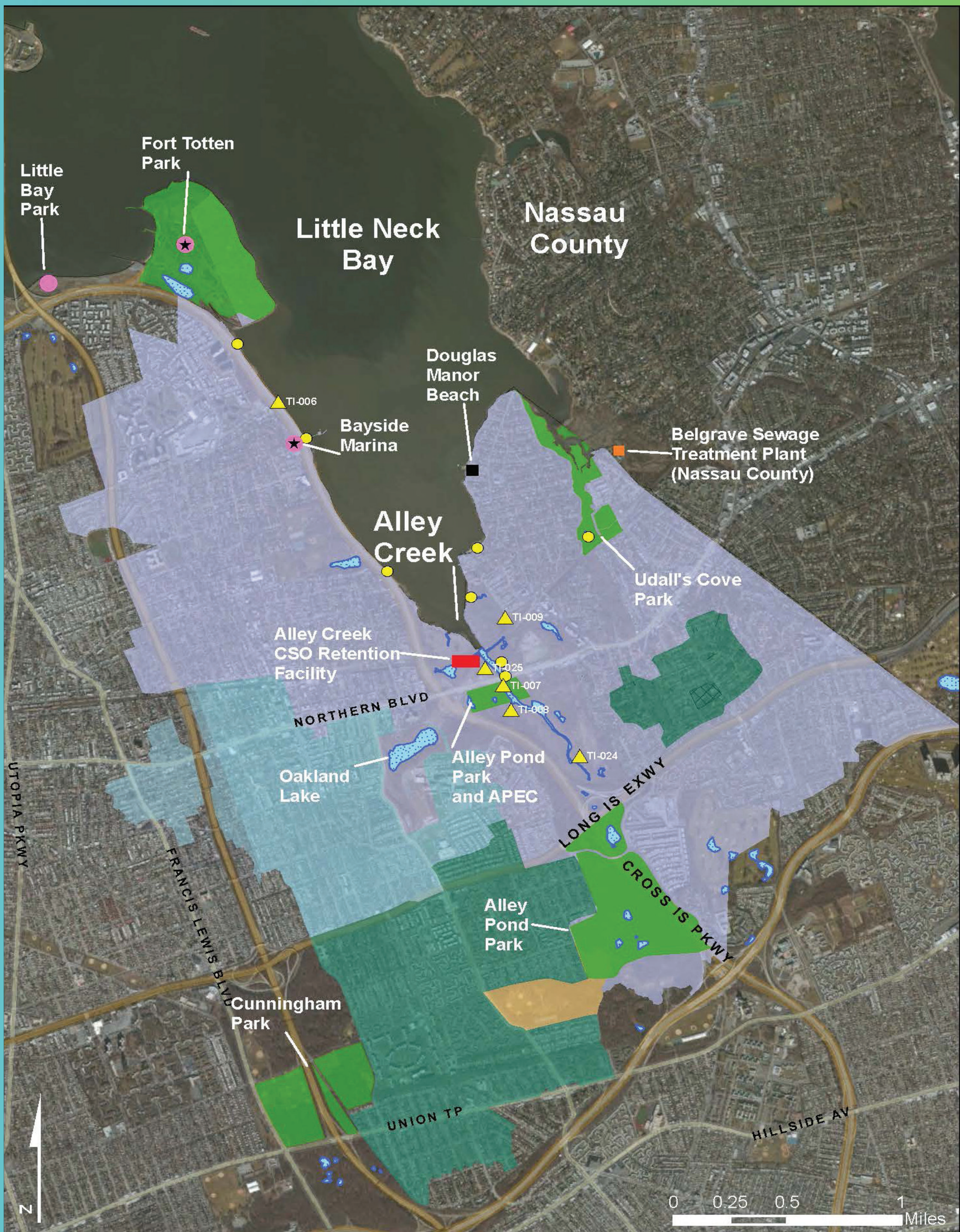
Environmental Protection

New York City Department of Environmental Protection

Capital Project No. WP-169
Long Term Control Plan II

Combined Sewer Overflow Long Term Control Plan for Alley Creek and Little Neck Bay



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The City of New York
Department of Environmental Protection
Bureau of Wastewater Treatment

Prepared by: AECOM USA, Inc.

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This Long Term Control Plan (LTCP) for Alley Creek and Little Neck Bay was prepared pursuant to the Combined Sewer Overflow (CSO) Order on Consent (DEC Case No. CO2-20110512-25) as modified, March 8, 2012 (2012 Order on Consent). Under the 2012 Order on Consent, the New York City Department of Environmental Protection (DEP) is required to prepare and submit 11 LTCPs to the New York State Department of Environmental Conservation (DEC) by December 2017. The Alley Creek LTCP is the first of those 11 LTCPs to be completed.

The goal of each LTCP, as described in the LTCP Goal Statement in the 2012 Order on Consent, is to identify, with public input, appropriate CSO controls necessary to achieve waterbody-specific water quality standards (WQS) consistent with the CSO Control Policy and water quality goals of the Federal Clean Water Act (CWA) and related guidance. Included in the 2012 Order on Consent Goal Statement is the following: *"Where existing water quality standards do not meet the Section 101(a)(2) goals of the Clean Water Act, or where the proposed alternative set forth in the LTCP will not achieve existing water quality standards or the Section 101(a)(2) goals, the LTCP will include a Use Attainability Analysis examining whether applicable waterbody classifications, criteria, or standards should be adjusted by the State."*

Regulatory Requirements

The waters of the City of New York are subject to Federal and New York State regulation. Particularly relevant to this LTCP is the U.S. Environmental Protection Agency (EPA) CSO Control Policy, which provides guidance on the development and implementation of LTCPs, and the setting of WQS for the waters of New York City (NYC). In New York State, CWA regulatory and permitting authority has been delegated to the DEC.

Under the BEACH Act of 2000, states with coastal recreation waters were to adopt new bacteria criteria for primary contact waters. For marine waters, like those in NYC, EPA proposed using enterococcus as the new indicator organism with a requirement that the geometric mean concentration of enterococci not exceed 35 col/100 ml. When this rule was promulgated, the EPA guidance document provided flexibility in the interpretation of the calculation of the geometric mean (GM). States were given the discretion by EPA to apply this new standard as either a seasonal GM, a monthly GM, or a rolling 30 day GM. Consistent with the DEC approved waterbody/watershed plans under the CSO Consent Order, DEP has revised the enterococci attainment calculations in the LTCP by applying a summer seasonal GM to calculate enterococci attainment. It should be noted that an earlier version of this LTCP, dated June 2013, had used a more stringent rolling 30-day GM. When using a summer seasonal GM, instead of a rolling 30-day GM, the short-term sources become less important and the constant sources become more important in terms of attainment of the standard.

DEC has adopted WQS for navigable waters, designating Little Neck Bay as a Class SB waterbody, which is defined as "suitable for fish, shellfish and wildlife propagation and survival." The best usages of Class SB waters are "primary and secondary contact recreation and fishing" (6 NYCRR 701.11). Class SB waterbodies include pathogen indicator standards that are currently in the NYSDEC WQS in addition to new pathogen indicator standards in the EPA 2004 BEACH Act Rule. DEC has designated Alley Creek as a Class I water body, defined as "suitable for fish, shellfish and wildlife propagation and survival". The best usages of Class I waters are "secondary contact recreation and fishing" (6 NYCRR 701.13).

The LTCP used the existing pathogen and DO criteria shown in Table ES-1 to evaluate the proposed alternatives. The LTCP also evaluates attainment based on potential future standards:

Table ES-1. Pathogen and DO Criteria

Class	Usage	Dissolved Oxygen (mg/L)	Fecal Coliform (MPN/100mL)	Enterococci (MPN/100mL)
SB	Primary and secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥4.8 ≥3.0	≤ 200(1)	≤ 35(2,3)
I	Secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥ 4.0	≤ 2,000(1)	N/A

(1) Both total and fecal coliform are based on a monthly GM that is supposed to consist of 5 samples or greater.
(2) The enterococci criterion was promulgated by the EPA 2004 BEACH Act Rule and attainment with this criterion is being assessed using a seasonal GM.
(3) For Douglaston Manner Association Beach, the DOHMH adopted a 30 day moving seasonal enterococci GM of 35 MPN/100 ml based on the 2004 BEACH Act.

LTCP Planning Approach

The LTCP planning approach includes several phases, including waterbody and watershed characterization, public participation, alternatives evaluation, phased and adaptive implementation strategies and post-construction monitoring. This LTCP builds upon DEP's prior efforts, most notably the June 2009 "Alley Creek and Little Neck Bay Waterbody/Watershed Facility Plan Report" (WWFP). Since the issuance of the WWFP, several important projects have been completed, including the 5-million gallon (MG) Alley Creek CSO Retention Tank, along with extensive improvements to the upstream combined and separate collections systems. DEP also implemented other collection system improvements to ensure that wet weather flows to the Tallman Island Wastewater Treatment Plant (WWTP) would be sustained at two times design dry weather flow (2xDDWF) during rain events. In addition, DEP completed a $20-million wetland restoration project for the 16-acre northern section of the Alley Pond Park.

The Alley Creek and Little Neck Bay LTCP planning process included extensive outreach to stakeholders. A public outreach participation plan was developed and implemented throughout the process.

Watershed Characteristics

The Alley Creek and Little Neck Bay watershed is comprised of approximately 4,879 acres along the north shore of eastern Queens County, adjacent to the Nassau County border. The land surrounding Alley Creek is mostly parkland, while the land surrounding Little Neck Bay is largely residential. Several parks are found within the watershed, the most notable of which is Alley Pond Park, which borders Alley Creek on its eastern, western, and southern shores. Current land uses for the watershed are shown in Figure ES-1.

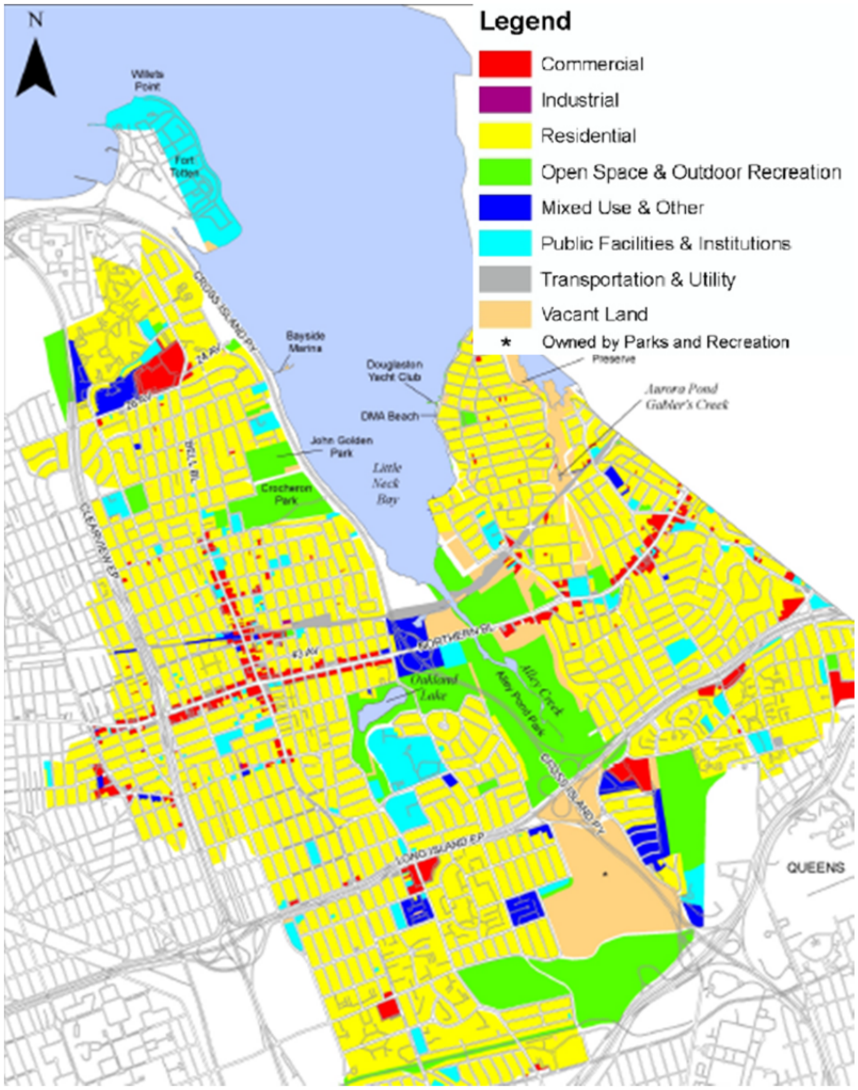


Figure ES-1. Alley Creek and Little Neck Bay Land Use

The Tallman Island WWTP, which has been providing full secondary treatment since 1978, has a design dry weather flow (DDWF) capacity of 80 million gallons per day (MGD), and is designed to receive a maximum wet weather flow of 160 MGD (2xDDWF), with 120 MGD (1.5xDDWF) receiving secondary treatment. Flows over 120 MGD receive primary treatment and disinfection. As shown on. Figure ES-2 the watershed, which is tributary to the Tallman Island WWTP, contains a complex wastewater system comprised of combined, separate, and storm sewers; interceptor sewers and pumping stations; several CSO and stormwater outfalls; and a CSO retention tank.

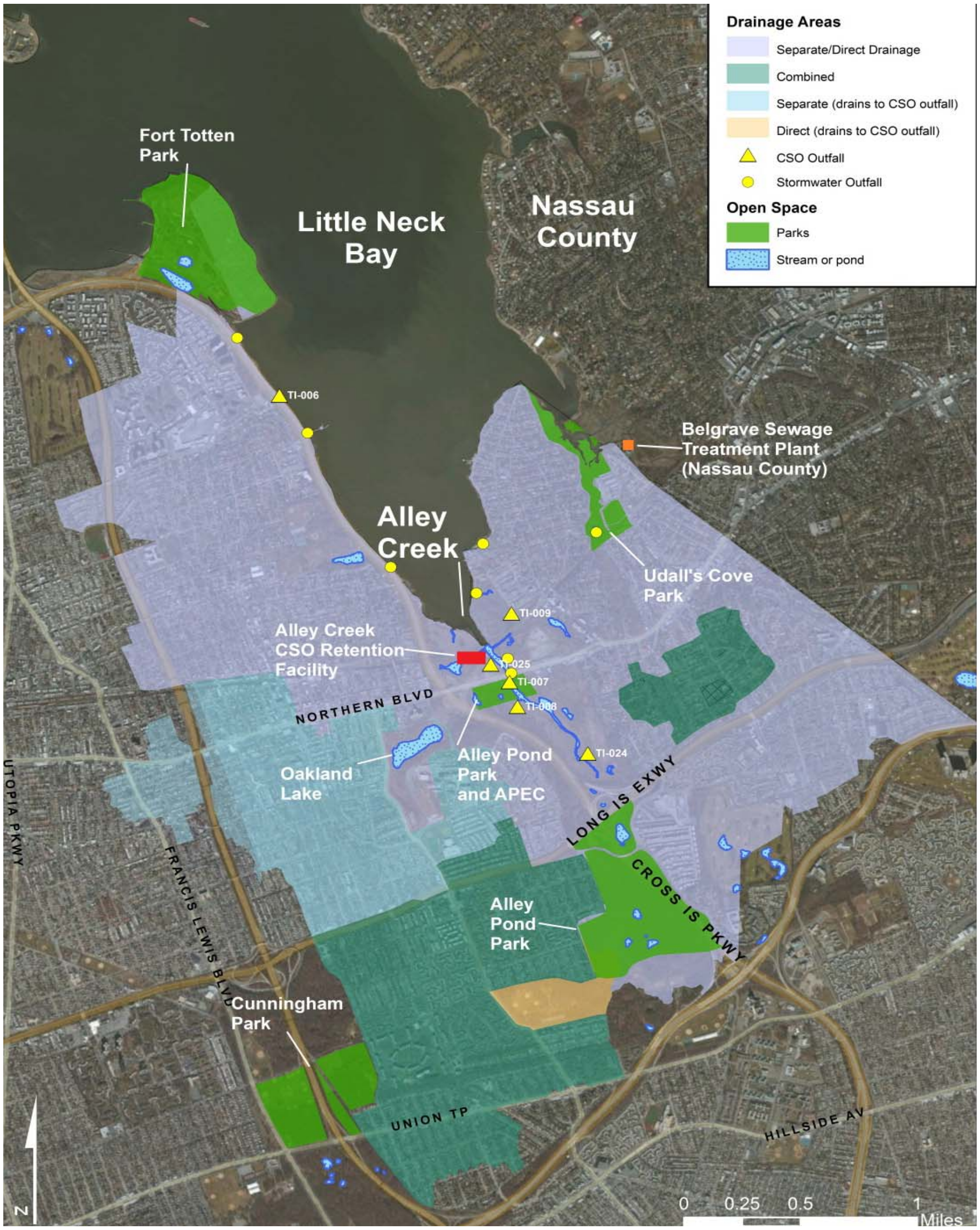
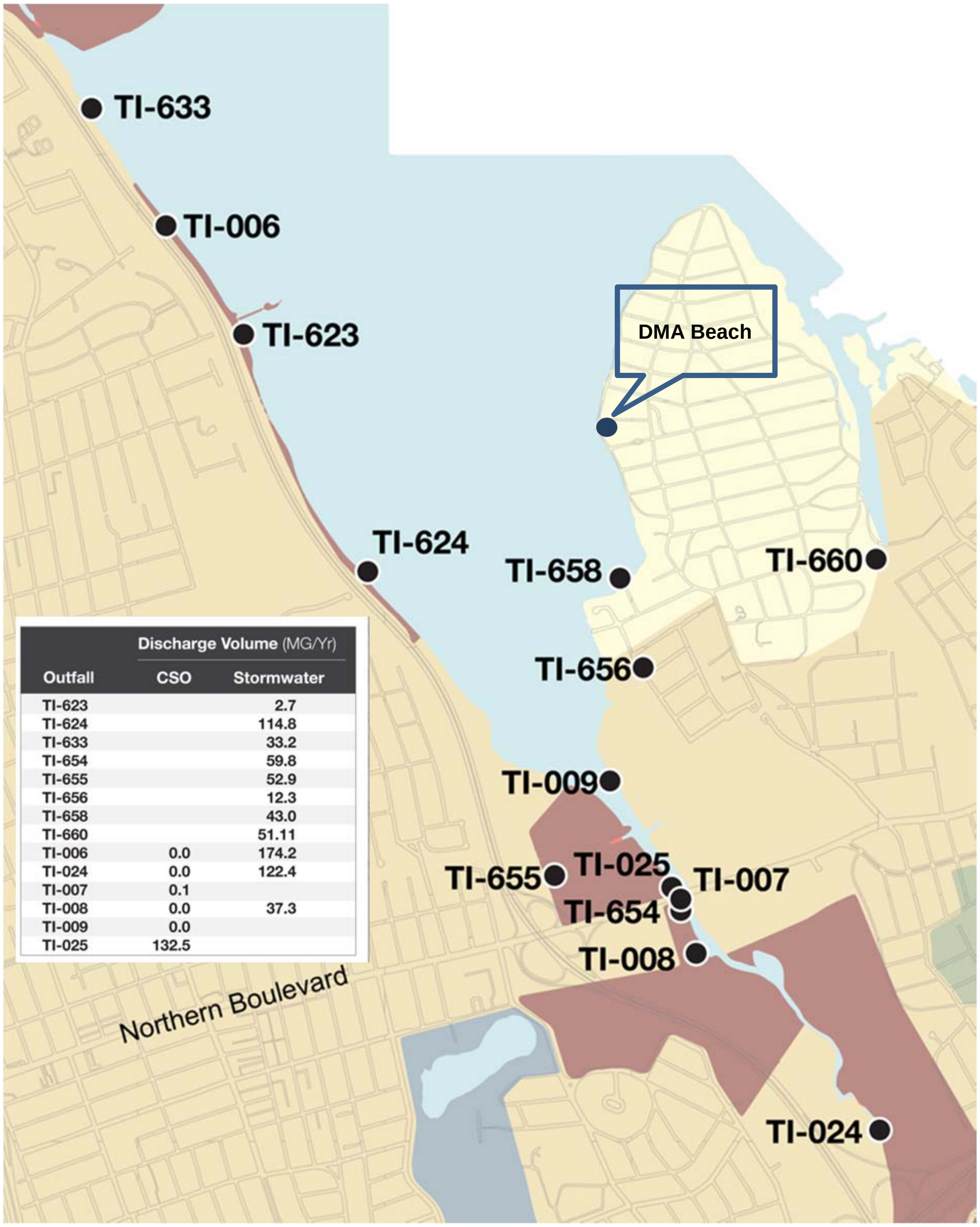


Figure ES-2. Watershed Characteristics

Several modifications have occurred within the collection system tributary to the Tallman Island WWTP since the InfoWorks (IW) model was calibrated in 2007. The IW model was subsequently revised accordingly. In addition to these model updates, DEP has made several other changes to the model as part of a citywide recalibration program, to reflect enhancements in runoff methodology, sediments, and other modeling inputs and parameters. These extensive efforts have resulted in more detailed and accurately calibrated watershed and water quality models that simulate the collection system and the receiving waterbody dynamics, for use in the Alley Creek and Little Neck Bay LTCP.

The Tallman Island SPDES-permitted CSO outfalls to Alley Creek, shown on Figure ES-3, include TI-007, TI-008, TI-009, TI-024 and TI-025; CSO outfall TI-006 discharges to Little Neck Bay. It should be noted that TI-025 is the outfall for the newly-constructed 5 MG Alley Creek CSO Retention Tank.



	Discharge Volume (MG/Yr)	
Outfall	CSO	Stormwater
TI-623		2.7
TI-624		114.8
TI-633		33.2
TI-654		59.8
TI-655		52.9
TI-656		12.3
TI-658		43.0
TI-660		51.11
TI-006	0.0	174.2
TI-024	0.0	122.4
TI-007	0.1	
TI-008	0.0	37.3
TI-009	0.0	
TI-025	132.5	

Figure ES-3. New York City Alley Creek and Little Neck Bay SPDES Permitted Outfalls

TI-008 and TI-025 also conveys and discharges a large portion of stormwater. In addition, outfalls TI-007, TI-006 and TI-024 serve as emergency bypasses for pump stations and are therefore designated as CSO outfalls. Under normal operating conditions, TI-006 and TI-024 discharge only stormwater; and TI-007 discharges CSO only during large precipitation events, typically less than once per year.

Also shown on Figure ES-3 are the nine permitted stormwater outfalls discharging to Alley Creek and Little Neck Bay: TI-623, TI-624, TI-633, TI-653, TI-654, TI-655, TI-656, TI-658 and TI-660. The figure displays the annual discharge volumes for the CSOs and stormwater outfalls for the baseline conditions defined later in this executive summary.

The area on the eastern shore of Little Neck Bay, known as Douglas Manor, is a private residential community. The neighborhood is predominantly composed of single-family residences served by on-site septic systems. Approximately 58 acres of drainage area generate runoff upstream of Shore Road, a waterfront roadway that follows the alignment of the eastern shore of Little Neck Bay. The Douglas Manor Association manages a permitted private community beach known as DMA Beach, along Shore Road. As seen in Figure ES-3, the DMA Beach is located approximately 0.7 miles north of the mouth of Alley Creek, and approximately one mile downstream from the principal CSO outfall on Alley Creek, TI-025.

Waterbody Characteristics

Alley Creek and Little Neck Bay have been classified by DEC as Class I and SB waterbodies, respectively. The WQS corresponding to these classifications are as shown in Figure ES-4. DEC uses dissolved oxygen (DO) as the numerical criterion to establish whether a waterbody supports aquatic life uses, while bacteria concentration is used to establish whether a waterbody supports recreational uses. In addition to numerical criteria, DEC has issued narrative criteria to protect aesthetics in all waters within its jurisdiction, regardless of classification.

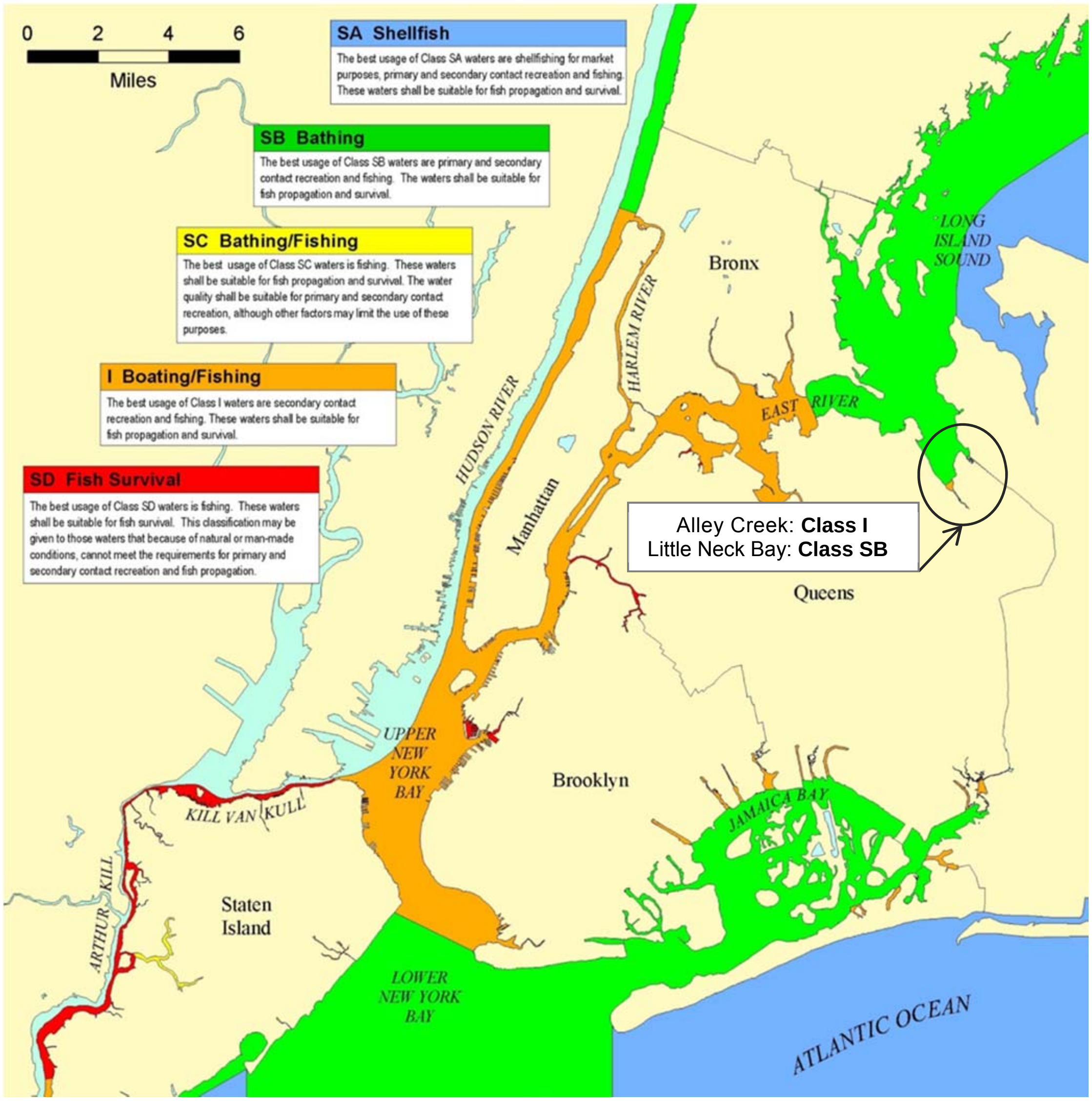


Figure ES-4. Surface Water Classifications and WQS

For designated bathing beach areas, the EPA 2004 BEACH Act Rule recommends a seasonal GM of 35 MPN/100 ml and also includes a single sample maximum enterococci value of 104 per 100 mL to be used by agencies for announcing bathing advisories or beach closings. The DMA Beach is permitted to operate by the NYC Department of Health and Mental Hygiene (DOHMH). DOHMH has adopted a seasonal 30 day GM of 35 enterococci per 100 mL that is used to trigger a beach closing. DOHMH also adopted the single sample maximum of 104 enterococci per 100 ml that is used to issue beach advisories. Although these are the existing DOHMH rules for bathing beaches, the operating criteria may change in the future as a result of recommendations provided in EPA's 2012 Recreational Water Quality Criteria (RWQC).

Alley Creek, its shoreline, areas immediately adjacent to the water, and much of the surrounding drainage area of the creek are within Alley Pond Park. Access to Alley Creek is provided by the park for passive, non-contact recreation, such as hiking trails, which offer views of the open waters and wetlands. Another significant passive use of Alley Creek is environmental education associated with wetlands habitat. The Alley Pond Environmental Center (APEC), located near the mouth of Alley Creek, offers an extensive naturalist program with outreach to local schools. As shown in Figure ES-5, the APEC is located southeast of the intersection between the Cross Island Parkway and Northern Boulevard, on the western shore of the creek.

Figure ES-5. Shoreline of Little Neck Bay and Alley Creek (Looking North)

The CSO Control Policy requires that the LTCP give the highest priority to controlling overflows to sensitive areas, which in the case of Little Neck Bay, is the DMA Beach. Accordingly, the LTCP devoted significant attention to this beach as part of the analysis of WQS attainment.

Analysis of WQS attainment in Alley Creek and Little Neck Bay was based on data collected from the DEP Harbor Survey between 2009 and 2012, and from sampling performed in late 2012 during the development of the Alley Creek and Little Neck Bay LTCP. The data indicate that pathogen concentrations within Alley Creek are elevated, with GMs for enterococci at approximately 500 MPN/100mL and fecal coliform bacteria near 2,000 MPN/100mL. These elevated pathogen values are attributable to illicit connections to the storm sewers that discharge out of TI-024. A portion of these illicit connections have been corrected and track-down efforts are still underway to ensure that all illicit connections are addressed.

Bacteria levels within Little Neck Bay are significantly lower, with GM concentrations of less than 10 MPN/100mL for enterococci and GMs between 10 and 100 MPN/100mL for fecal coliform bacteria during the sampling/survey period. Locally at DMA Beach, enterococci concentrations, as measured by the DOHMH, have a GM that is very close to the moving 30-day criterion of 35 MPN/100mL. Between 2009 and the end of 2012, the water quality at DMA Beach was in attainment with the seasonal rolling 30-day GM for enterococci, from a low of 5 percent of the time in 2011, to a high of 67 percent of the time in 2012.

As a result of the high concentrations of pathogens found in Alley Creek and at the DMA shoreline, additional targeted sampling was conducted as part of the Alley Creek and Little Neck Bay LTCP. This additional sampling was aimed at further evaluating the spatial extent of the area within the waterbodies that experience elevated pathogen concentrations. These sampling locations and a “synoptic” summary of results (i.e., conditions existing simultaneously over a broad area) are shown in Figure ES-6.

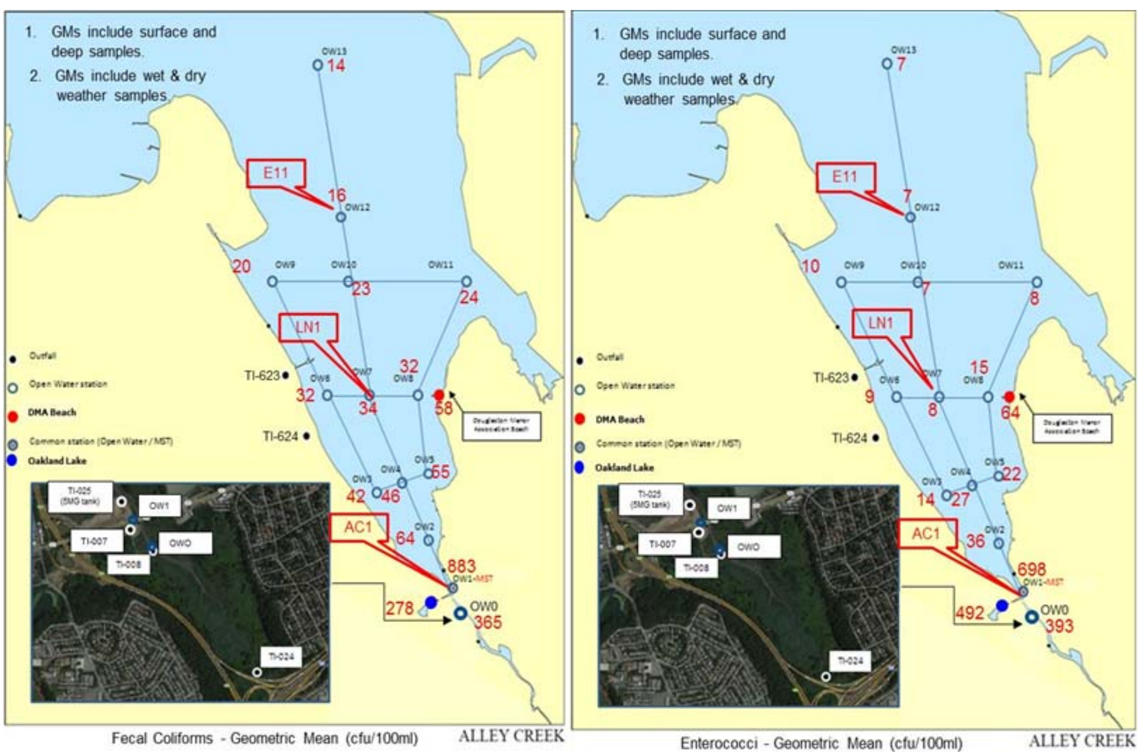


Figure ES-6. Synoptic Summary of LTCP Sampling Program

The results of this sampling program revealed the highest levels of bacteria concentrations in Alley Creek and in the transition zone area of inner Little Neck Bay. Localized contamination was also noted at the DMA Beach and in Alley Creek. As shown in Figure ES-6, the high concentrations drop significantly, moving from the mouth of Alley Creek to the open waters of the Bay this is also the case for the samples collected at DMA Beach.

As discussed above, the high bacteria concentrations in Alley Creek were associated with illicit discharges detected in TI-024 that essentially serves as a separate stormwater outfall. Those found in late 2012 were promptly corrected as outlined in a letter to DEC, dated November 7, 2012. This letter described the tracking and corrective actions taken as a result of this ongoing program. Follow-up investigations conducted in 2013, prompted by continued high bacteria levels, suggest that other illicit connections may still exist. Accordingly, DEP will continue to conduct water quality sampling and dye studies and work with relevant authorities to ensure that all illicit connections are tracked down and corrected. This is a high priority for DEP and continued sampling of the TI-024 outfall tributary area is included in Section 9 as one of the three follow-up water quality and pollution characterization investigations.

In addition to Alley Creek and lower Little Neck Bay, high pathogen concentrations were also found at the DMA beach. These are believed to be caused by highly localized source of contamination associated with septic systems in the drainage area. It should be noted that while these septic systems are not within DEP's jurisdiction, the matter has been brought to the attention of other agencies including the DEC, NYC Department of Buildings (DOB), and DOHMH.

Slightly elevated enterococci and fecal coliform values were also observed during dry weather conditions at the outlets of Oakland Lake and from a "Duck Pond", south of the Long Island Expressway. With regards to Oakland Lake, it is unclear if these elevated levels are from natural background conditions or if illicit connections are contributing to these slightly elevated pathogen values. With regards to the Duck Pond, high populations of waterfowl were observed in this dedicated Department of Transportation (DOT) stormwater impoundment. DEP intends to investigate and better characterize the pathogen loadings but does not anticipate that illicit connections are contributing to these slightly elevated pathogen levels in the Duck Pond or Oakland Lake. The sampling program associated with these efforts is also described in Section 9.

CSO Best Management Practices

In accordance with the SPDES permit requirements, annual reports summarizing the citywide implementation of the 14 Best Management Practices (BMPs) are required to be submitted to DEC annually on April 1st. To date, DEP has submitted annual reports covering calendar years 2003 through 2012. Typical reports are divided into 14 sections – one for each of the BMPs in the individual SPDES permits. Each section of the annual reports describes ongoing DEP programs, provides statistics for initiatives occurring during the preceding calendar year, and discusses overall environmental improvements.

Status of Grey Infrastructure Projects Recommended in the WWFP

The grey infrastructure elements of the 2009 WWFP included:

- New diversion chamber (Chamber 6) to direct CSO to the new Alley Creek CSO Retention Tank and to provide tank bypass to TI-008;
- New CSO Retention Tank (5 MG Alley Creek CSO Retention Tank);
- New 1,475 foot long multi-barrel outfall sewer extending to a new outfall on Alley Creek (TI-025);
- New CSO outfall, TI-025, for discharge from the Alley Creek Tank;
- Fixed baffle at TI-025 for floatables retention, minimizing release of floatables to Alley Creek; and
- Upgrade of Old Douglaston PS to empty tank and convey flow to Tallman Island WWTP after the end of the storm.

These WWFPs elements were all operational by mid-2011.

Post-Construction Monitoring

DEP conducted Post-construction Compliance Monitoring (PCM) for the Alley Creek CSO Retention Tank, consisting of sample collection at one location in Alley Creek (Station AC1) and another location in Little Neck Bay (Station LN1). In addition, DEP collected water quality samples at two other locations in the waterbody during November and December 2012, near the mouth of Alley Creek (Stations OW0 and OW1), and in Little Neck Bay near Station LN1 (Station OW2). Figure ES-6 showed these station locations. During the 25 events in 2012 when the tank did overflow, floatables removal at the tank was enhanced by means of an underflow baffle. Retained floatables are removed either at trash racks at the Old Douglaston PS or the influent screens at the Tallman Island WWTP. Overall, the facility performance has met or exceeded its predicted CSO volumetric control and the pollutant capture targets set forth in DEP's facility planning studies (1992).

Green Infrastructure

The Alley Creek and Little Neck Bay watershed has one of the smallest total combined sewer impervious areas among the list of New York City's managed watersheds, totaling 1,490 acres, which are significantly controlled by existing CSO facilities and sewer enhancements. Therefore, as part of this LTCP, DEP assumes no investment in green infrastructure (GI) implementation in the right-of-way or onsite public properties. This GI investment decision takes into account water quality with WWFP improvements in place, coupled with the potentially more effective allocation of GI resources in other priority watersheds in the City that can provide more water quality benefits for the same level of implementation. However, DEP does expect approximately 45 acres to be managed through onsite private GI implementation in the Alley Creek and Little Neck Bay watershed by 2030. This acreage would represent three percent of the total combined sewer impervious area in the watershed, and assumes new development or redevelopment, based on a detailed review of New York City Department of Buildings (DOB) building permit data from 2000 to 2011.

Baseline Conditions and Performance Gap

Key to development of the LTCP for Alley Creek and Little Neck Bay is the assessment of water quality within each waterbody. For this LTCP, water quality was assessed using the East River Tributary Model (ERTM), a water quality model that was created and calibrated during the development of the WWFP in 2007. The model was modified as part of the LTCP development to significantly increase the grid resolution in Little Neck Bay, and was recalibrated using DEP water quality monitoring data, DOHMH DMA Beach monitoring data, and the synoptic water quality sampling data collected in 2012 Model outputs for both fecal and enterococci bacteria as well as DO were compared with various monitored datasets during calibration in order to improve the accuracy and robustness of the models to adopt them for LTCP evaluations. The water quality model was then used to calculate ambient pathogen concentrations within the waterbodies for a set of baseline conditions. Baseline conditions were established in accordance with the guidance established by DEC to represent future conditions. These included the following assumptions: the design year was established as 2040; Tallman Island WWTP would receive peak flows at 2xDDWF; grey infrastructure would include those elements recommended in the 2009 WWFP; and waterbody-specific GI application rates would be based on the best available information. In the case of Alley Creek and Little Neck Bay, GI was assumed to have 3 percent coverage. In addition, the LTCP assumed future conditions with some amount of dry weather sources of bacteria in the upper portions of Alley Creek from Oakland Lake and the Duck Pond.

These water quality assessments were conducted using continuous water quality simulations – a one-year (2008 rainfall) simulation for bacteria and DO assessment to support alternatives evaluation, and a longer term, 10-year (2002 to 2011 rainfall) simulation for bacteria for attainment analysis for selected alternatives. The gaps between calculated baseline bacteria as well as DO were then compared to the applicable pathogen and DO criterion to quantify the level of non-attainment.

The results of the 10-year simulation, shown in Figure ES-7, indicate that the fecal coliform concentrations calculated for the baseline within Little Neck Bay would be in attainment with the existing monthly GM fecal coliform criteria a high percentage of the time (97 percent attainment or greater). The 10-year simulation also indicated that, for the baseline, Little Neck Bay (including DMA Beach) will be in 100 percent attainment with the 90-day summer recreation seasonal GM for enterococci. The DMA Beach area of the Bay was calculated to be in attainment with the DOHMH seasonal rolling 30-day GM for enterococci approximately 92 percent of the time. The projected DO attainment for Little Neck Bay is greater than 97 percent on an annual basis.

Alley Creek is essentially in full attainment with the existing DO and pathogen criteria for Class I. However, when Alley Creek was assessed against the Class SB standard for primary contact, it was projected to be able to be in attainment with the seasonal enterococci criteria only 30 percent of the time, for the 10 year period evaluated. Even with 100 percent control of all CSOs, through additional storage or disinfection of the existing tank effluent, the projected attainment with the seasonal enterococci criteria only increased to 40 percent of the time for the same 10 year period. Accordingly, DEP has prepared a Use Attainability Analysis (UAA) for Alley Creek, which is attached to this LTCP.

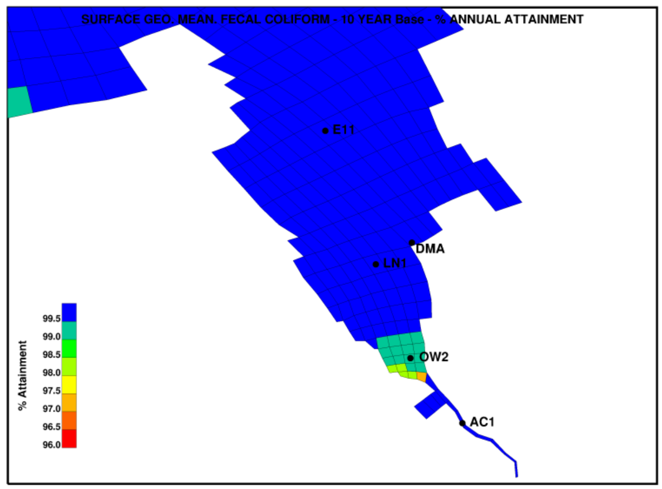


Figure ES-7. Fecal Coliform Annual Attainment

Public Outreach and Coordination

DEP followed a comprehensive public participation plan in ensuring engagement of interested stakeholders in the LTCP process. Stakeholders included both citywide and regional groups, a number of whom offered comments at public meetings held on the LTCP. DEP will continue to gather public feedback on waterbody uses, and will provide the public UAA-related information at the third Alley Creek and Little Neck Bay Public Meeting.

It should be noted that at the second of two public meetings conducted to date, there was a high degree of public support for DEP's findings that additional grey infrastructure based-CSO controls were not warranted, due to the water quality improvements achieved from implementation of the 2009 WWFP recommendations, as well as from the related additional enhancements to the area wetlands and habitat. This $130M in public investment was well-received, and no support was expressed for additional CSO controls or a higher standard for Alley Creek during public participation meetings.

Evaluation of Alternatives

This LTCP developed and evaluated various CSO control measures and watershed-wide alternatives using a three-step procedure:

Step 1: Screening of Potential Control Measures
Step 2: Development and Ranking of Control Measures
Step 3: Final Evaluation and Selection of Preferred Watershed-Wide Alternative

An overview of the three-step procedure is shown in Figure ES-8. Each alternative is evaluated considering several parameters, including: feasibility of construction and implementation; improvements to the waterbody in terms of water quality parameters and aesthetics; significant reductions in the number of CSO events and annual CSO volume; and construction costs. Overall, the methodology for ranking control measures transforms from being highly qualitative to more quantitative as the steps progress.

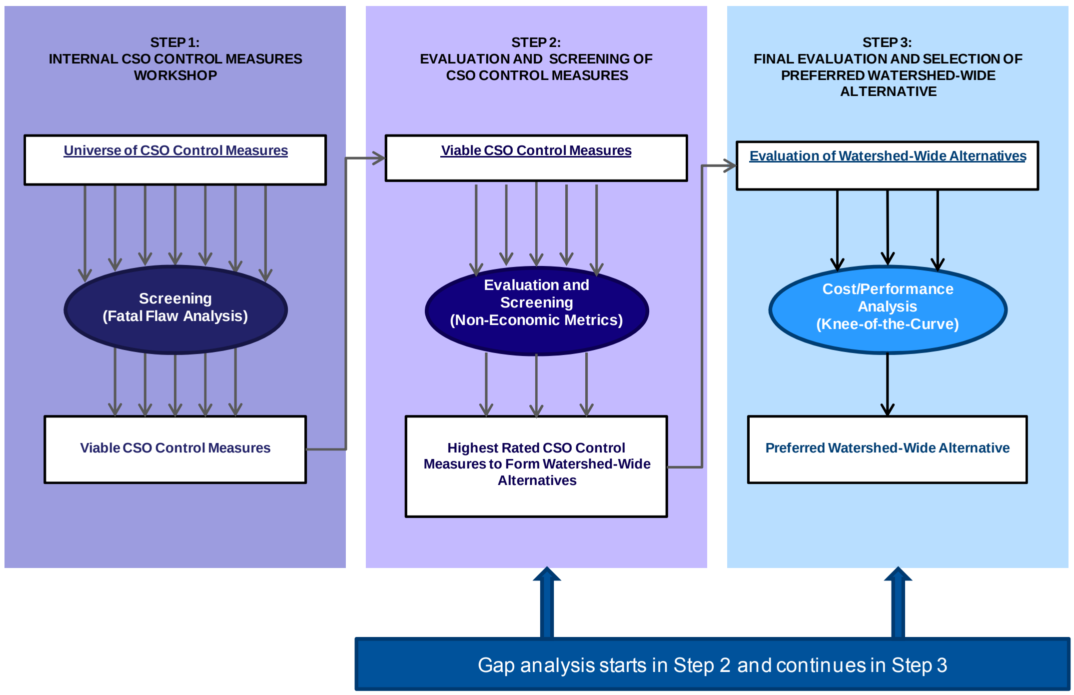


Figure ES-8. Three-Step LTCP Evaluation and Screening Alley Creek and Little Neck Bay Alternatives

Step 1 qualitatively judges the ability of control measures to meet the LTCP goals and identifies fatal flaws that could disqualify them. In Step 2, the resulting, most favorable control measures are then rated using non-economic criteria or metrics covering the following three categories:

- Environmental Benefits/Performance
- Community and Societal Impacts
- Implementation and O&M Considerations

The highest ranked control measures are then passed on to Step 3, where they are assembled to form watershed-wide alternatives, and are evaluated in greater detail using economic criteria and water quality attainment criteria, such as reductions of bacteria loading and CSO discharge volume and frequency. The cost and performance estimates are used to evaluate the cost performance and conduct knee-of-the-curve (KOTC) analysis.

Control measures that were evaluated through Step 3 are summarized in Table ES-1, along with associated volumetric and bacteria reductions and related costs.

Table ES-2. Alley Creek and Little Neck Bay Alternatives Summary

Alternative	CSO Volume (MGY)	AAOV Reduction[1] Percent	Fecal Coliform Reduction[2] Percent	Enterococci Reduction[2] Percent	May 2013 Present Worth ($M)[3]
Baseline Conditions	132	0	0	0	$0
1. HLSS (High Level Sewer Separation)	65	51	5.5	-5.4	$658
2A. 3.0 MG Additional Downstream Retention	98	25	12.5	10.5	$93
2B. 6.5 MG Additional Downstream Retention	65	50	25.1	21.1	$156
2C. 12 MG Additional Downstream Retention	33	75	37.8	31.8	$310
2D. 29.5 MG Additional Downstream Retention	0	100	50.1	42.2	$569
3A. 2.4 MG Additional Upstream Retention	98	25	19.2	15.0	$113
3B. 6.7 MG Additional Upstream Retention	65	50	36.2	28.5	$173
4. Disinfection in Existing Retention Tank	N/A	N/A	50.1	42.2	$550
5A. 10 percent Green Infrastructure	112	15	6.1	5.4	$63
6. Hybrid – HLSS plus 3.0 MG Retention	38	71	11.4	0.1	$751

[1] CSO Average Annual Overflow Volume (AAOV) reduction from baseline conditions.
[2] Includes both CSO and stormwater; reduction from baseline conditions.
[3] Based on Probable Bid Cost plus O&M cost for 20-year life, assuming 3 percent interest.

One high level sewer separation (HLSS) alternative was developed for the combined sewer system (CSS) that is tributary to Regulators 46 and 47. The CSS associated with these regulators is west of Alley Pond Park.

Retention alternatives reduce overflows by intercepting combined sewage in an offline or inline storage element during wet weather, for controlled release into the WWTP after the storm event. Two candidate locations for siting additional retention facilities were identified:

- Downstream, near the existing CSO Retention Tank (including both adjacent to the existing tank and to the south of Northern Boulevard); and
- Upstream of the existing tank, at the CSO regulators for the CSS area (within the interchange for the Long Island and Clearview Expressways).

Four retention alternatives near the downstream location were developed. Two alternatives were developed for the upstream location, both located within the interchange for the Long Island and Clearview Expressways, and designed to capture CSO flow from Regulators 46 and 47.

Because it is unlikely that HLSS alone would be capable of reducing CSO volume beyond 50 percent, a hybrid combination of HLSS with additional retention was developed. This hybrid HLSS-Retention alternative essentially combines HLSS for the areas upstream of Regulators 46 and 47 with a new retention tank located downstream at the Alley Creek Retention Tank site. It should also be noted that HLSS alone would increase the overall pollutant loading to the waterbodies (Alternative 1), since the flows and pollutant loads that were captured and sent to the WWTP for small to moderate storms would now be discharged directly into the waterbodies.

Initially, two alternatives that would employ additional GI beyond the baseline were identified, but one was subsequently determined to be infeasible due to siting difficulties. Only one GI alternative, sized for managing runoff from 10 percent of the impervious area within the combined sewer system within the Alley Creek and Little Neck Bay watershed, was carried through to the economic evaluation.

CSO Reductions and WQ Impact of Retained Alternatives

As presented in Table ES-1, the percent of CSO capture for the retained alternatives ranged from 0 (baseline) to 100 percent AAOV reduction (additional 29.5 MG downstream retention), with costs of up to $751M (additional 3.0 MG downstream retention with HLSS). With respect to the control of bacteria discharges, the best performing alternatives included 100 percent retention (Alternative 2D) and disinfection (Alternative 4), both of which would be implemented at TI-025, the CSO outfall for the existing Alley Creek Tank. These controls would reduce the overall fecal loading to the waterbodies by roughly 50 percent, and the enterococci loading by 42 percent, at a cost ranging from $550M to $569M, respectively. Because of the pollutants contained in stormwater, none of the CSO control alternatives could eliminate all of the bacteria discharged to Alley Creek and Little Neck Bay. HLSS (Alternative 1) was deemed the poorest performing alternative, yielding a net increase in enterococci. Although HLSS reduces CSO and its associated pollutants, they also significantly increase the volume of annual stormwater discharges; as a result, the increased pollutant loads associated with the increased stormwater would exceed the benefits from the reduced CSO.

Figures ES-9 and ES-10 show the present worth of the retained alternatives compared to annual total fecal coliform and enterococci loading reductions, respectively. The bacteria loadings are represented with two vertical axes. In both figures, the secondary vertical axis shows percent bacteria loading reductions at TI-025, and represents the reduction of enterococci from CSO sources. The primary vertical axis shows percent enterococci loading reduction based on all sources – CSO and stormwater. Because CSO is not the only source of bacteria, and some alternatives (notably HLSS) affect stormwater discharge volumes in addition to CSO volumes, attainment of standards cannot be evaluated based on bacteria discharged at TI-025 alone. The cost curve was based on selected alternatives determined to be the most cost-effective. The less cost-effective alternatives, shown in red, were excluded from the best-fit plot. The resulting plot does not show a clear knee-of-the-curve, but it does start to flatten as the bacteria reduction increases, indicating that, from this point on, increasing reductions would become even less cost-effective than the lower cost alternatives.

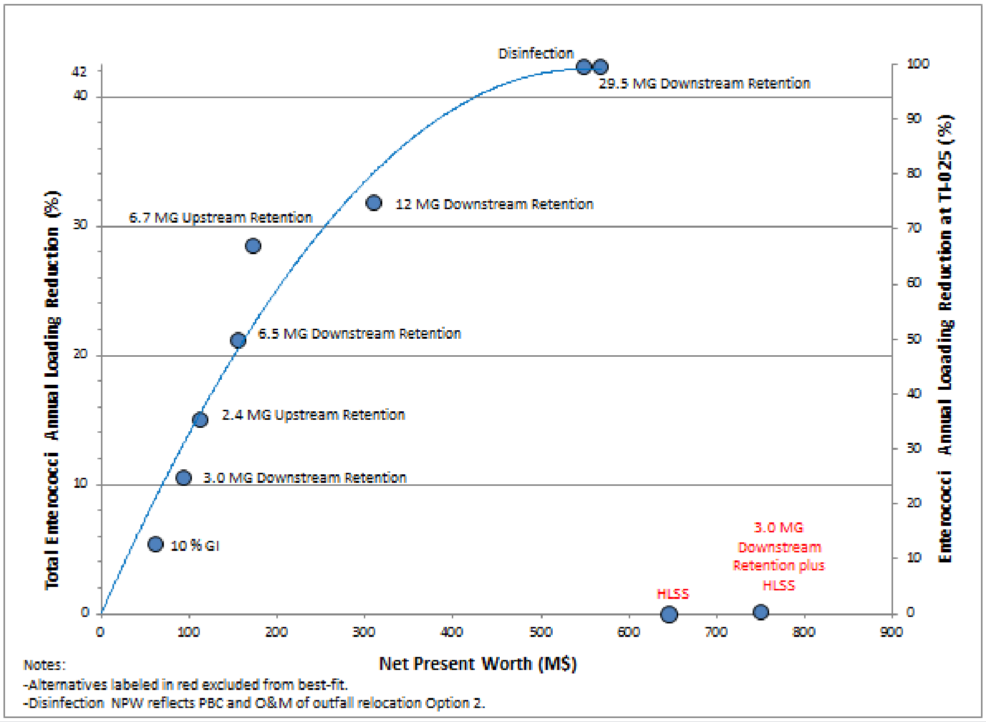


Figure ES-9. Cost vs. Total Enterococci Loading Reduction

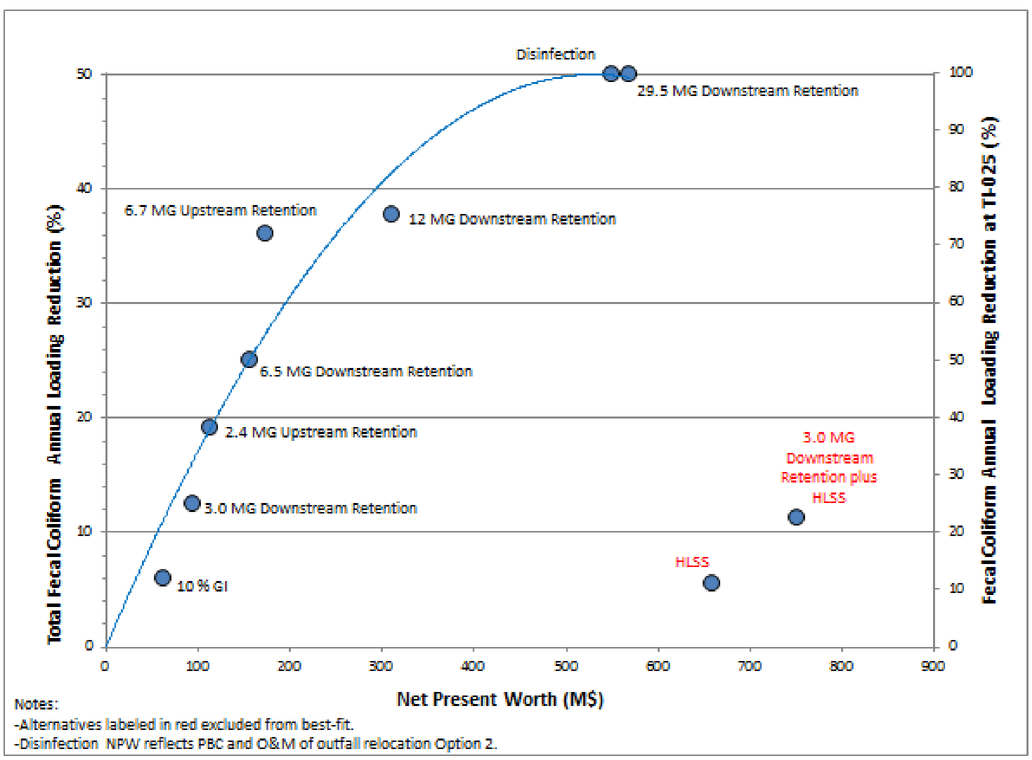


Figure ES-10. Cost vs. Total Fecal Coliform Loading Reduction

Plots showing WQS attainment assist in evaluating the performance of proposed alternatives. As demonstrated in Figure ES-11, attainment of existing applicable bacteria criteria, (i.e., Class I for Alley Creek and Class SB for Little Neck Bay) currently occurs essentially 100 percent of the time under baseline conditions. The figure includes predicted modeled improvement in bacteria criteria attainment versus net present worth at Stations E11, LN1, OW2 and AC1, and at DMA Beach, for each alternative. As previously noted, attainment of bacteria criteria for Little Neck Bay occurs essentially 100 percent of the time. At the southern end of the Bay, the bacteria criteria performance gap was very small, with attainment of fecal coliform criteria occurring 99.2 percent of the time at Station OW2 under baseline conditions. Predicted improvements at Station OW2 are marginal, rising just 0.8 percent for the 100 percent CSO control alternatives. At DMA Beach, baseline conditions are in attainment with Class SB standards and NYSDOH standards 100 percent of the time.

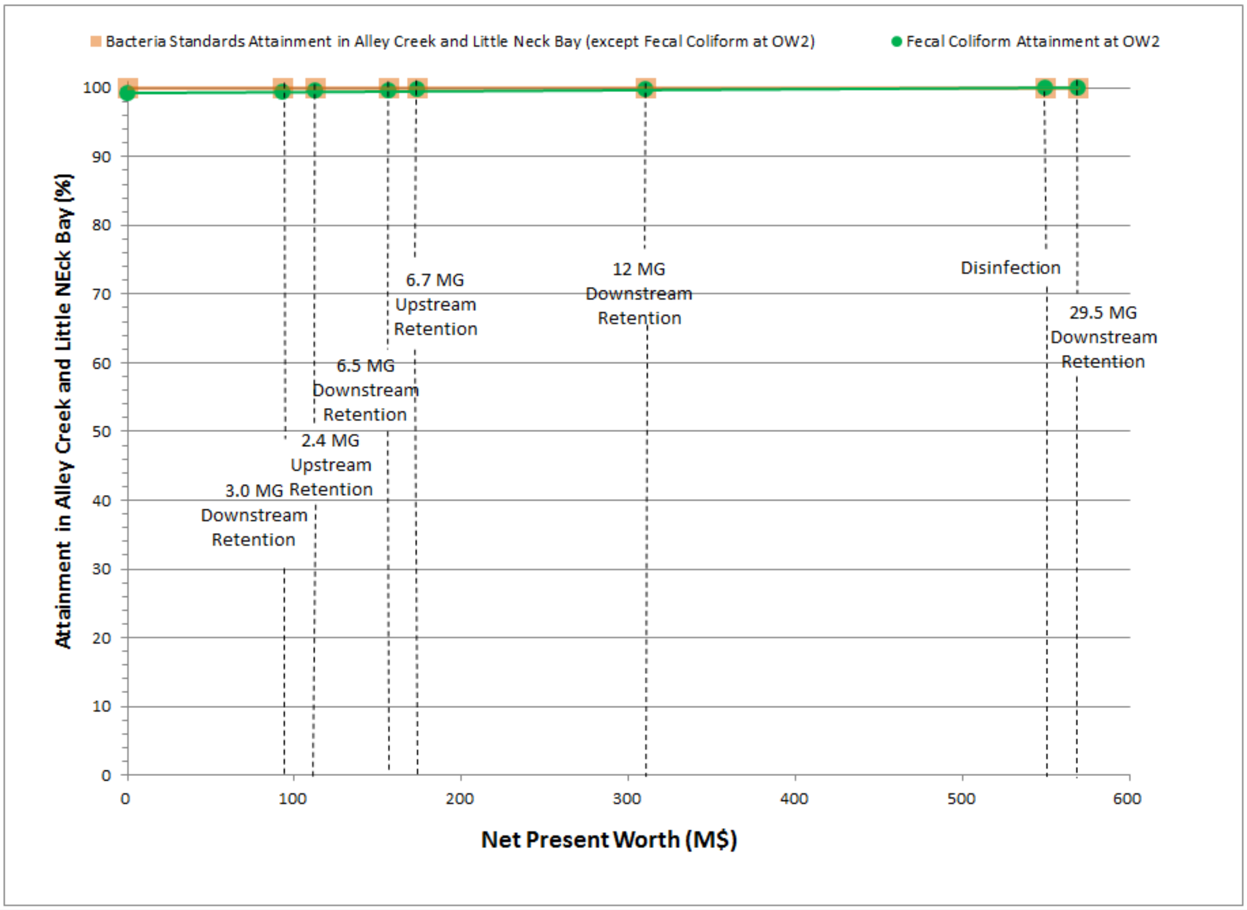


Figure ES-11. Alley Creek and Little Neck Bay WQS Attainment

Figure ES-11 also shows that capturing 100 percent of the CSO would result in only a 0.8 percent increase in an already high attainment, with all other alternatives having a lesser degree of improvement. Overall, results show that capturing additional volumes of CSO, regardless of the degree of capture, does not significantly improve attainment with the numerical criteria. These marginal improvements come at a significant cost – up to $569M for the 29.5 MG Downstream Retention alternative, because the remaining residual non-attainment of bacteria criteria is caused by other, non-CSO sources of pollutants. A similar extremely high cost is associated with the other 100 percent control alternative, Disinfection in the Existing CSO Retention Tank at $550M, also for marginal gain.

Throughout the LTCP process, it was understood that alternatives offering 100 percent CSO control, either through volumetric retention or 3- to 4-log bacteria loading reduction, could result in some negative environmental impacts. One such possible negative aspect of further CSO control is associated with

Alternative 4, Disinfection, and the damage it would cause to the sensitive biota of the two waterbodies and tidal wetlands where DEP has recently restored 16 acres. Means to mitigate such damage, the construction of an effluent pumping station and force mains, made that alternative costly to implement and detrimental to the restored area adjacent to Alley Creek through its construction.

Furthermore, the public expressed their satisfaction with the current uses of Alley Creek and Little Neck Bay, made possible by DEP's $130M investments in grey infrastructure and related wetland restoration work. As such, the public was not in favor of additional construction in the watershed that could impact the restored area.

Long Term CSO Control Plan Implementation

Based on the outcome of the facility planning and water quality improvement evaluations completed as part of the LTCP, and the progress made from implementing the recommendations of the 2009 WWFP and earlier DEP facility plans, DEP does not recommend the implementation of new grey infrastructure to further address the CSO discharges in the watershed. As demonstrated throughout the LTCP, the remaining minor gaps in attaining WQS remaining are primarily due to non-CSO sources.

DEP will continue to investigate the localized, non-CSO sources of pollution in the upper Alley Creek watershed, including the direct drainage from Oakland Lake and other similar tributaries. While it is currently understood that waterfowl contribute a significant portion of these pollutant loadings, this will be quantified to the extent practical. A work plan for such investigations is being developed by DEP, complementing ongoing data collection programs such as the PCM, the Harbor Survey Monitoring (HSM) and Sentinel Monitoring (SM) programs, and enhancing the source characterization and supporting potential variations of designated uses in the future.

Use Attainability

The Alley Creek and Little Neck Bay LTCP was developed to comply with the requirements of the EPA CSO Control Policy and, including applicable related guidance documents, as well as the broader CWA goal that the waterbodies shall support fishable and swimmable water quality, where attainable. The LTCP reveals that Alley Creek currently meets the Class I bacteria criteria, but cannot support the next highest Class SB standard, even with 100 percent CSO control. It also shows, however, that Alley Creek is not suitable for contact recreation, due to several natural and manmade factors. As such, a UAA has been prepared and is attached to the LTCP as Appendix D as a means to formalize the suitability of continued Class I designation for Alley Creek. DEP is seeking a SPDES variance from the anticipated Water Quality Based Effluent Limitation (WQBEL) for the Alley Creek CSO Facility, and an application is attached as Appendix E of this report per DEC requirements.

SECTION 1.0
INTRODUCTION

1.0 INTRODUCTION

This Long-Term Control Plan (LTCP) for Alley Creek and Little Neck Bay was prepared pursuant to the Combined Sewer Overflow (CSO) Order on Consent (DEC Case No. CO2-20110512-25), as modified March 8, 2012 (2012 Order on Consent). Under the 2012 Order on Consent, the New York City Department of Environmental Protection (DEP) is required to prepare and submit 11 LTCPs for submittal to the New York State Department of Environmental Conservation (DEC) by December 2017. The Alley Creek LTCP is the first of these 11 LTCPs to be completed.

1.1 Goal Statement

The following is the LTCP Introductory Goal Statement, which appears as Appendix C in the 2012 Order on Consent. It is generic in nature, so that waterbody-specific LTCPs will take into account, as appropriate, the fact that certain waterbodies or waterbody segments may be affected by the City's concentrated urban environment, human intervention, and current waterbody uses, among other factors. DEP will identify appropriate water quality outcomes based on site-specific evaluations in the drainage basin specific LTCP, consistent with the requirements of the CSO Control Policy and Clean Water Act (CWA).

> *"The New York City Department of Environmental Protection submits this Long Term Control Plan (LTCP) in furtherance of the water quality goals of the federal Clean Water Act and the State Environmental Conservation Law. We recognize the importance of working with our local, State, and Federal partners to improve water quality within all City-wide drainage basins and remain committed to this goal.*
>
> *After undertaking a robust public process, the enclosed LTCP contains water quality improvement projects, consisting of both grey and green infrastructure, which will build upon the implementation of the U.S. Environmental Protection Agency's (EPA) Nine Minimum Controls and the existing Waterbody/Watershed Facility Plan projects. As per EPA's CSO Control Policy, communities with combined sewer systems are expected to develop and implement LTCPs that provide for attainment of water quality standards and compliance with other Clean Water Act requirements. The goal of this LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with EPA's 1994 CSO Policy and subsequent guidance. Where existing water quality standards do not meet the Section 101(a)(2) goals of the Clean Water Act, or where the proposed alternative set forth in the LTCP will not achieve existing water quality standards or the Section 101(a)(2) goals, the LTCP will include a Use Attainability Analysis, examining whether applicable waterbody classifications, criteria, or standards should be adjusted by the State. The Use Attainability Analysis will assess the waterbody's highest attainable use, which the State will consider in adjusting water quality standards, classifications, or criteria and developing waterbody-specific criteria. Any alternative selected by a LTCP will be developed with public input to meet the goals listed above.*
>
> *On January 14, 2005, the NYC Department of Environmental Protection and the NYS Department of Environmental Conservation entered into a Memorandum of Understanding (MOU), which is a companion document to the 2005 CSO Order also executed by the parties and the City of New York. The MOU outlines a framework for coordinating CSO long-term planning with water quality standards reviews. We remain committed to this process outlined in the MOU, and understand that approval of this LTCP is contingent upon our State and Federal partners' satisfaction with the progress made in achieving water quality standards, reducing CSO impacts, and meeting our obligations under the CSO Orders on Consent."*

This Goal Statement has guided the development of Alley Creek and Little Neck Bay LTCP and UAA.

1.2 Regulatory Requirements (Federal, State, Local)

The waters of the City of New York are subject to Federal and New York State regulation. The following sections provide an overview of the regulatory issues relevant to long term CSO planning. Detailed discussions of regulatory requirements are provided in the June 2009 Alley Creek and Little Neck Bay WWFP (DEP, 2009).

1.2.a Federal Regulatory Requirements

The Clean Water Act (CWA) established the regulatory framework to control surface water pollution, and gave EPA the authority to implement pollution control programs. The CWA established the National Pollutant Discharge Elimination System (NPDES) permit program. NPDES regulates point sources discharging 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, the NPDES permit program is administered by the DEC, and is thus a State Pollution Discharge Elimination System (SPDES) program. New York City has had an approved SPDES program since 1975. Section 303(d) of the CWA and 40 CFR §130.7 (2001) require states to identify waterbodies that do not meet water quality standards and are not supporting their designated uses. These waters are placed on the Section 303(d) List of Water Quality Limited Segments (also known as the list of impaired waterbodies). The List identifies the pollutant or stressor causing impairment, and establishes a schedule for developing a control plan to address the impairment. Placement on this list can lead to the development of a Total Maximum Daily Load (TMDL) for each waterbody and associated pollutant/stressor on the list. Pollution controls based on the TMDL serve as the means to attain and maintain water quality standards for the impaired waterbody. Alley Creek was included in the 2010 list of impaired waterbodies for dissolved oxygen, and Little Neck Bay was included for pathogen impairments due to CSO discharges, storm discharges, and urban runoff. However, as shown in Table 1-1, these waterbodies, which are under the CSO Order, have been delisted from the 2012 303(d) list (updated February 2013) as a Category 4b waterbody for which required control measures other than a TMDL (i.e., consent order) are expected to restore uses. Furthermore, the Category 4a notation has been applied to Little Neck Bay, which indicates that the waterbody already has a TMDL (Long Island Sound TMDL).

Table 1-1. 2012 DEC 303(d) Impaired Waters Listed and Delisted (with Source of Impairment)

Waterbody	Pathogens	DO/Oxygen Demand	Floatables
Little Neck Bay	(1)Urban/Storm/CSO	(4a)Municipal, Urb, CSOs	--------
Alley Creek	---------	(4b)Urban/Storm/CSO	(4b)CSOs, Urban/Storm

Notes:

(1) Individual Waterbodies with Impairment Requiring a TMDL

(4a) Impaired Waters NOT INCLUDED on the NYS 2012 Section 303(d) List; TMDL development is not necessary, since a TMDL has already been established for the segment/pollutant.

(4b) Impaired Waters NOT INCLUDED on the NYS 2012 Section 303(d) List; a TMDL is not needed, since other required control measures are expected to result in restoration in a reasonable period of time.

1.2.b Federal CSO Policy

The 1994 EPA CSO Control Policy provides guidance to permittees and NPDES permitting authorities as to the development and implementation of a LTCP, in accordance with the provisions of the CWA. The CSO policy was first established in 1994 and codified as part of the CWA in 2000.

1.2.c New York State Policies and Regulations

The State of New York has established WQS for all navigable waters within its jurisdiction. Little Neck Bay is classified as an SB waterbody, defined as “suitable for fish, shellfish and wildlife propagation and survival.” The best usages of Class SB waters are “primary and secondary contact recreation and fishing” (6 NYCRR 701.11). Alley Creek is classified as a Class I waterbody, which is defined as “suitable for fish, shellfish and wildlife propagation and survival.” The best usages of Class I waters are “secondary contact recreation and fishing” (6 NYCRR 701.13), per the Interstate Environmental Commission (IEC).

The states of New York, New Jersey and Connecticut are signatories 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, including Alley Creek and Little Neck Bay. The IEC has recently been incorporated into and is now a district of the New England Interstate Water Pollution Control Commission (NEIWPCC), a similar multi-state compact of which NYS is a member. Both waterbodies are classified as Type A under the IEC system. Details concerning the IEC classifications are presented in Section 2.2.

1.2.d Administrative Consent Order

The City and DEC have entered into Orders on Consent to address CSO issues, including the 2005 CSO Order on Consent, which was issued to bring all DEP CSO-related matters into compliance with the provisions of the CWA and the New York State Environmental Conservation Law (ECL), and requires implementation of LTCPs. The 2005 Order on Consent required DEP 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 the 1994 EPA CSO Control Policy. The 2005 Order on Consent was modified as of April 14, 2008, to change certain construction milestone dates. In addition, DEP and DEC entered into a separate Memorandum of Understanding (MOU) to facilitate WQS reviews in accordance with the EPA CSO Control Policy. The last modification prior to 2012 occurred in 2009, which addressed the completion of the Flushing Creek CSO Retention Tank.

In March 2012, DEP and DEC amended the 2005 Order to provide for incorporation of Green Infrastructure (GI) into the LTCP process, as proposed under the City’s 2010 Green Infrastructure Plan, and to update certain project plans and milestone dates.

1.3 LTCP Planning Approach

The LTCP planning approach includes several phases. The first is the characterization phase – an assessment of current waterbody and watershed characteristics, system operation and management practices, the status of current green and grey infrastructure projects, and an assessment of current system performance. DEP is gathering the majority of this information from field observations, historical records, and analysis of studies and reports. The next phase involves the identification and analysis of alternatives to reduce the frequency of wet weather discharges and improve water quality. DEP expects that alternatives will include a combination of green and grey infrastructure elements that will be carefully evaluated using both the collection system and receiving waterbody models. Following the analysis of alternatives, DEP will develop a recommended plan, along with an implementation schedule and strategy. If the proposed alternative will not achieve existing WQS or the Section 101(a)(2) goals of CWA, the LTCP will include a UAA examining whether applicable waterbody classifications, criteria, or standards should be adjusted by the State.

1.3.a Integrate Current CSO Controls from Waterbody/Watershed Facility Plans (Facility Plans)

This LTCP builds upon prior efforts by capturing the findings and recommendations from the previous facility planning documents for this watershed, and integrating the findings into the LTCP.

In June 2009, DEP issued the Alley Creek and Little Neck Bay WWFP. The WWFP, which was prepared pursuant to the 2005 Order on Consent, includes an analysis and presentation of operational and structure modifications targeting the reduction of CSOs and improvement of the overall performance of the collection and treatment system within this watershed. Several of the recommended improvements, which were selected to target the attainment of existing WQS, were set forth in earlier facilities planning efforts and have since been completed; these include the 5-MG Alley Creek CSO Retention Tank, along with extensive improvements to the upstream combined and separate collections systems within the Alley Creek watershed.

Wet weather flows to the Tallman Island WWTP were limited to less than two times Design Dry Weather Flow (2xDDWF), due to certain characteristics of the associated conveyance system. These problems, however, were comprehensively examined in the *Facility Plan for Delivery of Wet Weather Flow to the Tallman Island WPCP* (HydroQual, 2005b). As a result of this examination, DEP modified Regulator TI-R09 (increased open area of side-overflow windows, raised weir), and Regulator TI-R10 was removed and replaced with a section of pipe. DEP incorporated these improvements into the baseline conditions for this LTCP.

1.3.b Coordination with DEC

As part of the LTCP process, DEP and DEC work closely together to share ideas, track progress, and work toward developing strategies and solutions to address wet weather challenges in the New York Harbor Complex.

Representatives from DEP and DEC, along with their technical consultants, conducted regularly-scheduled technical meetings during the development of the Alley Creek and Little Neck Bay LTCP. The purpose of these meetings was to discuss many of the plan components, including technical analysis, the proposed recommended plan, and resulting water quality benefits, as well as coordination for public meetings and other stakeholder presentations. On a quarterly basis, DEC, DEP, and outside technical consultants convene for a larger progress meeting that typically includes technical staff and representatives from DEP and DEC's legal departments, as well as department chiefs who oversee the execution of the program.

In addition to these structured meetings, DEP and DEC typically co-host LTCP-related public meetings, sharing the responsibility for presentation of material and execution of the workshop or event.

1.3.c Watershed Planning

DEP prepared its CSO WWFPs before the emergence of GI as an established method for reducing stormwater runoff; consequently, the WWFPs did not include a full analysis of GI alternatives for controlling CSOs. In comments on DEP's CSO WWFPs, community and environmental groups voiced widespread support for GI and urged that DEP place greater reliance upon that sustainable strategy. Including GI in the LTCPs is consistent with the 2012 Order and recent EPA guidance. To the extent that such installations are feasible in any given area, the use of GI will lead to the achievement of better water quality and sustainability benefits than using solely "grey" technologies. A sustainable approach includes the management of stormwater at its source, through the creation of vegetated areas and other GI, bluebelts and greenstreets, green parking lots, green roofs, and other technologies, as discussed in detail in Section 5 of this report.

1.3.d Public Participation Efforts

A concerted effort was made during the Alley Creek and Little Neck Bay LTCP planning process to involve all relevant and interested stakeholders, and keep the public and stakeholders informed about the project. A public outreach participation plan was developed and implemented throughout the process; the plan is posted and continuously updated on DEP's LTCP program website, www.nyc.gov/dep/ltcp.

Specific objectives of this initiative included the following:

- Develop and implement an approach that reaches all stakeholders;
- Integrate the public outreach efforts with all other aspects of the planning process; and
- Take advantage of other on-going public efforts being conducted by DEP and other City agencies as part of other related programs.

The public participation efforts for this Alley Creek and Little Neck Bay LTCP are discussed in detail in Section 7.

SECTION 2.0
WATERSHED/WATERBODY CHARACTERISTICS

2.0 WATERSHED/WATERBODY CHARACTERISTICS

This section summarizes the major characteristics of the Alley Creek and Little Neck Bay Watershed and Waterbody, building upon earlier documents that present a characterization of the area; these include the WWFP for Alley Creek and Little Neck Bay (DEP, 2009), which describes the characteristics of the watershed and waterbody.

2.1 Watershed Characteristics

The Alley Creek and Little Neck Bay watershed is urbanized and sub-urbanized, comprised primarily of residential areas with some commercial, industrial, and open space/outdoor recreation areas. The most notable outdoor recreation area within this watershed is the Alley Pond Park, located along the banks of Alley Creek, south of the Little Neck Bridge (Northern Boulevard).

This subsection contains a summary of the watershed characteristics as they relate to the sewer system configuration, performance, and impacts to the adjacent waterbodies, as well as the modeled representation of the collection system used for analyzing system performance and CSO control alternatives.

2.1.a Description of Watershed

The Alley Creek and Little Neck Bay watersheds comprise approximately 4,879 acres, located on the north shore of eastern Queens County, adjacent to the Nassau County border. The land surrounding Alley Creek is mostly parkland, while that surrounding Little Neck Bay is largely residential. Several parks are found within the watershed; most notable is the Alley Pond Park, which surrounds Alley Creek on its eastern, western, and southern shores. As described later in this section, the area is served by a complex wastewater system comprised of combined, separate, and storm sewers; interceptor sewers and pumping stations; several CSO and stormwater outfalls; and a CSO retention tank.

Although the watershed has undergone major changes as this part of the City has developed, significant effort and interest by the citizens living in the area and New York City agencies has resulted in recognition of the ecological, environmental and educational value of Alley Creek and its tidal wetlands. In contrast to the filling in of wetlands and "hardening" of the shoreline with bulkheads that characterizes most of New York City's pre-colonial wetlands, much of Alley Creek's wetlands and the Little Neck Bay wetlands in Udalls Cove are designated parks.

The urbanization of Alley Creek and Little Neck Bay has led to the creation of both a combined sewer system (CSS) and separate sewer system (SSS), including its companion stormwater systems that discharge to the two waterbodies. Combined sewage, which does not overflow through one of the CSO structures, is conveyed to the Tallman Island WWTP for treatment. As shown in Figure 2-1, Alley Creek and Little Neck Bay are located along the eastern edge of the Tallman Island WWTP tributary area.

As a residential community within New York City, several large and notable transportation corridors cross the watershed providing access between dense commercial and residential areas. These access routes include the Cross Island Parkway, the Long Island Expressway, the Grand Central Parkway, and the Long Island Railroad (Figure 2-2). These transportation corridors limit access to some portions of the waterbody, and must be taken into consideration when developing CSO control solutions.

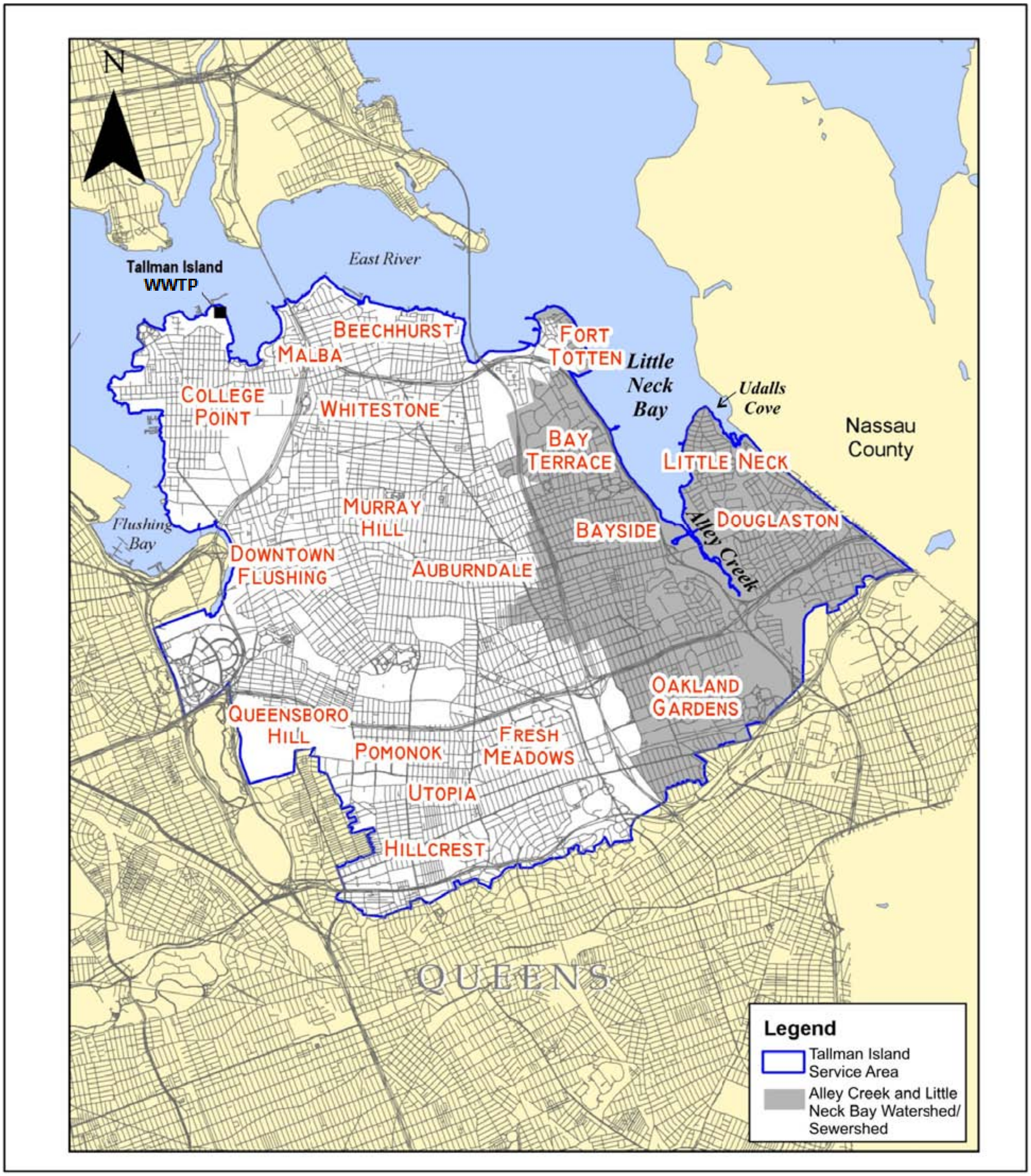


Figure 2-1. Alley Creek and Little Neck Bay Watershed within Tallman WWTP

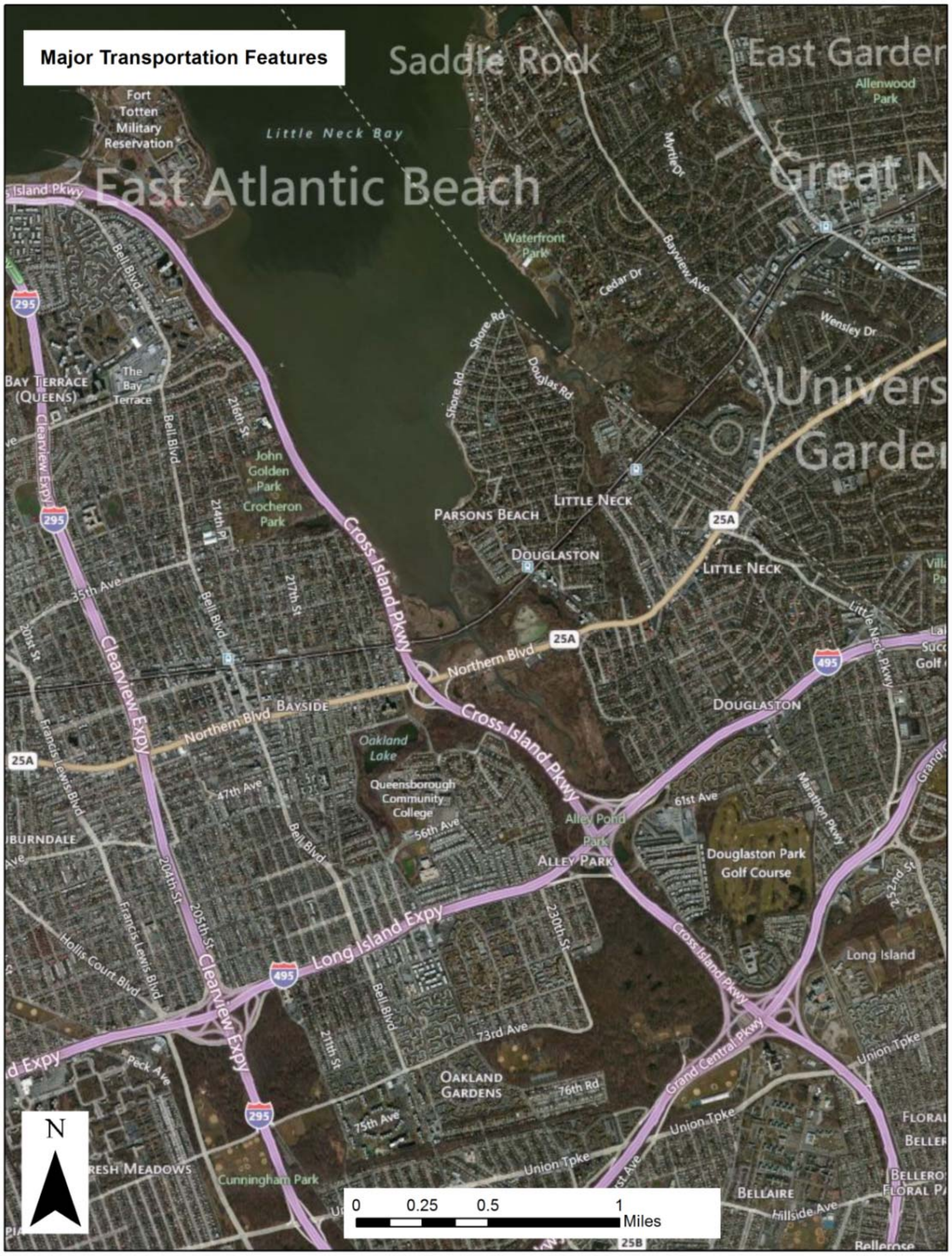


Figure 2-2. Major Transportation Features of Alley Creek and Little Neck Bay

2.1.a.1 Existing and Future Land Use and Zoning

Current land use for the watershed is shown in Figure 2-3**,** and generally aligns with the established zoning. Starting at the northeast edge of the waterbody within New York City, land immediately southeast of Udalls Cove is zoned C3 (commercial local retail), while surrounding land is zoned for low density residential, detached and attached (R1-2, R-2 and R3-1). The whole Douglaston Peninsula is zoned for detached housing on large lots (R1-2). The land immediately surrounding Alley Creek is designated parkland. The residential area to the east of the creek is R1-2, while that to the west is R2. Residential land on the western shore, north of the railroad tracks is zoned R3-2 and R2. Moving north, Crocheron Park and John Golden Park are designated parkland. The area between John Golden Park and Fort Totten is known as Bayside. Previous zoning allowed R5 (mid-density, including multi-story rowhouses). The New York City Department of City Planning (DCP) rezoned 350 blocks in the Bayside area of northeastern Queens, Community District 11 (CD11). Much of the area is now rezoned to contextual districts, permitting development of only one- and two-family homes, to maintain Bayside's longstanding neighborhood character. To curb recent development trends toward unusually large single-family houses in areas currently zoned R2, DCP established a new low-density contextual zoning district, R2A. This new district limits floor area and height and other bulk regulations that are different from the former R2 district (DEP website 2005). Fort Totten is zoned R3-1, C3 and NA-4. The NA-4designation is a Special Natural Area District (SNAD). This protects the area by limiting modifications in topography, by preserving trees, plant and marine life, and natural water courses, and by requiring clustered development to maximize preservation of natural features. Generalized land use within the New York City portion of the Alley Creek and Little Neck Bay assessment area within the riparian area of ¼-mile of Alley Creek and Little Neck Bay shoreline is shown in Figure 2-4. Land use within the Alley Creek and Little Neck Bay drainage area is summarized in Table 2-1. The main land use is residential, with sizeable fractions of Open Space and Outdoor Recreation and Vacant Land.

Table 2-1. Land Use within the Alley Creek and Little Neck Bay Drainage Area

Land Use Category	Percent of Area	
	Riparian Area (1/4-mile radius) Percent	Drainage Area Percent
Commercial	1	4
Industrial	0	0
Open Space & Outdoor Recreation	29	15
Mixed Use & Other	2	3
Public Facilities	17	7
Residential	38	62
Transportation & Utility	2	1
Vacant Land	11	8

As of the report date, there are no proposed land use changes or major New York City development projects in the Alley Creek or Little Neck Bay assessment area.

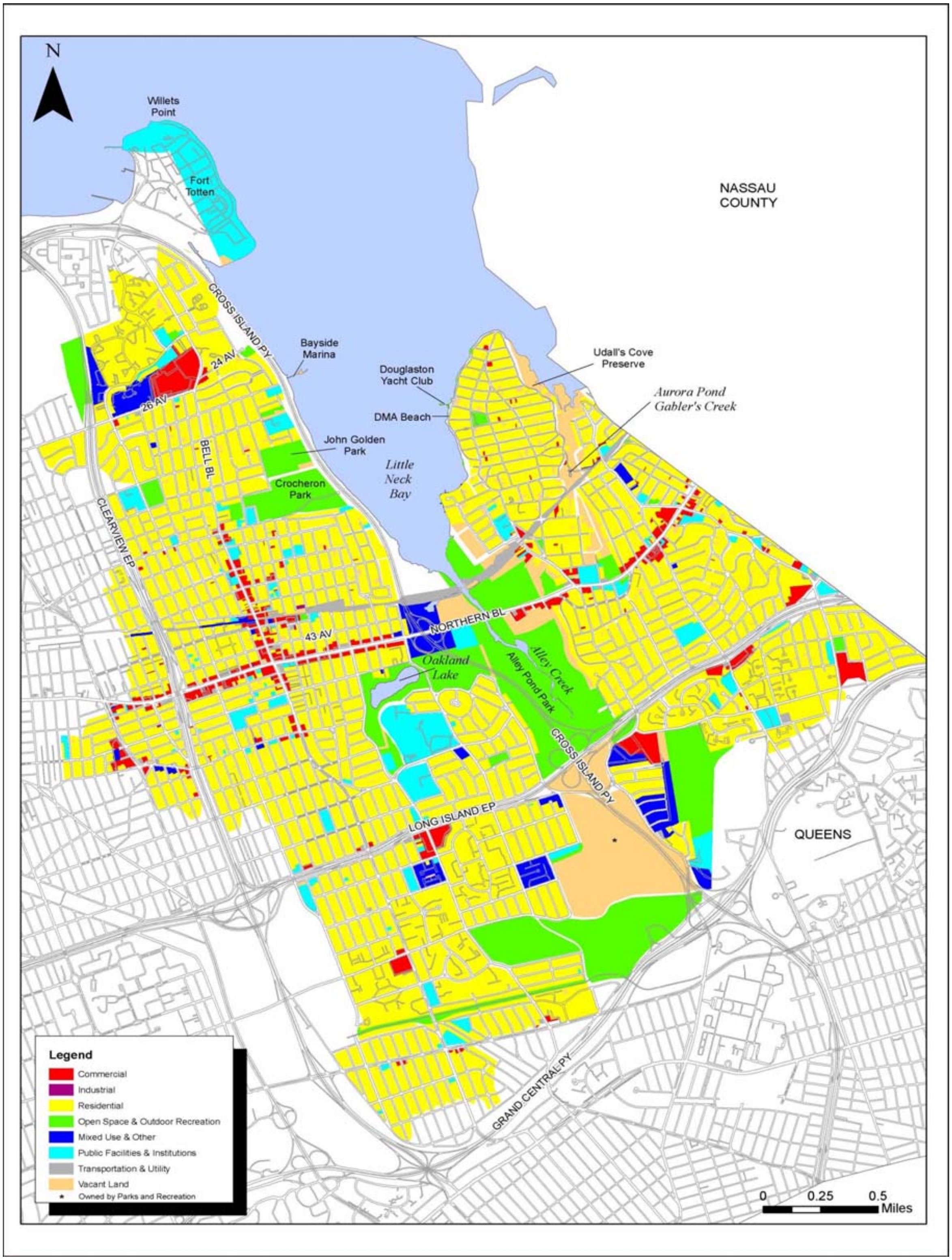


Figure 2-3. Land Use in Alley Creek/Little Neck Basin

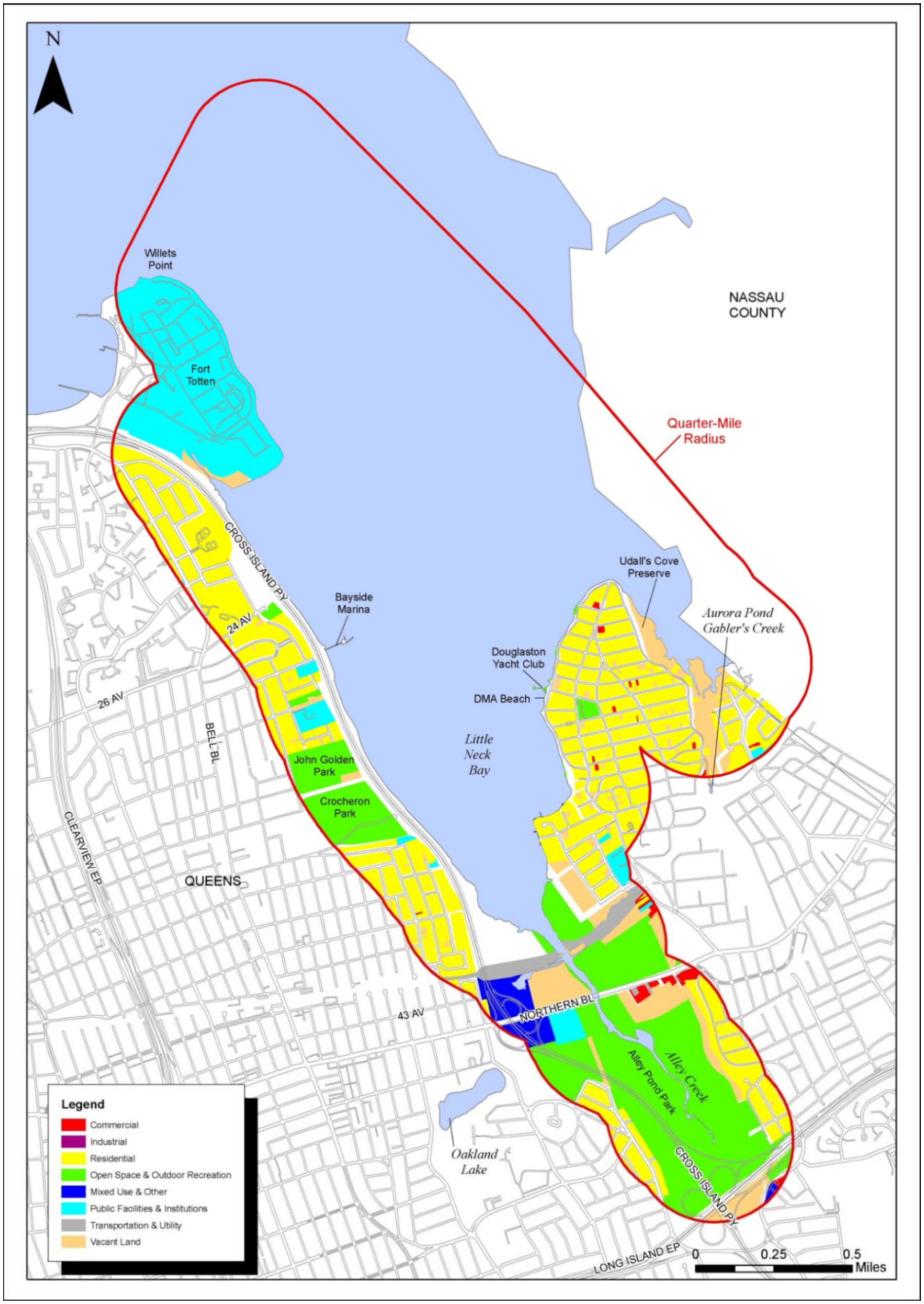


Figure 2-4.¼ Mile Land Use in Alley Creek and Little Neck Bay

2.1.a.2 Permitted Discharges

The Belgrave WWTP,SPDES NY-0026841, located in Great Neck, Nassau County, discharges to the head of Udalls Cove (Little Neck Bay), near 34thAvenue and 255th Street. The Belgrave WWTP is a 2.0-MGD wastewater treatment plant discharging an average of 1.3 MGD of secondary treated, disinfected effluent (Figure 2-5).

In addition to the Belgrave WWTP, there are several permitted stormwater discharge points. These are discussed in more detail in Section 2.1.c.

Figure 2-5. Location of the Belgrave WWTP, Adjacent to Udalls Cove

2.1.a.3 Impervious Cover Analysis

Impervious surfaces within a watershed are those characterized by an artificial surface, such as concrete, asphalt, rock, or rooftop. Rainfall occurring on an impervious surface will experience a small initial loss through ponding and seasonal evaporation on that surface, with the remaining rainfall volume becoming overland runoff that directly flows into the sewer system and/or separate stormwater system. The impervious surface is important when characterizing a watershed and CSS performance, as well as construction of hydraulic models used to simulate the performance of the CSS.

A representation of the impervious cover was made in the 13 WWTPs combined area drainage models developed in 2007 to support the WWFPs submitted in 2009. However, efforts to update the model and the impervious surface representation are ongoing.

As the City started to focus attention on the use of GI to manage street runoff by either slowing it down prior to entering the combined sewer network, or preventing it from entering the network entirely, it became clear that a more detailed evaluation of the impervious cover would be essential. In addition, the City realized that it would be important to distinguish between impervious surfaces that directly introduce runoff [Directly Connected Impervious Areas – (DCIA)] to the sewer system from those impervious surfaces that may not contribute any runoff to the sewers. For example, a rooftop with roof drains directly connected to the combined sewers (as required by the NYC Plumbing Code) would be an impervious surface that is directly connected. However, a sidewalk or pervious surface adjacent to a parkland may not contribute any runoff to the CSS.

In 2009 and 2010, DEP invested in the development of high quality satellite measurements of impervious surfaces required to conduct the analyses that improved the differentiation between pervious and impervious surfaces, as well as the different types of impervious surfaces. The data and the approach used are described in detail in the IW City-wide Model Recalibration Report (DEP, 2012a).

The result of this effort yielded an updated model representation of the areas that contribute runoff to the CSS. This improved set of data aided in model recalibration, and provided the DEP with a better idea where GI can be deployed to reduce the runoff contributions from impervious surfaces that contribute flow to the collection system. The result of the recalibration efforts was a slight increase in the amount of runoff that enters the Tallman Island WWTP CSS.

2.1.a.4 Population Growth and Projected Flows

The Bureau of Environmental Planning and Analysis (BEPA) of DEP routinely develops water consumption and dry weather wastewater flow projections for DEP planning purposes. Water and wastewater demand projections were developed by BEPA in 2012; an average per capita water demand of 75 gallons per capita per day was determined to be representative of future uses. The year 2040 was established as the planning horizon, and populations for that time were developed by the DCP and the New York Transportation Metropolitan Council.

The 2040 population projection figures were then used with the dry weather per capita sewage flows to establish the dry weather sewage flows contained in the IW model for the Tallman Island WWTP sewershed. This was accomplished by using GIS tools to proportion the 2040 populations locally from the 2010 census information for each landside subcatchment, tributary to each CSO. Per capita dry weather sanitary sewage flows for these landside model subcatchments were established as the ratio of two factors: the year per capita dry weather sanitary sewage flow, and 2040 estimated population for the landside model subcatchment within the Tallman Island WWTP service area.

2.1.a.5 Updated Landside Modeling

The Alley Creek and Little Neck Bay watershed is part of the overall Tallman Island WWTP system model (TI model). Several modifications to the collection system, which is tributary to the Tallman Island WWTP, have occurred since the model was calibrated in 2007. Since the TI model has been used for analyses associated with the annual reporting requirements of the SPDES permit BMPs and PCM for the Flushing Creek CSO Retention Tank, also known as Flushing Creek CSO Retention Tank, many of these changes have already been incorporated into the model. Major changes to the modeled representation of the collection system that have been made since the 2007 update include:

- Representation of the Flushing Creek CSO Retention Tank for model simulations after May, 2007.
- Representation of the Alley Creek CSO Retention Tank for model simulations after March 10, 2011.
- Inclusion of the Bowery Bay drainage areas that contribute CSOs to Flushing Creek CSO Retention Tank and to TI-010. Because the overflows from three of the Bowery Bay High Level sewershed are conveyed to this tank through Park Avenue outfall, this model update was performed to avoid the need to run the Bowery Bay model as precursor to every Tallman Island model run.

In addition to changes made to the modeled representation of the collection system configuration, several other changes have been made to the model, including:

- ***Runoff generation methodology***, including the identification of pervious and impervious surfaces. As described in Section 2.1.a.3 above, the impervious surfaces were also categorized into DCIAs and impervious runoff surfaces that do not contribute runoff to the collection system.

- ***GIS Aligned Model Networks.*** Historical IW models were constructed using record drawings, maps, plans, and studies. Over the last decade, the Bureau of Water and Sewer Operations (BWSO) of DEP has been developing a GIS system that will provide the most up-to-date information available on the existing sewers, regulators, outfalls, and pump stations. As part of the update and model recalibration, data from the GIS repository for interceptor sewers were used. The models will continue to evolve and be updated as more information becomes available from this source and any other field information.

- ***Interceptor Sediment Cleaning Data.*** DEP recently completed a City-wide interceptor sediment inspection and cleaning program. From April 2009 to May 2011, approximately 136 miles of the City's interceptor sewers were inspected. Data on the average and maximum sediment in the inspected interceptors were available for use in the model as part of the update and recalibration process. Multiple sediment depths available from sonar inspections were spatially averaged to represent depths for individual interceptor segments included in the model, for sections not yet cleaned.

- ***Evapotranspiration Data.*** Evapotranspiration (ET) is a meteorological input to the hydrology module of the IW model that represents the rate at which depression storage (surface ponding) is depleted and available for use for additional surface ponding during subsequent rainfall events. In previous versions of the model, an average rate of 0.1 inches/hour (in/hr) was used for the model calibration, while no evaporation rate was used as a conservative measure during alternatives analyses. During the update of the model, a review of hourly ET estimates obtained from four National Oceanic and Atmospheric Administration (NOAA) climate stations [John F. Kennedy (JFK), Newark (EWR), Central Park, and LaGuardia (LGA)] for an 11-year period. These data were used to calculate monthly average ETs, which were then used in the updated model. The monthly variations enabled the model simulation to account for seasonal variations in ET rates, which are typically higher in the summer months.

- ***Tidal Boundary Conditions at CSO Outfalls.*** Tidal stage can affect CSO discharges when tidal backwater in a CSO outfall reduces the ability of that outfall to relieve excess flow. Model updates took into account this variable boundary condition at CSO outfalls that were influenced by tides. Water elevation based on the tides was developed using a customized interpolation tool that assisted in the computation of meteorologically-adjusted astronomical tides at each CSO outfall in the New York Harbor complex.

- ***Dry Weather Sanitary Sewage Flows.*** Dry weather sewage flows were developed as discussed in Section 2.1.a.4 above. Hourly dry weather flow (DWF) data for 2011 were used to develop the hourly diurnal variation patterns at each plant. Based on the calibration period, the appropriate dry weather flows for 2005 or 2006 or another calendar year was used.

- ***Precipitation.*** A review of the rainfall records for model simulations was undertaken as part of this exercise, as discussed in Section 2.1.b below.

In 2012, 13 of the City's landside models underwent recalibration after the updates and enhancements were complete. This effort and calibration results are included in the IW City-wide Recalibration Report (DEP, June 2012) required by the updated Order on Consent. Following this report, DEP submitted to

DEC a Hydraulic Analysis report in December 2012. The general approach followed was to recalibrate the model in a stepwise fashion beginning with the hydrology module (runoff). The following summarizes the overall approach to model update and recalibration:

- ***Site scale calibration (Hydrology)*** – The first step was to focus on the hydrologic component of the model, which had been modified since October 2007 using updated satellite data. Flow monitoring data were collected in upland areas of the collection systems, remote from (and thus largely unaffected by) tidal influences and in-system flow regulation, for use in understanding the runoff characteristics of the impervious surfaces. Data were collected in two phases – Phase 1 in the Fall of 2009, and Phase 2 in the Fall of 2010. These areas ranged from 15 to 400 acres in spatial extent. A range of areas with different land use mixes was selected to support the development of standardized set of coefficients that can be applied to other unmonitored areas of the City. The primary purpose of this element of the recalibration was to adjust pervious and impervious area runoff coefficients to provide the best fit of the runoff observed at the upland flow monitors.

- ***Area-wide recalibration (Hydrology and Hydraulics)*** – The next step in the process was to focus on larger areas of the modeled systems where historical flow metering data were available, and which were neither impacted by tidal backwater conditions nor subjected to any flow regulation. Where necessary, runoff coefficients were further adjusted to provide reasonable simulation of flow measurements made at the downstream end of these larger areas. The calibration process then moved downstream further into the collection system, where flow data were available in portions of the conveyance system where tidal backwater conditions could exist, as well as potential backwater conditions from throttling at the WWTPs. The flow measured in these downstream locations would further be impacted by regulation at in-system control points (regulator, internal reliefs, etc.). During this step in the recalibration, minimal changes were made to runoff coefficients.

The result of this effort is a model with better representation of the collection system and its tributary area for the Tallman Island WWTP basin, including Alley Creek and Little Neck Bay. This updated model is used for the alternatives analysis as part of this LTCP. A comprehensive discussion of the recalibration effort can be found in the IW City-wide Recalibration Report (June 2012).

2.1.b Review and Confirm Adequacy of Design Rainfall Year

DEP has been consistently applying the annual precipitation characteristics of 1988 to the landside models to develop pollutant loads from combined and separately sewered drainage areas. To date, 1988 has been considered to be representative of long-term average conditions, and therefore has been used for analyzing facilities where "typical" rather than extreme conditions serve as the basis of design, in accordance with federal CSO policy of using an "average annual basis" for analyses. The selection of 1988 as the average condition was re-considered, however, in light of the increasing concerns over climate change, with the potential for more extreme and possibly more frequent storm events. Recent landside modeling analyses in the City have used the 2008 precipitation pattern to drive the runoff-conveyance processes, along with the 2008 tide observations, which DEP believes to be more representative than 1988 conditions as a typical year, that includes some extreme storms also.

The Alley Creek WWFP was based on 1988 rainfall conditions, but future baseline/alternative runs are performed using 2008 as the typical precipitation year. A comparison of these rainfall years, which led to the selection of 2008, is provided in Table 2-2.

Table 2-2. Comparison of Rainfall Years to Support Evaluation of Alternatives

Parameter	WWFP JFK 1988	Present Day Average 1969-2010	Present Best Fit JFK 2008
Annual Rainfall (in)	40.7	45.5	46.3
July Rainfall (in)	6.7	4.3	3.3
November Rainfall (in)	6.3	3.7	3.3
Number of Very Wet Days (>2.0 in)	3	2.4	3
Average Peak Storm Intensity (in/hr)	0.15	0.15	0.15

2.1.c Description of Sewer System

The Alley Creek and Little Neck Bay watershed/sewershed is divided between two major political jurisdictions – the Borough of Queens (Queens County, within New York City), and Nassau County, Long Island. Most of the Queens County portion of the watershed is served by the Tallman Island WWTP and associated collection system, as shown on Figure 2-6. The Douglas Manor neighborhood, on the east bank of Little Neck Bay in Queens, is principally served by on-site septic systems. Wastewater management in the Nassau County portion of the watershed is accomplished by three sanitary sewer districts: the Belgrave Water Pollution Control District, the Great Neck Water Pollution Control District, and the Village of Great Neck. The treated effluent from the Belgrave WWTP discharges to Udalls Cove, on the east side of Little Neck Bay. The treatment plants for the other two districts discharge to Manhasset Bay, on the east side of the Great Neck Peninsula. In addition, many properties use on-site septic systems, which are not in the service areas of these three sewer districts. The locations of the three wastewater treatment facilities and the respective sewershed boundaries are as shown in Figure 2-6.

The following section describes the major features of the Tallman Island WWTP tributary area, including the Alley Creek and Little Neck Bay watershed.

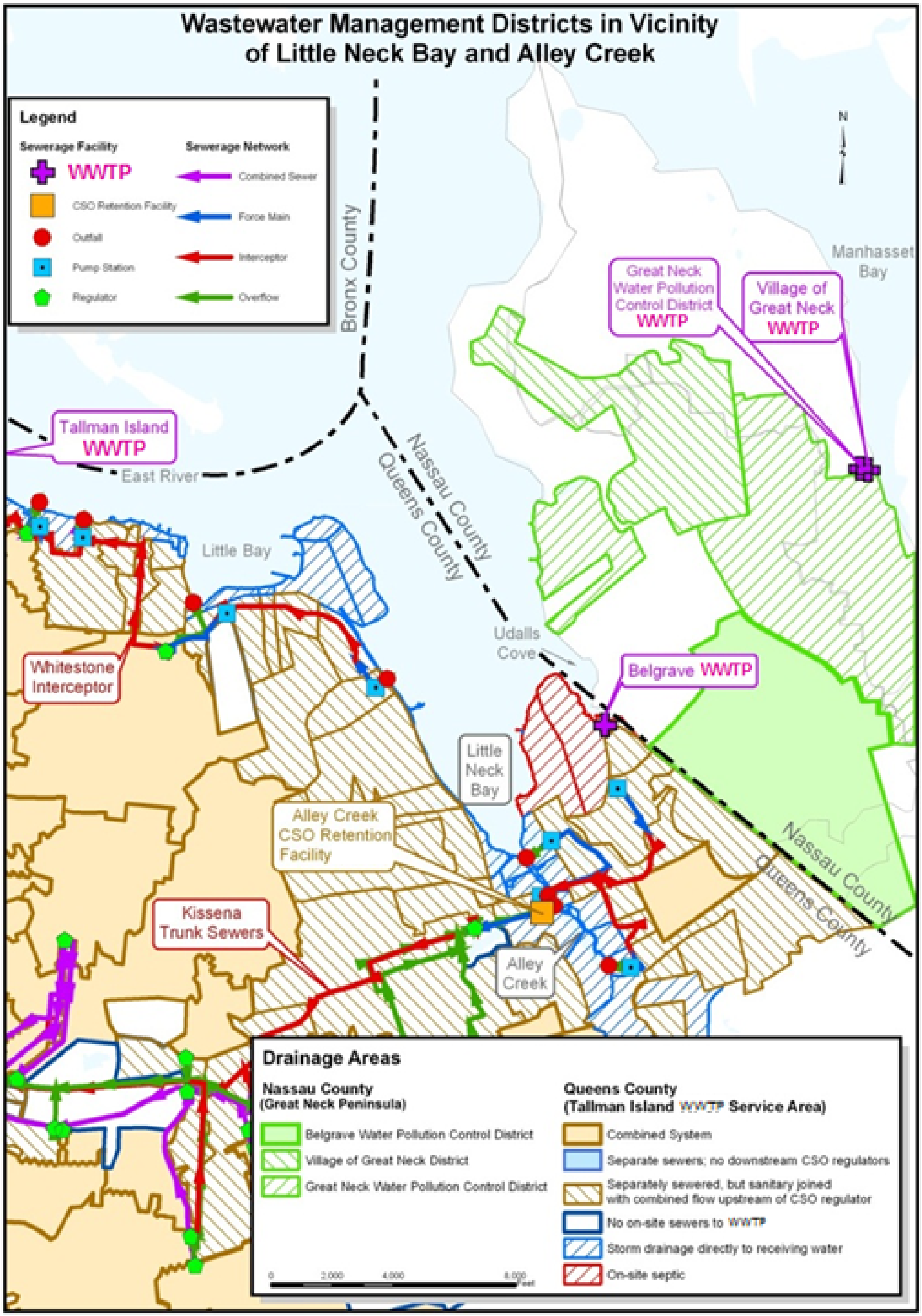


Figure 2-6. Alley Creek Wastewater Service Areas

2.1.c.1 Overview of Drainage Area and Sewer System

Alley Creek and Little Neck Bay are served by the Tallman Island WWTP. The Tallman Island sewershed includes sanitary and combined sewersheds, as summarized in Tables 2-3 and 2-4. The Tallman Island service area includes:

- Sixteen pumping stations, with five serving combined system areas;
- Forty-nine combined sewer flow regulator structures; and
- Twenty-four CSO discharge outfalls, two of which are permanently bulkheaded.

Table 2-3. Tallman Island WWTP Drainage Area(1): Acreage Per Sewer Category

Sewer Area Description	Area (acres)
Combined	**8,712**
Separate • Fully-separated • Watershed separately sewered, but with sanitary sewage subsequently flowing into a combined interceptor, and stormwater discharging either directly to receiving water or into a combined interceptor	**5,903** (923 acres) (4,980 acres)
Total	**14,615**

(1)An additional 3,080 acres of area, for facility planning and certain permitting purposes, are considered to be part of the Tallman Island drainage area, but do not contribute to the WWTP. These include areas with direct drainage of stormwater to water courses (either directly or via storm sewers), other areas not served by piped drainage systems (e.g., parks and cemeteries), and areas that use "on-site" septic systems (Douglas Manor on Douglaston Peninsula).

Table 2-4. Tallman Island WWTP Drainage Area: Acreage By Outfall/Regulator

Outfall	Outfall Drainage Area	Regulator	Regulator Drainage Area	Regulated Drainage Area Type	Receiving Water
East River					
TI-003	494.5	R10A	224.6	Separate	Powells Cove
		R10B	269.9	Combined	Powells Cove
		R10	114.2	Separate	Powells Cove
TI-004	68.1	R11	68.1	Combined	East River
TI-005	179.3	R12	179.3	Separate	East River
TI-019	27	R02	27	Combined	East River
TI-020	60.1	R01	60.1	Combined	East River
TI-023	769.9	R13	769.9	Combined	Little Bay
Alley Creek and Little Neck Bay					
TI-006	597.3	24th Ave PS	74.8	Separate	Little Neck Bay
		Clear View PS	522.5	Separate	Little Neck Bay
TI-007	1074.9	Old Douglaston PS	1074.9	Combined and Separate	Alley Creek
TI-008	1044.4	R46	404.4	Combined	Alley Creek
		R47	455.9	Combined and Separate	Alley Creek
		R49	80.5	Separate	Alley Creek

TI-024	376.2	New Douglaston PS	77.1	Separate	Alley Creek
TI-025	1550.7	Alley Creek Tank	1550.7	Combined and Separate	Alley Creek
Flushing Bay and Creek					
TI-010	6416.0	R29	122.9	Combined and Separate	Flushing Creek
		R30	787	Combined and Separate	Flushing Creek
		R31	503.4	Combined, Separate and Other	Flushing Creek
		R32	2.7	Combined	Flushing Creek
		R33	2.5	Combined	Flushing Creek
		R34	7.6	Combined	Flushing Creek
		R35	43.6	Combined	Flushing Creek
		R37	366	Combined	Flushing Creek
		R39	35.3	Combined	Flushing Creek
		R40	135.4	Combined	Flushing Creek
		R40A	119.8	Combined	Flushing Creek
		R41	529	Combined and Other	Flushing Creek
		R43	515.7	Combined, Separate and Other	Flushing Creek
		R44	141.4	Combined	Flushing Creek
		R45	613.1	Combined	Flushing Creek
		R45A	1043.3	Combined	Flushing Creek
		R50	343.6	Combined	Flushing Creek
		R59	68.6	Combined	Flushing Creek
TI-011	943.2	R09	278.2	Combined and Separate	Flushing Creek
		R51	369.4	Combined	Flushing Creek
		R52	16.3	Combined	Flushing Creek
		R53	46.3	Combined	Flushing Creek
		R54	28.1	Combined	Flushing Creek
TI-012	13	122nd St PS	13	Separate	Flushing Bay
TI-013	28.3	R08	Disconnected from R08	Separate	Flushing Bay
TI-014	18.5	R07	18.5	Combined	Flushing Bay
TI-015	18.6	R06	18.6	Combined	Flushing Bay

TI-016	73.5	R05	73.5	Combined	Flushing Bay
TI-017	3.5	R04	3.5	Combined	Flushing Bay
TI-018	30.9	R03	30.9	Combined	Flushing Bay
TI-022	308.2	R55	156.8	Combined	Flushing Creek
		R56	85	Combined	Flushing Creek
		R57	14.6	Combined	Flushing Creek
		R58	51.8	Combined	Flushing Creek

Note: For locations with regulators in series, the incremental regulator drainage area is listed

The Tallman Island WWTP is located at 127-01 134th Street, in the College Point section of Queens, on a 31-acre site adjacent to Powells Cove, leading into the Upper East River, and bounded by Powells Cove Boulevard. The Tallman Island WWTP serves a sewered area in the northeast section of Queens, including the communities of Little Neck, Douglaston, Oakland Gardens, Bayside, Auburndale, Bay Terrace, Murray Hill, Fresh Meadows, Hillcrest, Utopia, Pomonok, Downtown Flushing, Malba, Beechhurst, Whitestone, College Point, and Queensboro Hill, as shown on Figure 2-7. The total sewer length that feeds into the Tallman Island WWTP, including sanitary, combined, and interceptor sewers, is 490 miles.

The Tallman Island WWTP 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. The Tallman Island WWTP has a DDWF capacity of 80 MGD, and is designed to receive a maximum flow of 160 MGD (2xDDWF) with 120 MGD (1.5xDDWF) receiving secondary treatment. Flows over 120 MGD receive primary treatment and disinfection.

The Tallman Island WWTP includes four principal interceptors: the Main Interceptor, the College Point Interceptor, the Flushing Interceptor, and the Whitestone Interceptor.

- The Main Interceptor is directly tributary to the Tallman Island WWTP, and picks up flow from the other three interceptors.

- The College Point Interceptor carries flow from sewersheds to the west of the treatment plant, discharges in the Powell's Cove Pump Station, which discharges into the Main Interceptor within the WWTP premises.

- The Flushing Interceptor can be considered an extension of the Main Interceptor south of the Whitestone connection, and serves most of the areas to the south in the system. The Flushing Interceptor also picks up flow from the southeast areas of the system, along the Kissena Corridor Interceptor (via trunk sewers upstream of the TI-R31 regulator), and from the Douglaston area. The Alley Creek area drains to Tallman Island WWTP via the Kissena Corridor Interceptor.

- The Whitestone Interceptor discharges to the Main Interceptor from the west side, shortly upstream of the College Point interceptor connection, via gravity discharge. The Whitestone conveys flow from the area east of the treatment plant along the East River.

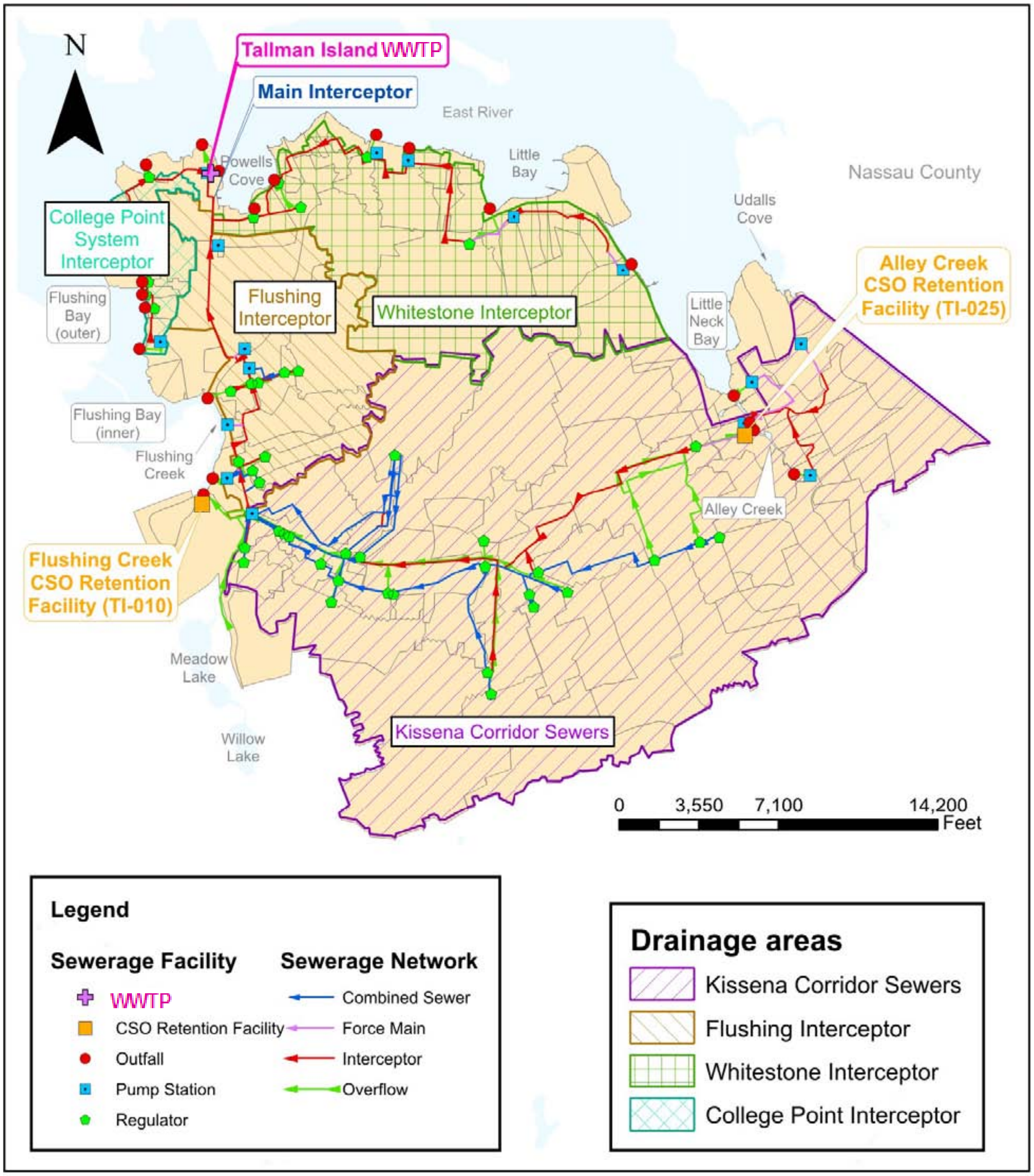


Figure 2-7. Tallman Island WWTP Service Area

The Tallman Island WWTP includes four principal interceptors: the Main Interceptor, the College Point Interceptor, the Flushing Interceptor, and the Whitestone Interceptor.

- The Main Interceptor is directly tributary to the Tallman Island WWTP, and picks up flow from the other three interceptors.

- The College Point Interceptor carries flow from sewersheds to the west of the treatment plant, discharges in the Powell's Cove Pump Station, which discharges into the Main Interceptor within the WWTP premises.

- The Flushing Interceptor can be considered an extension of the Main Interceptor south of the Whitestone connection, and serves most of the areas to the south and east in the system. The Flushing Interceptor also picks up flow from the southeast areas of the system, along the Kissena Corridor Interceptor (via trunk sewers upstream of the TI-R31 regulator), and from the Douglaston area. The Alley Creek area drains to Tallman Island WWTP via the Kissena Corridor Interceptor.

- The Whitestone Interceptor discharges to the Main Interceptor from the west side, shortly upstream of the College Point interceptor connection, via gravity discharge. The Whitestone conveys flow from the area east of the treatment plant along the East River.

This service area also includes two CSO retention facilities planned, designed and constructed based on the East River Facility Planning and WWFP. The first one is the Flushing Creek CSO Retention Tank, also referred to as Flushing Creek CSO Retention Tank, with a total capacity of 43.4 MG (28.4 MG of offline storage and 15 MG of inline storage in large outfall pipes). This facility has been operational since May 2007. Post event, retained flow is pumped to the upper end of the Flushing Interceptor, upstream of Regulator TI-009. This structure was reconstructed in 2005 to provide adequate capacity to convey both sanitary flows and dewatered flow from the retention tank subsequent to wet weather periods.

The second facility is the Alley Creek Retention Tank, built in 2010, which was operational as of March 11, 2011. This tank has an offline storage capacity of 5 MG. During wet weather, flows that reach the TI-008 CSO regulator are directed to the offline storage tank by the diversion weir in Chamber 6 of the Alley Creek CSO Retention Tank. When the storage tank reaches capacity, excess water overflows the storage basin and is discharged to Alley Creek through Outfall TI-025, after receiving floatables control. The retention tank provides some degree of primary settling. Post-event dewatering of this tank is accomplished through the upgraded Old Douglaston PS, which has a peak capacity of 8.5 MGD.

Tallman Island Non-Sewered Areas

Some areas within the Tallman Island service area are considered direct drainage areas and on-site septic areas, as shown in Figure 2-8 (next page), where stormwater drains directly to receiving waters without entering the CSS. Generally, these are shoreline areas adjacent to waterbodies, and were delineated based on topography and the resultant direction of stormwater sheet flow. In addition, the on-site septic areas, located in the northern portion of Douglaston Peninsula, are unsewered. Stormwater flows across lawns and down gutters to Little Neck Bay. Further, near surface groundwater flow is a potential source of pollutants to Little Neck Bay.

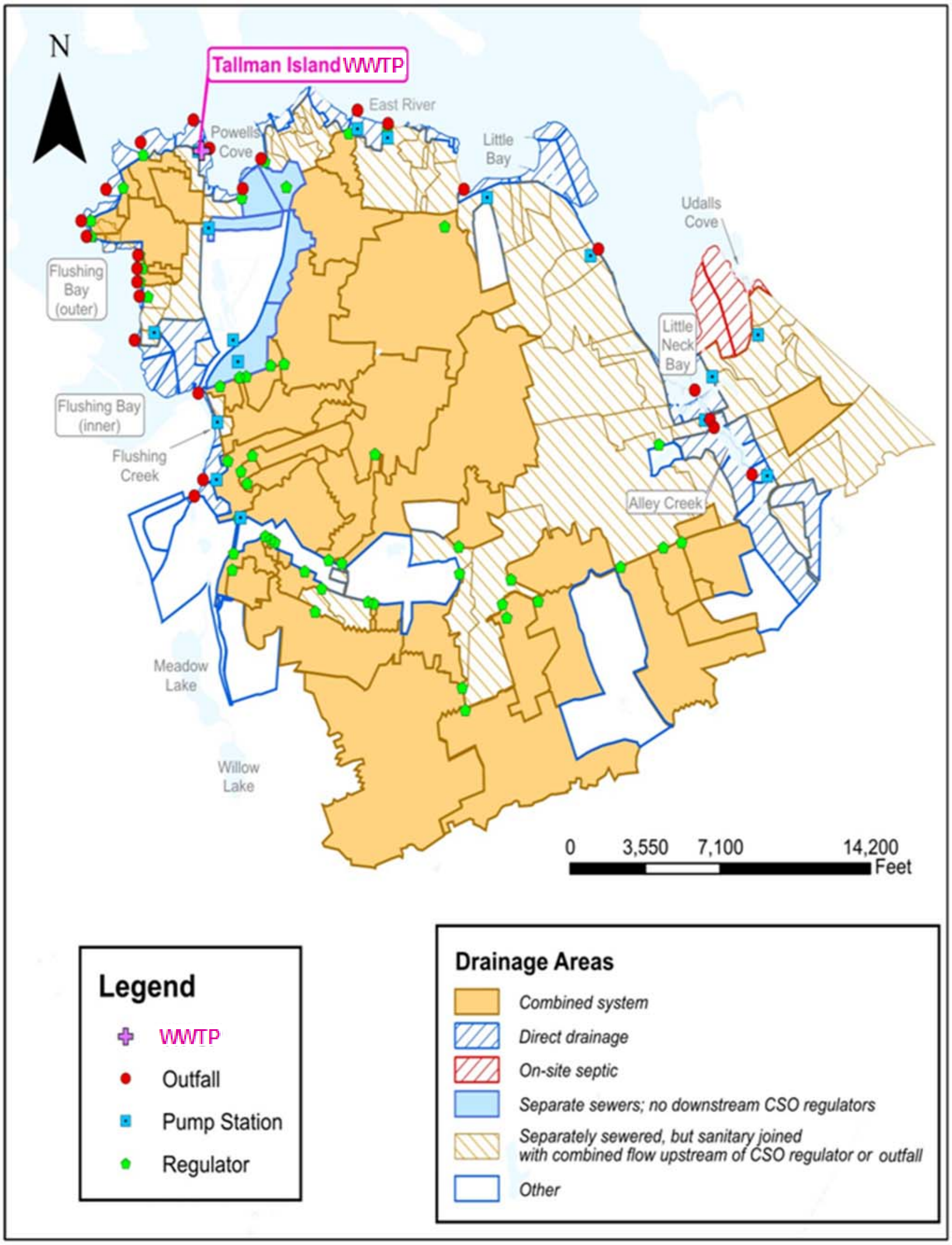


Figure 2-8. Tallman Island WWTP Drainage Area

Tallman Island Stormwater Outfalls

There are nine permitted stormwater outfalls discharging to Alley Creek and Little Neck Bay, as shown on Figure 2-9 (next page); these include TI-623, TI-624, TI-633, TI-653, TI-654, TI-655, TI-656, TI-658 and TI-660. These outfalls drain stormwater runoff from the separate sanitary sewer areas around Alley Creek and Little Neck Bay. While runoff from these areas does not enter the combined system, the direct stormwater discharges to Alley Creek and Little Neck Bay can impact water quality.

Tallman Island/Alley Creek CSOs

The Tallman Island SPDES permit CSO outfalls to Alley Creek are TI-007, TI-008, TI-009,TI-024 and TI-025. CSO outfall TI-006 discharges to Little Neck Bay. The locations of Alley Creek and Little Neck Bay SPDES CSO outfalls are shown on Figure 2-9. It should be noted that TI-025 is the CSO outfall for the Alley Creek CSO Retention Tank, and that TI-008 and TI-025 are used to convey and discharge a large portion of stormwater. In addition, outfalls TI-007, TI-006 and TI-024 serve as emergency bypasses for pump stations, and are therefore designated as CSO outfalls. Under normal conditions, TI-006 and TI-024 discharge stormwater from their tributary areas, and TI-007 can overflow during large precipitation events.

Wet weather flows in the CSS, with incidental sanitary and stormwater contributions as summarized above, result in overflows to the nearby waterbodies when the flows exceed the hydraulic capacity of the system, or the specific capacity of the local regulator structure.

Douglas Manor

The area on the eastern shore of Little Neck Bay known as Douglas Manor, The neighborhood is predominantly composed of single family residences served by on-site septic systems, built in individual lots zoned as R1-1 and R1-2, except for the Douglaston Club House, which is a three-story structure with a 17,100 sq. ft. building area, located on a 102,060 sq. ft. lot zoned for open space/outdoor recreation. Approximately 58 acres of drainage area generate runoff upstream of Shore Road, a waterfront roadway that follows the alignment of the eastern shore of Little Neck Bay. The Douglas Manor Association (DMA) manages a permitted private community beach known as DMA Beach, along Shore Road. The location of DMA Beach and Douglaston Club House, and photos depicting the overall residential land use of the neighborhood can be seen in Figure 2-10.

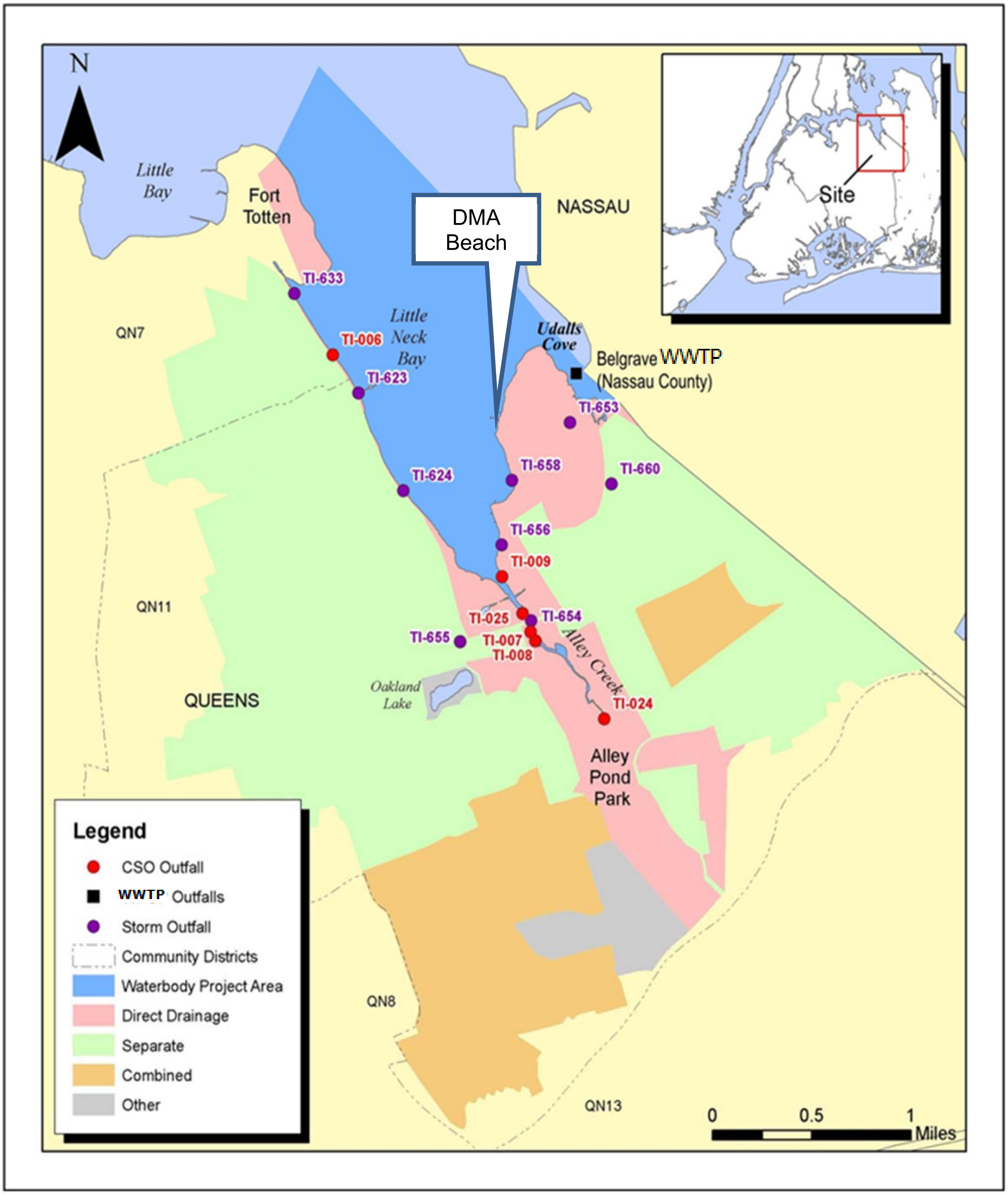


Figure 2-9. Alley Creek and Little Neck Bay SPDES Permitted Outfalls

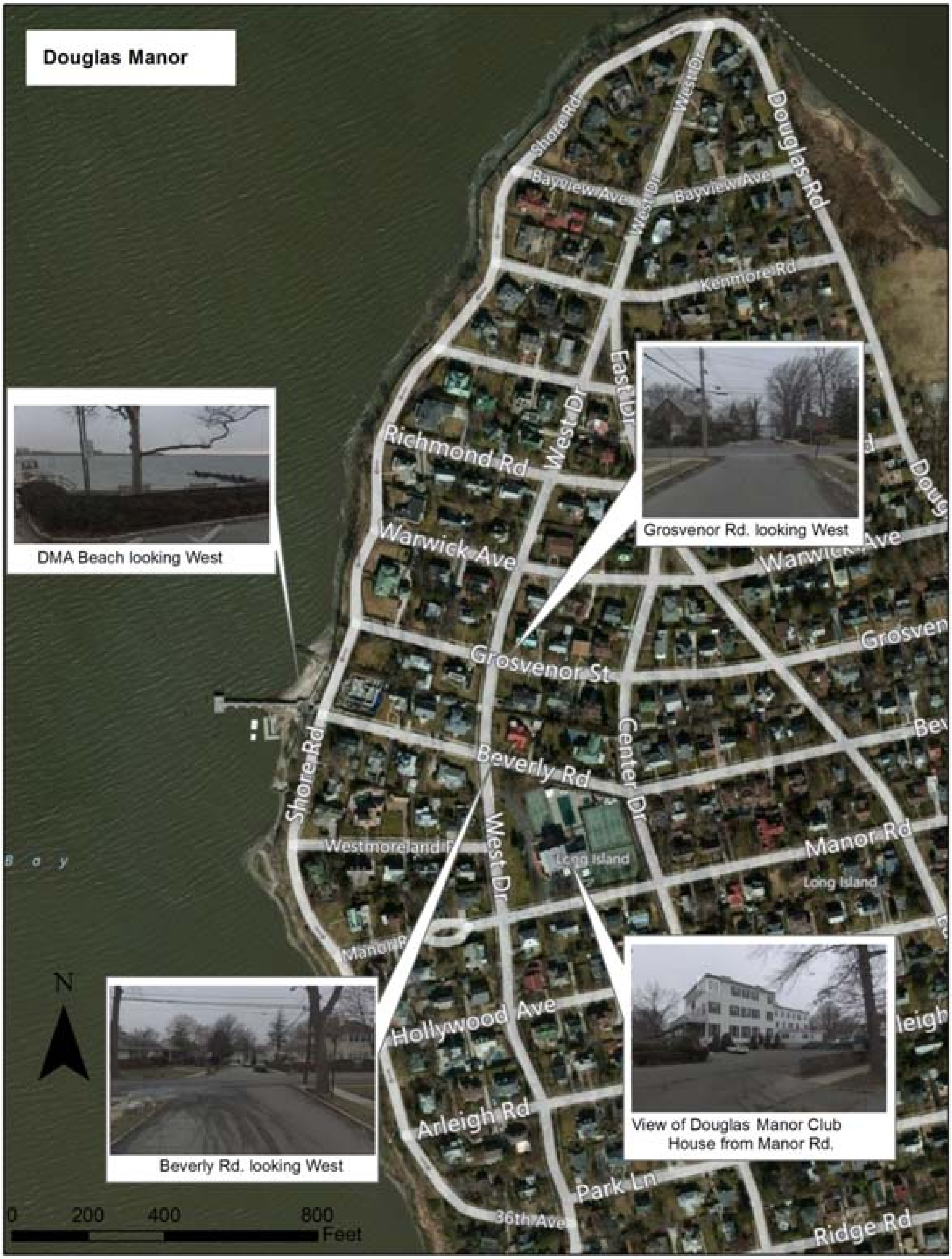


Figure 2-10. Douglas Manor Community

2.1.c.2 Stormwater and Wastewater Characteristics

The pollutant concentrations found in wastewater, combined sewage, and stormwater can vary based on a number of factors, including flow rate, runoff contribution, and the matrix of the waste discharged to the system from domestic and non-domestic customers. Since the matrix of these waste streams can vary, it can be challenging to identify a single concentration of pollutants to use for analyzing the impact of discharges from these systems to receiving waters.

To more effectively characterize pollutant loads from CSO discharges, the EPA's Nationwide Urban Runoff Program (NURP) developed the concept of the Event Mean Concentration (EMC). EMC is a function of total constituent mass, the total runoff volume, and percent amount of impervious cover in the sub-watershed (EPA, 1983).

Data collected from sampling events were used guide the selection of concentrations of CBOD, TSS, total coliform, fecal coliform, and enterococci to use in calculating pollutant loadings from various sources. Values noted below may not reflect actual measurements made in 2012, where there is reason to suspect the data as not being representative of actual conditions. Tables 2-5 and 2-6 show both the sanitary and stormwater concentrations for discharges to Alley Creek and Little Neck Bay from both the Tallman Island WWTP service area and Nassau County, respectively. Influent dry-weather samples at the WWTP were used to model sanitary concentrations (HydroQual, 2005b). Previously collected City-wide sampling data from Inner Harbor Facility Planning Study (DEP, 1994) was combined with data for the EPA Harbor Estuary Program (HydroQual, 2005a) to develop the stormwater concentrations.

Effluent data were taken from DEC discharge monitoring reports (DMR) submitted for the Belgrave WWTP by the Nassau County Department of Public Works, as shown on Table 2-7. The plant discharges an average of 1.3 MGD. Total coliform, fecal coliform, and enterococci are assumed to be negligible, since the facility provides disinfection.

Table 2-5. Sanitary and Stormwater Discharge Concentrations, Tallman Island WWTP

Constituent	Sanitary Concentration	Stormwater Concentration
$CBOD_5$ (mg/L) [1]	140	15
TSS (mg/L) [1]	130	15
Total Coliform Bacteria (MPN/100mL) [2,3]	$25x10^6$	150,000
Fecal Coliform Bacteria (MPN/100mL) [2,3]	$4x10^6$	35,000
Enterococci (MPN/100mL) [2,3]	$1x10^6$	15,000

(1) HydroQual, 2005b.
(2) Hydroqual Memo to DEP, 2005a.
(3) Bacterial concentrations expressed as "most probable number" (MPN) of cells per 100 mL.

Table 2-6. Stormwater Discharge Concentrations, Nassau County

Constituent	Stormwater Concentration
CBOD5 (mg/L) (1)	15
TSS (mg/L) (1)	15
Total Coliform Bacteria (MPN/100mL) (2,3)	50,000
Fecal Coliform Bacteria (MPN/100mL) (2,3)	25,000
Enterococci (MPN/100mL) (2,3)	15,000

(1) HydroQual, 2005b.
(2) Hydroqual Memo to DEP, 2005a.
(3) Bacterial concentrations expressed as "most probable number" (MPN) of cells per 100 mL.

Table 2-7. Belgrave WWTP (Nassau County) Discharge – Effluent[(1)]

Constituent	Concentration
$CBOD_5$ (mg/L)	10
TSS (mg/L)	10
Total Coliform Bacteria (MPN/100mL) [(2)]	<200
Fecal Coliform Bacteria (MPN/100mL) [(2)]	<200
Enterococci (MPN/100mL) [(2)]	<200

(1) DEC, DMR data, 475 MG/yr, at an average flow rate of 1.3 MGD.
(2) Disinfection practiced year-round.

A sampling program targeting CSO and other sources of pollutants contributing to Alley Creek and Little Neck Bay was implemented as part of this LTCP. Data were collected to supplement the flows/volumes and concentrations of various sources of pollutants to Alley Creek and Little Neck Bay. During dry weather, the flows and concentrations were collected from Oakland Lake and from a pond located south of the Long Island Expressway (LIE); these are continuous sources of flow and pollutants to Alley Creek. Both fresh water impoundments support recreational activities, such as bird-watching of diverse species of waterfowl that inhabit them, and as such, bacteria sampling was a vital element of this sampling program. Additionally, as identified by BWT's illicit sewer connection tracking and removal enforcement program, illegal connections to the stormwater sewers discharged through outfall TI-024 were detected and subsequently eliminated. These illicit connections generated a low flow contribution to upper Alley Creek with a high concentration of pollutants. Sampling of the sources above was conducted to provide information to the water quality modeling tasks, and the locations of these sources are depicted in Figure 2-11.

Sampling, data analyses, and water quality modeling calibration resulted in the assignment of flows and pollutant loadings to these sources of pollution for inclusion in the calibration of the water quality model for the 2011 and 2012 period.

Oakland Lake flows were determined based on three months of monitoring the lake outflow in the storm sewer that bypasses Chamber 6 upstream the Alley Creek CSO Retention Tank. The Duck Pond (pond south of LIE) flows were based on a few discrete measurements. Oakland Lake concentrations were based on a GM of dry-weather samples collected at the lake outlet during 2012. The Duck Pond concentrations were based on the dry-weather GM of samples collected during February 2013.

Figure 2-11. Upper Alley Creek Point – Source Locations

Data used during the calibration process for the years 2011 and 2012 suggested that constant sources of bacteria were located near the head of Alley Creek and near DMA Beach. High dry-weather concentrations could not be accounted for by the wet-weather CSO and stormwater sources. As part of the calibration process, dry-weather sources were added at TI-024 and DMA Beach. These sources were assigned the characteristics shown in Tables 2-8 and 2-9, respectively.

At TI-024, estimated groundwater infiltration (from short-term continuous metering of a 96 inch and 72 inch diameter storm sewers discharging through TI-024 during 2012) and suspected illicit connections were combined, to estimate flows and concentrations. The final concentrations were estimated as part of the calibration process. These loads were subsequently removed for the LTCP analysis, assuming that illicit discharges would be abated outside of the CSO LTCP process.

Table 2-8. Upper Alley Creek Source Loadings Characteristics

Source	Flow (MGD)	Enterococci (org./100 mL)	Fecal Coliform (cfu/100 mL)	BOD-5 (mg/L)
Oakland Lake flow through outfall TI-008	2.5	120	120	15
Upstream Pond	1.5	70	30	0
TI-024 Illicit Connections	0.04	1,000,000	4,000,000	15
TI-024 Infiltration	0.2	4,000	1,200	6.3
See Figures 2-9 and 2-11 for source locations				

Table 2-9. DMA Source Loadings Characteristics

Source	Flow (MGD)	Enterococci (org./100 mL)	Fecal Coliform (cfu/100 mL)	BOD-5 (mg/L)
DMA groundwater inflow (continuous)	0.06	50,000	100,000	0
DMA stormwater	Calculated from rainfall and runoff coefficient	300,000	700,000	15

During wet weather conditions, Alley Creek and Little Neck Bay receive flow contributions from multiple stormwater outfalls, CSO that exceeds the retention capacity of the 5 MG tank at TI-025, and direct runoff from unsewered drainage areas along the eastern shore of Little Neck Bay. In particular, at DMA, the runoff originated by the impervious surfaces of the lots and public roadways, along with the rainfall volume that exceeds the infiltration capacity of the pervious surfaces, is discharged to Little Neck Bay in the vicinity of DMA Beach, at the seven main locations depicted in Figure 2-12. Most of the runoff is conveyed as surface sheetflow or poorly-defined shallow surface flow, until crossing a concrete retaining wall between Shore Road and the beach. The main runoff drainage paths of the approximately 14 acres contributing directly to DMA Beach can be seen in Figure 2-12. The NYCDOT Capital Project HWQ-985, intended primarily to protect the concrete retaining wall from static force loads that compromise its stability, will divert runoff from the current discharge points on both sides of the pier at DMA Beach to a location farther south of the recreational area. The planned future configuration can be seen in Figure 2-13. This project is expected to be completed in 2016.

During dry weather, it is suspected that near surface groundwater flows downslope toward Little Neck Bay from DMA, carrying pathogens from septic systems with it. This suspected source of pollutants may also generate higher loadings during wet periods at a local geographical scale, when the ground water flow is higher. Groundwater flows were estimated by assuming 200 homes, with four persons per household contributing 75 gallons per capita per day. Concentrations were adjusted as part of the calibration process. These loads were subsequently removed from the LTCP analysis, assuming that this source would be abated outside of the CSO LTCP process.

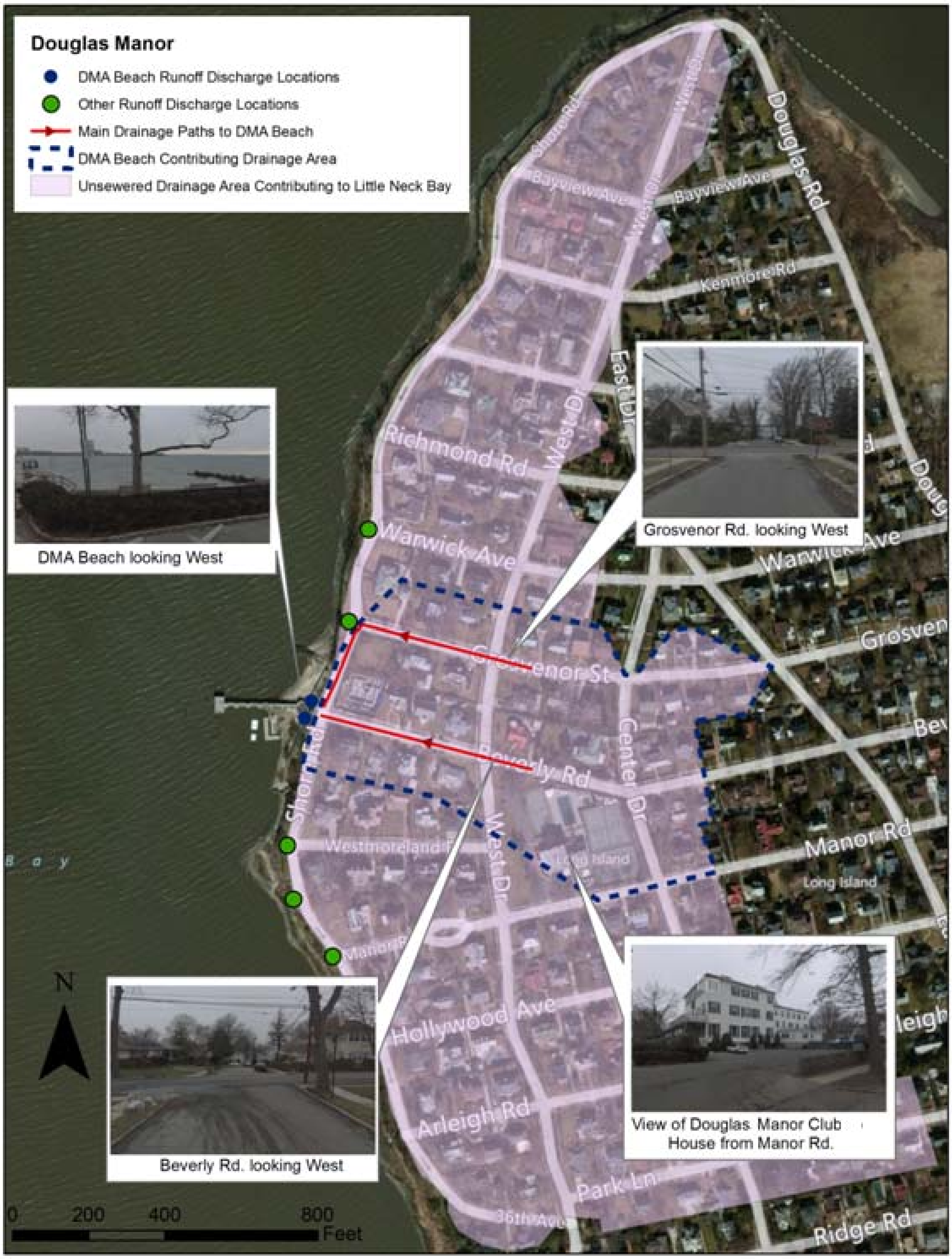


Figure 2-12. Little Neck Bay and DMA Beach Overland Drainage Characteristics

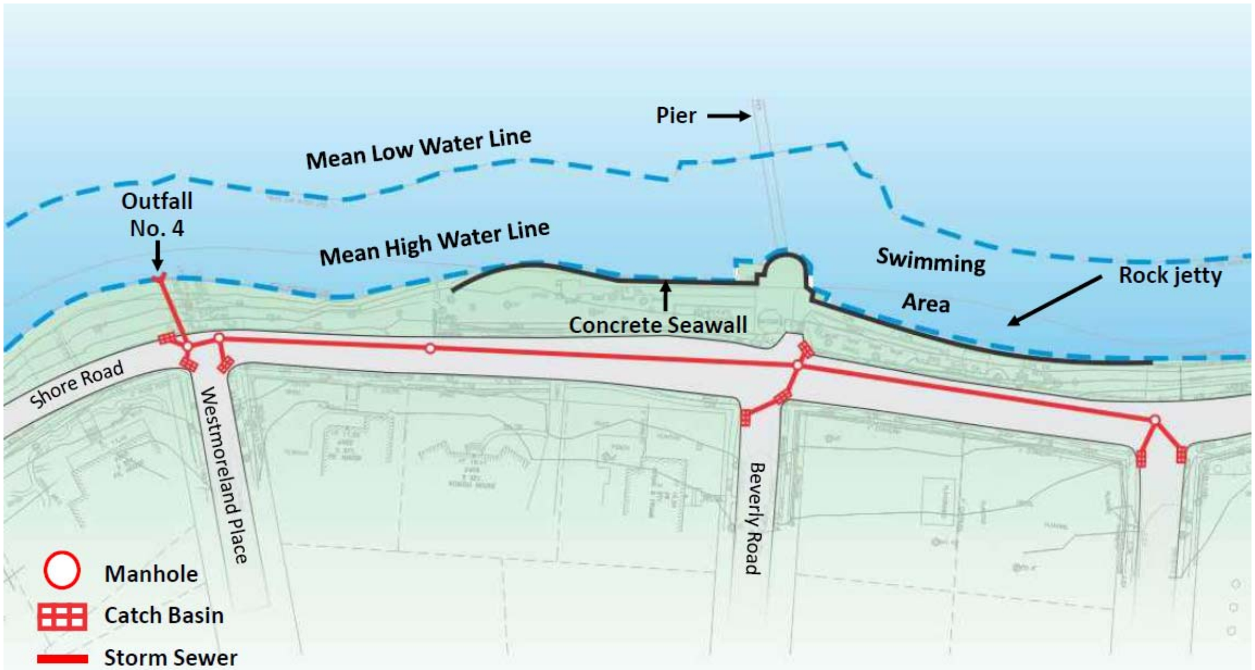


Figure 2-13. DMA Planned Drainage Improvements

The following characteristics were associated with the dry and wet weather sources of pollutants suspected to be associated with the septic systems in DMA.

2.1.c.3 Hydraulic Analysis of Sewer System

A City-wide hydraulic analysis was completed in December 2012 (an excerpt of which is included in this sub-section), to provide further insight into the hydraulic capacities of key system components and system responses to various wet weather conditions. Since the IW model was updated in the Alley Creek drainage area after this effort was completed, and in support of the development of this LTCP, the model results reported in this sub-section, while relevant for their intended use to document overall system-wide performance beyond the Alley Creek watershed, may differ slightly from volumes reported in the remainder of this LTCP report. The hydraulic analyses can be divided into the following major components:

- Annual simulations to estimate the number of annual hours that the WWTP is predicted to receive and treat up to 2xDDWFfor rainfall years 2008, and with projected 2040 DWFs; and
- Estimation of peak conduit/pipe flow rates that would result from a significant single event with projected 2040 DWFs.

A detailed presentation of the data were contained in the December 2012 Hydraulic Analysis Report submitted to DEC. The objective of each evaluation and the specific approach undertaken are briefly described in the following paragraphs.

Annual Hours at 2xDDWF for 2008 with Projected 2040 DWFs

Model simulations were conducted to estimate the annual number of hours that the Tallman Island WWTP would be expected to treat 2xDDWF for the 2008 precipitation year, which contained a total precipitation of 46.26 inches, as measured at the JFK Airport. These simulations were conducted using projected 2040 DWFs for two model input conditions – the re-calibrated model conditions as described in the June 2012 IW City-wide Recalibration Report, and the Cost-Effective Grey (CEG) alternative defined for the service area. The CEG elements represent the CSO controls that became part of the 2012 Order on Consent. For these simulations, the primary input conditions that applied were as follows:

- Projected 2040 DWF conditions.
- 2008 tides and precipitation data.
- WWTP at 2xDDWF capacity of 160 MGD.
- No sediment in the combined sewers (i.e., clean conditions).
- Sediment in interceptors representing the sediment conditions after the inspection and cleaning program completed in 2011 and 2012.
- No green infrastructure.

The CEG conditions applicable to the Tallman Island service area included the two CSO retention facilities and Whitestone Interceptor and associated sewer/regulator improvements. Due to the construction of Flushing Creek Retention Tank and associated Regulator TI-09 improvements in 2005, and completion of the Alley Creek Retention Tank in 2011, the recalibrated models include both of these facilities. The Whitestone Interceptor and associated sewer/regulator improvements therefore constitute the primary difference between pre-CEG and CEG scenarios. Key observations/findings are summarized below:

- Simulation of the 2008 annual rainfall year resulted in a prediction that the Tallman Island WWTP would operate at its 2xDDWF capacity for 49 hours under the no-CEG condition. When the CEG conditions were applied in the model, the annual number of hours at 2xDDWF increased to 99 hours.
- The total volume (dry and wet weather combined) treated at the plant annually for the 2008 non-CEG condition was predicted to be about 24,038 MG, while the 2008 with-CEG condition resulted in a prediction that 24,301 MG would be treated at the plant – an increase of 263 MG.
- The total Annual Average Overflow Volume (AAOV) predicted for the outfalls in the Tallman Island service area were as follows:
  - 2008 non-CEG: 2,163 MG
  - 2008 with CEG: 2,098 MG

The above results indicate an increase in the number of hours at the 2xDDWF operating capacity, an increased annual volume being delivered to the WWTP, and a decrease in AAOV from the outfalls in the service area.

Estimation of Peak Conduit/Pipe Flow Rates

Data tables containing information on several pipe characteristics were prepared, coupled with calculation of the theoretical, unsurcharged, full-pipe flow capacity of each sewer included in the model. To test the conveyance system response under what would be considered a large storm event condition, a single-event storm that was estimated to approximate a five-year return period (in terms of peak hourly intensity as well as total depth) was selected from the historical record.

The selected single event was simulated in the model for two conditions, the first being prior to implementation of CEG conditions, and the second with the CEG conditions implemented. The maximum flow rates and maximum depths predicted by the model for each sewer segment in the model were retrieved and aligned with the other pipe characteristics. Columns in the tabulations were added to indicate whether the maximum flow predicted for each conduit exceeded the unsurcharged, full-pipe flow, along with a calculation of the maximum depth in the sewer as a percentage of the pipe full height. It was suspected that potentially, several of the sewer segments could be flowing full, even though the maximum flow may not have reached the theoretical maximum full-pipe flow rate for reasons such as downstream tidal backwater, interceptor surcharge or other capacity-limiting reasons. The resulting data were then scanned to identify the likelihood of such capacity-limiting conditions, and also provide insight into potential areas of available capacity, even under large storm event conditions. Key observations/findings of this analysis are described below.

- Capacity exceedances for each sewer segment were evaluated in two ways for both interceptors and combined sewers:
  - Full flow exceedances, where the maximum predicted flow rate exceeded the full-pipe unsurcharged flow rate. This could be indicative of a conveyance limitation.
  - Full depth exceedances, where the maximum depth was greater than the height of the sewer segment. This could be indicative of either a conveyance limitation or a backwater condition.
- For the single storm event simulated, the model predicted that between 66 and 77 percent (by length) of the interceptor sewer segments would exceed full-pipe capacity flow for the non-CEG and CEG scenarios, respectively. About 30 to 37 percent (by length) of the upstream combined sewers would exceed their full-pipe flow under the same scenarios.
- Between 78 and 93 percent (by length) of the interceptors were predicted to flow at full depth or higher. Between 56and 59 percent (by length) of the combined sewers were also predicted to flow at full depth, and 72 percent of the combined sewers flowed at least 75 percent full.
- The results for the system condition with CEG improvements showed that the overall peak plant inflow and HGL near the plant improved, in comparison to the non-CEG conditions in the Tallman Island service area.
- About 72 percent of the combined sewers (by length) reached a depth of at least 75 percent under the CEG simulations. This indicates that little additional potential exists for in-line storage capability in the Tallman Island system.

Based on the review of various metrics, the Tallman Island system generally exhibits full or near-full pipe flows during wet weather, allowing little potential for inline storage capability.

2.1.c.4 Identification of Sewer System Bottlenecks, Areas Prone to Flooding and History of Sewer Backups

The DEP has made substantial improvements to the Alley Creek drainage system, in which over $90M was spent under Contract ER-AC1 to help eliminate some historical flooding issues. These drainage system improvements took place between from December 2002 through December 2006, and consisted of installing larger combined sewers in certain segments of the sewershed to increase conveyance capacity; constructing storm sewers in select drainage areas to reduce volume of storm water entering the combined system; and construction of associated combined and stormwater outfalls to discharge the excess wet weather flows. These drainage area improvements have substantially mitigated these historical flooding issues.

DEP maintains the operation of the collection systems throughout the five boroughs using a combination of reactive and proactive maintenance techniques. The City's "Call 311" system routes complaints of sewer issues to DEP for response and resolution. Though not every call reporting flooding or sewer backups (SBUs) correspond to an actual issue with the municipal sewer system, each call to 311 is responded to. Sewer functionality impediments identified during a DEP response effort are corrected as necessary.

2.1.c.5 Findings from Interceptor Inspections

In the last decade, DEP has implemented technologies and procedures to enhance its use of proactive sewer maintenance practices. DEP has many programs and staff devoted to sewer maintenance, inspection and analysis. GIS and Computerized Maintenance and Management System CMMS systems provide DEP with expanded data tracking and mapping capabilities, and can facilitate identification of trends to allow provision of better service to its customers. As referenced above, reactive and proactive system inspections result in maintenance including cleaning and repair as necessary. Figure 2-14 (next page) illustrates the interceptors that were cleaned for the Alley Creek sewershed.

DEP also conducted a sediment accumulation analysis to quantify levels of sediments in the combined sewer system and verify that the baseline assumptions are valid for this CSO LTCP. For this analysis, the normal approximation to the hypergeometric distribution was used to randomly select a sample subset of sewers representative of the modeled system as a whole, with a confidence level commensurate to that of the IW watershed model itself. Field crews investigated each location, and estimated sediment depth using a rod and tape. Field crews also verified sewer pipe sizes shown on the maps, and noted physical conditions of the sewers. The data were then used to estimate the sediment levels as a percentage of overall sewer area. The aggregate mean for the entire City was approximately 1.25 percent, with a standard deviation of 2.02 percent; the mean sediment accumulation in the Tallman Island drainage area was 1.00 percent, with a standard deviation of 1.63 percent. Table 2-10 shows the sediment depths for the interceptors in the Alley Creek sewershed.

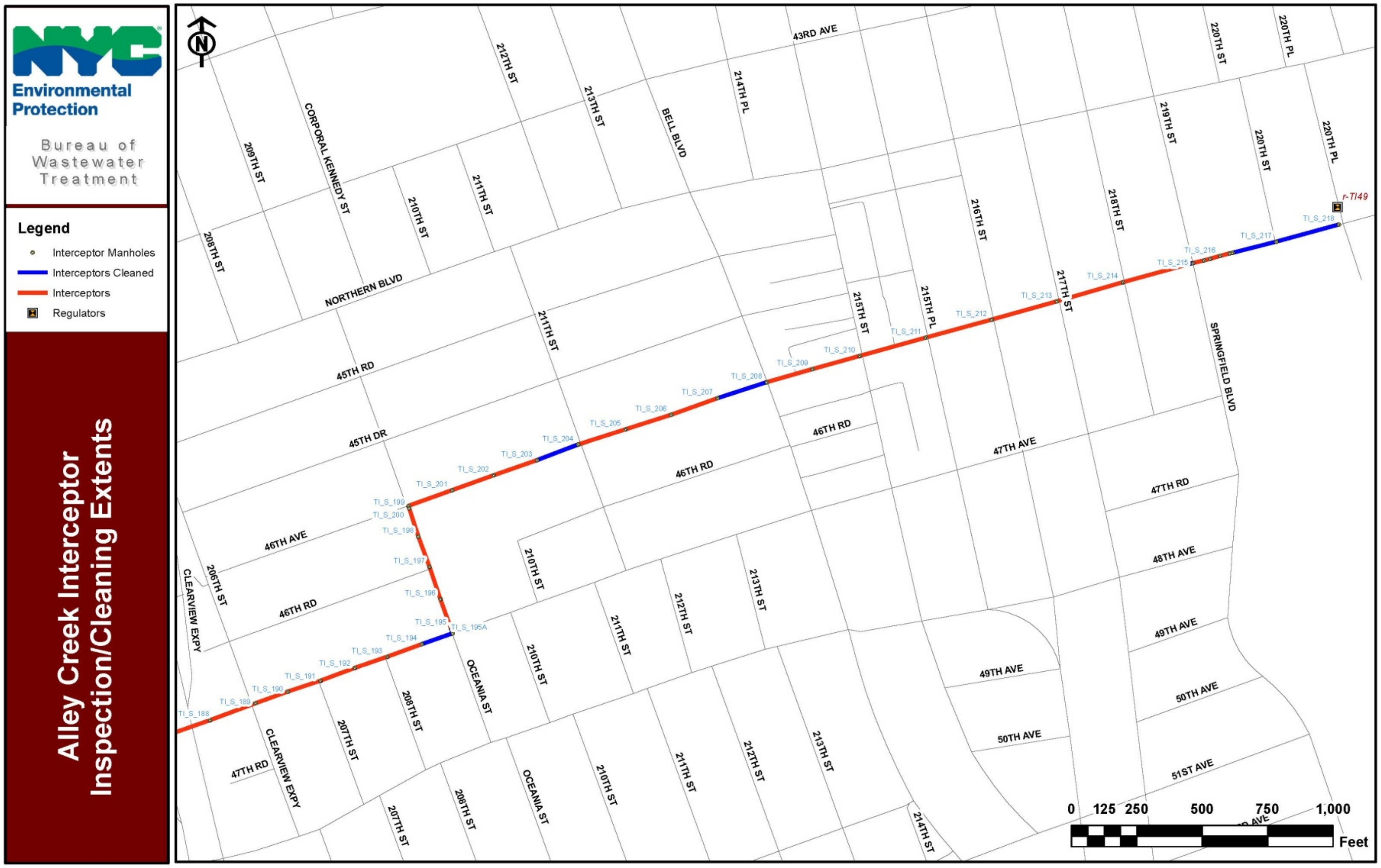


Figure 2-14. Alley Creek Interceptor Inspection Cleaning Extents

Table 2-10. Alley Creek Interceptor Inspection-Cleaning Map, 2012

Pipe ID	Surveyed Length (ft)	Pipe Diameter (in)	Avg Sed. Depth (in)	Date Cleaning Completed
TI_S_188	176.7	60	3.9	
TI_S_189	186.5	60	4.2	
TI_S_190	138.8	60	2.5	
TI_S_191	136.7	60	4.7	
TI_S_192	141.1	60	1.7	
TI_S_193	138.2	60	3.1	
TI_S_194	140.9	60	4.3	
TI_S_195	19.3	60	10.7	7/11/2012
TI_S_195A	124.2	60	9.1	7/11/2012
TI_S_196	144.4	60	7.7	
TI_S_197	132.1	60	5.7	
TI_S_198	120.7	60	5.2	
TI_S_199	112.8	60	5.9	
TI_S_200	8.5	60	4.9	
TI_S_201	178.1	60	5	
TI_S_202	168.2	60	5.3	
TI_S_203	176.7	60	8.6	
TI_S_204	170.2	60	13	5/19/2012
TI_S_205	189.5	54	6.8	
TI_S_206	186.5	54	5.9	
TI_S_207	190.0	54	4.4	
TI_S_208	198.5	54	8.8	5/18/2012
TI_S_209	182.3	54	2.8	
TI_S_210	185.0	54	4	
TI_S_211	261.0	54	3.2	
TI_S_212	264.2	54	4.4	
TI_S_213	260.6	54	5.3	
TI_S_214	260.1	54	4.4	
TI_S_215	21.1	54	8.7	7/3/2012
TI_S_215A	255.0	54	5.4	
TI_S_216	40.4	54	5.3	
TI_S_216A	25.1	54	6	
TI_S_216B	43.2	54	7.7	
TI_S_217	177.6	54	9.5	5/7/2012
TI_S_217A	11.3	54	5.3	
TI_S_217B	36.4	54	8.2	
TI_S_218	241.0	54	10.3	5/7/2012

2.1.c.6 Status of Receiving Wastewater Treatment Plants (WWTPs)

The Alley Creek and Little Neck Bay basin is entirely within the Tallman Island WWTP service area. The Tallman Island WWTP is currently undergoing upgrades for Biological Nutrient Removal (BNR) and improvements that will enable the collection system and treatment facility to delivery, accept, and treat influent at twice the plant's design flow during any storm event.

2.2 Waterbody Characteristics

This section of the report describes the features and attributes of Alley Creek and Little Neck Bay. Characterizing the features of these waterbodies is important for assessing the impact of wet weather inputs and creating approaches and solutions that mitigate the impacts from wet weather discharges.

2.2.a Description of Waterbody

Alley Creek and Little Neck Bay are tidal waterbodies located in eastern Queens and western Nassau County, New York. Alley Creek is tributary to Little Neck Bay, and the Bay is tributary to the East River. Alley Creek and Udalls Cove, an embayment of Little Neck Bay, have major areas of watershed preserved as parkland adjacent to the water. However, water quality in Alley Creek and Little Neck Bay is influenced by CSO and stormwater discharges. The following section describes the present-day physical and water quality characteristics of Alley Creek and Little Neck Bay, along with their existing uses.

2.2.a.1 Current Waterbody Classification(s) and Water Quality Standards

New York State Policies and Regulations

In accordance with the provisions of the CWA, the State of New York has established WQS for all navigable waters within its jurisdiction. The State has developed a system of waterbody classifications based on designated uses that includes five saline classifications for marine waters. DEC considers the Class SA and Class SB classifications to fulfill the CWA goals. Class SC supports aquatic life and recreation, but the primary and secondary recreational uses of the waterbody are limited due to other factors. Class I supports the CWA goal of aquatic life protection as well as secondary contact recreation. SD waters shall be suitable only for fish, shellfish and wildlife survival because natural or man-made conditions limit the attainment of higher standards. DEC has classified Alley Creek as Class I, and Little Neck Bay as Class SB.

Numerical criteria corresponding to these waterbody classifications are as shown in Table 2-11 (next page). Dissolved oxygen (DO) is the numerical criterion that DEC uses to establish whether a waterbody supports aquatic life uses. Total and fecal coliform bacteria concentrations are the numerical criteria that DEC uses to establish whether a waterbody supports recreational uses. In addition to numerical criteria, New York State has narrative criteria to protect aesthetics in all waters within its jurisdiction, regardless of classification (see Section 1.2.c.). As indicated in Table 2-11, these narrative criteria apply to all five classes of marine waters. Narrative WQS criteria are presented in Table 2-12.

Table 2-11. New York State Numerical Surface WQS (Saline)

Class	Usage	Dissolved Oxygen (mg/L)	Total Coliform (MPN/100mL)	Fecal Coliform (MPN/100mL)	Enterococci (MPN/100mL)
SA	Shellfishing for market purposes, primary and secondary contact recreation, fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥ 4.8(1) ≥3.0(2)	≤ 70(3)	N/A	-------
SB	Primary and secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥4.8(1) ≥3.0(2)	≤ 2,400(4) ≤ 5,000(5)	≤ 200(6)	≤ 35
SC	Limited primary and secondary contact recreation, fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥4.8(1) ≥3.0(2)	≤ 2,400(4) ≤ 5,000(5)	≤ 200(6)	N/A
I	Secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥ 4.0	≤ 10,000(6)	≤ 2,000(6)	N/A
SD	Fishing. Suitable for fish, shellfish and wildlife survival. Waters with natural or man-made conditions limiting attainment of higher standards.	≥ 3.0	N/A	N/A	N/A

Chronic criterion based on daily average. The DO concentration may fall below 4.8 mg/L for a limited number of days, as defined by the formula:

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

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

It should be noted that the enterococci criterion of 35 MNP/100 mL listed in Table 2-11, although not promulgated by DEC, is now an enforceable standard in New York State as EPA established January 1, 2005, as the date upon which the criteria must be adopted for all coastal recreational waters. Further, DEP interprets that the criterion is applicable to summer seasonal GM.

Table 2-12. New York State Narrative WQS

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.

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 IEC includes all tidal waters of greater New York City. Alley Creek and Little Neck Bay are interstate waters and are regulated by IEC as Class A waters. Numerical criteria for IEC-regulated waterbodies are shown in Table 2-13, while narrative criteria are shown in Table 2-14.

The IEC also restricts CSO discharges to within 24 hours of a precipitation event, consistent with the DEC definition of a prohibited dry weather discharge. IEC effluent quality regulations do not apply to CSOs if the CSS is being operated with reasonable care, maintenance, and efficiency. Although IEC regulations are intended to be consistent with State WQS, the three-tiered IEC system and the five New York State marine classifications in New York Harbor do not spatially overlap exactly.

Table 2-13. IEC Numeric WQS

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 River, east of the Whitestone Br.; Hudson River north of confluence with the Harlem River; Raritan River. east of the Victory Bridge 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 River, south of confluence with Harlem River; upper New York Harbor; East River from the Battery to the Whitestone Bridge; Harlem River; 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

Table 2-14. IEC 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.

EPA Policies and Regulations

For designated bathing beach areas, the EPA criteria require that an enterococci reference level of 104 cfu/100 mL to be used by agencies for announcing bathing advisories or beach closings in response to pollution events. DMA is a private club with a permit to operate a beach by DOHMH. DOHMH uses a 30-day moving GM of 35 cfu/100mL. If the GM exceeds that value, the beach is closed pending additional analysis. An enterococci of 104 cfu/100mL is an advisory upper limit used by DOHMH. If beach enterococci data are greater than 104 cfu/100 mL, a pollution advisory is posted on the DOHMH website. Additional sampling is initiated, and the advisory is removed when water quality is acceptable for primary contact recreation. Advisories are posted at the beach and on the agency web-site. In addition, there is a preemptive standing advisory for DMA Beach for no swimming for 48 hours after a rainfall of 0.2 inches in 2 hours, or a rainfall of 0.4 inches in 24 hours.

For non-designated beach areas of primary contact recreation, which are used infrequently for primary contact, the EPA criteria require that an enterococci reference level of 501cfu/100 mL be considered indicative of pollution events.

Little Neck Bay is classified SB (primary contact recreation use). With the exception of the DMA Beach, Little Neck Bay is used infrequently for primary contact recreation. These reference levels, according to the EPA documents, are not criteria, 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 are to be used for announcing beach advisories or beach closings in response to pollution events.

EPA released its Recreational Water Quality Criteria (RWQC) recommendations In December 2012 that are designed to protect human health in coastal and non-coastal waters designed for primary recreation use. These recommendations were based on a comprehensive review of research and science that evaluated the link between illness and fecal contamination in recreational waters. The recommendations are intended as guidance to states, territories, and authorized tribes in developing or updating WQS to protect swimmers from exposure to pathogens found in water with fecal contamination.

The 2012 RWQC offers two sets of numeric concentration thresholds, as listed in Table 2-15, and includes limits for both the GM (30-day) and a statistical threshold value (STV). The STV is a new limit, and is intended to be a value that should not be exceeded by more than 10 percent of the samples taken.

Table 2-15. 2012 RWQC Recommendations

Criteria Elements	**Recommendation 1 (estimated illness Rate 36/1,000)**		**Recommendation 2 (estimated illness Rate 32/1,000)**	
Indicator	**GM (cfu/100 mL)**	**STV (cfu/100 mL)**	**GM (cfu/100 mL)**	**STV (cfu/100 mL)**
Enterococci (marine and fresh)	35	130	30	110
E. coli (fresh)	126	410	100	320

While DEC is planning to adopt the RWQC by 2015, it is not known at this time how these recommendations will be used to update water quality criteria.

2.2.a.2 Physical Waterbody Characteristics

Alley Creek and Little Neck Bay are located in the northeastern corner of Queens, near the Nassau County border. Alley Creek opens into the southeast end of Little Neck Bay. Little Neck Bay opens to the East River, between Willets Point and Elm Point, near the western portion of the Long Island Sound. Udalls Cove, an embayment on the eastern shore of Little Neck Bay, spans the Queens/Nassau County border, between Douglas Manor and Great Neck Estates.

Alley Creek is located at the southern end of Little Neck Bay, and is contained within Alley Pond Park. The tidal tributary runs northward and its mouth opens to Little Neck Bay. The 624-acre park contains forests, several ponds, facilities for active landside recreation, salt marshes and wetlands, and the creek itself. The creek constitutes one of the few remaining undisturbed marsh systems in the City. The head of Alley Creek is near the intersection of the Cross Island Parkway and the Long Island Expressway. Freshwater flows to Alley Creek include stormwater and CSO discharge. Alley Creek water quality is also influenced by the saline water of Little Neck Bay.

Little Neck Bay comprises an area of approximately 1,515 acres. This open water fish and wildlife habitat extends to Fort Totten in the west, and the village of Elm Point, Nassau County in the east. The bay is bordered by residential development, Fort Totten and the Cross Island Parkway. According to the New

York City Comprehensive Waterfront Plan entitled “Plan for the Queens Waterfront” issued by the DCP, Little Neck Bay is one of the major waterfowl wintering areas on Long Island’s north shore. In addition to waterfowl use, Little Neck Bay is a productive area for marine fish and shellfish. As a result of the abundant fisheries in the bay and its proximity to the metropolitan New York area, Little Neck Bay is a regionally important recreational fishing resource.

Udalls Cove is located in the northeastern corner of Queens and extends into Nassau County. The New York City portion comprises an area of approximately 52 acres, from Little Neck Bay to the vicinity of Northern Boulevard. Most of Udalls Cove is mapped as parkland and managed by DPR as the Udalls Cove Preserve.

Little Neck Bay, Alley Creek, and Udalls Cove are located within the Coastal Zone Boundary and within a Special Natural Waterfront Boundary as designated by the DCP. All three waterbodies are also located within Significant Coastal Fish and Wildlife Habitats, as designated by the New York State Department of State (DOS).

Shoreline Physical Characterization

Alley Creek is predominantly characterized by natural, vegetated shorelines, except for the footings of the bridges for the Long Island Railroad and Northern Boulevard. The Creek is contained within Alley Pond Park, except for the eastern shore north of the Long Island Railroad. Little Neck Bay is generally characterized by altered shorelines, mainly rip-rap, with some bulkhead from Bay Street to Shore Road and from Westmorland Drive to Bayview Avenue in Douglaston. Based on field observations, vegetation exists on the waterside of some of the altered areas of Parsons Beach and Douglaston. Natural, sandy and natural, vegetated areas exist along the shores of Little Neck Bay in the inlet on the southeastern portion of Fort Totten, near the mouth of Alley Creek, along the Parsons Beach and Douglaston shore, and in Udalls Cove. Most of the natural shoreline areas are within parkland. Small piers also exist along the shores, mainly along the Douglaston Peninsula.

Figures 2-15, 2-16 and 2-17 show shoreline typical for the regions of the study area. Figure 2-15 shows the rip-rap that typically fortifies much of the western shoreline of Little Neck Bay. Figure 2-16 shows the varied types of bulkheading, rip-rap and natural shoreline found along the eastern shoreline of Little Neck Bay. Figure 2-17 shows the natural shorelines typical around the southern end of Little Neck Bay and Alley Creek.

The shorelines of Udalls Cove, an embayment of Little Neck Bay, consist primarily of natural, vegetated areas. Intact, concrete bulkhead areas exist from Bayview Drive to the mouth of the cove. Along Virginia Point near the Nassau County border, dilapidated timber bulkheads exist among the wetland vegetation. Much of the shoreline along the western edge of the cove borders residential areas or the esplanade park that runs between Marinette Street and the water. These areas are natural in the sense that they lack riprap or bulkheading, although many of these areas are maintained by landscapers, and may have been modified during road and property development.

In Udalls Cove, from the Long Island Railroad in the south to north of Sandhill Road, Gablers Creek runs through the wetlands of Aurora Pond and the cove. The Gablers Creek in this area is contained within a cobble-lined ditch. Physical shoreline conditions and shoreline habitat are as shown in Figure 2-18.

Shoreline Slope

Shoreline slope has been qualitatively characterized along shoreline banks where applicable, and where the banks are not channelized or otherwise developed with regard to physical condition. Steep is defined as greater than 20 degrees, or 80-foot vertical rise for each 200-foot horizontal distance perpendicular to the shoreline. Intermediate is defined as 5 to 20 degrees. Gentle is defined as less than 5 degrees, or 18-

foot vertical rise for each 200-foot horizontal distance. In general, the three classification parameters describe the shoreline slope well for the purposes of the LTCP project.

Gentle and intermediate slopes characterize the shorelines of Little Neck Bay, Alley Creek and Udalls Cove. The slope of the eastern shoreline of Little Neck Bay is generally characterized as intermediate. The slope of the western shoreline is generally characterized as gentle, with an area of intermediate shoreline located along Fort Totten. The slopes of both shorelines of Alley Creek are characterized as gentle. The slope of the eastern shoreline of Udalls Cove is characterized as gentle. The slope of the western shore is characterized as predominantly gentle, with one area of intermediate slope. The area of intermediate slope extends along the shoreline from Beverly Road to the mouth of the cove. Shoreline slopes are as shown in Figure 2-19.

Figure 2-15. Western Shoreline of Little Neck Bay Near 27th Ave. (Looking West)

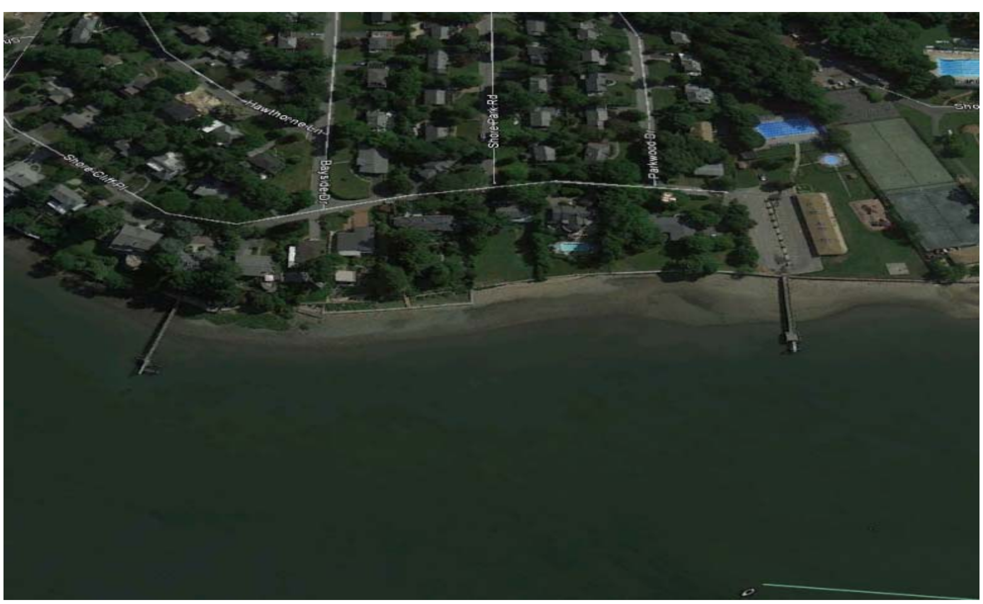


Figure 2-16. Eastern Shoreline of Little Neck Bay Near Shorecliff Place (Looking West)

Figure 2-17. Shoreline of Alley Creek (Looking North)

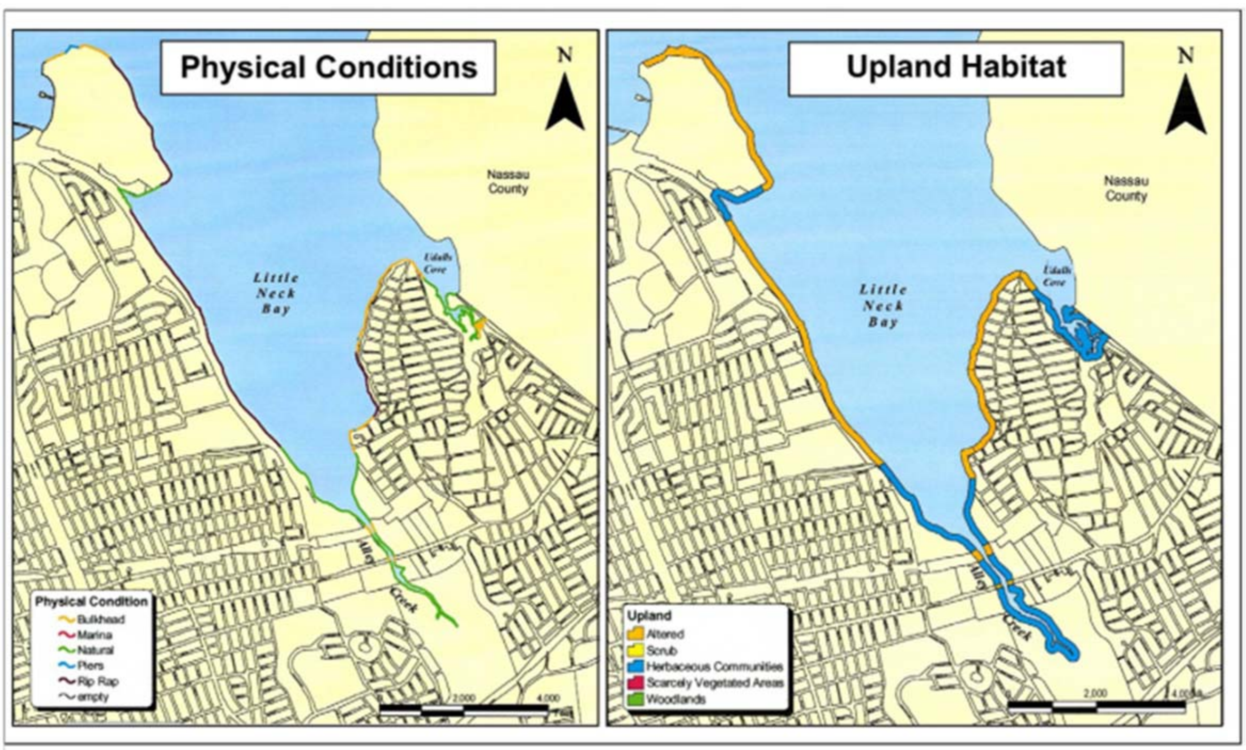


Figure 2-18. Shoreline Physical Conditions and Upland Habitat

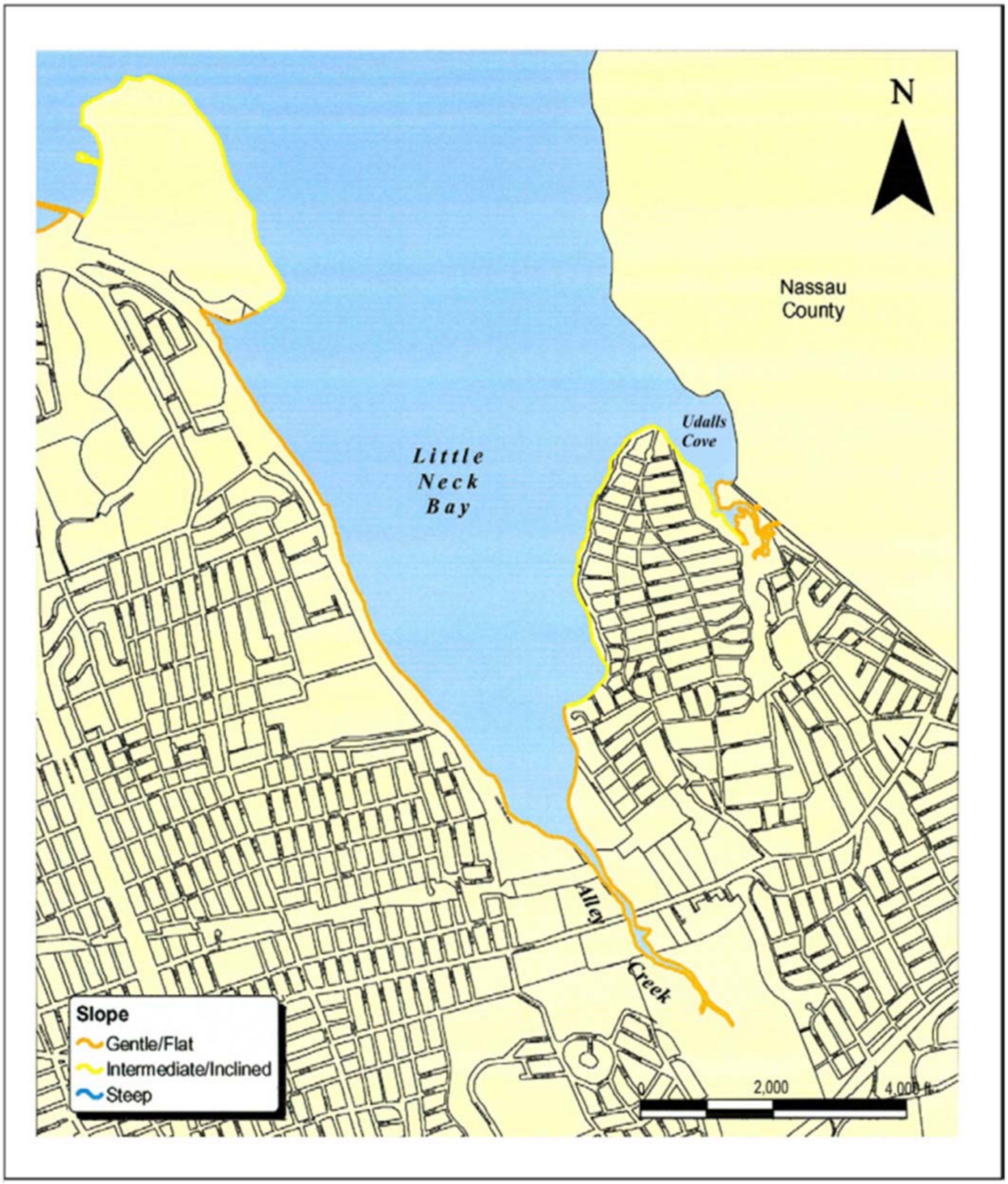


Figure 2-19. Alley Creek Existing Shoreline Slope

Waterbody Sediment Surficial Geology/Substrata

The waterbody bottom of Little Neck Bay is generally characterized as sand. The waterbody bottom of Alley Creek is generally characterized as mud/silt/clay. These classifications have been assigned based on the following two sediment sampling programs, which analyzed sediment grain size: grab samples taken at one HydroQual, Inc. sampling station in 2001; and grab samples taken at three HydroQual sampling stations in 2002. Both sampling programs were conducted as part of a Use and Standards

Attainment Study (USA) performed for DEP. For the purpose of defining surficial geology/substrata, those areas where bottom samples were more than 50 percent mud/silt/clay were designated as mud/silt/clay; those areas where bottom samples were more than 50 percent sand were designated as sand. Based on one Little Neck Bay grab sample taken by USA (2001), bottom mud/silt/clay composition was approximately 16.5 percent, while sand composition was 83.5 percent.

USA sediment sampling (July 2002) consisted of one grab collected at one station in Little Neck Bay and two in Alley Creek. For the sample obtained in Little Neck Bay, bottom mud/silt/clay composition was approximately 37.40 percent, and sand composition was approximately 62.6 percent. For the two samples obtained in Alley Creek, bottom mud/silt/clay composition ranged from approximately 61.38 to 85.15 percent, while sand composition ranged from approximately 14.85 to 38.62 percent.

Waterbody Type

Little Neck Bay and the mouth of Udalls Cove are classified as embayments. Alley Creek and the portion of Udalls Cover south of Knollwood Avenue are classified as tidal tributaries. Freshwater sources to Udalls Cove include Gablers Creek, the Belgrave WWTP discharge, and discharge from the freshwater wetlands located near the cove. Similarly, Alley Creek receives freshwater from stormwater and CSO discharge, from groundwater inflows, and from the freshwater wetlands located near the Creek. All of the waters in the Alley Creek and Little Neck Bay waterbody assessment area are tidal and saline.

Tidal/Estuarine Systems Biological Systems

Tidal/Estuarine Wetlands

Tidal/Estuarine generalized wetlands in the Alley Creek and Little Neck Bay watershed are shown in Figure 2-20 and are described in this section. According to the DEC tidal wetlands maps, there are numerous designated wetlands mapped throughout the study area. The western and eastern shorelines of Little Neck Bay support many areas of inter-tidal marshes from Willets Point to the mouth of Alley Creek, with an area of coastal shoals, bars and mudflats mapped to the south and southwest of Fort Totten. Extensive wetlands have been mapped by the DEC on both shores of Little Neck Bay south of Parsons Beach and Crocheron Park and throughout Alley Creek. These extensive wetlands tend to be mapped with high marsh or salt meadow wetlands inland of inter-tidal marsh wetlands, and in some areas, most notably north of the Long Island Railroad and surrounding the mouth of Alley Creek, the wetland areas are mapped on the order of 1,000 feet wide. Formerly connected wetlands are also mapped immediately south of the Long Island Railroad, inland from Alley Creek.

Udalls Cove, an embayment of Little Neck Bay, also supports extensive wetlands, generally with inter-tidal marsh wetlands and high marsh or salt meadow wetlands mapped inland of coastal shoals, bars and mudflats. The open waters of Little Neck Bay are generally mapped as littoral zone. The DEC maps designate three discontinuous inter-tidal wetland areas along the western bank of Little Neck Bay and Alley Creek, from roughly 1,500 feet southeast of Willets Point, along the east and south shorelines of Fort Totten, and south to 23rd Street. Three other areas of discontinuous inter-tidal marsh wetlands are mapped from 28th Road to Crocheron Park. A continuous inter-tidal wetland area is mapped from 35th Avenue to the Long Island Railroad. South of the Long Island Railroad, inter-tidal marshes are mapped roughly from 440 to 520 feet and 880 to 1,500 feet south of Northern Boulevard and 1,860 feet south of Northern Boulevard to the head of Alley Creek. High marsh or salt meadow wetlands are mapped from 37th Avenue to the Long Island Railroad, and from roughly 120 to 1,520 feet south of Northern Boulevard.

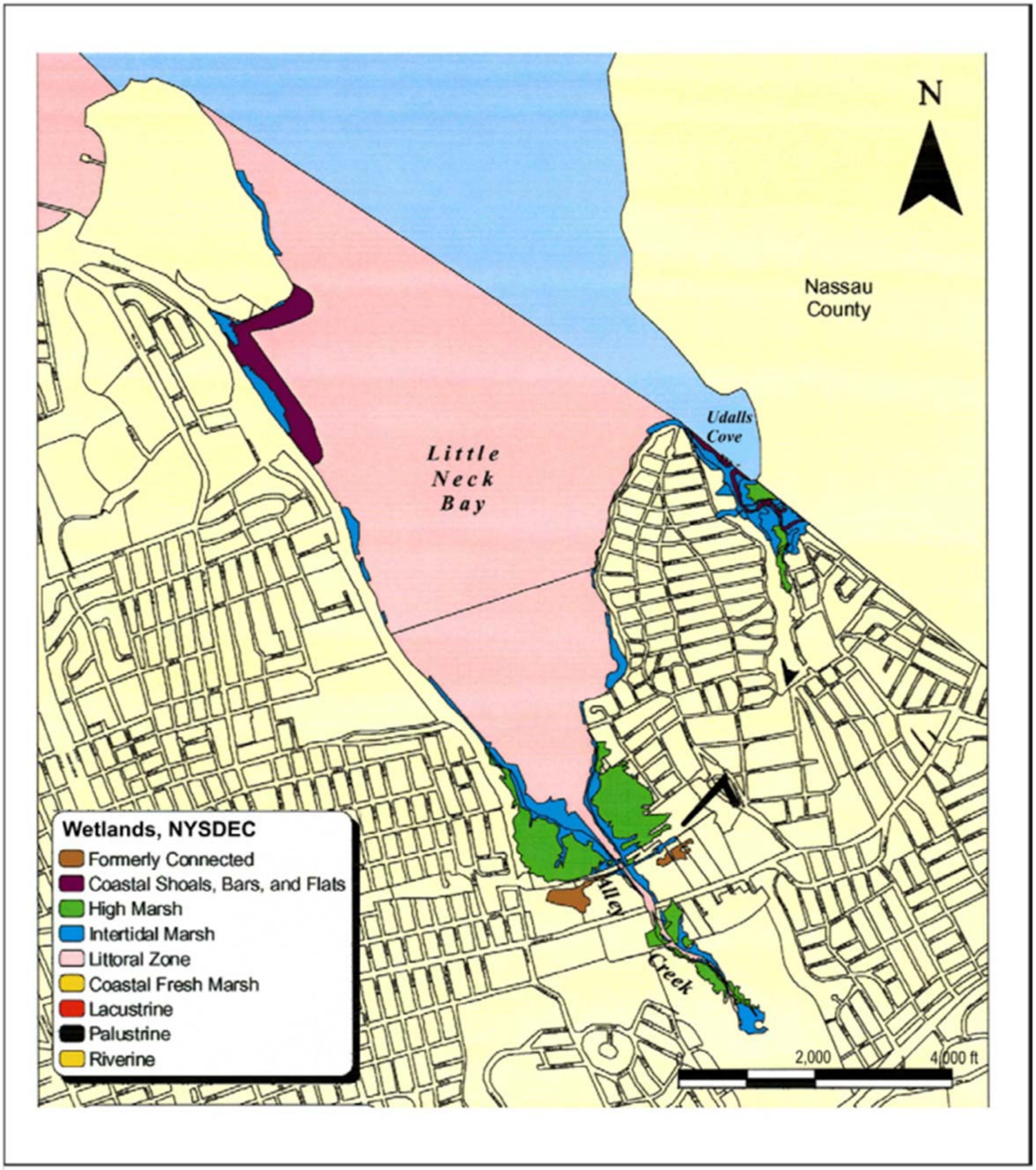


Figure 2-20. DEC Existing Mapped Wetlands. Source: WWFP, June 2009

The DEC maps also show inter-tidal marsh wetlands along the eastern shorelines of Little Neck Bay and Alley Creek. Two areas of inter-tidal marsh wetlands are mapped from the pier at Beverly Road to Manor Road. Other areas of inter-tidal marsh wetlands exist from Arleigh Road to 233rd Street, from Regatta Place to Bay Street, and from just south of Bay Street, to the Long Island Railroad. The DEC maps show inter-tidal marsh wetlands stretching along the eastern shore of Alley Creek, from the Long Island Railroad to Northern Boulevard. South of Northern Boulevard, the inter-tidal marsh wetlands are not contiguous and are interspersed along the eastern shoreline, from Northern Boulevard to the mouth of Alley Creek, from roughly 100 to 280 feet south of Northern Boulevard, from 360 to 1,380 feet south of Northern Boulevard, and from approximately 1,660 feet south of the boulevard to the head of the Creek. High marsh or salt meadow wetlands are also mapped as interspersed along the eastern shoreline of Little Neck Bay and Alley Creek, from Little Neck Road to the Long Island Railroad, adjacent to the south edge of the Long Island Railroad, from 100 to 720 feet south of Northern Boulevard, from approximately 780 to 800 feet south of Northern Boulevard, and from approximately 1,380 to 1,680 feet south of the boulevard.

Thin extensions of inter-tidal marsh wetlands, from about 20 to 60 feet wide, extend inland from both shorelines of Alley Creek, along the southern edge of the Long Island Railroad, parallel to the train tracks. To the east of Alley Creek, these inter-tidal marsh wetlands extend roughly 840 feet inland along the train tracks, and two areas of formerly connected wetlands are mapped to the south of these inter-tidal wetlands, approximately 300 and 560 feet inland of the Creek. To the west of Alley Creek, the inter-tidal wetlands extend inland approximately 240 feet along the railroad tracks, with a small break between them, and an area of formerly connected wetlands that extends inland for approximately another 1,000 feet.

In the New York City portion of Udalls Cove, the DEC has mapped inter-tidal marsh wetlands from the mouth to approximately 2,500 feet south of the mouth, along both east and west shorelines. High marsh or salt meadow wetland areas are mapped in the study area, from approximately 2,000 feet to 3,000 feet southeast of the mouth of the cove, along the western shoreline of the cove. Coastal shoals, bars and mudflats are mapped throughout the mouth, and along the open water portions of Udalls Cove within the study area. The wetlands of Udalls Cove extend up to 1,600 feet from the western shoreline in New York City to the eastern shoreline in Nassau County.

The United States Fish and Wildlife Service National Wetlands Inventory (NWI) maps show extensive wetlands throughout the Little Neck Bay, Alley Creek, and Udalls Cove study area. The NWI mapped wetlands are shown in Figure 2-21, and Table 2-16 summarizes the classification used. In the inlet between Forth Totten and Bay Terrace, three adjacent wetland areas – estuarine, inter-tidal, flat, regular (E2FLN); estuarine, inter-tidal, emergent persistent, irregular (E2EM1P); and palustrine, emergent, persistent, semi-permanent (PEM1F) – are mapped in series, stretching to the northwest from the mouth of the inlet on Little Neck Bay. Along the western shoreline of Little Neck Bay, there are two areas of estuarine, inter-tidal, beach/bar, regular (E2BBN) wetlands between 17th and 29th Avenues. Along the eastern shoreline of Little Neck Bay, the NWI has mapped E2BBN wetlands at 33rd Street, and estuarine, inter-tidal, emergent, narrow-leaved persistent, regular (E2EM5N) wetlands along Parsons Beach. South of Crocheron Park, on the western shoreline of Little Neck Bay and Alley Creek, and south of Parsons Beach, on the eastern shoreline of the bay and creek, the NWI has mapped multiple wetland areas along both shorelines that span the waterbodies.

Listed from north to south, these wetland areas include E2EM5N, estuarine, inter-tidal, emergent, narrow-leaved persistent, irregular (E2EM5P); E2EM1P; and another area of E2EM5P; stretching from southern Little Neck Bay to the head of Alley Creek. An area of estuarine, sub-tidal, open water/unknown bottom, sub-tidal (E1OWL) wetland is mapped inland, to the west of Alley Creek, northwest of the Cross Island Expressway cloverleaf, and south of the Long Island Railroad. The open waters of Alley Creek are mapped estuarine, inter-tidal, streambed, irregularly exposed (E2SBM) wetlands.

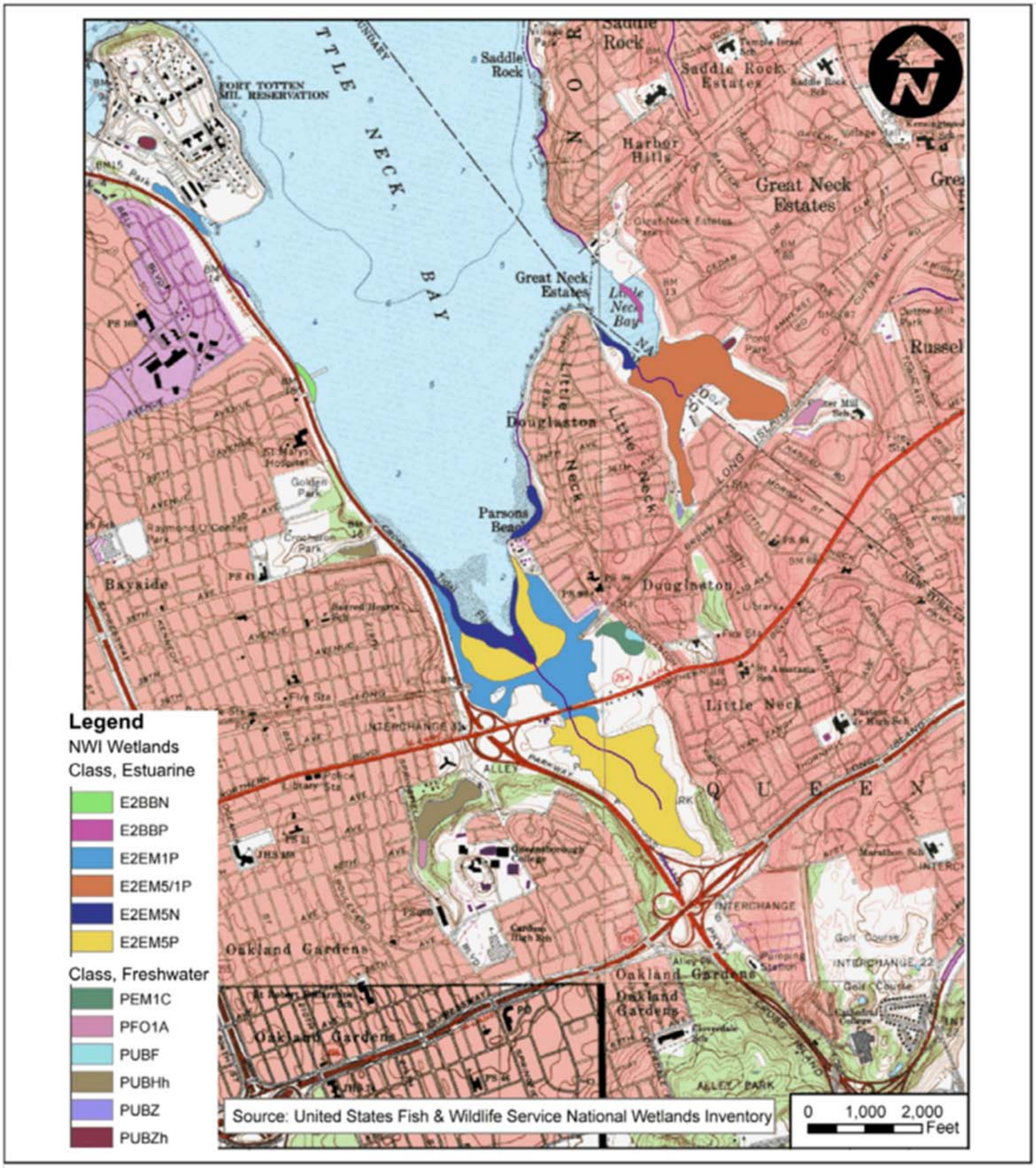


Figure 2-21. National Wetlands Inventory (NWI) Source: WWFP, June 2009

Table 2-16. NWI Classification Codes

NWI Classification	Description
E1OWL	Estuarine, sub-tidal, open water/unknown bottom, sub-tidal
E2BBN	Estuarine, inter-tidal, beach-bar, regular
E2BBP	Estuarine, inter-tidal, beach-bar, irregular
E2EM1P	Estuarine, inter-tidal, emergent-persistent, irregular
E2EM5/1P	Estuarine, inter-tidal, emergent, narrow-leaved persistent/persistent, irregular
E2EM5N	Estuarine, inter-tidal, emergent, narrow-leaved, persistent, regular
E2EM5P	Estuarine, inter-tidal, emergent, narrow-leaved, persistent, irregular
E2FLN	Estuarine, inter-tidal, flat, regular
E2SBM	Estuarine, inter-tidal, streambed, irregularly exposed
PEM1C	Palustrine, emergent, persistent, seasonal
PEM1F	Palustrine, emergent, persistent, semi-permanent
PFO1A	Palustrine, forested, broad-leaved deciduous, temporarily flooded
POWF	Palustrine, open water/unknown bottom, intermittently exposed/permanent
POWZ	Palustrine, open water/unknown bottom, intermittently exposed/permanent
PUBF	Palustrine, unconsolidated bottom, semi-permanent
PUBHh	Palustrine, unconsolidated bottom, permanent, diked/impounded
PUBZ	Palustrine, unconsolidated bottom, intermittently exposed/permanent
PUBZh	Palustrine, unconsolidated bottom, intermittently exposed/permanent, diked/impounded

The NWI mapped multiple wetlands along the shorelines of Udalls Cove. The open waters of the cove are mapped as E10WL. Within the New York City study area of Udalls Cove, the western shoreline north of 28th Avenue is mapped as E2EM5N. South of 28th Avenue, both shorelines of Udalls Cove within the study area are mapped as estuarine, inter-tidal, emergent, narrow-leaved persistent/persistent, irregular (E2EM5/1P) wetlands. The NWI has mapped the waters as E2SBM where the cove's open waters narrow into a tidal river.

Aquatic and Terrestrial Communities

The DCP Plan for the Queens Waterfront (DCP, 1993) reports a diverse range of species supported by the habitat in the Alley Creek and Little Neck Bay area. Little Neck Bay is a productive area for marine finfish and shellfish. The Bay serves as an important nursery and feeding area for striped bass and numerous other species. A variety of finfish species can be found in the tidal shallows and Alley Creek. Although its waters are not certified for commercial shellfishing, Little Neck Bay is a hard clam producing area. Alley Pond Park and Udalls Cove contain abundant shellfish and crustaceans. The habitats also serve as breeding areas for several species of birds, as a spring and fall stopover for several migratory species, and as avian wintering areas for several species. Shorebirds and wading birds use the Udalls Cove area extensively. The area also supports numerous terrestrial and amphibious wildlife species. A more detailed summary of the aquatic and terrestrial communities can be found in the June 2009 Alley Creek and Little Neck Bay WWFP.

Freshwater Systems Biological Systems

The generalized freshwater wetlands areas shown in Figure 2-20 are described in more detail in this section. The DEC Freshwater Wetlands Maps show seven areas of fresh water wetlands in the study area. The areas are mapped in the inlet between Fort Totten and Bay Terrace, extending along the Cross Island Parkway southeast of Totten Avenue; on the west shoreline of Alley Creek, extending south along the Cross Island Parkway from the cloverleaf at Northern Boulevard to the Creek, roughly 800 feet south of Northern Boulevard; inland from the eastern shoreline of Alley Creek, extending along the southern edge of the Long Island Railroad and the western edge of the Douglaston Parkway; in two discontinuous areas along both shorelines of Alley Creek, from roughly 600 feet south of Northern Boulevard to the head of thecreek; and in Udalls Cove, from Hollywood Avenue to Sandhill Road, and between Sandhill Road and the Long Island Railroad.

The NWI maps show three areas of freshwater (palustrine) wetlands in the Little Neck Bay, Alley Creek, and Udalls Cove study area, as indicated in Figure 2-21. In the inlet between Fort Totten and Bay Terrace, a palustrine, emergent, persistent, semi-permanent (PEM1F) wetland is mapped at the northeast edge of tidal wetlands, as described above. An area of palustrine, emergent, persistent, seasonal (PEM1C) is mapped inland of the eastern shore of Alley Creek adjacent, to the southern edge of the Long Island Railroad, with an area of palustrine, open water/unknown bottom, intermittently exposed/permanent (POWF) wetlands adjacent to the PEM1C wetlands. In addition, an area of palustrine, open water/unknown bottom, intermittently exposed/permanent (POWZ) is mapped to the west of Udalls Cove, between Sandhill Road and the Long Island Railroad.

2.2.a.3 Current Public Access and Uses

Alley Creek, its shoreline, areas immediately adjacent to the water, and much of the surrounding drainage area of the creek are within Alley Pond Park. Access to Alley Creek is provided for by the park but no facilities for primary contact recreation are available. The park does not provide any regular secondary contact recreation opportunities; however, the Urban Park Rangers do run structured programs. One such program, “Alley Pond Adventure”, is an overnight summer camping program that includes supervised canoeing (secondary contact recreation use) and fishing.

The major use of Alley Creek is passive, non-contact recreation. There are hiking trails that offer views of the water. Another significant, passive use of Alley Creek is for environmental education associated with wetlands habitat. The Alley Pond Environmental Center, located near the mouth of Alley Creek offers an extensive naturalist program with outreach to schools throughout the City.

Swimming (primary contact recreation use) is an existing use in Little Neck Bay at the privately owned bathing beach located on the eastern shore of the bay at Douglas Manor. As seen in Figure 2-9, the DMA Beach is located approximately 0.7 miles north of the mouth of Alley Creek, and approximately one mile downstream from the principal CSO outfall on Alley Creek, TI-025. DOHMH beach monitoring is conducted weekly during the bathing season from May through September. In addition to the supervised bathing at the DMA Beach, bathing has been reported to occur from the boating docks along this shoreline, but this is not a sanctioned use.

On the western side of Little Neck Bay, access to the water is limited by the Cross Island Parkway, which runs parallel to the shoreline. There is no swimming noted along this shoreline. Access to the Bay for boating (secondary contact recreation use) is provided at the public marina in Bayside, operated under a concession from the DPR. This facility is open seasonally between May 1 and October 31, and has accommodation for 150 boats. Fort Totten, located at the northeast point of Little Neck Bay, is also operated by DPR, and provides public access for canoeing and kayaking. In addition, fishing is allowed from the docks for special events.

Passive recreation is a major use of Little Neck Bay. There is also a hiking/bicycle path that runs between the shoreline of Little Neck Bay and the Cross Island Parkway, providing viewing of the Bay, and fishing takes place along this pathway. Another wetland area used for environmental education is Aurora Pond, adjacent to Udalls Cove, an eastern tributary to the Little Neck Bay. Environmental education, hiking, biking, and promenades are passive waterbody uses that do not involve either primary or secondary contact with the water. Fishing in Little Neck Bay may include limited contact with the water.

These locations are further discussed in Section 8.6.

2.2.a.4 Identification of Sensitive Areas

Federal CSO Policy requires that the LTCP give the highest priority to controlling overflows to sensitive areas. 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;
- Waters with threatened or endangered species and their habitat; and
- Additional areas determined by the Permitting Authority (i.e., DEC).

General Assessment of Sensitive Areas

An analysis of the waters of the Alley Creek and Little Neck Bay with respect to the CSO Policy was conducted and is summarized in Table 2-17.

Table 2-17. Sensitive Areas Assessment

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

(1) Classifications or Designations per CSO Policy.
(2) As shown at http://www.sactuaries.noaa.gov/oms/omsmaplarge.html.
(3) DOS Significant Coastal Fish and Wildlife Habitats website (http://nyswaterfronts.com/water-front_natural_narratives.asp).
(4) Existing uses include secondary contact recreation and fishing, Class I.
(5) These waterbodies contain salt water.

This analysis identified two issues of potential concern:

- *Threatened or endangered species at Alley Creek.* The Coastal Fish and Wildlife habitat rating form indicates that the Northern harrier, a threatened (T) bird species, winters in Alley Pond Park.
- *Primary contact recreation in Little Neck Bay.* The DMA Beach, a private beach, is located on the western shore of the Douglaston Peninsula.

The Northern harrier (T) is a raptor whose diet consists strictly of land mammals (mice, voles and insects), and its presence is due to the relatively large protected wetlands in Alley Pond Park, however, and not the waters or aquatic life of Alley Creek. The presence of the Northern harrier therefore does not define Alley Creek as a sensitive area for threatened species, according to EPA CSO Policy. There are no threatened or endangered species present in Udalls Cove or Little Neck Bay.

Findings for Sensitive Areas

One sensitive area is located within Little Neck Bay – the DMA Beach (Figure 2-10), as defined by the EPA CSO Control Policy. Accordingly, the LTCP addresses the policy requirements, which include: (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 (EPA, 1995a).

2.2.a.5 Tidal Flow and Background Harbor Conditions and Water Quality

DEP has been collecting New York Harbor water quality data since 1909. These data are utilized by regulators, scientists, educators, and citizens to assess impacts, trends, and improvements in the water quality of New York Harbor.

The Harbor Survey Monitoring Program (HSM) has been the responsibility of DEP's Marine Sciences Section (MSS) for the past 27 years. These initial surveys were performed in response to public complaints about quality of life near polluted waterways. The initial effort has grown into a survey that consists of 72 stations distributed throughout the open waters of the harbor and smaller tributaries within the City. The number of water quality parameters measured has also increased from five in 1909, to over 20 at present.

Harbor water quality has improved dramatically since the initial surveys. Infrastructure improvements and the capture and treatment of virtually all dry-weather sewage are the primary reasons for this improvement. During the last decade, water quality in NY Harbor has improved to the point that the waters are now utilized for recreation and commerce throughout the year. Still, impaired areas remain within the Harbor. The LTCP process has begun to focus on those areas within the Harbor that remain impacted; it will examine 10 waterbodies and their drainage basins, and develop a comprehensive plan for each waterbody.

The HSM program focuses on fecal coliform bacteria, DO, chlorophyll 'a,' and Secchi transparency as the water quality parameters of concern. Data are presented in four sections, each delineating a geographic region within the Harbor. Alley Creek and Little Neck Bay are located within the Upper East River – Western Long Island Sound (UER-WLIS) section. This area contains nine open water monitoring stations and five tributary sites. Figure 2-22 shows the location of Stations E11, LN1, and AC1 of the HSM program.

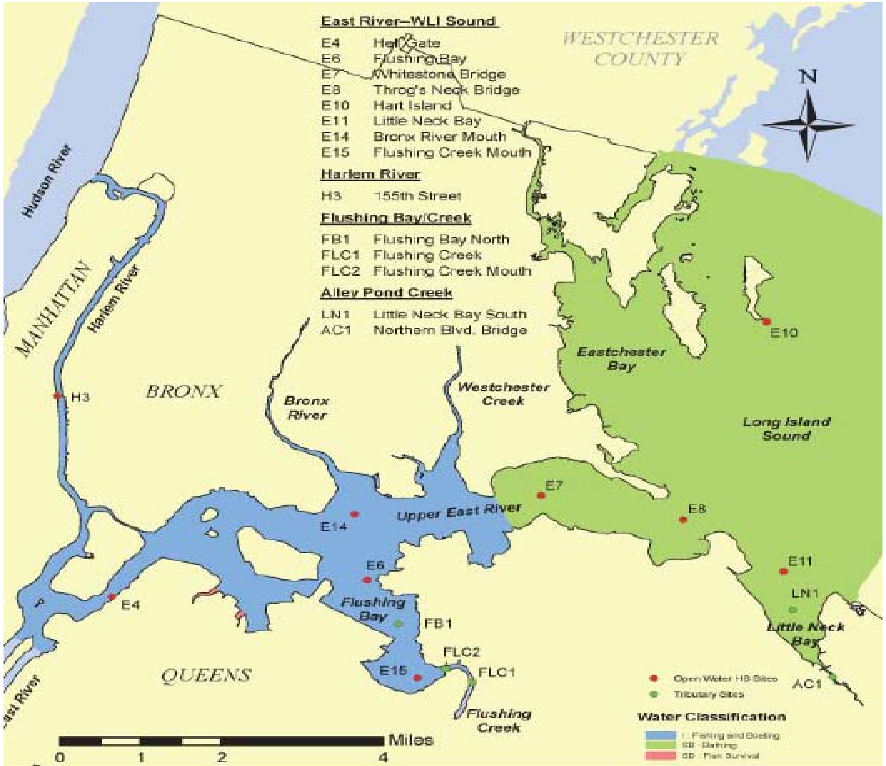


Figure 2-22. Harbor Survey UER-WLIS Region

Fecal coliform and enterococci are indicators of human waste and pathogenic bacteria. According to 2009 data, the UER-WLIS saw a rise in summer GM from 36 cells/100 mL to 43 cells/100 mL. However, fecal coliform and enterococcus concentrations continued to be in attainment with their respective classification standards for Stations E11, LN1, and AC1. Fecal coliform and enterococci levels have remained below the compliance criteria, due to a reduction in CSOs and upgrades to the WWTP.

Dissolved oxygen is the oxygen in a waterbody available for aquatic life forms. Average dissolved oxygen levels have exceeded the compliance requirement of 5.0 mg/L. In 2010, the average surface DO was measured at 5.6 mg/L, while the average bottom DO was measured at 5.2 mg/L. During summer months, all surface waters obtained their classification requirement, but bottom waters met their classification for only five out of eight sites. The “DO never-less-than” percentage for surface and bottom waters increased to 77 percent and 72 percent, respectively, in 2010, and from 74 percent and 66 percent in 2009. Hypoxia is another water quality condition associated with DO, and occurs when DO levels fall below 3.0 mg/L. Stations for Alley Creek and Little Neck Bay did not have any such incidents.

Chlorophyll ‘a’ is the green pigment in algae and plankton. The amount of chlorophyll ‘a’ is a gauge of primary productivity, which is used to measure ecosystem quality. A concentration of 20 µg/L or above is considered eutrophic. In a state of eutrophication, phytoplankton reproduction rates greatly increase, causing a depletion of DO. The average chlorophyll “a” reading for UER-WLIS was 9.5 µg/L in 2010. The general trend has remained close to 10 µg/L since chlorophyll ‘a’ level collection started in 1986. Little Neck Bay reported an average of over 20 µg/L. This is a common condition for confined bodies of water.

Secchi transparency is a measure of the clarity of surface waters. Clarity is measured as a depth when the Secchi disk blends in with the water. Clarity is most affected by the concentrations of suspended solids and plankton. Lack of clarity limits sunlight, which inhibits the nutrient cycle. The average summer

Secchi depth for UER-WLIS was 4.0 feet. No stations in Alley Creek and Little Neck Bay reported a low transparency (under 3.0 feet).

2.2.a.6 Compilation and Analysis of Existing Water Quality Data

More recent data collected within Alley Creek and Little Neck Bay are available from sampling conducted by DEP Harbor Survey between 2009 and 2012, and from sampling collected in late 2012 during the development of the LTCP. Figure 2-23 shows the GM of the data set over the period of record, along with data ranges (minimum to maximum and 25th percentile to 75th percentile). For reference purposes, the figure also shows the 30-day GM water quality criterion for enterococci and the 30-calendar day GM water quality criterion for fecal coliform.

Figure 2-24 (enterococci) and Figure 2-25 (fecal coliform) present bacteria data collected at locations AC1, LN1 and E11, in Alley Creek and Little Neck Bay, respectively, and at the DMA Beach. These data represent the period of January 2009 through April 2011, prior to when the Alley Creek CSO Retention Tank came on-line. Also shown on this figure are data from May 2011 through the end of 2012, the period for which the Retention Tank was online. These data indicate that the pathogen concentrations within Alley Creek are elevated with the data period GMs for enterococci at approximately 500 cfu/100mL and for fecal coliform bacteria near 2,000 cfu/100mL. The 75th percentile excursions above these values reach nearly 2,000 cfu/100mL for enterococci and exceed 5,000 cfu/100mL for fecal coliform bacteria. Figure 2-24 (enterococci) and Figure 2-25 (fecal coliform) present bacteria data collected at locations AC1, LN1 and E11, in Alley Creek and Little Neck Bay, respectively, and at the DMA Beach. These data represent the period of January 2009 through April 2011, prior to when the Alley Creek CSO Retention Tank came on-line. Also shown on this figure are data from May 2011 through the end of 2012, the period for which the Retention Tank was online. These data indicate that the pathogen concentrations within Alley Creek are elevated with the data period GMs for enterococci at approximately 500 cfu/100mL and for fecal coliform bacteria near 2,000 cfu/100mL. The 75th percentile excursions above these values reach nearly 2,000 cfu/100mL for enterococci and exceed 5,000 cfu/100mL for fecal coliform bacteria. While it is apparent that the GMs increased slightly from pre- to post-tank conditions, this is primarily due to the extreme amount of rainfall in 2011. All indications are that future sampling will show improvement in GMs for the post-tank conditions.

Pathogen levels within Little Neck Bay are significantly lower, where period GM concentrations are less than 10 cfu/100mL for enterococci and are between 10 and 100cfu/100mL for fecal coliform. Locally, at DMA Beach, enterococci concentrations, as measured by the DOHMH, have a period GM that is very close to the maximum 30-day GM criterion of 35 cfu/100mL. DMA Beach use is regulated by the DOHMH, who samples the beach routinely between late April and mid-September, in an effort to control when it can be used within the bathing season (approx. Memorial Day to Labor Day). Between 2009 and the end of 2012, the water quality was measured to be in attainment with the maximum 30-day GM enterococci criterion, from a low of 5 percent of the time in 2011, to a high of 67 percent of the time in 2012, as shown in Figure 2-24.

These sampling locations are depicted in Figure 2-26.

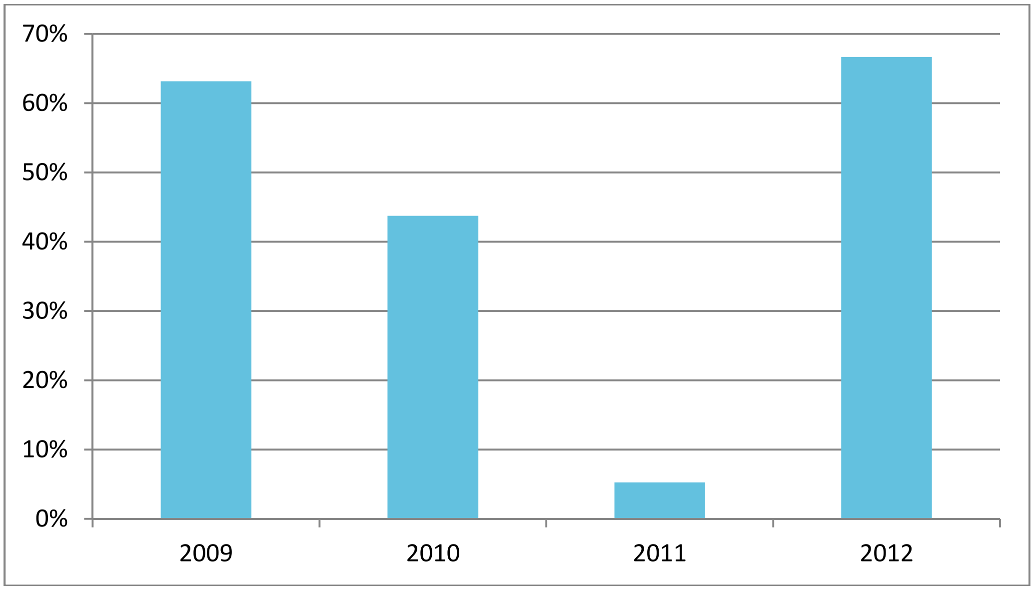


Figure 2-23. Percent of Enterococci Samples with 30-day GM<35 cfu/100mL

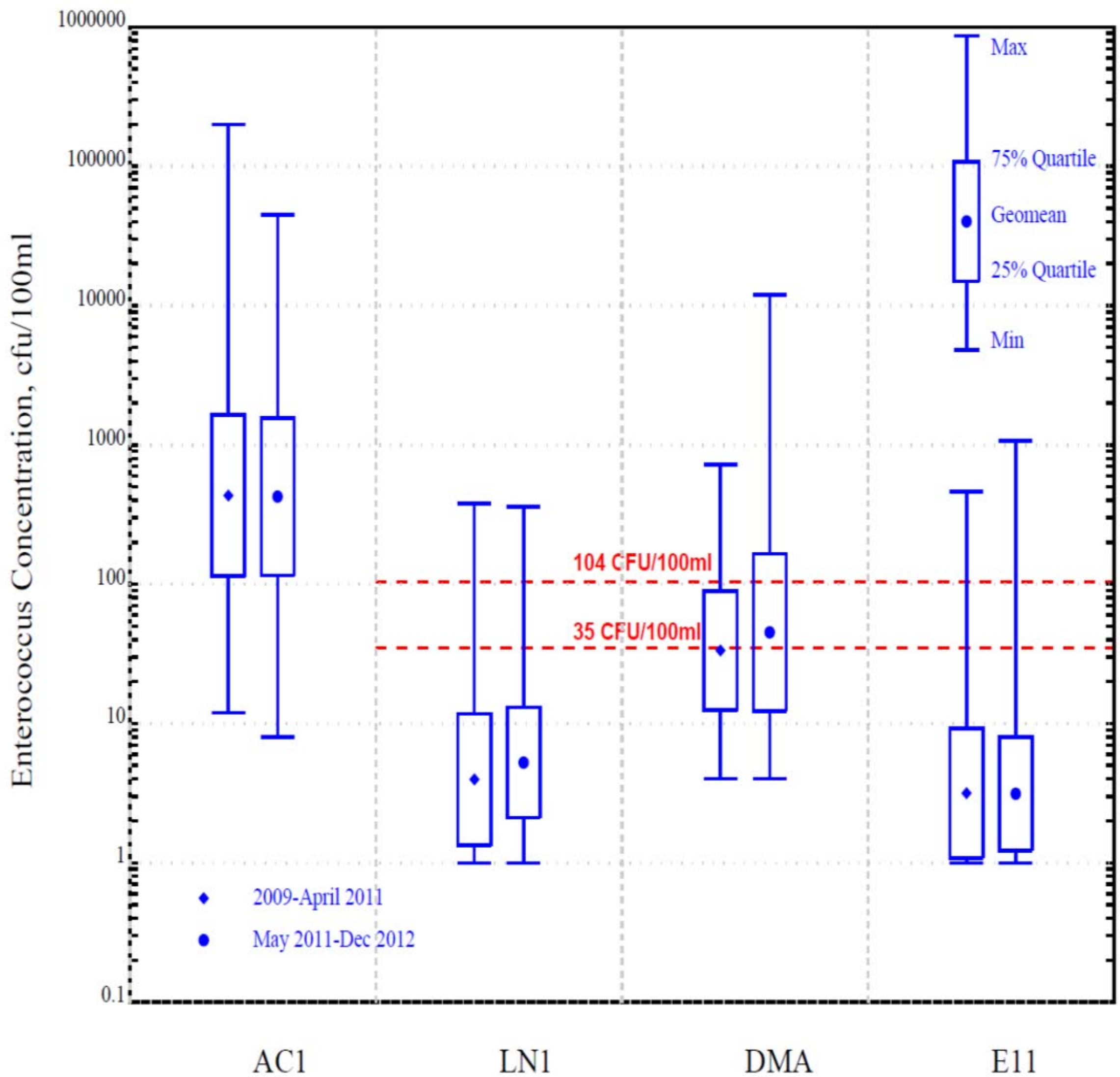


Figure 2-24. Enterococci Concentrations at Alley Creek and Little Neck Bay Monitoring Stations

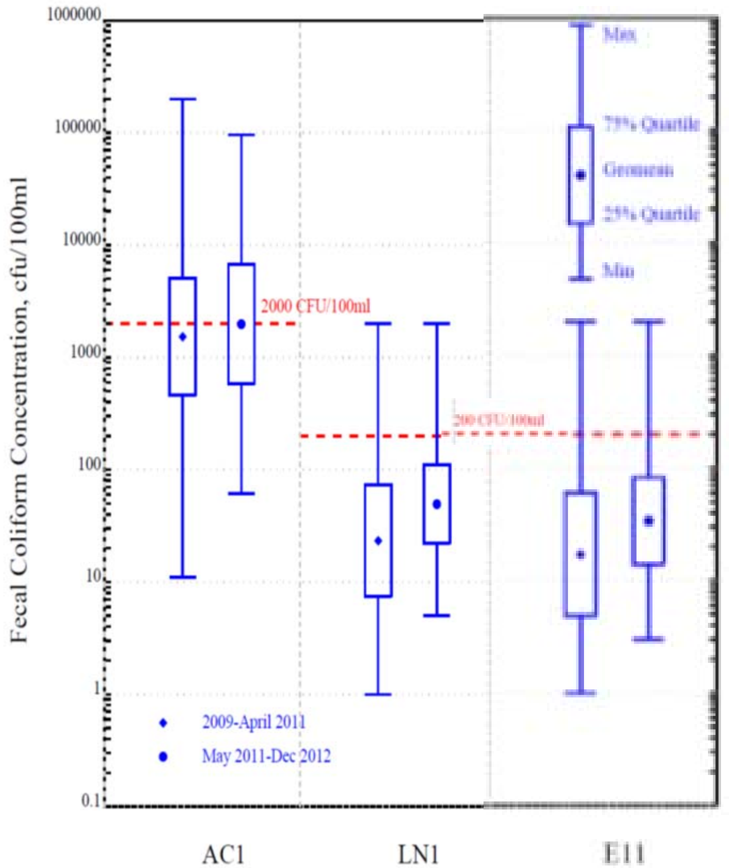


Figure 2-25. Fecal Coliform Concentrations at Harbor Survey Monitoring (HSM) Stations

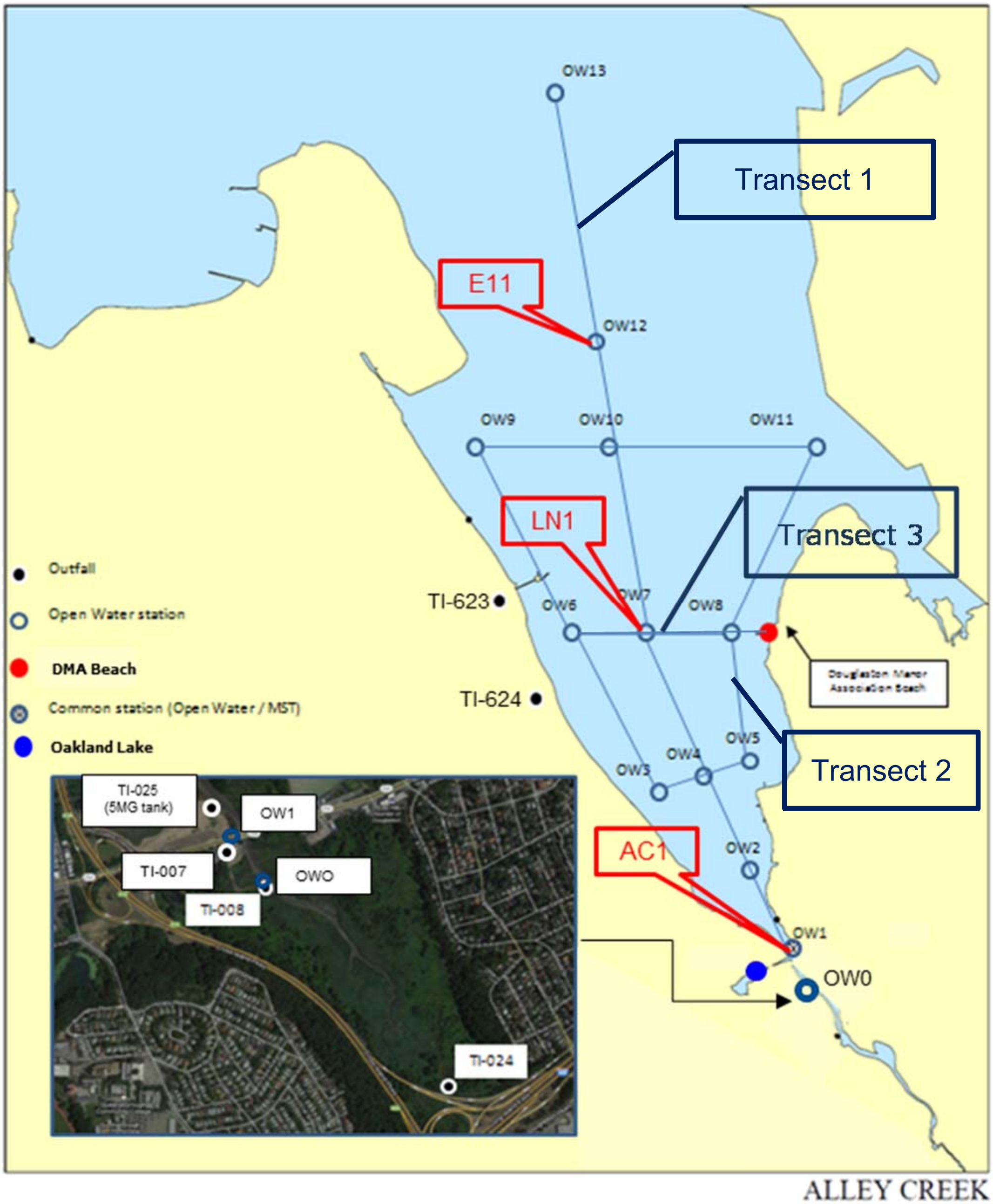


Figure 2-26. FSAP and HSM Locations

The results of this sampling effort are provided in Figures 2-27A and 2-27B for enterococci and fecal coliform in wet weather, and Figures 2-28A and 2-28B present these results for dry weather. As shown in Figures 2-27A and 2-27B, there appears to be a gradient of pathogens from Alley Creek to the center portion of Little Neck Bay along the Bay centerline (Stations OW2, OW4 and OW7), along the eastern shoreline (OW2, OW5 and OW8), and along the western shoreline (Stations OW2, OW3 and OW6). Locations further removed from Alley Creek (Stations OW9 through OW13) seem to have bacteria concentrations that are almost equal, and appear to be unrelated to the gradient of elevated bacteria emanating from the Creek. Although these outer stations are elevated above dry weather concentrations

(Figures 2-28A and 2-28B), the lack of a gradient from the Creek outward indicates that these elevated concentrations above dry weather concentrations are likely associated with other sources of bacteria to the system that are impacting the greater East River and western Long Island Sound.

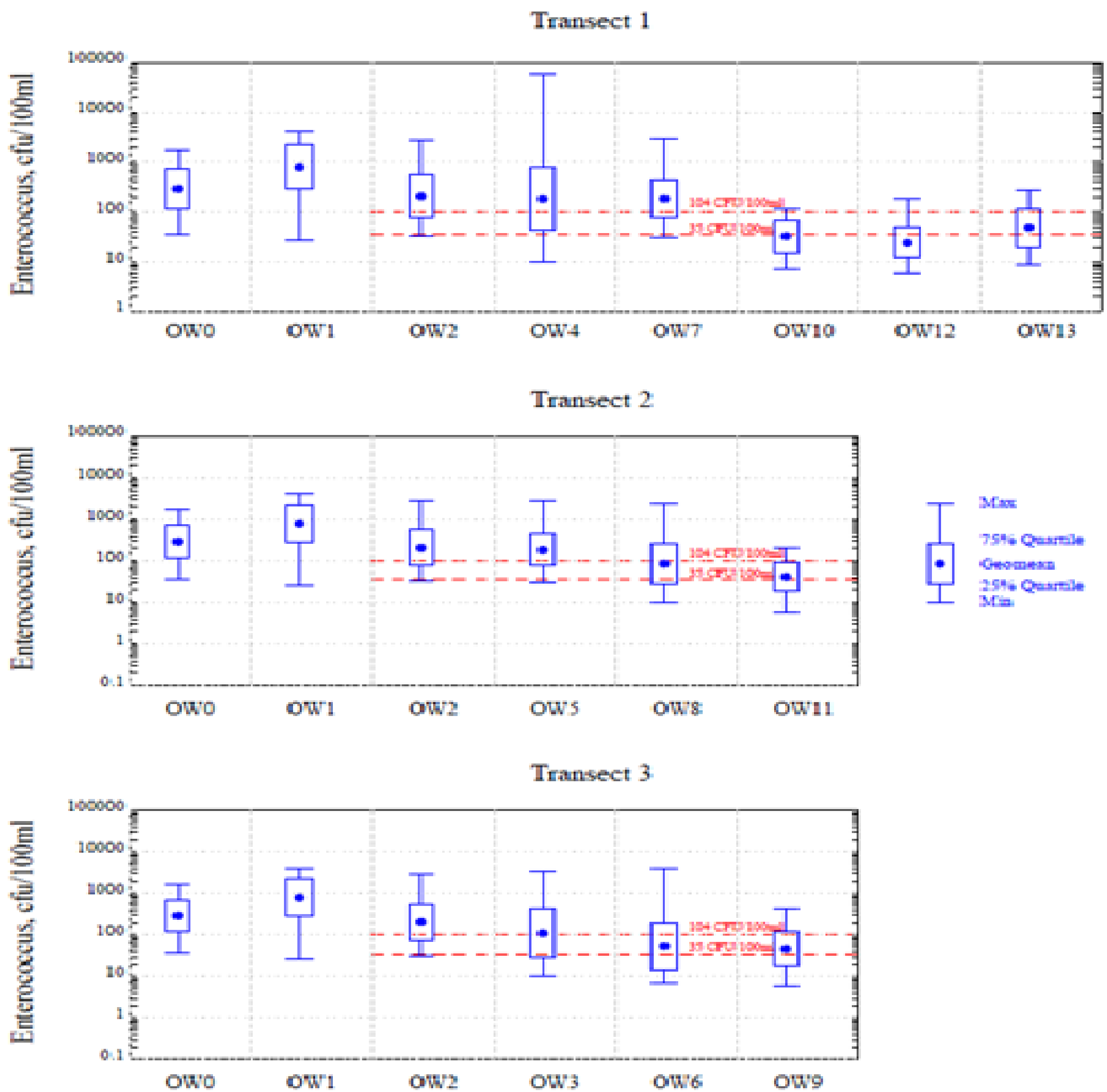


Figure 2-27A. FSAP Wet Weather Enterococci Concentrations

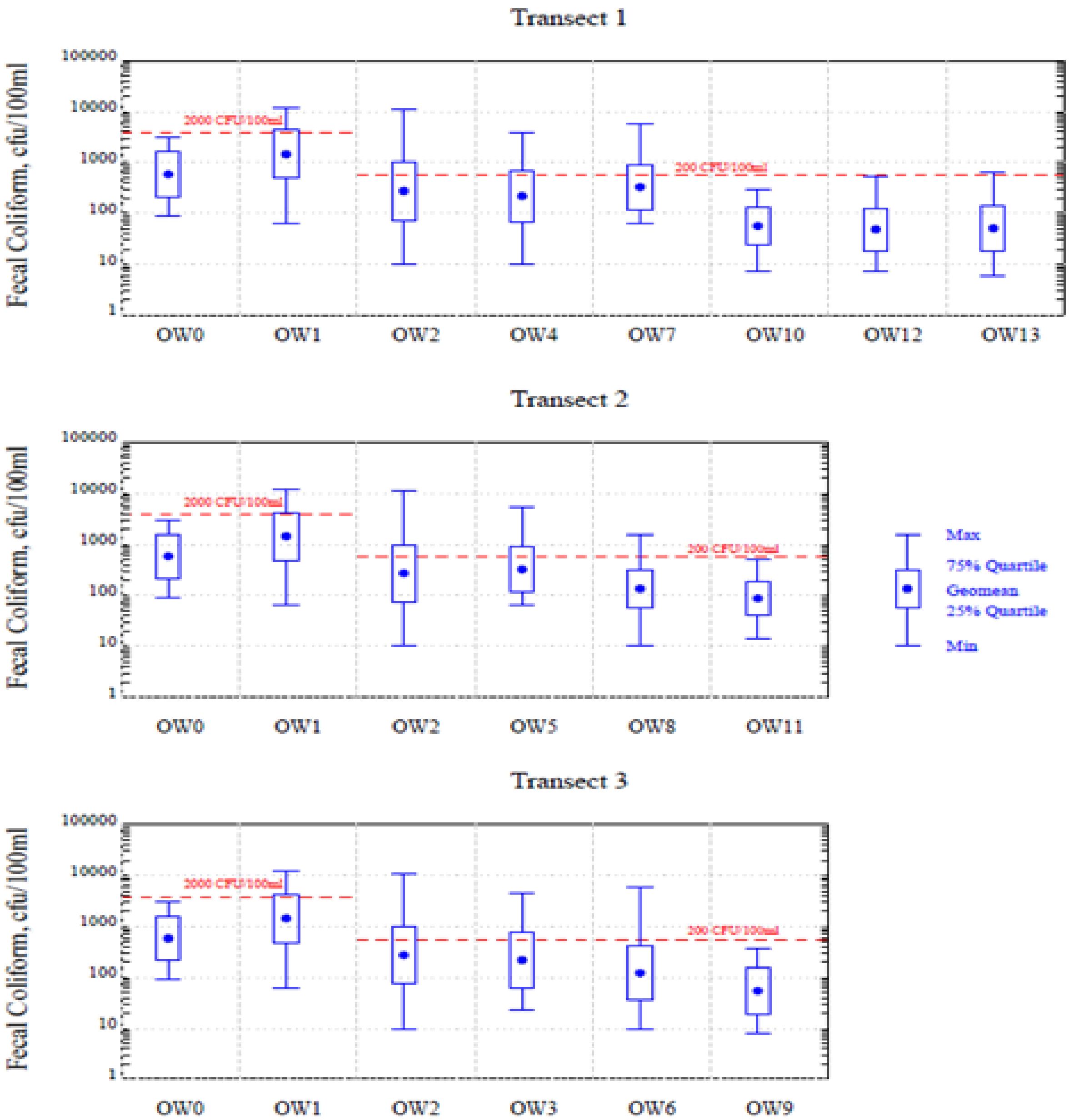


Figure 2-27B. FSAP Wet Weather Fecal Coliform Concentrations

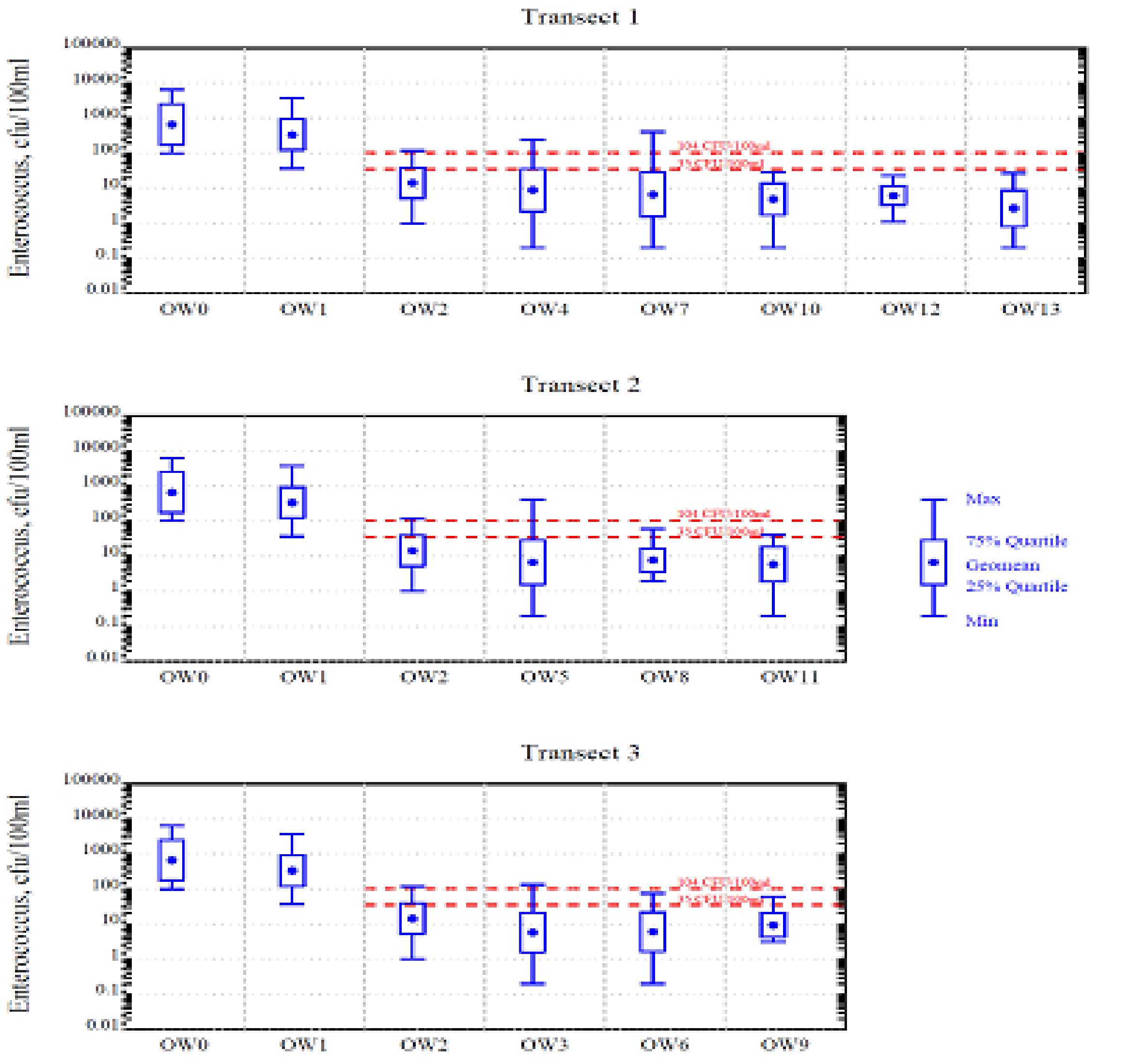


Figure 2-28A. FSAP Dry Weather Enterococci Concentrations

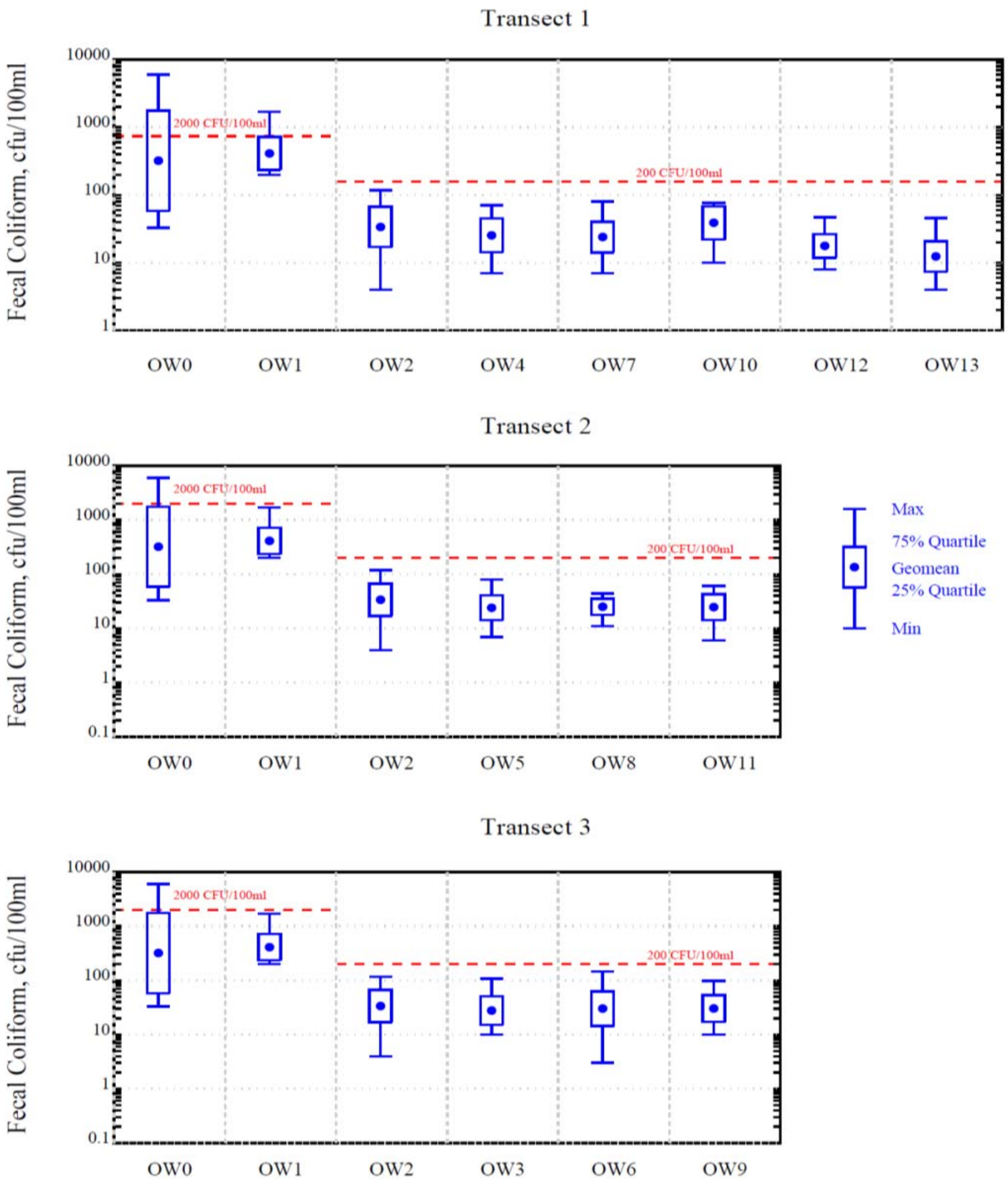


Figure 2-28B. FSAP Dry Weather Fecal Coliform Concentrations

Similarly, the concentrations of pathogens at the DMA Beach shoreline that appear on Transect 3 (Stations OW6, OW7, OW8 and DMA Beach), in close vicinity to Station OW8, are higher in wet weather than the Station OW8 concentrations, suggesting a local source of bacteria in the DMA area.

DO concentrations for the period of 2009 through April 2011 and May 2011 through the end of 2012 for Alley Creek and Little Neck Bay areas summarized in Figure 2-29. The figure shows the surface DO concentrations in the upper panel, and the bottom level DO concentrations in the lower panel. For the Alley Creek sampling locations (Station AC1), there is only a single DO reading taken (mid-depth), which is displayed in the upper panel. DO concentrations are as shown as the period mean, the 25th percentile and 75th percentile concentrations, as well as the period minimum and maximum values.

Although there are some slight difference in the Bay samples between the surface and bottom, it does not appear that the Bay is stratified with respect to DO. The Bay also appears to be fairly uniform with respect to DO, with the inner location at Station LN1 and the outer Station E11 having very similar DO concentrations.

These data indicate that about 58 percent of the measured DO concentrations in the Bay at Station LN1 are greater than the Class SA chronic criteria of 4.8 mg/L, and 89 percent of the measured samples have DO concentrations greater than the 3.0 mg/L acute criteria, prior to May 2011. After May 2011, these values increase to 75 percent of the measurements being greater than 4.8 mg/L, and 100 percent of the measurements being greater than 3.0 mg/L. Further out into the Bay at Station E11, these data indicate that about 84 percent of the measured DO concentrations are greater than the chronic criteria of 4.8 mg/L, and 98 percent of the measured samples have DO concentrations greater than 3.0 mg/L, prior to May 2011. After May 2011, these values change to 73 percent of the measurements being greater than 4.8 mg/L, and 99 percent of the measurements being greater than 3.0 mg/L. It should be noted that the ERTM results confirmed that the low DO concentrations in Little Neck Bay are, in part, associated with the hypoxia and nutrient enrichment in western Long Island Sound, and are not a result of CSO or stormwater sources.

DO concentrations at Station AC1 are more limited, and prior to May 2011, all the data show concentrations greater than 4.0 mg/L. After May 2011, only 68 percent of the measurements were found to be greater than 4.0 mg/L.

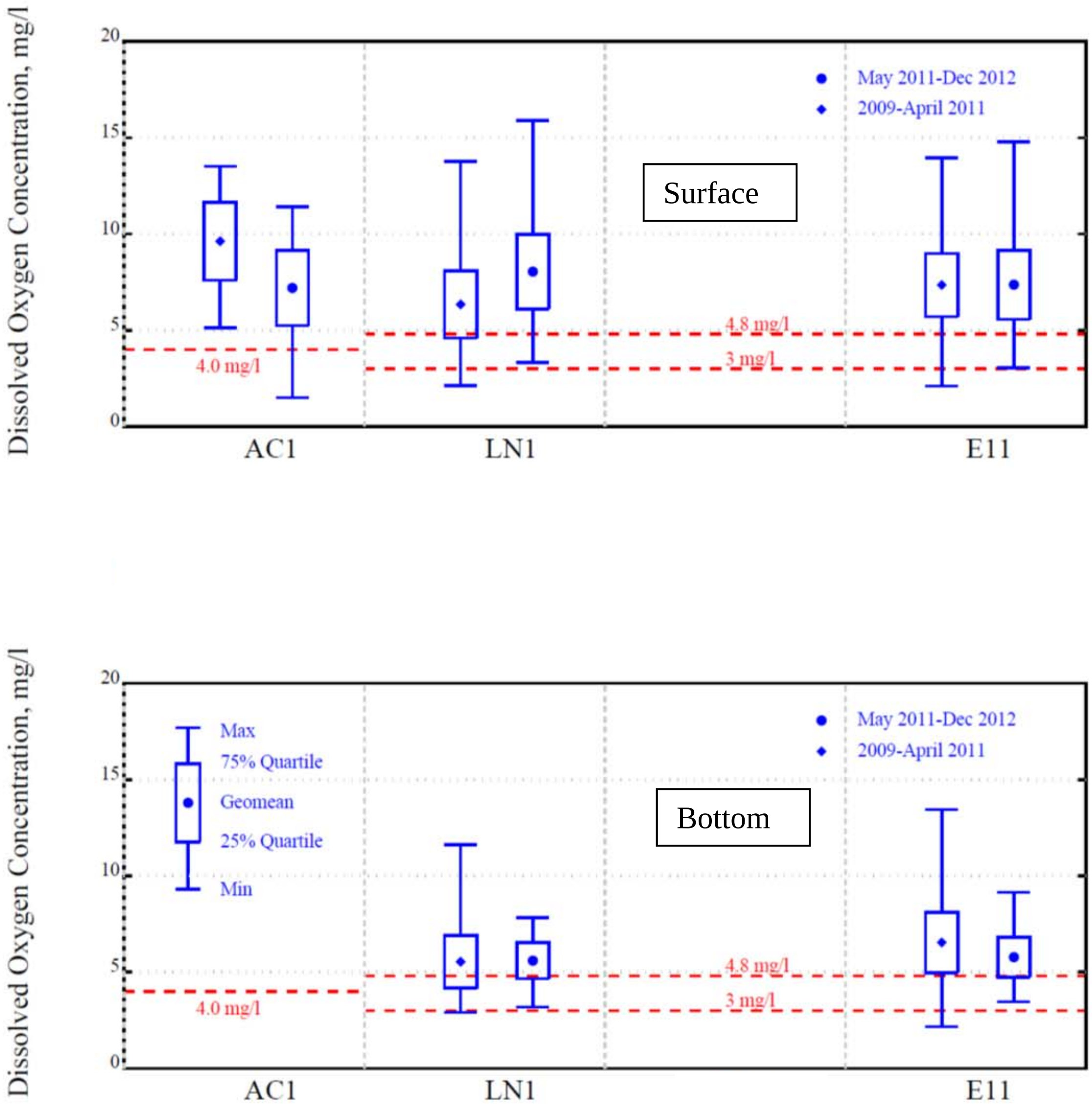


Figure 2-29. FSAP Dissolved Oxygen Concentrations

SECTION 3.0
CSO BEST MANAGEMENT PRACTICES

3.0 CSO BEST MANAGEMENT PRACTICES

The SPDES permits for all 14 WWTPs in New York City require DEP to report annually on the progress of the following 13 CSO BMPs:

1. CSO Maintenance and Inspection Program
2. Maximum Use of Collection Systems for Storage
3. Maximize Flow to POTW
4. Wet Weather Operating Plan
5. Prohibition of Dry Weather Overflow
6. Industrial Pretreatment
7. Control of Floatable and Settleable Solids
8. Combined Sewer System Replacement
9. Combined Sewer Extension
10. Sewer Connection & Extension Prohibitions
11. Septage and Hauled Waste
12. Control of Runoff
13. Public Notification

These BMPs are equivalent to the Nine Minimum Controls (NMCs) required under the EPA National Combined Sewer Overflow Policy, which were developed by the EPA to represent BMPs 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 best available technology-based controls that could be implemented within two years by permittees. EPA developed two guidance manuals that embodied the underlying intent of the NMCs for permit writers and municipalities, offering suggested language for SPDES permits and programmatic controls that may accomplish the goals of the NMCs (EPA 1995a, 1995b). A comparison of the EPA’s NMCs to the 13 SPDES BMPs is as shown in Table 3-1.

This section is currently based on the practices summarized in the 2012 Best Management Practices Annual Report.

Table 3-1. Comparison of EPA Nine Minimum Controls Compared with SPDES Permit BMPs

EPA Nine Minimum Controls	SPDES Permit Best Management Practices
NMC 1: Proper Operation and Regular Maintenance Programs for the Sewer System and the CSOs	BMP 1: CSO Maintenance and Inspection Program BMP 4: Wet Weather Operating Plan BMP 8: Combined Sewer System Replacement BMP 9: Combined Sewer Extension BMP 10: Sewer Connection & Extension Prohibitions BMP 11: Septage and Hauled Waste
NMC 2: Maximum Use of the Collection System for Storage	BMP 2: Maximum Use of Collection Systems for Storage
NMC 3: Review and Modification of Pretreatment Requirements to Assure CSO Impacts are Minimized	BMP 6: Industrial Pretreatment
NMC 4: Maximization of Flow to the Publicly Owned Treatment Works for Treatment	BMP 3: Maximize Flow to POTW BMP 4: Wet Weather Operating Plan
NMC 5:Prohibition of CSOs during Dry Weather	BMP 5: Prohibition of Dry Weather Overflow
NMC 6: Control of Solid and Floatable Material in CSOs	BMP 7: Control of Floatable and Settleable Solids
NMC 7: Pollution Prevention to Reduce Contaminants in CSOs	BMP 6: Industrial Pretreatment BMP 7: Control of Floatable and Settleable Solids BMP 12: Control of Runoff
NMC 8: Public Notification	BMP 13: Public Notification
NMC 9: Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls	BMP 1: CSO Maintenance and Inspection Program BMP 5: Prohibition of Dry Weather Overflow BMP 6: Industrial Pretreatment BMP 7: Control of Floatable and Settleable Solids

This section presents brief summaries of each BMP and its respective relationship 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 CSS, thereby reducing water quality impacts.

3.1 Collection System Maintenance and Inspection Program

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer Systems and CSOs) and NMC 9 (Monitoring to Effectively 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 work, dry weather overflows and leakage can be prevented, and maximization of flow to the WWTP 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 events that cause discharge at outfalls during dry weather; and

- DEC review of inspection program reports.

Details of recent preventative and corrective maintenance reports can be found in the Appendices of the BMP Annual Reports.

3.2 Maximizing 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, thereby reducing the amount of overflow. DEP provides general information in the BMP Annual Report, describing the status of Citywide SCADA, regulators, tide gates, interceptors, in-line storage projects, and collection system inspections and cleaning.

3.3 Maximizing Wet Weather Flow to WWTPs

This BMP addresses NMC 4 (Maximization of Flow to the Publicly Owned Treatment Works for Treatment), and reiterates the WWTP operating targets established by the SPDES permits regarding the ability of the WWTP to receive and treat minimum flows during wet weather. The treatment plant must be physically capable of receiving a minimum of 2xDDWF through the plant headworks; a minimum of 2xDDWF through the primary treatment works (and disinfection works if applicable); and a minimum of 1.5xDDWF through the secondary treatment works during wet weather. The actual process control set points may be established by the Wet Weather Operating Plan (WWOP) required in BMP 4.

All of the City's WWTPs are physically capable of receiving a minimum of twice their permit-rated design flow through primary treatment and disinfection or their DEC-approved Wet Weather Operating Plans. The maximum flow that can reach a particular WWTP is controlled by a number of factors including: hydraulic capacities of the upstream flow regulators; storm intensities within different areas of the collection system; and plant operators, who can restrict flow using "throttling" gates located at the WWTP entrance, to protect the WWTP from flooding and process upsets. DEP's operations staff are trained as to how to maximize pumped flows without impacting the treatment process, critical infrastructure, or public safety. For guidance, DEP's operations staff follow their plant's DEC-approved WWOP, which specifies the "actual Process Control Set Points," including average flow, as per Section VIII (3) and (4) of the SPDES permits. Analyses presented in the 2012 BMP report indicate that DEP's facilities complied with this BMP during 2012.

3.4 Wet Weather Operating Plan

To maximize treatment during wet weather events, WWOPs were developed for each WWTP drainage area, in accordance with the DEC publication entitled, *Wet Weather Operations and Wet Weather Operating Plan Development for Wastewater Treatment Plants*. Components of the WWOPs include:

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

This BMP addresses NMC 1 (Proper Operation and Regular Maintenance Programs for the Sewer System and the CSOs) and NMC 4 (Maximization of Flow to the Publicly Owned Treatment Works for Treatment). The Tallman Island WWTP WWOP, which includes the Alley Creek CSO Tank WWOP, was approved by DEC in September 2011.

3.5 Prohibition of Dry Weather Overflows

This BMP addresses NMC 5 (Prohibition of CSOs during Dry Weather) and NMC 9 (Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls), and requires that any dry weather flow event be promptly abated and reported to DEC 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 BMP Annual Report.

Dry weather overflows from the CSS are prohibited, and DEP's goal is to reduce and/or eliminate dry weather bypasses. An examination of the data for regulators, pump stations and WWTPs revealed that there were no dry weather bypasses to Alley Creek or Little Neck Bay during 2012.

3.6 Industrial Pretreatment Program

This BMP addresses three NMCs: NMC 3 (Review and Modification of Pretreatment Requirements to Assure CSO Impacts are Minimized); NMC 7 (Pollution Prevention Programs to Reduce Contaminants in CSOs); and NMC 9 (Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls). By regulating the discharges of toxic pollutants from unregulated, relocated, or new Significant Industrial Users (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 WWTP, especially for continuous discharges;
- Exclusion of non-contact cooling water from the CSS and permitting of direct discharges of cooling water; and
- Prioritization of industrial waste containing toxic pollutants for capture and treatment by the WWTP over residential/commercial service areas.

Since 2000, the average total industrial metals loading to NYC WWTPs has been declining. As described in the 2012 BMP Annual Report, the average total metals discharged by all regulated industries to the NYC WWTPs was 12.8 lb/day, and the total amount of metals discharged by regulated Industrial Users remained very low. Applying the same percentage of CSO bypass (1.5 percent) from the CSO report to the current data, it appears that, on average, less than 0.2 lb/day of total metals from regulated industries bypasses to CSOs in 2012 (DEP, 2012a).

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 Effectively Characterize CSO Impacts and the Efficacy of CSO Controls), by requiring the implementation of the following four practices to eliminate or minimize the discharge of floating solids, oil and grease, or solids of sewage origin that cause deposition in receiving waters:

- Catch Basin Repair and Maintenance: This practice includes inspection and maintenance scheduled 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, citywide.
- 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 also established.
- Institutional, Regulatory, and Public Education: 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.

3.8 Combined Sewer Replacement

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and CSOs), requiring all combined sewer replacements to be approved by the New York State Department of Health (DOH) and to be specified within DEP's Master Plan for Sewage and Drainage. Whenever possible, separate sanitary and storm sewers should be used to replace combined sewers. The BMP Annual Report describes the general citywide plan, and addresses specific projects occurring in the reporting year. No projects are reported for the Tallman Island WWTP service area in the Best Management Practices 2012 Annual Report.

3.9 Combined Sewer Extension

To minimize storm water entering the CSS, this BMP requires combined sewer extensions to be accomplished using separate sewers whenever possible. If separate sewers must be extended from combined sewers, analyses must be performed to demonstrate 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 Regular Maintenance Programs for the Sewer System and CSOs).A brief status report is provided in the Best Management Practices 2012 Annual Report, although no combined sewer extension projects were completed during that year.

3.10 Sewer Connection and Extension Prohibitions

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and CSOs), and prohibits sewer connections and extensions that would exacerbate recurrent instances of either sewer back-up or manhole overflows. Wastewater connections to the CSS downstream of the last regulator or diversion chamber are also prohibited. The 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 DEC when necessary. For the calendar year 2012, conditions did not require DEP to prohibit additional sewer connections or sewer extensions.

3.11 Septage and Hauled Waste

The discharge or release of septage or hauled waste upstream of a CSO (e.g., 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 Regular Maintenance Programs for the Sewer System and CSOs). The 2008 CSO BMP Annual Report summarizes the three scavenger waste acceptance facilities controlled by DEP, and the regulations governing discharge of such material at the facilities. The facilities are located in the Hunts Point, Oakwood Beach, and 26th Ward WWTP service areas. The program remained unchanged through the 2011 CSO BMP Annual report.

3.12 Control of Runoff

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

A rule to "reduce the release rate of storm flow from new developments to 10 percent of the drainage plan allowable or 0.25 cfs per impervious acre, whichever is higher (for cases when the allowable storm flow is more than 0.25 cfs per impervious acre)," was promulgated on January 4, 2012, and became effective on July 4, 2012.

3.13 Public Notification

BMP 13 addresses NMC 8 (Public Notification) as well as NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and CSOs) and NMC 9 (Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls).

This BMP requires easy-to-read identification signage to be placed at or near CSO outfalls, with contact information for DEP, 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 NYC Department of Health and Mental Hygieneto implement and manage the notification program. Accordingly, the Wet Weather Advisories, Pollution Advisories and Closures are tabulated for all NYC public and private beaches. Douglas Manor Association Beach, a private beach on Little Neck Bay, was closed a total of 81 days and had Pollution Advisories posted for a further 23 days during the 2011 bathing season due to localized elevated bacteria levels.

3.14 Characterization and Monitoring

Previous studies have characterized and described the Tallman Island WWTP collection system and the water quality for Alley Creek and Little Neck Bay (see Chapters 3 and 4 of the Alley Creek and Little Neck Bay WWFP, 2009). Additional data were collected and are analyzed in this LTCP (see Section 2.2). Continuing monitoring occurs under a variety of DEP initiatives, such as floatables monitoring programs and DEP Harbor Survey, and is reported in the BMP Annual Reports under SPDES BMPs 1, 5, 6 and 7, as described above.

3.15 CSO BMP Report Summaries

In accordance with the SPDES permit requirements, annual reports summarizing the citywide implementation of the 13 BMPs described above are submitted to DEC. DEP has submitted ten annual reports to date, covering calendar years 2003 through 2012. Typical reports are divided into 13 sections – one for each of the BMPs in the SPDES permits. Each section of the annual reports describes ongoing DEP programs, provides statistics for initiatives occurring during the preceding calendar year, and discusses overall environmental improvements.

SECTION 4.0
GREY INFRASTRUCTURE

4.0 GREY INFRASTRUCTURE

4.1 Status of Grey Infrastructure Projects Recommended in Facility Plans

CSO Facility Planning for Alley Creek and Little Neck Bay began in 1984, predating the current LTCP program. Evaluation of the Tallman Island WWTP collection system showed that outfall TI-008 was the primary source of CSO discharges to these waterbodies. To address CSO discharges, DEP developed and modified several facility plans including the 2003 Alley Creek CSO Facility Plan (URS, 2003) and the 2009 Alley Creek and Little Neck Bay WWFP. The 2003 Alley Creek CSO Facility Plan proposed to reduce discharges from TI-008 by diverting the flow through a new chamber to a new 5 MG CSO Retention Tank and its new CSO outfall TI-025, located in Alley Creek. The 2009 WWFP recommended retaining the proposed Alley Creek CSO Facilities Plan, the Alley Creek Retention Tank and outfall TI-025. A summary of the grey infrastructure elements of the WWFP are listed as follows:

- New diversion chamber (Chamber 6) to direct CSO to the new Alley Creek CSO Retention Tank and to provide tank bypass to TI-008
- New CSO Retention Tank (5 MG Alley Creek Tank)
- New 1,475 foot long multi-barrel outfall sewer extending to a new outfall on Alley Creek (TI-025)
- New CSO outfall, TI-025, for discharge from the Alley Creek Tank
- Fixed baffle at TI-025 for floatables retention, minimizing release of floatables to Alley Creek
- Upgrade of Old Douglaston PS to empty tank and convey flow to Tallman Island WWTP after the end of the storm

4.1.a Completed Projects

The Alley Creek CSO Retention Tank was operational as of March 11, 2011. DEP certified construction completion of the facilities on June 27, 2011. DEC accepted DEP’s certification of completion on September 25, 2012.

4.1.b Ongoing Projects

There are no additional grey infrastructure projects currently in progress.

4.1.c Planned Projects

No additional grey infrastructure projects are planned for the Alley Creek and Little Neck Bay watersheds for the reasons explained in Sections 6 and 8 of this LTCP.

4.2 Other Water Quality Improvement Measures Recommended in Facility Plans (dredging, floatables, aeration)

There are no other water quality improvement measures planned for Alley Creek and Little Neck Bay.

4.3 Post-Construction Monitoring

The Post-Construction Compliance Monitoring (PCM) Program is integral to the optimization of the Alley Creek CSO Retention Tank, providing data for model validation, feedback to facility operations, and an assessment metric for the effectiveness of the facility. Each year's data set will be compiled and evaluated to refine the understanding of the interaction between Alley Creek, Little Neck Bay, and the Alley Creek CSO Retention Tank, with the ultimate goal of fully attaining compliance with current WQS or for supporting a UAA to revise such standards. The data collection monitoring will contain three basic components:

1. The Alley Creek CSO Retention Tank WWOP as appended to Tallman Island WWTP WWOP;
2. Receiving water data collection in Alley Creek and Little Neck Bay using existing DEP Harbor Survey Monitoring (HSM) locations and adding stations as necessary; and
3. Modeling of the associated receiving waters to characterize water quality.

The details provided herein are limited to the Alley Creek and Little Neck Bay PCM and may be modified as the City-wide program takes form. Any further modifications to the PCM program will be submitted to DEC for review and approval as described in Section 9.5.

4.3.a Collection and Monitoring of Water Quality in Receiving Water

PCM for the Alley Creek CSO Retention Tank consists of sample collection at one location in Alley Creek (HSM Station AC1) and one location in Little Neck Bay (HSM Station LN1). In addition, DEP collected water quality samples at two other locations in the affected water body during November and December 2012 near the mouth of Alley Creek (LTCP FSAP Stations OW0 and OW1), and in Little Neck Bay south of HSM Station LN1 (Station OW2). Figure 4-1 presents a map of the HSM stations location. The location of the LTCP FSAP Stations OW0, OW1 and OW2 was depicted in Figure 2-26.

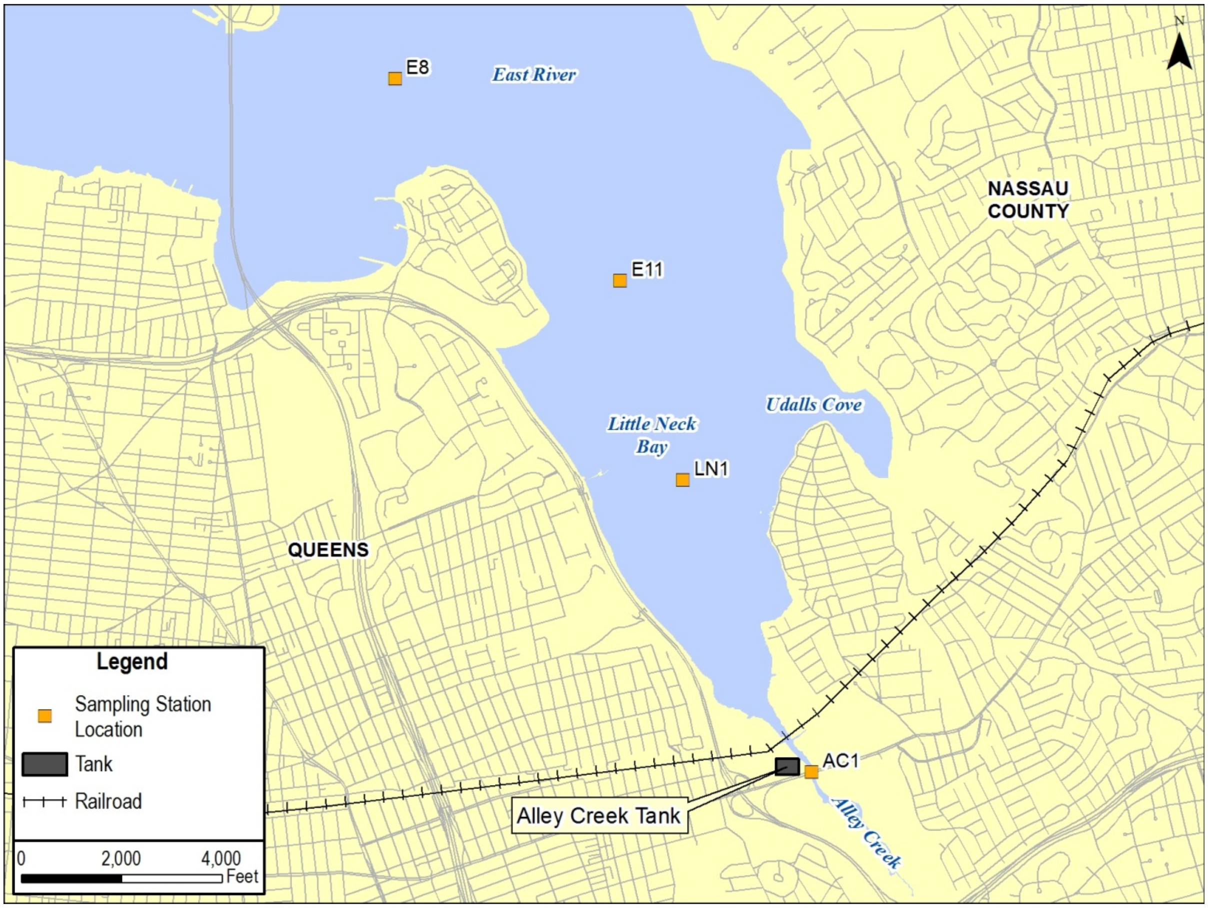


Figure 4-1. Alley Creek CSO Retention Tank
Location of Facility and Water-Quality Monitoring Stations

The Alley Creek and Little Neck Bay monitoring results are provided on Figures 4-2 through 4-5. The results are shown for DO, fecal coliform bacteria, enterococci bacteria, and TSS, respectively. The top panel of each figure shows the daily rainfall for 2012 (at LaGuardia Airport). The second presents the reported overflow volumes discharged from the Alley Creek CSO Retention Tank during the same period. The third panel shows the measured constituent concentrations for the stations in Alley Creek, and the bottom panel shows the measured constituent concentrations for the stations in Little Neck Bay. Applicable NYS WQS (Class I for Alley Creek and SB for Little Neck Bay) are also shown.

On Figure 4-2, the DO-monitoring results for Alley Creek show occasional excursions below the criterion (4.0 mg/L) from July through October. In Little Neck Bay, DO values are generally above the chronic criterion of 4.8 mg/L, one measurement in June and three sampling events during mid-August to early-September. All DO measurements in Little Neck Bay were above the acute criterion of 3.0 mg/L.

Figure 4-3 presents the fecal coliform concentrations measured in Alley Creek and Little Neck Bay. Discrete values in Alley Creek are often above the GM criterion (2,000 cfu/100mL), with the majority of high concentrations occurring during the summer. In Little Neck Bay, most discrete measurements are below the GM criterion of 200 cfu/100mL. The few discrete measurements above the criterion occurred during August, November and December.

As shown on Figure 4-4, enterococci levels in Alley Creek are generally elevated with many values above 1,000 cfu/100mL and some values above 10,000 cfu/100mL. In Little Neck Bay, most samples are less than 10 cfu/100mL but there are a number of values above 35 cfu/100mL during November and December.

Figure 4-5 presents the results of TSS sampling in Alley Creek and Little Neck Bay. TSS concentrations in Alley Creek are quite variable with some measurements greater than 150 mg/L. Measured TSS concentrations are generally below 25 mg/L in Little Neck Bay with a few higher values during August and September.

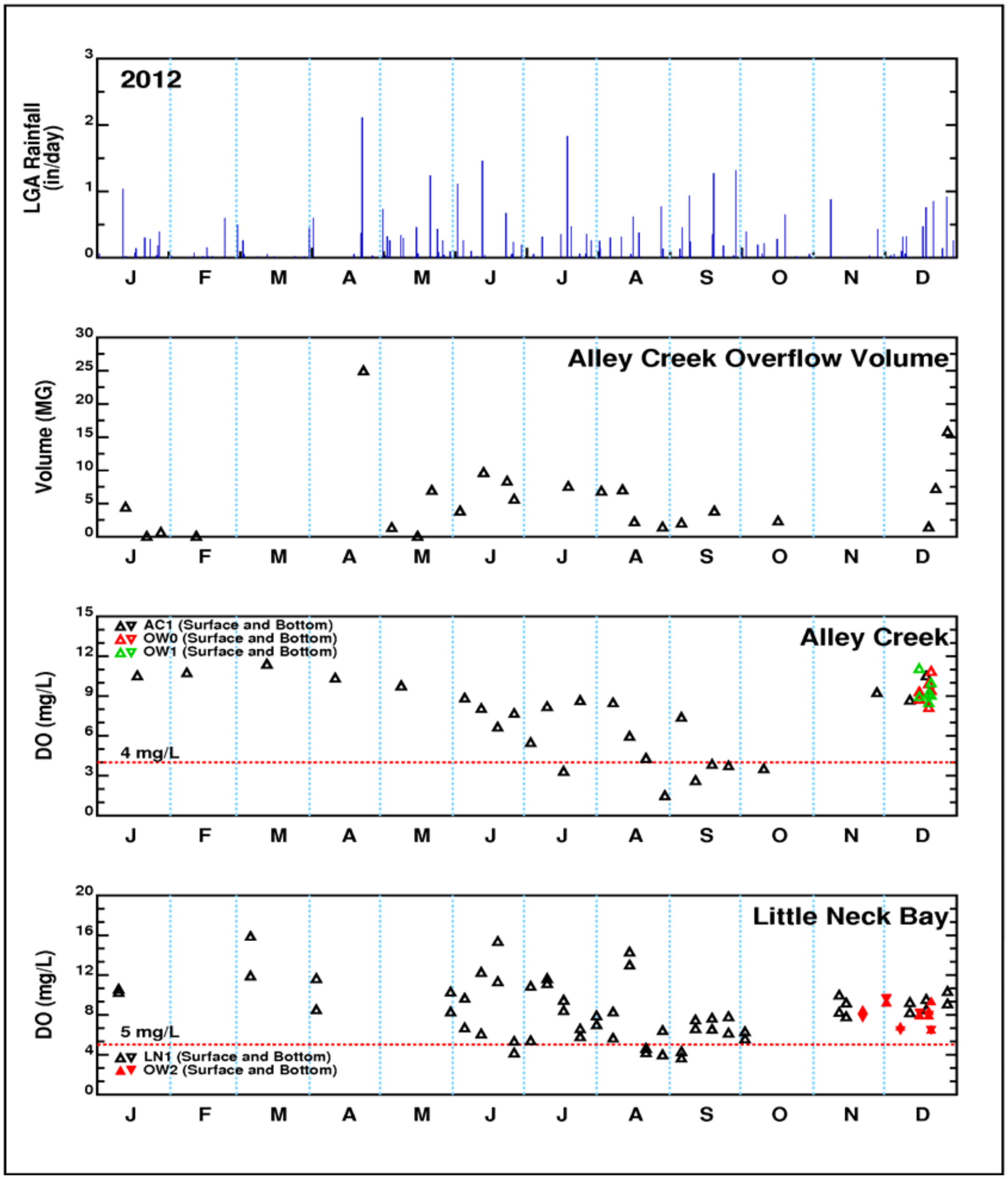


Figure 4-2. Alley Creek CSO Retention Tank
Ambient Water-Quality Monitoring – Dissolved Oxygen, 2012

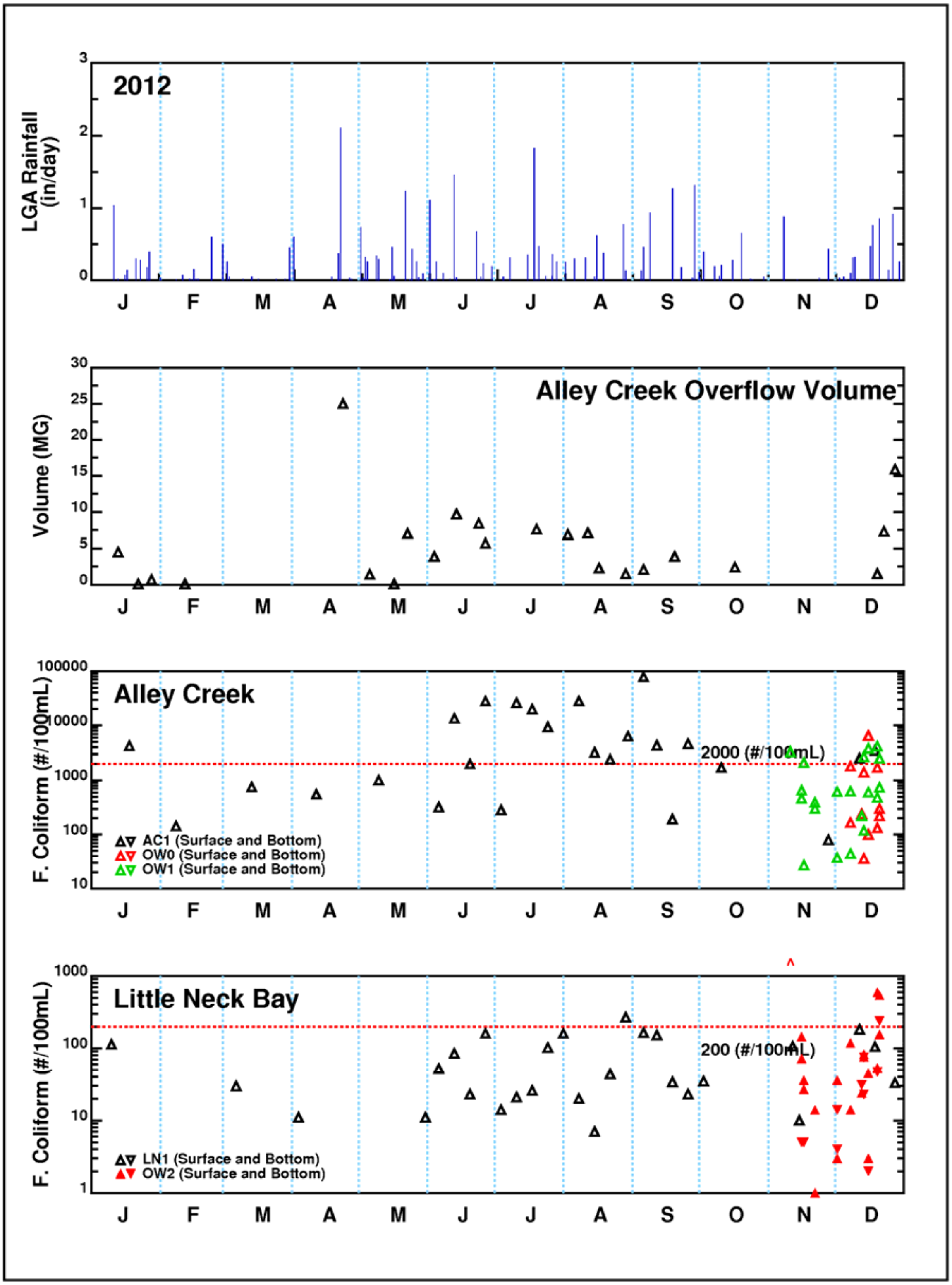


Figure 4-3. Alley Creek CSO Retention Tank
Ambient Water-Quality Monitoring – Fecal Coliform Bacteria, 2012

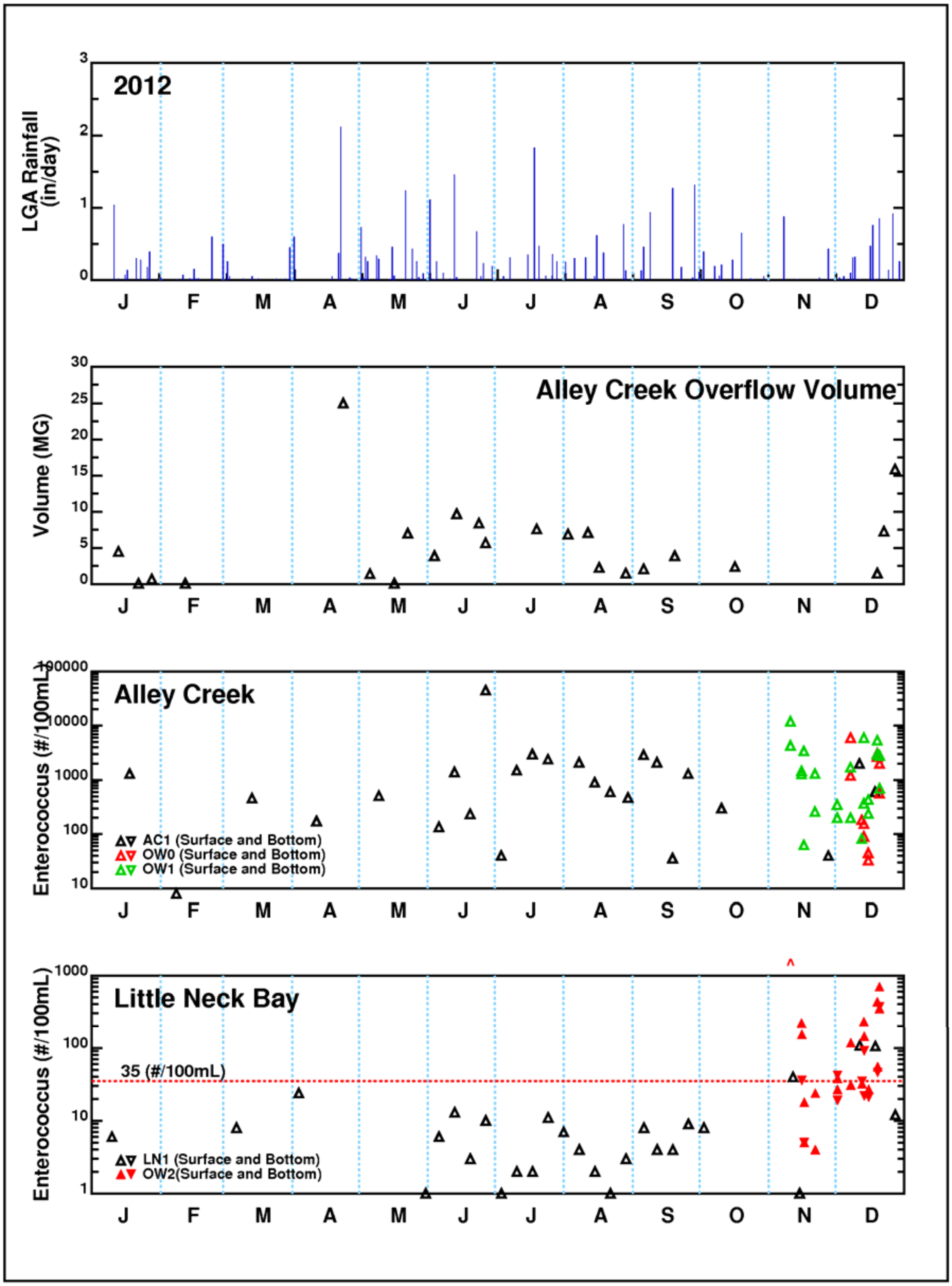


Figure 4-4. Alley Creek CSO Retention Tank
Ambient Water-Quality Monitoring – Enterococci Bacteria, 2012

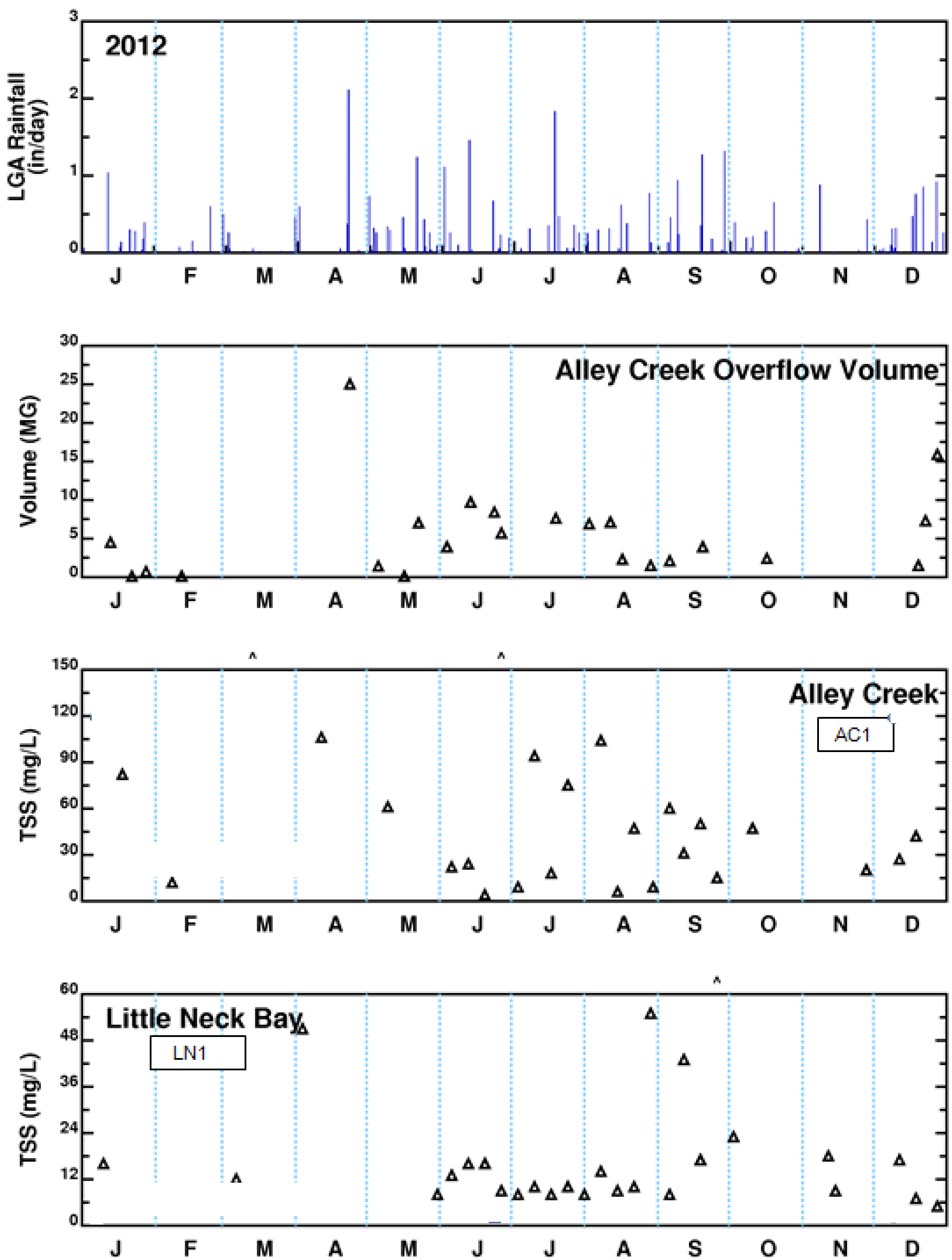


Figure 4-5. Alley Creek CSO Retention Tank
Ambient Water-Quality Monitoring – TSS, 2012

4.3.b CSO Facilities Operation – Flow Monitoring and Effluent Quality

Flow Monitoring

DEP monitors water-surface elevations and pumped volumes over time at the Alley Creek CSO Retention Tank. Based on these measurements and other information, DEP estimates daily inflow and infiltration (I/I), wet weather retained volume, pumpback volume, and overflow periods and overflow volumes. Tables 4-1 and 4-2 present a summary of the monthly and per-overflow-event estimates, respectively. Monthly monitoring data are also summarized graphically on Figure 4-6 (monthly total retained volume pumped back for treatment) and 4-7 (monthly overflow volume).

Analysis[1] of rainfall data recorded at the National Weather Service's LaGuardia Airport (LGA) gauge indicates that, with 125 storms totaling 36.18 inches, 2012 had less total rainfall and smaller storms than the long-term average in New York City. Monthly rainfall ranged from 0.91 to 5.06 inches. As summarized in Table 4-2, the Alley Creek tank overflowed during 25 storm events in 2012, meaning that the tank fully captured flow generated during the other 100 rainfall events (80 percent) in 2012. DEP reported that the tank retained a total of 256 MG of combined sewage for pumpback and treatment at the Tallman Island WWTP. A more detailed discussion of this information, including detailed discharge monitoring reports and methodology, can be found in the *Post Construction Compliance Monitoring and CSO Retention Facility Overflow Summary for Calendar Year 2012* (August 2013, NYC DEP). DEP is in the final stages of a CSO Flow Monitoring Pilot Study, one of the primary goals of which is to better understand the monitoring technology's ability to measure CSO overflows from regulator structures as well as at CSO storage facilities. The current measurement approach employed at the Alley Creek facility relies on depth measurements and weir equations that have inherent weaknesses due to the use of indirect measurements of overflows. Preliminary results of the CSO Flow Monitoring Pilot Study indicate that direct flow measurements have the highest accuracy, with subtraction methodology (e.g., downstream meter minus upstream, etc.) being lower in the accuracy scale. The depth and weir calculation approach falls even lower on a relative scale of confidence. DEP is moving to improve this measurement approach and apply what is learned in the pilot study accordingly.

The last four columns in Table 4-1 summarize the model-predicted retained and overflow volumes for each month in 2012. The model-calculated and monitoring-based estimates of monthly retained volume follow the same trends, but model-calculated retained volumes are consistently higher than the monitoring-based volumes. Model-calculated overflow volumes are generally less than the monitoring-based estimates. It should be noted that, although farther than LGA to this watershed, a sensitivity analysis performed using CPK rainfall which resulted in larger model-calculated overflow volumes than did the LGA gauge rainfall.

Differences between actual overflows and model-predicted overflows are often attributable to the fact that the model results are based on the rainfall measured at a single NOAA rain gauge being taken to represent the rainfall over the entire drainage area. In reality, storms move through the area so that the rainfall actually varies over time and space. Since rainfall patterns tend to even out over the area over time, the practice of using the rainfall measured at one nearby location typically provides good agreement with long-term performance for the collection system as a whole; however, model results for any particular storm may vary somewhat from the observed. Further, as discussed above, DEP will be improving its measurement approach for flows retained and discharged from the Alley Creek facility, and thus at this point in time variations between model-predicted performance and monitored data are expected.

[1] *Analyses of rainfall statistics performed using EPA's SYNOP program using minimum inter-event time of 4 hours and minimum storm threshold of zero inches.*

Table 4-1. Alley Creek CSO Retention Tank – Estimated Monthly Retained Volume and Overflows, 2012

Month	Rain at LGA (in)	Monthly Recorded Data			Model Data (LGA)	
		Retained Volume (MG)	Overflow Events (Count)	Overflow Volume (MG)	Retained Volume (MG)	Overflow Volume (MG)
January	2.51	16	4	5	30	1
February	1.43	10	1	0	20	0
March	0.91	11	0	0	24	0
April	3.18	14	1	25	27	13
May	4.67	34	3	9	40	2
June	4.19	27	4	28	34	9
July	3.77	23	1	8	31	15
August	2.95	32	4	18	32	1
September	5.06	29	3	6	41	18
October	1.86	18	1	2	25	0
November	1.35	15	0	0	24	0
December	4.30	26	3	25	43	2
Totals:	36.18	256	25	125	370	62
(1) From Monthly Operation Reports						

Table 4-2. Overflow-Event Timing and Hours Since Prior Storm, Alley Creek CSO Retention Tank, 2012

Overflow Event at Alley Creek Tank			Rain Event at LaGuardia Airport(1)			Hours Since Prior Rain(4)	Overflows	
Overflow No.	Start Mo/Da Hr:Mn	End Mo/Da Hr:Mn	Start Mo/Da Hr:Mn	End Mo/Da Hr:Mn	Rainfall (inch)(2)		Meas.	Model (LGA)
1	01/11 07:25	01/11 18:44	01/11 23:00	01/12 14:00	**1.04**	241	4.5	0.9
2	01/21 12:17	01/21 22:50	01/21 04:00	01/21 14:00	0.30	83	0.1	
3	01/22 11:24	01/22 16:05	(3)	(3)	0.00(3)	**21**	0.01	
4	01/27 11:32	01/28 07:58	01/27 08:00	01/27 14:00	0.39	**7**	0.7	
5	02/11 12:04	02/11 16:15	02/11 04:00	02/11 11:00	0.07(3)	52	0.1	
6	04/22 19:04	04/23 18:00	04/22 11:00	04/23 08:00	**2.11**	**9**	25.0	13.0
7	05/04 07:00	05/04 13:52	05/04 05:00	05/04 07:00	0.26	**25**	1.4	
8	05/15 16:13	05/16 01:20	05/15 11:00	05/15 16:00	**0.46**	**19**	0.1	
9	05/21 10:21	05/22 05:32	05/21 09:00	05/22 07:00	**1.24**	122	7.0	2.3
10	06/02 01:32	06/02 08:58	06/02 00:00	06/02 09:00	**1.11**	73	3.9	4.1
11	06/12 23:36	06/13 13:44	06/12 12:00	06/13 04:00	**1.46**	56	9.7	5.4
12	06/22 15:26	06/23 10:58	06/22 14:00	06/23 04:00	**0.67**	217	8.4	
13	06/25 17:07	06/26 01:31	06/25 16:00	06/25 19:00	0.23(3)	**6**	5.7	
14	07/18 16:49	07/19 01:10	07/18 15:00	07/18 19:00	**1.83**	64	7.6	15.4
15	08/01 11:58	08/01 21:17	08/01 13:00	08/01 16:00	0.14	**4**	6.9	
16	08/10 13:00	08/10 21:57	08/10 12:00	08/10 14:00	0.31(3)	104	7.1	
17	08/15 14:12	08/16 04:23	08/15 13:00	08/15 21:00	**0.62**	**24**	2.3	
18	08/27 13:25	08/27 20:06	08/27 12:00	08/27 14:00	**0.77**	218	1.5	1.0

Overflow Event at Alley Creek Tank			Rain Event at LaGuardia Airport[(1)]			Hours Since Prior Rain[(4)]	Overflows	
Overflow No.	Start Mo/Da Hr:Mn	End Mo/Da Hr:Mn	Start Mo/Da Hr:Mn	End Mo/Da Hr:Mn	Rainfall (inch)[(2)]		Meas.	Model (LGA)
19	09/04 12:14	09/04 20:35	09/04 11:00	09/04 22:00	0.13	**9**	0.5	
20	09/05 11:42	09/05 20:44	09/05 09:00	09/05 13:00	**0.46**	**6**	1.5	
21	09/18 22:58	09/19 05:12	09/18 19:00	09/18 23:00	**1.27**	**8**	3.9	8.6
22	10/15 19:07	10/16 02:28	10/15 17:00	10/15 20:00	0.28[(3)]	128	2.4	
23	12/18 01:47	12/19 00:17	12/17 22:00	12/18 06:00	**0.76**	**14**	1.5	0.9
24	12/21 07:04	12/22 01:06	12/21 00:00	12/21 11:00	**0.85**	54	7.3	0.4
25	12/26 22:09	12/28 07:14	12/26 17:00	12/27 11:00	**0.92**	**34**	15.9	0.3

(1) Statistics generated using EPA SYNOP program with 4-hr inter-event time and zero minimum rain threshold.
(2) Bold rain events are 0.46 inch or more and are therefore expected to fill or exceed the tank capacity.
(3) Radar shows the facility drainage area received up to: 0.75 inches on 1/21; 0.20 inches on 2/11; 1.50 inches on 6/25; 0.75 inches on 8/10; and 0.50 inches on 10/15.
(4) Bold values reflect less than the 36 hours required to dewater the tank, subject to available capacity in the collection system and at Tallman Island WWTP. (Date and time of prior rain not shown in this table.)

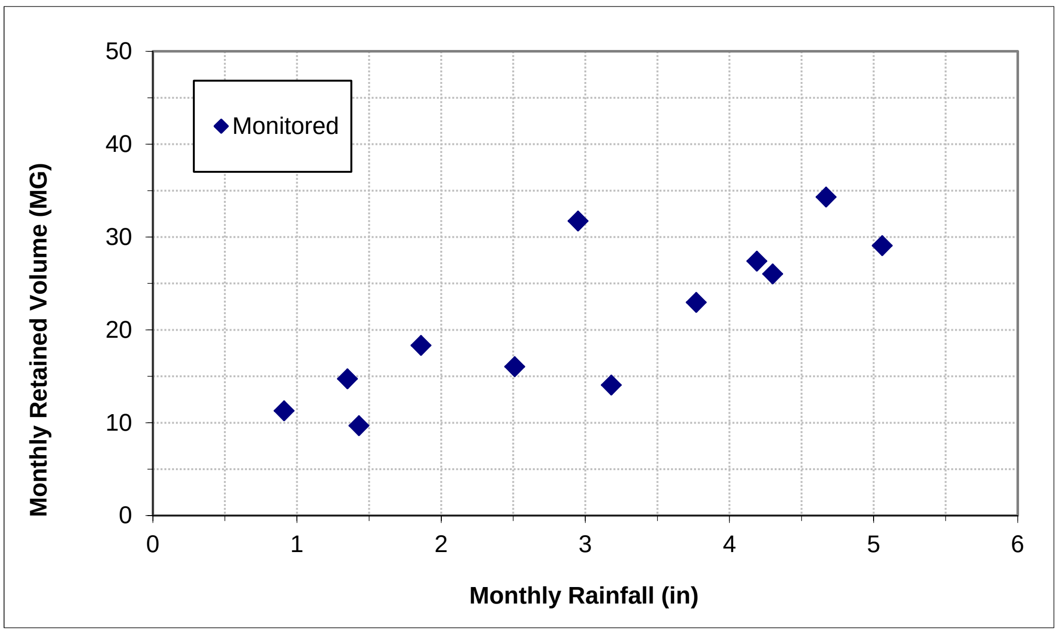


Figure 4-6. Monthly Retained Volume vs. Rainfall, Alley Creek CSO Retention Tank, 2012

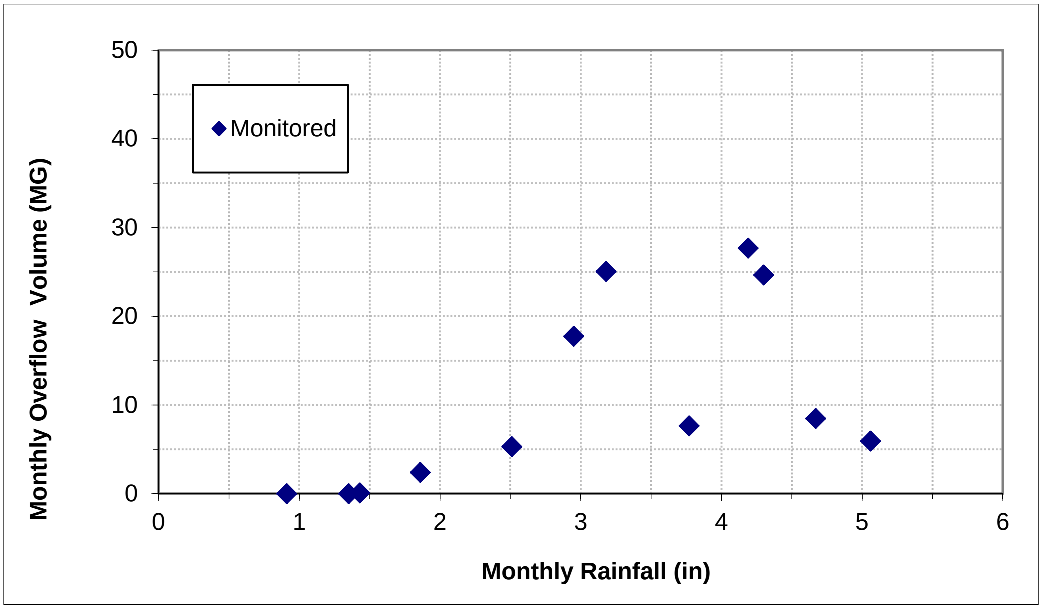


Figure 4-7. Monthly Overflow Volume vs. Rainfall, Alley Creek CSO Retention Tank, 2012

Even during dry weather, the Alley Creek Retention Tank collects a combination of I/I from the influent sewers and seepage. To quantify the I/I, DEP tracks the water-surface elevations in the tank cells and estimates[2] the overall I/I on a daily and monthly basis. The I/I estimates are summarized in the facility monthly operating reports. In 2012, the average I/I rate was 0.55 MGD, with monthly average values ranging from 0.00 to 0.91 MGD and a highest daily estimate of 4.4 MGD (following a large storm event). The Alley Creek tank is operated such that I/I volumes are pumped back to the WWTP prior to anticipated wet weather events to minimize the impact on wet weather capture of combined sewage at the facility.

Effluent Quality

Because it is an unmanned facility, overflow effluent quality was not measured at the Alley Creek CSO Retention Tank during 2012. Limited effluent quality data were, however, sampled as part of the development of the LTCP in an attempt to better quantify the tank loadings. Two overflow events were sampled, one on December 18, 2012, and the other on January 31, 2013. The tank's effluent sampling system was used for both events.

Data from the first sampling event were un-usable because of inadequate laboratory dilutions. The data from the second event were also suspect as the bacteria concentrations far exceeded what would be expected for CSO discharges, being closer to the strength of typical dilute sanitary sewage. This could have been caused through re-growth in the sampling lines or other anomalies due to the attempted use of the tank's sampling system. As such, the data from the second event were also not used. Instead, a modeling mass balance approach, described later in the report, was used to assess TI-025 bacteria loadings.

Because of these issues associated with collecting reliable tank effluent bacteria quality, DEP will be taking additional samples in the coming months. In order to avoid use of the tank sampling system, and the possibility of line contamination, influent grab sampling will be taken as a surrogate of effluent quality. This, and other follow-up monitoring resulting from the LTCP, is described in Section 9.

[2] For the Alley Creek facility, DEP's monthly reporting indicates that "Estimated I&I Volume on dry weather days= pump back volume + change in the total retained volume (7:00 a.m.-7:00 a.m.)".

4.3.c Assessment of Performance Criteria

The 2003 CSO Abatement Facilities Plan for Alley Creek set forth the basis of design for the Alley Creek CSO Retention Tank. Specifically, the design objectives were to meet, to the extent feasible and practical, DEC Class I water-quality criteria for DO and for total and fecal coliforms in Alley Creek by reducing the volume of CSOs discharged to Alley Creek. As the time of the Facilities Plan, DO represented the primary parameter of concern, as CSO control alone was not deemed to cost effective in meeting the bacteria criteria. The Facilities Plan also contained as a secondary objective, independent of CSO abatement, the alleviation of surcharging and street flooding in the area upstream of outfall TI-008. This LTCP focuses on the first objective, bacteria attainment.

CSO Storage

Analysis[3] of the 2012 rainfall records at LGA indicates that there were 125 rainfall events, of which 25 had more than 0.46 inches of rain (the approximate design storm for the Alley Creek CSO Retention Tank). Based on this information and the operational records in the monthly operating reports, the Alley Creek CSO Retention Tank fully captured combined sewage generated in 100 of the 125 storms, or 80 percent of all storms in 2012.

Table 4-2 lists the start and end times of each of the 25 overflow events in 2012, along with the corresponding rainfall characteristics as measured at LGA. Rainfall at LGA exceeded the 0.46-inch design capacity of the facility during 15 of these overflow events, and inspection of radar information indicates that 0.46 inches or more likely occurred over the service area during another 4 overflow events (January 21, February 11, August 10, and October 15). Another 6 overflow events occurred during storms that began within 36 hours of prior rainfall so that there was insufficient time for the tank to fully dewater. As a result, the facility met the CSO-storage metric for 124 of the 125 storms in 2012.

IW modeling performed for the 2012 period indicates that, compared to the pre-tank condition, operation of the Alley Creek CSO Retention Tank reduced the number of CSO events 73 percent, which is just above the annual-average target of 70 percent. In terms of CSO volume, operation of the tank is calculated to have reduced discharge volume by 73 percent, which exceeds the annual-average volume reduction target of 54 percent.

CSO Pollutant-Load Reduction

Based upon the IW modeling analyses, the operation of the Alley Creek CSO Retention Tank reduced 2012 pollutant loadings of both TSS and BOD by 85 percent, versus the pre-tank condition, thereby exceeding the annual-average target reductions of 70 and 66 percent, respectively.

As noted above, the Alley Creek CSO Retention Tank fully captured combined sewage and associated floatables for 100 of the 125 rainfall events in 2012. During the 25 events in 2012 when the tank did overflow, floatables removal at the facility was enhanced by means of an underflow baffle. Retained floatables are removed either at trash racks at the Old Douglaston PS or the influent screens at the Tallman Island WWTP. Overall, the facility satisfied this performance criterion through substantially reducing the discharge of floatables to Alley Creek.

[3] *Statistic developed using EPA's SYNOP program with 4-hour inter-event time and 0 inch minimum storm threshold.*

SECTION 5.0
GREEN INFRASTRUCTURE

5.0 GREEN INFRASTRUCTURE

Recent studies around the country have shown that integrating GI into CSO LTCPs can be an effective way of capturing stormwater runoff and controlling CSO discharges into receiving waterbodies. Such an approach has been taken by the City of New York, and it has been incorporated into the 2012 Order on Consent with DEC.

The 2012 Order on Consent requires DEP to manage one-inch of runoff from 10 percent of impervious surfaces in combined sewer areas citywide by 2030. In the near term, DEP is to implement sufficient GI to attain an initial application rate of 1.5 percent, or encumber $187M toward implementation by December 31, 2015. If this 1.5 percent goal is not met, DEP must submit a contingency plan to DEC by June 20, 2016. As part of each LTCP, DEP will refine watershed-specific application rates and anticipated CSO volume reduction benefits, based on the results of modeled initial application rates. DEP will also demonstrate that watershed-specific GI implementation, combined with adaptive management, will achieve the targets in the Citywide LTCP due in 2017. The current GI program and planned GI implementation in NYC and the Alley Creek and Little Neck Bay watershed are described below.

5.1 NYC Green Infrastructure Plan (GI Plan)

In September 2010, New York City published the *NYC Green Infrastructure Plan*, effectively presenting an alternative approach to improving water quality through additional CSO volume reductions by outlining strategies to implement decentralized stormwater source controls. DEP estimated that a hybrid green/grey infrastructure approach would reduce CSO volume by an additional 3.8 billion gallons per year (BGY), or approximately 2 BGY more than implementing an all-grey strategy. In addition to its primary objective, enhancing water quality in NYC, the Plan will yield co-benefits such as more open space, improved air quality, reduced energy use, increased shade, sustained pollination, beautification, and increased property values.

In January 2011, DEP created the Office of Green Infrastructure (OGI) to implement the goals of the GI Plan, and budgeted $187M of its capital budget plus an additional $5M in Environmental Benefits Project (EBP) funds, through FY 2015.[1] Together with other bureaus within DEP and other City agencies, OGI has developed several approaches for designing and constructing GI practices that divert stormwater away from the sewers and direct it to areas where it can be infiltrated, evapotranspired, stored, or detained. OGI has developed standardized designs for right-of-way bioswales (ROWBs) and detailed plans to construct other GI technologies, including pervious pavement, rain gardens, and green and blue roofs. The diverse strategies and activities initiated by OGI to implement these designs and plans and achieve the milestones in the 2012 Order on Consent are described in more detail below.

5.2 Citywide Coordination and Implementation

5.2.a Community Engagement

Stakeholder participation is a critical success factor for the effective implementation of decentralized GI projects. To this end, DEP engages and educates local neighborhoods, community groups, and other environmental and urban planning stakeholders about their role in the management of stormwater. DEP's outreach efforts involve presentations and coordination with elected officials, community boards, stormwater advocacy organizations, green job non-profits, environmental justice organizations, schools and universities, Citizens Advisory Committees (CACs), civic organizations, and other City agencies.

[1] EBP projects are undertaken in connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State law and DEC regulations.

In February 2011, DEP held the first Citywide Green Infrastructure Citizens Group meeting, providing an opportunity for the general public to learn about the Plan's implementation since its inception. In this forum, the public asked questions and made recommendations on the implementation of the Plan. Other issues discussed at the meetings included the Green Infrastructure Grant Program, programmatic updates, and DEP's agreement with DEC to improve New York Harbor water quality by using GI as an integral component of the 2012 Order on Consent. Citizens Group members received periodic updates from DEP and will meet once a year; the first annual meeting of the Citizens Group was held in November 2011. Future meetings will be scheduled to coincide with the release of the Green Infrastructure Annual Report due to DEC in April of each year, to provide the public with regular updates on GI planning, construction, and monitoring.

DEP convened the Green Infrastructure Steering Committee comprised of a cross-section of stakeholders, ranging from environmental justice and economic development organizations, to architecture, design, green jobs training organizations, and other experts in stormwater management issues. The Steering Committee meets quarterly, and serves as a liaison between the Citizens Group and DEP, to represent their respective ideas and concerns. In 2012, the Steering Committee organized itself into three separate Working Groups, structured around the specific concentrations of DEP's GI implementation strategy – Green Jobs, Education & Engagement, and Technical Advice & Research.

Throughout the implementation of the Green Infrastructure Program, DEP has conducted additional community engagement activities, such as a Rain Barrel Giveaway Program, which distributes free rain barrels for stormwater detention at private sites; DEP has also created educational and informational materials that are available on its website. DEP has participated in several workshops, such as Grow Our Grassroots with MillionTreesNYC and the Mayor's Office of Long-term Planning and Sustainability, and Green Infrastructure; its beauty and function, with the NYC ReLeaf Committee. Furthermore, DEP notifies the public of upcoming construction by sending informational postcards to all mailing addresses within an average three-block radius of project sites, informing communities of right-of-way bioswale GI build-out for every project area, and coordinating with the Bureau of Engineering Design and Construction (BEDC) on construction project newsletters.

5.2.b Interagency Coordination

In 2011, the City created an interagency Green Infrastructure Task Force to identify opportunities to add GI to existing and planned capital projects across NYC. Since the creation of the OGI, DEP has established a schedule of standing Green Infrastructure Task Force meetings with representatives of the NYC Departments of Buildings, City Planning, Citywide Administrative Services, Cultural Affairs, Design and Construction, Education, Transportation (DOT), Parks and Recreation (DPR), Sanitation, Housing and Preservation Development, as well as the NYC Economic Development Corporation (EDC), Law Department, Housing Authority, Office of Management and Budget, Mayor's Office of Long Term Planning and Sustainability, and the Health and Hospitals Corporation.

In 2011 DEP, DOT, and DPR signed an agreement that stipulates DPR will use Greenstreets crews to maintain vegetated GI in the right-of-way through June 2015. The agreement clearly defines roles and responsibilities for right-of-way GI installations, establishing that DEP will provide funding to DPR for maintenance of plants, trees, and landscaped areas; DOT will maintain (to the extent practicable) the existing grades during milling and resurfacing operations when working around GI sites; and DEP will continue to maintain catch basins and other existing roadway drainage elements.

5.3 Completed Green Infrastructure to Reduce CSOs (Citywide and Watershed)

5.3.a Green Infrastructure Demonstration and Pilot Projects

The GI program applies an adaptive management approach, based on pilot monitoring results and information collected and assessed for demonstration projects. In particular, this information will be used to develop a GI performance metrics report by 2016, relating the benefits of CSO reduction with the amount of constructed GI.

Pilot Monitoring Program: DEP initiated site selection and design of its Pilot Monitoring Program in 2009. The program has provided DEP opportunities to test different designs and monitoring techniques, to determine the most cost-effective, adaptable, and efficient GI strategies that can be implemented citywide. Specifically, the pilot monitoring has aimed to assess the effectiveness of each of the evaluated source controls at reducing the volume and/or rate of stormwater runoff from the drainage area through measuring quantitative aspects (e.g., source control inflow and outflow rates) as well as qualitative issues (e.g., maintenance requirements, appearance and community perception). Data collection began in 2010 and 2011, as construction for each of the 25 monitoring sites was completed. Pilot Monitoring Program results are currently being used to improve GI designs and validate modeling methods and parameters. Results are further discussed in Section 5.3.e.

Neighborhood Demonstration Area Projects: The 2012 Order on Consent contains milestones related to the construction of three Neighborhood Demonstration Area Projects. DEP will build and monitor GI on 63 acres across the Newtown Creek, Hutchinson River, and Jamaica Bay watersheds, to study the benefits of GI application on a neighborhood scale. The development of these Demonstration Projects will culminate in the submission of a Phasing Post Construction Monitoring Report in August 2014, and will be incorporated into the 2016 performance metrics report.

Construction of ROWBs as part of the Hutchinson River Green Infrastructure Demonstration Project (Demo Area 1) started in September 2012. Demo Area 1 is comprised of 24 acres of GI, and cost just over $300,000. The Jamaica Bay Green Infrastructure Demonstration Project in 26th Ward Sewershed (Demo Area 2) encompasses 23 acres, and DEP has spent $575,000 to the construction of ROWBs. As is the case with the Hutchinson River Demonstration Project, construction work and performance monitoring initiated in Demo Area 2 in 2012. Finally, the Newtown Creek Demonstration Project (Demo Area 3) includes ROWBs over a 14-acre area, and cost about $330,000. Construction has been completed for all ROWBs as well as for additional GI constructed on public properties within Area 2 and 3. DEP has committed to spend a minimum of $2M worth of EBP funds to construct the neighborhood-scale GI demonstration projects.

While DEP’s Pilot Monitoring Program provides performance data for individual GI installations, the Neighborhood Demonstration Area Projects will provide standardized methods and information for calculating, tracking and reporting derived CSO volume reductions and other benefits associated with both multiple installations within a concentrated area and common connections to the sewer system. The data collected from each of the three demonstration areas will enhance DEP’s understanding of the benefits of GI relative to runoff control and CSO reduction. The results will then be extrapolated for calculating and modeling water quality and cost-benefit information on a citywide and waterbody basis.

5.3.b Public Projects

As of May 2013, DEP has identified and selected seventeen Priority CSO Tributary Areas for GI implementation, based on CSO volume, frequency, and receiving waterbody quality. Additional criteria were considered to identify specific outfall subcatchments for GI implementation, including proximity to public access locations, and WWFP improvement projects already constructed or which will be constructed. When added together, the priority CSO tributary areas total 18,705 acres and are spread across the Bronx, Queens, and Brooklyn, as shown in Figure 5-1 (next page).

DEP will utilize area-wide contracts for designing and constructing decentralized GI systems, primarily right-of-way bioswales over the entire CSO tributary areas. Area-wide GI contracts have been awarded to three DEP consultants covering seven Priority CSO Tributary Areas. Moreover, additional Priority Areas have been assigned to agency partners including BEDC, DPR, and the NYC EDC. By the end of 2012, the first 45 ROWBs had been built using the NYC Green Infrastructure Standards for ROWBs established by DEP earlier in the year. DEP projects the implementation of approximately 6,000 ROWBs by 2015, contributing to the 1.5 percent citywide GI application rate.

DEP has partnered with the Green Infrastructure Task Force to initiate GI retrofits on public properties within Priority CSO Tributary Areas. As of December 2012, DEP had initiated designs with the NYC Housing Authority at three developments – one in the Bronx and two in Brooklyn. In addition, DEP has committed to work with the Trust for Public Land, in coordination with the NYC School Construction Authority and the Department of Education, to construct up to 10 GI projects in schoolyards per fiscal year. DEP will also work with the NYC Health and Hospitals Corporation, DPR, the Department of Cultural Affairs, and other City agencies to site and build GI projects to contribute to the 1.5 percent citywide GI application rate by 2015. Because of the factors noted earlier in the section, no GI public projects – on-site or in the right-of-way – are currently being implemented or have been completed in the Alley Creek and Little Neck Bay watershed.

5.3.c Performance Standard for New Development

On July 4, 2012, DEP's stormwater performance standard came into effect as an amendment to Chapter 31, Title 15 of the Rules of the City of New York. The standard modifies the flow rate of stormwater to the City's CSS for new and existing development, as part of sewer availability and connection approvals. The rule applies to development lots where new buildings or horizontal alterations of existing buildings that would result in an expansion of building footprint or impervious surfaces are proposed.

DEP developed the rule in coordination with other City agencies and utilized prototypical development, overlay of potential site conditions and sewer system design. The purpose of the rule amendment is to more stringently control the flow of stormwater runoff from development lots to the City's sewer system, in an effort to improve the performance of the system and increase its capacity, while ensuring that the system is protected from uncontrolled or pressurized flow.

The stormwater performance standard applies to all development lots, regardless of size, and extends to all stormwater recycling systems. For infiltration practices, the cap was removed for proposed volume reductions, as demonstrated by soil borings and in-situ permeability tests. The rule specifies overall site runoff coefficient reductions for different surface types, including open space, green roofs, and permeable pavement.

Costs for compliance as part of new developments and alterations are expected to be less than 1.5 percent of total development costs. Moreover, the new rule allows for a phased approach toward attaining future and potentially more stringent federal and State stormwater requirements, and also provides substantial flexibility for applicants to comply with stricter release requirements, based on the availability of different technologies and site specific conditions.

Parallel to the enactment of the new stormwater performance standard, DEP published a set of "Guidelines for the Design and Construction of Stormwater Management Systems", to assist New York City's development community and licensed professionals in the selection, planning, design and construction of onsite source controls that comply with the new rule. The guidelines feature guidance on siting, design and construction considerations for various stormwater control systems, as well as operation and maintenance recommendations.

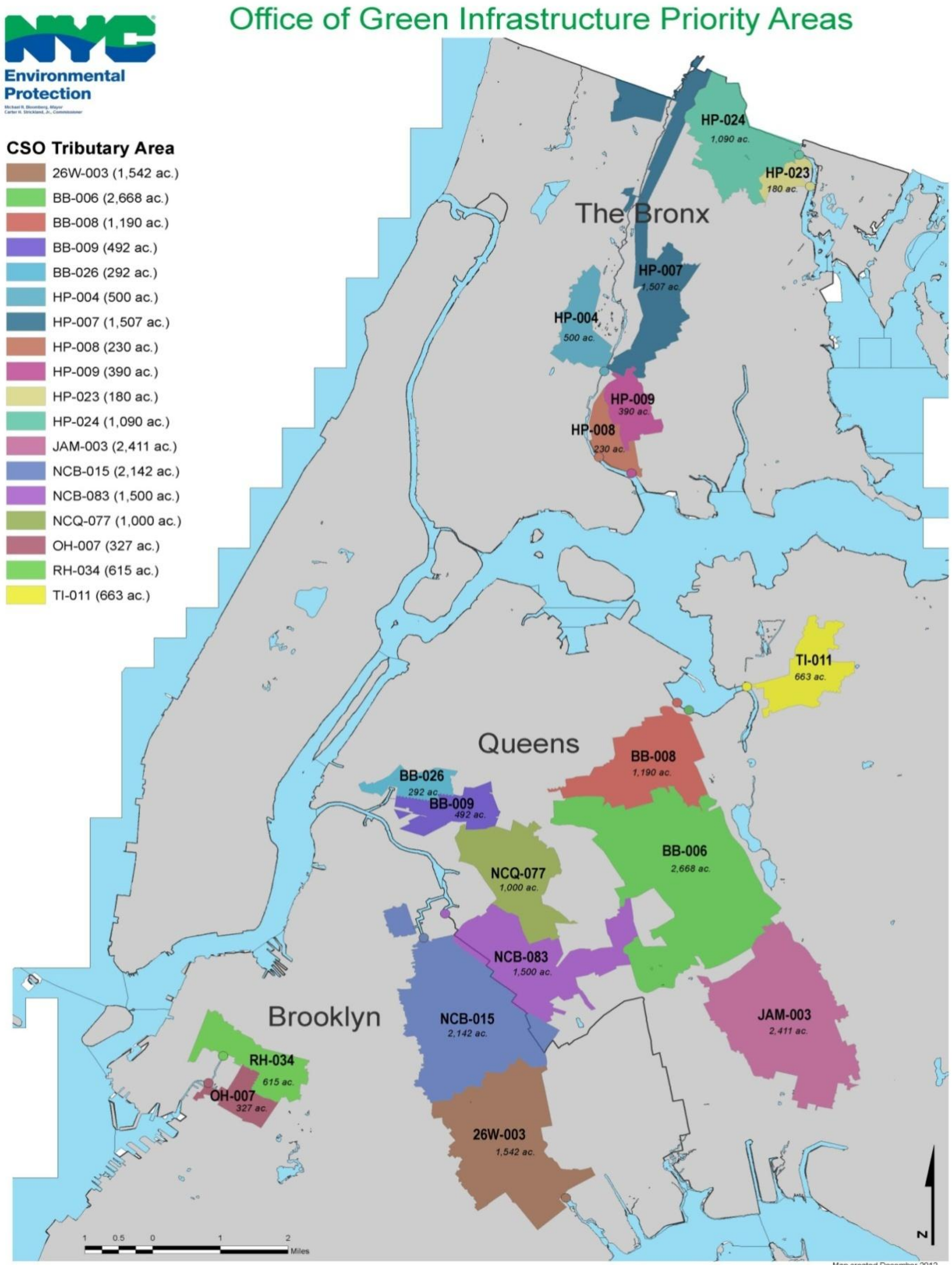


Figure 5-1. Priority CSO Tributary Areas for Green Infrastructure Implementation

5.3.d Other Private Projects (Grant Program)

Application in Private Property

The Green Infrastructure Grant Program has awarded approximately $7M to private property owners to build GI projects in the combined sewer areas of NYC. Since its introduction in 2011, the Grant Program has sought to strengthen public-private partnerships and public engagement in regard to the design, construction and maintenance of GI.

For the 2011 grant cycle, $3.4M was awarded among 12 projects across four boroughs and three watersheds. Projects included rooftop farms, permeable pavement, rain gardens, as well as green and blue roofs. Notably, the first completed Green Infrastructure Grant projects were the rooftop farm at Brooklyn Navy Yard and the rain garden-permeable pavement at Queens College, which were completed in summer 2012.

The Grant Program awarded $3.6M to nine proposals for the 2012 cycle. Projects are also spread across four boroughs and three watersheds, and include green roofs, rain gardens, porous pavement and bioinfiltration. During the 2012 grant cycle, DEP created an online application to standardize and streamline processes, and make the overall Program substantially more efficient. DEP hosts workshops throughout the City to equip applicants with the tools necessary to submit successful applications, and works to improve the Program each cycle by sending surveys to all applicants. DEP has expanded the Grant Program by announcing $6M for 2013, thus adding to the previously awarded $7M. Currently, no GI projects under the Grant Program are being implemented or have been completed in the Alley Creek and Little Neck Bay watershed.

In addition, the 2012 Order on Consent requires the extension of DEP's current Grant Program and a commitment to use a minimum of $3M of Environmental Benefit Project funds by 2015, to expand available grant funding for applicants. By the end of 2012, three grant projects were being implemented using EBP funds.

The NYC Green Roof Tax Abatement (GRTA) has provided a fiscal incentive to install green roofs in private property since 2008. DEP has worked with the Mayor's Office of Long Term Planning and Sustainability (OLTPS), DOB, the Department of Finance (DOF) and the Office of Management and Budget (OMB), as well as environmental advocates and green roof designers, to modify and extend the GRTA through 2018. DEP has met with stakeholders and incorporated much of their feedback to improve the next version, and help increase the number of green roofs in the City. Proposed changes include an increase in the abatement value to account for 2012 construction costs, a doubling of the abatement cap to encourage rooftop farms, text allowing native species and agricultural plants, and allowing more time to meet plant coverage requirements. Likewise, DEP will fund an outreach position to educate applicants and assist them through the abatement process, to help facilitate application approval and respond to issues that may arise.

5.3.e Projected vs. Monitoring Results

Pilot Monitoring Program: Data collection for DEP's Pilot Monitoring Program began in 2010 and 2011 as construction for each of the 25 monitoring sites was completed; subsequent quantitative monitoring parameters included:

- Water quantity: inflow, outflow, infiltration, soil moisture and stage.
- Weather: evaporation, rainfall, wind, relative humidity and solar radiation.
- Water/soil quality: diesel/gas, nutrients, TSS, TOC, salts, metals, soil sampling and infiltrated water sampling.

Quantitative monitoring was conducted primarily through remote monitoring equipment, such as pressure transducer water level loggers in conjunction with weirs or flumes to measure flows, monitoring aspects of source control performance at a 5-minute interval. On-site testing and calibration efforts included infiltration tests and metered discharges, to calibrate flow monitoring equipment and assess the validity of assumptions used in pilot performance analysis.

The *Preliminary Pilot Monitoring Report* has provided useful information that has influenced siting procedures and the designs of GI systems. Preliminary observations indicate that all GI applications are providing stormwater management benefits and bioretention source controls are close to fully managing the 1-inch runoff. Though initial results are encouraging, further data analysis and refinement of metrics will provide greater insight into the relationship between CSO volume reductions and GI planning, as well as the development of future CSO LTCPs and the adjustment of GI application rates for specific watersheds.

Neighborhood Demonstration Area Projects: As previously discussed, the objective of DEP's Neighborhood Demonstration Area Projects is to maximize management of stormwater runoff near where it is generated, and then monitor the reduction of combined sewage originating from the drainage sub-basins. The development of these demonstration projects will culminate in the submission of a PCM Report in August 2014, and ultimately in a 2016 performance metrics report. The 2016 report will relate the benefits of CSO reduction associated with the amount of GI constructed, and detail methods by which DEP will use to calculate the CSO reduction benefits in the future.

The three Neighborhood Demonstration Areas where DEP will test the effectiveness of GI implementation were selected because the existing CSSs were suitable for monitoring flow in a single sewer pipe of a certain size, and are not influenced by surcharging hydraulic conditions. In each of the Demonstration Areas, DEP has identified GI opportunities such as bioswales and stormwater Greenstreets in the right-of-way, and on-site detention and retention opportunities on City-owned property.

The combined sewer flow reductions achieved by GI implementation will be monitored through the collection of high quality flow monitoring data at the point at which the combined sewers exit Demonstration Area catchments. Monitoring activities consist of recording flow and depth, using meters placed within key outlet sewers. Data acquisition is continuous, with measurements recorded at 15-minute intervals.

Data analysis will involve a review of changes in pervious and impervious surface coverage between pre- and post-construction conditions, consisting of several elements, including statistical analyses and modeling refinements. The statistical analyses will enable DEP to:

- Determine the overall amount of CSO reduction associated with GI implementation;
- Determine rules of thumb (gallons per acre controlled) for use in scaled-up GI planning and implementation in other (non-demo) areas of the City;
- Determine a representative permeability range for ROWBs infiltration; and
- Utilize monitoring data to inform future ROWB designs.

Project data collected will be used to calibrate the IW computer model to the monitored flows for both pre- and post-construction conditions. Post-construction performance data will be used to ensure that retention modeling techniques adequately account for the degree of flow reduction within subcatchments with planned GI and equivalent CSO volume reductions.

It is beneficial to understand the performance of individual source controls in addition to the cumulative effect of GI on total flows from a sewershed. Right-of-way GI sizing and effectiveness is dictated in large part by the storage capacity within the source control and the ability of the system to infiltrate water. The source control scale monitoring approach proposed as part of the Demonstration Areas is intended to provide a better understanding of these elements, informing future designs. Individual bioswale monitoring will consist of surface water level measurements, subsurface water level measurements, and soil moisture readings at three specified depths.

5.4 Future Green Infrastructure in the Watershed

5.4.a Relationship Between Stormwater Capture and CSO Reduction

CSO reduction and pollutant load reduction through additional stormwater capture in the Alley Creek and Little Neck Bay watersheds can be evaluated using the landside model, developed in IW modeling software, based on the extent of retention and detention practices in combined sewer areas. The extent of retention and detention is configured in terms of a percent of impervious cover where one inch of stormwater is managed through different types of source controls. Retention at different source controls is lumped on a sub-basin or subcatchment level in the landside model, due to their distributed locations within a watershed; this is also due to the fact that the landside model does not include small combined sewers, and cannot model them in a distributed manner. Retention is modeled with the applicable storage and/or infiltration elements. Similarly, the distributed detention locations within a watershed are represented as lumped detention tank, with the applicable storage volume and constricted outlet configured based on allowable peak flows from their respective drainage areas. Modeling methods designed during the development of DEP's GI plan have been refined over time to better characterize the retention and detention functions.

As reviewed in the existing system configuration, CSO volumes in Alley Creek are essentially discharged from the outfall TI-025, which is the bypass for Alley Creek CSO Retention Tank. Discharges to this outfall include both CSO and stormwater discharges being conveyed together through the old outfall, TI-008, and then diverted to the tank through Chamber 6 weir. Therefore, the future GI opportunities will be evaluated in both combined and separate areas draining to the tank, to assess the associated reductions in CSOs at TI-025. As discussed in Section 8, two future GI scenarios (10 and 50 percent retention GI) will be evaluated in terms of both CSO volume reduction and pollutant load reductions.

A large volume of stormwater is discharged into Alley Creek and Little Neck Bay from separately-sewered drainage areas or direct drainage areas (wetlands, open areas, and parklands). Therefore, GI application in combined/separate areas draining to TI-025 alone would not result in appreciable improvements in water quality of Alley Creek and Little Neck Bay. The 10 percent retention GI application reflects the citywide goal of managing the equivalent of one-inch of stormwater generated from 10 percent of impervious surfaces in combined sewer areas by 2030, per the 2012 Order on Consent. It is important to note, however, that a 50 percent application rate would require constructing GI projects on both public onsite properties as well as private property, since right-of-way opportunities comprise, on average, 30 percent of gross impervious area throughout the City (based on the experience gained by the OGI in the exploration of opportunities for right-of-way bioswales). Thus, a 50 percent application rate would be highly difficult to achieve.

5.4.b Opportunities for Cost-Effective CSO Reduction Analysis

Concurrent with the Alley Creek and Little Neck Bay LTCP, DPR’s Natural Resources Group (NRG) is preparing the Alley Creek Watershed Plan (“Watershed Plan”), focusing on ecological restoration and stormwater management for the Alley Creek watershed and receiving waterbodies of Little Neck Bay. The development of the Watershed Plan is funded by a New York State Department of State (DOS) grant, with matching funds from New York City. By articulating a vision for the watershed, categorizing impacts and threats to habitat and water quality, and identifying opportunities for restoration, the Watershed Plan is intended to provide a road map for managing and improving ecological resources and maximizing ecological values.

As a first step in developing the Watershed Plan, NRG has begun characterizing the historic and current land use, ecological communities, and physical and hydrologic conditions of the Alley Creek watershed, by collating existing data and professional and community knowledge, and collecting information from rapid assessments in the field. These field assessments will include reconnaissance of the salt marshes, the ephemeral, perennial, and tidal stream reaches, and invasive plant extent in the upland forested areas. Issues such as dumping, invasive plants, and erosion, identified during the field assessment, will provide an inventory of potential opportunities for restoration.

As required by DOS, NRG established a Watershed Advisory Committee (WAC), consisting of governmental and non-governmental stakeholders from the watershed, to guide and review the development of the Watershed Plan. Broader community input solicited during a series of public meetings will also be incorporated during Plan development. In addition, to leverage and build on ongoing regional coastal zone restoration efforts, Watershed Plan development is being coordinated with other watershed planning efforts, such as the DEP's Alley Creek and Little Neck Bay LTCP, and other regional plans, including the Long Island Sound and the NY-NJ Harbor and Estuary Comprehensive Restoration Plans.

In the built landscape of the watershed, a significant component of the Watershed Plan focuses on identifying stormwater management opportunities on DPR's opens spaces, park edges and larger right-of-way opportunities particularly in separately sewered (non-CSO) areas. The goal is to identify several feasible projects for which conceptual designs and costs will be developed, with the ultimate aim of seeking additional funding to support construction. Numeric models will be utilized to assess the potential performance of identified GI opportunities.

In the parkland sections of the watershed, restoration opportunities will focus on protecting, enhancing and restoring ecological communities and their functions, from forested upland to salt marshes along Little Neck Bay. NRG has reviewed the extent and results of past restoration efforts in the watershed and identified a range of opportunities, from stream channel and riparian corridor vegetation restoration near the headwaters (e.g. along Douglaston Parkway), to vernal pool restoration opportunities in the adjacent upland, closer to the mouth of Alley Creek. Additional opportunities for vegetation community restoration and eliminating inadvertent point source discharges have been flagged in Udall's Cove Park.

Broader ecosystem restoration opportunities will also focus on the management of invasive species and their deleterious effects, such as suppression of natural recruitment of diverse native woody species that help stabilize stream banks. In conjunction with Mayor Bloomberg's PlaNYC, invasive removal and habitat restoration is currently underway along the eastern shore of Alley Creek, between Northern Boulevard and the Long Island Expressway. Approximately 20 acres of aggressive invasive plant species, such as phragmites, autumn olive, and porcelainberry, are in the process of being controlled and removed. The first phase of replanting with coastal maritime forest species began with a large volunteer event on April 27, 2013, as part of the MillionTreesNYC spring planting day. Contract work will continue in this area until fall of 2015.

5.4.c Watershed Planning to Determine 20-year Penetration Rate for Inclusion in Baseline Performance

To meet the 1.5-, 4-, 7-, and 10-percent citywide GI application rates by 2015, 2020, 2025 and 2030, respectively, DEP has developed a watershed prioritization system based on watershed-specific needs. This approach has provided an opportunity to build upon existing data and make informed estimates available; it has also provided DEP a footprint for ongoing GI implementation.

Watershed-specific implementation rates for GI are estimated based on the best available information from modeling efforts. Specific waterbody/watershed facility plans, the Sustainable Stormwater Management Plan, the Green Infrastructure Plan, CSO outfall tiers data, and historic building permit information are all being reviewed to better assess waterbody-specific GI application rates.

The following criteria were applied to compare and prioritize watersheds in order to determine watershed-specific GI application rates:

- WQS
  - Fecal Coliform
  - Total Coliform
  - Dissolved Oxygen
- Cost effective grey investments
  - Planned/constructed grey investments
  - Projected CSO volume reductions
  - Remaining CSO volumes
  - Total capital costs
- The ratio of separate stormwater discharges to CSO discharges
- Preliminary watershed sensitivity to GI in terms of cost per gallon of CSO reduced
- Additional considerations:
  - Background water quality conditions
  - Public concerns and demand for higher uses
  - Site specific limitations (i.e., groundwater, bedrock, soil types, etc.)
  - Presence of high frequency outfalls
  - Eliminated or deferred CSO storage facilities
  - Additional planned CSO controls not captured in WWFPs or 2012 Order on Consent (i.e., high level storm sewers, HLSS)

The overall goal for this prioritization is to distribute GI implementation rates among different priority watersheds, such that the total managed impervious acres will still be achieved in accordance with the 2010 Green Infrastructure plan, except for the East River and Open Waters.

Green Infrastructure Baseline Application Rate – Alley Creek and Little Neck Bay

Based on the above criteria, Alley Creek and Little Neck Bay's characterization ultimately determined the watershed's individual GI application rate. This particular watershed has one of the smallest total combined sewer impervious areas among the list of managed watersheds, totaling 1,490 acres. This area is significantly controlled by existing CSO facilities and sewer enhancements. Therefore, DEP assumes no investment in GI implementation in the right-of-way or onsite public properties, taking into account water quality with WWFP improvements in place, as well as the potentially more effective allocation of GI resources in other watersheds that can provide more water quality benefits for the same level of implementation.

DEP, however, does expect 45 acres of implemented GI to be managed in onsite private properties in Alley Creek and Little Neck Bay by 2030. This acreage would represent three (3) percent of the total combined sewer impervious area in the watershed, and assumes new development based on DOB building permit data from 2000 to 2011. The data has been projected for the 2012-2030 period, to account for compliance with the stormwater performance standard.

In summary, DEP expects stormwater to be managed through onsite private GI implementation in three (3) percent of the total combined sewer impervious areas in Alley Creek and Little Neck Bay by 2030. Furthermore, as LTCPs are developed, baseline GI application rates for specific watersheds may be adjusted based on the adaptive management approach and GI requirements set forth in the 2012 Order on Consent. The model has predicted a reduction in annual overflow volume of 0.5 MG as the CSO benefit from this GI implementation, for the 2008 baseline rainfall condition.

SECTION 6.0
BASELINE CONDITIONS AND PERFORMANCE GAP

6.0 Baseline Conditions and Performance Gap

Key to development of the LTCP for Alley Creek and Little Neck Bay is the assessment of water quality within each waterbody. Water quality was assessed using the ERTM water quality model, recalibrated with both Harbor Survey and the synoptic water quality data collected in 2012. The ERTM water quality model simulated ambient pathogen concentrations within the two waterbodies for a set of baseline conditions, as described below. The InfoWorks CS sewer system model was used to provide flows and loads from intermittent wet weather sources as input to the water quality model.

Two types of continuous water quality simulations were performed to evaluate the gap between the calculated pathogen levels and the WQS. As detailed below, one-year (2008 rainfall) simulation was performed for pathogens and dissolved oxygen (DO). This shorter term continuous simulation served as a basis for evaluation of control alternatives. A longer term 10-year simulation was performed for pathogens, to assess the baseline conditions, evaluate the performance gap, and analyze the impacts of the final selected control plan.

This section of the report describes the baseline conditions and the pathogen concentrations calculated by the ERTM water quality model. It further describes the gap between calculated baseline pathogen concentrations and the WQS when the calculated concentrations exceed the criteria.

6.1 Define Baseline Conditions

Establishing baseline conditions is an important step in the LTCP process, since the baseline conditions will be used to compare and contrast the effectiveness of CSO controls and to predict whether water quality goals would be attained after the implementation of the recommended LTCP. Baseline conditions for this LTCP were established in accordance with guidance established by DEC to represent future conditions. Specifically, these conditions included the following assumptions: the design year was established as 2040; Tallman Island WWTP will receive peak flows at 2xDDWF; grey infrastructure would include those recommended in the 2009 WWFP; and waterbody specific GI application rates would be based on the best available information. Mathematical modeling tools were used to calculate the CSO volume and pollutants loads and their impacts on water quality. The performance gap between calculated WQS was assessed herein through the evaluation of additional CSO control alternatives.

The IW model was used to develop stormwater flows, conveyance system flows, and CSO overflows for a set of future conditions (Baseline Conditions). For Alley Creek and Little Neck Bay LTCP, the baseline conditions were developed in a manner consistent with the earlier 2009 Alley Creek and Little Neck Bay WWFP approved by DEC. However, based on more recent data as well as the public comments received on the WWFP, it was recognized that some of the baseline condition model input data needed to be updated, to reflect more recent meteorological conditions as well as current operating characteristics of various collection and conveyance system components. Furthermore, the mathematical models were also updated from their configurations and levels of calibration developed and documented during development of the earlier WWFP. IW model alterations reflected a better understanding of dry and wet weather sources, catchment areas, and new or upgraded physical components of the system. Water quality model updates included more refined model segmentation. Model input changes that have resulted from physical changes in the system are described in Section 2.1. The new IW model network was then used to establish the baseline conditions and was used as a tool to evaluate the impact of alternative operating strategies and physical changes to the system.

Following are the baseline modeling conditions primarily related to DWF rates, wet weather capacity for the Tallman Island WWTP, sewer conditions, precipitation conditions, and tidal boundary conditions. Each of these is briefly discussed in the section below:

- Wet Weather Capacity: The rated wet weather capacity at the Tallman Island WWTP is 160 MGD (2xDDWF). Projects are underway to ensure that the system will convey and treat this wet weather flow. These projects include: the ongoing TI-3 stabilization project, the programmatic interceptor inspection and cleaning program, and the construction of a new parallel interceptor.

- Sewer conditions: The IW model was developed to represent the sewer system on a macro scale that included including all conveyance elements greater than 48" in equivalent diameter, along with all regulator structures and CSO outfall pipes. Post cleaning levels of sediments were also included for the interceptors in the collection system, to better reflect actual conveyance capacities to the WWTPs.

6.1.a Hydrological Conditions

Previous evaluations of the Alley Creek watershed used the 1988 precipitation characteristics as the representative typical precipitation year. However, for this LTCP, the precipitation characteristics for 2008 were used for the baseline condition, as well for alternative evaluations. In addition to the 2008 precipitation pattern, the observed tide conditions that existed in 2008 were also applied in the models as the tidal boundary conditions at the CSO Outfalls that discharge to tidally influenced waterbodies. For longer term 10-year evaluations, the period from 2002 through 2011 was analyzed.

6.1.b Flow Conservation

Consistent with all of the previous studies, the dry weather sanitary sewage flows used in the baseline modeling were escalated to reflect anticipated growth in the City. In the past, flow estimates were based on the 2000 census, and growth rates were estimated by the Mayor's Office and DCP, to arrive at projected 2045 sanitary flow rates. These flows were then applied to the model, although they were conservative and did not account for flow conservation measures. The updated analyses use the 2010 census data to reassign population values to the watersheds in the model and project up to 2040 sanitary flows. These projections also reflect water conservation measures that have already significantly reduced flows to the WWTPs and freed up capacity in the conveyance system.

6.1.c BMP Findings and Optimization

A list of BMPs, along with brief summaries of each and their respective relationships to the EPA NMCs, were reported in detail in Section 3, as they pertain to Alley Creek CSOs. 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 CSS, thereby improving water quality conditions.

The following provides an overview of the specific elements of various DEP, SPDES and BMP activities as they relate to development of the baseline conditions, specifically in setting up and using the IW models to simulate CSO discharges, and in establishing non-CSO discharges that impact water quality in Alley Creek and Little Neck Bay:

- Sentinel Monitoring – In accordance with BMPs #1 and #5, DEP collects quarterly samples of pathogen water quality at the mouth of Alley Creek in dry weather to assess whether dry weather sewage overflows occur. In 2011 and 2012, DEP used its in-house personnel to trace and remove dry weather sewer connections from eleven homes that were improperly connected to storm sewers that discharge through Outfall TI-024. Dye testing and inspections of homes continues to identify and remediate any remaining illegal connections on an as needed basis. Although localized sources of pollution were included in the water quality model calibration exercises to accurately simulate the observed ambient pathogen concentrations, these sources were excluded from the baseline conditions, to reflect future corrected conditions.

- Interceptor Sediments – DEP inspected and performed cleaning of the Flushing and Whitestone interceptors in 2011. Sewer sediment levels determined through the post-cleaning inspections are included in the IW model.

- Combined Sewer Sediments – The IW models assume no sediment in upstream combined trunk sewers in accordance with BMP #2.

- WWTP Flow Maximization – In accordance with BMP #3, DEP treats wet weather flows up to 2xDDWF that are conveyed to the Tallman Island WWTP. DEP follows this wet weather plan and received and treated 2xDDWF for a few hours in 2011 and 2012; cleaning of the interceptor sediments has increased the ability of the system to convey 2xDDWF to the treatment plant. With the installation of the Whitestone interceptor extension, the WWTP will be receiving 2xDDWF more frequently. The baseline IW model was setup to simulate CSO discharges with the WWTP accepting and treating 2xDDWF and with the Whitestone interceptor extension, currently being constructed.

- Wet Weather Operation Plans (WWOP) – The Alley Creek CSO Retention Tank WWOP (BMP #4) is contained within the Tallman Island WWTP WWOP. This Plan establishes procedures for pumping down the retention tank after wet weather events, to make room for the next event. The IW models were set up to simulate operating conditions and pumping rates/methods consistent with the WWOP.

6.1.d Elements of Facility Plan and GI Plan

Alley Creek and Little Neck Bay LTCP includes the following grey projects recommended in the 2009 WWFP. Construction of this grey infrastructure was completed in early 2011 and Alley Creek CSO Retention Tank became operational on March 11, 2011.

- A new 1,475-foot long multi-barrel outfall sewer extending to a new outfall on Alley Creek (TI-025).
- A new 5 MG Alley Creek CSO Retention Tank:
  - ➢ New diversion chamber (Chamber 6) to direct CSO to the new Alley Creek CSO Retention Tank and to provide tank bypass to TI-008.
  - ➢ Weir set within Chamber 6 to pass all flows up to the DEP 5-year design flow into the tank.
  - ➢ New CSO outfall, TI-025, for discharge from the tank.
  - ➢ Fixed baffle at TI-025 for floatables retention, minimizing release of floatables to Alley Creek.
  - ➢ Upgrade of Old Douglaston PS to empty tank and convey flow to Tallman Island WWTP after the end of the storm.

As discussed in Section 5, the Alley Creek and Little Neck Bay watershed has one of the smallest total CSS impervious areas. DEP estimated that 3 percent of the combined sewer impervious area in the watershed (approximately 45 acres) will have new development based on the projections, and will apply on-site GI controls. This level of GI implementation has been assumed in the baseline model.

6.1.e Non CSO Discharges

In several sections of the Tallman Island WWTP drainage area, stormwater drains directly to receiving waters without entering the combined system. These areas are depicted as “Direct Drainage” or “Local Sources” in Figure 2-8 (Section 2), and were delineated based on topography and the direction of stormwater runoff flow in those areas. In general, shoreline areas adjacent to waterbodies comprise the direct drainage category. Significant “direct drainage” areas include Fort Totten, Douglaston Manor, and

Alley Pond Park, all of which are tributary to Alley Creek and Little Neck Bay. In addition, the northern portion of Douglaston Peninsula, as indicated in Figure 2-8, is currently unsewered. This area appears to contribute pollutants to adjacent Little Neck Bay waters during dry and wet weather.

“Other” areas are largely comprised of parkland, such as the portions of Flushing Meadows, Corona Park, Kissena, Cunningham and Clearview Parks, and Mt. Hebron and Flushing Cemeteries. These areas were depicted as “other” drainage areas in Figure 2-8. The “other” category also includes special cases, such as the former Flushing Airport in College Point (now a commercial distribution center), where sanitary flow is conveyed to the WWTP, and stormwater is conveyed through storm water collection systems to receiving waters. The abovementioned areas are generally outside the Alley Creek and Little Neck Bay watershed, including Oakland Lake and an area in the headwaters of Alley Creek.

Overall, the “direct drainage” and “other” areas cover roughly 3,654 acres of the Tallman Island WWTP (1,484 direct drainage acres and 2,170 “other” acres). In Alley Creek and Little Neck Bay, the “direct drainage” and “other” areas are 828 acres and 192 acres, respectively, totaling 1,020 acres.

6.2 Baseline Conditions – Projected CSO Volumes and Loadings after the Facility Plan and GI Plan

The IW model was used to develop CSO annual average overflow volumes (AAOVs) for the baseline conditions; it included the Alley Creek CSO Retention Tank, which is operational, and assumed the implementation of 3 percent onsite GI. Using these overflow volumes, pollutant loadings from the CSOs were generated using the enterococci, fecal coliform, and BOD concentrations that were used in the recalibration of the Alley Creek portion of the ERTM water quality model. In addition to CSO, pollutant loadings, storm sewer discharges, and other continuous sources of flow impact water quality in Alley Creek and Little Neck Bay.

Continuous flows and loadings from Oakland Lake and the upstream Alley Creek area were assumed to be the same for the baseline condition as they were in the 2011 and 2012 existing conditions, for which the pathogen water quality model was calibrated, with the following exceptions:

- Little Neck Bay DMA area – Localized sources of non-CSO contamination were assumed to be mitigated, outside the LTCP program.
- Upper Alley Creek watershed – Sources of possible contaminated stormwater into Oakland Lake and other tributaries will be tracked down and reduced as part of ongoing monitoring programs and possible future programs required under the new MS4 permit. Illicit discharges and other sources of dry-weather contamination into TI-024 at the head end of Alley Creek were assumed to be mitigated.
- During the 2011 and 2012 pathogen model calibrations, stormwater runoff from DMA was assigned higher than normal stormwater pathogen concentrations, which represented the impact of localized sources. Based on the assumption that improvements will be undertaken to address these localized sources, the additional pathogen loading from the stormwater runoff has been eliminated from the future condition baseline evaluations. As such, in the baseline condition, stormwater runoff from the DMA area was assigned the same pathogen concentrations used for other portions of the system that have stormwater discharges within the Alley Creek and Little Neck Bay watershed.

The pollutant concentrations assigned to the various sources of pollution to Alley Creek and Little Neck Bay, are summarized in Table 6-1.

Table 6-1. Pollutant Concentration for Various Sources in Alley Creek

Pollutant Source	Enterococci (cfu/100mL)	Fecal Coliform (cfu/100mL)	BOD_5 (mg/L)
Stormwater	15,000	35,000	15
Sanitary Sewage	1,000,000	4,000,000	140
Direct Drainage	15,000	35,000	15
Oakland Lake DW	120	120	15
Duck Pond DW	70	30	0

Annual average baseline volumes of CSO, stormwater, direct drainage and localized dry weather sources of pollution to Alley Creek are summarized in Table 6-2. Tables 6-3 and 6-4 provide summaries of enterococci and fecal coliform annual loadings, and Table 6-5 summarizes annual BOD loadings expressed as 5-day values. The information in these tables is provided for the 2008 rainfall condition. CSO effluent concentrations were calculated using the stormwater and sanitary concentrations assigned in Table 6-1, multiplied by the flow calculated by the IW model; the model provides a calculated fraction of flow from stormwater and flow from sanitary sources. For 2008, InfoWorks calculates that a total of 132 MG discharges from the tank, but only 1.9 MG, or 1.4 percent of the flow is sanitary, and the remainder is stormwater. This mixture of flows results in average CSO concentrations roughly 1.1 to 2.6 times greater than the stormwater concentrations for enterococci, fecal coliform, and BOD_5. An example calculation for CSO enterococci concentration is presented below using concentrations from Table 6-1.

$C_{cso} = fr_{san} * C_{san} + fr_{sw} * C_{sw}$

where: C_{cso} = CSO concentration
C_{san} = sanitary concentration
C_{sw} = stormwater concentration
fr_{san} = fraction of flow that is sanitary
fr_{sw} = fraction of flow that is stormwater

28,720 cfu/100mL* = 0.014 x 1,000,000 cfu/100mL + 0.986 x 15,000 cfu/100mL

*Note: This concentration is approximately twice the stormwater concentration.

For the following tables, reference Figure 2-9 for the location of the Alley Creek and Little Neck Bay SPDES Permitted Outfalls.

Table 6-2. Annual CSO, Stormwater, Direct Drainage, Local Sources Baseline Volumes (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Alley Creek	TI-007	ODPS Bypass	0.1
Alley Creek	TI-008	R07	0.0
Alley Creek	TI-025	R29, R30	**132.0**
Little Neck Bay	TI-009	------	0.0
		Total CSO	**132.1**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge, (MG/Yr)**
Alley Creek	TI-008	Oakland Lake	36.4
Alley Creek	TI-024	NA	122.4
Alley Creek	TI-654	NA	59.8
Alley Creek	TI-655	NA	38.6
Alley Creek	TI-659	NA	24.3
Alley Creek	TI-629	NA	4.1
Alley Creek	TI-630	NA	9.8
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Direct Drainage	NA	NA	47.6
Little Neck Bay	TI-006	NA	174.2
Little Neck Bay	TI-543	NA	13.0
Little Neck Bay	TI-623	NA	2.7
Little Neck Bay	TI-625	NA	114.8
Little Neck Bay	TI-628	NA	29.4
Little Neck Bay	TI-633	NA	33.2
Little Neck Bay	TI-658	NA	43.0
Little Neck Bay	TI-656	NA	12.3
Little Neck Bay	TI-660	NA	51.1
Little Neck Bay	TI-668	NA	44.6
		Total Stormwater	**861.3**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Alley Creek	TI-008	Oakland Lake	755.6
Alley Creek	Duck Pond		547.5
		Total Dry Weather	**1,303.1**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Alley Creek			1,778.1
Little Neck Bay			518.4

Totals by Source			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
CSO			132.1
Stormwater			861.3
Local Sources-Baseflows			1,303.1

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Discharge (MG/Yr)**
Alley Creek	CSO	7	132.1
	Stormwater	19	342.9
	Local Sources	73	1,303.1
		Total	**1,778.1**
Little Neck Bay	CSO	0	0
	Stormwater	100	518.4
	Local Sources	0	0
		Total	**518.4**

Table 6-3. Annual CSO, Stormwater, Direct Drainage, Local Sources Enterococci Loads (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-007	ODPS Bypass	0.1
Alley Creek	TI-008	R07	0.0
Alley Creek	TI-025	R29, R30	145.8
Little Neck Bay	TI-009		0.0
		Total CSO	**145.9**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-008	Oakland Lake	20.7
Alley Creek	TI-024	NA	69.5
Alley Creek	TI-654	NA	34.0

Alley Creek	TI-655	NA	21.9
Alley Creek	TI-659	NA	12.8
Alley Creek	TI-629	NA	2.3
Alley Creek	TI-630	NA	5.6
Direct Drainage	NA	NA	27.0
Little Neck Bay	TI-006	NA	98.9
Little Neck Bay	TI-543	NA	7.4
Little Neck Bay	TI-623	NA	1.5
Little Neck Bay	TI-625	NA	65.2

Waterbody	Outfall	Regulator	Total Org.x10^12
Little Neck Bay	TI-628	NA	16.7
Little Neck Bay	TI-633	NA	18.8
Little Neck Bay	TI-656	NA	7.0
Little Neck Bay	TI-658	NA	24.4
Little Neck Bay	TI-660	NA	29.0
Little Neck Bay	TI-668	NA	25.3
		Total Stormwater	**488.0**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-008	Oakland Lake	3.4
Alley Creek	Duck Pond		1.5
		Total Dry Weather	**4.9**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek			344.6
Little Neck Bay			294.2

Totals by Source			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
CSO			145.9
Stormwater			488.0
Local Sources			4.9

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Org.x10^12**
Alley Creek	CSO	42	145.9
	Stormwater	56	193.8
	Local Sources	1	4.9
		Total	**344.6**
Little Neck Bay	CSO	0	0
	Stormwater	100	294.2
	Local Sources	0	0
		Total	**294.2**

Table 6-4. Annual CSO, Stormwater, Direct Drainage, Local Sources Fecal Coliform Loads (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-007	ODPS Bypass	0.1
Alley Creek	TI-008	R07	0.0
Alley Creek	TI-025	R29, R30	460.0
Little Neck Bay	TI-009		0.0
		Total CSO	**460.1**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-008	Oakland Lake	48.2
Alley Creek	TI-024	NA	162.2
Alley Creek	TI-654	NA	79.2
Alley Creek	TI-655	NA	51.2
Alley Creek	TI-659	NA	32.1
Alley Creek	TI-629	NA	5.4
Alley Creek	TI-630	NA	13.0
Direct Drainage	NA	NA	63.0
Little Neck Bay	TI-006	NA	230.8
Little Neck Bay	TI-543	NA	17.3
Little Neck Bay	TI-623	NA	3.6
Little Neck Bay	TI-625	NA	152.0

Little Neck Bay	TI-628	NA	39.0
Little Neck Bay	TI-633	NA	43.9
Little Neck Bay	TI-656	NA	16.3
Little Neck Bay	TI-658	NA	57.0
Little Neck Bay	TI-660	NA	67.0
Little Neck Bay	TI-668	NA	59.1
		Total Stormwater	**1,140.3**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-008	Oakland Lake	3.4
Alley Creek	Duck Pond		0.6
		Total Dry Weather	**4**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek			918.4
Little Neck Bay			686.0

Totals by Source			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
CSO			460.1
Stormwater			1,140.3
Local Sources			4

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Org.x10^12**
Alley Creek			
	CSO	50	460.1
	Stormwater	49	454.3
	Local Sources	0	4.0
		Total	**918.4**
Little Neck Bay			
	CSO	0	0
	Stormwater	100	686.0
	Local Sources	0	0
		Total	**686.0**

Table 6-5. Annual CSO, Stormwater, Direct Drainage, Local Sources BOD_5 Loads (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Alley Creek	TI-007	ODPS Bypass	13
Alley Creek	TI-008	R07	0
Alley Creek	TI-025	R29, R30	18,494
Little Neck Bay	TI-009		0
		Total CSO	**18,507**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Alley Creek	TI-008	Oakland Lake	4,555
Alley Creek	TI-024	NA	15,313
Alley Creek	TI-654	NA	7,481
Alley Creek	TI-655	NA	4,834
Alley Creek	TI-659	NA	3,035
Alley Creek	TI-629	NA	513
Alley Creek	TI-630	NA	1,230
Direct Drainage	NA	NA	5,912
Little Neck Bay	TI-006	NA	21,796
Little Neck Bay	TI-543	NA	1,629
Little Neck Bay	TI-623	NA	341
Little Neck Bay	TI-625	NA	14,358
Little Neck Bay	TI-628	NA	3,681
Little Neck Bay	TI-633	NA	4,150
Little Neck Bay	TI-656	NA	1,539
Little Neck Bay	TI-658	NA	5,382
Little Neck Bay	TI-660	NA	6,397
Little Neck Bay	TI-668	NA	5,582
		Total Stormwater	**107,728**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Alley Creek	TI-008	Oakland Lake	0
Alley Creek	Duck Pond		0
		Total Dry Weather	**0**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Alley Creek			61,380
Little Neck Bay			64,855

Totals by Source			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
CSO			18,507
Stormwater			107,728
Local Sources			0

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Lbs**
Alley Creek			
	CSO	30.2	18,507
	Stormwater	69.8	42,873
	Local Sources	0.0	0
		Total	**61,380**
Little Neck Bay			
	CSO	0.0	0
	Stormwater	100.0	64,855
	Local Sources	0.0	0
		Total	**64,855**

6.3 Performance Gap

Concentrations of pathogens and DO in Alley Creek and Little Neck Bay are controlled by a number of factors, including the volumes of all sources of pollutants into the waterbodies and the concentrations of the respective pollutants. Since a large amount of the flow and pollutant loads discharged into these waterbodies are caused by rainfall events, the frequency, duration and amounts of rainfall will also strongly influence water quality in these waterbodies. The Alley Creek portion of the ERTM model was used to simulate pathogen and DO concentrations in the Creek for the baseline conditions, using 2002-2011 data. Hourly model calculations were saved for post-processing and comparison with the existing, swimmable/fishable, and potential future WQS (see section 6.3.c below). The performance gap was then developed as the difference between the model-calculated baseline waterbody DO and pathogen concentrations and the applicable numerical WQS. Accordingly, the analysis is broken up into three sections:

- Existing WQS;
- Upgrading Alley Creek Classification to Class SB; and
- Potential Future WQS.

The existing WQS include Little Neck Bay as a Class SB waterbody and Alley Creek as a Class I waterbody, with the numeric criteria presented in Table 2-10. The enterococci criterion is applied as a 90-day summer period GM. Existing conditions also consider DMA Beach as an officially recognized swimming beach, therefore the DOHMH criterion for enterococci is applied using a seasonal rolling 30-day GM. Potential future standards refer to the enterococci criteria presented in Table 2-14. A summary of the standards that were applied is shown in Table 6-6.

Table 6-6. Classifications and Standards Applied for Gap Analysis

Analysis	Numeric Criteria Applied		
	Alley Creek	Little Neck Bay	DMA Beach
Existing WQ Standards	Class I	SB (Fecal Monthly GM) SB (Entero 90-d GM)	SB (Fecal Monthly GM) SB (Entero rolling 30-d GM)
Upgrade Alley Cr (SB)	SB (Fecal Monthly GM) SB (Entero 90-d GM)	----	----
Potential Future WQS	SB (Entero rolling 30-d GM + STV)	SB (Entero rolling 30-d GM + STV)	SB (Entero rolling 30-d GM + STV)

Note: GM = Geometric Mean; STV = 90 Percent Statistical Threshold Value

6.3.a CSO Volumes and Loadings Needed to Attain Current Water Quality Standard

2008 Rainfall Annual Simulation

Typical model results are shown in Figures 6-1 through 6-5, for Alley Creek (AC1) and Little Neck Bay (Stations OW2, LN1, DMA, E11), respectively, with 2008 rainfall conditions. As described in Section 2, Alley Creek is currently designated as a Class I waterbody, and Little Neck Bay is designated as a Class SB waterbody. As such, both waterbodies have a fecal coliform criterion, and only Little Neck Bay has a summer recreational GM enterococci criterion. The panels in each figure show the Class I fecal coliform criterion of 2,000 org/100mL (dashed red line) and Class SB fecal coliform criterion of 200 org/100mL (dashed green line). The post processed monthly GM water quality output lines are shown as solid black lines. For Station DMA, the instantaneous (black line) and rolling 30-day GM (green line) enterococci calculated concentrations are also presented.

As shown by the figures, the modeling results indicate that at Alley Creek location AC1 (Figure 6-1), fecal coliform concentrations are in full attainment with the existing water quality criteria of a monthly GM of 2,000 org/100mL. The model calculations also show that the Little Neck Bay stations (Figures 6-2 through 6-5) are in attainment of the fecal coliform criterion during 2008 conditions. Non-attainment of the enterococci criteria at DMA (Figure 6-4) is calculated to occur during periods of some of the colder months of 2008 conditions.

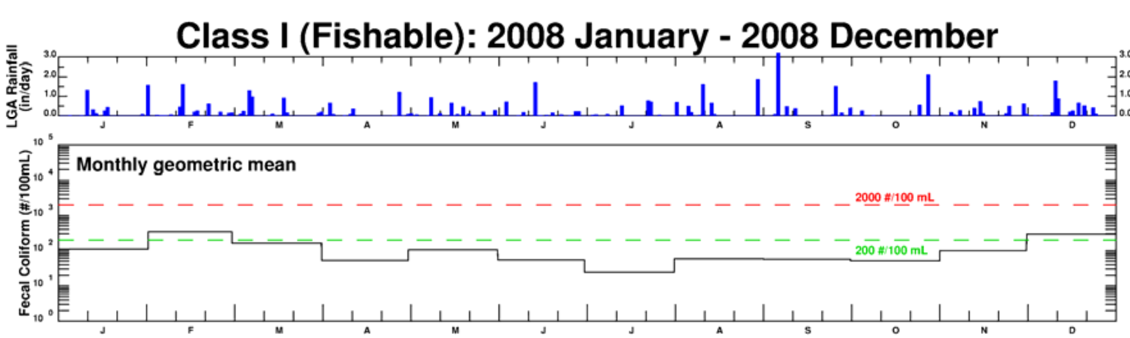


Figure 6-1. Calculated Baseline AC1 Pathogen Concentrations (2008 Rainfall)

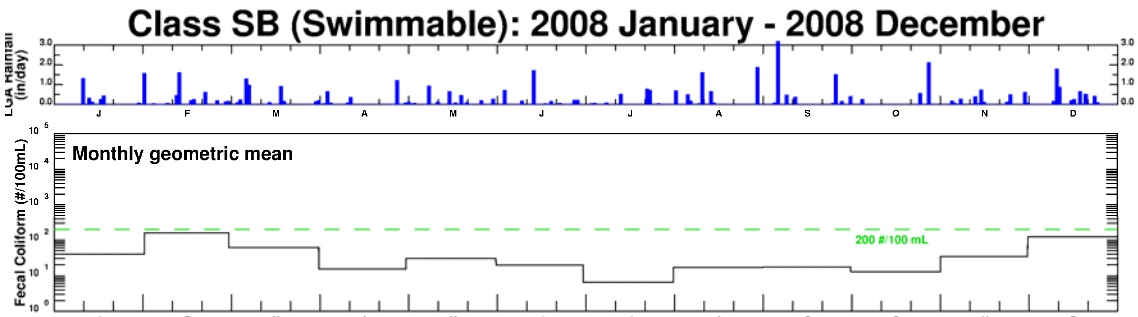


Figure 6-2. Calculated Baseline OW2 Pathogen Concentrations (2008 Rainfall)

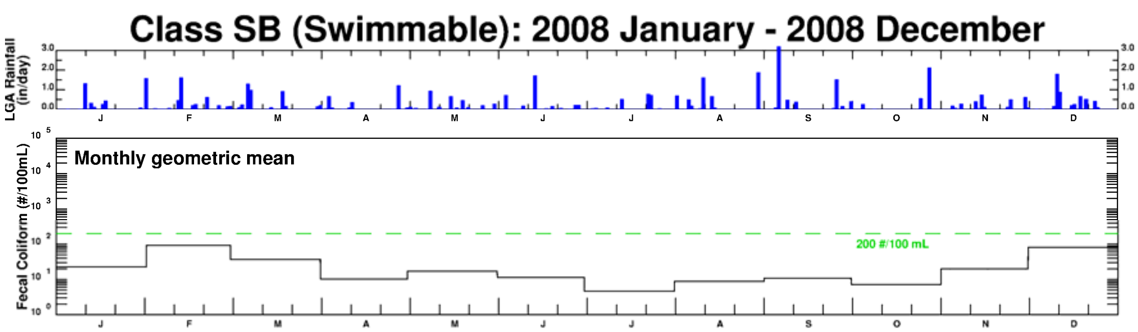


Figure 6-3. Calculated Baseline LN1 Pathogen Concentrations (2008 Rainfall)

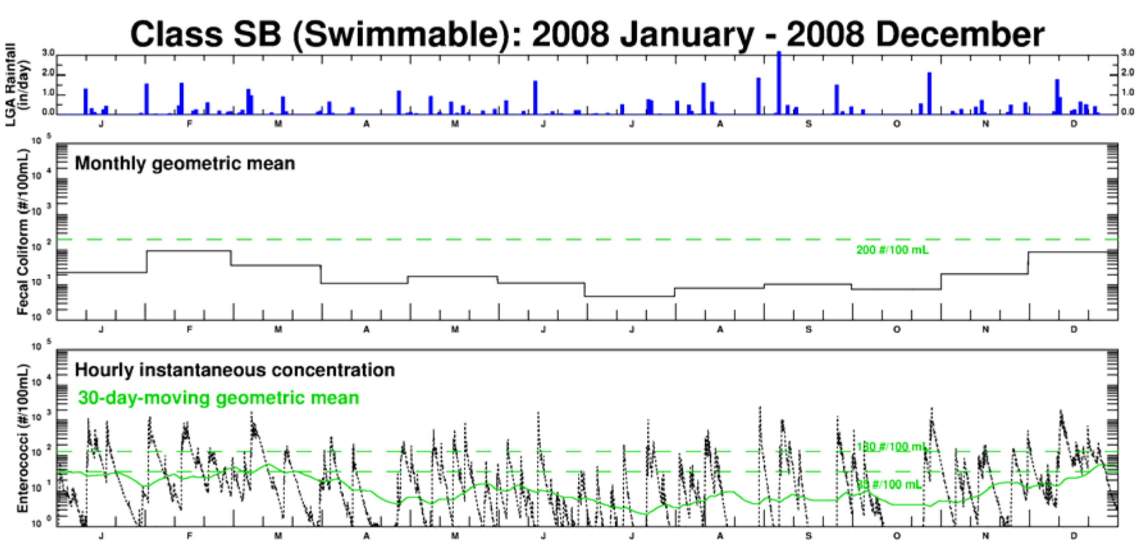


Figure 6-4. Calculated Baseline DMA Pathogen Concentrations (2008 Rainfall)

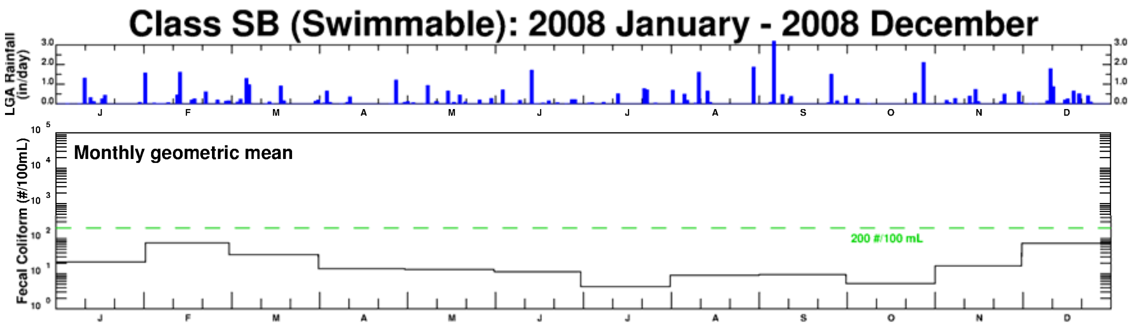


Figure 6-5. Calculated Baseline E11 Pathogen Concentrations (2008 Rainfall)

10-Year Long-Term Simulation

A 10-year baseline simulation of pathogen water quality was also performed for the baseline loading conditions, to assess year-to-year variations in water quality. The results of these simulations are summarized in Figure 6-6 and in Tables 6-7 and 6-8.

These figures show that the 10-year long term attainment of the existing fecal coliform criteria under baseline conditions is quite high. Most areas achieve 100 percent attainment, while a small area in lower Little Neck Bay has between 97 and 100 percent attainment of the fecal coliform criterion. Table 6-7 provides further insight into the baseline fecal coliform attainment. As noted in the table, fecal coliform concentrations are calculated to be in attainment 100 percent of the time at all locations for each of the 10 years within the simulation period, with the exception of 2009 for Station OW2, which has one month of non-attainment.

Table 6-8 presents the 90-day recreational period GM for enterococci at each station for the 10-year period. The criterion is not applicable at Station AC1, as the classification for that location is Class I. At all of the Class SB stations, the 90-day GM is less than 35 cfu/100mL. Attainment at DMA Beach for the 30-day rolling GM is 93 percent on an annual basis, and 100 percent based on the summer season rolling 30-dayGM. Since DMA beach operates only during the summer, it would be considered in attainment of the criterion.

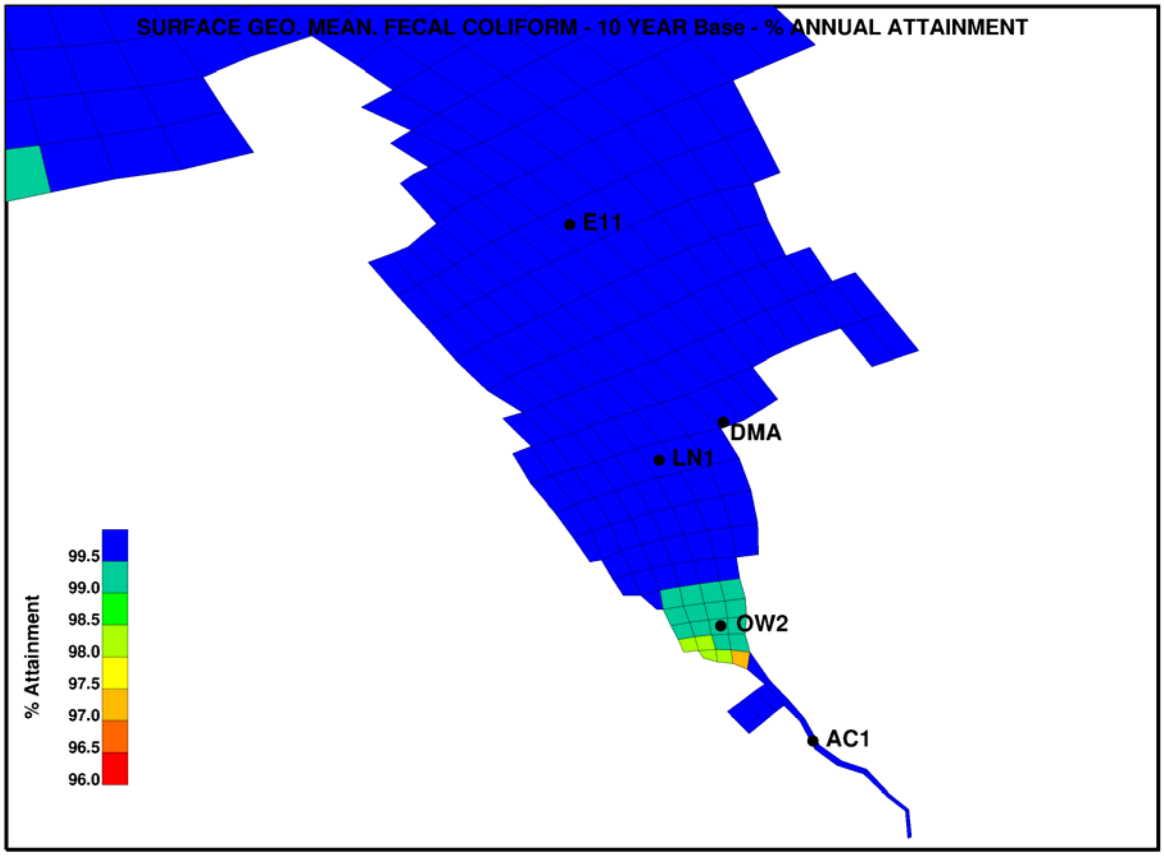


Figure 6-6. 10-Year Attainment of Existing Fecal Coliform Criteria

Table 6-7. Calculated 10-Year Baseline Fecal Coliform Attainment of Existing Criteria - Percent of Months in Attainment

Station	Projection Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Percent Attainment
AC1	100	100	100	100	100	100	100	100	100	100	100
OW2	100	100	100	100	100	100	100	92	100	100	99
LN1	100	100	100	100	100	100	100	100	100	100	100
DMA	100	100	100	100	100	100	100	100	100	100	100
E11	100	100	100	100	100	100	100	100	100	100	100

Table 6-8. Calculated 10-Year Baseline Enterococci 90-day Summer Recreation Period Geometric Means (cfu/100mL)

Station	Projection Year									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
AC1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OW2	6	16	12	6	14	13	9	20	5	15
LN1	3	7	6	3	7	7	4	10	2	8
DMA	2	7	6	3	7	7	3	9	2	7
E11	2	5	5	2	6	6	3	8	2	5

2008 Rainfall Annual Simulation – Dissolved Oxygen

Water quality model simulation of DO concentrations and measures of attainment with the numerical WQS are presented in Table 6-9. Water quality calculations indicate that the minimum DO concentrations in Alley Creek (Stations AC1 and Tanks Discharge Location) would be below 2 mg/L during July, but the overall attainment with the Class I criterion of 4 mg/L is more than 89 percent for this month and 98 percent for the year. Under the baseline conditions the calculated DO concentrations tend to be somewhat higher in Little Neck Bay. In July, however, DO concentrations were calculated to be below 4.8 mg/L for 66 percent of the time at Station LN1, and 80 percent of the time at Station E11, with a minimum projected DO of 2.8 mg/L and 3.5 mg/L, respectively. Even though there are excursions below the DO criteria in a few summer months, DO concentrations were calculated to be in attainment with the WQS a high percent of the time. As noted in Table 6-9, annual DO attainment is between 96 and 99 percent, depending on the area of the Bay.

Table 6-9. Model-Calculated DO and Measures of Attainment for Baseline Conditions

Station: AC1			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.0 mg/L**
Jan	11.0	7.3	100
Feb	12.0	8.7	100
Mar	11.0	6.4	100
Apr	8.9	5.1	100
May	6.5	3.2	99
Jun	5.1	2.1	89
Jul	6.6	3.1	95
Aug	6.8	3.5	99
Sep	5.6	1.2	91
Oct	8.0	4.4	100
Nov	8.6	4.4	100
Dec	9.7	6.2	100
Year	8.3		**98**

Station: Tank Discharging Location			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.0 mg/L**
Jan	11.2	8.3	100
Feb	12.1	9.2	100
Mar	11.1	7.4	100
Apr	9.1	5.6	100
May	6.7	3.2	100
Jun	5.3	2.9	93
Jul	6.8	2.6	96
Aug	7.1	4.0	100
Sep	5.8	1.7	93
Oct	8.1	4.4	100
Nov	8.7	6.0	100
Dec	9.8	6.5	100
Year	8.4		**99**

Station: LN1			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.0 mg/L**
Jan	11.7	10.1	100
Feb	12.9	11.3	100
Mar	12.2	10.8	100
Apr	10.3	9.1	100
May	8.1	6.6	100
Jun	5.9	4.5	98
Jul	5.6	2.8	66
Aug	7.0	3.2	95
Sep	7.4	5.8	100
Oct	9.1	6.6	100
Nov	9.1	7.8	100
Dec	10.3	8.9	100
Year	9.1		**96**

Station: E11			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.8 mg/L**
Jan	10.8	9.5	100
Feb	12.1	10.9	100
Mar	11.9	10.5	100
Apr	10.1	8.8	100
May	8.0	6.3	100
Jun	6.0	4.9	99
Jul	6.0	3.5	80
Aug	6.1	4.2	90
Sep	6.6	5.1	100
Oct	8.0	6.0	100
Nov	8.4	7.3	100
Dec	9.6	8.3	100
Year	8.5		**97**

The model results for the 10-year baseline period indicate that Alley Creek and Little Neck Bay would meet the existing water quality criteria. Therefore, there is no performance gap for pathogens and DO using existing criteria.

6.3.b CSO Volumes and Loadings that would be Needed to Support the Next Highest Use of Swimmable/Fishable Uses

Pathogens

The DEC is required to periodically review whether or not a waterbody can be reclassified to its next highest attainable use. Alley Creek, which is a Class I waterbody, could potentially be upgraded to Class SB to meet the fishable/swimmable goals of the CWA.

Model calculations presented in Figure 6-1 show that Station AC1 does not meet the class SB criterion for fecal coliform for two months during 2008 conditions. Figure 6-7 presents a spatial depiction of 10-year attainment for fecal coliform if Alley Creek were to be upgraded to Class SB. Overall; the attainment of the fecal coliform criterion at Station AC1 is 89 percent for the 10 year period. Table 6-10 presents the actual monthly fecal coliform GM at Station AC1. Months with GM greater than 200 cfu/100mL are in bold text. In all, 13 out of 120 months, or just less than 10 percent, do not attain the Class SB fecal coliform criterion.

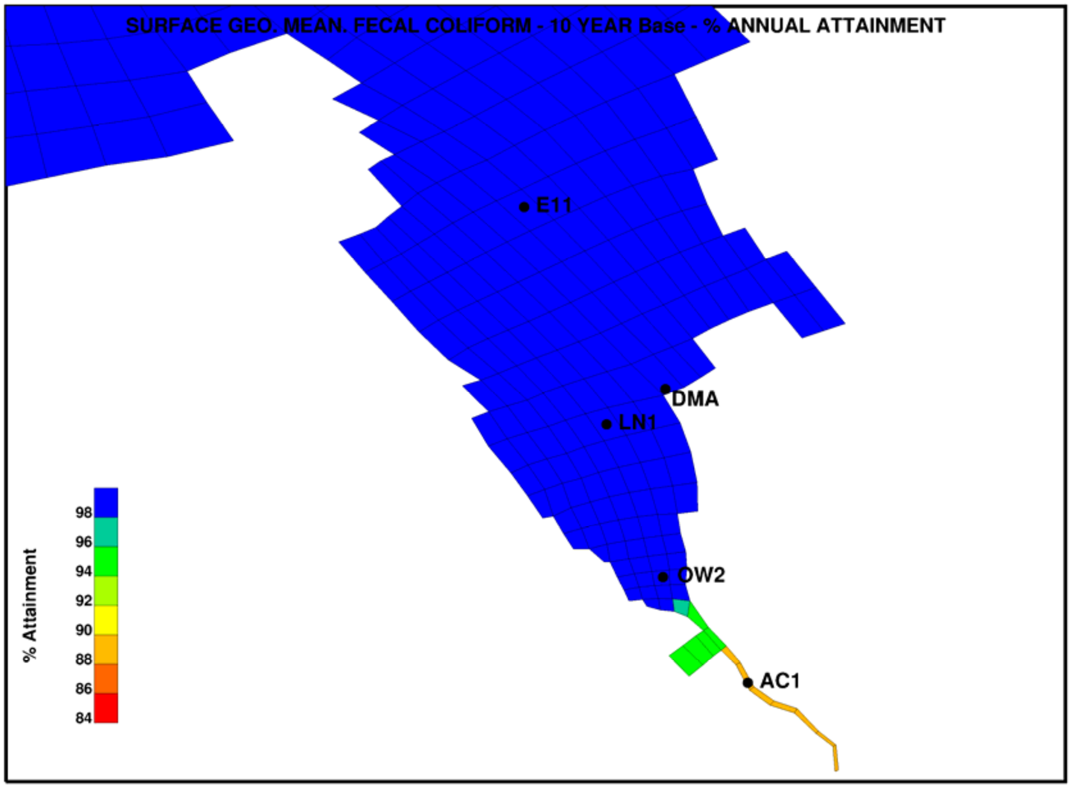


Figure 6-7. 10-Year Attainment of Class SB Fecal Coliform Criterion – Baseline Conditions

Table 6-10. Monthly Fecal Coliform Geometric Mean (cfu/100mL) – Baseline Conditions

Year	Month												Percent Attainment
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2002	72	33	152	83	55	54	20	30	56	82	**208**	85	92
2003	39	133	172	84	64	**218**	32	62	97	55	154	149	92
2004	55	60	122	118	107	40	80	47	74	34	140	118	100
2005	129	81	113	100	34	38	27	21	16	**228**	83	**226**	83
2006	**265**	76	31	90	72	117	50	45	42	132	184	72	92
2007	135	79	136	198	38	49	67	51	20	81	131	**292**	92
2008	112	**353**	165	54	107	55	25	60	59	52	103	**303**	83
2009	83	49	60	124	85	**309**	79	43	24	121	47	**455**	83
2010	55	181	**227**	52	38	24	22	25	33	67	50	88	92
2011	148	135	**273**	146	62	42	31	**222**	72	112	92	137	83
% Att.	90	90	80	100	100	80	100	90	100	90	90	60	89

Applying the 90-day seasonal GM enterococci criteria to Alley Creek, the 10-year pathogen attainment was calculated and is depicted graphically in Figure 6-8. As the figure shows, most of Alley Creek has an attainment level of 30 percent or less. Table 6-11 presents the 90-day seasonal GM at Station AC1 for each of the 10 years; only three out of the ten years attain the Class SB criterion. The GM concentrations that do not meet the criterion are in bold text.

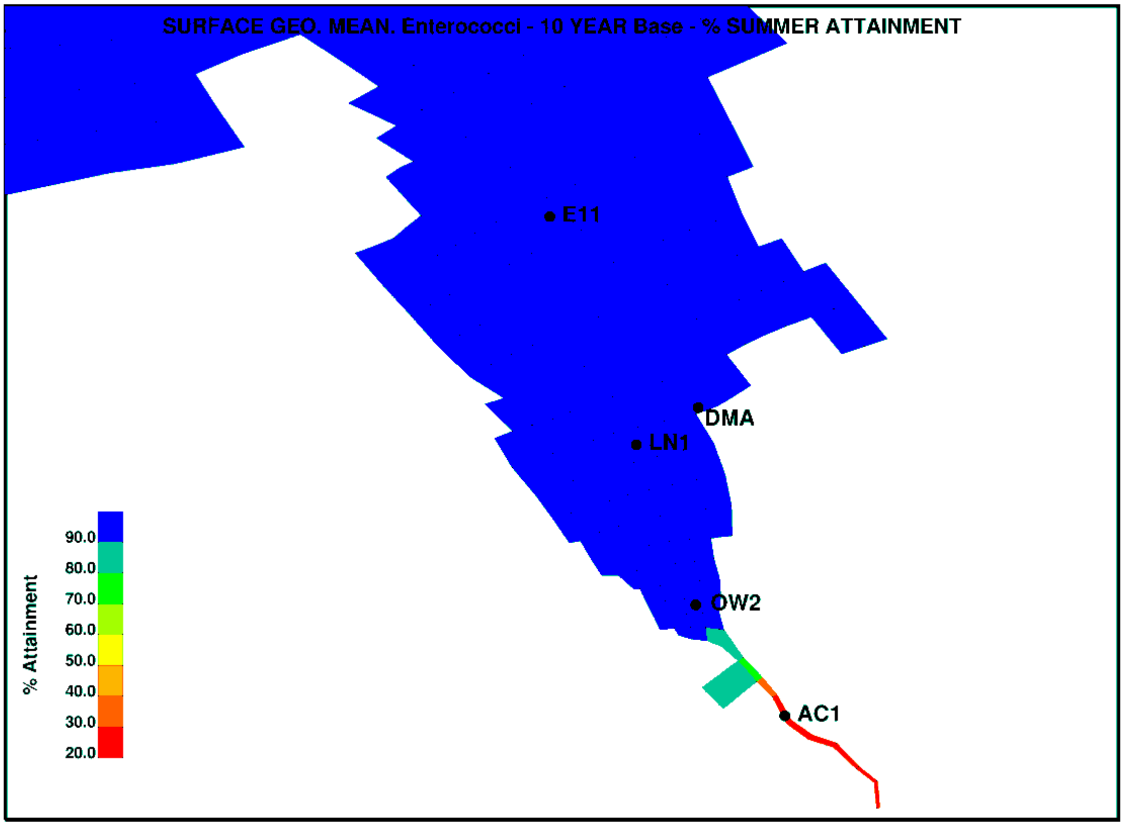


Figure 6-8. 10-year Attainment with Class SB Enterococci Criterion – Baseline Conditions

Table 6-11. Annual 90-day Seasonal Geometric Mean for Enterococci at Station AC1-Baseline Conditions

Year	Geometric Mean (cfu/100mL)
2002	28
2003	**58**
2004	**43**
2005	25
2006	**50**
2007	**44**
2008	**36**
2009	**73**
2010	23
2011	**52**

Because Alley Creek would not meet Class SB criteria under baseline conditions, an analysis was conducted to determine how much of the gap between projected water quality and the Class SB criteria was due to CSO discharges. Figure 6-9 presents the 10-year attainment of the Class SB fecal coliform criterion with complete CSO removal. For the discussion that follows, “complete removal” can be taken as either 100 percent volumetric control, or disinfection, but would be the same in terms of model results. Attainment of the fecal coliform criterion would improve in Alley Creek under the 100 percent CSO control scenario, and the 10-year attainment at Station AC1 would improve to 93 percent. Table 6-12 presents the monthly fecal coliform GM for each month at Station AC1 during the 10-year assessment period. Eight months would not be in attainment of the Class SB criterion for fecal coliform under the 100 percent CSO control scenario conditions – representing an increase of five months.

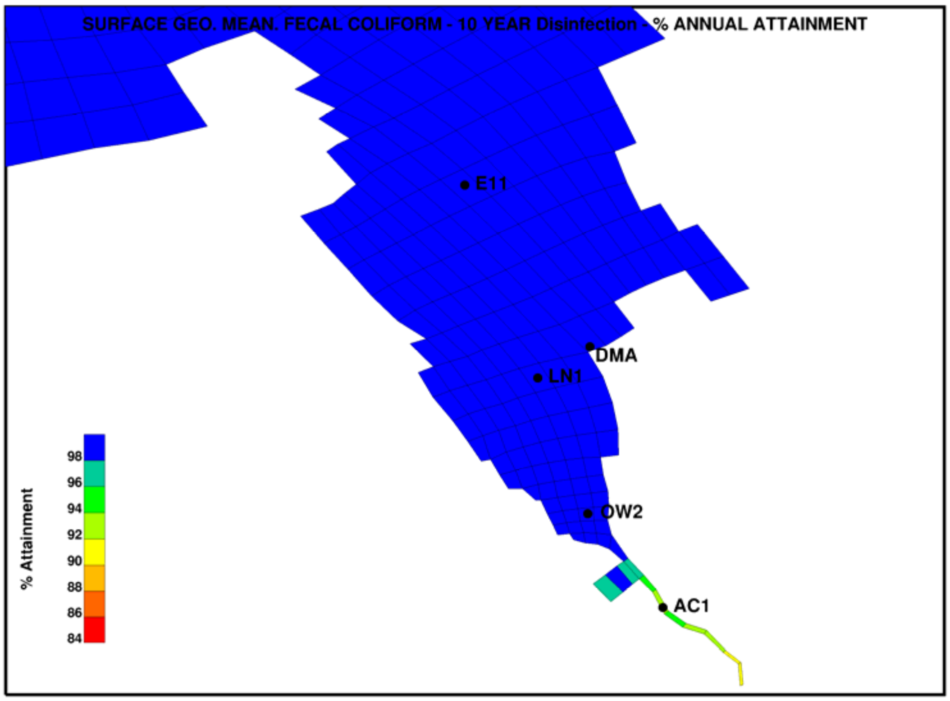


Figure 6-9. 10-Year Attainment of Class SB Fecal Coliform Criterion- 100 Percent CSO Control

Table 6-12. Monthly Fecal Coliform Geometric Mean (cfu/100mL) with 100 Percent CSO Control

Year	Month												Percent Attainment
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2002	72	33	144	78	55	53	19	28	50	75	**201**	83	92
2003	39	122	158	79	64	183	30	56	89	50	132	133	100
2004	55	53	122	108	107	39	66	45	62	33	134	115	100
2005	128	80	104	89	34	38	26	19	16	181	80	188	100
2006	**240**	69	31	83	72	105	42	42	42	110	157	70	92
2007	115	79	122	157	38	45	56	48	20	75	126	**284**	92
2008	107	**290**	149	53	107	53	24	53	51	49	100	**276**	83
2009	81	49	60	115	85	**271**	76	43	24	112	47	**380**	83
2010	52	168	180	50	38	24	21	24	32	61	50	76	100
2011	135	130	**230**	128	62	37	30	166	59	105	77	123	92
% Att.	90	90	90	100	100	90	100	100	100	100	90	70	93

The level of attainment of the enterococci criteria when the CSO tank discharge achieves 100 percent control is presented in Figure 6-10. There is limited improvement over baseline conditions. As shown in

Table 6-13, the 10-year 90-day enterococci GM would improve slightly due to 100 percent CSO control. The year 2008 90-day enterococci GM would improve from 36 cfu/100mL in the baseline condition (Table 6-11) to 35 cfu/100mL under the 100 percent CSO control scenario, thereby increasing 10-year attainment from 30 percent to 40 percent.

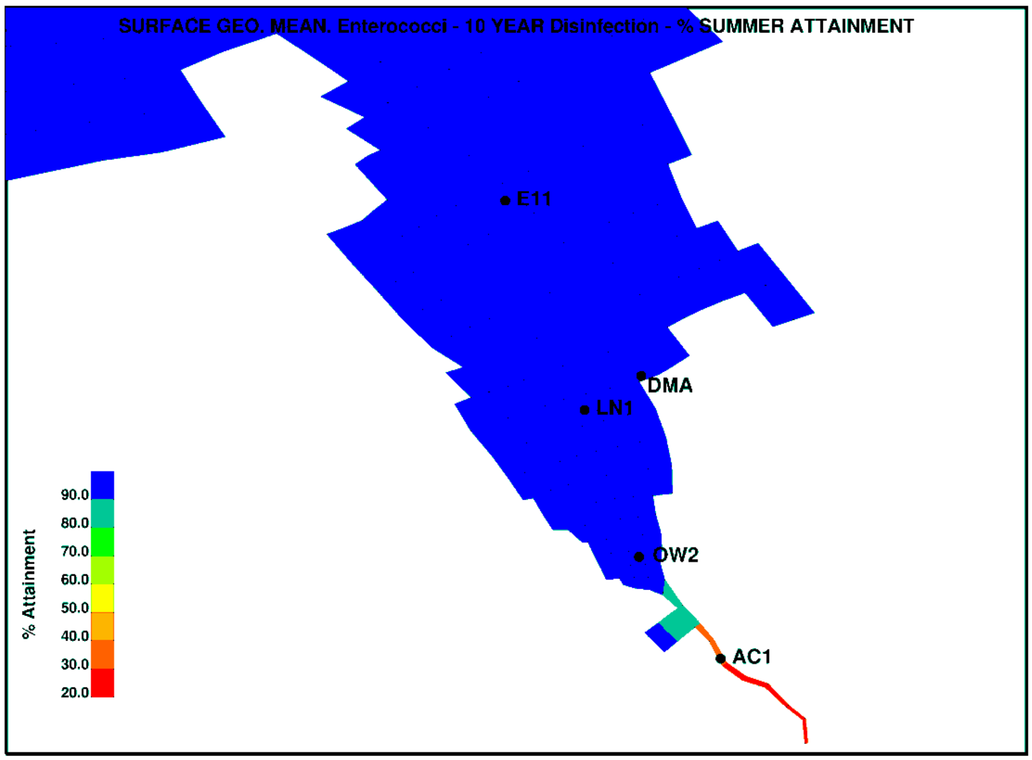


Figure 6-10. 10-year Attainment with Class SB Enterococci Criterion under the 100 Percent CSO Control

Table 6-13. Annual 90-day Seasonal Geometric Mean for Enterococci at Station AC1 under the 100 Percent CSO Control

Year	Geometric Mean (cfu/100mL)
2002	27
2003	**53**
2004	**40**
2005	25
2006	**47**
2007	**41**
2008	35
2009	**70**
2010	22
2011	**47**

Dissolved Oxygen

Upgrading Alley Creek to Class SB would require that it meet the DO criterion of a daily average DO concentration of greater than or equal to 4.8 mg/L, with some allowance for excursions based on the DO exposure-duration curve. Table 6-14 presents the monthly attainment with the Class SB DO criteria at Station AC1. Monthly attainment would range from 56 to 100 percent, with an annual attainment of 91 percent and June through September attainment of 76 percent.

Table 6-14. Model-Calculated DO Results for Class SB Criterion under Baseline Conditions

Station: AC1			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.8 mg/L**
Jan	11.0	7.3	100
Feb	12.0	8.7	100
Mar	11.0	6.4	100
Apr	8.9	5.1	100
May	6.5	3.2	94
Jun	5.1	2.1	56
Jul	6.6	3.1	82
Aug	6.8	3.5	94
Sep	5.6	1.2	72
Oct	8.0	4.4	99
Nov	8.6	4.4	100
Dec	9.7	6.2	100
Year	**8.3**		**91**

A complete CSO capture scenario was conducted to assess the impact of CSO discharges on non-attainment of the DO criteria, or the gap between attainment and non-attainment caused by CSO discharges. The attainment of the Class SB criteria for DO at Station AC1 with complete CSO capture is presented in Table 6-15. As the table shows, the monthly DO attainment would improves from 64 to 100 percent under these conditions. The annual attainment would increase to 93 percent and the summer attainment would rise to 81 percent. The overall annual average DO concentration would increase by 0.1 mg/L. This scenario suggests that complete removal of the CSO input into Alley Creek would not be sufficient for the Creek to meet the Class SB criteria for DO.

Table 6-15. AC1 DO Results for Class SB Criteria – 100 Percent CSO Control

Station: AC1			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.8 mg/L**
Jan	11.1	7.5	100
Feb	12.0	8.9	100
Mar	11.1	6.7	100
Apr	9.0	5.2	100
May	6.6	3.4	96
Jun	5.2	2.2	64
Jul	6.7	3.2	85
Aug	7.1	3.6	95
Sep	5.9	1.3	80
Oct	8.1	4.6	99
Nov	8.6	4.6	100
Dec	9.8	6.6	100
Year	**8.4**		**93**

6.3.c Potential Future Water Quality Criteria

In 2012, EPA released recreational water quality criteria recommendations for protecting human health in all coastal and non-coastal waters designated for primary contact recreation use. The standards would include a rolling 30-day GM of either 30 cfu/100mL or 35 cfu/100mL, and a 90th percentile statistical threshold value (STV) during the rolling 30-day period of either 110 cfu/100mL or 130 cfu/100mL. An analysis of the 10-year baseline and 100 percent CSO control conditions model simulation results was conducted using the 35 cfu/100mL GM and 130 cfu/100mL 90th percentile criteria, to assess attainment with these potential future criteria.

10-Year Long-Term Simulation

Figure 6-11 presents the model results for baseline conditions against the potential future criterion of a rolling 30-day GM of 35 cfu/100mL. The figure shows that the 10-year long term annual enterococci concentrations calculated for the baseline within Little Neck Bay are divided into three areas – ones that are in attainment with the potential enterococci criterion a high percentage of the time (outer Little Neck Bay); a transition zone (inner Little Neck Bay) where attainment with the criterion ranges from a low of 68 to a high of 92 percent; and Alley Creek, where very low (<30 percent) attainment is achieved. Table 6-16 presents the attainment at the five chosen stations with all of the potential future criteria. While the rolling 30-day GM of 35 cfu/100mL appears to be achievable a high percentage of the time in much of Little Neck Bay, attainment would decline for the 30-day rolling GM of 30 cfu/100mL, and decline still further for the 90th percentile STV criteria. The difficulty in meeting the 90th percentile STV criteria stems from the discharge of stormwater, since stormwater outfalls can discharge during more than 1,000 hours per year (more than 10 percent of the time).

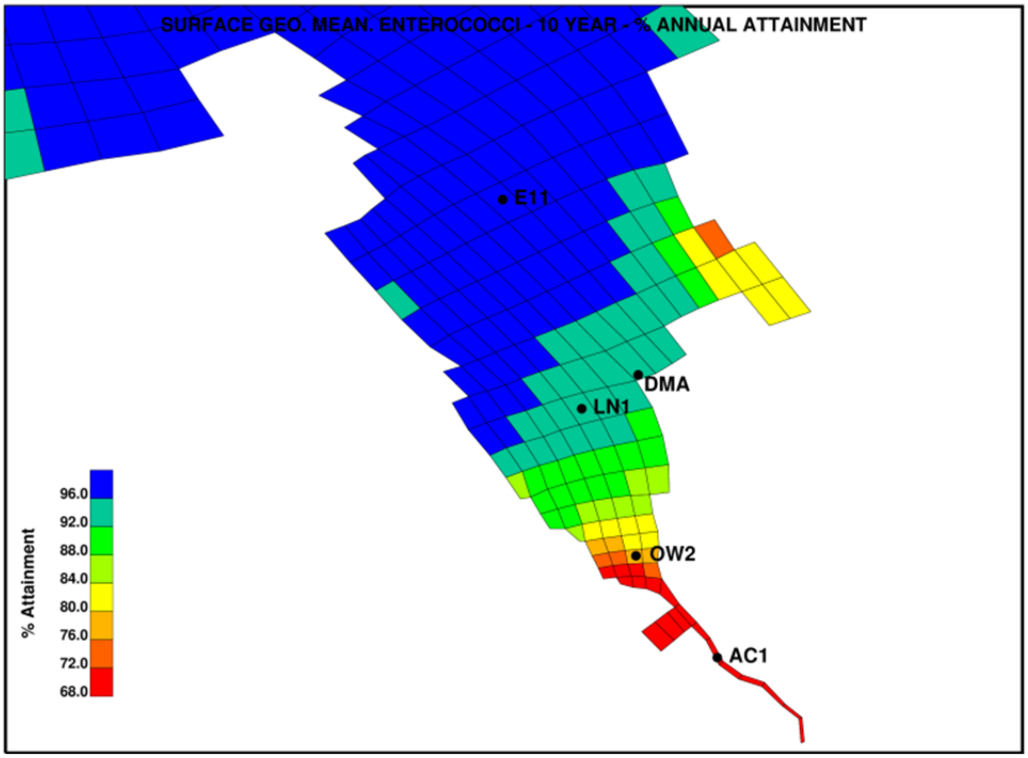


Figure 6-11. Enterococci Annual Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 35 cfu/100mL

Table 6-16. Annual Attainment with Potential Future Enterococci Criteria

Station	Enterococci Percent Attainment							
	Baseline				w/Disinfection			
	30-day rolling GM		90^{th} percentile		30-day rolling GM		90^{th} percentile	
	<=35 cfu/ 100mL	<=30 cfu/ 100mL	<=130 cfu/ 100mL	<=110 cfu/ 100mL	<=35 cfu/ 100mL	<=30 cfu/ 100mL	<=130 cfu/ 100mL	<=110 cfu/ 100mL
AC1	19	14	7	5	21	14	7	6
OW2	79	73	27	22	82	77	30	24
LN1	94	89	65	52	95	92	73	64
E11	99	97	83	77	99	98	86	80
DMA	93	89	62	52	95	91	72	59

Figure 6-12 presents the 10-year annual attainment of the potential future enterococci criterion for the 100 percent CSO control. Only minor improvements are calculated over the baseline condition. Table 6-16 also presents the attainment of potential future enterococci criteria for the 100 percent CSO control scenario. Some minor improvement is calculated nearest the CSO tank at Stations AC1 and OW2, on the order of 2 to 4 percent; greater improvement is calculated at Stations LN1 and DMA. Overall, the 90^{th} percent STV criterion attainment is still low, with only 6 percent annual attainment at Station AC1.

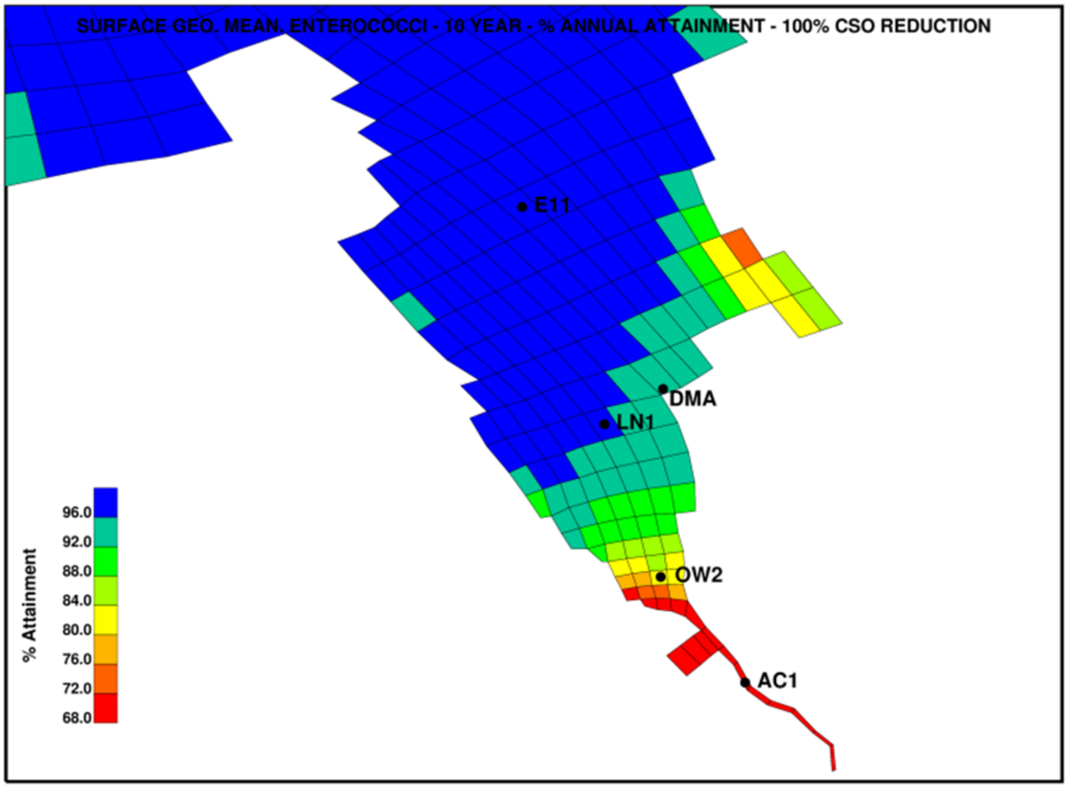


Figure 6-12. Enterococci Annual Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 35 cfu/100mLwith 100 percent CSO Control

The DMA Beach area of the Bay was calculated to be in attainment with the potential future enterococci criterion of a 30-day rolling GM of 35 cfu/100mL approximately 92 percent of the year. This situation changes dramatically when the examination is focused on the summer bathing season, as shown in Figure 6-13. During the 10-year period, the majority of the Bay would be in attainment greater than 96 percent of the time. The transition zone in the inner Little Neck Bay would still exist as a small area of the Bay immediately adjacent to the mouth of Alley Creek, but the attainment level is estimated to be between 84 and 92 percent of the time. During the bathing season, the DMA Beach is calculated to attain the potential future SB enterococci criterion100 percent of the time, according to model predictions.

Figure 6-14 presents the 10-year summer attainment of the potential future enterococci criterion for the 100 percent CSO control. Only minor improvements are calculated over the baseline condition. Table 6-17 presents a comparison between baseline and 100 percent CSO control during the summer period at the five stations, and, like the annual attainment, only small improvements in attainment are calculated.

Table 6-17 provides further insight into the baseline pathogen concentrations during the summer. Overall, attainment would be higher during the summer due to faster die-off rates associated with higher ambient water temperatures. Attainment of the 30-day rolling GM would occur at fairly high levels in the outer Bay, but attainment would still be low at Station AC1 (at 42 percent). Attainment of the 90th percentile STV criteria would remain very low at Stations AC1 and OW2.

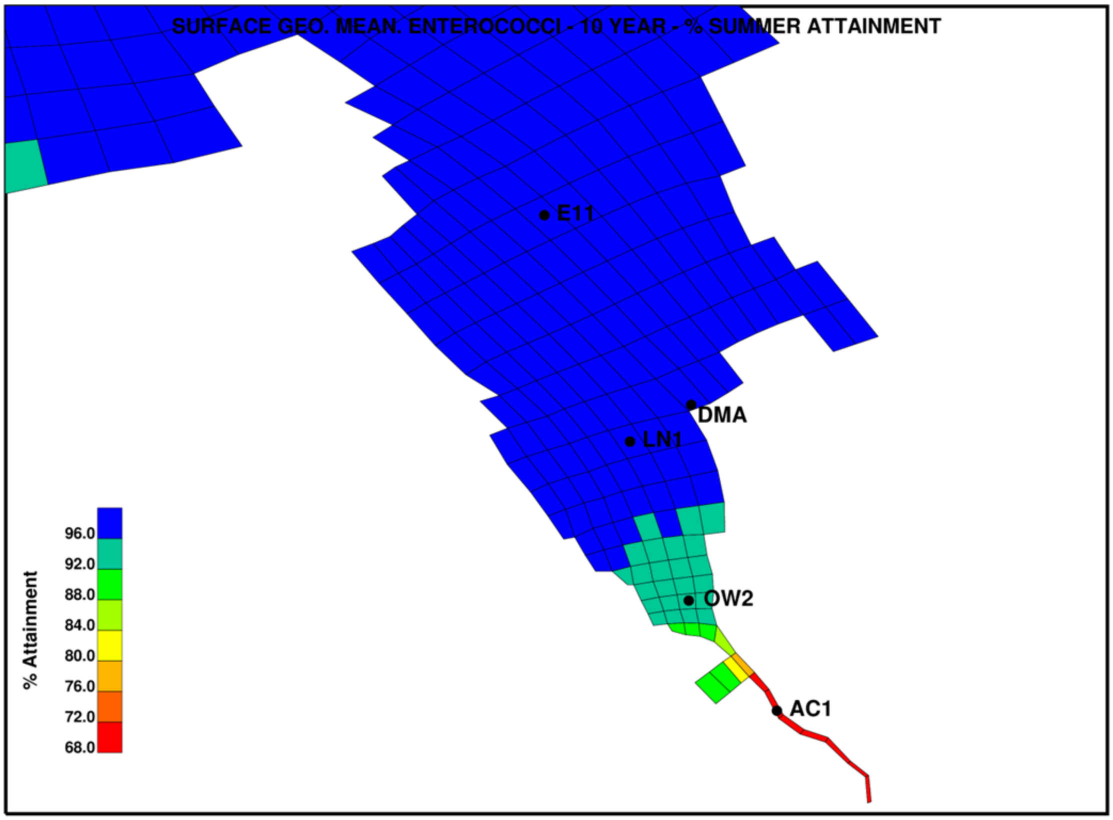


Figure 6-13. Enterococci Summer Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 35 cfu/100mL

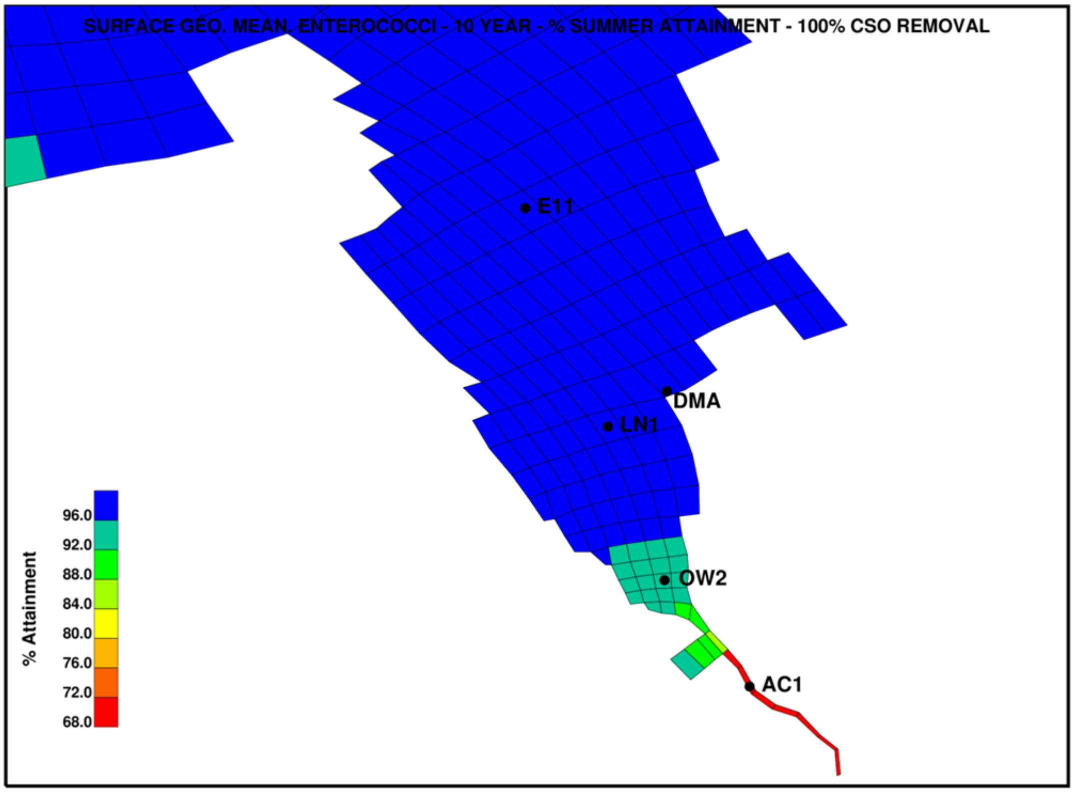


Figure 6-14. Enterococci Summer Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 35 cfu/100mL, with 100 percent CSO Control

Table 6-17. Summer Attainment with Potential Future Enterococci Criteria

Station	Enterococci Percent Attainment							
	Baseline				w/Disinfection			
	30-day rolling GM		90th percentile		30-day rolling GM		90th percentile	
	<=35 cfu/100mL	<=30 cfu/100mL	<=130 cfu/100mL	<=110 cfu/100mL	<=35 cfu/100mL	<=30 cfu/100mL	<=130 cfu/100mL	<=110 cfu/100mL
AC1	42	32	14	9	45	34	15	11
OW2	93	92	41	36	95	93	45	42
LN1	100	98	82	74	100	100	91	85
E11	100	100	90	87	100	100	94	91
DMA	100	99	86	80	100	100	95	89

6.3.d CSO Volumes and Loadings Needed to Attain Potential Future Water Quality Criteria

These analyses indicate that complete removal of CSOs alone will not close the gap between the predicted baseline enterococci concentrations and the potential future rolling 30-day GM criterion of 35 cfu/100mL to achieve 100 percent attainment. Additional water quality modeling analyses were performed to assess the extent to which CSO and non-CSO sources impact enterococci concentrations at key locations in Alley Creek and Little Neck Bay. A load source component analysis was conducted for the

2008 baseline condition, to provide a better understanding of how each source type contributes to enterococci concentrations in Alley Creek and Little Neck Bay. The source types include the East River at the mouth of Little Neck Bay, dry-weather inputs (Oakland Lake and the Duck Pond), Nassau County stormwater, New York City stormwater, and CSOs. The analysis was completed at water quality Stations AC1, OW2, LN1, E11 and DMA using the ERTM model. The analysis included the calculation of GM and 90th percentile STV for the summer period (June-August), on an annual basis, and the 30-day period with the maximum GM. The GMs from each source can be added to determine the total GM. The 90th percentile STV concentrations are not necessarily additive, but are presented for illustrative purposes. The results of the component analysis are presented in Table 6-18.

Table 6-18. Calculated Baseline Enterococci Concentrations from Various Loading Sources

Source	Station	Enterococci Contribution, cfu/100mL					
		Geometric Mean			90th Percentile		
		Summer	Year	Max 30-day	Summer	Year	Max 30-day
East River	AC1	1	1	3	1	4	30
Local Sources	AC1	9	12	17	15	18	15
Nassau County Stormwater	AC1	1	2	5	1	7	15
NYC Stormwater	AC1	24	48	212	477	1,153	2,738
CSO	AC1	1	3	47	113	183	1,653
Total	**AC1**	**36**	**66**	**284**	**607**	**1,365**	**4,451**
East River	OW2	1	2	5	2	7	51
Local Sources	OW2	1	1	4	2	4	2
Nassau County Stormwater	OW2	1	3	9	5	19	38
NYC Stormwater	OW2	6	11	75	123	234	515
CSO	OW2	0	2	17	20	43	497
Total	**OW2**	**9**	**19**	**110**	**151**	**307**	**1,103**
East River	LN1	1	2	8	4	12	63
Local Sources	LN1	0	0	1	0	0	8
Nassau County Stormwater	LN1	2	4	14	15	42	83
NYC Stormwater	LN1	2	4	29	41	72	152
CSO	LN1	0	1	5	5	14	107
Total	**LN1**	**5**	**11**	**57**	**65**	**140**	**413**
East River	E11	2	4	19	21	43	176
Local Sources	E11	0	0	0	0	0	0
Nassau County Stormwater	E11	2	3	14	23	27	53
NYC Stormwater	E11	0	1	8	8	17	42
CSO	E11	0	0	1	3	4	22
Total	**E11**	**4**	**8**	**42**	**54**	**91**	**293**
East River	DMA	1	2	9	5	14	76
Local Sources	DMA	0	0	1	0	0	0
Nassau County Stormwater	DMA	2	5	18	21	56	117
NYC Stormwater	DMA	1	2	30	30	63	124
CSO	DMA	1	2	4	6	12	79
Total	**DMA**	**5**	**11**	**62**	**61**	**145**	**396**

Assessing attainment with the current Class SB criterion for a 90-day summer period GM, it the model predicted that only Station AC1 would have a GM higher than 35 cfu/100mL. However, since Alley Creek is not currently a Class SB waterbody, the criterion is not applicable at this location, but could be if it were upgraded. Local sources and NYC stormwater are the primary contributors to the high enterococci GM concentration, while CSO discharge contributes very little to the 90-day GM. Since local sources are constant during dry weather each year in the model, it is likely that 9 cfu/100mL is the typical contribution from these sources to the 90-day GM. Thus, this concentration could be subtracted from the concentrations in Table 6-13 to approximate the number of years in attainment with both the CSO and local sources were completely removed. Both Stations AC1 and OW2 had summer recreational period 90^{th} percentile STV concentrations greater than 130 cfu/100mL. For the 90^{th} percentile concentrations, NYC stormwater and CSOs are the primary contributors. The remaining locations analyzed had enterococci levels less than the proposed criterion or the summer period.

On an annual basis, Station AC1 would remain the only location with a GM enterococci concentration greater than 35 cfu/100 mL. Stations AC1 and OW2 would have 90^{th} percentile concentrations well above 130 cfu/100mL. Stations LN1 and DMA would be added to the list of stations with a 90^{th} percentile greater than 130 cfu/100 mL, although they do not exceed this concentration by much, with 140 cfu/100 mL and 145 cfu/100 mL, respectively.

During the maximum 30-day period, all locations were calculated to have GM concentrations greater than 35 cfu/100 mL. During this period, even the East River boundary contributes a large portion of the enterococci concentrations. As CSO LTCPs are implemented in other sewersheds, East River enterococci concentrations should decline. The 90^{th} percentile enterococci concentrations during the maximum 30-day period would be well above 130 cfu/100 mL. While the high concentrations are primarily a result of stormwater and CSO discharges, the East River can also be a significant contributor.

For the maximum 30-day period, the calculations indicated that removal of 100 percent of either NYC CSOs or NYC stormwater would not result in full attainment. To obtain full attainment during the maximum 30-day period, depending on location, 100 percent CSO removal along with reductions to other sources would be needed to reduce the calculated enterococci concentrations to below the potential future 30-day rolling GM criterion of 35 cfu/100mL.

The water quality modeling assessment made herein indicates that the Bay is not calculated to fully attain the potential future enterococci WQS during baseline conditions when subjected to the 2008 rainfall conditions, or when subjected to the 10-year rainfalls, although there is attainment a high portion of the time. As noted in Figure 6-11, although Little Neck Bay is in attainment with the criteria a high percent of the time, there is a transition zone where attainment with the criteria is reduced because of the proximity to Alley Creek, which has a lower water quality use classification. This changes somewhat when bathing season (June 1 through August 31) attainment is examined, as presented in Figure 6-13. There nevertheless remains a portion of the time that Little Neck Bay is calculated for the baseline conditions to exceed the pathogen criteria. Figure 6-15 shows the GM concentrations during the 10-year simulation when the maximum or highest 30-day GM enterococci concentration is calculated. This figure indicates the following:

- The maximum 10-year 30-day GM concentrations in the outer portions of Little Neck Bay, near Station E11, equals 7 cfu/100mL above the criterion of 35cfu/100 mL.
- Near DMA, the calculated maximum 30-day GM concentrations are between 20 and 30 cfu/100 mL above the criterion.
- In the inner portion of the Bay near the mouth of Alley Creek, the calculated maximum concentrations exceed the criterion by about 70 cfu/100mL.

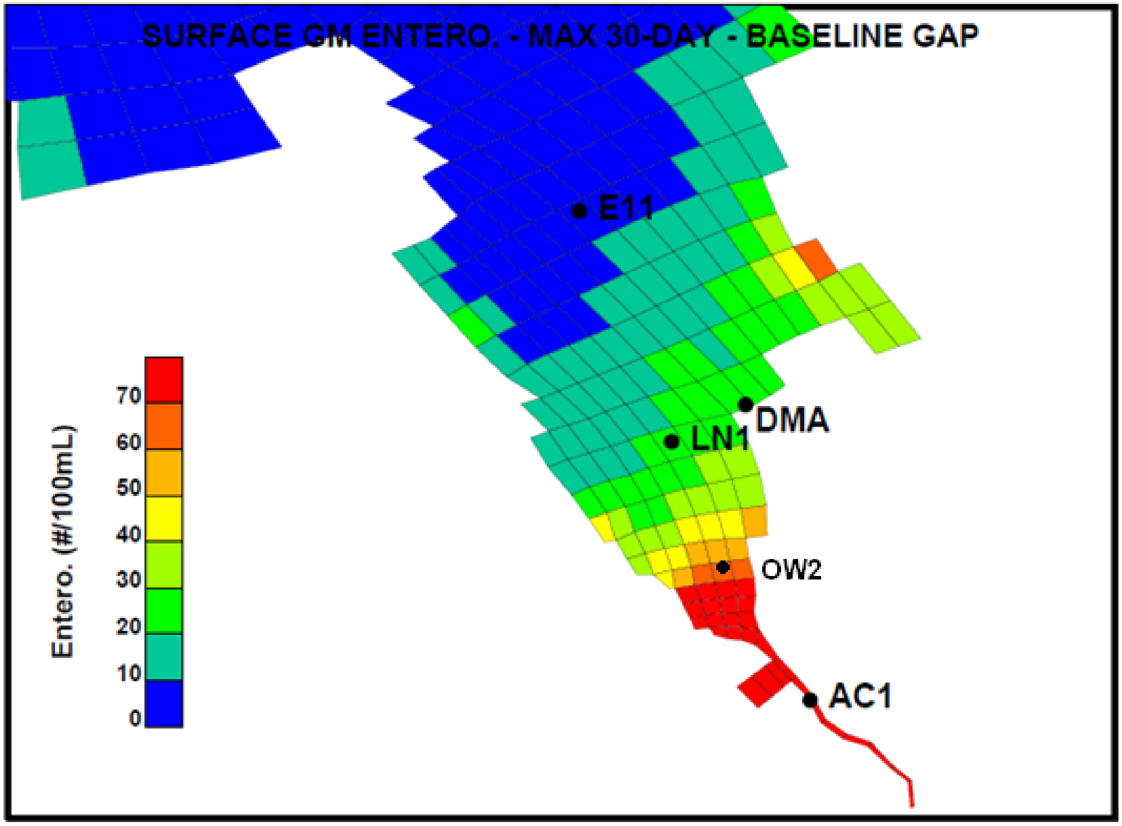


Figure 6-15. Max. 30-Day Geometric Mean Enterococci Concentration Gap (10-Yr Simulation)

Figure 6-16 provides a summary of the maximum 30-day GM concentrations above the GM criterion of 35 cfu/100mL for the 10-year simulation period for the baseline case, with 100 percent CSO control conditions. The graphic clearly shows that all areas of the Bay still have enterococci concentrations that are above the GM criterion of 35cfu/100 mL.

This analysis indicates the following:

- The maximum 10-year 30-day GM concentrations in the outer portions of Little Neck Bay, near Station E11, remain less than 10 cfu/100mL, well below the of 35 cfu/100mL criterion.
- Near DMA, the calculated maximum concentrations are between 10 and 20 cfu/100 mL above the criterion.
- In the inner portion of the Bay near the mouth of Alley Creek, the calculated maximum concentrations are reduced from the baseline (Figure 6-5), but still exceed the criterion by about as much 70 cfu/100mL. The exceedance is less at the outer portion of the transition zone, where it is about 40 cfu/100 mL above the criterion of 35cfu/100mL.

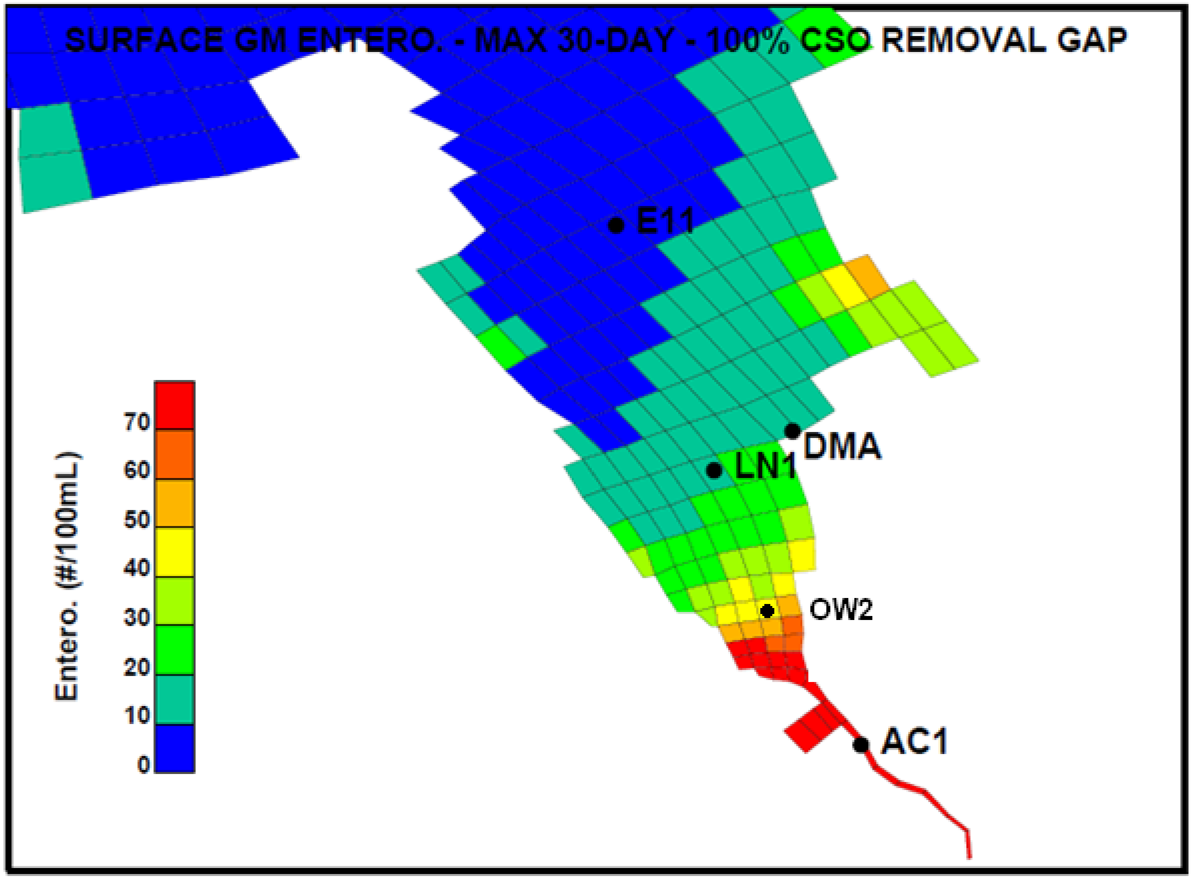


Figure 6-16. Max. 30-Day Geometric Mean Enterococci Concentration Gap (10-Yr Simulation) with 100 Percent CSO Control

Performance Gap Conclusions

The modeling shows that, over the 10-year period analyzed, baseline conditions would be near full attainment of existing criteria, and no further action beyond what is specified in the baseline conditions would be required. Alley Creek is currently classified as Class I, which does not have enterococci limits, but does require an upper fecal coliform limit of 2,000 org/100mL on a monthly GM basis. Water quality modeling calculations at location AC1 in Alley Creek show that this criterion would be met under the baseline conditions. Upgrading the Class I standard to Class SB (swimmable/fishable) would impose an enterococci 30-day GM of 35 org/100mL, and would reduce the fecal coliform criterion from 2,000 org/100mL to 200 org/100mL.

As shown in Figure 6-1, fecal coliform concentrations are calculated to exceed the Class SB levels. The maximum calculated monthly GM fecal coliform concentration is about 400 cfu/100mL. The fecal coliform sources would have to be reduced by 50 percent [1-(200/400)] to bring the monthly fecal coliform GM to equal the Class SB swimmable criterion. With respect to DO concentrations, Alley Creek has a very high level of attainment of the "never less than 4 mg/L" Class I criterion (Table 6-8). As noted above, however, 100 percent CSO control does not result in complete attainment. Consequently, attainment with the higher 4.8 mg/L SB criterion would not be possible through CSO control alone.

The maximum calculated 30-day GM enterococci concentration (future potential criterion) at Station AC1 for 2008 conditions is 284 cfu/100mL (Table 6-17). The enterococci sources would have to be reduced by 88 percent [1-(35/284)] to bring the maximum 30-day rolling enterococci GM to equal the potential future

Class SB swimmable criterion. Because the Alley Creek CSO Retention Tank overflows only 5 percent of the hours within the period during which the maximum 30-day GM enterococci concentrations are computed, and stormwater discharges occur during 26 percent of those hours, CSO control alone would not bring the waterbody into full attainment with potential future Alley Creek water quality (SB) criteria. The 90^{th} percentile STV enterococci criteria of 130 cfu/100mL would be even more challenging to meet; a 97 percent reduction [1-(130/4451)] of enterococci sources would be required during the maximum 30-day period.

SECTION 7.0
PUBLIC PARTICIPATION AND AGENCY COORDINATION

7.0 PUBLIC PARTICIPATION AND AGENCY COORDINATION

DEP is committed to implementing a proactive and robust public participation program to inform the development of the watershed-specific and Citywide LTCPs. Public outreach and public participation are important aspects of plans designed to reduce CSO-related impacts to achieve waterbody-specific WQS, consistent with the federal CSO Policy and the water quality goals of the CWA, and in accordance with EPA and DEC mandates.

DEP's Public Participation Plan was released to the public on June 26, 2012, and describes the tools and activities DEP will use to inform and involve and engage a diverse group of stakeholders and the broader public throughout the LTCP process. The purpose of the Plan is to create a framework for communicating with and soliciting input from interested stakeholders and the broader public concerning water quality and the challenges and opportunities for CSO controls. As described in the Public Participation Plan, DEP will strategically and systematically implement activities that meet the information needs of a variety of stakeholders, in an effort to meet critical milestones in the overall LTCP schedule outlined in the 2012 Order on Consent, signed by DEC and DEP on March 8, 2012.

As part of the CSO Quarterly Reports, DEP will report to DEC on public participation activities outlined in the public participation plan. Updates to the Public Participation Plan implemented as a result of public comments received will be posted annually to DEP's website, along with the quarterly summary of public participation activities reported to DEC.

7.1 Local Stakeholder Team

DEP began the public participation process for the Alley Creek and Little Neck Bay LTCP by reaching out to the Queens Borough President's Office and Community Board 11, to identify the stakeholders who would be instrumental to the development of this LTCP. Stakeholders identified included both citywide and regional groups, including environmental organizations (APEC, Natural Resources Defense Council, Metropolitan Waterfront Alliance, IEC and Udalls Cove Preservation Society); community planning organizations (Douglaston Historical Society, DMA, Bayside Marina; design and economic organizations, Queens Chamber of Commerce and Auburndale Improvement Association); academic and research organizations (Queens College and Polytechnic University of New York); and City government agencies (DCP, DOHMH, and DOH).

Given the proximity of the study area to an existing park, DEP has also worked closely with DPR. In addition to engaging DPR as a stakeholder in the LTCP process, DEP and DPR are already collaborating to coordinate data collection and the identification of stormwater management strategies included in DPR's Alley Creek Watershed Planning and Habitat Restoration Study. This two-year study endeavors to identify ways DPR can shift from an opportunistic pursuit of restoration actions to intentional watershed-based restoration planning. As part of this process, DPR identified stakeholders and is in the process of forming a WAC to help formulate resource management goals for the study; map watershed resource uses and future uses; identify and prioritize opportunities; and help develop a strategy for implementation. DEP plans to continue to meet with DPR and the WAC to coordinate planning efforts and leverage opportunities for plan implementation.

In addition, DEP will continue to coordinate with the DOH and DOHMH regarding fish advisory promotion information and outreach strategies. DEP ensures this information is available to local and regional stakeholders on the LTCP website and at public meetings.

7.2 Summaries of Stakeholder Meetings

DEP has held public meetings and several stakeholder group meetings to aid in the development and execution of the LTCP. The objective of the public meetings and a summary of the discussion are presented below:

Public Meetings

- Public Meeting #1: Alley Creek LTCP Kickoff Meeting (October 24, 2012)

  Objectives: Provide overview of LTCP process, public participation schedule, watershed characteristics and improvement projects; solicit input on waterbody uses.

  DEP and DEC co-hosted a Public Kickoff Meeting to initiate the water quality planning process for long term control of CSOs in the Alley Creek and Little Neck Bay Waterbody. The two-hour event, held at APEC in Queens, served to provide overview information about DEP's LTCP Program, present information on the Alley Creek and Little Neck Bay watershed characteristics and status of waterbody improvement projects, obtain public information on waterbody uses in Alley Creek, and describe additional opportunities for public input and outreach. The presentation can be found at http://www.nyc.gov/dep/ltcp. Approximately 15 stakeholders attended the event, from over ten different non-profit, community planning, environmental, economic development, and governmental organizations, as well as the general public.

  The Alley Creek LTCP Kickoff Public Meeting was the first opportunity for public participation in the development of the LTCP. In response to stakeholder comments, DEP provided detailed information for each of the following as part of the development of the LTCP:

  - CSO reductions and cost of existing and future CSO-related projects in Alley Creek;
  - Modeling baseline assumptions utilized during LTCP development;
  - Rainfall numbers and assumptions utilized during LTCP development;
  - Water quality data collection;
  - Existing Alley Creek and Little Neck Bay CSO discharges; and
  - Future public meeting announcements.

  Stakeholder comments and DEP's responses were emailed to all attendees and posted to DEP's website, and are also described in Appendix A, Long Term Control Plan (LTCP) Alley Creek Kickoff Meeting – Summary of Meeting and Public Comments Received

- Public Meeting #2: Alley Creek LTCP Alternatives Review Meeting (May 1, 2013)

  Objectives: Review proposed alternatives, related waterbody uses and water quality conditions.

  On May 1, 2013, DEP hosted a second Public Meeting to continue the water quality planning process for long term control of CSOs in Alley Creek and Little Neck Bay. The purposes of the two-hour event, held at APEC in Queens, were to provide background and an overview of the LTCP planning process; present Alley Creek watershed characteristics and status of existing water quality conditions; obtain public input on waterbody uses in Alley Creek and Little Neck Bay; and describe the alternatives identification and selection process. The presentation is on DEP's LTCP Program Website: http://www.nyc.gov/dep/ltcp. Ten stakeholders attended the event, from five different non-profit, community planning, environmental, economic development, and governmental organizations, as well as the general public.

In response to stakeholder comments, DEP provided detailed information for each of the following as part of the development of the LTCP:

- Modeling baseline assumptions utilized during LTCP development, including the rainfall conditions utilized;
- Water quality data collection;
- Stormwater inputs/contributions to Alley Creek and Little Neck Bay;
- Green infrastructure and grey infrastructure potential alternatives;
- Ecological restoration opportunities in Alley Creek and Little Neck Bay;
- Opportunity to review and comment on the draft Alley Creek LTCP;
- Existing Alley Creek and Little Neck Bay CSO discharges; and
- Future public meeting announcements.

Stakeholder comments and DEP's responses were emailed to all attendees and posted to DEP's website, and are also described in Appendix B, Alley Creek Meeting #2 – Summary of Public Comments Received and DEP Responses.

During this Public Meeting #2, there was a high degree of public support for the DEP's findings that additional grey infrastructure-based CSO controls were not warranted, due to the improvements made from the 2009 WWFP and additional construction projects could affect the natural ecosystem conditions in this upper Alley Creek watershed.

- Public Meeting #3: Draft LTCP Review Meeting (Fall 2013)

  Objectives: Present LTCP and associated UAAs

  This meeting is scheduled to be held in the Fall of 2013. Outcomes of the discussion and a copy of presentation materials will be posted to DEP's website.

Stakeholder Meetings

- September 12, 2012

  DEP attended the Queens Borough Cabinet Meeting and presented information on public outreach for the Alley Creek LTCP to Queens Borough President, Helen Marshall, and Queens Borough Cabinet members. In addition to presenting information on public outreach, DEP answered questions regarding the Alley Creek LTCP development schedule and process, elements of the approved Alley Creek WWFP and CSO controls. DEP provided Community Board representatives with a PowerPoint presentation on September 21, 2012, to be forwarded to their constituents. The presentation was also posted to DEP's LTCP Program website: http://www.nyc.gov/dep/ltcp.

- September 29, 2012

  DEP staffed a table at the Little Neck Bay Festival at the APEC in Douglaston, Queens. DEP distributed an Alley Creek LTCP summary, an Alley Creek LTCP Kickoff notice and other LTCP-related educational materials to attendees. Approximately 20 stakeholders from over seven organizations and the broader public asked to be added to DEP's LTCP stakeholder database.

- October 24, 2012

  DEP met with APEC staff to discuss APEC's existing educational programs and ways that DEP can support and build upon these efforts. DEP will continue to meet and work with APEC throughout the development of waterbody-specific LTCPs, to support the development of environmental educational information for grades K-12.

7.3 Coordination with Highest Attainable Use

In cases where existing WQS do not meet the Section 101(a)(2) goals of the CWA, or where the proposed alternative set forth in the LTCP will not achieve existing WQS or the Section 101(a)(2) goals, the LTCP will include a UAA to examine whether applicable waterbody classifications criteria or standards should be adjusted by the State. The UAA assesses the waterbody's highest attainable use, which the State will consider in adjusting WQS, classifications, criteria and developing waterbody-specific criteria.

Comprehensive analysis of baseline conditions, along with the future anticipated conditions after implementing the recommended LTCP projects, show that Alley Creek will remain a highly productive Class I waterbody that can fully support secondary uses, including nature education and wildlife propagation. Alley Creek is in attainment with its current Class I classification, but it is not feasible for the waterbody to meet the water quality criteria associated with the next highest or Class SB classification. Furthermore, combinations of natural and manmade features prevent both the opportunity and feasibility of primary contact recreation in Alley Creek. Little Neck Bay generally meets the Class SB criteria, but fails to do so 100 percent of the time. It should be noted, however, that the summer season compliance is 100 percent at DMA Beach, the only official bathing beach in the waterbody. The continued presence of non-CSO discharges, most notably stormwater from MS4 outfalls, prevents annual attainment of Class SB standards, even when 100 percent CSO volume reduction is considered. Given that CSO control alone is projected to be ineffective in meeting Class SB criteria, upgrading the classification of Little Neck Bay to Class SA under the LTCP program is not feasible.

DEP obtained public feedback on waterbody uses in Alley Creek and Little Neck Bay at the May 1, 2013, Public Meeting. It should be noted that there was a high degree of public support for DEP's findings that additional grey infrastructure-based CSO controls were not warranted, due to the improvements made from the 2009 WWFP. DEP will continue to gather public feedback on waterbody uses and will provide the public UAA-related information at the third Alley Creek and Little Neck Bay Public Meeting in the Fall of 2013.

7.4 Internet Accessible Information Outreach and Inquiries

Both traditional and electronic outreach tools are important elements of DEP's overall communication effort. DEP will ensure outreach tools are accurate, informative, up-to-date and consistent, and are widely distributed and easily accessible. Table 7-1 (next page) presents a summary of Alley Creek LTCP public participation activities.

Table 7-1. Summary of Alley Creek LTCP Public Participation Activities Performed

Category	Mechanisms Utilized	Dates (*if applicable*) and Comments
Regional LTCP Participation	City-wide LTCP Kickoff Meeting and Open House	• June 26, 2012
	Annual City-wide LTCP Meeting – Modeling Meeting	• February 28, 2013
Waterbody-specific Community Outreach	Public meetings and open houses	• Kickoff Meeting: October 24, 2012 • Meeting #2: May 1, 2013 • Meeting #3: TBD
	Stakeholder meetings and forums	• Little Neck Bay Festival: September 29, 2012 • APEC meeting: October 24, 2012
	Elected officials briefings	• Queens Borough Cabinet Briefing: September 12, 2012
Data Collection and Planning	Establish online comment area and process for responding to comments	• Comment area added to website on October 1, 2012 • Online comments receive response within 2 weeks of receipt
	Update mailing list database	• DEP updates master stakeholder database (700+ stakeholders) after each meeting and briefing
	Solicit input via surveys	• TBD
Communication Tools	Program Website or Dedicated Page	• LTCP Program website launched June 26, 2012 and frequently updated • Alley Creek LTCP webpage launched October 1, 2012 and frequently updated
	Social Media	• TBD
	Media Outreach	• TBD
	FAQs	• LTCP FAQs developed and disseminated beginning June 26, 2012 via website, meetings and email
	Print Materials	• LTCP FAQs: June 26, 2012 • LTCP Goal Statement: June 26, 2012 • LTCP Public Participation Plan: June 26, 2012 • Alley Creek Summary: October 15, 2012 • LTCP Program Brochure: February 28, 2013 • Glossary of Modeling Terms: February

Table 7-1. Summary of Alley Creek LTCP Public Participation Activities Performed

Category	Mechanisms Utilized	Dates (*if applicable*) and Comments
		28, 2013 • Meeting advertisements, agendas and presentations • PDFs of poster board displays from meetings • Meeting summaries and responses to comments • Quarterly Reports • WWFPs
	Translated Materials	• As-needed basis
	Portable Informational Displays	• Poster board displays at meetings
	Advisories and Notifications	• TBD
	Construction Outreach	• N/A
Student Education	Participate in ongoing education events	• Little Neck Bay Festival: September 29, 2012
	Provide specific green and grey infrastructure educational modules	• TBD
	Partner with local universities	• TBD
	Offer tours of waterways	• TBD

DEP launched its LTCP Program website on June 26, 2012. The website provides links to documents related to the LTCP program, including CSO Orders on Consent, approved WWFP, LTCP Quarterly Reports, links to related programs such as the Green Infrastructure Plan, and handouts and poster boards distributed and displayed at public meetings and open houses. A LTCP feedback email account was also created to receive LTCP-related feedback, and stakeholders can sign up to receive LTCP Program announcements via email. Refer to Appendix C, Summary of Public Comments Received via Email and DEP Responses, for this feedback. In general, DEP's LTCP Program website:

- Describes the LTCP process, CSO related information and City-wide water quality improvement programs to date;
- Describes waterbody-specific information including historical and existing conditions;
- Provides the public and stakeholders with timely updates and relevant information during the LTCP process including meeting announcements;
- Broadens DEP's outreach campaign to further engage and educate the public on the LTCP process and related issues; and
- Provides an online portal for submission of comments, letters, suggestions, and other feedback.

A specific Alley Creek LTCP webpage was created in September 2012, and includes the following information:

- Alley Creek public participation and education materials
  - Alley Creek and Little Neck Bay Summary Paper
  - Alley Creek Waterbody/Watershed Facility Plan
  - LTCP Public Participation Plan
- Alley Creek LTCP Meeting Announcements
- Alley Creek Kickoff Meeting Documents – October 24, 2012
  - Advertisement
  - Meeting Agenda
  - Meeting Presentation
  - Meeting Summary and Response to Comments
- Queens Borough Cabinet Presentation – September 12, 2012
- Alley Creek Meeting #2 Meeting Documents – May 1, 2013
  - Advertisement
  - Meeting Agenda
  - Meeting Presentation

Meeting Summary and Response to Comments

SECTION 8.0
EVALUATION OF ALTERNATIVES

8.0 EVALUATION OF ALTERNATIVES

This section of the LTCP describes the development and evaluation of CSO control measures and watershed-wide alternatives, including those contained in the 2009 Alley Creek and Little Neck Bay WWFP. A control measure is any technology (e.g., treatment, storage, etc.), practice (e.g., NMC or BMP), or other method (e.g., source control, GI, etc.) capable of abating CSO discharges or the effects of such discharges on the environment. Alternatives are comprised of a single control measure or a suite of control measures that will collectively address the water quality goals and objectives for Alley Creek and Little Neck Bay. Each alternative is evaluated considering several parameters, including: feasibility of construction and implementation; improvements to the waterbody in terms of water quality parameters and aesthetics; significant reductions in the number of CSO events and annual CSO volume; and cost.

8.1 Considerations for LTCP Alternatives under the Federal CSO Policy

The LTCP addresses the water quality goals of the federal CWA and the New York State Environmental Conservation Law, building upon the EPA NMCs as well as the conclusions presented in the 2009 WWFP. In cases where existing WQS do not meet the Section 101(a)(2) goals of the CWA, or where the proposed alternative set forth in the LTCP will not achieve existing WQS or the Section 101(a)(2) goals, the LTCP includes a UAA to examine whether applicable waterbody classifications, criteria, or standards should be adjusted by the State. The UAA assesses the waterbody's highest attainable use, which the State will consider in adjusting WQS, classifications, criteria and developing waterbody-specific criteria.

The remainder of Section 8.1 discusses the applicable water quality goals, and how the CSO controls and watershed-wide alternatives were developed and evaluated to comply with the CWA in general, and with the CSO Control Policy, in particular.

8.1.a Performance

Section 6 presented evaluations of baseline conditions and concluded that there are no performance gaps because baseline conditions attain current WQS. Specifically, both Alley Creek and Little Neck Bay are in attainment with current DO and bacteria criteria. Also, Alley Creek cannot attain the next highest water quality standards for contact recreation, the SB Classification. Therefore, discussion of performance for Alley Creek and Little Neck Bay alternatives will focus on bacteria criteria and standards.

Sensitivity analyses were also performed in Section 6 regarding future WQS. The results indicate that CSO control alone – even 100 percent – would not close the bacteria performance gap for Alley Creek when considering existing or potential future SB standards.

During the development of control alternatives, performance is more closely examined to evaluate WQS attainment. LTCPs are typically developed with alternatives evaluated spanning a range of CSO volume reductions. Accordingly, this LTCP includes alternatives for zero, 25, 50, 75 and 100 percent reduction in CSO AAOV. However, for some alternative control measures, such as disinfection, there is no net gain in AAOV. Performance of each control measure and subsequent alternative is measured against its ability to meet the goals of the CWA and water quality requirements at the 2040 planning horizon. It is essential that any proposed control measure be capable of meeting the modeled anticipated performance. As such, only proven control measures are included in the plan alternatives.

8.1.b Impact on Sensitive Areas

During the development of alternatives, special consideration was made to minimize the impact of construction, to protect existing sensitive areas, and to enhance water quality in sensitive areas. As described in Section 2, there is one sensitive area within Alley Creek and Little Neck Bay, namely the

DMA Beach. The LTCP therefore addresses the following EPA policy requirements: (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 (EPA, 1995a).

8.1.c Cost

Cost estimates for the alternatives were computed using a costing tool based on parametric costing data. This approach is assumed to provide an Association for the Advancement of Cost Engineering (AACE) Class V estimate, which is appropriate for this type of planning evaluation.

For the LTCP alternatives, total project cost includes the capital cost of the project, including construction, engineering and other project development costs. Annual operation and maintenance (O&M) costs are then used to calculate the total present worth or value over the projected useful life of the project. To quantify costs and benefits, alternatives are compared based on reductions of both CSO discharge volume and bacteria loading against the total cost of the alternative. The resulting graph, called the knee-of-the-curve, is then used to help select the final recommended alternative. In doing so, the alternative that achieves the greatest appreciable water quality improvements at the lowest cost is selected; this may not necessarily be the lowest cost alternative, however. Beyond the comparative evaluation of alternatives, cost-effectiveness must be assessed from a broader perspective. Recommended alternatives must be capable of achieving water quality goals in a fiscally responsible manner to ensure that resources are properly allocated across the overall City-wide LTCP program.

8.1.d Technical Feasibility

Several factors were considered when evaluating technical feasibility, including:

- Effectiveness for controlling CSO
- Reliability
- Implementation

The effectiveness of CSO control measures were assessed based on their ability to reduce CSO frequency, volume, and intensity. Reliability is an important operational consideration, and can have an impact on overall effectiveness of a control measure. Therefore, reliability and proven history are essential factors for assessing the technical feasibility and cost effectiveness of a control measure.

Several site specific factors were considered when evaluating an alternative's technical feasibility including available space, neighborhood assimilation, impact on parks and green space, and overall practicability of installing the CSO control. In addition, the method of construction was factored into the final selection. Some technologies require specialized construction methods that typically incur additional costs.

8.1.e Cost-Effective Expansion

All alternatives evaluated were sized to handle the 2040 design year CSO volume, with the understanding that the predicted flow value, and actual volume may differ. To help mitigate the difference between predicted and actual flows, an adaptive management framework consideration was given to those CSO technologies that can be expanded in the future to capture additional CSO volume, should it be needed. In some cases, this may have affected where the facility is constructed, or gave preference to a facility that it can be expanded at a later date with minimal cost and disruption of operation.

Breaking construction into segments allowed adjustment of the design of future phases based on the performance of already-constructed phases. Lessons learned during operation of the current facilities can be incorporated into the design of the future facilities. However, phased construction also exposes the local community to a longer construction period. For those alternatives that can be expanded, the LTCP discusses how easily they can be expanded, what additional infrastructure may be required, and if additional land acquisition is needed.

As regulatory requirements change, the need for improvements in nutrient removal or disinfection could arise. The ability of a CSO control technology to be retrofitted to handle these types of processes improved the rating of that technology.

8.1.f Long Term Phased Implementation

The final recommended plan is structured in a way that makes it adaptable to change via expansion and modifications in response to new regulatory and/or local drivers. If applicable, the project(s) would be implemented over a multi-year schedule. Because of this, permitting and approval requirements have to be identified prior to selection of the alternative. Where necessary, a permit schedule was developed outlining when permit applications should be submitted or renewed to meet the project schedule. With the exception of GI, which is assumed to occur on both private and public property, most if not all of the CSO grey technologies are limited to City-owned property and right-of-way-acquisitions. DEP will work closely with other City agencies, and possibly the State of New York, to ensure proper coordination with these other agencies.

8.1.g Other Environmental Considerations

Impacts on the environment and surrounding neighborhood will be minimized as much as possible during construction. These considerations include traffic impacts, site access issues, park and wetland disruption, noise pollution, air quality, and odor emissions. To ensure that these ancillary environmental considerations are minimized, they will be identified with the selection of the recommended plan and communicated to the public. Any identified potential concerns will be addressed in a pre-construction environmental assessment.

8.1.h Community Acceptance

As described in Section 7, DEP is committed to involving the public and regulators early in the planning process through a community participation about the scope and goals of the LTCP, and continuing public involvement during its development, evaluation, and selection of plan elements. Community acceptance of the recommended plan is essential to its success. The Alley Creek and Little Neck Bay LTCP is intended to be an integral part of the community, enhancing the quality of life in the neighborhood while addressing CSOs. The public's health and safety are the first priority of the Plan. Raising awareness of and access to waterbodies is a goal of the Plan and was considered during the alternative analysis. Several CSO control measures, such as GI, have been shown to enhance the community while increasing local property values and, as such, the benefits of GI were considered in the formation of the final recommended plan.

8.1.i Methodology for Ranking Alternatives

The Alley Creek and Little Neck Bay LTCP employed a three-step procedure developed to evaluate and rank control measures and alternatives:

- Step 1: Screening of Potential Control Measures
- Step 2: Development and Ranking of Control Measures
- Step 3: Final Evaluation and Selection of Preferred Watershed-Wide Alternative

This process, with possible minor revision, could also be used for the other LTCPs within New York City. The goal of the process was to implement a triple bottom line approach when evaluating alternatives, by taking into account environmental, economic, and social considerations.

An overview of the three-step procedure is as shown in Table 8-1. Overall, the methodology for ranking control measures transforms from being highly qualitative to more quantitative as the steps progress. This is particularly true for Step 3, where cost estimates, capital and annual operation and maintenance (O&M), and predicted performance data (both CSO control measures and water quality impacts) are used to perform the cost performance or knee-of-the-curve (KOTC) analysis.

Table 8-1. Three-Step Control Measure and Watershed-Wide Alternative Evaluation and Screening Process

Factor	Step 1: Screening of Potential Control Measures	Step 2: Evaluation and Ranking of Control Measures	Step 3: Final Evaluation and Selection of Preferred Watershed-Wide Alternative
Type of Process	Qualitative	Quantitative	Cost/Performance using KOTC
Rating Criteria	Fatal flaw analysis (no quantitative metrics)	Non-economic metrics	1. Lifecycle costs: capital plus annual O&M. 2. Control level performance (see below)
Purpose/Outcome	Selection of the most viable control measures for the watershed under consideration	Determination of the highest-ranked control measures for development of alternatives	1. Final ranking of alternatives based on cost per MG of CSO volume controlled ($/gallon). 2. Other KOTC parameters could also be considered such as unit cost of pollutant reduction or unit cost of days/hours of additional WQS attainment
Process Implementation	1. Develop a list of potential control measures in a workshop setting. 2. Evaluate and screen potential control measures based on applicability to the specific waterbody/ watershed. Examine for fatal flaws or weaknesses that would prevent or limit a control measure's efficacy for CSO abatement	1. Evaluate, score and rank the remaining control measures from Step 1. 2. Develop alternatives for the watershed using the highest ranked control measures, 3. Alternatives will be subjected to economic and cost-performance evaluations in Step 3	1. Use the most recent waterbody and watershed modeling data to transform the process into a more quantitative direction. 2. Develop updated costing templates with the addition of annual O&M costs. 3. Determine water quality gaps. 4. Perform KOTC analysis using the most viable watershed-wide alternatives

In Step 1, the potential technologies and control measures are evaluated qualitatively to judge their ability to meet the LTCP goals and identify fatal flaws that could disqualify a control measure from use in the watershed under consideration. Examples of fatal flaws could include insufficient land or less than desirable siting for a particular technology, a technology that is unproven in addressing the performance objectives required or an approach or alternative that would cause wide/spread impact to the local community during and after construction.

In Step 2, the resulting most favorable control measures are then rated using pre-defined non-economic criteria or metrics, covering the following three categories:

- Environmental Benefits
- Community and Societal Impacts
- Implementation and O&M Considerations

Factors considered for each of these three categories are described in Table 8-2. Economic considerations are not included in Step 2, but are evaluated in Step 3, when the watershed-wide alternatives are more fully developed. The control measures are rated by assigning a score for each metric with a value of “5” indicating a highly favorable rating and a “1” indicating the most unfavorable rating. The scoring scale is shown in Table 8-3.

Table 8-2. Definitions of Step 2 Metrics

Metric	Description
A. Environmental	
A1. CSO Frequency/ Volume	Decrease in discharge frequency and AAOV.
A2. Pollutant Reduction/ Water Quality improvements	Decrease in discharge of pollutants including floatables, TSS, BOD and pathogens.
A3. Control of Discharge to Sensitive Areas	Degree to which sensitive areas, such as bathing beaches and marinas, are protected from the remaining CSO discharges.
B. Community/Societal	
B1. Environmental Justice	Degree to which the control measures affects low- and moderate-income neighborhoods.
B2. Ancillary Community Benefits	Benefits include streetscape improvements; enhanced recreational opportunities; localized street flooding; and control of discharge to waterfront public access areas.
B3. Community Disruption/ Potential for Nuisances	Disruption to the affected area during construction and subsequent routine O&M of the control measures including traffic, dust, noise, aesthetics, etc.
C. Implementation and O&M	
C1. Constructability/Permitting	Possible impediments to implementation including, but not limited to: degree of construction difficulty; environmental and operational permitting; presence of hazardous materials, subsurface or topographic conditions; permanent land requirements, easements or deed restrictions; planned redevelopment; inter-governmental jurisdictional issues; and other land use and zoning requirements.

Metric	Description
C2. Operating Complexity/ Ease of O&M	Consistency with existing O&M practices and/or level of complexity of the project components including, but not limited to: use of chemicals; reliance on multiple sensors/meters; operation of upstream and/or downstream facilities, etc.
C3. Sustainability	Degree to which the construction and routine O&M of the control measures consumes labor, materials, chemicals, power and fuel over their useful life.

Table 8-3. Step 2 Scoring Scale

Score	General Definition
5	Highly Favorable
4	Favorable
3	Neutral
2	Unfavorable
1	Highly Unfavorable

Because the various metrics are not considered equal in terms of their relative importance, a system of weighting factors was established to ensure that the evaluation, ranking and screening process is reflective of both DEP and community goals and objectives for the LTCP program. Different weighting factors were assigned to the three major categories of metrics, with the total adding to 100 percent. Furthermore, weighting factors also were assigned to each metric within each major category as the individual metrics may have different levels of importance within the major category. The overall metric weighting factor is the product of the individual metric weight and the major category weight. The overall metric weighting factors are shown in Table 8-4.

Table 8-4. Weighting Factors for Step 2 Metrics

Major Category	Category Weighting Factor	Metric	Metric Weighting Factor
A. Environmental	0.45	A1. CSO Volume/Frequency	0.16
		A2. Pollutant Reduction/Water Quality Improvements	0.16
		A3. Control of Discharge to Sensitive Areas	0.13
B. Community/ Societal	0.25	B1. Environmental Justice	0.08
		B2. Ancillary Community Benefits	0.08
		B3. Community Disruption/ Potential for Nuisances	0.09
C. Implementation and O&M	0.30	C1. Constructability/Permitting	0.15
		C2. Operating Complexity/Ease of O&M	0.09
		C3. Sustainability	0.06

The most promising or highest ranked control measures then pass on to Step 3, where they form watershed-wide alternatives, which are evaluated in greater detail using economic criteria and other cost-performance and water quality attainment criteria. Using these expanded criteria, including the latest results from both updated landside and water quality modeling, cost-performance or KOTC evaluations are performed so that the most environmentally-sound and cost-effective alternative can be selected. To construct the cost-performance curves, alternatives were developed to cover a range of CSO control including 25, 50, 75 and 100 percent AAOV capture, and to address the performance gaps described in Section 6.3.

8.2 Matrix of Potential CSO Reduction Alternatives to Close Performance Gap from Baseline

Using this evaluation methodology, 11 control measures were deemed as being viable from the Step 1 process and passed onto Step 2. They were then scored using the metrics shown in Table 8-2, scoring definitions in Table 8-3, and weighting factors in Table 8-4. The results of Step 2 are shown in Table 8-5 (next page).

As shown in the table, scores ranged from a high of 4.02 (80.4 percent) for expanding the existing CSO Retention Tank, to a low of 2.17 (43.4 percent) for netting facilities. HLSS and VTS storage were also highly ranked, with scores of 3.50 (70.0 percent) and 3.35 (67.0 percent), respectively. System optimization and GI also ranked in the top five control measures, with scores of 2.94 (58.8 percent) and 2.92 (58.4 percent), respectively. It is important to note, however, that while GI and system optimization ranked in the top five, they were not viewed as being able to close the performance gap in water quality as standalone control measures, and would have to be combined with other control measures to fulfill the LTCP goals. Disinfection within the existing CSO Retention Tank had a score of 2.76 (55.2 percent), and was also retained for further evaluation.

The top-ranked control measures from Step 2, listed in Table 8-6, were further developed into alternatives by identifying specific levels of CSO control, along with potential locations for implementation of the control measures. In keeping with the LTCP guidance, the alternatives spanned a range of CSO volumetric and/or pollutant reduction controls, including the 100 percent control level. To assist in this process, the Alley Creek and Little Neck Bay watershed IW model was used to match the retained control measures to various levels of reduction in AAOV and pollutant loading, most notably bacteria. As shown in Table 8-7, alternatives were matched with targeted AAOVs, ranging from 15 percent for 10 percent GI coverage, to 100 percent for a 29.5 MG expansion of the existing Alley Creek CSO Retention Tank. It should be noted that GI coverage, as referred in this section, was based upon the concept of retention. Thus, as will be demonstrated later in Table 8-7, a 10 percent GI converge results in a 15 reduction in AAOV. Also, while not providing AAOV reduction, disinfection within the Alley Creek CSO Retention Tank was included as a 100 percent control measure. Because of the expected 3- to 4-log reduction in bacteria concentration that would result from disinfection, the WQ modeling, described in Section 6, assumed that disinfection was virtually equivalent to the 100 percent AAOV control that would be realized with the 29.5 MG tank expansion described later in this section. As noted, in addition to the 100 percent control target, there are also multiple alternatives for the 50 and 75 percent AAOV targets. Expanded development of the alternatives is presented in the following sections.

Table 8-5. Step 2 Scoring of Control Measures

CSO Control Measure	Environmental			Community/Societal			Implementation/ O&M			Raw Score	Weighted Score	Weighted Score % of Possible Total Score
	CSO Volume & Frequency	Pollutant Reduction/ WQ Improvement	Control of Discharge to Sensitive Areas	Environmental Justice	Ancillary Community Benefits	Community Disruptions/ Potential for Nuisances	Constructability/ Permitting	Operating Complexity/ O&M Requirements	Sustainability			
	16%	16%	13%	8%	8%	9%	15%	9%	6%	#	#	%
High Level Sewer Separation (HLSS)	5	3	2	4	4	2	3	5	4	32	3.50	70.0
Expand Existing CSO Retention Tank	5	5	5	3	3	4	3	4	2	34	4.02	80.4
Disinfection in Existing CSO Retention Tank	1	4	4	3	3	4	3	1	1	24	2.76	55.2
Chemically Enhanced Settling in Existing CSO Tank	1	3	2	3	3	4	4	2	1	23	2.58	51.6
Bar Screen in Existing CSO Tank	1	1	1	3	3	4	5	2	3	23	2.40	48.0
Increase Pump Station and Interceptor Capacity to WWTP	2	2	2	3	3	3	3	4	2	24	2.58	51.6
VTS Storage	5	4	5	3	3	2	2	2	2	28	3.35	67.0
Netting Facilities	1	2	1	3	3	3	3	2	3	21	2.17	43.4
Green Infrastructure	2	2	2	4	4	3	3	4	5	29	2.92	58.4
System Optimization (Sewer Enhancements)	2	2	2	3	3	5	4	3	4	28	2.94	58.8
Real Time Control (RTC)	2	2	2	5	3	5	2	2	3	24	2.49	49.8

Table 8-6. Control Measures Retained for Watershed-Wide Alternatives Development

Core Control Measure(s)	Remarks
HLSS	1. For closure of moderate to large performance gaps 2. Could be supplemented by GI and/or System Optimization
Expand Existing CSO Retention Tank (or Additional New Downstream Retention Tank)	1. For closure of moderate to large performance gaps 2. Could be supplemented by GI and/or System Optimization
VTS Storage	1. For closure of moderate to large performance gaps 2. Could be supplemented by GI and/or System Optimization 3. For either additional downstream or new upstream storage
Disinfection in Existing CSO Retention Tank	1. For closure of moderate to large performance gaps 2. Could be supplemented by GI and/or System Optimization
GI	Limited to closure of small performance gaps
System Optimization (Sewer Enhancements)	Limited to closure of small performance gaps

Table 8-7. Potential Alternatives for Targeted AAOV Control Levels

Target AAOV Reduction Percent	Control Measures	Remarks
15	10 percent GI Coverage	See Section 8.2.b
25	3.0 MG Downstream Tank and 2.4 MG Upstream Tank	See Section 8.2.a.3
50	1. 6.5 MG Downstream Tank and 6.7 MG Upstream Tank 2. 100 percent HLSS (51 percent)	1. See Section 8.2.a.3 for tank and treatment alternatives 2. See Section 8.2.a.1 for HLSS alternative
65	50 percent GI Coverage (69 percent)	See Section 8.2.b
75	1. 12 MG Downstream Tank 2. 3.0 MG Downstream Tank and HLSS (71 percent)	1. See Section 8.2.a.3 for tank and treatment alternatives 2. See Section 8.2.d For the hybrid tank plus alternative
100	1. 29.5 MG Downstream Tank 2. Disinfection in Existing Retention Tank	See Section 8.2.a.3 for tank and treatment alternatives

8.2.a Other Future Grey Infrastructure

"Grey infrastructure" refers to single-purpose systems used to control, reduce or eliminate discharges from CSOs. These are the technologies that have been traditionally employed by DEP and other wastewater utilities in their CSO planning and implementation programs, and encompass retention tanks; dedicated and centralized treatment plants, including high-rate physical-chemical treatment (also referred to as high-rate clarification); and other similar capital-intensive facilities. Grey infrastructure implemented under previous CSO control programs and facility plans is described in Section 4 and includes the Alley Creek CSO Retention Tank (a traditional, shallow, below-ground concrete retention tank), along with major related sewer system and pump station modifications.

The existing Alley Creek CSO Retention Tank captures up to 5 MG of CSO volume per storm event, and was designed for capture of over 50 percent of the CSO AAOV discharged to Alley Creek and Little Neck Bay. For the purpose of this LTCP, “Other Future Grey Infrastructure” refers to potential grey infrastructure beyond any existing grey infrastructure control measures implemented under previous planning documents, such as the 2009 WWFP.

8.2.a.1 High Level Sewer Separation

High Level Sewer Separation (HLSS) is a form of partial separation that separates the combined sewers only in the streets or other public rights-of way, while leaving roof leaders or other building connections unaltered. In NYC, this is typically accomplished by constructing a new stormwater system and directing flow from street inlets and catch basins to the new storm sewers. Challenges associated with HLSS include constructing new sewers with minimal disruption to the neighborhoods along the proposed alignment, finding a viable location for any necessary new stormwater outfalls, and avoiding conflicts with recent system improvements upstream of the Alley Creek CSO Retention Tank. Separation of sewers minimizes the amount of sanitary wastewater being discharged to receiving waters, but also results in increased separate stormwater discharges (which also carry pollutants) to receiving waters.

One HLSS alternative was developed for the CSS that is tributary to Regulators 46 and 47; this is referred to as Alternative 1. The CSS associated with these regulators is west of Alley Pond Park (Figure 2-9 in Section 2), represents 86 percent of the entire Alley Creek and Little Neck Bay CSS, and corresponds to 16 percent of the total watershed. An enlarged view of the area served by these two regulators is shown in Figure 8-1. Under this alternative, newly-separated stormwater would be conveyed through a new municipal separate storm sewer system (MS4) to Alley Creek along the route shown in Figure 8-2. The new outfall would have to be permitted under the MS4 program.

Hydraulic modeling using the re-calibrated IW model determined that HLSS could provide up to a 51 percent reduction of the CSO AAOV. Because this level was deemed to be insufficient to close the performance gap described in Section 6.3, HLSS was also considered in combination with VTS storage (see Section 8.2.d).

Figure 8-1. Combined Sewer Service Area Tributary to Regulators 46 and 47

Figure 8-2. HLSS for CSS Tributary to Regulators 46 and 47 (Alternative 1)

8.2.a.2 Sewer Enhancements

Sewer enhancements, also known as system optimization, aim to reduce CSO through improved operating procedures or modifications to the existing collection system infrastructure. Examples include control gate modifications, regulator or weir modifications, inflatable dams and real time control (RTC). These control measures generally retain more of the combined sewage within the existing sewer pipes during storm events. The benefits of retaining this additional volume must be balanced against the potential for sewer back-ups and flooding. Viability of these control measures are system-specific, depending on existing physical parameters such as pipeline diameter, length, slope and elevation.

Evaluations performed under previous facility plans have shown that the Alley Creek and Little Neck Bay sewer system is not amenable to significant CSO reductions through sewer system enhancements or optimization. After updating the IW collection system model and re-examining the state of RTC technology, it was found that the previous conclusions are still valid, and RTC is still not viable within Alley Creek and Little Neck Bay. Elevated static weir heights, opportunities for inflatable dams and/or control gates, and similar alternatives within the sewer system pipes have been eliminated from further consideration, due to risk of flooding in the community. At best, alternatives relying solely on sewer enhancements would be limited to closure of small performance gaps. Although this LTCP does not propose any specific alternatives under this control measure category, sewer enhancements may be indirectly considered under other alternatives (e.g., additional storage/retention alternatives may need to include sewer enhancements if the evaluation identifies pump station and sewer system conveyance limitations that impact storage dewatering).

8.2.a.3 Retention/Treatment Alternatives

Retention Alternatives

The objective of retention is to reduce overflows by intercepting combined sewage in an offline or inline storage element during wet weather for controlled release into the WWTP after the storm event. Retention control measures considered in this LTCP include traditional, shallow, closed concrete tanks and VTS storage. More detailed description for traditional tanks can be found in the Alley Creek and Little Neck Bay WWFP (2009).

As an alternative to a traditional shallow tank, additional capacity could be added by construction of a VTS for the purposes of storage only. Extending deeper into the ground compared to a traditional shallow tank, the VTS can provide a large storage capacity while occupying a smaller ground surface footprint. The smaller footprint may allow for versatility when siting the VTS. As with traditional shallow tanks, VTSs typically include odor control systems, washdown/solids removal systems, tank dewatering pumps, and access for cleaning and maintenance.

Siting considerations are key factors in determining the viability of additional storage and may influence the selection of the type of tank – traditional shallow tank or VTS storage – and its location. Evaluation of the Alley Creek and Little Neck Bay watershed identified two candidate locations for siting additional retention facilities:

- Downstream, near the existing CSO Retention Tank (including both adjacent to the existing tank and to the south of Northern Boulevard); and
- Upstream of the existing tank near the CSO regulators for the CSS area.

Retention Alternatives - Downstream Sites

Downstream sites are near the existing Alley Creek CSO Retention Tank, which is located just north of Northern Boulevard between the Cross Island Parkway and Alley Creek. Additional retention could be constructed adjacent to the existing facility, sharing the influent sewers, control structures, tank drain piping, and outfall that have already been built. Several retention alternatives, spanning a range of 25 to 100 percent AAOV reduction, were developed near this downstream location. As shown in Table 8-8, under baseline conditions with the Alley Creek Retention Tank in operation, virtually all of the CSO discharge to Alley Creek and Little Neck Bay is conveyed through outfall TI-025, which is the outfall associated with the Alley Creek Retention Tank.

Table 8-8. Dewatering Time for Retention Alternatives

Outfall	Waterbody	Total AAOV in MG/yr				
		Baseline	100 Percent Capture	75 Percent Capture	50 Percent Capture	25 Percent Capture
TI-007	Alley Creek	0.1	0.1	0.1	0.1	0.1
TI-008	Alley Creek	0.0	0.0	0.0	0.0	0.0
TI-009	Little Neck Bay	0.0	0.0	0.0	0.0	0.0
TI-025	Alley Creek	132.5	0.0	33.4	66.8	99.7
Total		132.6	0.1	33.5	66.9	99.8
Additional Tank Volume Required (MG)		--	29.5	12.0	6.5	3.0
Additional Dewatering Capacity for Retention Alternatives (MGD)		NA	15	6	3.5	1.5
Dewatering Time for Retention Alternatives (days)		NA	2.0	2.0	1.8	1.9

To capture 100 percent of the 132.5 MG/yr AAOV discharged through TI-025, an additional 29.5 MG of retention would be required. For lesser captures of 75, 50, and 25 percent, additional retention volumes of 12 MG, 6.5 MG and 3.0 MG would be required, respectively. Alternatives corresponding to these levels of CSO AAOV capture are:

- **Alternative 2A – 3.0 MG Retention.** Alternative 2A is designed to capture 25 percent of the CSO AAOV. Alternative 2A is a 3.0-MG traditional shallow tank located north of and abutting the existing tank but south of the marsh grass (see Figure 8-3). In essence, it is an expansion of the existing Alley Creek Retention Tank that would drain through the existing gravity drain to the Old Douglaston PS. Adequacy of the Old Douglaston PS capacity (8.5 MGD) must be evaluated to determine whether it can handle the additional volume of captured CSO. An optional approach would employ a 3.0 MG VTS storage facility instead of a traditional shallow tank (see Figure 8-4). The VTS alternative would significantly reduce the footprint required for a new retention tank, but would extend to a much greater depth to provide the same storage volume. Because this would place the bottom of the VTS below the drain pipe at the existing Alley Creek Retention Tank, the VTS would not be drained by gravity, but would instead require new pump facilities to dewater the VTS between rain events.

- **Alternative 2B – 6.5 MG Retention**. Alternative 2B is designed to capture 50 percent of the AAOV and requires a volume of 6.5 MG, through a VTS storage facility located north of the existing tank but south of the marsh grass wetland (see Figure 8-5). Another option would employ a traditional tank located south of Northern Boulevard, as shown in Figure 8-6. To fit within the proposed sites, the 6.5 MG retention alternatives require depths that extend below the drain pipe at the existing Alley Creek Retention Tank and will therefore require new pump facilities to dewater them between rain events.

- **Alternative 2C – 12 MG Retention**. Alternative 2C is a 12 MG traditional rectangular concrete tank designed to capture 75 percent of the AAOV. The proposed location is south of Northern Boulevard, as shown in Figure 8-7. The required tank depth would extend below the drain pipe at the existing Alley Creek Retention Tank, and this alternative would therefore require new pump facilities to dewater the tank.

- **Alternative 2D – 29.5 MG Retention**. Alternative 2D is designed to capture 100 percent of the AAOV. This alternative is comprised of a 29.5 MG rectangular tank and a pumping facility to dewater the tank between rain events. The proposed location for the facility is south of Northern Boulevard, as shown in Figure 8-8.

Siting Consideration

The proposed location for these alternatives carries with it potential siting restrictions. The existing retention tank is located adjacent to wetlands in designated special Forever Wild Park Land. Special permits and permissions from regulatory agencies and potentially from the DPR would need to be obtained in order to construct in this area. Note that the larger traditional tank expansions (50, 75 and 100 percent capture) would be difficult to site in the region north of the existing Alley Creek Tank without encroaching into the marsh grass wetland area. Therefore, traditional tank alternatives for 50 to100 percent capture were placed south of the Alley Creek Retention Tank. Due to the limited space at this location, however, the required volume cannot be obtained unless the new tanks are deeper than the existing tank.

Figure 8-3. Alternative 2A - 3 MG Downstream Tank

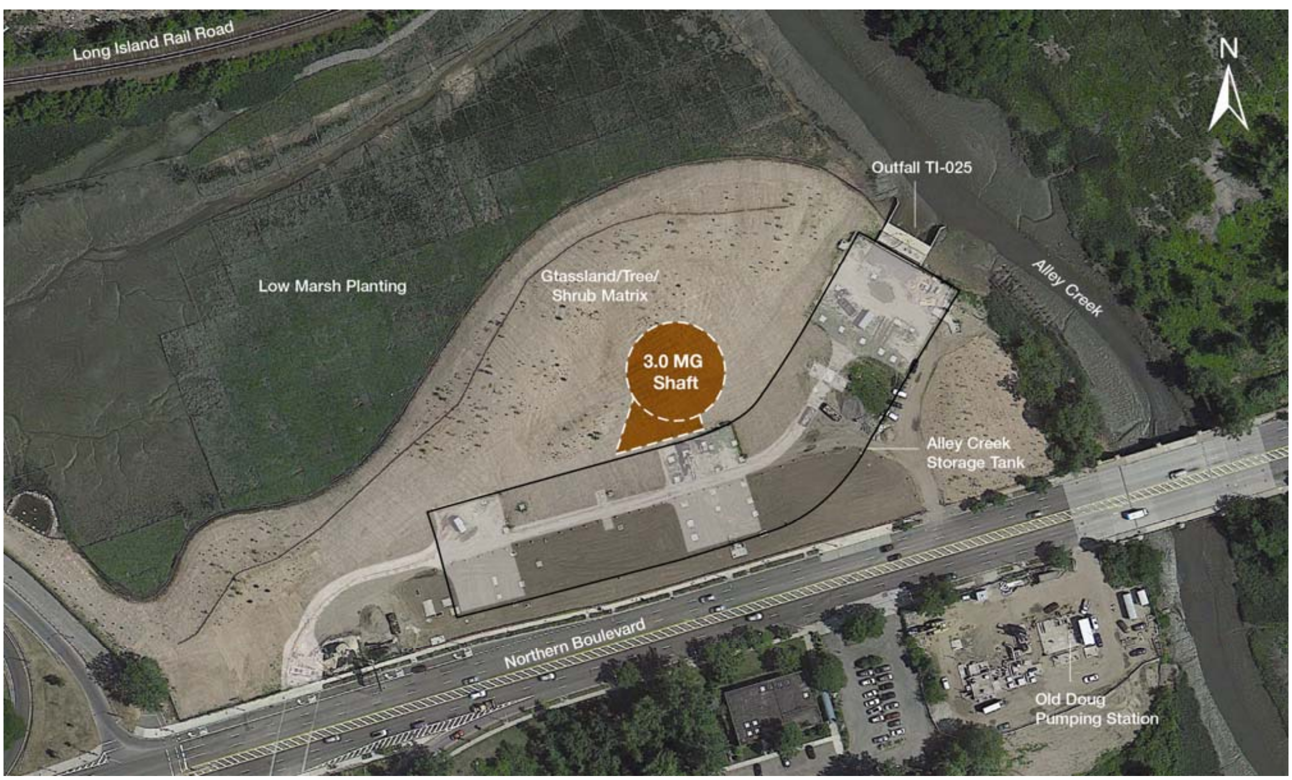


Figure 8-4. Alternative 2A – Optional Approach for 3 MG Downstream Tank

Figure 8-5. Alternative 2B – 6.5 MG Downstream Tank

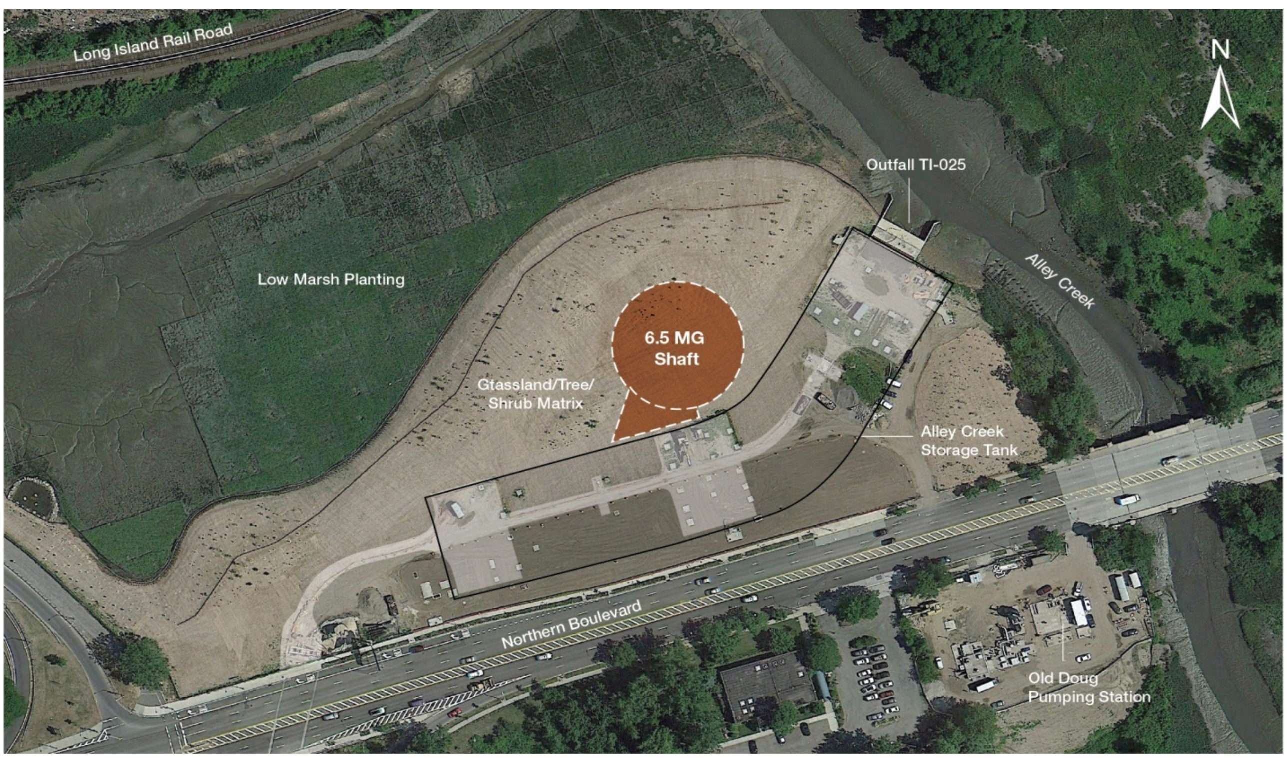


Figure 8-6. Alternative 2B – Optional Approach for 6.5 MG Downstream Tank

Figure 8-7. Alternative 2C – 6.5 MG Downstream Tank

Figure 8-8. Alternative 2D – 29.5 MG Downstream Tank)

Dewatering Considerations

With the exception of Alternative 2A (3.0 MG traditional tank expansion), all of these retention alternatives are deeper than the existing tank and therefore cannot drain by gravity to the Old Douglaston PS. Instead, they would require new pump stations to pump the captured sewage either directly to the collection system in the direction of the Tallman Island WWTP or to the Old Douglaston PS (a two-pump process).

Retention alternatives would temporarily store captured CSO volume until the end of the rain event, after which they would be dewatered into the collection system for conveyance to the Tallman Island WWTP. Potentially competing constraints must be evaluated to determine the feasibility of any retention alternative. The captured CSO volume must be pumped within a reasonable time following a storm event, to avoid generation of odor and corrosion associated with septic conditions, and to dewater the retention tank before the next storm event. At the same time, however, the collection system must be evaluated to determine whether it can convey the additional dewatering flow to Tallman Island WWTP.

There are two locations where flow restrictions may limit the conveyance capacity (Flushing Interceptor Chamber 2 is limited to 58 MGD, and Flushing Interceptor Regulator 9 is limited to 65 MGD). The dewatering scheme for any expanded Alley Creek and Little Neck Bay retention must be coordinated with the dewatering from the existing Alley Creek Retention Tank, along with dewatering from the Flushing Creek Retention Tank, to ensure that conveyance system capacity is not exceeded. Furthermore, dewatering flows from all of these retention facilities combined with dry weather flow must not exceed the Tallman Island WWTP peak design dry weather flow of 80 MGD.

The treatment plant and conveyance system constraints were included in the IW model to determine whether they are significant enough to prevent any alternative from being dewatered within the target time of 2-3 days. As shown in Table 8-8, all of the alternatives can be dewatered within the target time.

Retention Alternatives - Upstream Sites

As an option to locating retention tanks or shafts downstream near the existing Alley Creek Retention Tank site, there may be advantages to locating retention facilities upland in the collection system, closer to the CSS. Overflow capture at these upland areas would be more concentrated, as the flow has not yet mixed with flows from stormwater from the downstream separate sewer system (SSS). Therefore, capture of a smaller volume of more concentrated combined sewage from the upland area may reduce the pollutant load to the waterbodies to the same extent as a larger volume of more dilute sewage captured at the existing retention tank facility. However, the upstream CSS area is more highly developed than that near the existing Alley Creek Retention Tank site, making it more difficult to find suitable retention tank sites upland. Because of the difficulty finding a suitable site, traditional shallow tanks were not considered for upstream locations. Instead, VTSs, which have a smaller footprint, were considered as LTCP alternatives at upland sites. Two such alternatives were developed, both located within the interchange for the Long Island and Clearview Expressways, and designed to capture CSO flow from Regulators 46 and 47:

- Alternative 3A is VTS storage designed to capture 25 percent of the AAOV. It is comprised of a 2.4 MG vertical shaft, along with a 96-inch diameter conduit to convey flow from Regulators 46 and 47 to the shaft, and a force main to convey pump-back from the vertical shaft to the interceptor (see Figure 8-9).

- Alternative 3B is VTS storage designed to capture 50 percent of the AAOV. It is comprised of a 6.7 MG vertical shaft, along with 78-inch x 84-inch and 108-inch x 84-inch conduits to convey flow from Regulators 46 and 47 to the shaft, and a force main to convey pump-back from the vertical shaft to the interceptor (see Figure 8-10).

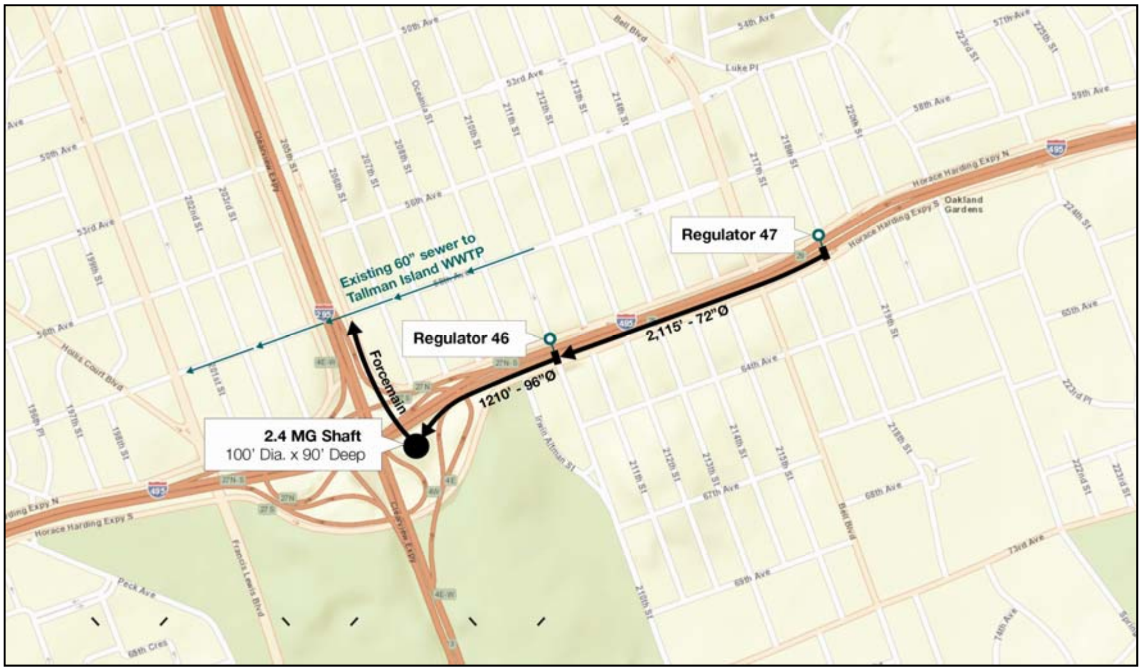


Figure 8-9. Alternative 3A – 2.4 MG Upstream Tank

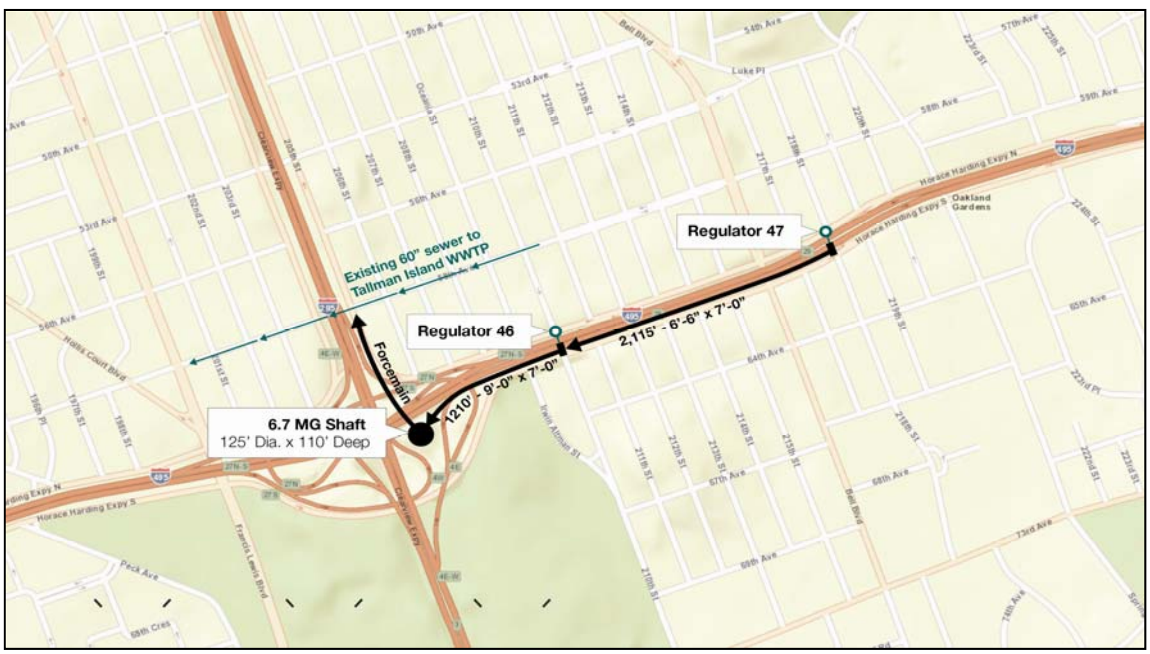


Figure 8-10. Alternative 3B – 6.7 MG Upstream Tank

In both cases, VTS storage would be located in City parkland or in New York State Department of Transportation (NYSDOT) property. Thus, both DPR and NYSDOT could be involved in the siting and permitting should these alternatives progress further in the evaluation process.

Treatment Alternatives – Disinfection in the Alley Creek CSO Retention Tank

Disinfection within the Alley Creek CSO Retention Tank, referred to as Alternative 4, would involve retrofitting the tank with chlorination and dechlorination systems, along with buildings to house the chemical delivery, storage and feed equipment. Ancillary electrical, controls and HVAC systems would also be included. Two chemicals would be used, each supported by its own building: sodium hypochlorite (NaOCl) for chlorination (disinfection), and sodium bisulfite ($NaHSO_3$) for dechlorination. As shown in Figure 8-11, the two buildings would be located at the site of the Old Douglaston PS, on the south side of Northern Boulevard.

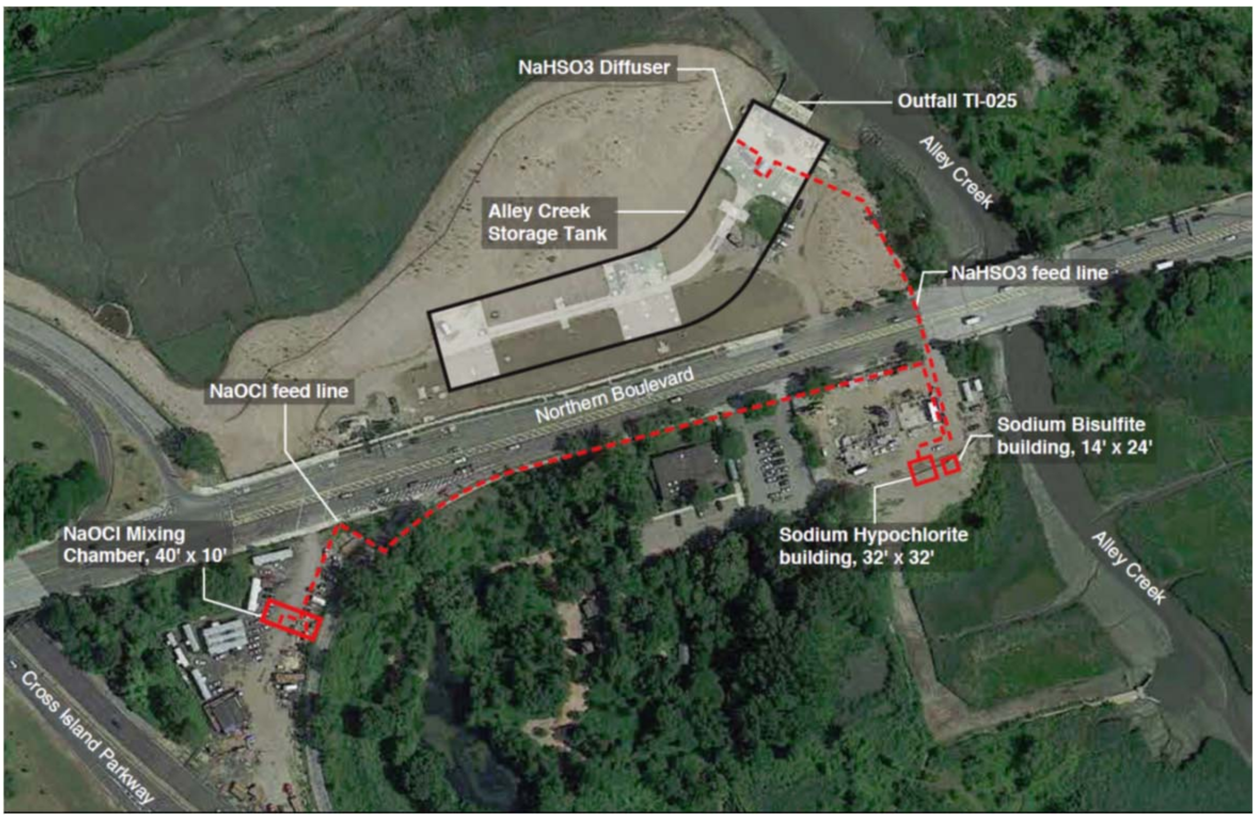


Figure 8-11. Alternative 4 – Disinfection in Existing CSO Tank

Because the tank was not originally designed as a chlorine contact tank, a computational fluid dynamics (CFD) modeling analysis was performed to determine if there would be adequate contact time. The CFD modeling confirmed that there will be slightly more than 11 minutes at the design peak of 327 MGD. This is safely within the range (5 to 10 minutes) of what is considered high rate disinfection (HRD) for wet weather flow. However, because HRD would be employed, care has to be taken to ensure the proper mixing of the chemicals occurs and that an adequate dose can be delivered. To accomplish good mixing, the analysis revealed that two mixers would be installed in each of the influent channels, each with 15 horse power, for a total of four mixers total. The mixers would be of the aspirating style that imparts the liquid sodium hypochlorite in fine particles to ensure that entire water column is disinfected. Diffusers would also be used below the mixer to ensure that low influent flows also received their proper dosage. The dechlorination system would not use mixers, but would rely on diffusers along the tank overflow weir.

With regard to dose, based on the preliminary design assumptions of a CT of 100 mg/L-min, minimum retention time of 10 minutes, and initial chlorine demand for ambient nitrogen, and organic color of 3.6 mg/L, a maximum dose of 10 mg/L of sodium hypochlorite would typically be required. However, the system would be able to feed at a higher dose to compensate for first-flush solids or other anomalies in the system. Actual bench- and pilot-scale testing would be used to establish the actual required doses. These tests would also establish the sodium bisulfite doses for dechlorination.

The system design also addresses the product decay associated with sodium hypochlorite. Decay of product strength is of critical importance to periodically-operated satellite facilities. To overcome this concern, the design was based on using a more dilute solution, which slows down the decay process. This, however, resulted in the need for larger storage tanks and, consequently, a larger storage and feed building. This is reflective in the cost estimates discussed in Section 8.4.

It should be noted that, while the disinfection process appears fairly straightforward, its operation of such would pose a number of challenges. This is due primarily to the satellite nature of the facility, which would not be staffed between storm events. As is reflective in the cost estimates of Section 8.4, dedicated wet weather operations staff would to be employed in the anticipation of an overflow event, to ensure that the chemicals and chemical feed systems are in order, and that all instrumentation is properly calibrated. During the event itself, the staff would need to closely monitor to process to ensure that the chemical dosages are within set parameters, and that over- or under-feeding is not occurring. Such monitoring is crucial as influent conditions rapidly change during events with regard to both flow rates and solids loadings, two important variables that need to closely monitored and factored into the operation. Following the event, the staff would need to drain the feed lines, monitor chemical strength and inventories and, as warranted, perform routine maintenance on the equipment. Should deliveries be needed, the staff would have to be present to monitor the operation. Again, while this level of effort is reflected in the cost estimates, such operations would put a strain on staff who are already overburdened during wet weather conditions.

In addition, from a water quality perspective, the chlorine-based disinfection process produces potentially harmful byproducts and associated ecological risk, even with dechlorination. These concerns are presented in the water quality discussions of Section 8.3.

8.2.b Other Future Green Infrastructure (Various Levels of Penetration)

As discussed in Section 5, DEP expects 45 acres of implemented GI to be managed in onsite private properties in Alley Creek and Little Neck Bay watershed by 2030. This acreage would represent 3 percent of the total combined sewer impervious area in the watershed. This GI has been included in the baseline model projections, and as such, is not categorized as an LTCP alternative. For the purpose of this LTCP, “Other Future Green Infrastructure” is defined as GI alternatives that have not been implemented under previous facility plans and which have not been included in the baseline models.

Two future GI alternatives were developed:

- Alternative 5A – GI developed for 10 percent of the combined sewer service area in the Alley Creek and Little Neck Bay watershed. This alternative corresponds to the overall level of GI proposed in the NYC Green Infrastructure Plan. The expected AAOV reduction for this alternative is 15 percent.

- Alternative 5B – GI developed for 50 percent of the combined sewer service area in the Alley Creek and Little Neck Bay watershed. The expected AAOV reduction for this alternative is 65 percent.

Difficulty finding sites to implement GI control measures is one of the challenges associated with GI. While the City-wide goal is to develop GI for 10 percent of New York City's land area, detailed evaluations of the Alley Creek and Little Neck Bay service area found that sufficient, suitable land area is difficult to find. Greater levels of GI would require implementation on public ROW in addition to the assumed level of private GI implementation (3 percent) in the baseline conditions. Alternative 5A would require 1,148 ROW bioswales, while Alternative 5B would require the equivalent of 5,743 ROW bioswales. Alternative 5B (50 percent of the Alley Creek and Little Neck Bay watershed) would not be possible without developing GI in Alley Pond Park and diverting some runoff into the park. As mentioned in Section 8.2.a.3., this park is designated special Forever Wild Park Land, and special permits and permissions from regulatory agencies and potentially from DPR would have to be obtained to construct in this area. Due to the potential siting difficulties, Alternative 5B would not be viable, and was thus eliminated from further consideration.

Also, as noted in the City of New York 2010 Green Infrastructure Plan, GI in the Alley Creek and Little Neck Bay watershed may not be cost-effective. With a large retention tank already in place, improvements in CSO reduction through GI would be relatively marginal and would likely have a high unit cost on a dollar- per-captured-gallon basis. It is important to recognize that the high cost of GI with marginal improvement in water quality makes additional GI less cost-effective.

8.2.c Hybrid Green/Grey Alternatives

Hybrid green/grey alternatives are those that combine traditional grey control measures with green control measures, to achieve the benefits of both. Using the two technologies together can enhance their ability to minimize CSO volume, optimize the collection system capacity, and capture storm water flows before they enter the system, thereby reducing CSO. However, preliminary evaluation of GI alternatives indicated that the water quality benefits were not sufficiently cost-effective to warrant the development of any hybrid green/grey alternatives.

8.2.d Hybrid Grey/Grey Alternatives

Because it is unlikely that HLSS alone would be capable of reducing CSO volume beyond 50 percent, a hybrid combination of HLSS with additional retention was considered. This alternative (Alternative 6) could take one of the following forms:

- HLSS plus closed concrete tank expansion at the existing Alley Creek Retention Tank site; or
- HLSS plus VTS storage at the existing Alley Creek Retention Tank.

Such combinations would be faced with the same challenges as when HLSS and retention control measures are considered independently, namely:

- Siting issues similar to those for tank expansion and VTS storage (park alienation, wetlands, permitting);
- Street disruptions associated with HLSS; and
- The need for routing of major new storm sewers and the permitting of a new MS4 outfall associated with HLSS.

Alternative 6 essentially combines HLSS of Alternative 1 for the areas upstream of Regulators 46 and 47 as described in Section 8.2.a.1, and a new 3.0 MG tank (or 3.0 MG upstream VTS storage) from Alternative 2A (or 2D), located downstream at the Alley Creek Retention Tank site, as described in Section 8.2.a.3.

8.2.e Retained Alternatives

A summary of the alternatives developed for the Alley Creek and Little Neck Bay LTCP is presented in Table 8-9. These alternatives will be subjected to economic and cost-performance evaluations in Step 3.

Table 8-9. Summary of Alternatives Developed in Step 2

Alternative	Description
1. HLSS	New HLSS for the CSS tributary to Regulators 46 and 47.
2A. 3.0 MG Additional Downstream Retention	New traditional tank expansion north of the existing Alley Creek CSO Retention Tank or new VTS storage at the existing Alley Creek Retention Tank site.
2B. 6.5 MG Additional Downstream Retention	New VTS storage or new traditional tank expansion at the existing Alley Creek CSO Retention Tank site.
2C. 12 MG Additional Downstream Retention	New traditional tank expansion south of the existing Alley Creek CSO Retention Tank.
2D. 29.5 MG Additional Downstream Retention	New traditional tank expansion south of the existing Alley Creek CSO Retention Tank.
3A. 2.4 MG Additional Upstream Retention	New upstream VTS storage for the CSS tributary to Regulators 46 and 47.
3B. 6.7 MG Additional Upstream Retention	New upstream VTS storage for the CSS tributary to Regulators 46 and 47.
4. Disinfection in Existing CSO Retention Tank	Use of existing 5 MG tank volume as chlorination contract time plus dechlorination in the effluent channel.
5A. 10 percent Green Infrastructure	GI for 10 percent of the CSS area in the Alley Creek and Little Neck Bay watershed.
6. Hybrid - HLSS plus Storage Tank	HLSS for the CSS served by Regulators 46 and 47 plus additional 3.0 MG downstream retention at existing Alley Creek CSO Retention Tank site.

8.3 CSO Reductions and Water Quality Impact of Retained Alternatives

To evaluate their effects on the pollutant loadings and water quality impacts, the retained alternatives listed in Table 8-9 were analyzed using both the Alley Creek and Little Neck Bay watershed (IW) and receiving water/waterbody (ERTM) models. Evaluations of AAOV reductions and/or bacteria load reductions for each alternative are presented below. In all cases, the reductions shown are relative to the baseline conditions using 2008 JFK rainfall as described in Section 6.

This section also contains a discussion of the potentially negative aspects of one of the alternatives, Alternative 4, Disinfection in the Existing Retention Tank. As was noted in Section 8.2, this alternative would result in the discharge of residual chlorine.

8.3.a CSO Reductions for Retained Alternatives

Table 8-10 (next page) summarizes the projected CSO reductions for the retained alternatives. Performance of the alternatives ranged from zero to 100 percent AAOV reduction, with the exception of Alternative 4, Disinfection in Existing CSO Retention Tank, which provides no additional AAOV reduction, even with its 100 percent CSO control, from a bacteria reduction perspective.

Table 8-10. CSO AAOV Performance

Alternative	CSO Volume (MGY)	AAOV Reduction Percent
Baseline Conditions	132	0
1. High Level Sewer Separation (HLSS)	65	51
2A. 3.0 MG Additional Downstream Retention	98	25
2B. 6.5 MG Additional Downstream Retention	65	50
2C. 12 MG Additional Downstream Retention	33	75
2D. 29.5 MG Additional Downstream Retention	0	100
3A. 2.4 MG Additional Upstream Retention	98	25
3B. 6.7 MG Additional Upstream Retention	65	50
4. Disinfection in Existing Retention Tank	N/A	N/A
5A. 10 Percent GI	112	15
6. Hybrid – HLSS plus 3.0 MG Retention	38	71

8.3.b Bacteria Reductions for Retained Alternatives

A summary of the projected pathogen discharges for the retained alternatives is presented in Table 8-11. Values shown in this table represent the total discharge into Alley Creek and Little Neck Bay from both CSO and stormwater. With respect to bacteria discharges, the best-performing alternatives were 100 percent retention (Alternative 2D) and disinfection (Alternative 4), which reduces the fecal coliform loading by roughly 50 percent and the enterococci loading by 42 percent. Because of the pollutants contained in stormwater, none of the CSO control alternatives could eliminate all of the bacteria discharged to Alley Creek and Little Neck Bay. HLSS (Alternative 1) was the worst-performing alternative, yielding a net increase in enterococci. Although HLSS would reduce CSO and its associated pollutants, it would also significantly increase the volume of annual stormwater discharges; the increased pollutant loads associated with the increased stormwater would thus exceed the benefits from the reduced CSO.

Table 8-11. Summary of the Projected Pathogen Discharges

Alternative	Enterococci Loading (Counts/Year x 10^{12})	Enterococci Reduction Percent	Fecal Loading (Counts/Year x 10^{12})	Fecal Reduction Percent
Baseline Conditions	345.3	0	918.2	0
1. HLSS	364.0	-5.4	867.2	5.5
2A. 3.0 MG Additional Downstream Retention	309.1	10.5	814.0	12.5
2B. 6.5 MG Additional Downstream Retention	272.5	21.1	687.7	25.1
2C. 12 MG Additional Downstream Retention	235.6	31.8	571.5	37.8
2D. 29.5 MG Additional Downstream Retention	199.5	42.2	458.2	50.1
3A. 2.4 MG Additional Upstream	293.6	15.0	742.2	19.2

Alternative	Enterococci Loading (Counts/Year x 10^{12})	Enterococci Reduction Percent	Fecal Loading (Counts/Year x 10^{12})	Fecal Reduction Percent
Retention				
3B. 6.7 MG Additional Upstream Retention	247.0	28.5	585.5	36.2
4. Disinfection in Existing Retention Tank	199.5	42.2	458.2	50.1
5A. 10 Percent GI	362.7	5.4	862.1	6.1
6. Hybrid -3.0 MG Storage plus HLSS	345.0	0.1	814.0	11.4

Figure 8-12 shows the relationship between the reductions in CSO AAOV and total bacteria loading. Alternatives in the region above the diagonal line have a higher reduction in total enterococci loading per unit of CSO AAOV reduction. Upstream retention alternatives fall into this region; since the upstream flow has not yet been diluted by stormwater from the separately sewered areas, the flow captured upstream is more concentrated, and each gallon captured upstream would therefore remove more bacteria than a gallon captured downstream near the existing Alley Creek Retention Tank.

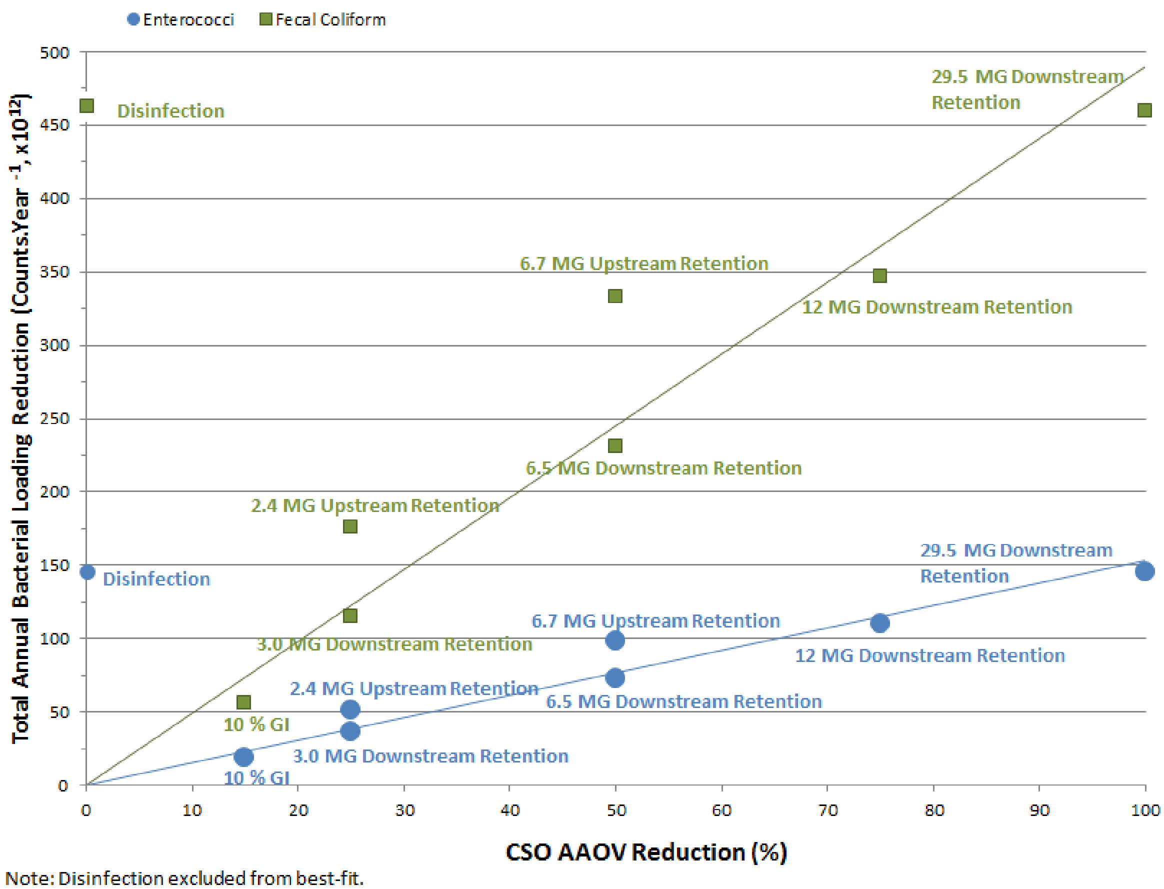


Figure 8-12. CSO AAOV Reductions vs. Annual Total Bacteria Loading Reduction

8.3.c Water Quality Impacts

This section describes the levels of attainment with applicable bacteria criteria within Alley Creek and Little Neck Bay that would be achieved through implementation of CSO control measures (Section 8.3.c.1). Also described are some of the potential negative water quality impacts associated with Alternative 4, Disinfection in the Alley Creek CSO Retention Tank (one of the two control measures that achieved the 100 percent level of CSO control; the other being Alternative 2D, a 29.5 MG expansion of the Alley Creek CSO Retention Tank.)

As noted earlier, the disinfection process (Alternative 4) would result in a residual chlorine in the tank effluent ranging between 0.1 and 1.0 mg/L of Total Residual Chlorine (TRC). Because the discharge of free chlorine or chlorine compounds, both of which are toxic to biota at low levels, an analysis of the TRC impacts on the receiving waterbodies was conducted, as described in Section 8.3.c.2.

8.3.c.1 Attainment of Bacteria Standards

Alley Creek

Alley Creek is a Class I waterbody. Historic and recent water quality monitoring, along with baseline condition modeling using ERTM, revealed that Alley Creek is currently in attainment with the Class I fecal coliform criteria. Because the Class I standards do not include enterococci, there was no need to perform a performance gap with respect to current waterbody classification. If raising the waterbody classification to the next level is considered, none of the alternatives would result in attainment with existing Class SB bacteria standards. As explained in the gap analysis presented in Section 6.3, bacteria loadings from other sources, such as stormwater and dry weather pathogen loadings, have significant influence on the fecal and enterococci concentrations, to the extent that even the 100 percent CSO control alternatives would not result in attainment of the Class SB standards for either fecal coliform or enterococci in Alley Creek.

Little Neck Bay

Little Neck Bay is a Class SB waterbody. As described in Section 6, Little Neck Bay is in attainment with both the Class SB fecal coliform and enterococci criteria essentially 100 percent of the time throughout the 10-year baseline period.

Near DMA Beach, the sole sensitive area in the Alley Creek and Little Neck Bay watershed, attainment with the 30-day GM standard occurred 100 percent of the time from roughly April 1 through October, a period which includes the bathing season (June 1 – September 1). However, there are some limited excursions above the enterococci standard outside of this period. Overall, the 10-year simulation is in compliance with the NYSDOH standard 93 percent of the time at the DMA Beach. The alternatives evaluated earlier in this section were not capable of closing this performance gap for enterococci. Even 100 percent CSO control would have a marginal effect, raising the overall annual attainment of enterococci standards at DMA Beach to 95 percent of the time – only a 2 percentage point improvement. A similar marginal improvement would occur at the northern end of the Bay, near the East River, where attainment was already near 100 percent of the time; attainment would rise only 0.2 percent, from 98.5 to 98.7 percent of the time near Harbor Survey Station E11. As explained in the gap analysis presented in Section 6.3, enterococci loadings from other sources, such as stormwater and dry weather pathogen loadings, would have significant influence on the GM concentration of enterococci, to the extent that even the 100 percent CSO control alternatives would not result in compliance with the Class SB standards for enterococci at all times.

8.3.c.2 TRC Toxicity and Environmental Risk

As noted earlier, 100 percent CSO control could be achieved through expansion of the existing CSO tank or implementation of disinfection (chlorination/dechlorination) at the CSO tank. Effective disinfection through a chlorination process will result in the need to dose the influent to the CSO tank to TRC concentrations of 5 to 15 mg/L. Since TRC concentrations this high are on the order of 1,000 times the DEC's receiving water standards, de-chlorination would be a required part of the disinfection process. In practice, however, the effluent TRC level from a satellite CSO facility implementing de-chlorination would still be elevated, at levels most likely between 0.1 to 1.0 mg/L (100 to 1,000 µg/L), and thus well above the criteria of 7.5 µg/L and 13 µg/L for chronic and acute toxicity, respectively. It is worthwhile to note that unlike a WWTP.

As a result of this concern, ERTM water quality modeling analyses were performed to project the potential effects of TRC within Alley Creek and Little Neck Bay, using estimated effluent TRC concentrations of 0.1 and 1.0 mg/L. The results showed that TRC concentrations would be well above the DEC water quality standards and, as such, would pose an environmental concern in the waterbodies, even with effluent concentrations as low as 0.1 mg/L.

Due to the small size of Alley Creek, and the relatively large volume of CSO tank overflows, there is very little local dilution of tank discharges. Therefore, maximum water column TRC concentrations are approximately equal to the tank overflow concentration. At 0.1 mg/L, the effluent would be more than seven times the acute TRC criteria of 13 µg/L. Figure 8-13 presents predicted TRC concentrations within Little Neck Bay, based on 2008 conditions and an effluent concentration of 0.1 mg/L. Although the figure shows conditions during an ebb tide, high TRC concentrations can also enter Alley Creek at flood tide. Figure 8-14 presents predicted TRC concentrations based on 2008 conditions and an effluent concentration of 1.0 mg/L.

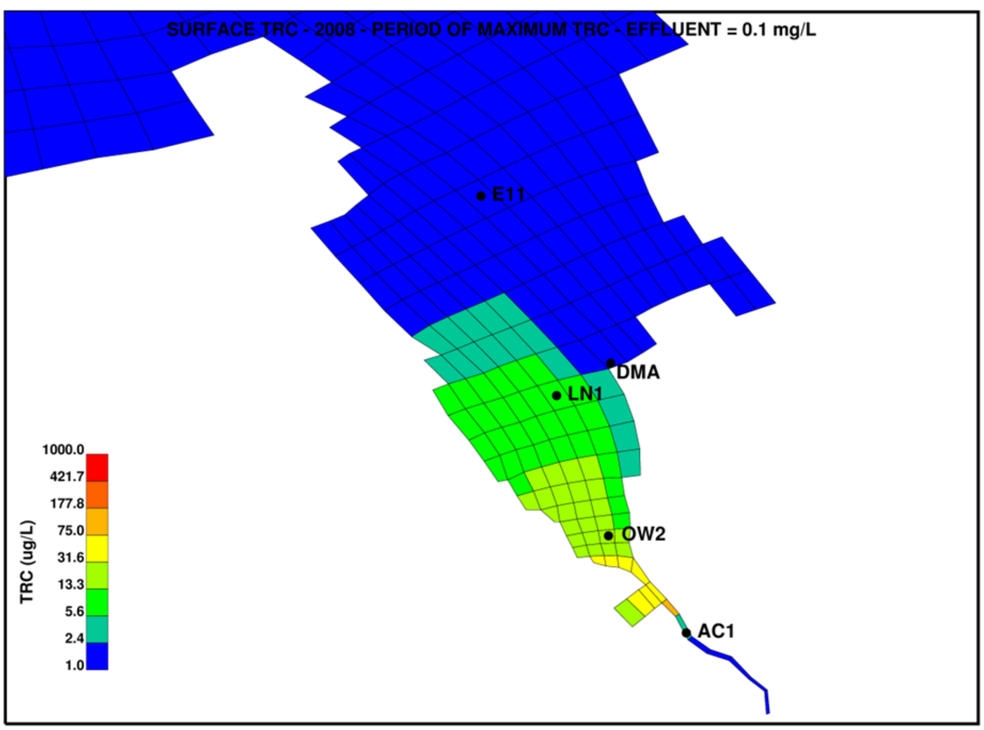


Figure 8-13. TRC Concentrations Calculated in Alley Creek and LNB during 2008 (Effluent TRC = 0.1 mg/L)

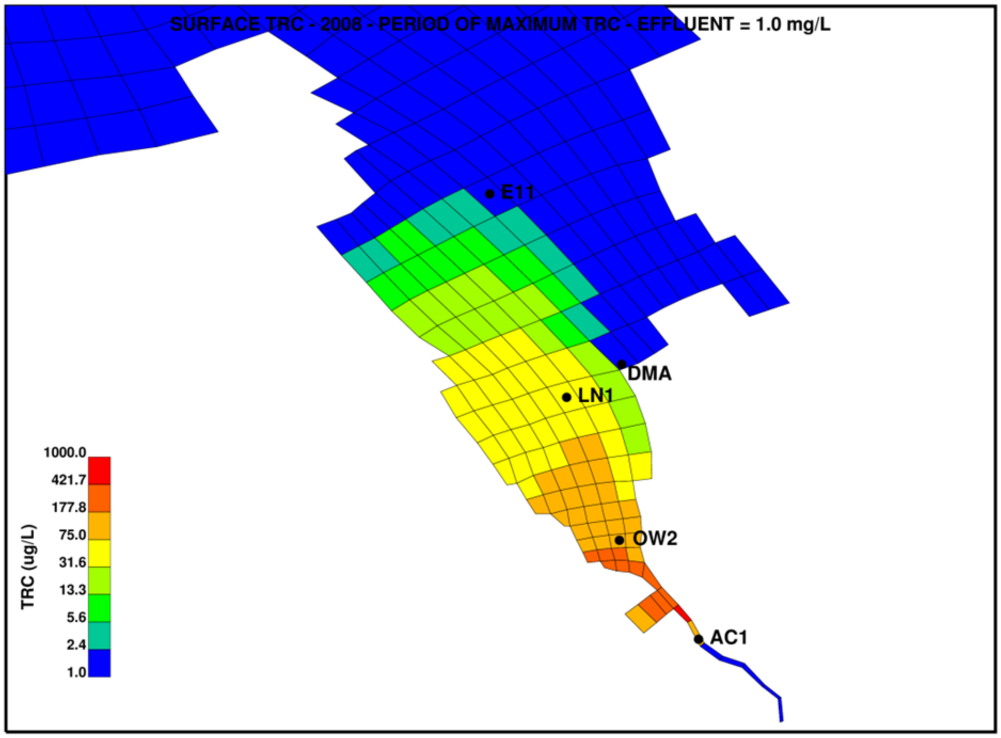


Figure 8-14. TRC Concentrations Calculated in Alley Creek and LNB during 2008 (Effluent TRC = 1.0 mg/L)

DEP evaluated to the possibility of relocating the the discharge of disinfected CSO effluent to a site where dilution would be more favorable. Two possible locations were selected for potential outfall relocation, each chosen based on local bathymetry. Because Little Neck Bay is relatively shallow, the outfall would have to be located at a significant distance from the existing CSO tank outfall to achieve any reasonable dilution of the discharge CSO and acceptable ambient TRC concentrations. As shown in Figure 8-15, the closest location, Option 1, is approximately 5,500 feet from the current location, at a depth of 10.5 feet below mean tide level (MTL); the second location, Option 2, is located approximately 8,300 feet from the existing CSO tank outfall, at a depth of about 12 feet at mean tide. Water quality model runs were completed using effluent TRC concentrations of 1.0 mg/L and 0.1 mg/L at the two potential outfall locations.

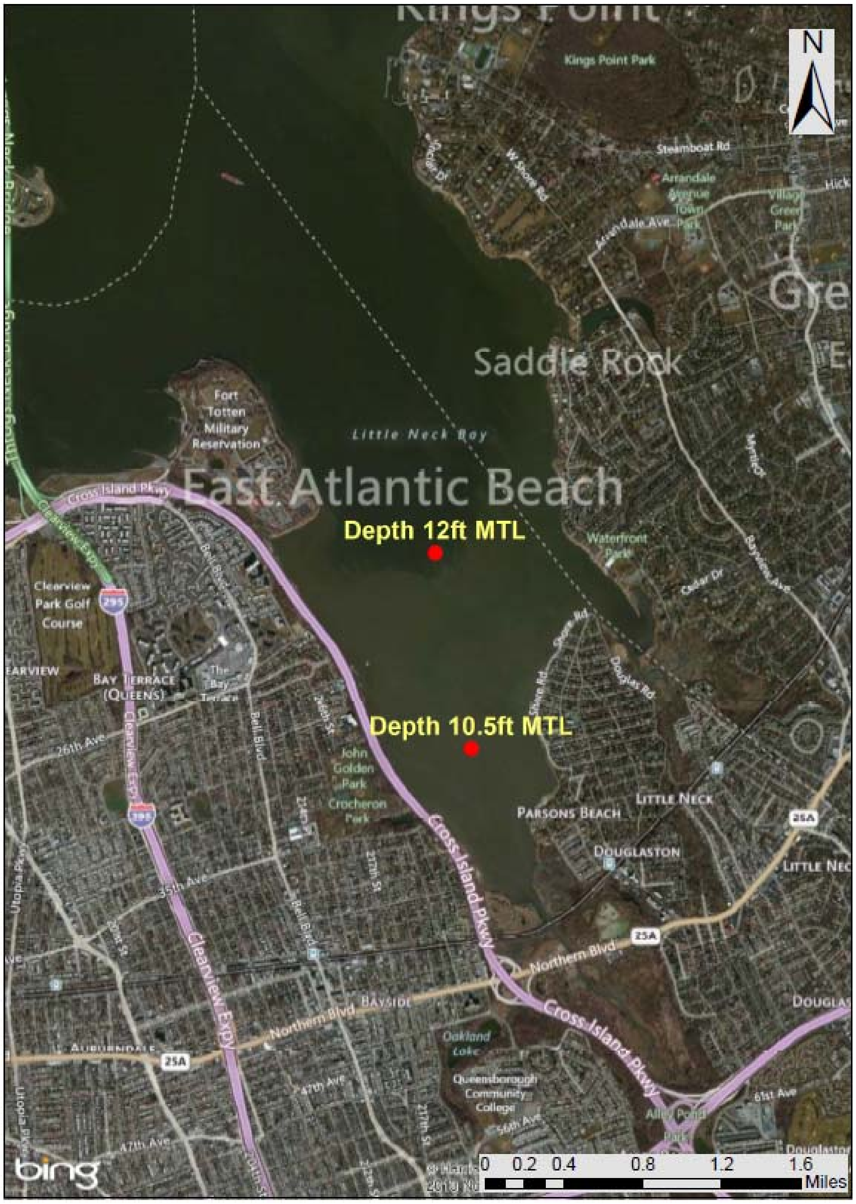


Figure 8-15. Potential Outfall Relocation Options

The modeling results depicted in Figures 8-16 and 8-17 demonstrate that outfall relocation Option 2 has the most favorable dilution conditions, leading to the lowest TRC levels in the receiving waterbody, and approach the acute TRC criteria at a discharge concentration of 0.1 mg/L. Additionally, Option 1 is close to DMA, and could have adverse effects on the swimming beach. Hence, outfall relocation Option 2 is retained for further analysis and costing. It should be noted that the model grid size in these locations is relatively large. At the Option 2 location, the grid size is 132 m by 237 m, so the model has a limited ability to reproduce the potential plume dynamics. Should the option of outfall relocation advance further, the use of CORMIX or a similar plume model would be used to further calculate the expected dilution in the near field area of the outfall.

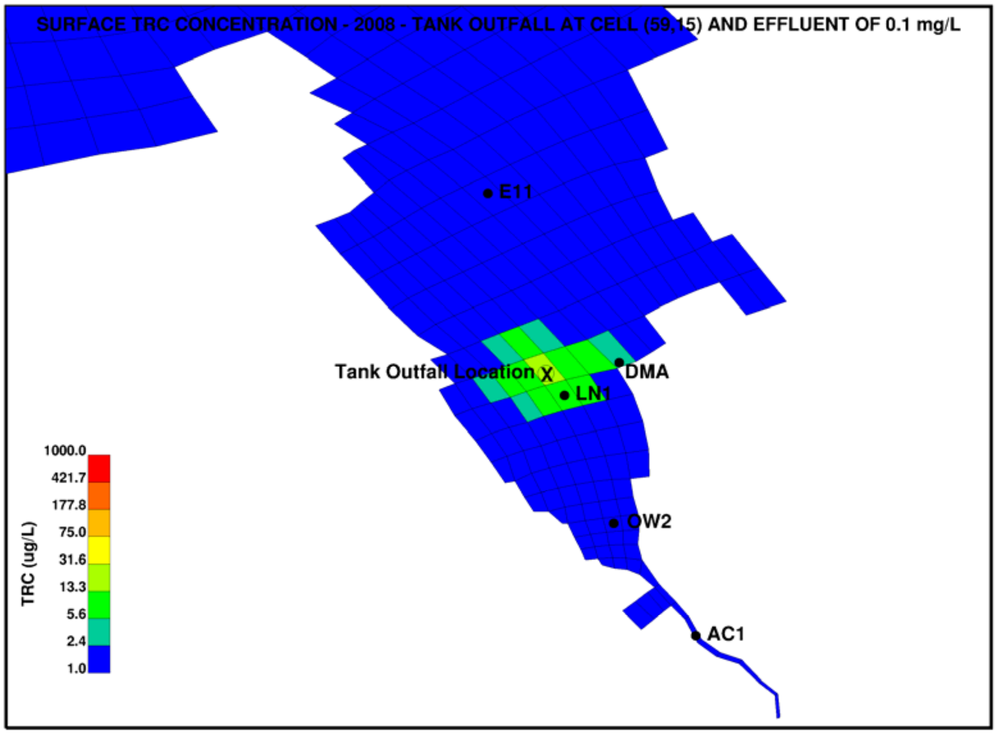


Figure 8-16. Maximum TRC Concentrations Calculated at Outfall Relocation Option 1 with Effluent TRC Concentration of 0.1 mg/L

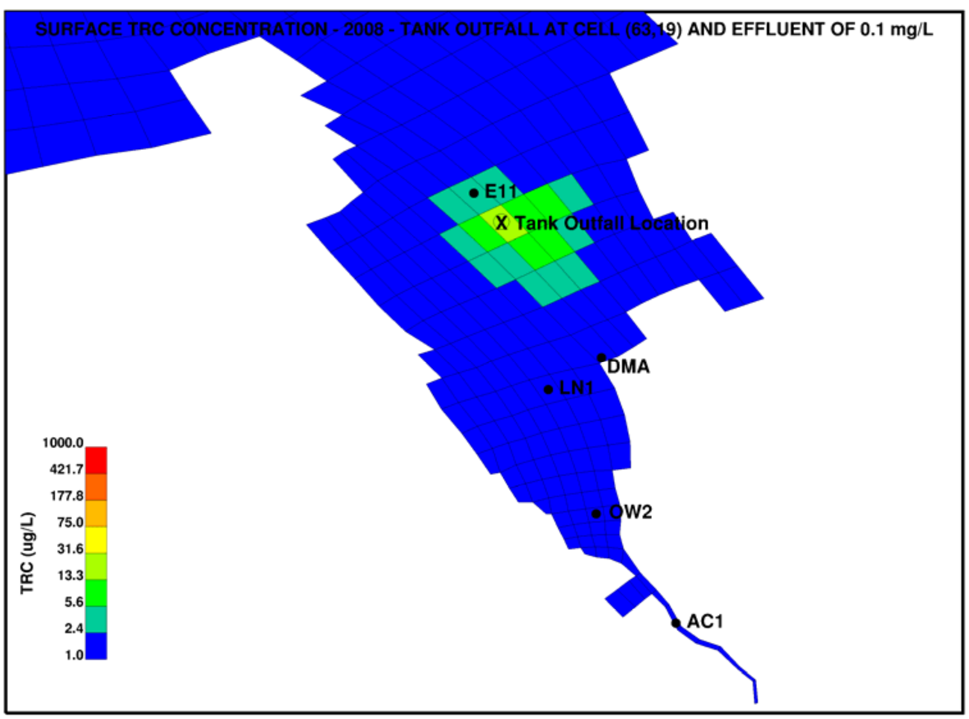


Figure 8-17. Maximum TRC Concentrations Calculated at Outfall Relocation Option 2 with Effluent TRC concentration of 0.1 mg/L

It should also be noted that due to the Bay's geomorphology, outfall relocation scenarios would be feasible only with the construction of an effluent pump station and force mains. Gravity alone cannot convey the CSO overflows over such distances with the available limited head differential. Further, significant environmental damage would occur during construction of such a gravity outfall extension, if it were hydraulically feasible.

A preliminary layout for a 315 MGD effluent pump station is shown in Figure 8-18. Because of its large size, the station would be located on the north side of Northern Boulevard, in lieu of constructing it at the Old Douglaston PS site. Multiple force mains to the proposed discharge location would also be included, to efficiently accommodate the range of tank effluent flow rates. The dechlorinated tank effluent would then discharge into the station wet well, where multiple submersible pumps would be housed.

Unlike the earlier layout of Alternative 4 in Figure 8-11, which was generally confined to the Old Douglaston Pump Station site, the revised layout on Figure 8-18 illustrates the encroachment onto the recently restored wetlands to the north of the Alley Creek CSO Retention Tank, as needed to accommodate the required effluent pump station and force mains.

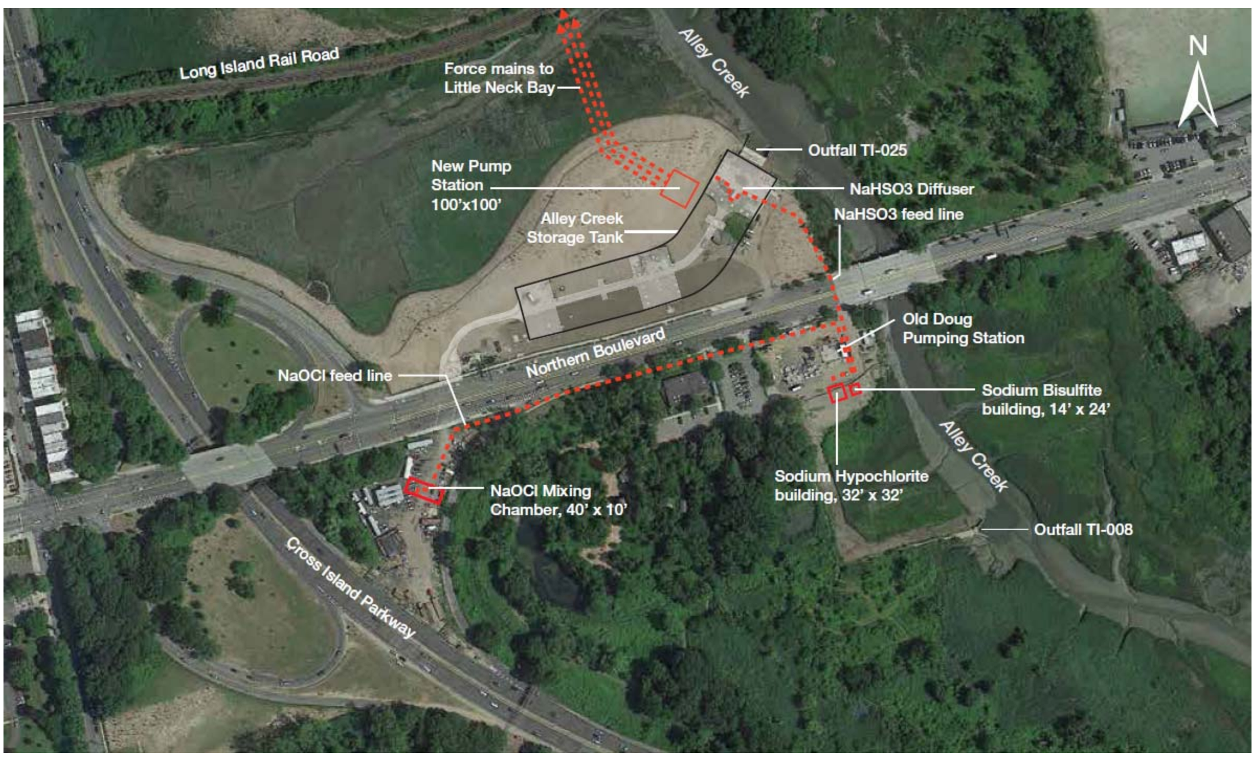


Figure 8-18. Alley Creek Tank Overflow Effluent Pump Station for Alternative 4

8.4 Cost Estimates for Retained Alternatives

Using a "triple bottom line" approach considering environmental, economic, and social impacts of the proposed alternatives requires accurate cost estimates for each alternative. Methodology for developing these costs is dependent on the type of technology and its unique operation and maintenance requirements. The capital costs were developed as Probable Bid Cost (PBC). Total net present worth costs were determined using the estimated capital cost estimated plus the net present worth of the projected operation and maintenance (O&M) costs, with an assumed interest rate of 3 percent over a 20-year life cycle, resulting in a present worth factor of 14.877. All costs are in May 2013 dollars.

8.4.a HLSS

Costs for the Alternative 1 (HLSS) include the costs for the local storm sewers and the trunk sewers to convey the stormwater to Alley Creek. Trunk sewer costs are based on the sewer diameter, length, and depth of cover. Manhole costs are based on diameter of the manhole and depth. Where necessary, cost of pile supports for both the trunk sewer and manholes are included.

Cost for the collector sewers is based on the total 843-acre drainage area to be separated (see Figures 8-1 and 8-2). The total cost for HLSS is $658 million (May 2013 dollars), calculated as shown in Table 8-14.

Table 8-12. HLSS Costs

Item	May 2013 Cost ($ Million)
HLSS PBC	657
Annual O&M	0.1
Total HLSS Present Worth	658

8.4.b Retention

Cost estimates for retention using traditional tanks were based on actual bid costs from similar existing tanks built in the City of New York. A cost curve plotting the storage volume (MG) against the actual bid cost was developed for the existing tanks, with all costs escalated to May 2013 dollars. Cost estimates for retention alternatives using traditional tanks were then read from the cost curve.

Estimated costs for VTS storage include costs for construction of the shafts along with associated costs including odor control equipment, earth work, concrete work, influent and effluent structure, chemical storage and control building, mechanical equipment, electrical equipment, instrumentation and control, process equipment, and site work. Costs are dependent on the desired storage volume and do not include any costs associated with land acquisition. For VTS storage located at the upstream site, costs for conduits to convey flow from Regulators 46 and 47 to the VTS are included, as well as costs for conduits to convey dewatering flow from the VTS to the existing collection system.

As shown in Table 8-13, costs for retention alternatives range from $93M to $569M.

Table 8-13. Retention Alternatives Costs

Retention Alternative	May 2013 PBC[1] ($ Million)	Annual O&M Cost ($ Million)	Total Present Worth ($ Million)
2A. 3.0 MG Additional Downstream	$83	$0.7	$93
2B. 6.5 MG Additional Downstream	$145	$0.8	$156
2C. 12 MG Additional Downstream	$294	$1.1	$310
2D. 29.5 MG Additional Downstream	$535	$2.3	$569
3A. 2.4 MG Additional Upstream	$101	$0.8	$113
3B. 6.7 MG Additional Upstream	$160	$0.9	$173
1. Average of costs for traditional shallow tank and VTS storage options			

8.4.c Disinfection in Existing Tank

The estimated costs for Disinfection in the Existing Tank (Alternative 4) are summarized in Table 8-14. As shown, the capital costs are broken into two components – the disinfection system and the effluent PS and force mains. The Probable Bid Cost for the former is $4.1M, and includes separate feed and storage buildings for the two chemicals, all of the ancillary support systems and equipment, and the associated electrical and instrumentation systems. Also included are the feed lines between the buildings and the tank, mixers, and diffusers. The PBC for the pump station and force mains is $523.2M.

In addition to the direct energy and chemical costs, the O&M costs associated with this alternative include a significant amount of additional staff time to maintain the new equipment and systems, above and beyond their current responsibilities for the CSO tank. As described earlier in Section 8.2.a.3, these include extensive pre-event preparations and post-event activities, including line flushing and general cleaning. These activities are in addition to the close process monitoring typically required during the events themselves, as well as preventative maintenance of all equipment between events. The annual O&M costs for the disinfection portion were estimated at $515,500, and the projected O&M costs for the effluent pump station were estimated at $0.99M. This results in a total projected annual O&M cost for both portions of this alternative at $1.5M/year. The resultant 20-year life cycle present worth is calculated at $549.7M.

Table 8-14. Disinfection in Existing CSO Tank Costs

Item	**Cost May 2013 ($ Million)**
Disinfection System PBC	4.1
Effluent PS and FM	523.2
Annual O&M	1.5
Disinfection Total Present Worth, $M	549.7

8.4.d Green Infrastructure

The estimated capital cost for Alternative 5A (10 percent GI) is $41M. With an expected annual O&M cost of $1.48M and a 20-year life cycle, the estimated present worth cost would be $63M.

8.4.e Hybrid HLSS plus Additional Retention

A total cost of $751M for Alternative 6 (hybrid of HLSS plus additional retention) was obtained by adding the costs for HLSS (Alternative 1) to the costs for Alternative 2A (3.0 MG additional downstream retention), as shown in Table 8-15.

Table 8-15. Hybrid HLSS Plus 3.0 MG Retention Costs

Item	Present Worth May 2013 ($ Million)
HLSS PBC	658
3.0 MG Additional Tank Storage	93
Hybrid HLSS Plus 3.0 MG Retention Total Present Worth, $M	**751**

8.5 Cost-Attainment Curves for Retained Alternatives

The final step of the analysis is determining the cost-effectiveness of the alternatives based on their projected water quality improvement, operational cost, and projected probable cost to construct.

8.5.a Cost-Performance Curves

Figure 8-19 shows the percent AAOV control compared to the total PBC of the project. Percent of CSO control ranges from 0 percent (baseline) to 100 percent control (additional 29.5 MG downstream tank or disinfection), with costs spanning up to $751M (additional 3.0 MG downstream retention with HLSS). A cost curve was developed based on alternatives that were judged more cost-effective. Less cost-effective alternatives, shown in red, were not included in the cost curve. For example, for 50 percent AAOV reduction, the 6.5 MG Downstream Retention alternative was more cost-effective than the 6.7 MG Upstream Retention alternative. Therefore, the 6.5 MG Downstream Retention alternative would be preferred with respect to CSO AAOV reduction, and was used in the creation of the cost curve, rather than the 6.7 MG Upstream Retention alternative. While the resulting curve does not show a clear knee-of-curve, a slight inflection can be seen between the 12 MG Downstream Retention and the two 100 percent control alternatives, 29.5 MG Downstream Retention and Disinfection.

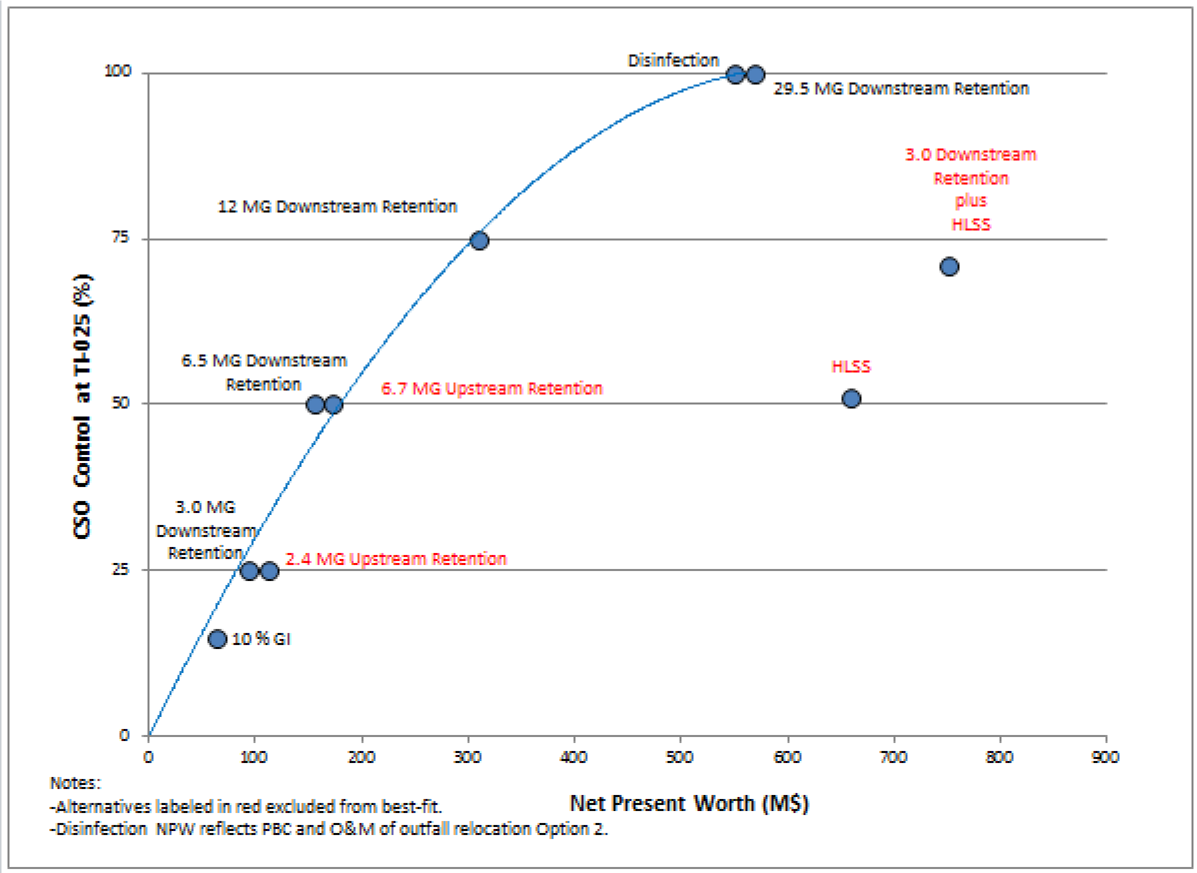


Figure 8-19. Cost vs. CSO Control

Along with overall CSO reduction, a goal of the LTCP is to reduce bacteria loadings to the waterbody to the extent such loadings are caused by CSOs. Figures 8-20 and 8-21 show the cost of the retained alternatives compared to annual total annual enterococci and fecal coliform loading reductions, respectively. The bacteria loading reductions are represented with two vertical axes. One axis shows percent bacteria loading reductions at TI-025 (the CSO outfall for the existing Alley Creek Tank), and represents the reduction of bacteria from CSO sources. The other axis shows percent bacteria loading reduction based on all sources – CSO and stormwater. Because CSO is not the only source of bacteria and some alternatives (notably HLSS) affect stormwater discharge volumes in addition to CSO volumes, attainment of standards cannot be evaluated based on bacteria discharged at TI-025 alone. Therefore, the axis representing total loading reduction from all sources was selected as the primary axis in Figures 8-20 and 8-21. Percent total enterococci loading reduction ranged from 0 percent (baseline) to 42 percent reduction, and percent overall fecal coliform loading reduction ranged from 0 percent (baseline) to 50 percent reduction (100% CSO control), with costs spanning up to $751M (additional 3.0 MG downstream retention with HLSS).Controlling 100 percent of CSO at outfall TI-025 would reduce bacteria loadings to Alley Creek by a maximum 42 percent and 50 percent of enterococci and fecal coliform, respectively. The 100 percent CSO control costs ranged from roughly $550M to $569M, for Disinfection and 29.5 MG Downstream Retention, respectively. As with the Cost vs CSO AAOV figure (Figure 8-19), the cost curves for bacteria loading reduction were based on selected alternatives judged to be the most cost-effective. The less cost-effective alternatives, shown in red, were excluded from the curves.

As with the previous AAOV reduction curve, there is no discernable KOTC. However, as with AAOV, the curve starts to flatten as the CSO AAOV increases, indicating that increasing volume reductions become less cost-effective.

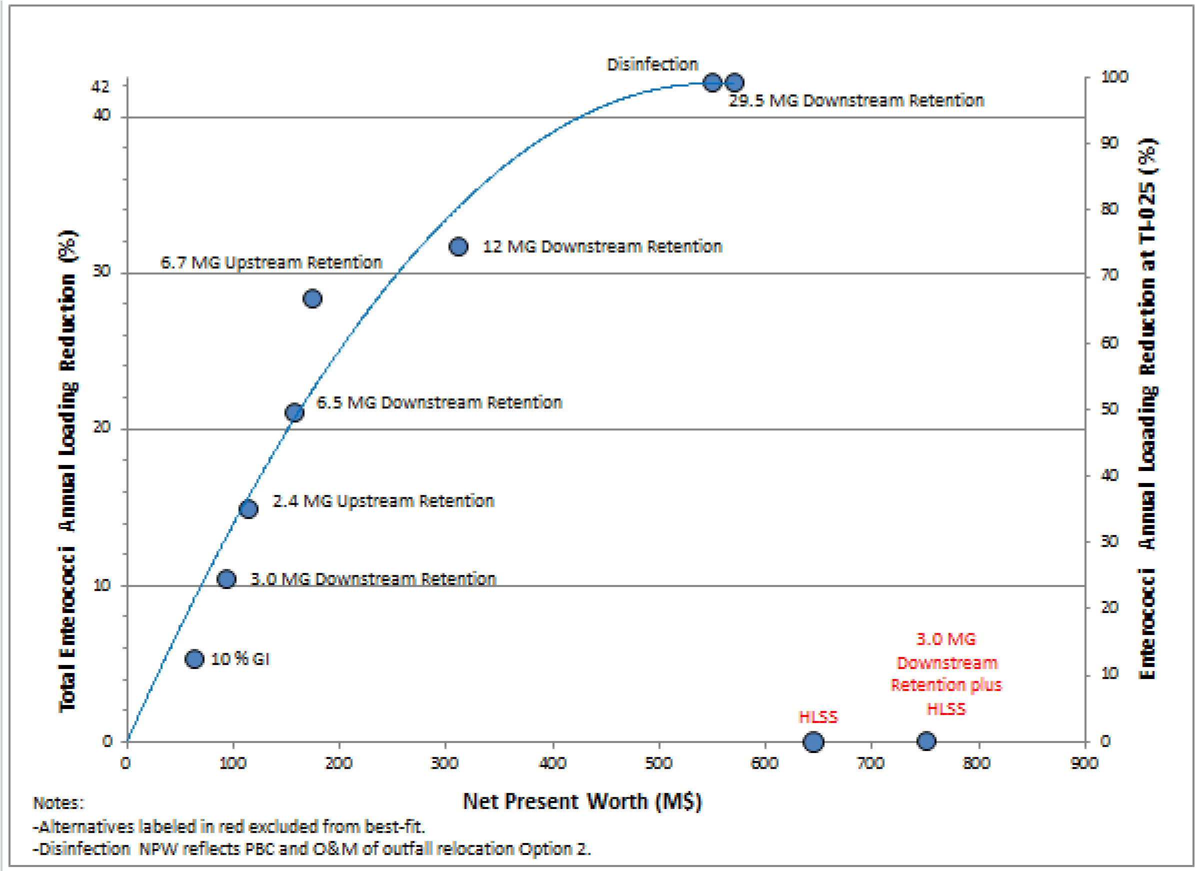


Figure 8-20.Cost vs. Total Enterococci Loading Reduction

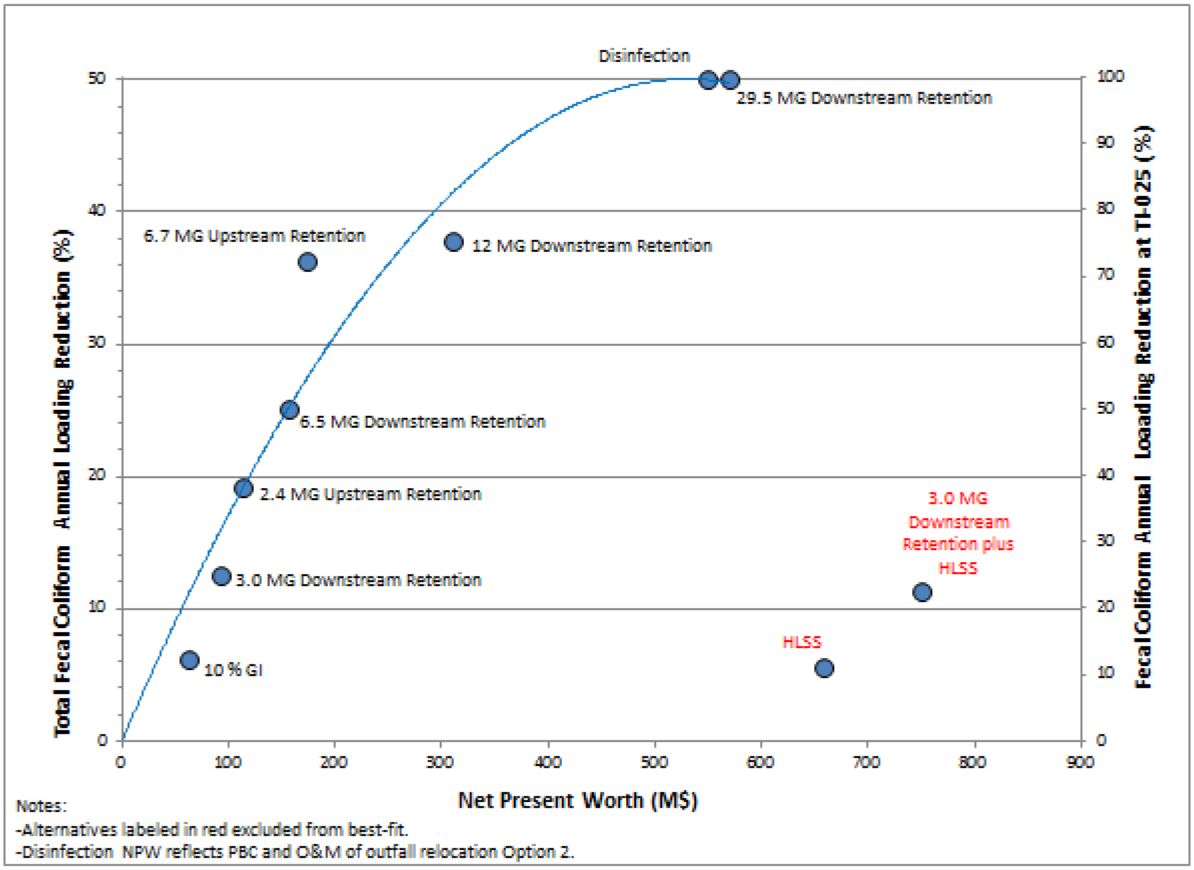


Figure 8-21.Cost vs. Total Fecal Coliform Loading Reduction

8.5.b Cost-Attainment Curves

As previously discussed, attainment of existing bacteria criteria occurs essentially 100 percent of the time for both Alley Creek and Little Neck Bay under baseline conditions. Because there was no performance gap, cost-attainment curves for existing bacteria standards are embedded in the cost attainment plots developed for other standards, as described in Section 2 and analyzed in Section 6, and are not presented separately.

Considering attainment with future enterococci criteria, namely the 35 cfu/100mL 30-day rolling GM and an STV of130 cfu/100mL, attainment of this enterococci criterion for Little Neck Bay varied with time of year and location in the Bay. Regarding the GM criterion at the northern end of the Bay, the performance gap was small, with annual attainment occurring 99 percent of the time at Station E11 under baseline conditions. Figure 8-22 shows the modeled improvement in annual attainment at Station E11 for each alternative. When considering an STV of 130 cfu/100mL, the performance gap was small, with annual attainment occurring 83 percent of the time at Station E11 under baseline conditions. As previously discussed, the improvements in attainment of potential future standards shown are marginal, rising a maximum of 3 percent, for the alternatives with the greatest improvement (100 percent CSO Control). These marginal improvements come at a significant cost – up to $569M for the 29.5 MG Downstream Retention alternative, and $550M for Disinfection.

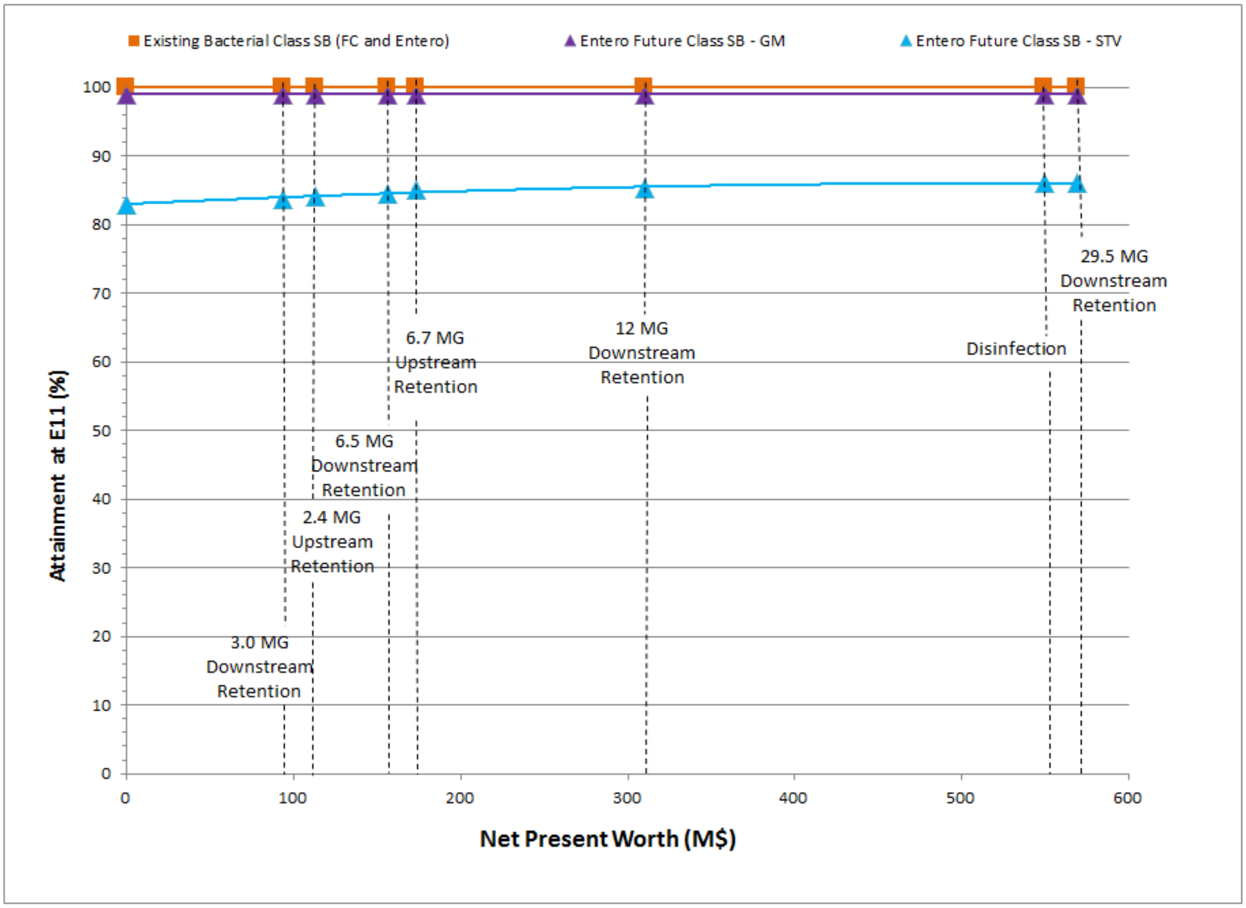


Figure 8-22. Cost vs. Bacteria Annual Attainment at Little Neck Bay

Figure 8-23 shows the ability of each alternative to attain existing and future Class SB WQS at DMA Beach, and summer attainment of NYSDOH recreational waters standards as a function of the total project cost. Baseline conditions are in attainment with existing standards (Class SB and NYSDOH) 100 percent of the time. Considering potential future standards, controlling 100 percent of the CSO would result in a maximum 10 percent increase in annual attainment of Class SB-STV, with all other alternatives having a lesser degree of improvement. The cost attainment curves for applicable existing and potential future standards for Station LN1, presented in Figure 8-24, are essentially identical to the curves for DMA Beach.

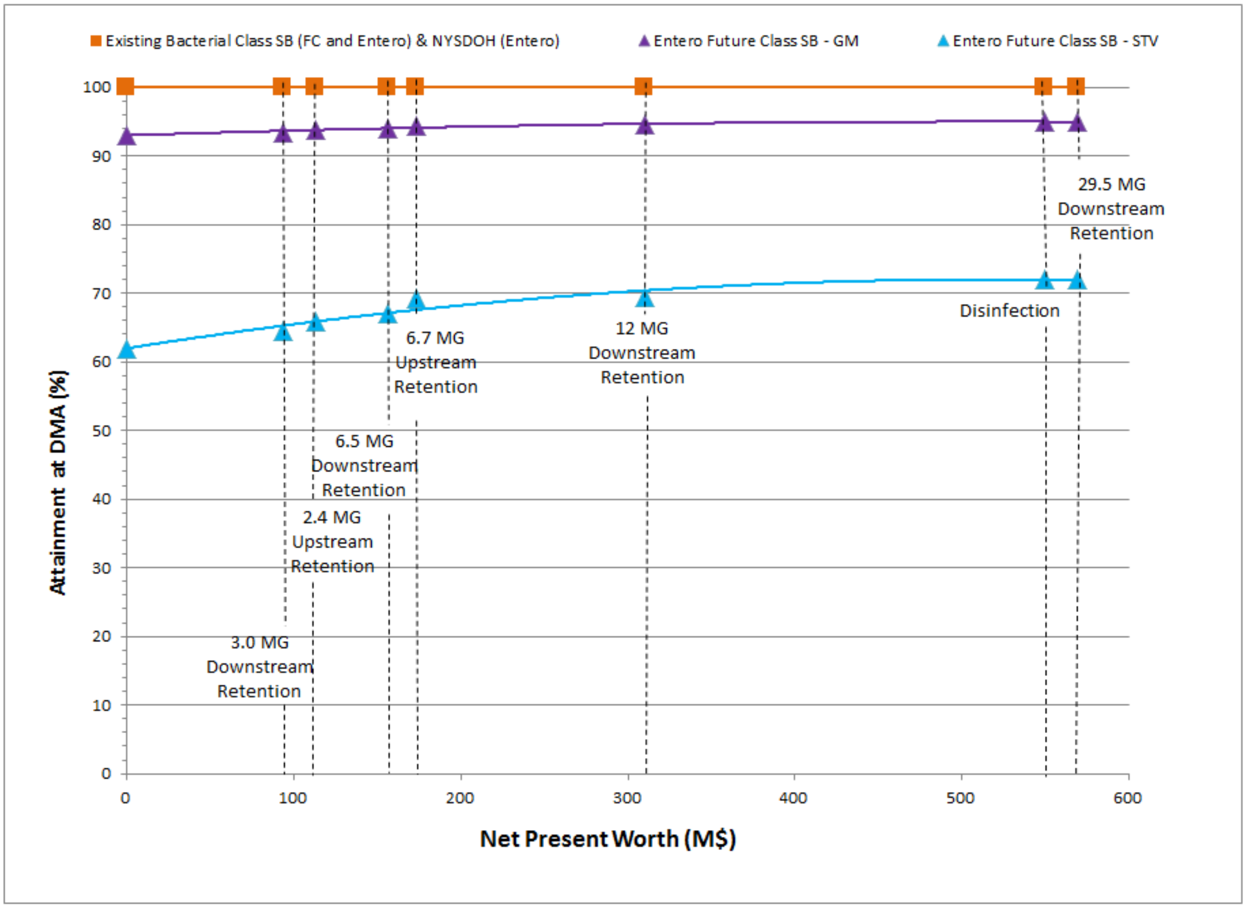


Figure 8-23. Cost vs. Bacteria Annual Attainment at DMA Beach

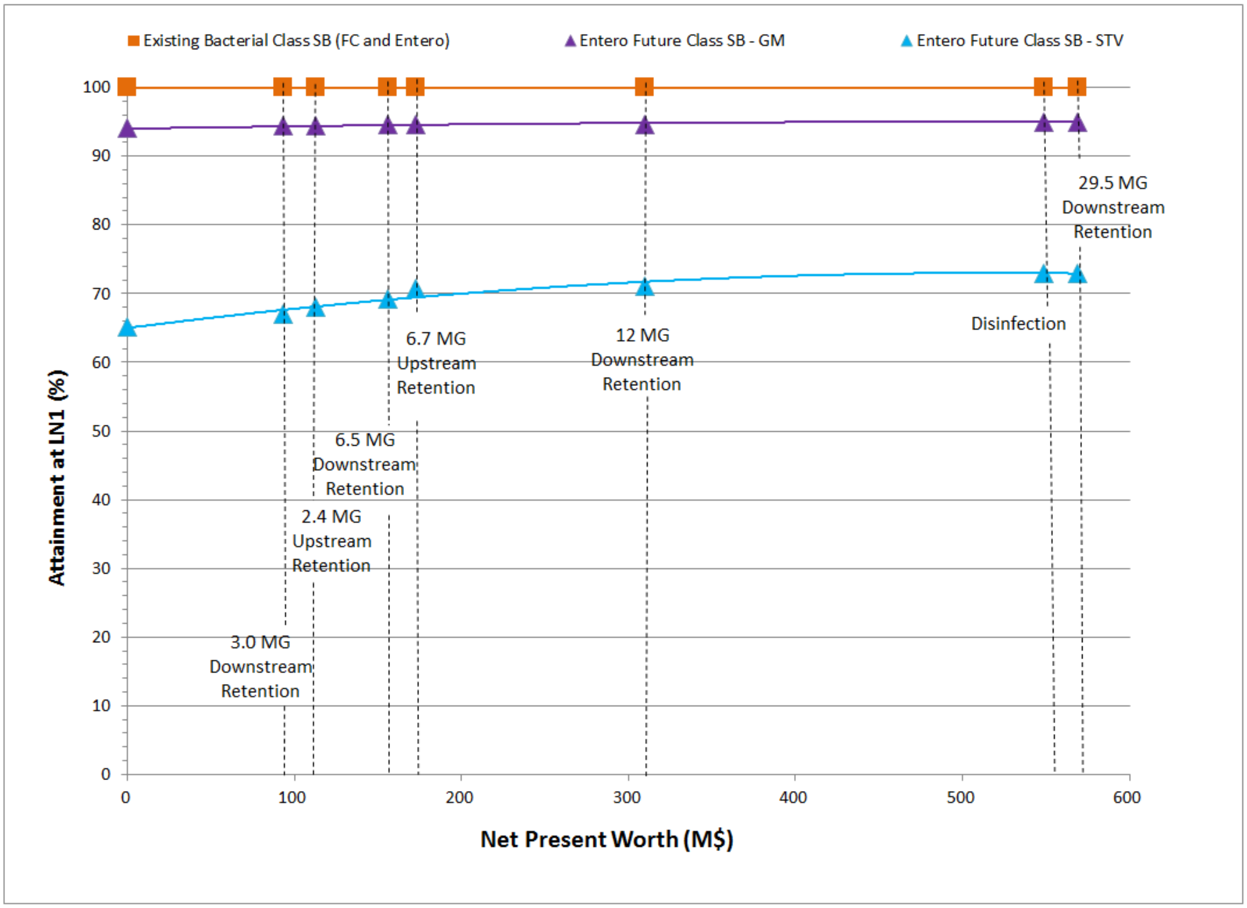


Figure 8-24. Cost vs. Bacteria Annual Attainment at LN1

Figure 8-25 shows that Station OW2, in the mixing zone between Alley Creek and Little Neck Bay, would attain existing bacteria criteria essentially 100 percent of the time. The figure also depicts the ability of each alternative to attain future Class SB bacteria WQS as a function of the total project cost. Baseline conditions would be in attainment with these potential future standards approximately 79 percent of the time regarding the GM criterion, and 27 percent of the time regarding the STV criterion. Controlling 100 percent of the CSO would result in only a 3 percent increase in annual attainment of both future enterococci criteria, with all other alternatives having a lesser degree of improvement.

Figure 8-26 depicts the attainment gain that would result from multiple alternatives under distinct WQS. The curves reflect attainment with existing applicable Class I standards at sampling Station AC1, hypothetical application of existing Class SB standards, and future potential Class SB standards. As shown, the largest improvement in annual attainment would be realized from a hypothetical upgrade of Alley Creek to what are the existing Class SB standards with 100 percent CSO control. Under this scenario, there would only be a 10 percent increase in attainment over baseline conditions, from 30 percent to 40 percent.

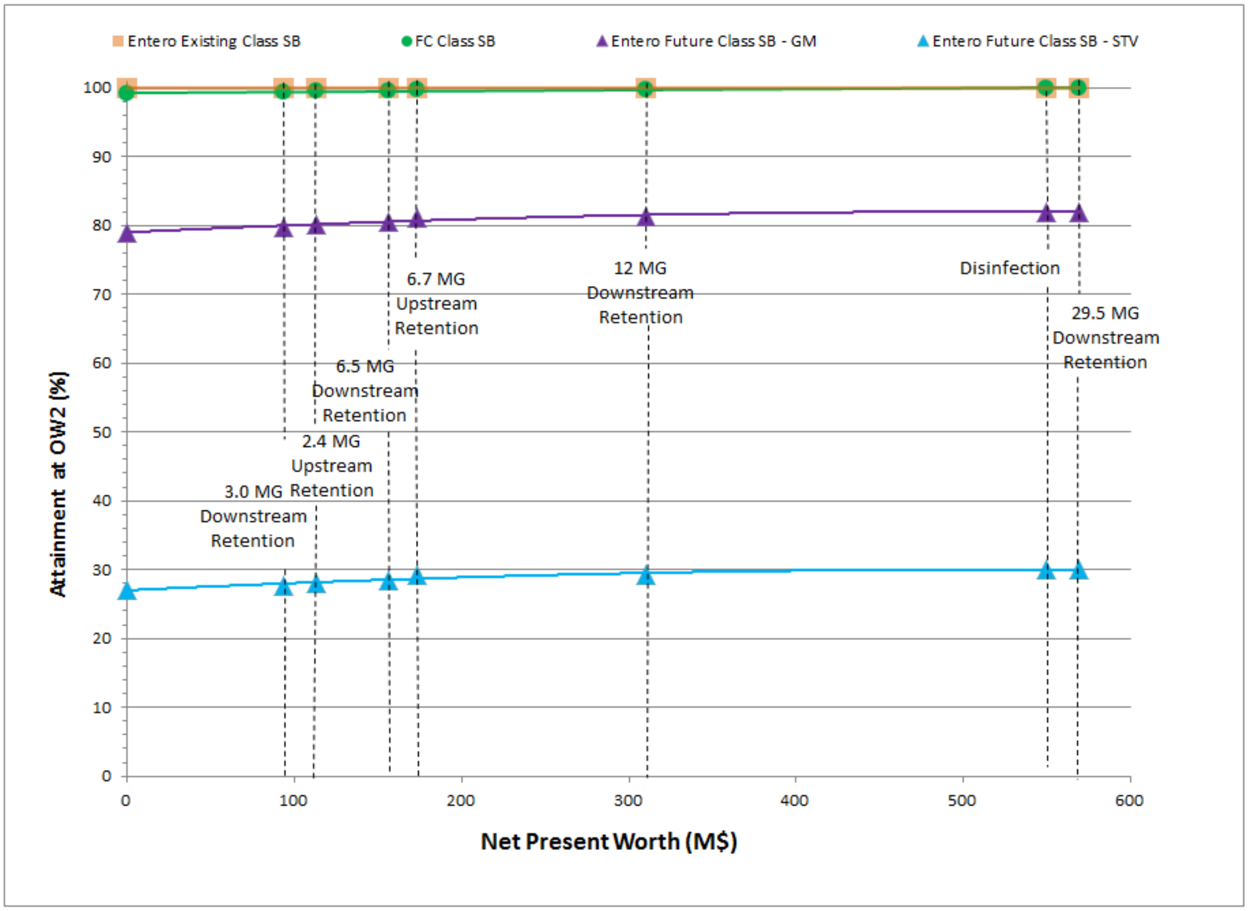


Figure 8-25. Cost vs. Bacteria Annual Attainment at OW2

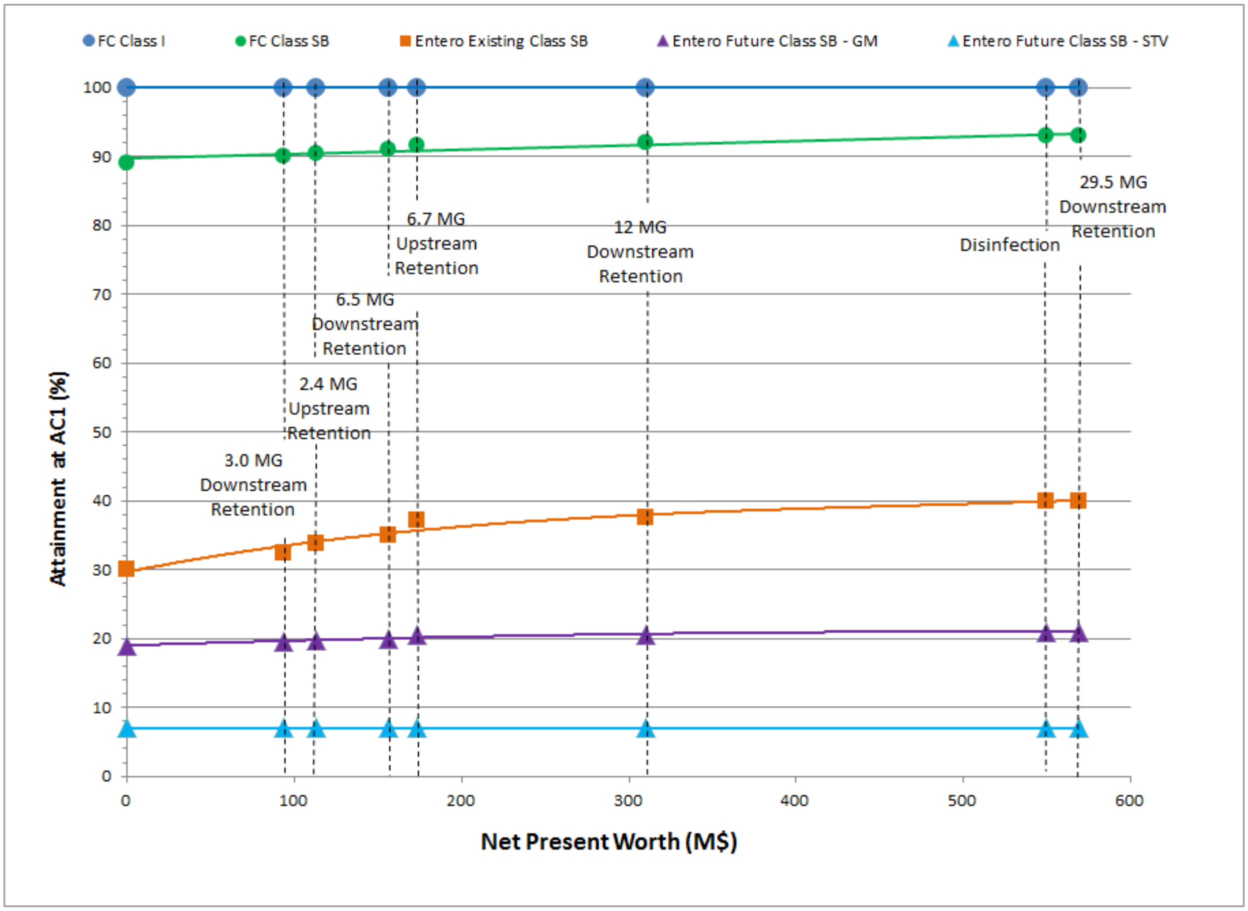


Figure 8-26. Cost vs. Bacteria Annual Attainment at AC1

Results show that capturing additional volume of CSO, regardless of the degree of capture, does not significantly improve the attainment of existing or future WQS at AC1. The remaining non-attainment of potential future standards is caused by other sources of discharge, such as stormwater and waterfowl that are specifically not addressed in the LTCP process. Ecological and physical changes to the characteristics of the waterbody may also be contributing to future non-attainment.

8.6 Use Attainability Analysis (UAA)

A UAA is a structured and scientific assessment of the factors affecting the attainment of uses of a waterbody, as specified in the CWA. The UAA process specifies that states can remove a designated use that is not an existing use, if the scientific assessment demonstrates that attaining the designated use is not feasible for at least one of six reasons:

1. Naturally occurring pollutant concentrations prevent the attainment of the use;

2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met;

3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place;

4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use;

5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

6. Controls more stringent than those required by Sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impacts.

As part of the LTCP, elements of a UAA, including the six conditions presented above will be used to determine if changes to the designated use are warranted, considering a potential adjustment to the next lowest or the next highest designated use classification, as appropriate. Accordingly, a UAA for Alley Creek is attached hereto as Appendix D.

8.6.a Use Attainability Analysis Elements

The objectives of the CWA are to provide for the protection and propagation of fish, shellfish, wildlife, and recreation in and on the water. Cost-effectively maximizing the water quality benefits associated with CSO reduction is a cornerstone of this LTCP Update. The 2012 Order on Consent Goal Statement stipulates that, in situations where the proposed alternatives presented in the LTCP will not achieve these objectives, the LTCP will include a UAA.

To simplify this process, DEP and DEC have developed a framework that outlines the steps taken under the LTCP in two possible scenarios:

- Waterbody meets WQ goals. This may either be the existing WQS (where Class SB is already designated) or an upgrade (where other standards exist). In either case, a high-level assessment of all of the factors that define a given designated use is performed, and if the level of control required to meet this goal can be reasonably implemented, a change in designation may be pursued following implementation and post-construction monitoring.

- Waterbody does not meet WQ goals. If this is the case, and a higher level of control is not feasible, the UAA must justify the shortcoming using at least one of the six criteria listed above. It is assumed that if 100 percent elimination of CSO sources does not enable attainment, the UAA would include factor #3 at a minimum as justification (human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied, or would cause more environmental damage to correct than to leave in place).

As discussed in Section 6.3 of this report, the dry weather sources of pollution and stormwater introduced through the urbanization of the Alley Creek watershed contribute significantly to pathogen impairments in Alley Creek., As noted in Table 6-18 of Section 6, “local sources” account for 25 percent of the calculated 90-day summer GM enterococci concentrations in Alley Creek for year 2008 conditions. New York City stormwater discharges account for another 67 percent of the 90-day summer GM concentrations.

DEP is committed to further characterization and reduction of the local sources and will be conducting follow-up investigations into their causes and possible mitigation. As discussed previously, there were large populations of waterfowl observed, and illicit sanitary connections to the stormwater system were found and corrected. In addition, while control of bacteria levels in NYC stormwater is currently being negotiated between the DEC and DEP, clear direction has not yet been provided as to the levels of stormwater reduction that are feasible.

8.6.b Fishable/Swimmable Waters

As noted in Section 8.1, and in other previous sections, the goal of this LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific WQS, consistent with EPA's CSO policy and subsequent guidance. DEC considers the SA and SB classifications as fulfillment of the CWA goals of fully supporting these goals.

Alley Creek

Water quality modeling analyses, conducted for Alley Creek and summarized in Table 6-10 of Section 6, show that the Creek generally complies with the Class SB monthly fecal coliform standard of 200 cfu/100mL for all but 13 of the 120 months in the 10-year simulation period. Compliance with the 90-day summer GM bathing standard of 35 cfu/100mL is much lower, with only 3 of the 10 summer recreational periods calculated to be in compliance for the baseline conditions. As such, Alley Creek does not comply with the SB WQS.

Little Neck Bay

As noted in Section 6, Little Neck Bay is projected to comply, under baseline conditions, with applicable bacteria WQS for Class SB waters. These waters are calculated to comply with the fecal coliform Class SB standards for all but one month during the 10-year simulation period (Table 6-7). Also, as noted in Table 6-8, enterococci concentrations are calculated to be lower than the 90-day summer GM concentration of 35 cfu/100mL for the Bay for the entire 10-year simulation period.

8.6.c Assessment of Highest Attainable Use

The analyses contained herein, as noted above, indicate that the Class SB standards for pathogens are attained within Little Neck Bay, but not within Alley Creek for the baseline conditions. As such, further analyses were conducted to assess whether additional CSO controls could be put in place to improve WQ conditions within Alley Creek to attain the next highest use. The NYS WQS do not define any use categories between secondary contact and primary contact. Therefore, for the purpose of this analysis, since Alley Creek is currently classified as Class I (secondary contact recreation), the next highest use was considered to be Class SB (primary contact recreation).

The first analysis assessed the impact of CSO disinfection, or 100 percent volumetric control, to ascertain whether treatment of CSO bacteria would improve water quality to allow for Class SB primary contact recreation. As shown in Section 6, Table 6-12, fecal coliform bacteria levels would improve slightly, decreasing the non-compliance from 13 out of 120 months to 8 out of 120 months. However, enterococci bacteria compliance would increase (Table 6-13) from 3 of 10 summer 90-day recreational periods being in compliance to only 4 of 10 summer periods calculated to be in compliance. As such, it is clear that CSO control alone would provide only a marginal improvement in pathogen compliance, but would not result in improvements that would allow Alley Creek to reach the Class SB bathing use.

In summary, assuming that local sources of contamination into Little Neck Bay are control, the waterbody generally meets the Class SB bacteria criteria, including nearly 100 percent compliance at DMA Beach. The existing WQS for Little Neck Bay fulfills the CWA goals, and is generally achievable based on the existing Class SB monthly fecal coliform and the seasonal 90-day GM enterococci criteria, respectively. Alley Creek, however, cannot attain a higher classification than secondary contact recreation through CSO controls.

8.7 Water Quality Goals

Based on the analyses of the waterbodies, and the WQS associated with the designated uses, the following conclusions can be drawn:

Alley Creek

Alley Creek remains a highly productive Class I waterbody that can fully support secondary uses, including nature education and wildlife propagation. Alley Creek is in attainment with its current Class I classification, but because sources of pathogens to the Creek, such as localized sources and municipal stormwater and CSO discharges, it is not feasible for the waterbody to meet the water quality criteria associated with the next highest, Class SB classification. Additional CSO controls, such as storage or disinfection, are projected to only marginally improve attainment of pathogen criteria within the waterbody. Alley Creek would remain out of attainment as much as 60 percent of the time for enterococci bacteria with 100 percent CSO control; attainment would increase only from 30 percent to 40 percent. In addition, as discussed in Section 8.3, one of the 100 percent control alternatives, Disinfection, comes with two major drawbacks – extremely high cost and the harmful effects of TRC toxicity.

As noted in Section 9, DEP is committed to investigating ways to improve water quality in Alley Creek by tracking down dry weather, local sources of pathogens (Duck Pond and Oakland Lake outlets and TI-024), and controlling them to the extent practical. DEP is also engaged in discussions with DEC related to control needs for municipal stormwater. However, at this time, the nature and full extent of practical controls for these two sources is unknown. Therefore, although attaining swimming quality pathogen quality in Alley Creek should be a long term future target, the secondary classification appears to be a practical short-term goal. Furthermore, combinations of natural and manmade features prevent the opportunity and feasibility of primary contact recreation in Alley Creek.

Little Neck Bay

Little Neck Bay generally meets the Class SB criteria almost 100 percent of the time when examined from the DEC fecal coliform monthly standard, as well as the 90-day summer GM enterococci standard. It should also be noted that the summer season compliance (30-day rolling GM) is nearly 100 percent at DMA Beach for the baseline condition, the only official bathing beach in the waterbody. The continued presence of non-CSO discharges, dry weather sources, and suspected failed septic systems in Douglaston Manor prevents attainment of Class SB standards at all times, under existing conditions. DEP, as noted in Section 9, is committing to pursuing the reduction of local sources, to continue to improve pathogen compliance in Little Neck Bay so that full attainment of the Class SB goals is achieved.

Finally, in accordance to the LTCP Goal Statement, and as described in Section 7, DEP has solicited public input during the LTCP process with respect to water quality goals and objectives. As noted earlier in this report, DEP has invested heavily in improving the water quality and natural features of the Alley Creek watershed, and that the results of this roughly $130-million investment have not gone unnoticed by the local residents. As was clearly expressed at the second public meeting, the attendees stated their support of the current state of WQS attainment and wetland restoration, and did not want to see additional grey CSO controls being implemented in the sensitive areas of Alley Creek and Little Neck Bay.

8.8 Recommended LTCP Elements to Meet Water Quality Goals

The recommended LTCP elements described in this section are the culmination of efforts by DEP to attain existing WQS. DEP recognizes that achieving water quality objectives may require more than the simple reduction in CSO discharges. DEP CSO Control Facility Planning for these waterbodies began in 1984, predating the current LTCP program. The Alley Creek CSO Facility Plan was accepted by DEC in 2000. The principal element of the 2003 Alley Creek CSO Facility Plan and the later 2009 WWFP was the construction of a 5 MG CSO Retention Tank and its new CSO outfall TI-025 to Alley Creek reconfiguration of Chamber 6.

With the facility now in operation, CSO volume has been reduced to 132 MG annually. Several alternatives that captured some portion or all of the remaining CSO discharge from outfall TI-025 were investigated. Based on water quality modeling, complete capture of CSO discharge to the waterbody would result in a negligible improvement of water quality in Alley Creek at a substantial cost. Alternatives capturing less than 100 percent of the CSO discharge would have an even less significant effect on water quality in Little Neck Bay. Therefore, no alternative is cost-effective, and the recommended LTCP elements are the baseline conditions – namely, the 2009 Alley Creek and Little Neck Bay WWFP recommendations plus 3 percent GI through on-site stormwater management on private properties. As such, the LTCP recommends that the CSO facility continues to operate without additional changes. However, as discussed further in Section 9, DEP is committed to investigating and reducing the local sources of human-source pollution to improve water quality of the waterbodies.

SECTION 9.0
LONG TERM CSO CONTROL PLAN IMPLEMENTATION

9.0 Long Term CSO Control Plan Implementation

As discussed in Sections 6 and 8 of this document, the Alley Creek and Little Neck Bay LTCP does not recommend any new grey infrastructure to be implemented to further address the CSO discharges in the watershed. This recommendation was based on the outcome of comprehensive facility planning and water quality improvement evaluations completed under the LTCP and the progress made from implementing the recommendations of the 2009 WWFP and earlier facility plans. It was also based on input received during the public participation process, conducted per the CSO Control Policy and the LTCP Goal Statement, as described in Section 7. These improvements have resulted in enhanced water quality in Alley Creek and Little Neck Bay, achieving essentially 100 percent attainment of existing WQS.

There are, however, some follow-up investigations that will be made as part of the LTCP in order to address the pollutant load contributions from other wet and dry weather sources that may be necessary to comply with the CWA as well as future City and State laws and regulations.

It should also be noted that during the development of the 2017 Citywide LTCP, the findings of the Alley Creek and Little Neck Bay LTCP may be reassessed. As additional information becomes available, including findings from ERTM modeling runs from other LTCPs, or in response to regulatory changes, these changing conditions may warrant an adjustment to this plan.

9.1 Adaptive Management (Phased Implementation)

Based on the outcome of the facility planning and water quality improvement evaluations completed as part of the LTCP, and the progress made from implementing the recommendations of the 2009 WWFP and earlier DEP facility plans, DEP does not recommend the implementation of new grey infrastructure to further address the CSO discharges in the watershed. As demonstrated in Section 6, there are no gaps in attaining existing WQS. Further, gaps to attaining future WQS are primarily due to non-CSO sources.

Although not recommended as a CSO control strategy in this LTCP, DEP will continue to investigate the localized non-CSO sources of pollution in the upper Alley Creek watershed including the direct drainage into Oakland Lake and other tributaries. While it is currently believed that waterfowl contribute a significant portion of these pollutant loadings, DEP plans to identify and quantify these sources to the extent practical. If DEP does identify any human sources, appropriate actions will be taken to abate these sources.

DEP is also committed to closing data gaps and/or improving on inadequate data, such as effluent loadings from the Alley Creek CSO Retention Tank. In summary, three such adaptive programs will be performed that will focus on characterization of dry weather sources of pollution into Oakland Lake and Duck Pond; continue the track down and abatement of illicit connections to outfall TI-024; and the effluent quality of the Alley Creek CSO Retention Tank. DEP has placed a high level of importance to these miscellaneous pollutant loadings. These investigations will also complement ongoing data collection programs such as the Post Construction Monitoring (PCM), the Harbor Survey Monitoring (HSM) and Sentinel Monitoring (SM) programs, enhancing the source characterization and supporting potential variations of designated uses in the future.

Each of these follow-up programs are described below:

Pollution Sources into Oakland Lake and Duck Pond

Following the completion of the Field Sampling and Analysis Program (FSAP) that was conducted as part of the LTCP, DEP performed additional preliminary field investigations along Oakland Lake. Based upon the results of the LTCP FSAP, and these follow up investigations, DEP prepared a preliminary work plan aimed at further characterizing these sources.

The preliminary work plan for the Oakland Lake and Duck Pond follow-up investigations include, but are not limited to, dry weather data collection of the following elements:

1. *Bacteria loadings quantification*:

   - Sampling (minimum five events) and flow monitoring (continuous) of the Oakland Lake and what is referred to as the Duck Pond outlets.

   - Sampling (minimum five events) of the influent to Oakland Lake at five locations, including one MS4 outfall (minimum two events); a spring (minimum five events); and other locations where shallow concentrated flow discharges to the lake during dry weather (minimum two events).

   The sampling results of the bacteria loadings quantification will include Fecal Coliform and Enterococci concentrations, temperature, salinity and DO.

2. *Loadings source characterization (2 events if warranted following bacteria sampling):*

   - Microbial Source Tracking (MST) analysis of Oakland Lake's effluent and influent spring to determine the nature of the sources of bacteria loadings (e.g., human, non-human, etc.)

   The sampling results of the bacteria loadings characterization will include laboratory results of DNA markers, specifically, General Bacteroides, HF183 and Bird Fecal ID, to allow determination of the nature of the sources of the loadings.

3. *Potential Human Source Tracking and Abatement (if warranted as follow-up to initial MST analysis of pond outlets):*

   - Additional Microbial Source Tracking (MST) sampling of influent locations and follow-up investigations conducive to source abatement if warranted.

Other investigatory methods could be used to supplement the above analyses including smoke and dye testing. Based on the interim results collected throughout the implementation of the work plan, expanding the scope to wet weather and/or other parameters could result.

Pollution Sources Tributary to TI-024

While illicit connections have been previously abated following the detection of fecal contamination at TI-024, the pathogen levels have remained elevated. DEP did some subsequent track down and have identified eleven additional establishments that are improperly connected to the separate stormwater system; DEP has issued Commissioner Orders to promptly remove all illegal connections. These eleven illegal connections have since been completed but DEP still intend to conduct additional dye studies and monitor water quality to ensure all illicit connections have been abated. Please note that DEP routinely monitors water quality as part of the Harbor Survey Monitoring Program (HSM) and performs routine inspections of the Stormwater Outfalls as part of the sentinel monitoring program to proactively trackdown and abate these illicit connections.

Alley Creek CSO Retention Tank Effluent Quality

As was described in Section 4, there are inadequate data pertaining to the effluent quality of the existing Alley Creek CSO Retention Tank. As such, DEP will be taking grab samples of the tank influent during overflow events as a surrogate of tank effluent quality. This approach will avoid the use of the tank sampling system and the potential of contaminated sampling lines caused by re-growth of bacteria.

9.2 Implementation Schedule

Because of the high level of attainment with current WQS, there are no additional grey CSO control measures being recommended as part of the LTCP beyond what was included, and subsequently implemented as part of the 2009 WWFP. There are, however, other water quality enhancement activities that will continue to be implemented. These include the follow-up investigations into bacteria sources described above and the ongoing DEP monitoring programs mentioned in Sections 9.4 and 9.5. The implementation schedules for the follow-up investigations are as follows:

9.2.a Oakland Lake and Duck Pond

- LTCP FSAP – Completed
- Preliminary follow-up investigations – Completed in mid-2013
- Development and execution of detailed investigation work plan – Late 2013/mid 2014
- Report on findings – Mid to late 2014
- Revise ERTM model, as appropriate – Late 2014
- Make corrections, as appropriate – Depending upon source of contamination (e.g., human, non-human, etc.)

This schedule is aimed at quickly characterizing and addressing, to the extent feasible, the unknown dry weather sources and follows the adaptive nature of DEP's LTCP implementation.

9.2.b TI-024

Similar to Oakland Lake, the TI-024 follow-up investigations is also an adaptive program, but with a potentially longer implementation period depending upon the need for corrective action. Dry weather TI-024 flows will be periodically monitored and samples taken during late 2013/mid-2014. Depending upon the findings, and results of the any necessary corrective action, the TI-024 program will be periodically re-assessed and adjusted accordingly.

9.2.c CSO Retention Tank Effluent

Samples will be taken at the CSO Retention Tank throughout late 2013/early 2014. As was previously described, the samples will be collected at the tank influent as a surrogate of the effluent quality. Up to five events are targeted in order to establish statistically-significant bacteria concentrations of both fecal coliform and enterococci.

9.3 Operation Plan/O&M

As there are no new CSO control facilities warranted for Alley Creek and Little Neck Bay, optimization of the operation of the existing Alley Creek CSO Retention Tank will remain a focus for DEP. This will ensure that the tank provides the maximum level of AAOV reduction through timely post-storm dewatering and inter-storm dewatering of groundwater infiltration and tank seepage. DEP will continue to collect and evaluate PCM data to optimize the operation and effectiveness of the tank.

9.4 Projected Water Quality Improvements

Improvements in the water quality of the two waterbodies are expected to continue as the result of ongoing efforts to further quantify, and abate to the extend feasible, the localized sources of pollution in the upper Alley Creek watershed, described above, and the application of three (3) percent GI. These improvements will be tracked and documented through continued DEP water quality monitoring as part of the PCM and Harbor Survey Programs. Other pollutant reduction programs, such as those pertaining to MS4s, will be implemented based on findings of future watershed characterization and modeling that demonstrates cost-effective improvements in the water quality of the two waterbodies.

9.5 Post Construction Monitoring Plan and Program Reassessment

Ongoing DEP monitoring programs will continue, including PCM associated with the Alley Creek CSO Retention Tank and the Harbor Survey program. This is in addition to DOHMH's DMA Beach monitoring and DEP's Sentinel Monitoring of the shoreline. Harbor Survey data collected from Stations AC1, LN1 and E11 will be used to periodically review and assess the water quality trends in the waterbodies. Depending upon the findings, the data from these programs could form the basis of additional recommendations for inclusion in, as appropriate, the 2017 Citywide LTCP.

9.6 Consistency with Federal CSO Policy

The Alley Creek and Little Neck Bay LTCP was developed to comply with the requirements of the EPA CSO Control Policy, including applicable guidance documents, and the broader CWA goal that the waterbodies shall support fishable and swimmable water quality. The LTCP revealed that Alley Creek currently attains the Class I bacteria criteria but cannot support the next highest use classification (SB) even with 100 percent CSO control. It also showed, however, that Alley Creek is not suitable for contact recreation for the several natural and manmade factors listed in the UAA discussion of Section 8.6. As such, a UAA has been prepared and is attached to the LTCP as a means to formally demonstrate and acknowledge the suitability of continued Class I designation for Alley Creek.

It should again be noted that this conclusion for retaining the current Alley Creek classification was supported by the attendees at the second public meeting where satisfaction was expressed on the improvements made to the waterbodies as the result of the earlier CSO control measures. As was noted in Section 8.7, additional grey infrastructure was not supported for any additional level of CSO control.

Unlike Alley Creek, the Class SB Little Neck Bay fully attains the existing bacteria criteria on an annual basis. This high level of attainment also includes 100 percent attainment of NYSDOH recreational waters criteria at DMA beach, the only sensitive area within the two waterbodies.

9.7 Compliance with Water Quality Goals

As noted above, Alley Creek is currently attaining the Class I bacterial criteria and the assessment of the waterbody's highest attainable use indicates that Alley Creek cannot support swimmable water quality (Class SB), nor is it suitable for such uses because of natural and manmade features, such as lack of access, marshy tidal flat conditions, and the fact that there are no practical means or opportunities to improve its water quality. The UAA, described above and attached as Appendix E, was prepared to document these findings.

DEP is seeking a SPDES variance from the anticipated Water Quality Based Effluent Limitation (WQBEL) for the Alley Creek CSO Facility, and the application is attached as Appendix E per DEC requirements. Specifically, the variance request is based on the anticipation of occasional exceedances of WQS for (a) suspended, colloidal and settleable solids; (b) oil and floating substances; and (c) DO. Because complete elimination of periodic excursions from the WQS would require 100 percent CSO control, and because even with their complete removal, DO numeric limits are not fully attained, a variance from the presumed WQBEL of 100 percent CSO control is being requested. The criteria for such a variance are identical to those for a UAA, and DEP anticipates that the same approval framework will be applicable to variance requests. For the Alley Creek CSO Facility SPDES variance, factor #3 is applicable (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 than to leave in place).

SECTION 10.0
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SECTION 11.0
GLOSSARY

11.0 Glossary

μg/L:	Microgram per liter
1.5xDDWF:	One and One-half Times Design Dry Weather Flow
2-D:	Two-Dimensional
2xDDWF:	Two Times Design Dry Weather Flow
3-D:	Three-Dimensional
A Posteriori Classification:	A classification based on the results of experimentation
A Priori Classification:	A classification made prior to experimentation
AAOV:	Annual Average Overflow Volumes
ACO:	Administrative Consent Order
ADWF:	Average Dry Weather Flow
ALJ:	Administrative Law Judge
APEC:	Alley Pond Environmental Center
AWT:	Advanced Wastewater Treatment
BASINS:	Better Assessment Science Integrating Point and Non-point Sources
BAT:	Best Available Technology
BEACH:	Beaches Environmental Assessment and Coastal Health
bgy:	billon gallons per year
BMP:	Best Management Practice
BNR:	Biological Nutrient Removal
BOD:	Biochemical Oxygen Demand
BSD:	Brooklyn Sewer Datum
BWSO:	Bureau of Water and Sewer Operations
CAC:	Citizens Advisory Committee

CALM:	Consolidated Assessment and Listing Methodology
CATI:	Computer Assisted Telephone Interviews
CB:	Community Board
$CBOD_5$:	Carbonaceous Biochemical Oxygen Demand
CCMP:	Comprehensive Conservation Management Plan
CD:	Community District
CEA:	Critical Environmental Area
CEG:	Cost-Effective Grey
CEQR:	City Environmental Quality Review
CERCLIS:	Comprehensive Environmental Response, Compensation and Liability Information System
CFR:	Code of Federal Regulation
CIP:	Capital Improvement Program
COD:	Chemical Oxygen Demand
Conc:	Abbreviation for “Concentration”.
Cr+6:	Chrome+6
CSO:	Combined Sewer Overflow
CSS:	Combined Sewer System
CWA:	Clean Water Act
CWP:	Comprehensive Waterfront Plan
CZB:	Coastal Zone Boundary
DCIA:	Directly Connected Impervious Areas
DCP:	New York City Department of City Planning
DDWF:	Design Dry Weather Flow
DEC:	New York State Department of Environmental Conservation
DEP:	New York City Department of Environmental Protection

DMA Beach:	Douglas Manor Association Beach
DMR:	Discharge Monitoring Report
DNA:	Deoxyribonucleic Acid
DO:	Dissolved Oxygen
DOB:	NYC Department of Buildings
DOC:	Dissolved Organic Carbon
DOF:	Department of Finance
DOH:	New York State Department of Health
DOHMH:	New York City Department of Health and Mental Hygiene
DOT:	New York City Department of Transportation
DPR:	New York City Department of Parks and Recreation
DSNY:	Department of Sanitation of New York
DWF:	Dry Weather Flow
E. Coli:	Escherichia Coli.
EBP:	Environmental Benefit Project
EIS:	Environmental Impact Statement
EMAP:	Environmental Monitoring and Assessment Program
EMC:	Event Mean Concentration
EPA:	United States Environmental Protection Agency
EPMC:	Engineering Program Management Consultant
ERTM:	East River Tributaries Model
ERTM:	East River Tributaries Model
ET:	Evapotranspiration
FEIS:	Final Environmental Impact Statement
FOG:	fats, oils, and grease
FOIA:	Freedom of Information Act

FSAP:	Field Sampling and Analysis Program
GI:	Green Infrastructure
GIS:	Geographical Information System
GM:	Geometric Mean
gpd/ft:	gallons per day per foot
gpd/sq ft:	gallons per day per square foot
GPD:	Gallons per Day
GPS:	Global Positioning System
GRTA:	NYC Green Roof Tax Abatement
GSD:	Green Site Development
H_2S:	Hydrogen Sulfide
HCP:	Habitat Conservation Plans
HGL:	Hydraulic Gradient Line
HLSS:	High Level Sewer Separation
HRT:	High Rate Treatment
I/I:	Inflow/Infiltration
IBI:	Indices of Biological Integrity
IDNP:	Illegal Dumping Notification Program
IEC:	Interstate Environmental Commission
IFCP:	Interim Floatables Containment Program
In situ: .	Measurements taken in the natural environment
in.:	Abbreviation for “Inches”.
IPP:	Industrial Pretreatment Programs
IW:	InfoWorks CS™
JABERRT:	Jamaica Bay Ecosystem Research and Restoration Team
JEM:	Jamaica Eutrophication Model

JFK:	John F. Kennedy International Airport
KOTC:	Knee-of-the-Curve
LA:	Load Allocation
lb/day/cf:	pounds per day per cubic foot
lbs/day:	pounds per day
LC:	Loading Capacity
LGA:	LaGuardia Airport
LID:	Low Impact Development
LID-R:	Low Impact Development - Retrofit
LIRR:	Long Island Railroad
LPC:	Landmark Preservation Commission
LTCP:	Long Term Control Plan
LUST:	Leaking Underground Storage Tank
mf/L:	Million fibers per liter
mg/L:	milligrams per liter
MG:	Million Gallons
MGD:	Million Gallons Per Day
MHI:	Median Household Income
mL:	milliliters
MLW:	Mean Low Water
MOS:	Margin of Safety
MOSF:	Major Oil Storage Facilities
MOU:	Memorandum of Understanding
MPN:	Most probable number
MS4:	Municipal separate storm sewer systems
MSS:	Marine Sciences Section

NEIWPCC:	New England Interstate Water Pollution Control Commission
NH3-N:	Ammonia (NH_3)
NMC:	Nine Minimum Control
NMFS:	National Marine Fisheries Service
No./mL (or #/mL):	Number of bacteria organisms per milliliter
NOAA:	National Oceanic and Atmospheric Administration
NPDES:	National Pollutant Discharge Elimination System
NPL:	National Priorities List
NPS:	Non-Point Source
NURP:	Nationwide Urban Runoff Program
NWI:	National Wetland Inventory
NYCDOB:	New York City Department of Buildings
NYCEDC:	New York City Economic Development Corporation
NYCRR:	New York State Code of Rules and Regulations
NYD:	New York District
NYSDOS:	New York State Department of State
O&M:	Operation and Maintenance
OGI:	Office of Green Infrastructure
OMB:	Office of Management and Budget
ONRW:	Outstanding National Resource Waters
Ortho P:	Ortho Phosphorus
P[H]:	**pH** is a measure of the activity of the hydrogen ion. **p[H]**, which measures the hydrogen ion concentration, is closely related to, and is often written as, pH, pure water has a pH very close to 7 at 25°C. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline.
PAH:	Polycyclic Aromatic Hydrocarbons
PCBs:	Polychlorinated Biphenyls

PCM:	Post Construction Monitoring
PCS:	Permit Compliance System
PE:	Primary Effluent
PERC:	Perchloraethylene
POTW:	Publicly Owned Treatment Plant
pounds per day:	lbs/day; unit of measure
ppm:	Parts per million
PS:	Pump Station or Pumping Station
PTPC:	Probable Total Project Cost
Q:	Symbol for Flow (designation when used in equations)
RCRAInfo:	Resource Conservation and Recovery Act Information
REMAP:	Regional Environmental Monitoring and Assessment Program
RL:	Reporting Limit
RNA: Acid.	Ribonucleic
ROWB:	Right-of-way bioswales
RTC:	Real-Time Control
RWQC:	Recreational Water Quality Criteria
SCADA:	Supervisory Control and Data Acquisition
scfm:	standard cubic feet per minute
SEQRA:	State Environmental Quality Review Act
SF:	Square foot
SIU:	Significant Industrial User
SNAD:	Special Natural Area District
SNWA:	Special Natural Waterfront Area
SOD:	Sediment Oxygen Demand

SOP:	Standard Operating Procedure
SPDES:	State Pollutant Discharge Elimination System
SPIL: t	Site Spill Identifier Lis
SRF:	State Revolving Fund
SSM:	Single sample maximum
SSO:	Sanitary Sewer Overflow
SSS:	Separate sewer system
SSWS:	Separate Storm Water System
STORET:	Storage and Retrieval
STV:	Statistical Threshold Value
SWEM:	System-wide Eutrophication Model
SWMM:	Stormwater Management Model
SWPP:	Stormwater Protection Plan
TC:	Total coliform
TDS:	Total Dissolved Solids
TKN:	Total Kjeldahl Nitrogen
TMDL:	Total Maximum Daily Load
TOC:	Total Organic Carbon
TOGS:	Technical and Operational Guidance Series
Total P:	Total Phosphorus
TSS:	Total Suspended Solids
UAA:	Use Attainability Analysis
UAE:	Use Attainability Evaluation
UER-WLIS:	Upper East River – Western Long Island Sound
ug/L:	Microgram per liter
ULURP:	Uniform Land Use Review Procedure

USA:	Use and Standards Attainment Project
USACE:	United States Army Corps of Engineers
USEPA:	United States Environmental Protection Agency
USFWS:	United States Fish and Wildlife Service
USGS:	United States Geological Survey
UST:	Underground storage tanks
UV:	Ultraviolet Light
VSS:	Total Volatile Suspended Solids
VTS:	Vertical Treatment Shaft
WAC:	Watershed Advisory Committee
WI/PWL:	Waterbody Inventory/Priority Waterbody List
WLA:	Waste Load Allocation
WPCP:	Water Pollution Control Plant
WQS:	Water Quality Standards
WRP:	Waterfront Revitalization Program
WWFP:	Waterbody/Watershed Facility Plan
WWOP:	Wet Weather Operating Plan
WWTP:	Wastewater Treatment Plant
XP-SWMM:	USEPA watershed/sewershed model software program
Zooplankton:	Free-floating or drifting animals with movements determined by the motion of the water.

APPENDICES

APPENDIX A
Long Term Control Plan (LTCP) Alley Creek Kickoff Meeting – Summary of Meeting and Public Comments Received

Appendices

Appendix A: Long Term Control Plan (LTCP) Alley Creek Kickoff Meeting – Summary of Meeting and Public Comments Received

On October 24th, 2012 DEP and the New York State Department of Environmental Conservation (DEC) co-hosted a Public Kickoff Meeting to initiate the water quality planning process for long term control of combined sewer overflows in the Alley Creek and Little Neck Bay Waterbody. The two-hour event, held at the Alley Pond Environmental Center in Queens served to provide overview information about DEP's Long Term Control Plan (LTCP) Program, present information on the Alley Creek watershed characteristics and status of waterbody improvement projects, obtain public information on waterbody uses in Alley Creek, and describe additional opportunities for public input and outreach. The presentation can be found at http://www.nyc.gov/dep/ltcp. Fifteen stakeholders from over 10 different non-profit, community planning, environmental, economic development, governmental organizations and the broader public attended the event.

The Alley Creek LTCP Kickoff Public Meeting was the first opportunity for public participation in a LTCP for the Alley Creek and Little Neck Bay Waterbody. As part of DEP's LTCP Public Participation Plan, Alley Creek's Long Term Control Planning process will be posted on DEP's website, shown above. The public will have more opportunities to provide feedback and participate in the development of Alley Creek's waterbody-specific LTCP. Specific questions asked during the Alley Creek LTCP public kickoff meeting are summarized below with DEP's responses for each.

- What are the CSO related projects in Alley Creek? When will they be built? How much did they cost?
    - *Sewer improvements and a new outfall have already been constructed to help increase sewer system capacity and reduce sewer surcharging and street flooding. This project consisted of installing storm sewers and the construction of a new outfall at a cost of $93 million. In addition, a combined sewer overflow (CSO) retention facility was built to collect about 5 million gallons of combined sewage during rain event. This facility, also referred to as a CSO retention tank, reduces CSOs discharging to Alley Creek by more than 50% or 517 million gallons per year (MGY) down to 256 MGY. The remaining CSO receives partial treatment before being discharged. This facility was built at a cost of $29 million.*

- Which CSO outfalls are connected to the CSO tank? Is TI-024 connected to the tank?
    - *Outfalls TI-008 and TI-025 are connected to the CSO tank. TI-025 receives partially treated overflow from the tank and TI-008 will rarely overflow (under extreme storms) due to the reconfiguration of Chamber 6 weir to divert all flows for a design storm towards the tank. Outfall TI-024 is connected to a pump station relief which rarely overflows.*

- Are the CSO projects that have been built included in the baseline of the model?
    - *Yes, the CSO improvement projects will be part of the baseline in the model.*

- Is DEP using JFK rainfall data only? What years of rainfall numbers is DEP using to model and plan for the long term control of combined sewer overflows in Alley Creek? How is climate change being taken into account?
    - *DEP has been using local rain gauge data (LaGuardia Airport and Douglaston Pump Station) and supplementing with radar rainfall data to support the model calibrations. However, to provide consistency in planning for citywide LTCP projects, DEP is using a specific rainfall record from JFK for baseline and alternatives' analyses scenarios. 2008 data from JFK which includes an annual rainfall of 46.3 inches was chosen based on*

statistical analyses. Projections for future rainfall and sea level rise conditions will be incorporated into the modeling scenarios as will a longer rainfall record covering the last 10 years (2002-2011) to assess pathogen compliance for meeting the appropriate water quality standards.

- Does the model take into account wastewater treatment plants that are not controlled by DEP, such as the Great Neck Wastewater Treatment Plant (WWTP) in Nassau County?
  - *Yes, the model accounts for flows and loadings based on discharge monitoring reports for the Belgrave WWTP in Great Neck.*

- How is the water quality data being collected in the Alley Creek and Little Neck Bay Waterbody? Is it automated or manual? Is data being collected from the CSO tank?
  - *DEP's Harbor Survey program collects ambient water quality grab samples at 3 locations in Alley Creek and Little Neck Bay weekly during recreational season (May 1-September 30) and monthly during non-recreational season (October 1-April 30). In addition, NYC DOHMH monitors Douglas Manor Association Beach 5-times in a 30-day period during recreational season for bacteria indicator concentrations. The ambient water quality monitoring data will be supplemented by additional water quality surveys that DEP will conduct in the fall of 2012 during wet and dry weather periods. Overflow data from the tank is being collected as part of the post-construction monitoring program, which will also be used to refine the model for supporting the LTCP project.*

- Does the model simulate tides? Was the sampling activity timed with the tides?
  - *The model does simulate tides. Kings Point is the closest tide station maintained by the National Oceanic and Atmospheric Administration (NOAA). Tidal adjustment factors developed by NOAA are applied to the Kings Point data to develop tidal conditions within AC/LNB waterbody. AC/LNB is part of the larger East River Tributaries Model (ERTM) to be used for the receiving water quality analyses. ERTM covers from Long Island Sound through the lower New York Bay/ Newark Bay areas and simulates the entire tidal variations within this area, calibrated based on NOAA gage data from Sandy Hook (NJ), The Battery and Kings Point. For the additional water quality sampling to be performed by DEP, sampling will take place in morning and afternoon surveys and bottom and top layer samples are collected. This is the protocol for city-wide sampling, being performed in a number of waterbodies over a period of several years.*

- Does the model simulate actual storms?
  - *Yes, the model simulates actual storms for an annual rainfall record. Spatially varied hourly rainfall records are provided as input, but the models have the ability to take 5-minute data if available and needed to meet a project need. Outputs can be generated at 5-minute intervals, although the receiving water quality models typically require hourly average inputs from the watershed models.*

- What is the plume in the satellite images of Alley Creek and Little Neck Bay in the presentation? Could it be smoke?
  - *As this is an image retrieved from publicly available Google maps, which are snapshots taken at different time periods, it is likely that these images had captured cloud cover. Images available from different public-domain sites were reviewed and this cloud cover didn't exist in those images.*

- What is the estimate of total CSO that goes into Little Neck Bay? What is the estimate for the total diluted sewage into Little Neck Bay?
    - *With the tank online, it is projected that 256 MGY of partially treated CSOs would be discharged to Alley Creek before flowing into Little Neck Bay. While the new annual rainfall from 2008 will create more overflows (in comparison to the above estimates developed from 1988 rainfall), DEP anticipates that the tank will perform better than projected and reduce CSOs further. DEP will continue to monitor the post-construction performance of the tank and will update the model with new data and use to generate revised annual overflows into Alley Creek and eventually into the Little Neck Bay.*

- Are there plans for separate sewers in the watershed/waterbody?
    - *DEP will evaluate the potential for separate sewers in the combined sewer area of the watershed and other alternatives as part of the LTCP development process. Stormwater from some portions of the Alley Creek/Little Neck Bay watershed are currently managed using seepage pits and the DEP's capital plan includes installation of new storm sewers in these areas since the seepage pits were originally built as temporary structures to manage Stormwater until new storm sewers were built.*

- Is DEP installing a new outfall on Udall's Cove? Where was storm water going before (at Udall's Cove)? How are storm water outfalls planned in Little Neck Bay and how is this related to the Bluebelt program?
    - *DEP, working with the Department of Parks and Recreation, is installing a new storm sewer outfall and outlet-stilling basin. Previously the stormwater runoff went directly overland into the cove. The project is similar to the DEP Bluebelt program which discharges stormwater into a managed wetland with a forebay before discharging to a receiving waterbody via an outfall structure.*

- When will a date be set for the second public meeting for Alley Creek and Little Neck Bay Long Term Control Plan Public Participation process?
    - *The next public meeting is scheduled for winter 2013. DEP will provide the date of the next meeting to stakeholders and community members well in advance to ensure maximum participation.*

APPENDIX B:
Long Term Control Plan (LTCP) Alley Creek Public Meeting #2 – Summary of Meeting and Public Comments Received

Appendix B: Long Term Control Plan (LTCP) Alley Creek Public Meeting #2 – Summary of Meeting and Public Comments Received

On May 1, 2013, DEP hosted a second Public Meeting to continue the water quality planning process for long term control of combined sewer overflows (CSOs) in Alley Creek and Little Neck Bay. The purpose of the two-hour event, held at the Alley Pond Environmental Center in Queens, was to provide background and an overview of the LTCP planning process, present Alley Creek watershed characteristics and status of existing water quality conditions, obtain public input on waterbody uses in Alley Creek/Little Neck Bay, and describe the alternatives identification and selection process. The presentation is on DEP's LTCP Program Website: http://www.nyc.gov/dep/ltcp. Ten stakeholders from more than five different non-profit, community planning, environmental, economic development, governmental organizations and the broader public attended the event.

The Alley Creek LTCP Public Meeting #2 was the second opportunity for public participation in the LTCP development process for Alley Creek/Little Neck Bay. As part of DEP's LTCP Public Participation Plan, all Alley Creek/Little Neck Bay LTCP development process documents will be posted on the above website. The public will have additional opportunities to provide feedback and participate in the development of this LTCP. Specific questions asked during the meeting and DEP's responses are summarized below.

- What is the overall goal for water quality in Alley Creek/Little Neck Bay?
  - *The goal of each LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with the Federal CSO Policy and water quality goals of the Clean Water Act. Specific water quality goals for all individual LTCPs are subject to public input and evaluation or potential alternatives during the LTCP development process.*

- Will the draft LTCP, to be issued in June 2013, be available for public comment?
  - *Yes, all stakeholders will have the opportunity to review and comment on the draft LTCP. DEP will submit the draft LTCP to DEC on June 30, 2013, at which time DEC will review and determine a date for public release and comment.*

- Regarding the graphs in the presentation, what are the modeled lines colored red and black and is the scale logarithmic?
  - *The red lines are model predictions at the top portion of water quality model segments. Each water quality model cell has ten layers from top to bottom. The black represent bottom depth predictions. Yes, the scale is logarithmic.*

- What are the acceptable levels of enterococci and fecal coliform in Alley Creek/Little Neck Bay?
  - *The fecal coliform monthly geometric mean standard is 200 per 100mL for Class SB (Little Neck Bay) and 2,000 per 100 mL for Class I (Alley Creek). The enterococci standard is 435 per 100 mL for Class SB (Little Neck Bay) and is not listed for Class I waterbodies (Alley Creek).*

- Do the values of enterococci go up to 1,000 per 100 mL? Are the enterococci measured data typically below model predications?
  - *The enterococci values do approach 1,000 per 100 mL. However, data are variable: sometimes model results are higher and sometimes lower. In general, the model results generally follow the trends in the data.*

- Based on the bar graphs of pollutant loadings in the presentation, are the largest loads to Alley Creek/Little Neck Bay from non-CSO sources?

  - *Yes, according to the data, stormwater appears to be the source of large pollutant loadings into Alley Creek and Little Neck Bay.*

- Is the bacteria measured in Little Neck Bay resulting from impacts of unsewered areas of Douglas Manor?
  - *No, based on the data, the water quality impacts from Douglas Manor appear to be localized.*

- Is DEP collaborating with Nassau County on reducing storm water pollution load?
  - *DEP anticipates future collaboration with Nassau County during the Municipal Separate Storm Sewer System (MS4) Citywide Permit development and implementation process.*

- What is grey infrastructure?
  - *Grey infrastructure typically denotes large-scale, centralized end-of-pipe controls such as retention tanks or sewer modifications. Examples include: bending weirs, CSO retention tanks and high level storm sewer separation.*

- What is the difference between detention and retention?
  - *Detained stormwater flows are captured, stored and then slowly released to the sewer system. Retained stormwater flows are captured and either infiltrate into the ground, undergo evapotranspiration, or are recycled onsite, and are not released to the sewer system.*

- In the *NYC Green Infrastructure Plan*, a three percent application rate (on private property) is assumed to occur by 2040. What is the basis of this?
  - *DEP estimates that through redevelopment and required adherence to DEP's revised Standards for Stormwater Release Rates, which requires redevelopment and new development projects to achieve a more stringent stormwater release rate in combined sewer areas, that green infrastructure will be implemented on private property. This percentage was developed based on redevelopment project applications received by the New York City Department of Buildings (DOB) over the last 10 years. In addition, DEP offers grants through the NYC Green Infrastructure Grant Program for private and residential properties in combined sewer areas.*

- Why is there not more green infrastructure planned in Alley Creek/Little Neck Bay?
  - *A 10 percent green infrastructure application alternative is being evaluated for the Alley Creek/Little Neck Bay LTCP, based on DEP's target of 10 percent green infrastructure application rate citywide (that is, 10% of the impervious combined sewer area) in combined sewer areas. A 50 percent green infrastructure application alternative (of the impervious combined sewer area) is also being evaluated.*

- The potential project footprint for the 29.5 million gallon CSO retention tank draft alternative would be large. Can DEP consider non-structural alternatives and green infrastructure solutions instead of grey infrastructure alternatives?
  - *As discussed during the presentation, the goal of each LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with the Federal CSO Policy and water quality goals of the Clean Water Act. Therefore, DEP is required to evaluate a myriad of potential alternatives, which will include green infrastructure, during the alternatives analysis component of the LTCP development process. The alternatives analysis is utilized to gauge potential CSO reductions and associated water quality improvements and does not take into account constructability.*

- Regarding the draft alternatives, what is the difference between an “upstream” and “downstream” tank?
  - *An upstream tank would capture flows at the upstream combined sewer area. A downstream tank would capture flows near the combined sewer outfall The downstream tank would need to be larger to achieve the same amount of combined sewer flow reduction since there is more stormwater mixed in.*

- Has the existing five million gallon Alley Creek CSO retention tank resulted in water quality improvements?
  - *Based on initial assessments, the CSO retention tank has contributed to water quality improvements. DEP will continue to assess and quantify water quality improvements.*

- Can the LTCP requirements be modified so that the plan addresses other sources as well as CSOs?
  - *The purpose and scope of all LTCPs, including the Alley Creek/Little Neck Bay LTCP where stormwater is the largest source of watershed pollutants, is to address CSOs in combined sewer areas and not other sources of water quality impairments (e.g., directly discharged stormwater inputs in separately sewered areas). The forthcoming MS4 Citywide Permit will include requirements related to stormwater inputs from separately-sewered drainage areas.*

- The focus of this LTCP should be changed to reducing storm sewer runoff into marsh land and improving habitat, and overall emphasis should be on ecology, rather than recreation.
  - *Each LTCP is a comprehensive evaluation of long term solutions to reduce CSOs and improve water quality in New York City’s waterbodies and waterways and does not focus on reducing storm sewer runoff. Improved or increased recreation is one of the main considerations required for each LTCP. Regarding enhanced ecology, in 2011, DEP completed a $20 million environmental restoration of the northern portion of Alley Pond Park in Bayside, Queens. DEP constructed eight acres of tidal wetlands and eight acres of native coastal grassland and shrubland habitat in an effort to reduce CSOs in Alley Creek and Little Neck Bay. The new plantings and restored wetlands absorb stormwater runoff, reducing the amount that enters and overwhelms the combined sewer system during wet weather events.*

- DEP should consider acquiring property as a means of water quality protection.
  - *In order to control significant amounts of stormwater and to achieve potential water quality improvements equivalent to potential improvements from grey and/or green infrastructure, DEP would need to acquire numerous larger properties, which may be infeasible considering the built-out and highly urbanized nature of New York City. DEP believes that its broad citywide effort to effectively manage stormwater and CSOs using a hybrid grey/green infrastructure approach will lead to improved water quality.*

- DEP should invest in salt marsh restoration. What kind of pollution reduction could be anticipated from salt marshes?
  - *The New York City Department of Parks and Recreation’s (DPR) ongoing and complementary watershed planning and restoration efforts would likely include these evaluations in non-CSO areas contributing to Alley Creek/Little Neck Bay. DEP will be providing support for these efforts even after the submittal of the LTCP on June 30, 2013. Dependent upon the design of the salt marsh, some pollution reduction may be possible.*

- At the end of the public meeting, Mr. Paul Kenline (NYSDEC) read a prepared statement on behalf of NYSDEC. A summary of the statement is included below:

  In March 2012, the State entered into a revised Order on Consent with DEP. This order provides the regulatory and technical framework for New York City to achieve compliance with the Clean Water Act's water quality goals through the development and implementation of CSO Long Term Control Plans. For the next 48 months, the City is required to submit ten waterbody-specific Long Term Control Plans for the State to review, culminating in a Citywide Long Term Control Plan in 2017. The Plans are required to achieve the highest attainable uses of the waters, regardless of their current New York State DEC water quality classification and standards.
  [1]With your input, and in collaboration with the City and EPA, the State will determine what types of water uses will be available to the public by evaluating, selecting and implementing CSO reduction projects or alternatives, including integrating the City's green infrastructure program. This June, DEP is required to submit for review the first of these water quality planning reports, for the Alley Creek/Little Neck Bay waterbodies and the combined sewage drainage areas. The State has had numerous technical discussions and will continue these discussions with the City over issues with the proposed Long Term Control Plan, including evaluating baseline conditions of the sewage treatment system concerning the CSO volume discharged to New York City's waters, verification of baseline conditions, and that DEP has verified the Long Term Control Plan assumption that all sewers are clean and free of significant sediment and/or obstructions by conducting representative physical inspections of larger diameter sewers within the drainage area (Technical Memorandum to DEC regarding Estimation of Sediment Levels for Pipes Represented in the Hydraulic Model of the NYC Sewer System used for LTCP Reporting (DEP, June 21, 2013)). DEC looks forward to reviewing the draft LTCP so that these technical issues may be vetted by the Department's technical staff. The State thanks you again for your interest and participation.

[1] NOTE: DEP does not agree with NYSDEC's statement that the Long Term Control Plans are required to achieve the highest attainable uses of the waters, though the Plans will assess the waterbody's highest attainable use. The CSO Consent Order includes the following statement of the goal of the LTCP:

The goal of this LTCP is to identify appropriate CSO controls necessary to achieve waterbody- specific water quality standards, consistent with EPA's 1994 CSO Policy and subsequent guidance. Where existing water quality standards do not meet the Section 101(a)(2) goals of the Clean Water Act, or where the proposed alternative set forth in the LTCP will not achieve existing water quality standards or the Section 101(a)(2) goals, the LTCP will include a Use Attainability Analysis examining whether applicable waterbody classifications, criteria, or standards should be adjusted by the State. The Use Attainability Analysis will assess the waterbody's highest attainable use, which the State will consider in adjusting water quality standards, classifications, or criteria and developing waterbody-specific criteria.

APPENDIX C:
Summary of Public Comments Received via Email and DEP Responses

Appendix C: Summary of Public Comments Received via Email and DEP Responses

- March 29, 2013: Thanks for keeping us all in the loop on the LTCP. That was an eye-opening meeting for me. I, and some of those with whom I spoke, left the meeting wondering if there are other DEP forums in which more feedback is solicited on the direction that the LTCP is taking. For example, I've been told that what largely got people recycling is that it was promoted in schools. When kids came home talking about it, adults started taking more interest. Along those lines, it occurred to me that the City has a captive audience of over a million public school kids. Why don't they all know about how the City functions as infrastructure? Why don't they all know to not do dishes, laundry etc. during rain events? Is there a process in the development of the LTCP for public input like this?
  - *Thanks for writing in. We completely agree. We do have an Education component at DEP to help introduce kids to their City's infrastructure; however this is mostly geared towards the Water Supply system and the watershed. While we would certainly like to do much more, we are also constrained by our resources. However, your suggestion is a good one and we have been exploring ways to tap into the school network to get the word out about what everyone can be doing to improve our City's water and sewer infrastructure.*

- April 17, 2013: I am unable to find the LTCP for Jamaica Bay, Paerdegat Basin that was apparently approved in February 2007. Is that document available? Also, does the Coney Island Water Pollution Control Plant have a Wet Weather Operating Plan?
  - *Thank you for your questions. The Waterbody Watershed Facility Plans (WWFP) for Jamaica Bay and Paerdegat Basin, one of Jamaica Bay's tributaries, was completed in October 2011 and can be found here:*
    http://www.hydroqual.com/projects/ltcp/wbws/jamaica_bay.htm.
  - *WWFPs were the precursor to Long Term Control Plans (LTCPs). The Jamaica Bay and Tributaries LTCP will be completed in June 2016. Please refer to our LTCP Program Website for additional information:*
    http://www.nyc.gov/html/dep/html/cso_long_term_control_plan/index.shtml. The Coney Island Wastewater Treatment Plant (WWTP) does have a wet weather operating plan.

APPENDIX D:
Alley Creek Use Attainability Analysis

Appendix D: Alley Creek Use Attainability Analysis

EXECUTIVE SUMMARY

The New York City Department of Environmental Protection (DEP) has performed a Use Attainability Analysis (UAA) in accordance with the 2012 CSO Order on Consent for Alley Creek, a tributary of Little Neck Bay, currently designated as a Class I waterbody. The mouth of Alley Creek is located approximately 500 feet north of the Long Island Railroad (LIRR) Bridge. The majority of the flow into the creek occurs north of the Long Island Expressway (LIE) as shown in Figure 1.

Figure 1. Aerial view of Alley Creek

Detailed analyses performed during the Alley Creek and Little Neck Bay Long Term Control Plan (LTCP) concluded that the designated Class I secondary contact recreational uses in Alley Creek are in full attainment (100 percent) for fecal coliform criterion. However, based on this technical assessment, it is not feasible to upgrade this waterbody for primary contact recreation. On the basis of these findings, the New York City Department of Environmental Protection (DEP) is requesting, through the UAA process, that the New York State Department of Environmental Conservation (DEC) retain Alley Creek as a Class I waterbody.

INTRODUCTION

Regulatory Considerations

DEC has designated Alley Creek as a Class I waterbody, defined as "suitable for fish, shellfish and wildlife propagation and survival". The best usages of Class I waters are "secondary contact recreation and fishing" (6 NYCRR 701.13). The next highest use is a Class SB waterbody, which is defined as "suitable for fish, shellfish and wildlife propagation and survival." The best usages of Class SB waters are "primary and secondary contact recreation and fishing" (6 NYCRR 701.11). The SB classification is presumed by DEC to be equivalent to attaining the fishable and swimmable goals of the CWA.

Federal criteria[1] also provide additional guidance that may be implemented by New York State. Non-designated beach areas of infrequent primary contact recreation require that the single sample maximum enterococci measurement never exceed 501 per 100mL.

Federal policy recognizes that the uses designated for a waterbody may not be attainable for reasons other than CSOs, and the UAA has been established as the mechanism to modify the WQS in such a case. Here, Alley Creek meets the designated use classification. However, elimination of all CSOs will not result in attainment of the higher SB classification.

This UAA identifies the attainable and existing uses of Alley Creek and compares them to those designated by DEC. An examination of several factors related to the physical condition of the waterbody

[1] In 2012 the EPA issued new Recreational Water Quality Criteria (RWQC) recommendations which could impact compliance in this waterbody. DEC has not adopted the RWQC at this time.

and the actual and possible uses suggests that the uses listed in the SB classification may not be attainable.

Under federal regulations (40 CFR 131.10), six factors may be considered in conducting a UAA:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the waterbody to its original conditions or to operate such modification in a way that would result in the attainment of the use; or
5. Physical conditions related to the natural features of the waterbody, such as the lack of proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
6. Controls more stringent than those required by sections 301(b) and 306 of the Act [CWA] would result in substantial and widespread economic and social impact.

Identification of Existing Uses

The Alley Creek watershed is primarily residential with some commercial, industrial, and open space/outdoor recreation areas. The immediate shorelines of Alley Creek are wholly contained within Alley Pond Park, and tidal wetlands extend from the open water portion of Alley Creek to its banks in most areas.

Much of Alley Creek's wetlands are designated parks. However, direct public access to Alley Creek is minimal because of the wetlands. There are no kayak launching locations or swimmable/wadable beach areas in this watershed. In summary, the marshland nature of the waterbody (Figure 2), its comparatively small incised channel that can be seen in the middle during low tides, and the substrate unsuitable for wading or bathing (Figure 3), make the waterbody unsuitable for primary contact uses.

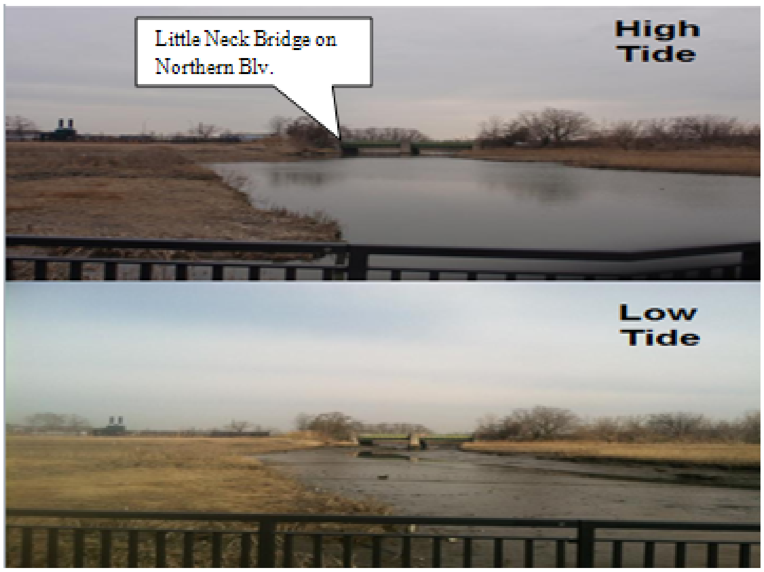

Figure 3. Looking North at Little Neck Bridge on Northern Boulevard

Local residents are known to fish in the area near the LIRR Bridge at the mouth of Alley Creek via small water craft, and from the Little Neck Bridge on Northern Boulevard. An increasingly popular use of Alley Pond Park is camping, wildlife observation and hiking (Figure 4).

Figure 4. Urban Park Rangers Day Camp Program

A significant number of waterfowl reside in Alley Pond Park and are regularly visible on the waters of Alley Creek, Oakland Lake and other tributary ponds, as shown in Figure 5. The evidence gathered at this time suggests that it is possible that this population is contributing pathogen loads to Alley Creek.

ATTAINMENT OF DESIGNATED USES

Alley Creek is a Class I waterbody, suitable for secondary contact recreation and aquatic life propagation and survival.

Figure 5. Waterfowl Population at Tributary Pond

As noted previously, Alley Creek is used infrequently for recreation of any kind, and no evidence of primary contact recreation could be identified. However, as part of the LTCP, an analysis was performed on the viability of Alley Creek meeting the WQS for the next highest classification, SB.

Water quality modeling and observed data indicate that the existing Class I WQS is being achieved. With respect to the Class SB WQS, the attainment of enterococci numeric criteria in Alley Creek is not possible due to additional pollutant sources other than CSO (namely, urban stormwater and waterfowl/wildlife). A component analysis on enterococci concentrations in Alley Creek showed non-attainment of the Class SB seasonal geometric mean of 35 throughout, and was a consequence of multiple sources of pathogen loads. Sensitivity analyses performed with removing individual sources indicate that no single source removed, including 100 percent CSO control, can lead to Class SB WQS attainment. Conclusions reached through these analyses are described below.

CONCLUSIONS

Alley Creek attains the existing Class I WQS but cannot fully achieve the highest attainable fishable and swimmable goals – Class SB - of the CWA due to non-CSO sources from Oakland Lake and other natural sources in the upper Alley Creek watershed. Alley Creek is not used for primary contact recreation, so the non-attainment of fishable/swimmable standard would not impair waterbody uses. Non-attainment of Class SB standards are attributable to the following UAA factors:

- Naturally occurring pollutant concentrations (waterfowl) prevent the attainment of the use (UAA factor #1)

- Human caused conditions (urban runoff) create high bacteria levels that prevent the attainment of the use and that cannot be fully remedied for large storms (UAA factor #3)

It should be emphasized that the Alley Creek watershed is among very few urban watersheds within New York City with extensive vegetation and wetland features. Human intervention in terms of boat access should be minimized or eliminated to maintain the natural characteristic of this watershed. This limited use concept was supported by many in attendance at the second public meeting held on May 1, 2013.

RECOMMENDATIONS

Alley Creek attains the current Class I water quality standard. Modifying the WQS to Class SB standards in Alley Creek is not appropriate given the marsh, wetlands and tidal flat nature of the waterbody, existing uses and the lack of adequate access points. Moreover, achievement of the SB WQS is not feasible given the current and projected dry and wet weather pollution loads, even following 100 percent control of CSO discharges. Therefore, revising the WQS is not recommended at this time.

APPENDIX E:
SPDES Variance

Appendix E: SPDES Variance

By submitting this variance application, the New York City Department of Environmental Protection (DEP) is not waiving its right to seek other regulatory options for addressing applicable water quality standards, including a request for water quality standards revisions based upon a Use Attainability Analysis.

APPLICATION FOR VARIANCE
TO WATER QUALITY BASED EFFLUENT LIMITATION

Tallman Island Water Pollution Control Plant
SPDES Permit No NY-0026239
Outfall TI-025

The New York City Department of Environmental Protection (NYCDEP) seeks a variance from the anticipated Water Quality Based Effluent Limitation ("WQBEL") for the Alley Creek CSO Facility permitted under the Tallman Island SPDES Permit as Outfall TI-025. This variance application is based on information set forth in the *Alley Creek Long-Term CSO Control Plan Report* (the "Report") submitted June 2013 as updated November 2013.

This variance request is based on the anticipation of occasional exceedances of the water quality standards for: (a) Suspended, colloidal and settleable solids; (b) Oil and floating substances; and (c) Dissolved oxygen (DO). Modeling and engineering estimations indicate that complete elimination of periodic excursions from those water quality standards would require a water quality-based effluent limitation (WQBEL) of 100% CSO capture. Accordingly, for the reasons set forth below, we hereby request a variance from the presumed WQBEL of 100% CSO capture.

Specifically, DEP requests that the permit will specify "operational conditions" based limits for the Facility as an "alternative effluent control strategy" defined under Section 302(a) of the Clean Water Act. Based on NYSDEC's April 12, 2006 letter regarding the Paerdegat Basin CSO facility, DEP understands that the enforceable conditions for the operation of the Alley Creek Facility would be based on its design specifications, its Wet Weather Operating Plan (WWOP), and the 14 BMPs for CSOs for the duration of the variance. This approach is consistent with NYSDEC's stated belief that numerical effluent limits are not appropriate for CSO-based discharges such as those that will occasionally occur from the Alley Creek CSO Retention Facility due to episodic heavy or intense rainfall events.

Alley Creek CSO Retention Facility

The Alley Creek CSO Retention Facility provides 5 million gallons of in-line storage of combined sewage. The facility was completed in June 2011 and was certified as being operational as of March 11, 2011. The facility has been in continuous operation since that time and remains so presently. The anticipated performance of the facility under typical annual conditions was a 54 percent CSO volume reduction, a 70 percent TSS loading reduction, and a 66 percent reduction in BOD discharged to Alley Creek. The resulting water quality benefits are expected to meet the WQS for pathogens in both Alley Creek and Little Neck Bay, and the dissolved oxygen standard at least 96 percent of the time during a typical rainfall year.

Because of its flow-through configuration, CSO discharges through the facility receive solids and floatables removal. However, the New York State standard for Suspended, Colloidal and Settleable Solids is “None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages." Similarly, for Oil and Floating Substances the limit is "No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease" (6 NYCRR Part 702.17). There is therefore a practical limitation to the facility being able to attain these WQBELs. Further, minimum DO requirements in Alley Creek (4.0 mg/L) and Little Neck Bay (4.8 mg/L) cannot be attained even with 100% CSO removal.

Environmental Benefits

The Alley Creek CSO Retention Facility significantly improves the water quality and environmental conditions in Alley Creek and Little Neck Bay, as demonstrated in the Alley Creek LTCP. Bacteriological conditions will improve to a level whereby the existing Class Icriteria for total coliform and fecal coliform should be fully achieved. Dissolved oxygen (DO) will also significantly improve, and is expected to be attained at least 96% of the time. Odors will be substantially eliminated by the high level capture of settleable material, and the benthic habitat and diversity of aquatic life in Alley Creek is expected to improve accordingly.

Regulatory Assessment

As described in the Alley Creek LTCP, complete attainment of numerical and narrative water quality criteria applicable to Alley Creek and Little Neck Bay would not be achieved even with 100% capture of CSO discharges, which would require an additional 29.5 million gallon storage facility with an estimated cost of $569 million. The Alley Creek CSO facility was selected based on the "knee-of-the-curve" analysis consistent with USEPA's CSO Control Policy.

USEPA guidance as contained in *Coordinating CSO Long-Term Planning with WQS Reviews* provides for regulatory reviews and revision, as appropriate, of water quality standards when considering CSO control plans to reflect the site-specific wet weather impact of CSOs and to reconcile designated uses with what is attainable cost-effectively. However, NYSDEC has stated that it prefers that DEP apply for a variance to the presumed WQBELs rather than seek water quality standards revisions.

Application for Variance to WQBELs

As noted, the requirements for variances to effluent limitations are based on standards and guidance values and contained in 6 NYCRR Part 702.17. Complete elimination of periodic excursions from the following water quality standards applicable to Alley Creek and Little Neck Bay would require a WQBEL of 100% CSO capture.

Water Quality Standards for Class I Waters*

Parameter	Standard
Suspended, colloidal and settleable solids	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages
Oil and floating debris	No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease.

Dissolved Oxygen	Not less than 4.0 mg/L at any time (Alley Creek) Not less than 4.8 mg/L at any time (Little Neck Bay)

*Compiled from 6 NYCRR Part 703.

In order to meet the above-referenced standards, DEP would be required to attain 100% CSO capture, As this level of CSO capture is neither cost-effective nor consistent with CSO Control Policy specifications, we request a variance to the presumed WQBEL of 100% CSO capture.

The following narrative presents the information or the source of information to support this application under 6 NYCRR Part 702.17. Responses are provided to those subsections of Section 702.17 which are applicable to DEP and to the Alley Creek CSO Facility.

Sec. 702.17(a) [DEC] may grant, to a SPDES permittee, a variance to a water quality-based effluent limitation included in a SPDES permit.

As the SPDES permittee, DEP seeks a variance to the presumed water quality based effluent limitation of 100% CSO retention for the Alley Creek CSO Retention Facility. The variance should be incorporated into the Tallman Island WPCP SPDES Permit, NY-0026239.

Sec. 702.17(a)(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.

The variance is requested for the following effluent constituents in the periodic overflows from the Alley Creek CSO Retention Facility.

- Suspended, colloidal and settleable solids;
- Oil and floating substances;
- BOD and other oxygen demanding substances (for DO).

It is understood that this variance is only applicable to the Tallman Island WPCP SPDES permit governing the Alley Creek Facility and would not modify any water quality standard or guidance value.

Sec. 702.17(a)(3) A variance shall not be granted that would likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of such species critical habitat.

The LTCP notes that the Northern Harrier (Circus cyaneus) is a threatened species known to over-winter in Alley Pond Park. Northern Harriers feed on small animals such as mice and voles, for which they hunt by flying low over fields and marshes. They eat their prey on the ground, they perch on low posts or trees, and their nests are concealed on the ground in grasses or wetland vegetation.

Because this bird species does not feed on aquatic life and does not use water for habitat, the variance would not jeopardize its continued existence or result in the destruction or adverse modification of its critical habitat.

Sec. 702.17(a)(4)) A variance shall not be granted if standards or guidance values will be attained by implementing effluent limits required under section 750-1.11(a) of this Title and by the permittee implementing cost-effective and reasonable best management practices for nonpoint source control.

The requirements applicable to CSO outfalls and CSO retention facilities are set forth in NYSDEC's Technical and Operational Guidance (TOGS) 1.6.3, which requires that all technology based effluent limits for CSOs must be developed using Best Professional Judgment (BPJ). BPJ has been used to develop the Alley Creek LTCP and some excursions from water quality standards are expected after implementation. Best management practices applied for nonpoint source control will also not achieve attainment.

Sec. 702.17(a)(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.

DEP acknowledges that the variance will not exceed the term of the Tallman Island WPCP SPDES permit; however, in the absence of a UAA, it is likely that the variance will need to be renewed. As appropriate, DEP may timely file an application for such renewal.

Sec. 702.17(b)(1), (2), (3) (4) and (5) A variance may be granted if the requestor 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 750-1.11(a) would result in substantial and widespread economic and social impact.

This subsection requires the applicant to demonstrate that achieving the WQBEL is not feasible due to a number of site-specific factors. These factors established by New York State Environmental Conservation Law are the same as those in 40 CFR 131.10(g) which indicate Federal requirements for a Use Attainability Analysis (UAA). In the framework DEP and DEC have agreed to for UAAs, at least one of these six criteria must be met, and it is expected that this agreement would also be applicable to a SPDES Variance request. Because 100% CSO removal does not enable attainment, factor #3 at a minimum would provide justification (human caused conditions).

Sec. 702.17(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.

This subsection requires the applicant to demonstrate to NYSDEC 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. As noted above under Sec. 702.17(a)(1), this variance application is for suspended, colloidal and settleable solids, and oil and floating substances in the periodic overflows from the Alley Creek CSO Retention Facility. These substances pose no significant risk to human health. In addition, pathogen criteria are expected to be fully attained and therefore no variance is requested for these parameters. Very limited risk to the environment is expected absent attainment of the standard.

Sec. 702.17(d), The requestor shall submit a written application for a variance to the department. The application shall include:

(I) 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 in subdivision (c) of this section.

This application and the Alley Creek LTCP satisfy the requirements of this subsection.