implemented. The LTCP will address the gap between the WB/WS plan and the attainment of targeted water quality. Sue believes that SB is a reasonable standard for the tidal portions of the Bronx River for the LTCP. WB/WS plans and the LTCP are linked because they share data and because the LTCP builds off of water quality improvements that result from the WB/WS plan. She stressed that the LTCP is a living document that could be ongoing for 30-50 years. Every five years, with the review of SPDES permits, the project team will assess whether new technology, including LIDs, can be integrated into the LTCP. Stakeholders' had the following questions and comments:

- A stakeholder requested that the project team follow Sue's lead and be specific about the distinction between the WB/WS plan and the LTCP.
- Another stakeholder asked how the current plan differs from the 2004 Facility Plan. Sue said that there was new modeling data.
- A stakeholder expressed that a 60-day review is short, if NYCDEP wants viable community input. Sue said that the NYCDEP could potentially request a variance.
- A stakeholder inquired as to the meaning of the term 'sensitive area' as applied to the Bronx River in the DEC response on sensitive areas regarding the LTCP for Paerdegat Basin. Angela Essner, Greeley and Hansen, said that the DEC response appeared to indicate that the Bronx River was important waterway and would receive careful consideration by DEC review. The term is not used to mean classified sensitive areas, such as endangered species habitat, shellfish harvesting, and sanctioned primary use, which require special water quality stipulations.
- A stakeholder asked how the impact of the WB/WS plan will be measured. The LTCP requires 10 years of post-construction monitoring.
- A stakeholder asked about Use Attainment Analysis (UAA). Sue said that a UAA is carried out if a plan cannot meet standards. However, a UAA does not establish permanent non-compliance as it is reassessed every three years. The UAA also requires a variance in applicable SPDES permits, which are reviewed every five years. Sue said that a variance on a SPDES permit could also be used to authorize a non-compliant plan that includes LIDs.
- A stakeholder asked that the team share data from Value Engineering sessions.

Next, Angela reviewed the main characteristics of the Bronx River Drainage Area and reviewed the assessed alternatives for the WB/WS plan. Charlie Dujardin spoke about the water sampling and modeling. One of the Bronx River's chief concerns is upstream water quality. Charlie said that the team is collecting new data, which will be used to develop a predictive tool for measuring upstream concentrations. With it, the modeling team can assign a boundary concentration for the model. Charlie described the Westchester County sampling program and showed the bacteria levels upstream of New York. The sampling, taken in wet and dry weather, shows bacteria levels above standards. The stakeholders asked whether the work includes the Attorney General's (AG) data. Charlie said that they were currently trying to integrate it. Until recently, the data was undisclosed pending ongoing litigation. Charlie summarized main observations from the bacteria analysis: different concentrations and distributions between dry and wet days; a correlation between rainfall and bacteria levels; and significant variability in bacteria levels on dry days. A stakeholder asked why modeling was important to the project. Charlie said that the model helps us to assign boundary conditions, which allow us to understand how upstream water quality affects the New York City portion of the river. The model also allows us to compare anticipated and existing conditions and will inform the selection of alternatives. A stakeholder inquired whether the model allows us to anticipate the impact of recent enforcement on water quality. Angela said that one of the model runs assumes that the river meets standards at the city line. There was concern that the model did not comprehend incoming changes in upstream flow. Charlie stressed that the sampling was one year in length to capture a range of conditions.

Next, John McLaughlin, NYCDEP, reviewed a pilot study for Jamaica Bay, stipulated by Local Law 71. The study will be carried out as a collaboration between NYCDEP and the Gaia Institute. The study will allow NYCDEP to understand how LIDs function in New York City and will inform their inclusion in the LTCP. John showed a map of different soil types in Jamaica Bay. Soil characteristics, particularly permeability and depth to bedrock, can determine the viability of source control for a specific site. Several soil types in the study area are similar to soil types in the Bronx River watershed. In those instances, data from the pilot study will be transferable. Information on soil types in the Bronx is currently being researched. A stakeholder offered to find that information for the group.

John spoke about the LIDs “toolbox” for the study. He stressed that LIDs need to be developed to the specificity of a site. A first tool the study will examine is stormwater diversion, wherein runoff is diverted from streets to pervious areas. John also spoke about street-side stormwater infiltration through enhanced street tree openings and improved water storage possibilities in tree pits. A stakeholder stated that enlarged tree pits could be used at Hunt’s Point and urged fellow stakeholders to advocate for them. John also spoke about street-side green infiltration swales, which are possible on wide roads; green roofs; constructed wetlands; and water capture in parking lots. John said that, although there is a wide body of data on the impact of LIDs worldwide, this data cannot be applied directly to conditions in New York City. The study will allow NYCDEP to understand the effect of LIDs across New York’s singularly dense urban watershed. As NYCDEP needs to provide an enforceable plan to NYSDEC, this data is necessary in order to anticipate the performance of LIDs in the LTCP.

A stakeholder inquired about the breadth of the study. John stated that Jamaica Bay will receive a package of pilot projects. Other areas in the city may also receive pilot projects and NYCDEP has received the Bronx River Alliance’s list of potential sites. A stakeholder proposed that the project team design a comprehensive pilot in the Bronx to understand how CSO events can be abated solely using LIDs. He argued that the Bronx River is an apt site for such a study, as one could focus on the 3 sub-watersheds that generate CSO events. He requested that the project team quantify the flow volume and the amount of LIDs necessary for such a study. Another stakeholder said that NYCDEP’s approach to LIDs is unnecessarily long. John said that the Agency’s approach is to first build an accurate database; this has not been carried out in New York yet and the unique density and harbor conditions of the city render other data non-transferable. A stakeholder responded that assessment of engineering solutions has been historically inaccurate, citing the initial projections of water quality for the Flushing Tank, and that pilots were not carried out for those projects. He argued that engineering and green solutions are treated inequitably. He advocated for a larger scale implementation of LIDs.

A stakeholder reviewed her group's proposed list of requirements for new construction projects. John said that NYCDEP is looking at zoning and code changes in an interagency group and emphasized that it will be a long-term effort. Sue stressed that green solutions are required in WB/WS plans but that they must be backed up with data. As there is currently no data, NYCDEP has been encouraged to leave a placeholder in the WB/WS plans for LIDs. Another stakeholder asked whether NYCDEP is looking at ways to structure the water bill in order to incentivize LIDs on private property. This is beginning to be examined. A stakeholder requested that the project team work with the Capital Division of the City's Parks and Recreation Department to develop a checklist for LIDS in park design. John said that NYCDEP is speaking with that Agency.

The project team set the next meeting date for April 25th and the location will be determined at a later date.

Long Term Control Plan
Bronx River Stakeholder Team
Meeting No. 4 April 25th, 2007

The fourth meeting of the Bronx River Stakeholder Team for the New York City Department for Environment Protection's (NYCDEP) Long Term Control Plan (LTCP) for Combined Sewer Overflow (CSO) took place on April 25th, 2007, at 6:00pm, at the Police Athletic League, 991 Longwood Avenue. Stephen Whitehouse, Starr Whitehouse, opened the meeting. Stephen reviewed the notes from the Bronx River Stakeholder team meeting of February 8, 2007; the notes were accepted without changes. Stephen said that John McLaughlin, from DEP's Bureau of Environmental Planning and Assessment had planned on attending the meeting but that unforeseen family circumstances had prevented him. Stephen said that John had offered to meet with the stakeholders at a later date.

Next, Karen Argenti, a stakeholder, presented an alternative plan developed by Dart Westphal, Teresa Crimmens, Paul Mankiewicz, and herself. Karen explained that their plan aimed to abate CSOs in an entire drainage area. A water budget will be developed for a drainage area. Then, green practices would be selected to meet that budget and abate the CSOs in that drainage area. Next, Karen discussed how impervious ground treatment prevents stormwater from being absorbed into the soil. Instead, it must be channeled into pipes where it contributes to CSOs. Karen reviewed various ways to accomplish to decrease the degree of imperviousness, including roof drains, porous pavement, green roofs, and parking lot retention. She spoke specifically about a proposed streetscape project on Lafayette Avenue in the Bronx. Karen said that there was a strong need to develop policy that will help to control runoff in new construction projects and encouraged the adoption of the Bronx Council for Environmental Quality's Doctrine of Low Impact Development (LID), which she helped to develop. She stressed that other places in the country, such as Washington D.C., have incorporated LIDs in their LTCPs. Lastly, she shared some figures that her group had developed which suggest that a combination of 4 miles of green, or swaled, streets and some green roofs would capture 20% of CSOs at outflow HP-007. She said that 10 miles of green streets would cost approximately $5 million, a comparatively small sum. Karen stressed that, along with end of pipe solutions, DEP should be considering broader implementation of green infrastructure. A stakeholder added that, while the Mayor's PLANYC's overall goals for water quality are commendable, he is disappointed by the quantity and time frame for pilot LIDs, which he believes to be both cost-effective and efficient. He cited as an example the proposed pilots for five trees with improved pit design in Jamaica Bay. He considers it a missed opportunity not to use the 16,000 new street trees that the Department of Parks and Recreation is slated to provide in the Bronx to contribute to the abatement of CSOs.

Next, Ray Hyland, Greeley and Hansen, presented the proposed Waterbody/Watershed (WB/WS) plan for the Bronx River. He reviewed the Bronx River drainage area and the CSO locations. Then, Ray reviewed the assessed alternatives, including netting and screening to control floatables; maintaining two times dry weather flow at the treatment plant; a boom modification on the Bronx River which would improve boating; repairs to collapsed outfalls; storage elements, such as tanks and tunnels; real time control, allowing for a range of alternatives which enable DEP to use the pipes to store CSOs; LIDs; and continued work to bring Westchester County into compliance. A stakeholder asked if the development of real time control would allow for improvements in public notification. She stated that improved public notification was extremely desirable as it enables individuals to make better decisions about their use of the waterbody and that both this group and the Open Waters stakeholders have advocated for such improvements. Ray said that the real time control proposed typically does not indicate or measure the incidence of overflows, and would not by itself support real time public notification.

Next, Ray showed a knee-of-the-curve analysis, which shows the cost of different alternatives against their benefit, in this case the percentage of CSO reduction as projected by the model. This analysis was used to select the WB/WS plan. He shared a chart which showed how different alternatives would bring the saline, tidal portion of the Bronx River into compliance with existing New York State Class I standards. This Class I standard for the Bronx River allows for secondary contact recreation, or boating, but does not allow for primary contact recreation, such as swimming and fishing. A stakeholder asked whether adding chlorine to the water would bring the water to fishable/swimmable levels. Ray said that chlorine directly to the river would not effectively raise water quality and that it also poses a threat to riparian ecologies. Another stakeholder asked if it was possible to bring potable water into the Bronx River to bring the water quality to swimmable levels. Stakeholders asked for a plot of the examined alternatives showing projected compliance with primary contact standards. They requested that the model analysis of the Bronx River's compliance with primary contact recreation look at two conditions, one with Westchester County's current water quality, one with Westchester County in compliance with applicable standards. Sue McCormick, DEC, added that while the WB/WS plans aim to attain current classifications, the LTCP will have higher use goals for the waterbodies and the standards may be changed accordingly.

Then, Ray reviewed the selected alternatives for the Bronx River WB/WS plan. He showed the effect of the 2004 improvements to the Hunts Point Water Pollution Control Plant on each of the different outfalls. He reviewed floatables alternatives that are proposed for different overflows and said that the main purpose of floatables control is to remove debris. Then, Ray presented the proposed boom modification to facilitate passage by hand-powered boats, which was received positively by the stakeholders.

Next, Ray spoke about water quality compliance in Westchester County and shared graphs that show how compliance of Westchester Creek would bring the Bronx River into compliance with secondary contact recreation standards. Ray reviewed the impact on fecal coliform, total coliform, annual dissolved oxygen (DO), and DO in July, the worst month for water quality. The group reiterated their request for data on the impact of compliance of Westchester County on the Bronx River's attainment of primary contact standards. Charlie Dujardin said that this analysis will be available in the June WB/WS plan. A stakeholder asked whether the plan will be available to the public in June. Sue McCormick explained that the New York State Department of Environmental Conservation (DEC) will review the plan first and then it will be released to the public. The group stated that they would like to see the analysis of the attainment of primary contact standards sooner.

In terms of additional public participation, Sue said that DEC will hold two additional public meetings, one for the WB/WS Facility Plan and one for the LTCP with a formal public comment period for each. The comment period will focus on the second submittal of the documents once DEP has incorporated DEC's comments on the initial submittals. Stephen said that a larger meeting, with the Mayor's Office of Sustainability and Long Term Planning and other stakeholders from other water bodies, was being considered. The stakeholders requested that their group continue to work with DEP on LIDs. It was suggested that they make this request to John McLaughlin at their upcoming meeting. Stephen Whitehouse said that he would work to set up a meeting with John McLaughlin. Several stakeholders spoke of having an oversight stakeholder group, who would ensure a coherent, citywide public participation process. Another stakeholder mentioned the lack of education material about the plan. She said that it was difficult to bring information back to her organization without concise materials.

Finally, Ray presented the components of the proposed plan including maintaining the plant upgrade that was completed in 2004. This upgrade was included in the overall cost to provide a comparison against the baseline condition prior to the upgrade. In addition, the benefits of the upgrade provide significant CSO reduction in the Bronx River.

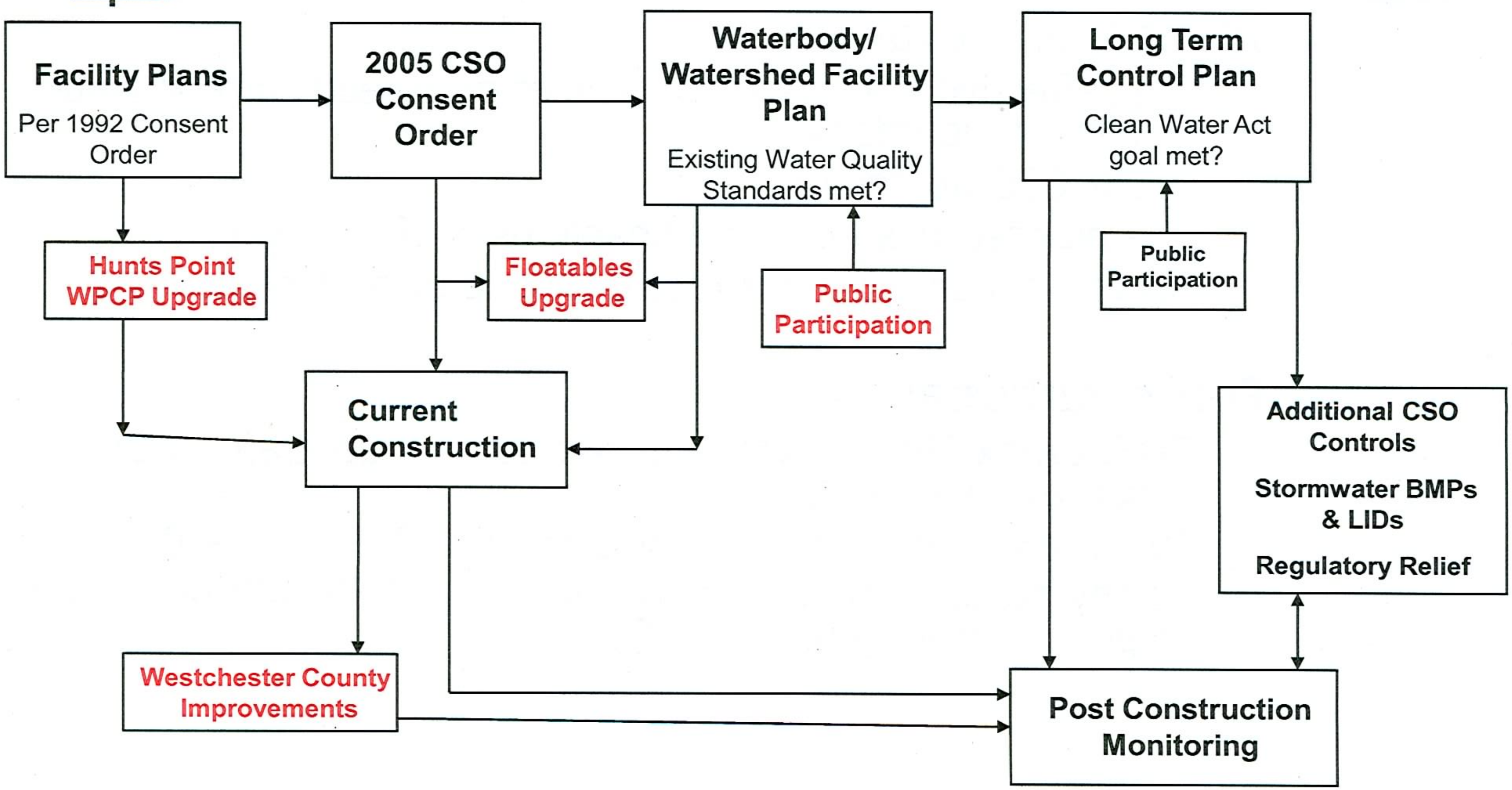
There was a request for plans for the boom modifications for stakeholder review.

The stakeholders asked for a change in the language of the powerpoint, strengthening the phrase, 'investigations of low impact development and best management practices feasibility' to 'investigations into green infrastructure.' Supporting the recommendation that green infrastructure alternatives be included in the Waterbody/Watershed Facility Plan, a stakeholder noted that the U.S. EPA had recently (4/19/07) signed a Green Infrastructure Statement of Intent to "affirm the belief...in the value of green infrastructure as both a cost effective and environmentally preferable approach ... in combination with, or in lieu of, centralized hard infrastructure solutions."

The meeting was concluded at 8:45.

B.2. NYSDEC PRESENTATION, AUGUST 19, 2009

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 Bronx River WWFP provided to the public after DEC's initial review – 7/22/09
  - Public information meeting held by DEC/DEP – 8/19/09
  - 30 day public comment period closes 9/18/09 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) – Green Infrastructure
- 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

- Bronx River LTCP due 6 months after DEC approval of WWFP

- Public Participation
  - Draft Bronx River 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"

Bronx River WWFP

- DEC and EPA support core components
- Implementation will provide increased floatables controls
- DEC is deferring decisions on water quality improvements for the LTCP
  - Effectiveness of Westchester Co. SSO and illicit connection removals

Contact Information

- Please send questions and comments by September 18, 2009 to:

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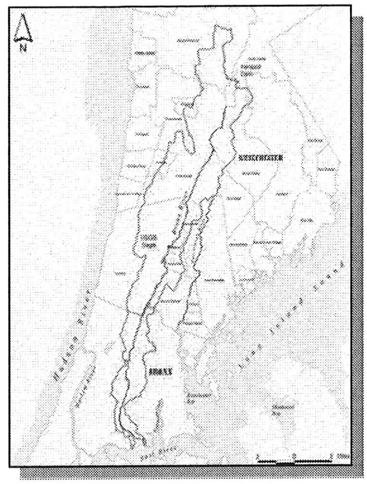
New York State Dept. of Environmental Conservation
625 Broadway
Albany, NY 12233-3506
sdmccorm@gw.dec.state.ny.us
Fax: 518-402-8082
Phone: 518-402-8199

B.3. NYCDEP PRESENTATION, AUGUST 19, 2009

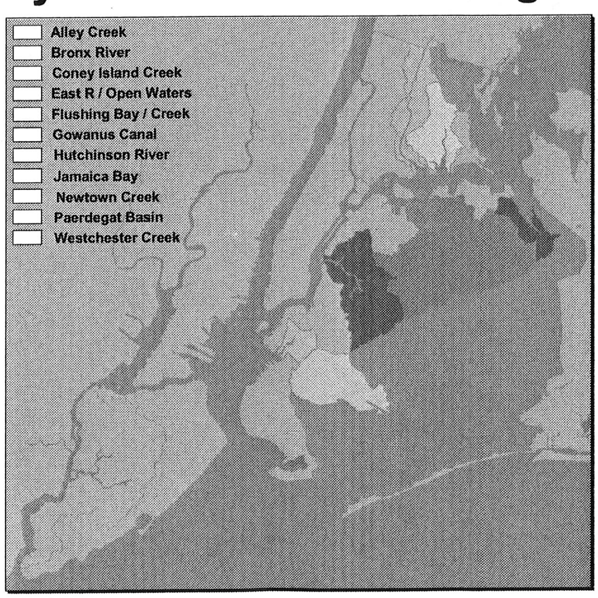
CSO Long-Term Control Plan Project

Bronx River Waterbody Watershed (WB/WS) Facility Plan

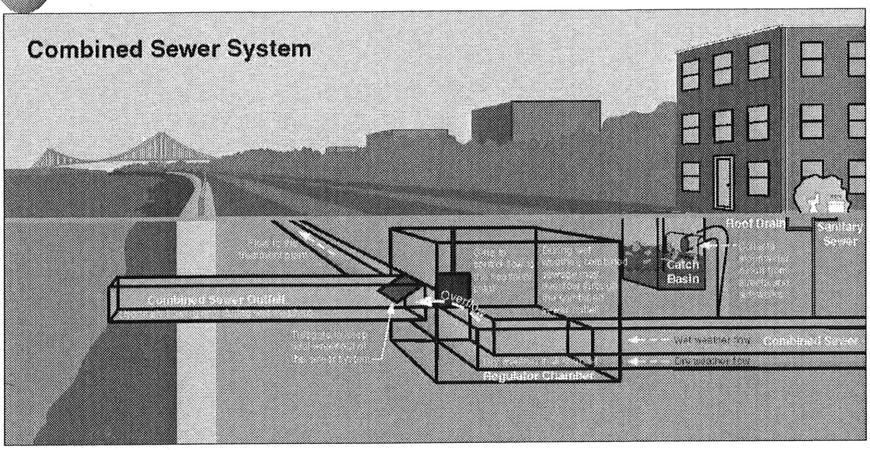


Public Meeting – August 19,2009

City-Wide CSO LTCP Program

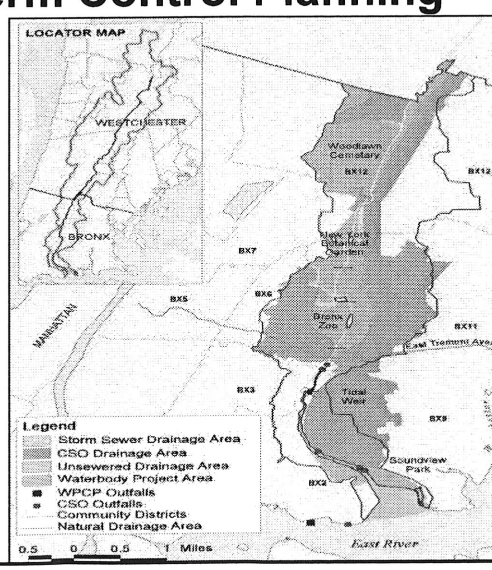


What is a CSO?



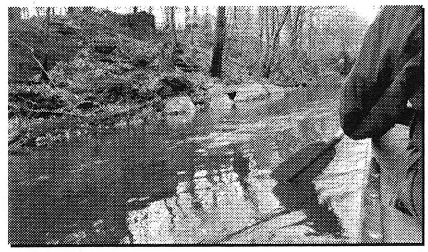
Bronx River CSO Long-Term Control Planning

- **Planning Area**
  - NYS delineates Bronx River as shown
- **NYS Waterbody Classification:**
  - **Class B** fresh water - Middle Bronx (within City)
    - Primary & secondary contact recreation
    - Fish propagation and survival
  - **Class I** saline waterbody - Lower Bronx
    - Secondary contact recreation
    - Fish propagation and survival
- **NYS 303(d) List**
  - Upper Bronx and Tribs (Westchester): DO/Oxygen Demand and Pathogens
  - Middle Bronx and Tribs: Pathogens
  - Lower Bronx: Pathogens and Oxygen Demand
- **CSO Consent Order**
  - Waterbody/Watershed Plan: submitted June 2007
  - Long Term Control Plan: pending DEC approval of WBWS plan



What is Attainable and Appropriate?

- Aquatic-Life Uses
  - Meet fish propagation & survival standard (Class B and I Dissolved Oxygen (DO) standard is ≥4 mg/L)
- Recreational Uses
  - Stakeholder team desires primary and secondary contact recreation (Class I does not support primary)
  - Bacteria levels are improving



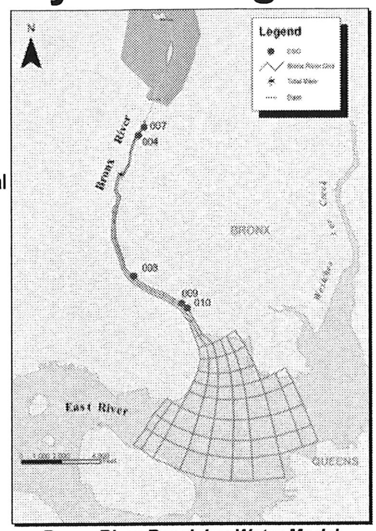
- Criteria for primary contact recreation (swimming/bathing) are not met; however, swimming has been observed in river
- Aesthetics
  - Floatables and other aesthetics conditions to be consistent with planned and proposed increases in shoreline access by local community

Westchester County Water Quality Compliance

- Over 80% of the Bronx River Watershed is in Westchester County
- Previous sampling concluded dry weather discharges in Westchester County section of Bronx River must be remediated
- In 2006, NYS Attorney General issued Assurance of Discontinuances (AUDs) for Yonkers, White Plains, Mount Vernon, Greenburgh, and Scarsdale to eliminate illicit sewage discharges
  - Municipalities agreed to eliminate discharges, monitor storm sewers, and pay civil fines
  - NYS Attorney General's office handles these actions and each municipality is currently in varying stages of compliance

Elements of Bronx River Facility Planning

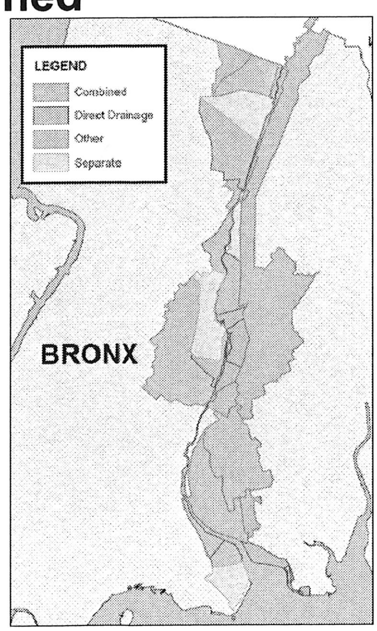
- Waterbody and Watershed Characterizations
  - Inspections and flow monitoring of sewer system
  - Sampling of physical, chemical & biological parameters
- Mathematical Modeling
  - Watershed
  - Receiving Waters
- Use-Attainability Evaluations
  - Aquatic Life
  - Recreation
  - Aesthetics
- Engineering Evaluations
  - To achieve water-quality standards
  - Integrate past/ongoing planning
  - Identify additional alternatives



Bronx River Receiving Water Model

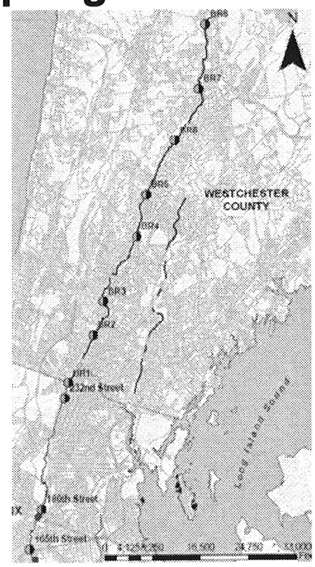
Waterbody/Watershed Characteristics

- Watershed Drainage Area
  - Urbanized sewer-shed
  - 24,260 acres total
  - Over 80% in Westchester County
  - 4,150 acres in City
    - 58% Combined
    - 15% Separate Stormwater
    - 27% Direct Drainage/Other
- Combined Sewer System
  - Hunts Point WPCP
  - Pump Stations
  - 5 CSO Outfalls, All in Saline Waters
  - 4 Storm Water Outfalls, All in Fresh Waters
- Annual Wet-Weather Discharge Volume:
  - 4000$^{+/-}$ Million Gallons (MG) (typical year)
    - CSO: ~25%
    - Separate Stormwater: ~75%



2006 Cooperative Sampling Initiative

- Westchester County: 8 Sampling Locations along 12 River Miles
- New York City: 3 Sampling Locations along 8 River Miles
- Sampling from March 2006 thru March 2007
- Weekly in NYC, Monthly in Westchester County
- Analyzed for Pathogens, Nutrients and Solids
- Fecal Coliform Contribution to Freshwater:
  - 91% from Westchester County
  - 9% from New York City Areas

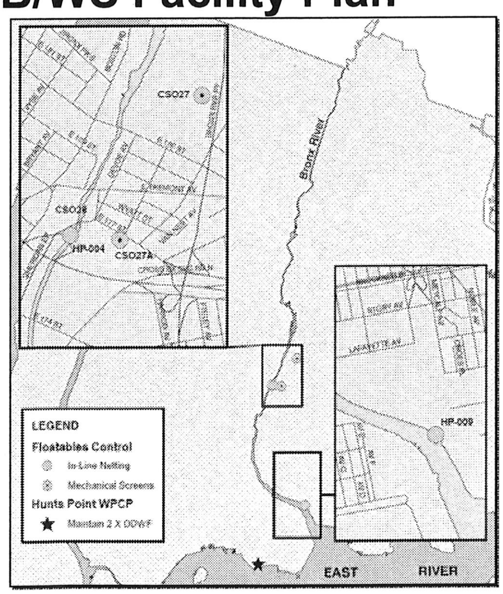


Bronx River WB/WS Facility Plan

Hunts Point WPCP Upgrades

Bronx River Floatables Control Facilities

Programmatic Controls

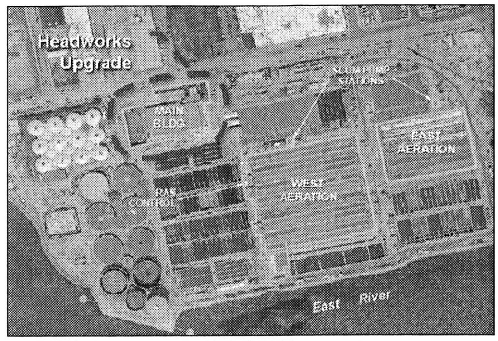


Bronx River WB/WS Facility Plan

Hunts Point WPCP Upgrades

Bronx River Floatables Control Facilities

Programmatic Controls



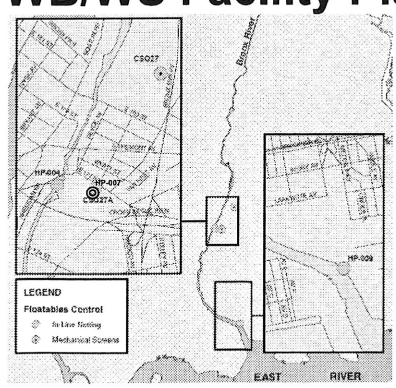
- New forebay gate chamber and gate
- Maintain treatment of 2xDDWF (Increases capacity from ~260 MGD to ~400 MGD)
- CSO Reduction - 42%
- Completed 2004

Bronx River WB/WS Facility Plan

Hunts Point WPCP Upgrades

Bronx River Floatables Control Facilities

Programmatic Controls



Floatables control facilities for HP-004, HP-007, HP-009

- **In-line netting facilities CSO outfalls HP-004 & HP-009**
- **Mechanical Screens at regulators CSO 27 & CSO 27A (HP-007)**

Complete reduction of floatables in 99% of discharge

Design complete and construction bid awarded

Regulator 27A
Outfall HP-007

Hunts Point WPCP Upgrades

Bronx River Floatables Control Facilities

Programmatic Controls

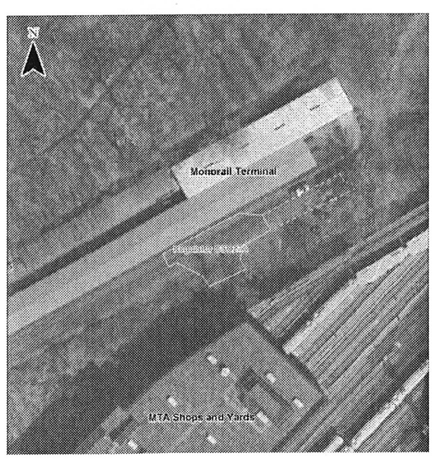
Depot

Regulator 27
Outfall HP-007

Hunts Point WPCP Upgrades

Bronx River Floatables Control Facilities

Programmatic Controls

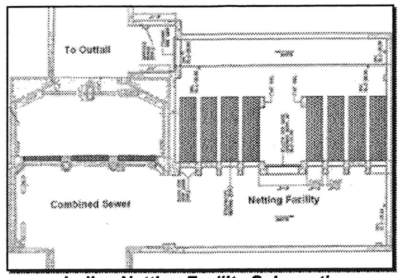


Bronx River WB/WS Facility Plan

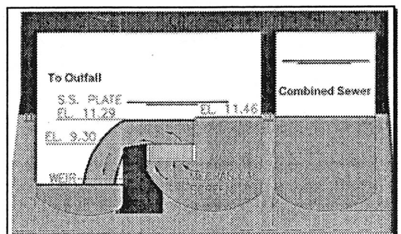
Hunts Point WPCP Upgrades

Bronx River Floatables Control Facilities

Programmatic Controls



In-line Netting Facility Schematic



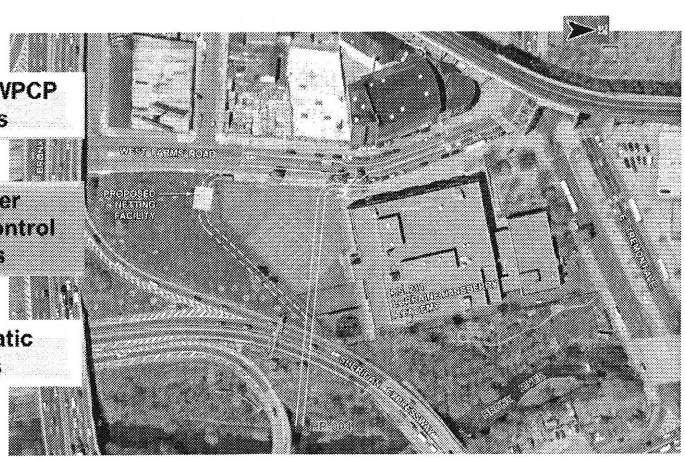
Mechanical Screen Schematic

Netting Facility Outfall HP-004

Hunts Point WPCP Upgrades

Bronx River Floatables Control Facilities

Programmatic Controls



Bronx River WB/WS Facility Plan Projected Benefits

- **Reduce 42% of CSO Volume (1,006 MG down to 592 MG/Year)**
  - Reduction of pollutant discharge to Bronx River
- **Complete Reduction of Floatables in 99% of Discharge**
  - Through Bronx River Floatables Control Facilities
- **Attain Dissolved Oxygen Standards**
  - Ensure fish survival
  - Allow for fish propagation in tidal region (near 100%)
  - *Additional controls do not increase attainment*
- **Attain Secondary Contact Standards for Bacteria**
  - With existing bacteria loads from upstream, all but small section projected to meet Class I compliance
  - With Westchester County at Class B compliance, entire river projected to meet Class I compliance

Bronx River WB/WS Facility Plan Projected Construction Costs

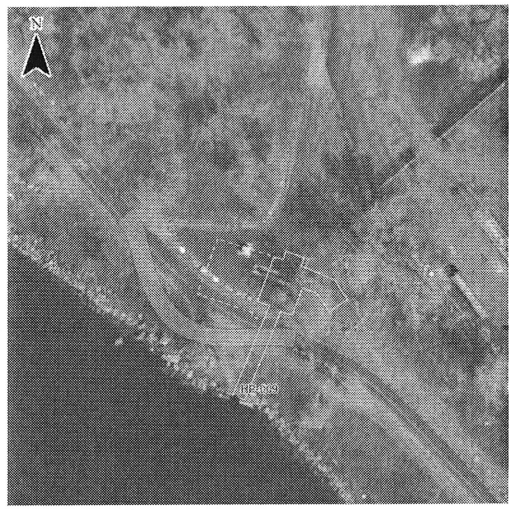
Hunts Point WPCP Upgrades	**$ 26 Million** (Cost included in East River Open Water Facility Plan)
Bronx River Floatables Control Facilities	**$39 Million**
Programmatic Controls	***(No direct construction costs)***

Regulator 13
Outfall HP-009

Hunts Point WPCP Upgrades

Bronx River Floatables Control Facilities

Programmatic Controls



Bronx River WB/WS Facility Plan

Hunts Point WPCP Upgrades

Bronx River Floatables Control Facilities

Programmatic Controls

- Best Management Practices (BMPs) for collection system:
  - SPDES permit requirement
  - Maintaining capacity of WPCP
  - Reduce contaminants in sewer system
- Floatables Control Plan
  - Comprehensive, City-Wide Plan
  - Street sweeping, catch basins, etc.
- Monitoring
  - Floatables, water quality
- Cooperate with Ecological Restoration Programs
  - USACE Bronx River Restoration project
  - Continued local sponsor along with Westchester County
- Low-Impact Development (LID)/BMP Assessment
  - Evaluation of most practical LIDs & BMPs
  - NYCDEP BMP pilot studies
  - To be incorporated into LTCP

Bronx River WB/WS Facility Plan Implementation Schedule

Hunts Point WPCP Upgrades	Completed 2004
Bronx River Floatables Control Facilities	2009 → 2012
Programmatic Controls	*Ongoing* →

Green Infrastructure Pilot Projects

- Three green infrastructure pilot projects in the Bronx River Drainage Basin
- Two were developed by DEP in response to an Environmental Benefit Project (EBP) in connection with the settlement of an enforcement action taken by New York State and DEC for violations of the New York State law and DEC regulations
- One is part of a larger city-wide pilot effort under the PlaNYC
- Pilot study results will be incorporated in the CSO Long Term Control Plans

Environmental Benefit Projects

- In conjunction with a USF&WS grant, DEP will be funding the implementation of higher density green infrastructure in a 2-block area (e.g., Manor Avenue, between 173rd and 174th Streets)
- Companion study to one currently underway through the National Fish and Wildlife Foundation with Drexel University
- Working with local stakeholder groups
- BMPs incorporated into to observe benefits – EBP project will build BMPs and test results against model
  - Measurement of sewer flows (with various precipitation events)
  - Modeling completed, construction will begin in spring 2010
- $850,000 of EBP funds allocated

Environmental Benefit Projects

- In conjunction with a US Forestry Service grant, DEP has provided a match grant for construction of green infrastructure in the Bronx and Newtown Creek drainage basins
- $250,000 of EBP funds have been allocated
- Planning and model development is ongoing, construction will begin in spring 2010

PlaNYC Project

- Development of a Bronx River watershed protection plan
- Coordination with ongoing studies (e.g, Bronx River Alliance Master Plan, USACE Bronx River Ecosystem Restoration Study
- Watershed impervious cover analysis
- Design and construction of stormwater capture BMP in Shoelace Park, Bronx

Questions?

B.4. RESPONSIVENESS SUMMARY

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 Bronx River Waterbody/Watershed Facility Plan (WWFP)

The WWFP accurately represents DEP's intentions and understanding as of August 19, 2009. The responsiveness summary reflects DEC and DEP's responses to the questions regarding this WWFP, based on the comments received at the meeting and during the public comment period, from August 19 through September 18, 2009.

A. QUESTIONS AND COMMENTS BY ATTENDEES AT PUBLIC MEETING HELD WEDNESDAY, AUGUST 19, 2009 AT THE OFFICES OF BRONX DISTRICT ATTORNEY

A1. Several comments were received regarding clarification of the goal of primary contact versus secondary contact for the Bronx River. One individual said that achievement of both primary and secondary contact standards is mandated under the US Clean Water Act. Another individual stated that his father learned to swim in the Bronx River and that he also immerses himself waist-high in the River. Some attendees asked what measures will be taken to insure the safety of those who are in direct (primary) contact with Bronx River water? One person asked if we will be able to swim in the River some day.

The Waterbody/Watershed Facility Plan (WWFP) focuses on the attainment of existing water quality standards within the waterbody where CSO outfalls discharge (tidal portion of the River). Although individuals may be swimming in the tidal reach of the Bronx River, the New York City Department of Health and Mental Hygiene (NYCDOHMH) only allows swimming at authorized bathing beaches and only during the bathing season. Article 167.05(d) of the New York City Health Code was amended on March 24, 2009 to allow boundaries delineated for primary contact recreation to be defined by applicable surface water classification regulations of the DEC. "No person shall operate, construct or maintain and no permit shall be issued for a bathing beach… located outside the boundary delineated for primary contact recreation as defined by applicable regulations of the New York State Department of Environmental Conservation." The tidal section of the Bronx River, where all Bronx River CSOs are located, is designated as Class I (secondary contact recreation, fishing), which does not support primary contact recreation. The Bronx River CSO Long Term Control Plan, which will follow DEC's approval of the WWFP, will evaluate the improvements necessary to achieve "swimmable" water quality (Class SB/SC) standards. However, even if the Bronx River met the Class SB/SC primary contact standards, swimming would only be permitted once NYCDOHMH designates a bathing beach along the River. Also see response to comment B7.f.

A2. Is all of the $26 million that has been earmarked for the project going towards floatables control? Why not include LIDs and BMPs (green infrastructure) in costs in order to obtain more federal money?

Yes, $26.5 million is the cost of the Bronx River Floatables Control Facilities. As discussed in the WWFP, the project reduces floatables entering the Bronx River. DEP has allocated other sources of funding including capital budget dollars for LID and BMP pilot projects in the Bronx River watershed. These projects include the design, construction, and monitoring of multiple BMPs in a park and existing high-density residential development; the total funding for these BMP and LID projects within the Bronx River watershed is approximately $3 million. 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, DEP is also working with DEC to implement BMPs within a two-square block area in the Bronx River watershed using CSO Consent Order Environmental Benefit Project (EBP) funds totaling $850,000. BMP technologies will be determined based on household surveys developed and compiled by eDesign Dynamics. In addition, the Bronx River Watershed Initiative has a total of $2.7 million available for stormwater retrofit projects, including low-impact development initiatives, to address the root causes of pollution from stormwater outfalls to improve water quality and river ecology along the Bronx River. Along with federal, state and local government, non-profit organizations, educational institutions, interstate entities, and regional water pollution control agencies are eligible for funding. These pilot studies are currently underway and their results will be evaluated and analyzed for expanded LID and BMP use in the LTCP.

A3. Why are sustainable stormwater solutions not included in the budget? An individual contended that green solutions are not part of this plan and the plan isn't being taken seriously enough. Another stated that he wanted to see more of a commitment to implementing green infrastructure than currently exists.

Sustainable stormwater solutions have not been included in the WWFP as the data to evaluate the cost/benefit of these solutions is still being gathered. Once the data is available, it will be used in the development of the LTCP to identify sustainable stormwater solutions for the Bronx River drainage area.

Strategies to promote sustainable stormwater solutions are detailed in Mayor Bloomberg's PlaNYC 2030 and Sustainable Stormwater Management Plan (December 2008). DEP has been working with the Mayor's Office of Long-term Planning and Sustainability and other City agencies to analyze and implement appropriate stormwater reduction techniques in the City.

In particular, DEP formed a BMP Code Review Task Force in March 2008 with two main initiatives: 1) to identify opportunities for code revisions based on a *review of existing codes and 2) to analyze the feasibility of a stormwater performance standard in NYC. As a result, a potential performance standard for new development was included as one of several potential stormwater initiatives in the Mayor's Sustainable Stormwater Management Plan. DEP is currently evaluating the costs and benefits of a possible rule. Stakeholder outreach and input for the potential new rule would be an important component of the process.*

DEP began a three-year, $15 million BMP Planning contract in May 2009 to assess the feasibility of implementing BMPs. Under this contract, DEP will construct stormwater BMP pilot projects throughout the city, create BMP Guidelines and complete BMP watershed plans. Various stormwater BMPs, including rooftop detention, subsurface detention, bioretention swales/cells, and porous pavement, are in various stages of design. Locations for BMP installations were selected to test different types of BMPs on various land uses including parks, right-of-ways, and existing residential development. For example, bioretention cells will be constructed in Shoelace Park to demonstrate the effectiveness and costs of such BMPs constructed on New York City parklands.

Once constructed, BMP installations will be monitored to collect data related to costs and benefits, maintenance needs, and additional information to identify BMP performance associated with New York City-specific climate and site conditions (i.e. local geology, cold weather impacts, rainfall intensities, etc.). The BMP Guidelines will provide specific guidance for designing, constructing, and maintaining BMPs based on New York City conditions and DEP stormwater requirements. The guidelines will provide planning and design guidance to New York City's development community including engineering professionals and architects to encourage the construction of onsite stormwater source controls for new development.

The first set of guidelines is expected to be completed in 2010 and will focus on six approvable detention systems to comply with DEP's potential performance standard including subsurface gravel beds, perforated pipes, stormwater chambers and tanks, and rooftop detention (blue roofs and green roofs). A task force of staff from New York City Department of Buildings (NYCDOB) and DEP has been convened to develop the technical guidance for the placement, design, construction, and operation and maintenance of each approved system and to ensure compliance with City codes and requirements. The information is being developed based on the implementation of similar systems in other cities as well as existing applications in New York City.

The BMP Guidelines will be updated based on information collected from ongoing pilots as well as for new BMP technologies as developed.

The pilot BMP technologies are being designed specifically for NYC's dense urban and subsurface conditions. The design of these BMPs will inform standards for right-of-way practices. The BMPs will be monitored to determine how much stormwater runoff flows in and out of the BMP as well as runoff *reductions to the sewer system. Streetside swales, for example, will be constructed behind the curb line and, where appropriate, with infiltration chambers partially under sidewalks to capture street runoff and infiltrate a portion of it before it goes into the combined sewers.*

Data collected from these installations will include information about soil types and infiltration rates to determine how much runoff is retained or infiltrated to subsurface soils and, therefore, permanently removed from the sewer system. Similar data will be collected for BMPs constructed in parks and highway medians including Shoelace Park in the Bronx River watershed and North and South Conduit Avenues in the Jamaica Bay watershed. Both of these projects are currently in design.

Another key component of the contract is the development of watershed plans. These plans will be based on a comprehensive water quality and ecological approach to identify BMP, restoration, and other low-impact/decentralized strategies.

As mentioned above in A2, DEC and DEP are using EBP funds to implement additional BMPs in the Bronx River watershed. Similar EBP Plans were also implemented in the Gowanus and Flushing Bay watershed. In addition, a BMP pilot study that will include the design, construction and monitoring of enhanced tree pits, streetside swales, a parking lot retrofit and blue/green roof comparison study was implemented in the Jamaica Bay watershed through a Nitrogen Consent Judgment EBP Plan. DEP submitted the EBP Plan to DEC 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. Data collected from the monitoring of BMPs constructed in specific watersheds will be assessed to determine citywide feasibility.

DEP is preparing a report, which includes an adaptive management strategy for reducing combined sewer overflow, which includes green infrastructure, grey infrastructure and sewer system optimization. This approach is called the "Adaptive Management Strategy" because it embraces a multi-pronged, modular approach by investing in capital projects, building a distributed network of source controls, and operating the existing system to its fullest capabilities. This report will be presented in two phases. The first report, to be released in the summer of 2010 by DEP, provides the framework for DEP's Adaptive Management Strategy.

A4. An attendee said, "Please make Bronx River the place where the green technology trials take place".

See responses to comments A2 and A3.

A5. How will the US Army Corps of Engineers' plan for the Bronx and Westchester Counties be integrated into this plan, in order to lead to cooperation and watershed-wide action?

Both DEP and Westchester County are the Non-Federal Sponsors supporting the development of the US Army Corps of Engineers (ACOE) Bronx River Feasibility Plan. DEP will work closely with the ACOE to review and, where feasible, to coordinate LTCP elements with the ACOE plan. The ACOE is a primary stakeholder whose input and coordination are solicited in development of each of the WB/WS Facility Plans. This federal agency has participated either directly or indirectly through its partners or consultants in many of the waterbody meetings that have led to approved plans or plans in progress. The development of a coordinated Bronx River plan for NYC and Westchester County that features ACOE facilities along with those in planning by the towns and villages along the river will not occur in the timeframe for this approvable Bronx River WWFP but is a goal for the longer range planning effort.

A6. Why does the Bronx River not qualify as a "sensitive area" even though there is primary contact recreation already taking place in the River?

The USEPA Combined Sewer Overflow (CSO) Long Term Control Policy ("the CSO Policy") defines a sensitive area as those designated as "…Outstanding National Resource Waters, National Marine Sanctuaries, waters with threatened or endangered species and their habitat, waters with primary contact recreation, public drinking water intakes or their designated protection areas, and shellfish beds." The WWFP for the Bronx River dated July 2009 does review the potential for sensitive area designations for those portions of the Bronx River that receive CSO discharge (tidal portion) and concludes that no sensitive areas exist. Under the "waters with primary contact recreation" category, it is stated that there are no public access points for swimming, i.e. bathing beaches, so the Bronx River does not meet the criteria to be a sensitive area. The City of New York does not condone bathing in the tidal Bronx River as the waterbody does not have any designated bathing beaches or a water quality classification that supports primary contact recreation. See response to comment A1 above.

A7. Is DEP working on capturing storm water before it goes into the combined sewer overflows?

See responses to comments A2 and A3.

A8. An individual criticized the ability of stakeholders to access the Bronx River Waterbody Plan. She advocated the placing of the Waterbody Plan into a hot link so that individuals may retrieve a portion or portions of the document without having to download all of it. She urged the DEC and DEP to use the benefits of internet technology.

The WWFP was and is available both on the web and at three repository locations in the Bronx. Future submittals of the Bronx River WWFP will be separated into chapters on the web. The separate links will enable persons who only want to review some of the document to download the parts that are of interest, instead of downloading the whole plan. DEP and DEC agree that technology adds to the public's ease of making comments and asking questions without necessarily leaving home. The public can study and have input into the Bronx River WWFP through various methods, including reviewing the plan online, perusing the plan at the local library or at other repositories, and attending public meetings as the plan moves forward to approval. Email, phone, fax and regular mail are consistently provided in the process as easy ways to register comments and ask questions.

The three repository locations are:

Bronx Borough President's Office of Planning & Development
851 Grand Concourse, 3rd Floor
Bronx, NY 10451

Bronx River Alliance
1 Bronx River Parkway
Bronx, NY 10462

New York Public Library, Soundview Branch
660 Soundview Avenue
Bronx, NY 10473

A9. Please get more into the plan and give more commitment to green infrastructure and individualize it. How will green infrastructure be implemented in the WWFP?

DEP will expand the green infrastructure assessment in the Bronx River LTCP. As described in detail under A3, DEP is working on a BMP Planning contract within which analyses will be conducted to customize assessments of green infrastructure throughout the city in addition to planned citywide evaluations as part of the LTCP development process. The results of these analyses will be incorporated into the LTCP submittals as developed and, dependent on these analyses, the LTCP for the Bronx River Watershed may provide a greater emphasis on green infrastructure than was included in the WWFP.

A10. What steps are being taken to ensure that Westchester County improves the discharges that are fouling the Bronx River outside New York City?

The New York State Attorney General's (AG) Office has Assurances of Discontinuance (AOD) with four Westchester County municipalities: Greenburgh, Mount Vernon, Scarsdale and White Plains. These AODs require the municipalities to disconnect all illegal connections to the storm sewers entering the Bronx River. They are in various stages of compliance at this time with the AG now moving to ensure compliance. The AG also has a Consent Judgment with the City of Yonkers under which Yonkers put $2.2M into an escrow account for the AG to hire a consultant to discover, map and remediate illicit discharges to the Bronx River. That work is in its final stages with a water quality report due in summer 2010. All of the discovered illicit discharges have been terminated by the City of Yonkers.

A11. Bring Parks, DEP, and NYCDOT to the table to plan green infrastructure. It is not sufficient to have the agencies only meet when a specific project or program requires it or when a Task Force is set up for a specific purpose. It is desired to have the government meet, and the public invited to the table as well, on a regular basis to discuss the future of NYC's environment and its infrastructure.

Mayor Bloomberg and his Administration have made interagency coordination a high priority in the planning and implementation of environmental improvements. The Mayor's Office of Long-term Planning and Sustainability established the BMP Interagency Task Force to incorporate BMPs into the design and construction of projects as part of PlaNYC 2030 and formulate additional stormwater strategies for inclusion in the Sustainable Stormwater Management Plan. While interagency coordination can be challenging for large municipalities, the BMP Interagency Task Force continues to meet to discuss interagency coordination issues and share information as different BMP projects are implemented citywide; this effort includes ongoing tracking of BMP projects throughout the City. The Sustainable Stormwater Management Plan will be updated regularly per Local Law 5; the update process will include an open process for the public to provide feedback on its implementation.

DEP has been working closely with NYCDPR, NYCDDC, and NYCDOT to develop approvable designs and permitting procedures to facilitate the installation of stormwater BMPs. The City has several programs to construct green infrastructure projects throughout the five boroughs which are described in the Mayor's Sustainable Stormwater Management Plan. In particular, NYCDPR's Greenstreets program will include modified designs in the right-of-way to increase stormwater capture and this program will be expanded as a result of funding received from the Federal Stimulus package. Also, NYCDOT recently released its 2009 Street Design Manual to encourage green infrastructure for upcoming road reconstruction projects, where applicable.

In addition, DEP has provided technical feedback for recently released NYCDOT Street Design Manual and the soon-to-be released NYCDPR Park Design for the 21st Century: High Performance Infrastructure Guidelines. Further, DEP has *been coordinating with other agencies to collect standardized climate-specific monitoring data and share results to develop a robust and relevant dataset for BMP performance in New York City. Finally, through interagency reviews of BMP pilot project submittals, templates have been created for permitting and design that can be applied to other BMP installations.*

While the public is encouraged to comment on the Bronx River LTCP development at meetings, via DEP's website, or by writing to the Commissioner or to DEC, the LTCP process for all waterbodies is currently under discussion between DEC and DEP. For example, DEC and DEP are discussing the system of public participation that will be part of development of the LTCPs.

A12. Get Environmental Justice input into all elements of the plan going forward, don't only hold high level meetings such as this one. Get into the community to solicit the communities' views.

This August 2009 meeting was just one of the several meetings to discuss the Bronx River WWFP. Environmental justice input is valuable for this plan and for other environmental improvements in the City. Several prior meetings were held on this plan in the South and North Bronx. It is important to acknowledge that the Bronx River Watershed covers a large geographic area that includes a range of communities, in and outside New York City. As such, there are other means of providing community input at more grass-roots levels. For example, the DEP and the community have ongoing discussions about water quality improvements through the Hunts Point facility monitoring committee at its open meetings. These are small community meetings in the South Bronx where all are welcome.

A13. A goal of 100% abatement of CSOs means nothing will be accomplished or come out of the Plan.

The Bronx River WWFP report describes the range of water-quality benefits attainable through various CSO controls, and assesses the cost-effectiveness of the selected controls, yielding a reasonable course of action that is expected to result in attainment of current water quality standards in the tidal portion of the River. This is the overarching goal of a WWFP. In contrast, the subsequent LTCP will attempt to attain the fishable/swimmable goals of the Clean Water Act, which the WWFP currently shows as not reasonably attainable due to the marginal cost benefits of additional CSO controls. This evaluation is consistent with the EPA CSO Control Policy, which allows cost/benefit analysis to be used in the selection of alternatives. Costs were developed based only on elements related to CSO abatement or water quality improvement, and were compared on a net present value basis per standard engineering practice.

A14. What year is the wet weather data from?

The rainfall data are from 1988. In accordance with EPA CSO Policy, DEP analyses are based upon long-term average conditions rather than extreme event conditions. DEP analyzed over 50 years of rainfall in the metropolitan area to identify a rainfall record that represents long-term average hydrologic conditions, thus satisfying the EPA requirement.

A15. Who is the contractor for the Bronx River Floatables project?

The contractor for the Bronx River Floatables Control Facilities is Northeast Remsco.

A16. What plant upgrades were made to the Hunts Point WPCP that are part of this selected alternative?

The Hunts Point WPCP upgrades that are part of this selected alternative include the headworks improvements completed as part of the larger BNR Phase I upgrade. The headworks improvements include new influent pumps, new headworks influent structures, new screens, and an influent throttling facility.

A17. Was meeting the dissolved oxygen standards a result of the Hunts Point WPCP upgrades?

No, the Hunts Point WPCP upgrades have little impact with regard to dissolved oxygen. Model projections using 1988 rainfall indicate that about 80% of the dissolved oxygen deficit in the critical areas is due to downstream and upstream boundaries - mainly the East River deficit and carbon and is exacerbated by stratification conditions in the river. Data collected in 2000 showed improvements in the freshwater dissolved oxygen. In addition, improvements are projected in the East River due mainly to nitrogen reductions associated with the Long Island Sound initiative.

A18. Is the reason for this meeting being held in August due to the federal funding for the project?

Yes. The schedule under which federal stimulus funding might assist the funding of facility construction dictated the schedule of the August 19th Bronx River WWFP meeting. Although elements of the plan are eligible for federal stimulus funding and such funding was desired when the meeting notice was published and the invitations sent out, the city has subsequently removed the project from the list of items for which federal stimulus funding is being requested. To the extent possible, the WWFP meetings are held when members of the public typically attend planning and development meetings.

A19. How will costs associated with the Environmental Benefit Projects be assessed and set aside?

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, the CSO EBP Work Plan proposes pilots in the Bronx River, Flushing Bay and Creek, and Gowanus Canal watersheds using the $4 million which has been placed in an EBP Fund. Using $2.9 million from the EBP Fund, DEP has established a Request for Grant (RFG) program that will enable local stakeholder groups to submit proposals for effective stormwater management projects that meet the objectives of capturing and treating stormwater (e.g., reduction of stormwater entering sewer system) within the Gowanus Canal and Flushing Bay and Creek watersheds covered by the CSO EBP Work Plan. A total of $850,000 will be used from the EBP Fund to construct various green infrastructure technologies at a specific two-block location within the Bronx River watershed. Funds for modeling associated with this work were obtained in September 2008 under a Long Island Sound Dissolved Oxygen Grant by Dr. Franco Montalto. The Bronx River watershed field survey analyses are underway, and detailed information resulting from the analyses will be submitted to DEC for review and comment prior to submitting a Stormwater BMP Location Plan which will identify the technologies to be built. Construction should begin in 2010 with a three-year monitoring period to follow. See responses to comments A2 and A3.

A20. In Section 8 of the WWFP, are sustainable stormwater management alternatives included under programmatic controls? If they are, since there are no allocated funds, these alternatives are not being taken seriously.

Yes, stormwater management alternatives are included under programmatic controls as stated in Section 8.1.4. DEP has allocated funds for stormwater management pilot studies which are discussed in detail in Section 5.9. Please see response to comment A3.

A21. Section 8 needs to be modified to make more of a commitment to use of green infrastructure (GI). DEP should take advantage of this opportunity to practice more GI.

Please see response to comment A9.

A22. How will Westchester County municipalities be forced to cooperate?

The New York State Attorney General's office has taken legal action against those municipalities in the County that have illegal discharges into the Bronx River. In addition, the DEC will be conducting an MS4 audit of municipalities along the Bronx River. Those that are not in compliance with MS4 regulations will be put under order to come into compliance.

A23. Please give an update on the progress being made in Westchester County to disconnect illegal connections to the storm sewers.

Please see response to comment A10.

A24. There is a public concern regarding general run-off from parks, cemeteries and construction sites.

Runoff from parks and cemeteries may be captured in storm or combined sewers as it flows towards public streets, or it may runoff directly to adjacent waterways. All construction sites are subject to State Pollutant Discharge Elimination System General Permit for Stormwater Discharge from Construction Activity (GP-0-08-001) which sets standards for acceptable stormwater management practice on an active construction site.

A25. During wet weather and sometimes dry weather there is a foul odor coming from outfall HP-007.

Combined Sewer Overflow outfalls discharge rainwater and sewage during heavy rainfall events. A portion of this may remain in the outfall and it will create a foul odor if it remains stagnant during warm weather. It should dissipate after the first flush of a rain event and should not be a source of odor during cooler weather. If there is a persistent problem, 311 can be called to investigate.

A26. Please use the original meeting location and a more temperate time of year for these meetings.

To the extent possible, the WWFP meetings are held when members of the public typically attend planning and development meetings. In the case of the August 19th Bronx River WWFP meeting, the schedule under which federal stimulus funding might assist the funding of facility construction dictated the schedule. As to its location, past Bronx River meetings have occurred in both the South and the North Bronx, neither of which location could comfortably accommodate this meeting due to the summer timing of the meeting. The Bronx River watershed covers a multitude of communities, thus there is the potential for many to participate in the meeting. The Bronx River WWFP is also of interest to organizations and individuals from outside the Bronx River area. The conference room at Ranaqua at the NYC Parks Dept's Bronx office was evaluated and deemed too small for the potential meeting audience. The location of the meeting, near the Bronx Borough President's office, was suitable for this meeting because of its convenience to a range of public transportation options, and because of the size and availability of the meeting room.

DEC and DEP will seek locations for future meetings that are convenient to attendees.

<u>B. QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD</u>

B1. QUESTIONS AND COMMENTS RELATED TO GREEN SOLUTIONS, BMPS, LIDS, ETC.

a. **DEC must hold the city accountable, including through enforceable interim milestones, for proposing a comprehensive "source control" component in its CSO plans, including the implementation of source control BMPs on both public and private property through a combination of direct spending, regulatory mandates, and incentives where there can be achieved cost-effective reductions in CSO discharges. DEP should provide a timeline for completing the necessary analyses based on information provided in the WWFP and the City's Sustainable Stormwater Management Plan (SSMP). The City is already engaged in a number of activities that should enable the City to propose a comprehensive green infrastructure component to all of its waterbody-specific LTCPs within the next three years or less. If such analyses are not complete by the time the waterbody-specific Bronx River LTCP is due, DEC must ensure that the Bronx River LTCP includes enforceable milestones for deliverables leading to the completion of the necessary analyses and the City's submission of proposed LTCP revisions that incorporate a comprehensive plan for implementing source control strategies.**

   DEC agrees. Additional source control BMP alternatives will be evaluated in the LTCP and the selected alternatives will have enforceable milestones under the CSO Order. The implementation timelines will be given in the approved LTCP.

b. **When will the BMP Design Manual be completed, what information will be included in the manual, and how can the public provide input? Guidance from DEC and DEP is needed to ensure the data collected from pilot projects already in the watershed will be useful in determining their future use. Because gathering and analyzing data from the DEP BMP pilot studies will take years to compete, data from other watersheds and cities with similar characteristics should provide a basis for planning and implementing green infrastructure in NYC in the interim.**

   DEC and DEP are currently working on a master LID/BMP monitoring plan that will be used by many entities that are currently conducting pilot stormwater management projects so that similar data sets will be collected and used for analyses of various technologies. The first phase of the BMP Design Guidelines will be crafted specifically to support of the anticipated *performance standard and drafted in consultation with experts in the field. Public outreach will include presenting the BMP Design Guidelines and the performance standard to the industry and stakeholders. The guidance document is anticipated to be living document that will evolve over time with input from the industry, as experience evolves. For additional information about the BMP Design Guidelines and BMP pilots, please see response to comment A3.*

c. **DEP should take the lead in developing a formal agreement with other City agencies to facilitate the implementation of the projects. Coordination should include mechanisms to expedite scoping, contracts, and permits, and the establishment of a clear division of labor for installation and maintenance, a monitoring protocol, and a timetable of milestones. DEP should facilitate stormwater capture wherever possible and should partner with other willing agencies to implement stormwater capture now. Through sustained inter-agency cooperation on this issue, NYC should identify locations or facilities for implementation of demonstration projects that can be monitored for effectiveness and assessed for potential use as a part of the strategy for mitigating pollution and reducing CSO discharges for the Long Term Control Plan.**

Please see response to comment A11 for information on how DEP has been working with other City agencies to implement BMP projects.

d. **LID and Green Designs should be written into the LTCP for the long term. Please clarify why the DEP maintains that they do not have enough information on new technologies. Available land and shelf-ready projects are on the attached list. (SEE LIST PROVIDED).**

Please see responses to comments A3 and A9.

e. **Where is the DEP report (referenced in footnote 4 on page 4 of BCEQ's 9/18/2009 letter to DEC) which states that this approach is not appropriate for the NYC? The footnote states that in 1999, DEP authorized a study by independent stormwater experts to evaluate the feasibility and potential application of runoff reducing techniques within NYC.**

The document is Copp, Roger S.; R. Claytor, E Strecker. "Assessment of the Feasibility of Infiltration to Reduce Combined Sewer Overflow Discharges from New York City." Prepared on behalf of HydroQual, Inc. and the New York City Department of Environmental Protection for the Citizens Advisory Committee for New York City Floatables Control Abatement Program, December 6, 1999.

See responses for comments A2 and A3 for current information about the City's stormwater management strategies, evaluations and various pilot projects to be implemented Citywide.

B2. QUESTIONS AND COMMENTS RELATED TO PUBLIC PARTICIPICATION, NOTIFICATION, AND EDUCATION

a. DEC must ensure that the City provides adequate opportunities for public participation in the development of the actual LTCP (as distinct from the WWFP), before DEP submits its draft to DEC as required by EPA's CSO Control Policy.

DEC and DEP are in the process of developing a public participation program for the LTCP process. It is anticipated that there will be multiple public meetings prior to a LTCP being approved by DEC. These meetings will be opportunities to review and discuss the LTCP process and for the public to offer input into the drafting of the LTCP.

b. Meetings integrating the public should take into consideration date, time & location. After waiting two years, calling a public meeting in the summer, outside the watershed itself was inappropriate. Stakeholder involvement seems to be of little interest to DEP.

Stakeholder involvement is very important to both DEP and DEC. DEC and DEP planned the Bronx River public meeting according to a schedule governing project eligibility for federal funding. More than 300 stakeholders were contacted about the meeting and a 30-day opportunity was provided for stakeholders to comment about the plan. Please see response to comment A26.

c. There should be opportunities for city-wide public participation regarding the development of source control alternatives. The East River and Open Waters CAC, or something similar, should be re-established as a venue for public involvement in the City's development of source control strategies for all of the LTCPs. DEP should work more closely with community organizations that are already installing green infrastructure projects. Also, DEP should partner with members of the public not averse to trying out green infrastructure on their own property to generate performance data on green infrastructure.

As noted in response to comment B2.a, DEP and DEC are developing a more robust public involvement process. DEP regularly communicates on green infrastructure with environmental organizations, community organizations and other stakeholders at meetings, workshops, task forces and other venues. DEP also partners and works with the Botanical Gardens, Cornell Cooperative, various universities, engineering *associations, educators, and with many other organizations to share information and provide resources about technology and green solutions.*

As discussed in response to comments A2, A3, and A19, DEC and DEP are using EBP funds to implement additional BMPs in the Bronx River watershed. With the EBP Fund, DEP has established a Request for Grant (RFG) program that will enable local stakeholder groups to submit proposals for effective stormwater management projects that meet the objectives of capturing and treating stormwater (e.g., reduction of stormwater entering sewer system) within the Gowanus Canal and Flushing Bay and Creek watersheds covered by the CSO EBP Work Plan.

d. An independent Science and Technical Advisory Committee (STAC) is recommended that integrates the City agencies and the environmental community. It should consist of experts on stormwater BMPs including those from other cities that have already implemented green infrastructure projects. The STAC would review and certify the monitoring protocol currently under development by DEP and review the data generated for both public and private projects. Their purpose would be to provide technical review, comments and, if necessary, a certification authority for monitoring data generated.

This suggestion may be considered by NYC government; however, it goes beyond the structure for approval of the Bronx River WWFP. The BMP Planning contract, which is described in more detail in the response to comment A3, subcontracts with many leading experts from organizations such as Low Impact Development Center, Biohabitats, and the Gaia Institute.

DEP participates in many multi-disciplinary venues, including workshops, task forces, and national forums of technical experts from urban municipal governments, the Clean Water America Alliance and National Association of Clean Water Agencies. These forums provide another opportunity for industry experts across several disciplines to get together and exchange ideas and continue to learn about new processes.

e. NYC will only be able to comply with the Clean Water Act by requiring that MULTIPLE agencies play an active role in finding ways to abate CSOs. This was promised in the Consent Decree documents.

The CSO Order was executed with the City of New York and the DEP. See response to comment A11.

f. DEC should ensure that the City improves its public notification program to comply with existing permit requirements and the EPA CSO Control Policy and impose a compliance schedule for the City to implement an effective public notification program. The WWFP should

provide an example of the new CSO signs and should include an enforceable deadline for installation. Although the new signs are a vast improvement over the current signage, they are insufficient to actually notify the public of the "location and occurrence" of CSO discharges.

NYC's implementation of an effective public notification program for CSO signage and other outreach mechanisms is underway. DEP believes that the new signs are a good step towards improving public notification relating to CSO events.

g. **While floatables controls are important, DEP should direct more resources into public education that will produce behavior change that will prevent the generation of floatables.**

Aggressive programs are being implemented by a multitude of agencies, including EPA, New York City Department of Health and Mental Hygiene (NYCDOHMH), DEC, Parks Dept, Dept of Sanitation, and DEP. Additionally, educational programs have been established by national environmental organizations and by associations such as the Advertising Council. It is often remarked that environmental awareness is best raised and behavioral changes best made when educators discuss how to improve the environment with their young students. DEP has seen the positive effect of these school programs on water conservation. DSNY has seen the positive effect of these school programs on recycling and litter prevention. In addition, not-for-profit environmental organizations such as NRDC and SOS (Save our Shores) have made good efforts to educate the public about floatables control, supplementing the efforts of government. We agree that the effectiveness of these programs and new opportunities for public education should be continuously evaluated.

B3. QUESTIONS AND COMMENTS RELATED TO SWIMMING

a. **The WWFP states that the Bronx River is not designated as a sensitive area because there are no primary contact recreation access points along the River. In fact, the absence of public access points does not deter the public from swimming in the River. Primary contact recreation in both the freshwater and tidal segments of the river has occurred for many years and cannot be ignored. This should provide an incentive for agencies involved in the WWFP to pursue vigorous efforts to make the river adequate for safe contact in the form of primary recreation.**

See responses to comments A1, A6 and B7.f.

b. **According to the WWFP, NYCDOHMH has posted "No Swimming" signs in areas where swimming is known to occur, however signs are not present in some areas where swimming occurs frequently. Signs alone without proper education of the risks involved and enforcement will not**

prevent primary recreational activity from occurring in the Bronx River.

Swimming is only a protected use at a "permitted" (by NYCDOHMH) location, with safety, water quality, facilities, and physical requirements met. Property owners, private or public, are liable for a summons if swimming occurs at a "non-permitted" place. See responses to comment A1, A6 and B7.f. It is well-known among Bronx River stakeholders that swimming takes place along the Bronx River. Several of the known swimming locations are parks. NYCDPR uses "Swimming Prohibited" signs and fences in some areas to prevent and discourage swimming. DPR is faced with a difficult decision because fencing along shorelines is not aesthetically pleasing, is expensive to install and maintain, and is ineffective in most cases. Improved education regarding this issue is a good point and it will be taken into consideration going forward.

B4. QUESTIONS AND COMMENTS RELATED TO CONTAINMENT BOOM

a. **DEP's containment boom at Westchester Avenue requires modification or removal to allow its current regulated use of secondary contact (i.e. boating) on the river. The existing boom is an impediment to boaters, is frequently damaged by commercial watercraft, creates an unsafe situation when boaters try to cross it, and is an eyesore. Modifications should be part of the LTCP for Bronx River. The public should be informed of the chosen plan to ensure that public access for a range of boat sizes is accommodated.**

   DEP has no plans to modify this boom until after the Bronx River Floatables Control Facilities come on line. However, in light of the expected reduction in floatables due to the construction of the floatables control facilities, it may be possible to modify or remove the existing floatables boom as requested by the community during the stakeholder process to allow passage by canoes and other recreational watercraft without portage. DEP will monitor floatables capture at this boom and will revisit modification or removal of the boom during LTCP development after the proposed floatables control facilities have been in service for a period of time.

b. **The floatables boom should only be an interim solution. It should be removed when floatables abatement has been achieved through other means.**

   The DEP will monitor floatables capture at this boom after the floatables control come online. See response to comment B4.a above.

B5. QUESTIONS AND COMMENTS RELATED TO WATER QUALITY STANDARDS

a. **The mandate of the Clean Water Act is "fishable swimmable" and this should be the goal for improving water quality. The Long Term Control Plan must aim to attain water quality standards for current designated and EXISTING USES in NYC water. For most waterbodies, this includes primary contact recreation (swimming) as well as fish survival and propagation.**

   As stated in responses to comments A1 and A6, the improvements necessary to achieve "swimmable" water quality (Class SB/SC) standards will be evaluated in the Bronx River CSO Long Term Control Plan.

b. **The WWFP should clarify that water quality standards can only be downgraded through a formal Use Attainability Analysis (UAA) process which will not be entertained until all CSO abatement projects are complete and post-construction monitoring has been evaluated. Until that time, the current water quality criteria are applicable. Water quality standards should not be revised prior to the completion of a TMDL.**

   The DEC agrees with these statements and does not intend to change any water quality standards without the WWFP recommended CSO projects having been completed with sufficient post-construction monitoring to determine the impact of these projects on the water quality and the development of a UAA which will involve full public participation. A TMDL may or may not be required depending on the outcome of the WWFP projects, the post-construction monitoring and the results of the LTCP for a given waterbody.

c. **The DEC should clarify that it does not endorse DEP's assertions in Section 9.2.3 of the WWFP that the City has demonstrated that it satisfies any of the requirements for a variance from water quality-based effluent limitations. That section purports to rely on a "Use Attainability Evaluation" report which does not exist, or at least has not been submitted to DEC with the WWFP. Some or all of the regulatory criteria cited by DEP do not actually appear to fit the circumstances of the Bronx River. EPA's regulations do not allow water quality standard revisions that eliminate a designated use that is an "existing use" which is defined as a use "actually attained" on or after 1975.**

   Section 9.2.3 has been rewritten. The City will need to submit a variance application with the LTCP that meets the requirements of Section 702.17 of the DEC's Water Quality Regulations prior to a variance being granted.

d. **DEC should remove the tidal portion of the Bronx River from Part 3(c) of the state's Section 303(d) List of Impaired Waters Requiring a TMDL**

and place it on Part 1 (Individual Waterbody Segments with Impairments Requiring TMDL Development). A TMDL is required to deal with the pollution loadings from Westchester County.

During the development of the LTCP, the City will be gathering the data necessary to develop waste load allocations (WLA) that may also be used to assist in the development of a TMDL, if deemed necessary. This data will be used to select appropriate alternatives for meeting the CWA goals of fishable/swimmable. A determination will be made as to whether a formal TMDL is required at that time. If the interjurisdictional issue cannot be resolved by the LTCP then the DEC will evaluate conducting a formal TMDL for the Bronx River.

e. **Since no one swims in water that is averaged over a month, the WWFP must analyze swimmability with respect to conditions at a given moment in time (as provided by "single sample maximum" enterococci criteria), rather than as a monthly geometric mean. Wherever compliance with the "infrequent use" criteria for enterococci is analyzed, compliance with the criteria for "lightly used" and "moderately used" waters should also be analyzed.**

No instantaneous criteria to protect swimmability currently exist. The Single Sample Maximum (SSM) criteria that was developed by EPA as part of the Beach Act promulgation is designed for beach closure notification purposes when insufficient data exists to calculate 30 day geometric means. The water quality models developed by the City allow for the calculation of 30 day geometric means that are the basis of the water quality standards promulgated by EPA based on the epidemiological analysis that were conducted at that time for the Beach Act of 2001.

f. **Even though six of the eight Bronx Watershed SPDES permit holders do not list the pollutants they produce, it does not imply that these pollutants do not exist, nor does it suggest that they have little impact. Metals and toxic pollutants should be considered 'pollutants of concern' because they find their way into the river via alternative routes (e.g.: illegal dumping) and pose a threat to organisms in and around the river. While each pollutant on its own may not represent a significant risk, the cumulative impact of these toxins should be considered with respect to their impact on overall water quality and their threats to public health.**

Six out of the eight SPDES permit holders are not located within New York City, and thus the City has no control over these industries. Furthermore, the typical pollutants of concern for CSO abatement are pathogens and DO according to current water quality standards. The New York City SPDES holders are not the types of industries that would typically produce oxygen consuming substances or pathogens.

B6. QUESTIONS AND COMMENTS RELATED TO COOPERATION WITH WESTCHESTER COUNTY

a. Post-compliance monitoring is needed for the work done in Westchester County to evaluate the current water quality conditions and resulting effects in the Bronx County portions of the river.

Agreed. See response to comment A10.

b. Increased cooperation is essential; a plan focusing solely on one section of the river is missing the potential for significant improvements in overall water quality. A formal mechanism is required to coordinate efforts between New York City and Westchester County for the entire watershed.

Agreed. The DEC is coordinating efforts for the two sections of the River with Westchester County, its municipalities, the NYS Attorney General's Office and the DEP. At this point in time, there are no plans for a formal agreement amongst the parties.

c. The Westchester [County] Plan should be written into the Long Term Control Plan for the long term. It is no longer appropriate to dismiss this.

Neither the DEC or the DEP is familiar with this plan. Inquiries to the questioning party have not been fruitful in obtaining the Plan.

d. A TMDL is required for the entire river to provide an enforceable performance standard and to identify waste load allocations in both the City and the County.

Waste load allocations in both the City and County will be determined during the development of the LTCP. The LTCP will be enforceable, originally under the CSO Order on Consent and following that, as a part of the SPDES permit for the Hunts Point WPCP. During the development of the LTCP, a determination will be made as to whether a formal TMDL is required.

B7. QUESTIONS AND COMMENTS RELATED TO ALTERNATIVES EVALUATION

a. Considering the substantial disparities between models presented by the DEP in 2004 and 2006, we do not believe that modeling alone is sufficient to prescribe water quality solutions in the Bronx River. Natural infiltration and stormwater BMPs should be used to lessen the volume of

water being diverted to the combined sewer system. It is suggested that an accounting of the impacts of these techniques be shown over a wide scale in the model.

DEP continues to update its models based on new data on imperviousness and other model inputs. While modeling will be done to understand the effectiveness of BMPs on a broad scale in NYC, modeling is just one component of a comprehensive effort to analyze BMP effectiveness and recommend BMP strategies for the City (see also response to comment A3). These strategies include BMP pilots that will be monitored to provide specific information on NYC climate and geologic conditions and ultimately identify the most promising BMP strategies for NYC. In addition, the BMP Guidelines currently under development will provide detailed information to ensure that the BMPs work effectively in the NYC environment.

b. **Since the DEP needs to prove a high likelihood of effectiveness for their *other* planned actions, we also suggest that they collect and analyze the necessary soil and land use data, and conduct some small-scale demonstration sites to test the efficacy of these techniques (see previous question). Implementation of demonstration sites is critical for proper analysis by DEP.**

DEP thoroughly evaluates the efficacy of all capital projects before implementation up to and including small-scale demonstration sites. As discussed in response to comment A3, NYCDEP is currently designing and constructing pilot BMPs to identify how soil characteristics among other considerations affect BMP performance. Further, as discussed in additional detail in responses to comments A2 and A19, a total of $850,000 will be used from the EBP Fund to construct various green infrastructure technologies at a specific two-block location within the Bronx River watershed. Funds for modeling associated with this work were obtained in September 2008 under a Long Island Sound Dissolved Oxygen Grant by Dr. Franco Montalto.

To aid in planning a BMP strategy, DEP is working with Columbia University's Lamont-Doherty Earth Observatory to develop satellite mapping of pervious surfaces in NYC. This analysis is largely based on latest pre-leaf-out Quickbird imagery. Mapping impervious surfaces with optical imagery is almost impossible due to a wide variety of colors, synthetic surfaces, and variability with NYC's urban fabric. However, mapping pervious surfaces to a degree of useful accuracy is feasible because vegetation and soils have distinctive spectral signatures. This data will be used to assess the impervious areas in NYC.

c. **The final WWFP should present modeled projections of CSO volumes and frequencies for the various alternatives under current conditions (present-day, dry weather flow from an average year), and not only the projected dry weather flow in 2045, so the reader can make a meaningful comparison of net improvements over time between today and 2045 in the WWFP.**

The hypothetical "Baseline" is established to compare alternatives to one another using conservative assumptions about future conditions. The Baseline condition represents a future typical year without implementing any further controls but with the added pressure of increased population. Each alternative in comparison results in a CSO reduction that can be attributed entirely to that alternative, and its implementation cost can be understood in terms of reduction value to CSO abatement.

d. **The 2004 Hunts Point Upgrade improvement should be part of the baseline as this is the current existing condition.**

A single baseline condition with the Hunts Point WPCP at 400 MGD will be adopted for the LTCP analyses.

e. **The final WWFP should analyze all alternatives with respect to their ability to achieve potential future water quality standards and enterococci criteria. Cost-benefit curves should be presented in terms of compliance with potential future water quality standards, not only compliance with existing standards (Figures 7-20 and 7-21). In WWFP Chapter 9, the ability of the selected alternative to comply with Class SB/SC standards and with EPA's enterococci criteria is analyzed. The same analysis should be presented for other alternatives, by way of cost-benefit curves, for purpose of comparing the cost-effectiveness of the alternatives at achieving these standards.**

The goal of the WWFP is to comply with current water quality standards. Alternatives will be analyzed with respect to their ability to attain potential future water quality standards for the LTCP analysis.

f. **All viable alternatives should be analyzed for their ability to *actually achieve "swimmable" water quality*, such that it would actually be safe to swim, not simply to achieve the water quality standard for primary contact under DEC's existing regulations.**

The LTCP will assess the ability of the Bronx River to meet the Clean Water Act goal of fishable/swimmable water quality. Assessing whether or not is it "safe" to swim in waters that meet appropriate water quality standards are determined by the NYCDOHMH. Many other criteria, in addition to water quality, must be taken into consideration. See responses to comments A1 and A6.

B8. QUESTIONS AND COMMENTS RELATED TO CORRECTIONS, CLARIFICATIONS OR REVISIONS NEEDED

a. **The waterbody plan is dense & not written for a general audience. Make it available in chapter format which is easier to download & comprehend.**

See response to comment A8.

b. **Table 8-3 of the WWFP is incorrect and should be fixed. The errors are apparent when comparing it with the text on pp 7-34 and 7-35 and with Table 3-8.**

Table 8-3 has been corrected in the revised December 2009 WWFP so that the modeled discharges correspond with the appropriate outfalls.

c. **The frequency of discharges at individual CSO outfalls, not only the volume, should be provided for each alternative (Table 8-3), as is done for the baseline condition (Table 3-8).**

A CSO event is defined by the discharge of CSO into a waterbody from any one of its outfalls. For each alternative, the expected number of overflows in a typical year is given in Figure 7-19.

d. **The WWFP should explain why the baseline CSO volumes and frequency for several of the outfalls changed from the June 2007 draft (Table 3-7) to the July 2009 draft (Table 3-8) of the WWFP.**

The landside models of the DEP sewershed/watershed, including the Hunts Point Model, are evolving tools that are being updated and evaluated on a continuing basis. The latest Hunts Point Model output available at the time of the Bronx River analyses was used. Comparison with older model output is not useful unless there is a significant change or an unexpected model response. The difference in Baseline annual volumes (947 MG vs. 1,006 MG) is typical of ongoing model development and is likely the result of updates and "modeling noise". Further, neither volume cited was intended to represent current or existing conditions, as noted in response to comment B7.c above.

e. **The WWFP should explain why the selected alternative results in a higher volume of CSOs at outfall HP-009 (Table 8-4) than the selected alternative in the June 2007 draft of the WWFP (p. 7-35).**

As noted in the above response, the Hunts Point Landside Model is continually being updated and refined. The July 2009 and December 2009 *reports used the latest Hunts Point Model outputs available at the time of analysis.*

f. **The WWFP should clearly explain, for each of the alternatives, what volume of CSO "captured" will only receive primary treatment. See WWFP at page 7-34 (discussing secondary bypass of volumes beyond 1.3xDDWF at the Hunts Point WPCP).**

DEP's Hunts Point WPCP SPDES permit requires that flows in excess of 1.3XDDWF (secondary treatment capacity) must receive primary treatment and chlorination. With respect to floatables and pathogens, there is virtually no difference in the effluent discharges under primary or secondary treatment as 100% of the influent flow will go through bar screening to remove floatables and 100% of the influent flow will get chlorinated prior to discharge.

g. **Section 8.1.6 of the WWFP should be revised to reflect that BMPs that use evapotranspiration and rainwater harvesting to reduce runoff to the combined sewer system are also essential source control strategies.**

The statement in Section 8.1.6, "NYCDEP will implement LIDs/BMPs that cost-effectively increase soil infiltration and detain stormwater flows" is a general statement and not intended to focus on particular BMPs. We agree that evapotranspiration and rain water harvesting are important runoff reduction strategies that DEP is currently analyzing.

Over the two past summers, DEP distributed 1,000 rain barrels to New York City residents targeting the Jamaica Bay watershed to encourage use of captured stormwater for irrigating lawns and gardens.

h. **Section 8.1.5 of the WWFP should be clarified to explain what is meant by the statement: detailed watershed planning is expected to be conducted within the Bronx River watershed, focusing on those technologies that prove to be most effective at reducing stormwater flow into the combined sewer system" including a schedule on which such planning will be conducted.**

As described in response to comment B7.a, the BMP Planning contract will provide a comprehensive evaluation of BMP technologies including monitoring and modeling to recommend a BMP strategy for the city. The schedule is currently under development.

i. **Section 5.9.6 of the WWFP should be revised to explain the new timetable for adopting this code revision (proposed new on-site detention requirement discussed in the SSMP) and, if it has not been adopted by the time a waterbody-specific LTCP for the Bronx River is submitted,**

DEC should require that the LTCP include a binding schedule for adopting such a regulation.

As discussed in response to comment A3, DEP is considering a potential performance standard for new development. DEP is currently proceeding with the environmental review to analyze the costs and benefits of the new rule and associated issues, such as City resources to review and enforce such a rule. The rule is expected to be promulgated in 2010; if promulgated, the LTCP will include a discussion of its anticipated impacts in the Bronx River watershed.

j. **Section 5.9.6 – The WWFP should be supplemented to explain specifically:**
   i. **the other specific "opportunities for revisions" to city codes that have been "identified" by the BMP Code Review Task Force**
   ii. **the steps being taken to pursue such revisions**
   iii. **the schedule on which such revisions will be made**
   iv. **The WWFP should also include estimates of the stormwater volumes that may be kept out of the combined sewer system as a result of each potential code revision.**

NYC Code revisions are not a part of the CSO WWFP or LTCP process. See response for comment A3.

k. **Real page numbers should be on the WWFP report, not just section and page.**

DEP and DEC concur and page numbers will be added.

l. **Table 6-1 Bronx River Waterbody/Watershed Stakeholder Team Participants should be edited as follows:**

   i. **Citizens Groups: Delete Bronx CBs; Add Bronx Council for Environmental Quality, North Bronx Bissel Gardens, Youth Ministries for Peace and Justice, and The Point CDC**
   ii. **Federal Government: Add Waterways and Trailways and Congressman Jose Serrano**
   iii. **Interest Groups: Add New York Academy of Sciences and New York Botanical Garden; Delete Youth Ministries for Peace and Justice and The Point CDC**
   iv. **Local/Multi Jurisdictional Government Agencies: Add CBs from above and Bronx River Alliance; Replace Soil and Water Conservation with New York City Soil and Water Conservation District; Delete The Bronx Council for Environmental Quality, North Bronx Bissel Gardens, New York Academy of Sciences, New York Botanical Garden**

DEP and DEC will make these changes, although "Waterways and Trailways" will reflect federal agency identifications of EPA, US Army Corps of Engineers and of Department of the Interior National Park Service.

B9. MISCELLANEOUS QUESTIONS AND COMMENTS

a. **Why did the cost of the floatables control facilities increase from $14.456 million in 2007 to $39.1 million in 2009 to $26 million as announced at the public meeting? The LTCP should clearly list and describe the components of the costs for floatables control.**

DEP received bids for construction of the floatables facilities in February 2009 and the winning bid was $26.47 million. Prior to that time, the cost for the floatables control facilities was represented as a probable total project cost from concept through construction and included estimates of design and other professional services, construction management, contingencies for unforeseen conditions, and many other costs outside the construction contract.

b. **Why is the cost of the Hunts Point WPCP upgrades ($26 M) so high? Does this cost include a portion of the estimated cost for the floatables control facilities? Provide a breakdown of costs for the plant upgrade.**

The $26M covered the cost of the Hunts Point WPCP headwork improvements and did not include any portion of the estimated cost for the floatable control facilities. The headworks improvements consisted of six new influent pumps each rated at 98.6 MGD, new headworks influent structures, new screens, and an influent throttling facility.

c. **This report is deficient. It is no wonder it was denied as a legitimate project for the American Recovery & Reinvestment Act.**

Public input will be considered and evaluated prior to the finalizing this draft Plan. The Plan is being developed consistently with other WWFPs using methodology approved by the EPA.

There was no denial of ARRA funding for infrastructure under this Plan; it was the decision of NYC to remove this item from the list of eligible projects that could receive funding under ARRA.

d. **CSO abatement funds should be re-directed to stormwater management projects that would provide long-term, cost effective and attractive solutions to the CSO problem.**

While DEP is not in the position to cancel budgeted or in-process CSO construction projects or re-direct funds away from CSO controls currently under Consent Order, DEP is open to direct future funding to stormwater management projects that may reduce CSO. As described in the responses to comments A2, A3 and A9, DEP is actively analyzing BMP/LID implementation with capital funding in a $15 million contract along with EBP funds. Since the Bronx River watershed is dense and heavily urbanized, the LTCP will most likely contain a mixture of green and grey infrastructure to address stormwater runoff and CSO abatement.

e. It is disturbing to imagine that the only freshwater river in New York City, a unique natural resource for 8 million people, is not considered "sensitive."

See responses to comments A1 and A6.

ATTACHMENT: Available Land for LID and Shelf-Ready LID Project Provided by BCEQ

Bronx Storm Water Management Projects

Type	Size	Location	Borough	CSO shed	Affiliated Organization	Contact Person	Notes
Full retrofit assessment/implementation (Greenroofs, swales, rain gardens, etc.)		Bronx River Houses, 173rd and Stratford Ave.	Bronx	HP-009	NYCHA		
Infiltration raingarden, porous pavement		211th Street Entrance to Shoelace Park (including part of road bed that will become parkland)	Bronx	HP-007	NYC DPR, NYC DOT		
Greenstreet	2500 square fe	Parking area at Bronx Park East and Bronxdale	Bronx	HP-007	Bronx River Alliance, NYC Parks	Teresa Crimmens, 718-430-4690	
Storm water tree pits		Streets within HP-009 sewershed	Bronx	HP-009	Bronx River Alliance, NYC Parks	Teresa Crimmens, 718-430-4691	
Curb cuts, BMP to manage road run off		Bx River Parkway, Northbound entrance ramp at Watson Ave. (green space on east side of parkway continuing north past Westchester Ave.)	Bronx	HP-009	NYS DOT, NYC Parks, Bronx River Alliance		
Infiltration swale, raingarden		Greenstreet median on Rosedale Ave. b/t Watson and Bruckner Blvd.	Bronx	HP-009	NYC DPR, NYC DOT		
Full retrofit assessment/implementation (Greenroofs, swales, rain gardens, etc.)		Bronxdale Housing Complex, 1700 - 1800 Watson Ave (East of Soundview Ave)	Bronx	HP-009			
Porous pavement*	500 sq. ft	Ranaqua Parking Lots	Bronx	HP-007	Bronx River Alliance, NYC Parks	Teresa Crimmens, 718-430-4692	
Green roof, parking lot retrofit*	1 acre	Con Edison facility at Bruckner Boulevard and Manor Ave	Bronx	HP-010	Con Edison, Bronx River Alliance	Teresa Crimmens, 718-430-4693	
Full retrofit assessment/implementation (Greenroofs, swales, rain gardens, curb cuts to green space, etc.)		Lafayette/Morrison Houses	Bronx	HP-080	NYCHA		
Green roof, parking lot retrofit*		ABC Carpet, Bruckner Blvd and Bronx Blvd.	Bronx	HP-080	ABC Carpet		
Parking lot retrofit (lots A and H)		Fordham University	Bronx	HP-004	Fordham University		
rainwater harvesting		2620 Briggs Ave	Bronx		Fordham Bedford Housing Corporation**, Bronx River Alliance	Pat Mangan (718.367.3200 x523), Teresa Crimmens	Children's park under construction. Park is 85% porous. It is an impervious surface turned pervious. We removed about 40 cubic yards of asphalt and concrete. Hope to do a gravity based rainwater harvesting system.
Green roof, street trees with storm chambers		2285 Davidson Ave	Bronx		Fordham Bedford Housing Corporation, Bronx River Alliance	Pat Mangan (718.367.3200 x523), Teresa Crimmens	New construction project nearly complete. Will install approximately 4000 square feet of green roofing. Have plans to add rainwater harvesting system which will draw water from underground cisterns and irrigate ground level planted space and green roof. 6000 square feet of open space is porous either through soil or porous safety surfacing.
Green roof, rainwater harvesting		2350 Webster Ave	Bronx		Fordham Bedford Housing Corporation, Bronx River Alliance	Pat Mangan (718.367.3200 x523), Teresa Crimmens	
green roof, rainwater harvesting system, storm chambers for street trees, porous surfacing and greywater reuse system		2668 Decatur Ave	Bronx		Fordham Bedford Housing Corporation, Bronx River Alliance	Pat Mangan (718.367.3200 x523), Teresa Crimmens	New construction project in development. Would like to install green roof, rainwater harvesting system, storm chambers for street trees, porous surfacing wherever possible and greywater reuse system that will capture greywater from showers and sinks and use it for flushing toilets.

*Project is idea that will still need approval from landowner and any other permits

**Fordham Bedford Housing Corporation is dedicated to building affordable housing in a sustainable manner. They have already installed one green roof, a rainwater harvesting system and 180 street trees. They are committed to do more if they find funding.

Comments Received from the Following:

Letter from Lawrence M. Levine, Staff Attorney, Natural Resources Defense Council, dated September 21, 2009

Letter from Jaime Stein, Robert Kriesberg, Dawn Henning, Larry Levine, Paul Mankiewicz, and Craig Michaels, Storm Water Infrastructure Matters (S.W.I.M.), dated September 18, 2009.

Letter from Joan Byron, Chair, Bronx River Alliance (BxRA), dated September 18, 2009.

Letter from Shino Tanikawa, District Manager, New York Soil and Water Conservation District, dated September 21, 2009

Letter from Dart Westphal and Karen Argenti, Co-Chairs, Water Committee, Bronx Council for Environmental Quality (BCEQ), dated September 18, 2009

Comments during the November 12, 2008 Public Meeting made by

Siddhartha Sanchez, Congress Member Serrano's Office
Wilhelm Ronda and Sam Goodman, Bronx Borough President's Office
Karen Argenti and Jorge Santiago, Bronx Council for Environmental Quality
Dawn Henning, Youth Ministries for Peace and Justice
Walt Matystik, Manhattan College
Kim DiGiovanni and Alisha Goldstein, Drexel University
Mitch Murdock and Marit Larson, NYC Parks and Recreation Department
Raissa Ange-Gaelle Dally, Robin Kriesberg and Damian Griffin, Bronx River Alliance
Bart Chezar, Gowanus Dredgers

From DEC
Susan McCormick
Arturo Garcia-Costas

From DEP
Mark Lanaghan
Debra Pucci
Keith Mahoney
Dorothy Chao
John McLaughlin
John Romano
Stacy Radine
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